Chapter 7

Optimal Taxation of Consumption in the Scope of Changing Elasticities of Demand: Re-reading Ramsey

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Abstract

Optimal taxation is the taxation that reflects society's choices between the rival goals of equality and economic efficiency, the starting point of which is to maximize social welfare. The optimal taxation of commodity that was launched by Ramsey is based on the rule of inverse elasticity, which holds that the taxation of goods with low elasticities of demand at a higher rate will reduce the loss of efficiency. The criticism of this rule is due to the fact that essential goods to meet basic needs have low price elasticity of demand, while luxury goods have high price elasticity. Under the assumption that consumers are similar, it is argued that the taxation of luxury goods at a lower rate than necessity goods will have a negative effect on tax justice. Changing market conditions thus change the elasticity of demand for luxury goods and necessity goods, and such change makes it necessary to reconsider the basic assumptions of optimal taxation and the criticisms directed at optimal taxation. In this context, the present study will investigate differing elasticities of demand in connection with changing market conditions in the scope of the liberalization of trade. In the light of these investigations, optimal commodity taxes will be reassessed.

Keywords: optimal commodity taxes, Ramsey rule, inverse elasticity, efficiency, equality, demand elasticity

1. Introduction

Tax is the main source of income, which is collected based on the sovereign authority of the government. In this context, taxation is one of the primary political tools that states use in order to obtain economic, social, and political goals. Taxation as a fiscal policy tool allows states to make effective practices in achieving their goals in macroeconomic terms. The role of tax policies in

the matter of obtaining the aforementioned macroeconomic goals reveals that taxation is one of the effective economy policy tools in the hands of the state. In accordance with the social state approach, taxation emerges as a transfer mechanism. Enabling equality/justice for each individual is accepted to be at the helm of the duties of states toward their citizens.

Citizens belonging to all income groups in a country to be able to benefit from public services within the context of equality and justice principle on the other hand can only be possible by the state to transfer the resource, which is collected from the higher income group via taxation to lower income groups as public services. Within this framework, taxation is the most important element of the transfer mechanism between income groups.

How to design taxes, which are the most important policy tools of the state in reaching the goal of effectiveness and equality, has been comprehensively discussed in the optimal taxation literature. Optimal taxation is a taxation, which reflects the preferences between the society's rivaling aims of equality and economic efficiency and which has maximizing social wealth as the starting point.

In today's conditions, in which the state has asymmetrical information about the individual's social and economic characteristics, the goal of income redistribution can be possible through the use of distortionary taxes. The state can assure income justice by using distortionary taxes only by conceding economic efficiency. Because of this reason, optimal taxation lays emphasis on tax subject, tax rate, and tax base, which will minimize thrashing in securing a certain amount of tax revenue.

In this context, two main studies exist in the optimal taxation literature with regard to tax subject. In his study, Ramsey [1] approached optimal tax subject on the basis of consumption, and in the second fundamental study, Mirless [2] identified revenue as the tax subject. In both studies, ideal tax rates were searched within the context of the determined tax subject.

In the Ramsey approach to optimal taxation, since the needed budget revenue is possible to be obtained only by distortionary taxes under the assumption that it is not possible for governments to resort to lump sum taxes, it will bring along a wealth loss in terms of economic efficiency and will move away from the optimal solution. Within this framework, Ramsey emphasizes on the tax subject and rate that will minimize efficiency loss. In Ramsey approach, it is generally agreed that the government can impose a linear income tax besides commodity tax [3].

Optimal commodity taxation, which was proposed in 1927 by Ramsey and whose theoretical structure has developed through today's modern approaches, is based on the inverse elasticity rule, which claims goods with low demand elasticity to be taxed at a higher rate will reduce efficiency loss, and Corlett-Hauge Rule [4], which claims leisure complement goods that will change the preferences of consumers between working and leisure on behalf of working need to be taxed at a higher rate.

In the inverse elasticity rule suggested by Ramsey, all goods are aimed to be affected equally from taxes by levying taxes at a high rate from goods with low demand elasticity and at a low rate from goods with high demand elasticity.

The most important criticism toward this rule originates from the fact that necessity goods devoted to meet basic needs have low price elasticity of demand, and luxury goods on the other hand have high price elasticity. Taxing luxury goods at a lower rate compared to necessity goods under the assumption that consumers resemble each other is claimed to influence justice of taxation in a negative way.

The assumption that luxury goods have high demand elasticity and necessity goods have low demand elasticity may change when short and long periods are in question and within the context of competition, which is the main incentives of market economy. In assuring the profit maximization, which is the main goal of firms competing in the market economy, their total revenues and demand elasticity for their products are important variables. Firms can increase their total revenues by decreasing the demand elasticity for their products. In this context, firms aim to reduce the vulnerability of the product they produce against price changes.

As markets open to foreign countries, together with the liberalization in trade, magnitude of the market and innovation increases, and this may increase price elasticity of demand by increasing substitution possibility of especially necessity goods [5–7]. On the other hand against this risk, firms try to lower the demand elasticity of their products within the context of the brands they create and by increasing loyalty to these brands [8]. Especially, in product groups including luxury goods such as technological products and automobiles, brand loyalty reduces the sensitivity of consumers to the product's price.

Within this framework, changing market conditions changes demand elasticity of luxury and necessity goods, and this change on the other hand necessitates reassessing basic assumptions of optimal taxation and criticisms against optimal taxation.

2. Optimal taxation

The most fundamental goal of economic and fiscal policies is to maximize wealth. This goal includes quite large sub-goals, such as providing stability, growth, efficient allocation of resources, and fair income distribution. Tax is the primary fiscal tool to be used in reaching the goals in question. Among the tax applications that are under the changing and developing state understanding, what type of taxation is the taxation that serves the goal of wealth maximization is considered in the literature especially in the framework of "Optimal Taxation" theory.

While within classical welfare economics understanding, optimal taxation theory considers taxes as effective tools in assuring resource allocation; new welfare economics' view of utility measurement and impossibility of inter-personal comparisons caused economic area of interest to rotate to Pareto efficiency. This situation focused on substitution effect of taxes, creating efficiency loss and lasted until the study of Mirrlees [2], which targets resolution of equality and efficiency conflict.

In this context, optimal taxation is the taxation that reflects the preferences of the society between equality and efficiency with rivaling goals, and that has social wealth maximization

as the starting point. Within this scope, balance between the goals of justice (equality) in taxation and economic efficiency is tried to be redressed. On the other hand, trade-off between these goals created different approaches to the topic.

Existence of the relevant trade-off depends on the existence and influence of distortionary taxes. In today's conditions, in which the state has asymmetrical information about the individual's social and economic characteristics, the goal of income redistribution can be possible through the use of distortionary taxes. The state can assure income justice by using distortionary taxes only by conceding economic efficiency. Because of this reason, optimal taxation lays emphasis on tax subject, tax rate, and tax base, which will minimize efficiency loss in securing a certain amount of tax revenue.

3. Distortionary taxes and efficiency loss

In general terms, distortionary taxes can be defined as taxes that will influence or change economic decisions of taxpayers. The main reason for distortionary taxation on the other hand is to assure redistribution of revenue, which is one of the fundamental functions of the state and thus to achieve a society structure more egalitarian than the one that could have been achieved via a uniform lump-sum tax [9].

The state, which has a social aim of distributing the tax burden in a fair and balanced way within the scope of fiscal policy, needs distortionary taxes in order to realize this aim. State's complete and absolute knowledge about the characteristics of each individual in the society underlies this need. In this context, use of distortionary taxes is a consequence of the aim to redistribute revenue in a world, where the state knows characteristics of individuals only incompetently [9]. Within this scope, in the assurance of justice (equality), individuals having the same ability to pay will be assumed to be in equal conditions, and same amount of taxes will be taken from them [10].

When different abilities to pay are at stake, the state redistributes revenue in a way to load a greater amount of public expenditures to higher income groups. Different societies may have different preferences on equality and efficiency. These differences bring along different tax systems in practice. Discussions on how progressive tax structure should be in order to enable equality are a result of value judgments about equality. In this context, inequality reduced through progressive tax structure can only be possible by the acceptance of a certain amount of efficiency loss.

According to Diamond and Mirrless [11], administratively, it is not possible for the state to realize its revenue distributer goal on the grounds of social justice and revenue creator goal on the grounds of public finance, through lump-sum taxes. Since lump-sum tax is not appropriate, optimal taxation will only be a taxation that will not impair the efficiency of production. This on the other hand is only possible if the taxation on the final production can be diversified between products at no cost [12].

In the light of these explanations, optimal tax structure is defined as the tax structure, which reflects the preferences of the society between the balance of efficiency loss and equality and

maximizes social wealth. Optimal taxation theory seeks answers basically to the following questions:

(i) On what will the tax be taken from (income-consumption-wealth)?

(ii) If the tax will be taken on consumption, is it going to be at a fixed rate?

(iii) If the tax will be taken on wealth, how will the tax base be? [13]

(iv) In the following parts of this study, optimal taxation will be taken on consumption.

4. Optimal commodity taxes: Ramsey rule

The main topic of discussion in the literature regarding optimal commodity taxes, which are approached under the heading of optimal taxation, is about the proportional structure of the taxes in question. In this context, literature searches which tax rates, single rate or varying, will create optimal results in the construction of optimal commodity taxes. Within this scope, while on one side, there is the view arguing that a single rate tax will not damage market forces and will be synonymous with a fixed rate tax on income [14]; on the other side, optimal commodity taxes within the context of Ramsey and varying rates take place.

Ramsey rule involves taxing commodity and zero capital taxes in the long run [15] for minimizing the deadweight loss. For public choice theory, equilibrium taxes and feasible tax structure apart from Ramsey analysis are important subjects because tax system can cause rent seeking when it is used as an income distribution tool [16, 17].

Optimal commodity taxation, which was proposed in 1927 by Ramsey and whose theoretical structure has developed through today's modern approaches, is based on the inverse elasticity rule, which claims goods with low demand elasticity to be taxed at a higher rate will reduce efficiency loss, and Corlett-Hauge Rule, which claims leisure complement goods that will change the preferences of consumers between working and leisure on behalf of working need to be taxed at a higher rate.

As seen in **Figure 1**, tax application may cause a decrease in social wealth by changing price before and after tax. The reason behind this is the decline of production under the amount before tax because of the change in price. Minimization of this efficiency loss, which is also called excess tax burden or deadweight loss (DWL), is the purpose of the tax systems.

Under the assumption that characteristics of individuals can only be known deficiently and thus lump-sum taxes are not applicable, Ramsey searched the tax structure that will minimize efficiency loss (deadweight loss) associated to the collection of a specific amount of tax revenue. Excess tax burden is caused by the reduction in equilibrium quantity because individuals change their behaviors and consume taxed product less. Decrease in the quantity of the product depends on demand elasticity. According to Ramsey rule, tax rate imposed on the good with high elasticity should be lower than the tax rate imposed on the good with low elasticity [18]. In this way, as seen in **Figure 1**, decrease in the equilibrium quantity of goods would be minimized.

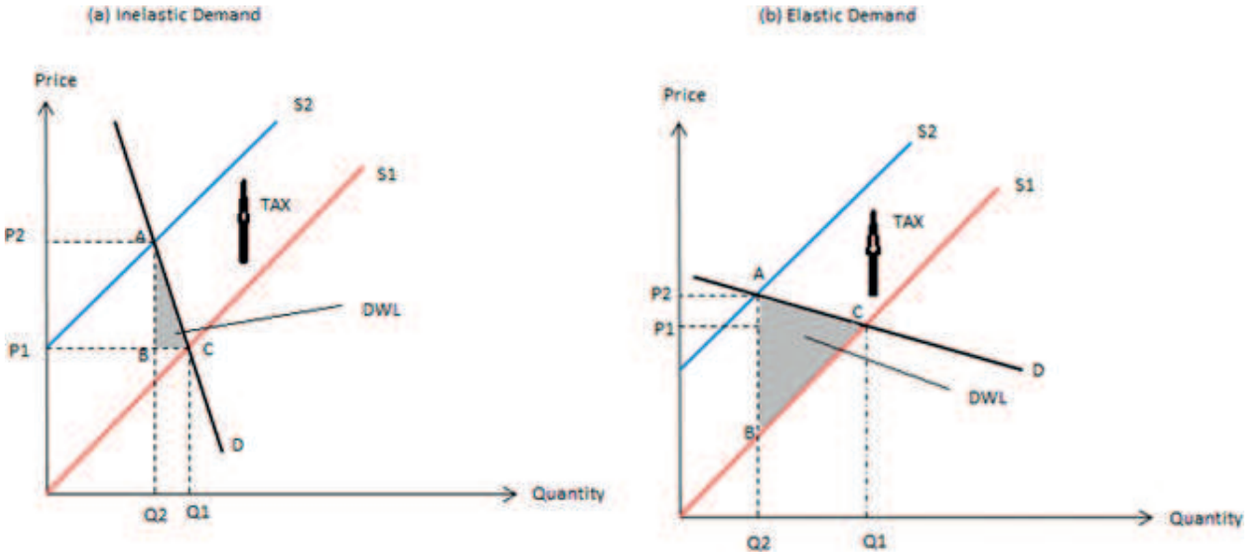

Figure 1. Deadweight loss of taxation. Source: Ref. [44].

Under the assumption that people resemble each other, Ramsey taxes are expressed as the sum of the inverses of supply and demand elasticity.

$$\frac{t}{p} = k\left(1/n_u^d + 1/n^s\right) \tag{1}$$

In this equation, t represents tax rate per unit, p represents price after tax, n_u^d represents compensated elasticity of demand, and n^s represents supply elasticity [9].

In the inverse elasticity rule suggested by Ramsey, under the assumption that supply curve is finite or, in other words, a horizontal supply curve exists, tax is stated to be inversely proportional to compensated demand elasticity. Accordingly, all goods to be affected equally from taxes are aimed by collecting lower rates of taxes from goods with high price elasticity of demand and higher rates of taxes from goods with low price elasticity of demand.

Within the framework of this purpose, Sandmo [19] expresses that Ramsey rule can be based on the following three hypotheses:

(i) Being able to minimize efficiency loss, which occurs as a result of distortionary taxation, is possible through tax applications with a low substitution effect. Because of this reason, goods with prices that do not create substitution effect are the ideal subject of the tax. In other words, in cases where lump-sum taxes cannot be imposed, commodity taxes with similar effects should be imposed.

(ii) Goods, which will be taxed at high rates, should have a high leisure complementary level.

Elasticity of substitution between goods and leisure lies behind the fact that single rate tax, which does not change the relative prices of goods and will not be different from the lump-sum tax that will be imposed on labor income, is not optimal [14].

However, according to Corlett-Hague Rule, varying tax rates, in which leisure complementary goods that will change the preferences of consumers between working and leisure in favor of working will be taxed at higher rates, serve for the assurance of optimality in commodity taxes. In this context, Diamond [11] proposed leisure complementary goods to be taxed at relatively higher rates intended to the efficiency purpose.

(iii) Tax rates are expected to be inversely proportional with uncompensated own-price elasticity of demand.

The most important criticism toward the Ramsey rule composed of above-mentioned hypotheses is caused by the fact that necessity goods devoted to meet basic needs to have low price elasticity of demand and luxury goods to have high price elasticity. Under the assumption that consumers resemble each other, taxation of luxury goods at a lower rate compared to necessity goods is claimed to influence justice of taxation negatively.

5. Redistribution and Ramsey taxes

Ramsey taxes, which were pointed out in the above section in detail, are criticized because of its current assumptions and negativity they might create in income distribution.

At this point, first main criticism to Ramsey analysis is the assumption that all individuals resemble each other. The fundamental reason for the state to use distortionary taxes instead of lump-sum taxes is to have redistribution goals, which are not possible to attain in another way. In case this assumption is valid, there are no causes of the state for not imposing lump-sum taxes.

Nevertheless, when taxes are imposed within the context of inverse elasticity rule, an equal amount of decrease in demand in all goods will be caused by collecting lower rates of taxes from goods with a high possibility of change in demand amount and at higher rates from goods with a low possibility of change in demand amount; and thus, efficiency loss will be minimized. According to this approach, taxation of necessity goods, which have low compensated demand elasticity and have a large share in the consumer's budget, at a higher rate than luxury goods comes to the fore [9].

Generally, price elasticity of demand for good, which are consumed with the purpose of meeting basic needs, is low, while price elasticity of demand for luxury goods is high. Based on this rule, tax rate to be imposed on basic necessity goods will be high, and tax rate to be imposed on luxury goods will be low. What needs attention here is the assumption that consumers are alike. However, since income distribution and demand for different products will vary, such a rule will create negative results in terms of tax equity especially in developing countries.

Ramsey defended this rule by placing economic efficiency to forefront. Therefore, although theoretically consistent, this analysis becomes contradictive in practice with the influence of socio-political reasons [20].

In short, when Ramsey's suggestion is applied, low-incomers, who relatively allocate majority of their income to necessity goods, have to face a high tax burden. Therefore, a conflict between the goals of decreasing the efficiency cost of tax and equitable tax emerges. Ramsey rule puts forward what needs to be done when efficiency purpose is desired to be pursued. Goal of justice is not within this rule's field of interest [18].

As a result in optimal commodity taxation, Ramsey's analysis requires a careful analysis of: the constraints on taxation; the elasticities of demand and supply; and the structure of the economy [21].

6. Changing demand elasticities

Criticisms done within the context of the basic assumptions of Ramsey taxes' inverse elasticity rule become more serious especially on the topic of income redistribution. Inverse elasticity rule creates a conclusion in line with efficiency but to the detriment of equality by suggesting taxation of necessity goods, which occupy a heavy place in the consumption basket of lower income groups, at a high rate and goods appealing to higher income groups at lower rate depending on demand elasticity.

Besides the assumptions in inverse elasticity rule mentioned above that are subject to criticisms, another topic to be emphasized is whether demand elasticity varies within the framework of macroeconomic and microeconomic variables.

A change that may occur in demand elasticity of luxury and necessity goods may build a fairer structure for the inverse elasticity rule in terms of income distribution, and the above-mentioned taxes criticized in practice within the context of enabling justice in income distribution, which is among the main functions of the state, may be reassessed as part of changing demand elasticity. Under this assumption, in this part, changes in elasticity of luxury and necessity goods that could be created by macrovariables and microvariables within the changing economic conjuncture will be addressed.

6.1. Short- and long-term changing demand elasticity

Existence of substitution possibility is the primary element affecting demand elasticity. Existence of close substitutes for some goods increases price elasticity of the demand in question. As seen in **Figure 2**, since development of substitution opportunities take time, while in short term, price elasticity of demand for many products is low, elasticity may increase in the long term [22]. Durable consumer goods have a different structure compared to other goods in short and long term elasticity. Despite the fact that elasticity differences are observed between terms in these goods as well, price elasticity of demand is more elastic for these goods in the short term, while it weakens in the long term [23].

At this point, the most basic example is the price elasticity of demand for oil changing in short and long terms against OPEC cartel shock in 1970s. Sudden price increase experienced in the so-called period was received with highly inelastic price elasticity of demand at a level that

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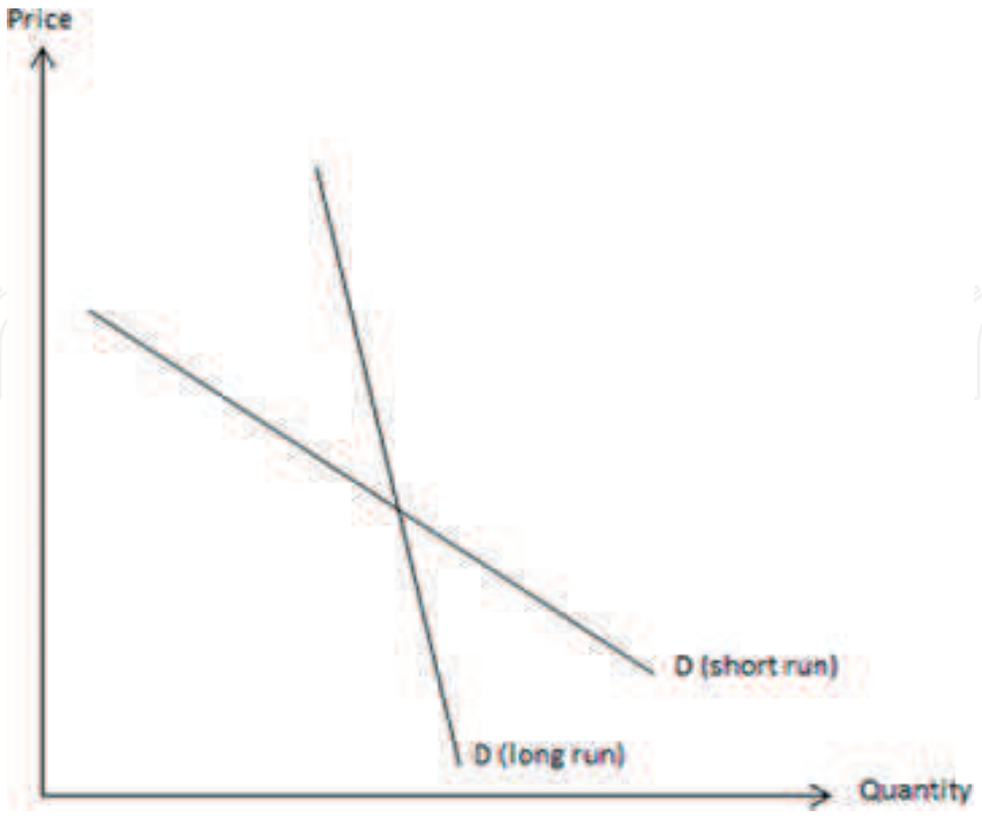

Figure 2. Changing demand elasticity.

did not cause a change in the amount demanded in the short term; however, fuel efficient solutions with the technology developed in the long term allowed price elasticity of demand to increase.

In this way, short and long term price elasticity of demand for products with substitutes that need time to be developed may differ. Because of this reason, although goods with low price elasticity of demand are advised to be taxed at higher rates in Ramsey taxes within the tax structure that will not damage efficiency, in the long term, price elasticity of demand for many goods including necessity goods increases. In such a case, since tax rates will decline as part of increased elasticity, it will be difficult to achieve the budget revenue planned in the beginning without negatively affecting efficiency.

6.2. Commercial liberalization and changing demand elasticity

Criticism of Ramsey taxes, which will be applied within the scope of the inverse elasticity rule because luxury goods have high demand elasticity and necessity goods have low demand elasticity, because of its elasticity assumptions may change as part of competition, which is the main abettor of market economy today. Total revenue and demand elasticity for products are important variables in providing profit maximization, which is the principal purpose of firms competing in market economy.

Firms can increase their total revenues by decreasing the demand elasticity for their products. In this context, firms aim to decrease the vulnerability of the products they produce against

price changes. Thus, they can increase their total revenues by raising product prices [24]. Yet, together with the increased competition, efficiencies [25, 26] increase, and together with liberalization, market size [27] increases.

Especially, liberalization in commerce influences export and import performances of industries, declines in tariffs cause scale increases [28], and thus, competition escalates [29]. As supported by quite a few studies, high protectionism in commerce leads firms to produce under optimal scale, and output increases to be negatively affected [30].

Commercial liberalization on the other hand allows the tariff structure to soften, large-scale firms to rise together with the increase in competition, and output levels of small-scale firms to rise [29]. Diversity increased in the market structure that grew by this means enhances the substitution opportunity between goods and thereby increases price elasticity of demand. By this way, the scale that increased through liberalization and competition raises diversity of goods and services and therefore their substitutability and serves for the increase of price elasticity of demand of all necessity and luxury goods.

6.3. Market size, innovation, and changing demand elasticity

In one of the first studies investigating the relationship between market size and innovation, Griliches [31] put forward in 1957 the existence of a significant relationship between technological change and technological adaptation and profitability and market size. In other studies analyzing different sectors following this study, a significant relationship between market size and innovation and innovation elasticity was exhibited [32–34]. In this context, the innovation process, which improves as market size grows, increases price elasticity of demand by supporting the increase of product range [35].

In the light of these analyses, macroeconomic variables, such as short and long term structures, commerce liberalization and competition, market size, and innovation, affect and change the price elasticity of demand for luxury and necessity goods. This change generally reveals itself as the increase of price elasticity of demand for goods. This macrochange of demand elasticity in both luxury and necessity goods composes a risk for firms in microterms. On the other hand against this risk, firms try to decrease the demand elasticity for their products by creating brands and increasing loyalty to these brands [8].

Brand loyalty decreases the sensitivity of consumers to the prices of products especially in product groups such as technological products and automobiles. At this point, it is useful to mention about brand loyalty as a microvariable effective on price elasticity of demand.

6.4. Brand loyalty and changing demand elasticity

While price elasticity of demand increases as part of macrovariables, this increase in elasticity requires different precautions to be taken, since it would negatively influence profit maximization goal. One of the fundamental elements for the firms to obtain their profit maximization goal is to be able to increase total revenue with price increases they gathered by decreasing substitutability opportunities and price elasticity of demand for their products [24]. Within this scope, primary methods for dropping price elasticity of demand for the firms' products at microlevel are creating or strengthening brand loyalty.

According to Palumbo and Herbig [36], brand loyalty, which has different definitions in literature, is in the most general sense a situation, in which consumers continuously tend to seek and purchase only a certain brand even when competitor businesses offer lower prices and sales promotions.

Brand loyalty to be also high in high-priced products [37] leads the consumer, whose brand loyalty increased, to be less sensitive to price changes. Firms, with a purpose of increasing market share and profitability, try to reduce the vulnerability of their products against substitution opportunities and price changes by raising loyalty to their brands. Within this framework, a close relationship between market share and purchase possibilities of brand loyal consumers, who do not respond to price changes, is in question [38].

Brand loyalty provides some advantages to firms against competition. These advantages can be listed as follows:

- Creating brand loyalty decreases an important amount of advertising and promotion costs [39]. Together with the fall in costs, consumers loyal to brand will be loyal to the brand and not be sensitive to price changes as long as they resolve problems they experience about the product.
- Brand loyalty ensures competitive advantage to businesses. It builds a large entrance barrier to new entrant businesses. These barriers lower price elasticity of demand by complicating substitution of products firms produce.
- Brand loyal consumers do not oppose to pay a higher price for the products and services the business offers, and this increases the profitability of the business in short and long term.
- They do not abandon the brand immediately after they experience a negative situation about the brand.

All these advantages enabled by brand loyalty on the other hand serve price elasticity of demand for the product to fall.

Brand loyalty with regard to Ramsey taxation has importance especially in terms of decreasing price elasticity of demand for luxury goods. Brand loyalty to be high especially in luxury goods [40] drops price elasticity of demand to the so-called goods by weakening substitution possibilities and thus weakens the sensitivity of consumers of luxury goods the price changes of these goods.

All these macrovariables and microvariables change price elasticity of demand for luxury and necessity goods as part of differential tax rates in optimal commodity taxes. Additionally, they give way to Ramsey's inverse elasticity rule to be re-evaluated as part of criticisms it receives about income distribution. At this point, price elasticity of demand for luxury and necessity goods rises depending on short and long term effect, commercial liberalization, and increased competition and innovation, which are all macroeconomic variables.

Thus, demand elasticity of necessity goods, which have a large share in the consumption spending of lower level income groups, increases as part inverse elasticity rule; and therefore, tax rates decrease in line with the increase in elasticity. A decline in the tax rate, which the lower income level group will be exposed to as part of inverse elasticity rule, may create a more agreeable result in income distribution.

The influence microvariables have on price elasticity of demand on the other hand is important especially for luxury goods. Firms, aiming to increase their total revenues by reducing demand elasticity for their products, have the purpose of decreasing the vulnerability of their products against price changes. Since brand loyalty, which is one of the primary microvariables firms use within this framework, is high especially in luxury goods as mentioned above, it affects price elasticity of demand for the goods.

Created brand loyalty prevents change in consumer preferences by reducing substitution possibilities of luxury goods and decreasing price elasticity of demand. By this way, in a tax that will be applied as part of inverse elasticity rule, luxury goods will be subject to high-rate taxes because of low demand elasticity. And therefore since aforementioned goods share in the consumption basket is very low for lower level income groups and high for higher level income groups, effect of this taxation, which is applied by considering elasticity, might be positive on income distribution.

Within this scope, while justice in income distribution is served on one hand, a certain budget revenue of optimal taxation goal is achieved through taxing goods with low demand elasticity at a high rate, and this goal is achieved without damaging any economic decisions or in other words without spoiling economic efficiency. Both inverse elasticity rule and leisure complementary goods, which will change preferences of consumers between working and leisure in favor of working, to be taxed at higher rates play a role. The fact that luxury goods are mostly substitutes of leisure lead to this conclusion.

Beginning from this century, labor market and accordingly preferences between leisure and working started to change. In this context, leisure industry has boomed. In many societies, leisure was equalized with luxury goods such as motor sports and traveling and became a symbol of postmodernity [41].

Thus, luxury goods have been effective in the change of the decision for working as a complementary of leisure. While luxury goods with a declined price elasticity of demand as part of brand loyalty are taxed at a higher rate with regard to inverse elasticity rule; at the same time, preferences of individuals in favor of working were strengthened by imposing taxes on leisure complementary goods and thus raising the cost of leisure.

Keeping in mind that criticisms Atkinson and Stiglitz [42, 43] made with regard to differential consumption taxes in terms of economic efficiency, the assumption that the single rate consumption tax will result efficiently in terms of optimal taxation, and under the agreement that other assumptions of Ramsey rule remain the same, demand elasticity of necessity and luxury goods, which changed with the influence of macrovariables and microvariables, will be able to serve in enabling the aimed public revenue without contradicting justice in income distribution under inverse elasticity rule.

7. Conclusion

On the basis of an imperative tradeoff between equality and efficiency assumption, optimal taxation literature which claims that egalitarian redistribution policies of the state will create negative

results oppose redistribution policies of the state because of equality-efficiency dilemma. The main starting point on this topic is not being able to enable a certain budget revenue goal via lump-sum taxes because of the asymmetrical information between state and individual and the need for distortionary taxes. In this context, one of the propositions for resolution in the literature is optimal commodity tax application.

In optimal tax application with the aim of efficiency, discussion of single rate or differential tax application is in question.

Ramsey's study on optimal commodity taxes, which suggest goods to be taxed inversely proportional with price elasticity of demand, is one of the primary studies in the literature. While Ramsey rule basically proposes goods with low price elasticity of demand to be taxed at higher rates, its purpose is to preserve individuals' decisions about the consumption of goods with increasing prices unchanged as part of low elasticity, or in other words, a deadweight loss or wealth loss not to be formed in the economy. This rule, in which economic efficiency concern dominates, faces the biggest criticism because of the unjust distribution emerging as a result of the assumption that all individuals resemble each other.

With the inverse elasticity rule, Ramsey suggests necessity goods, which occupy a large share in the consumption basket of lower income groups, to be taxed at higher rates and goods, which appeal to higher income groups, to be taxed at lower rates due to demand elasticity. What is important in this context is whether price elasticity of demand for goods change or not as part of macrovariables and microvariables.

Price elasticity of demand for luxury and necessity goods rises depending on short and long term effect, commercial liberalization, and increased competition and innovation, which are all macroeconomic variables. On the other hand, since brand loyalty, which is the leading microeconomic variable, is high especially for luxury goods, it affects price elasticity of demand for the aforementioned goods.

Additionally, luxury goods to be taxed at higher rates under the assumption that they are leisure complementaries may affect the decisions of individuals on behalf of working. In this context, the criticisms brought about by Ramsey's rule in terms of economic efficiency at the differential taxation, it can be seen that the rule of inverse elasticity on equality can be reconsidered.

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Chapter 8

The Right to Water and Hydric Injustice: A Study on the (Un)Constitutionality of Tax Benefits to the Hydro-Intensive Industrial and Port Complex of Pecém-Ceará

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Additional information is available at the end of the chapter

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Abstract

The present work seeks to examine the compatibility of the instruments of taxation and tariff applied to the companies that compose the Industrial and Port Complex of Pecém, in order to analyze their compatibility with the Brazilian legal system, thus confirming their (in)constitutionality. Since the water crisis is a worldwide reality, especially for the semi-arid state of Ceará, water management is of extreme importance, with taxes being a tool for this, and its misuse can cause a real water injustice. In order to advance in this research, we carried out a comprehensive bibliographical and documentary investigation, besides a case study, which made us investigate the close relationship between the state's economic policy and the current water scarcity for human supply. We conclude that, considering that the Brazilian normative framework understands water as a human right and public good, the tax and tributaries benefits granted to the Industrial and Port Complex of Pecém constitute an affront to Articles 225 of the Federal Constitution and to Article 326 of the State Constitution and thus are unconstitutional.

Keywords: water management, human right, public good, tax and tributaries benefits, water injustice

1. Introduction

The current context of climate changes imposes severe challenges to the global order, as well as to the necessary reflections in the field of critical theory. Morin and Kern, analyzing the

"planetary agony," conceptualize the state of art of the "Earth-Homeland," as well as the "humankind-community of destiny" as a "polycrisis," or the "polycritical collective," all that are set on a context of interlacing crises of development, modernity and societies, therefore, a civilizational crisis [1]. Water shortage is one of the faces of the scenario of world clime, when it makes evident the focal points of the current development policy in Brazil. In this context, the State of Ceará experiences the perverse side of the hydric crisis.[1] It is well-marked by the unfair distribution of water and its intensive destination to large-scaled development enterprises. The Industrial and Port Complex of Pecém[2] is an emblematic case of a hydric-intensive and polluting[3] [2] enterprise, which relies on state subventions and public infrastructure to guarantee the feasibility of the enterprise. Such subventions challenge the effectiveness of the Right to Water and the dictates of the National Policy for Hydric Resources. In this research, we aim to investigate how the mechanisms of the unfair distribution of water threat the fundamental Right to Water and reinforce the selectivity of the access to the good. We use the case of the Industrial and Port Complex of Pecém as reference.

For the analysis, we emphasize the study of taxation and charging instruments and their compatibility with the legal system. In this way, the economic legal instruments that subsidize such an enterprise are analyzed under two prisms: the first concerns the balance between constitutionally protected assets and the second about the systematic interpretation of infraconstitutional hierarchy rules.

Conceptual rigor is necessary to distinguish and perceive the legal instruments under analysis. This is because the Industrial Complex of the Port of Pecém receives an articulated set of state subsidies; see:

1. The State Act n. 14.920/2011 authorizes the Companhia de Gestão de Recursos Hídricos (Company for Management of Hydric Resources, COGERH, in Portuguese acronym) to grant to the companies Porto do Pecém Geração de Energia S/A (08.976.495/0001–09) and MPX Pecém II Geração de Enerbia S/A (CNPJ 10.471.487/0001–44,) 50% discount on the cost of water tax.

[1]In May 2012, the Government of the State of Ceará declared situation of emergency in 168 of its Municipalities, affected by drought, through the Decree n. 30,922/ 2012, because of the confirmation of the abnormal situation in function of the relevant irregularity in the amount and distribution in time and space of rainfall in the state lands. This subject will be detailed through this analysis.

[2]The Industrial and Port Complex of Pecém (CIPP, in Portuguese acronym) was founded in 1995 and is situated in an area of 32.956,445 acres, 50 km (31 miles) from the state capital city, Fortaleza. The structures of the complex include a port terminal, a retroporto and in it there is an industrial district. Among the operating factories, there is a steel industry and a thermos-electric power plant UTE Pecém (for Usina Termelétrica Energia Pecé, working since 2012. It is coal-fired and its operation supplies electric power for 5 million inhabitants. The power-plant needs an amount of 30,000 m of water to generate 1 Megawatt, the quantity of power required to supply energy to 1000 residences.

[3]For instance, the Brazilian Institute for the Environment and Natural Renewable Resources (IBAMA, in Portuguese) condemned Ceará Portos, the company in charge of the CIPP, to pay 13.8 million Reais for environmental damage. The discard of mineral coal on the Pecém beach was the cause. Several seizures and penalties have already been imposed to CIPP, which is operating without some of the required licenses.

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2. The State Act n. 14.456/2009 ratifies the deal in which the "State commits to make feasible the negotiations with CSP to adjust the cost of average tax charged per m^3 of raw water offered in the moment of initialization of the industrial installations."
3. The State Act n. 15.593/2014, the State of Ceará authorized the concession of ownership to MPX Energia S/A of buildings in the plots of land 720 and 722, destined to the implementation of the Energetic Substation of Pecém II, in the Municipality of São Gonçalo do Amarante, through extra-judicial agreement of disappropriation.
4. The State Act n. 14.863/2011 authorizes the state to exchange the immobile good denominated Sítio Bom Jesus with the immobile present in the Anexo II, correspondent to a smaller part of the immobile with number registration 4509, of the 2nd Office of Immobile Registration of São Gonçalo do Amarante, of propriety of Rex Empreendimentos Imobilirários Ltda.
5. The State Act n. 16.024 granted tax benefits to the other unity of the Complex, to be build, reducing in 58.8% the basis for calculation of the Tax of Goods Circulation and Provision of Service of Interstate and Intercity Transportation (ICMS, in Portuguese Acronym,) incident on the internal operations and on the importation of natural gas destined to the thermal-electric power plant, resulting in a tax burden equivalent to 7%. It is important to underline that the reduction is destined to internal operations of natural gas being destined to the thermal-electric power plant that is intended to build and operate in the Complex.

Such institutes will be analyzed together in the research, but distinctions will be made from the particular legal nature in which they are grouped. This is because some of them constitute the reduction of tariffs, which constitute in the so-called public prices, that is, remuneration for the provision of services, which is charged by private individuals provided with public service, for a profit-making purpose, and there is no tax and binding legal nature. Here are the reductions on the cost of water tariffs.

The tax exemptions are presented under another legal nature. The tributes express manifestation of the state power, of which the taxes, fees and contributions are species. Its regulation is made constitutionally obeying the principles of the economic order. They constitute compulsory benefits necessarily instituted by law and, when they are charged for the provision of services, they must be specific and divisible.

The other subsidies are not of pecuniary nature, but of real rights, with the concession of land and infrastructure for the enterprise. In this research, the emphasis is on the analysis of the economic institutes that reduce the charging and the taxation, interpreting it in accordance with the constitutional and legal framework that rules the matter.

At first, the central hypothesis of the work is consistent with the vertical and horizontal effectiveness of fundamental rights, to affirm that the protection of the human right to water must be guaranteed in both the tariff instruments and in the tax instruments. There is a complex normative system that governs the right to water, in which the tariff mechanisms break with

the protective logic of the environment by favoring the economic model to the detriment of the norms that direct the priorities of water use.

Thus, we emphasize that the concession of tariff and tax subsidies does not constitute a decision exclusively discretionary of public managers but must primarily be fully compatible with the legal system. Having said that, it is essential to find the legal protection of water in order to analyze the legal economic instruments.

2. The hydric crisis in the background of the Anthropocene and of the climate changes: the Brazilian Northeastern semi-arid

In the context of how the case under study is inserted, it should be pointed out that the planet is immersed in a social-environmental and civilizational crisis yet not experienced by the human society. Its graver and more evident face, but not the only one, is the super warming of Earth and the climate changes. Even with the presentation of the 5th Assessment Report on Climate Change of the Intergovernmental Panel on Climate Change (IPCC), the publicizing of the previous report in February 2007 caused an unvulgar impact, due its utmost grievous conclusions. They indicate that the warming in the climate system is unequivocal, concerning to the climate changes and their consequences, as well as the causes of the warming, which are related to the emission of greenhouse gases. They are anthropogenic and not natural. The impacts on nature and society are already tangible [3]. The current situation has aggravated. 2016 was the warmest year since the beginning of temperature measurement in 1880, when this record had been broken for the third consecutive year [4]. The projections of the climate science are already indicating the catastrophic increase of 3°C (37.4° F) in the global average temperature [5]. In this scenario, the existence of extreme climate-environmental phenomena is recurrent: droughts, hurricanes, floods, etc. Such phenomena have become gradually more intense, until the moment when a war-vocabulary word had been lent to the ecological repertoire with the figure of the "climate refugee" or "environment refugee," which are already millions of people on the planet. In 2001, the International Red Cross published the "World Disasters Report," predicting the existence of 50 million climate refugees in 2050 [6]. However, the climate changes as well as the global warming are only the more evident face of a deeper crisis. It is directly related to the current configuration of the Capitalist mean of production-with its development model grounded on the fossil fuel paradigm and its productive-consumerist–centered vision.

Such social-environmental has multiple nuances, and the hydric problem is one among them. It has been manifested in the planetary order. According to the UN, water shortage affects more than 40% of the global population and must increase. It is estimated that 783 million people have no access to clean water and more than 1.7 billion people nowadays live in hydrographic basins where the use of water exceeds the reloading capacity [7]. Historically marked by inequality of access to water, the Northeastern region of Brazil, where the Pecém Port Complex is located, subsidized by tariff and tax instruments, is the part of the country where droughts are more usual. According to the Brazilian Panel for Climate Change, the decrease in rainfall during the Winter can reach 50% by the end of the century [8]. It is important to

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add to this a physical-climate factor-the fact that the lands of the State of Ceará are in the drought-polygon, right in the Northeastern semi-arid. In such region, the evaporation amount exceeds the precipitation one, which aggravates the climate situation: in the analysis made by Frischkonr, Araújo and Santiago:

A mean annual rainfall of about 900 mm competes with a potential evaporation of 2200 mm powered by 3000 h of sunshine. Real evapotranspiration is of the order of 700 mm (SUDENE 1980; corresponding to 78% of rainfall), leaving only about 120 mm (13%) for runoff and 80 mm (9%) for percolation. Specific runoff in the region is of the order of 4 L/s/km^2 to be compared with 21 L/s/km^2 for all of Brazil (Barth et al. 1987) [9]. In this scenario – a collapse – in the environmental, climate and hydric spheres, we intend to research, in the following, the Right to Water and the violation to it, what happens because of the development policies adopted by the last governments of the State of Ceará.

3. Water: a common good and a fundamental human right and the denying of it as hydric unfairness

3.1. The right to water in the international law

The United Nations broach the Right to Water in many of its documents, some of them centerpiece here: The General Commentary n. 15, from November 2002, from the United Nations Committee for Economic and Social Rights, for instance, affirmed that "the human right to water presupposes that everybody should have sufficient, safe, acceptable and physically accessible water with reasonable prices for personal and domestic use."[4] [10] And the Resolution 16, from April 2011, from the Council for Human Rights, with the adoption of the access to potable and safe water and sanitation as human rights. However, the major centerpiece is the Resolution A/RES/64/292 [11], passed on July 28, 2010, by the General Assembly of the United Nations[5] [10], which declares that clean and safe water and sanitation are an essential human right for the full enjoyment of rights, as well as for all the other rights. For Wolkmer and Melo, the international recognizing of the Right to Water made the international community commit—by the National states—to the protection and tutelage of such right [12]. Nevertheless, in the field conventionally called Latin-American Neo-constitutionalism, particularly in the case of multinational States, such as Bolivia and Ecuador—countries where the Andean indigenous tradition of Well Living is spread, we can find the best deal of the hydric problem (as well as for the other environmental problems), specially from the innovating concept that Nature is itself a rights holder.

The Mother-Earth Act (*"Ley de Derechos de la Madre Tierra")* in Bolivia, for instance, recognizes the rights of Earth as a living system. [13] In Ecuador, similar mechanisms can be found in the Constitution of the Republic itself. [14] For Marques, the recognizing of

[4]Gabriela Riva considers the General Commentary 15 as "the most complete document on the Right to Water, clarifying the duties decurrent of such right and defining precisely its bounders."

[5]In Riva's view, this resolution was "the greatest victory for the access to water movement […] passed by 144 votes in favor, 41 abstentions and no vote in con. […]"

the rights of nature stands beyond the "long history of the universalization of the subjects of right." Indeed, the author considers unsurpassable concept that it emanates from the demand of the conservation of the planetary biota to save, ultimately, the survival of the current society [15]. From that notion, water can be considered, in this eco-centered or bio-centered background, as a rights holder subject. Ana Alice de Carli defends this concept from the fundamental necessity of "awaking the ecological conscience and the duty of taking care of the water of all people." [16]. In the same direction, there have been taken important decisions in March 2017, in India, where the Ganges and Yamuna Rivers had obtained the status of "an alive human entity," and in New Zealand, where the Whanganui River obtained the same rights of a human being [17]. Following, it will be shown that the Brazilian law takes the management of hydric resources and the right to access to water according to the main documents of International Law, which assure the Right to Water, embodying such right into the National Law.[6]

3.2. The right to water in the Brazilian law

The conception that the political formula for the Brazilian Constitution of 1988 is the State of Environmental Law (or, in a more detailed definition, a socio-environmental democratic state under the rule of law), results of a dialectical synthesis "post-positivist," which surpasses the antinomy jusnaturalism x positivism [18], according to Belchior. It acknowledges the status of self-applicable juridical rule, and not only as a promise of rights. Marlmestein refers to what he defines as the "triumph of constitutionalism, with the renovation of the thinking and the judges in charge of the Supremo Tribunal Federal (also known as STF) the Brazilian supreme court. In his analysis of court works, he observes that"[…] nowadays, it is matter of no discussion in the jurisprudence of the STF, the understanding that it is possible to extract from the constitutional principles direct commands on the lawmakers [19], by force of the maximal effectiveness of the constitution." Among those fundamental rights-of socio-environmental nature, strictly according to the already mentioned meaning by Sarlet and Fenterseifer [20]-there are the Right to an Ecologically Balanced Environment, to Health and to Water. The Brazilian Constitution directly recognizes the first and the second ones in its own text. Even though expressed in different articles of the Constitution, there is no possibility to interpret them independently from the Rights to Health, presupposed in the Article 196, as well as the Right to Balanced Environment, in the Article 225.

The relation between the quality of the environment, which is supposed to be ecologically balanced, and the healthy quality of life, presupposed in the Article 225, can be found in the synthesis definition of the World Health Organization (WHO) that states health as "a complete state of physical, mental and social well-being and not merely the absence of disease and infirmity" [21]. Thus, there is no possible way to think a dignified life in a non-balanced, non-healthy and non-sustainable environment—in its natural, artificial or cultural dimensions. Machado stands by the idea of water as a fundamental human right, as a direct consequence

[6]The expressed rights ant guarantees in the Constitution do not exclude other ones, decurrent of the its regime and principles, or in the international deals that the Federative Republic of Brazil participates. (The Article 5, Paragraph 2 of the Brazilian Federal Constitution.)

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of the Rights to a Balanced Environment and to Health, since the access to the "precious liquid," even in quantity or decent quality, is a *conditio sine qua non* for a healthy quality of life. In his own words:

The individual access to water deserves to be understood as a universal human right, which means that any person, in any part of the planet, can collect, use or appropriate water to the specific intend of survival, in other words, to not die because of lack of water, and at the same time, to enjoy the Right to Life and to Ecological Balance [22]. D'Isep, after adducing that the Right to Water is a precursor of all the other rights, clarifies a series of definitive conclusions in which those rights are present and states that the Right to Water is manifest as a "universal principle of the fundamental right to water-life" [22]. The Right to Water and Right to Sanitation are also encountered in the reflections of Sarlet and Fernsterseifer, when the authors state that it is in the theoretical framework of the State of Environmental Law that one can find what he/she denominates as the fundamental socio-environmental rights. This concept is related to the idea of indivisibility and interdependence of the fundamental human rights, in which the authors gather the rights, which are, at the same time, social and environmental. In their own words:

> *The environmental protection […] is directly related to the guarantee of the social rights, since the enjoyment of these ones is dependent of favorable environmental conditions. As in the case, for instance, of the access to potable water (through sanitation, which is also a fundamental social right of the minimal necessary to existence.) […] The effectiveness of the supply service of water and sanitary sewage integrates, directly or indirectly, the normative field of diverse fundamental rights (but, especially, the social rights), as the Right to Health, the Right to Decent Dwelling, the Right to Environment and the "forthcoming" Right to Water (essential to human dignity) as well as, in extreme cases, also the Right to Life* [22].

What the authors denominate "forthcoming" right-despite the claim of its insertion in the current positive normative framework of the Constitution of the Republic, as required by Machado [22]-is already present in some recent acts, such as the *Estatuto da Cidade* (the Basic Law of the City, Act 10.257/ 2001), the *Lei de Saneamento Básico* (Sanitation Act, Act 11.445/2007), and specially, the Act that instituted the National Policy for Hydric Resources (Act 9.443/1997).[7]

Whereas in the first rule-*the Estatuto da Cidade*-the right to the environmental sanitation integrates the first list of guarantees of the so-called right to sustainable cities (one of the guidelines of urban policy), presupposed in its Article 2, Incise 1; the Act 11.445/ 2007 in its Article 3, Incise 1, defines sanitation as a collection of services, infrastructure and logistic installations of "potable water supply, sanitary sewage, urban cleanness and management of solid resources and drainage and management of urban rain water." (Act 11.445/2007, Article 3, Incise I.) The act also established as one of its fundamental principles the universalization of access (the progressive enlargement of access of sanitation for all occupied residences), in the words of its Article 2, Incise 1, combined with Article 2, Item 3.

[7]Nowadays, the Proposes of Amendment to the Constitution n. 39/ 2007 and 213/ 2012 are submitted to the Congress examination. They propose to transform the Right to Water in a Constitutional Right.

Finally, the Act that instituted the National Policy for Hydric Resources, in this search for grounding of the fundamental socio-environmental right to water, should not be forgotten. It is the Act 9433/1997, especially concerned with the use of raw water, since the issues of potable water are part of the already mentioned policy of sanitation.

It is important to say that the principles of the National Policy of Hydric Resources (article 1 of the law) bring fundamental (some contradictory) definitions for the treatment of the right to water, namely, the character of water as a "public property" (which is consonant with the concept of the environment as "good of common use of the people", inscribed in article 225 of our Constitution) and endowed with "economic value" - which could, in theory, contain a term contradiction.[8]

The act also deals with a vision of "multiple uses" in the management of hydric resources, which alludes a perspective of conflict of the terms in a quarrel of a limited resource, as the act itself acknowledges and tends to deepen in times of climate change. It also assures that, in the situation of scarcity (and only in such cases, which is the other contradiction with the guarantee of the Right to Water), the prior use of water will be destined for human consumption and animal watering.

Water shortage, treated as a "calamity," is one of the circumstances that can lead to the suppression, partial or total, definitively or with no determined deadline, of the grants of the right to the use of hydric resources, besides other cases, such as the prevention or reversal of severe environmental degradation or the necessity to respond to prior uses, of collective interest, for those there are no other alternative source (Article 15, PNRH). According to D'Isep, the instrument of granting is an answer to the rarity of such resource, since "it legitimates the intervention of the State into the management of the access to water, therefore, in the regimentation of its use, in order to assure the social satisfaction, which is the healthy and dignified life" [22]. The grants of the rights of hydric resources consist in the instrument created to guarantee the "quantitative and qualitative control of the uses of water and the effective activation of the rights to access to water" (Article 11, PNRH) in order to guarantee, at least instance, the prime objective of the National Policy of Hydric Resources, which is, "assuring to this generation and to the next to come, the necessary availability of water, within the adequate patterns of quality to its respective uses."

And it is precisely this instrument created to guarantee the Right to Water for present and future generations that can, on the other hand, be responsible for situations of what can be called today water injustice, a concept that stems from environmental justice conception developed by Acselrad et al. [23], for whom this is a set of principles and practices aimed at equity, access to information and, fundamentally, democratic and participatory processes of defining not only the uses of environmental resources and the destination of tailings, but mainly, of public policies, especially those of socioeconomic development. In a counterpoint, the authors define environmental injustice as the mechanism through which unequal societies,

[8]The criticism against the vision of water as a worth is well grounded by Gabriela Riva, for who "the exclusive use of the economic approach did not consider the ecological bounders imposed by the water cycle and also the economic limits imposed by poverty and inequality, having done no contribution to the conservation of water and the democratization of the access to it. (Refer to the text, p. 39.)

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from an economic and social view, allocate the major amount of environmental damage in lower income populations, groups racially discriminated, traditional ethnic peoples, workers' neighborhoods, the marginalized and vulnerable populations [23]. Martinez Alier, on the other hand, works with this concept-environmental justice-as one of the chains of the ecologic movement, synonym of *ecology of the poor*, or *popular ecology*. For that author, the Ethics of this movement is decurrent of the demand for social justice. According to him, "disgracefully, economic growth implies in bigger impacts on the environment, drawing one's attention to the geographical displacement of the sources of resources and the areas for waste discard" [24]. When that fair distribution of social and environmental goods is alluded, it must include water among them, a good of public domain (Article 1, Incise 1, Ac 9.433/1997) and an essential factor to healthy quality of life, preconized by the Article 225 of the Brazilian Constitution. The unfair distribution, the denial or the obstruction of that common good, as already mentioned, as well as the favorability to economic groups instead of human populations, is considered, evidently, as hydric injustice.

Working the concept of hydric injustice, as taught by Porto-Gonçalves, means thinking of water as a territory, or in other words, "[…] as the inscription of society in nature, with all the contradictions implied in the process of appropriation of nature by man and women through their social relations of power" [25]. It is interesting in this research to observe how the economic legal instruments of taxation and tariff are related to the promotion or reduction of this water injustice from the empirical case study. Those relations of power are exactly what produce environmental injustice, through the private appropriation of hydric resources, even when legalized by the instrument of grant of the right to use. The case of the "thirsty industries," in other words, hydro-intensive, located in the Industrial and Port Complex of Pecém (CIPP, in Portuguese) in the Municipality of São Gonçalo do Amarante, in the State of Ceará is a relevant example of the exposed scenario.

4. The tax benefits for the hydro-intensive industries of the Complex of Pecém: a debate on its (un)constitutionality

The economic policy of the Estate of Ceará is inserted in the context of neo-developmentism [26], associated with neo-extractivism [27]. Both share the idea of progress with unlimited growth, a perspective that justifies the appropriation of environmental goods and the conception that the state and the market consist of complementary fields, to provide economic growth, powered by large-scaled enterprises.

In such context, it is important to highlight the fundamental role the state plays in the contribution of these large-scaled enterprises. The case of CIPP is not different from others, for which the state works as a factor of stimulation and facilitation for their installation. The specific literature indicates the recurrence of environmental conflicts involving a productive hydro-extensive matrix subsidize by the state. In Ceará, the following cases are remarkable: the agribusiness in the Chapada do Apodi [28], the project of mining of uranium and phosphates in Santa Quitéria [29, 30] and the shrimp production in traditional Quilombos' lands [31].

A distinctive trace of those enterprises is in the emphasis of this research: the state subsidizing of the enlargement of environmental goods supplies, violating the nature of water as a human right and a common good [32], as discussed in the previous chapters.

The character of economic worth that is also attributed to water by the normative system is defined by Enrique Leff as a process of privatization of water, which would be "promoted in a narrative that intends to obtain the 'rational use and efficient management of water,' turning the users into payers for the 'real cost' of the resource supplying." And, in addition to that, it is characterized as one of the "strategies of the expansion of the natural capital to absorb environmental goods and services, in other words, the natural common goods of humankind." However, large-scaled enterprises happen to be polluting and hydro-extensive, in which we observe the perverse inversion in the logic of pricing of the environment: those with major economic capacity receive tax benefits from the state.

Here, there is the core of the proposed work, which is the analysis of the anti-law nature and the hydric injustice in the subsidizing granted by the state to the Industrial and Port Complex of Pecém. But before going into the analysis itself, it is important to briefly define the enterprise in question. Only for the Steel Company of Pecém, there are innumerous other public grants, and their operation obtained the grant of 1500 L a second for the company. Also, the infamous thermal-electric power plants of Pecém are owners of grants of voluminous water flows, available in the Portal Hidrológico do Ceará (Hidryc Website of Ceará, in free translation) Below follow the systemized grants:

1. Grant n. 41. Granted volume: 9.460.800 m^3-flow 300 1/s-Recipient: PORTO DO PECÉM GERAÇÃO DE ENERGIA S/A;
2. Grant n. 136. Granted volume: 15.768.000 m^3-flow 500 1/s-Recipient MPX Mineração e Energina LTDA;
3. Grant n. 454/2016. Granted volume: 9.460.800 m^3-flow 300 1/s-Recipient MPX PECEM II GERAÇÃO DE ENERGIA S/A;
4. Grant n. 577. Granted volume: 2.57.944-flow 891 1/s-Recipient TERMOCEARÁ LTDA.

To guarantee the feasibility of the hydric consume of the enterprise, the fifth part Eixão das Águas was inaugurated in 2014. It consists in a mean for transferring of water and interlinking of hydric basins. Besides that, the other source of water supply for the thermal-electric power plant of Pecém was the Reservoir of Sítios Novos. Its data in 2015 indicated it supplied a volume of 600 L a second, which caused its drain. In February 2017, its volume was 0.07% of its natural capacity, according to Portal Hidrológico [33].

Observing the investigative purposes of this research, initially the analysis is centered in the benefits that grant a reduction of 50% in the water tax for thermal-electric power plants and for the steel industry of the Complex. It is also remarkable how the tax subside is inserted in a complicated contribution of fiscal reductions and the availability of public infrastructure for the enterprise. This is State Law No. 14,920/2011 and State Law No. 14456/2009.

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Having said that, the analysis goes through the comprehension on the juridical nature of the apparatus of the water bill. It is consistent with the propitious way that establishes the public prize and tax for the industrial consumers, presupposed in the National Policies (Federal Act n. 9433/1997) and in the State Policy of Hydric Resources (State Act n 14.844/2010). Both laws state the function of the apparatus, which is to guarantee a rational use of water.

The Act that instituted the National Policy of Hydric Resources has one chapter dedicated to the apparatus of billing water, discussing on its criteria, later regimented by the State Decree n. 32.032, on September 2, 2016. It confirms the prime goal of water bill, seen as an instrument of rationalization of water use.[9]

In Ceará, it is used as a model of billing water different from the billing used in other hydrographic basins. It is as follows:

> *… it is characterized by its binomial form, grounded in its marginal cost of management of hydric resources and in its capability of payment of each category of consumer. […] However, in consequence of the necessity of structuration of the management authority, the universalization of grant, as well as a wider comprehension and acceptance of the consumers, the charging was implemented in a mononomial form, admitting taxes only defined by the water consumed. (Consumer tax)* [34].

For the juridical doctrine, billing water is an instrument capable to promote sustainable development. Because of its character of public good of common use, it is affirmed that "the payment of the use does not imply in the creation of any kind of right on the water, as already observed, for being a public good, it is inalienable [35].

In the case of Ceará, the Decree that regiments the billing water presupposes different taxes for "enterprises considered as structuring for the State of Ceará" (Article 9, Decree n. 32.032/2016), which threatens the prime goals of the instituted bill.

The unsustainable water demand of the project caused the State of Ceará to approve, by law, the creation of the Emergency Water Charge, which burdened the water consumption of the thermals. In reaction to the measure, the two largest coal-fired thermals, Pecém I and II, contacted the National Electric Energy Agency (Aneel) stating that they would not be able to continue operating if the price adjustment of the energy tariff is not allowed, as a way of compensating the increase in water costs. The request was rejected by the Agency and later by the Judiciary.

The Contingency Tariff consists of an instrument authorized by State Law 16.103/2016, which created the Contingency Tariff for the use of water resources during a critical situation of scarcity. The norm was regulated by the Resolution of CONERH (Council of Water Resources of the State of Ceará) number 006/2016, providing that:

[9]The Decree defines the following criteria for the Industrial Water Bill: Article 3: The billing for the use of raw water in the domain of Ceará will vary according to the following categories of users, for surficial and underground collection: II – Industry: (a) The supply of water with complete collection and adduction by COGERH: T = 2.067 Reais and 59 Cents per 1000 m; (b) The supply of water with complete or partial collection and adduction by the user from water sources, such as reservoirs, rivers, lagoons, underground lakes and rivers or channels: T = 601 Reais and 03 Cents per 1000 m.

> *Article 1. Establish the value of contingency tariff for the use of the water resources of the State of Ceará, in the industrial purpose, granted to thermoelectric companies Porto do Pecém Generation of Energy, MPX Pecem II Generation of Energy S/A and MPX Mining and Energia Ltda.*

In its sole paragraph, it remains clear that "The contingency fee for the use of water resources differs from the tariff for the use of water resources because it is transitory, objective to cover the additional expenses arising from the Critical Situation of Water Scarcity and stimulate rational use".

That would be sufficient to ensure that there was no confusion between the legal instruments at issue. Thus, it should also be clarified that the Resolution established that:

> *Article 2. The contingency tariff for the use of water resources applied to users established in the caput of Article 1 will have the value of R $ 7210.00/1000 cubic meters.*
>
> *Sole Paragraph. The amount indicated in the caput of this article will be added to the value of the collection fee for the use of water resources and applied to all the volume consumed.*
>
> *Article 3. The value of the contingency fee for the use of resources provided for in this Resolution shall be charged for the duration of the Declaratory Act no. 01/2015/SRH, published in Official Gazette of October 7, 2015.*

The act to which Article 3 refers consists of a Statement of Critical Situation of Water Scarcity in the State of Ceará. According to Article 2, the Tariff will have the value of R $ 7210.00 /1000 cubic meters. If the Tariff, which is eminently transitory, is no longer applied, the companies benefiting from State Law 14,920/2011 would pay half of the industrial tariff.

It should be noted that, despite the mitigation measure created with the Emergency Charge, the consumption of water by the thermals is not decreasing, nor has the volume granted been altered, revealing that the measure proves insufficient to guarantee the protection of human supply and that there must be a complete revision of the tariff economic instruments on a permanent and non-temporary basis.

That said, it is considered that economic compensation measures cannot be ignored to reduce water consumption and increase efficiency in economic activity, either because these companies tend to pass the costs of the tariff to the price of electricity or because costing and profitability remain in force, even though the economic sector is strained by passing on the increase in costs.

In this research, it is remarked that the subject does not approach exclusively to a discretionary politic decision, since the fundamentality of the Right to Water and the infra-constitutional regimenting of the hydric management institutions conditionate and design the discretionary margin of the state agencies.

The second legal regime that merits analysis concerns tax exemptions, according to the distinction made in the introduction of this research. In the present case, in addition to the reduction on the water tariff price, the State of Ceará also reduces taxes on the main inputs of the project, notably the tax called ICMS, Service and Goods Circulation Tax.

It occurs that taxes, a kind of tribute, instituted by law and regulated under a specific legal regime, are disciplined under their own norms and principles. In Brazilian systematics, ICMS

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is a tax of an extra-fiscal nature, which is a competence of all the states of the federation, subject to the principles of selectivity and essentiality, that is, to the regime of harmonious protection of assets protected by the constitutional order.

On the tax instruments, then, we must make some observations. The principle of selectivity consists of an instrument of state extrafiscality and includes a minimum selection of taxes, among them the ICMS, which was reduced as a financial contribution to the industries of the Pecém Complex. Extrafiscality consists in the use of instruments of the Tax Law whose primary purposes are not cash collection, but non-fiscal objectives, of stimulus or control to certain behaviors and economic activities.

On the other hand, the principle of selectivity establishes that, for goods of greater essentiality, the rate will be lower, and the inverse will occur for less essential (or harmful) goods. It applies to indirect taxes, that is, those that have repercussions on the final consumer, and still, a fiscal justice technique to foster the progressiveness of the tax system. It is expressly provided for in the constitutional text:

> *Article 153:*
>
> *Paragraph 3. The tax established in item IV:*
>
> *I - will be selective, depending on the essentiality of the product;*
>
> *Article 155:*
>
> *§ 2. The tax provided in item II shall comply with the following:*
>
> *III - may be selective, depending on the essentiality of goods and services;*

Although subsection III, Paragraph 2 of Article 155, regarding the ICMS speaks of "may", the application of selectivity does not consist of a faculty. The correct and predominant interpretation is that the term "may" corresponds to a "must," as it is present in item I of Paragraph 3 of Article 153 of the Brazilian Federal Constitution of 1988, which establishes on the principle of selectivity also for the Industrialized Products Tax. Thus, there is no faculty, but mandatory in observance of the principle, this being the dominant understanding and that appears in the Proposal of Constitutional Reform Tax, in process in the National Congress. In RMS n° 28.227/GO, from the report of the Minister Herman Benjamin, the Second Panel of the Superior Court of Justice unanimously decided that "there is no doubt that the state legislature can not simply disregard the norm set forth in Article 155, § 2°, III, of CF, because of the inherent appropriateness of the expression "should be selective."

It should be noted that the National Tax Code also enshrines the norm, stating in Article 48 that "The tax is selective according to the essentiality of the products.". Essentiality, which guides the application of tax selectivity, is not only a moral or ideological conception, but a real verification of the importance of a merchandise or service for tax justice. The possible tax favorability seeks facilitate access to essential products for a life with quality and dignity. This is why the state charges cigarettes and alcoholic beverages, for example, and exempts medicines, food and items essential to human dignity.

It is also necessary to understand the relationship between essentiality, instruments of fiscal justice and the promotion of material equality. One of the elements that guides the extrafiscality has to be to ensure that those with greater capacity, expecially when they profit from economic activity whose nature involves risks and damage to the environment and health, deal with the tax burden. In the present case, large industries are benefiting from the fiscal renunciation of the State, with full tax capacity, making the rules that subsidize it even more incompatible with the legal system.

On the other hand, the data that indicate the annual liquid profit of the company EDP Energias do Brasil (Holder of Porto do Pecém Geração de Energia S/A – Pecém I) are relevant. It was 1265 billion Reais [36], making evident the economic capacity of the sector. It corroborates the thesis of the absence of reasonable and juridical justification and normatively based of the granted subsidies.

Synthesizing, the normative aim is to privilege the essential products for a good life, dignity, social justice, and not extremely polluting economic activities that have ample capacity to bear the regular tax burden. Therefore that is no reason to go against the increase of the final product, considering that the objective of the extra-fiscal standard is exactly discourage harmful behaviors to the community, such as the intensive and wasteful use of water, in addition to the environmental pollution caused by the thermoelectric company of the Pecém Complex.

Thus arises the reflection about the compatibility between, on one hand, the water tax reduction and subsides offered by the CIPP and, on another hand, the normative content of the constitutional principles that found the juridical order. Taking a look at the issue, the policy of subsidies with the effectiveness of the constitutional right to the balanced environment and the healthy quality of life, from which the democratic and regulated access of essential goods to guarantee human dignity, consonant with the theoretical contribution exposed in the previous items of the research.

The normative environmental discipline also deals with the protection of the hydric resources. *A priori*, it is important to remark water as a member constituent of the environment and include it in the words of the Article 225 of the Brazilian Constitution.

The constitutional embodiment of water and other rules characterizes the phenomenon denominated "Constitution of the Environment and Ecology of the Law" [37]. The normative analysis of the subject, presented in the initial chapters of this work, indicates an incongruence between the Right to Water and to Environment and the grant of tax subsidies for hydro-intensive enterprises.

In addition to that, it is worth to mention that the Article 225 also emanates from other related principle, which finds technical terminologies differenced in the doctrine, such as "the Principle of Obligation of Intervention of the Public Force," in Machado. [22] Such intervention is oriented under the criteria of distributive justice, social equality and the maximal environmental tutelage. Therefore, the state intervention in the case of CIPP is a threat to this paradigm.

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Finally, the principles that interest the debate concerning water should not exclude the principles of precaution and preventive actuation, which are founded in Principle 15, of the Declaration of Rio on Environment and Development, which Brazil signs. Paulo de Bessa Antunes [38] indicates that the principle of prevention should be applied when the possible impacts in the future are acknowledged, whereas the principle of precaution (or caution) should be applied when the probable impacts are uncertain or unknown. In both cases, when the impacts are known and in front of scientific indications for the scenario of climate change, the incentive to the intensive, prodigal and polluting use of environmental goods violates the normative protective mark of the environment.

Looking at the Constitution of the State of Ceará [39], it can be observed that its text presents regimenting apparatus and its normative content is deeply damaged by the public subsidies grant to the hydro-intensive enterprises of CIPP. In its Article 318, the constitutional text states that "the State and the Municipalities have the duty do preserve their waters and to promote its rational use." In the Article 326, it states that the administration should guarantee "the multiple use of hydric resources and the apportionment of cost of the respective works in the rule of law" (Article 326, II, C.E.) and "the protection of water against actions that might compromise its present or future use" (Article 326, III, C.E.). The duty to preserve the waters, promote their rational use, and priority for human use and animal watering, are guidelines that can be observed in all legal systems in the country and state.

Thus, it can be also observed that the billing of use of hydric resources constitutes an indispensable instrument to the legality of the public management of water. This is not an option, or a discretionary act of the Administration, which can change depending on the individual to be disadvantaged. This is an administrative act fully linked to the law and its regimentations.

Therefore, our understanding is that a total or partial exemption from the billing of the use of hydric resources, with no justification under proportionality and impersonality criteria, violates the normative constitutional order. In addition to that, it does not consider the dictates of the National Policy and the State Policy of Hydric Resources in their priority of water supplying to human individuals, also damaging the principles of proportionality, reasonability and isonomy. It happens because the economic sector has a rather differenced treatment with no juridical justification.

Such considerations associated to the fatidic scenario and its severity should not be despised. In Ceará, the basin Gavião, which supplies water to the Metropolitan Zone of Fortaleza, with the Castanhão as the main reservoir in the state lands, is found in grievous situation. This reinforces the state of water shortage in Ceará and the necessity to take urgent decisions in hydric management, to guarantee the legal dictate that establishes the priority for water supplying for human individuals. It should also be highlighted that Castanhão had 4.94% of its water volume in February 2017. Currently, even after a rainfall period, the reservoirs in the state have 12.3% [40] of their capacity. On April 18, 2017, the State of Ceará declared Situation on Emergency in 168 of its municipalities for water shortage [41].

Thus, the tax and tariff instruments must be managed in accordance with the constitutionally defined environmental protection.

5. Articulated conclusions

As a contribution to the environmental critical field of investigation, we indicate the following considerations as a conclusion for this thesis:

1. There is an intimate relationship between the increasing climate change, the actual hydric crisis in the State of Ceará and the scarcity of water for the human supply service in diverse locations of the state, which tend to turn for the worse under the direction of the financial policy adopted by the state.
2. The Brazilian and Ceará's normative legal milestone allows to understand water as a human right and a common good.
3. The high consumption of water by the Industrial and Port Complex of Pecém (CIPP in Portuguese) materializes a case of hydric injustice and violates the priority of human water supply, established by the National Policy of Hydric Resources, as well as by the State Policy for Hydric Resources.
4. The granting of tax and tributaries benefits, constituent part of the context neo-developmentism, outrages the juridical nature of the instrument of billing of the use of water and the legal text of the National Policy and the State Policy for Hydric Resources, which state the rational use of water and the priority of human supply, and still defies the principles of the tax order. Both legal institutes, although of a distinct nature, are configured in economic instruments that must be in harmony with the system of environmental protection.
5. The reduction of 50% in the water tax for thermal-electrical power plants, as well as for the steel industry in CIPP, is unconstitutional, for the direct outrage it does to the Article 225 of the Federal Constitution of Brazil, in addition to its fundamental principles, as well as the Article 226 of the State Constitution of Ceará.

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Chapter 9

Current Status of and Problems with the Forest Inheritance Tax in Japan

Koji Matsushita

Additional information is available at the end of the chapter

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Abstract

The number of aged forest owners is increasing as Japanese society ages and the number of inheritances involving forest is increasing. The current forest inheritance policies, including the inheritance tax, were introduced after World War II and the entire inheritance system urgently needs improving. Although tax-reduction policies have decreased the forest inheritance tax, private forest owners are facing a greatly decreased domestic timber market and low stumpage prices. The number of non-resident and non-farmer forest owners is increasing, and the traditional farm family-based forestry system is facing a crisis. As the population of Japan decreases, especially in rural areas, the forest inheritance tax must be reconsidered so that non-resident and non-farmer forest owners who have little knowledge of forest management will sell their forests to new owners who are interested in forest management, such as current resident forest owners and forestry companies. Although the 2014 measure that postpones payment of the forest inheritance tax is an important way to support sustainable forest management, especially by large-scale forest owners, the targeted individuals who obtain the advantage must be reconsidered.

Keywords: family-based forestry, small-scale forestry, non-resident forest owners, non-farmer forest owner, aged forest owner, depopulation, tax reduction, postponement of tax payment, stumpage price, Glaser formula, forest management plan

1. Introduction

Two-thirds of all land in Japan is covered by forests and is classified by ownership. As of March 31, 2012, 7.7 million ha (30.6% of total forest) constituted the national forest, 2.9 million ha (11.6%) were public forest (owned mainly by prefectural and municipal governments), and 14.4 million ha (57.6%) were private forest (Forestry Agency [1]). Private forest

includes many types of ownership, but the highest proportion is owned by individual private foresters (hereinafter, called "forest owners" or "private forest owners"), many of whom were small-scale farmers in the past. A total of 1,018,752 people are forest owners with a total forested area of 5.7 million ha.[1] The forested areas owned by individual forest owners in Japan are generally small, as approximately 761,086 of the 1,018,752 owners have <5 ha of forest.[2] Almost all forest land owned by private forest owners was obtained by inheritance from family members, until now.

Japan has one of the most rapidly aging societies in the world, and 26.6% of the population was >65 years of age in 2015, more than any European country. In mountainous regions, in particular, depopulation and aging have progressed simultaneously. In about 44.4% of forest households, householders were ≥65 years old in 2000 [2]. Therefore, the proportion of households of which the householder is ≥75 years old is increasing. Forest inheritance will increase under these conditions and there will likely be problems related to forest inheritance in the near future.

Since the national land survey has not been completed, the number of forested areas for which the correct boundaries are not known is increasing, as many owners do not know the specific boundaries of their forested areas. Forest owners were more aware of their boundaries in the 1950s when fuelwood was consumed for heat. This relationship between the forest and forest owner weakened when fuelwood consumption decreased. In addition, as a result of depopulation and aging, some hamlets have disappeared [3]. In such districts, the new owners who inherited forested land were non-residents and were likely to abandon any forest management activities.

An inheritance tax is due when any property, including forest, is inherited. However, the inheritance tax and annual fixed property tax became a burden to private forest owners once they were no longer gaining additional economic benefits from the forest. The economic importance of broad-leaved trees decreased drastically when fuelwood was no longer consumed, and stumpage prices for coniferous plantation forests, such as *Cryptomeria japonica* and *Chamaecyparis obtusa*, decreased greatly. This became a problem because owners cannot afford the costs of planting and weeding after cutting when the stumpage price is low, and they cannot harvest the coniferous trees.

The problems of forest inheritance are complex and are related to various conditions and problems surrounding Japanese forestry. In this chapter, the problems related to forest inheritance in the current and near future are revealed from the perspective of the inheritance tax system. Section 2 presents the research methodology. A general explanation of the Japanese and forest inheritance tax systems is described in Section 3. In addition, three current problems are discussed: preferential treatments to reduce the forest inheritance tax, the relationship between the forest inheritance tax and the forest planning system, and the

[1] Ministry of Agriculture, Forestry, and Fisheries, the 2000 World Census of Agriculture and Forestry (in Japanese)

[2] In the 1990 World Census of Agriculture and Forestry, the minimum holding size of the surveyed forest owners was 0.1 ha, and 1,452,225 forest owners owned forest land from 0.1 ha to 1 ha.

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relationship between the forest inheritance tax and forest holding size. Finally, in Section 4, conclusions are reached and future research topics are proposed.

2. Methods

This research included a literature survey and analysis based on government statistics, predominantly from three sources.

The first data source was the National Tax Agency Annual Statistics Report,[3] in particular the national total number of ancestors and value of forest land properties from a breakdown table of inherited property by type. Although this data provided information on the ancestors, it was difficult to obtain data on inheritors. The value of timber was based on the price of standing timber at the standard cutting age, which is published almost annually in the form of a circular notice on legal interpretation from the Director General of the National Tax Agency to the heads of regional taxation bureaus. For example, in Yoshino, the calculation was based on the Yoshino forestry area of Nara prefecture under the authority of the Osaka Regional Tax Bureau.

The second source of data was the Census of Agriculture and Forestry, which included basic statistics related to forest owners, although the data were not always continuous due, for example, to national budget cuts. The minimum holding size of forest land included in the survey was 0.1 and 1 ha in the 1990 and 2000 censuses, respectively. Moreover, since 2005, the survey interval changed from 10 to 5 years, and the survey method changed completely. To account for these differences, only forest owners with ≥1 ha were considered in this study.

Finally, the third source of data was Housing and Land Statistics. The Statistics Bureau of Ministry of Internal Affairs and Communications collect this data every 5 years. Although the main objective of these statistics is to survey the housing situation, survey items related to land owned by each household were added in the 1998 survey. There are two surveys: survey A was completed by approximately 3 million householders and survey B was completed by 0.5 million householders. For the first time in the 2013 survey, survey A included a survey item on ownership of land other than current residence, including farmland and forest land.

In this chapter, examples of tax calculations for forest owners were not included, in part because the inheritance tax is estimated for all inheritance properties including forest and it is difficult to show a separate calculation for forests. Usui and Hayashi [4] noted that the contents of inheritance properties differ, and the value of the inheritance tax for forest and the burden it places on the inheritor may differ. Furthermore, it is generally difficult to determine all inheritance property based on on-site surveys.

[3]Tax statistics are available at https://www.nta.go.jp/foreign_language/tax_statics/index.htm. This statistic is published in both Japanese and English.

3. Status of forest inheritance tax

3.1. Inheritance tax

All inheritors must pay an inheritance tax, which is applied to all inherited properties, including forests. The amount charged is the exempted amount subtracted from the total value of the property. The current exemption is 30 million yen plus 6 million yen per inheritor. The tax rate is determined by the classification of the chargeable amount. A progressive taxation system is used, and the current rate is 10–55%. In 2015, the exemption was reduced from 50 to 30 million yen and the exemption per person was reduced from 10 to 6 million yen, resulting in a decrease in the minimum value for inheritance tax. In addition, the tax rate classification table was changed in 2015, and the maximum taxation rate was raised from 50 to 55%. The current tax rate table is shown in **Table 1**. The maximum tax rate decreased from 75 to 70% in 1988, and from 70 to 50% in 2003. In 2015, the maximum rate increased to 55%.[4]

3.2. Forest inheritance tax

The major taxes related to private forest owners include inheritance tax, which is a national tax, fixed property tax, which is paid as an annual municipal tax, and forest income tax, which is a national sales tax that must be paid by sellers of standing trees.[5]

Forests are evaluated by dividing the area into forested land and standing trees. The forested land evaluation is calculated by multiplying the evaluation of the property tax[6] by a constant number. When forest land is located near an urban area, its value is generally high due to the effect of the housing land price.[7]

Chargeable amount (million yen)	Taxiation Rate (%)
less than 10	10
10 – 30	15
30 – 50	20
50 – 100	30
100 – 200	40
200 – 300	45
300 – 600	50
600 and over	55

Source: National Tax Agency.

Table 1. Tax rate.

[4]In the United States, the maximum rate was 35% in 2011 (Butler [5], p. 374).

[5]There is limited literature related to inheritance tax in Japan in English. Examples include GHQ/SCAP ([6], pp. 64–66), the Forestry Agency [7], and Iwai [8].

[6]The registered area is used to evaluate the annual property tax ([9], p. 145). Generally, in areas where the national land survey has not been completed, the registered area is less than the actual area.

[7]Except for areas restricted to forest practices, forest owners can transfer the land use from forest to other uses, such as housing land.

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The current method to calculate standing trees is as follows [10]. The value of 1- to 39-year-old standing trees is based on the standard reforestation cost, in which the value for a 1-year-old tree is determined by the national tax office, and the value for 2- to 39-year-old trees is calculated as 1.5% the compound interest rate. The value of trees from 40 years old to the standard final cutting age[8] is calculated using the Glaser formula. **Figure 1** shows an example of this calculation based on *C. japonica*, with a standard final cutting age of 60 years.[9] In **Figure 1**, the black line shows the value from 1-year old to the fixed tree age and the red line shows the value from the fixed tree age to the standard final cutting age calculated using the Glaser formula.

In 2004, the compound interest rate was reduced from 2 to 1.5%, the fixed tree age at which the calculation method changed rose from 10 to 39 years, and the standard reforestation cost decreased.[10] **Figure 1** shows examples of the calculations before and after the 2004 amendment. The value of standing trees per ha decreased markedly for all tree ages after these changes.[11]

To calculate the value of trees older than the standard final cutting age, the value of standing trees, from the standard final cutting age to twice the standard final cutting age, is calculated

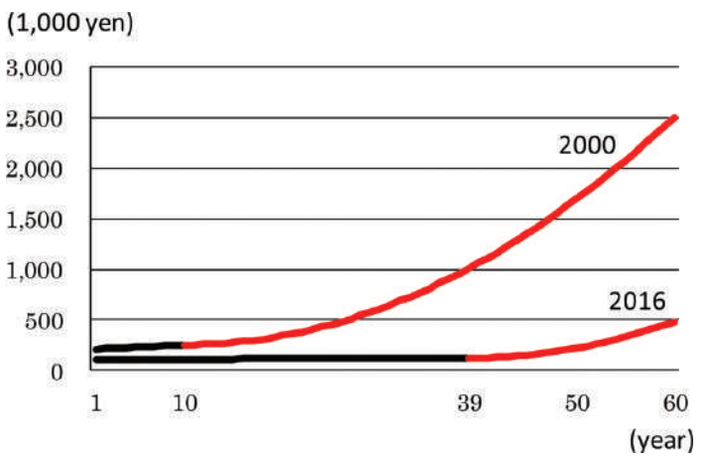

Figure 1. Example of evaluation of standing trees. Note: This is an example calculated using the final cutting age and the value of standing *C. japonica* trees at the final cutting age in the Yoshino forestry area.

[8]The standard final cutting age is determined by the circular notice from the Director General of the National Tax Agency for forestry areas. In the case of *C. japonica*, the standard final cutting age may be 50, 55, or 60 years, while that of *C. obtusa*, may be 60 or 65. In the amendment in 1993, the standard final cutting age was postponed by 5 or 10 years based on actual practices of tree cutting ([11], pp. 18–19). This postponement resulted in a decrease in the standing tree value. In the amendment, the standard distance between the location of trees to the nearest timber yard along forest road was changed. The distance changed from 1.5–2 to 0.3–0.5 km ([11], p. 19), resulting in a decrease in the evaluation of standing trees. Tezuka [12] noted that a distance of about 2 km was the average ca. 1955.

[9]This graph is based on **Figure 2** of Yamamoto [10].

[10]For example, the standard reforestation cost decreased from 210,000 to 103,000 yen for *C. japonica* and from 245,000 to 141,000 yen for *C. obtusa* ([10], p. 38).

[11]The 2004 amendment resulted in an average decrease in value to 50%, and maximum decrease to almost 30% ([10], p. 40). In the example in **Figure 1**, the decreasing rate is greater than the average decrease in the amendment in 2004, because the standard value at the standard final cutting age decreased, as shown in **Figure 2**.

based on a 2% compound interest rate.[12] The value of standing trees over twice the standard final cutting age is estimated based on expert opinions.[13]

The standard value of the standard final cutting age changes based on the actual stumpage price. The example in **Figure 1** is based on the standard value at the standard final cutting age in the Yoshino forestry area of Nara Prefecture, under the jurisdiction of the Osaka Regional Tax Bureau, a representative privately owned traditional forestry area in Japan. The standard value at the standard final cutting age in this area is shown in **Figure 2**. Over the past 20 years, the value has decreased, although this decreasing trend recently stopped.[14]

Table 2 shows the standard values per ha at the standard final cutting age in 1999 and 2016. The standard values decreased in all forestry areas. The value in the Yoshino forestry area, used in the example of **Figure 1**, decreased at a rate of 82.5%, showing the maximum decrease.

As a result of a number of changes, including the standard value of standing trees at the standard final cutting age, the value of standing trees has decreased in recent years.

3.3. Measures to reduce the forest inheritance tax

After evaluating forested land and standing trees, several tax reductions are available. If the forest is specified as a protected forest under the Forest Act (Act No. 249 of 1951), the value of

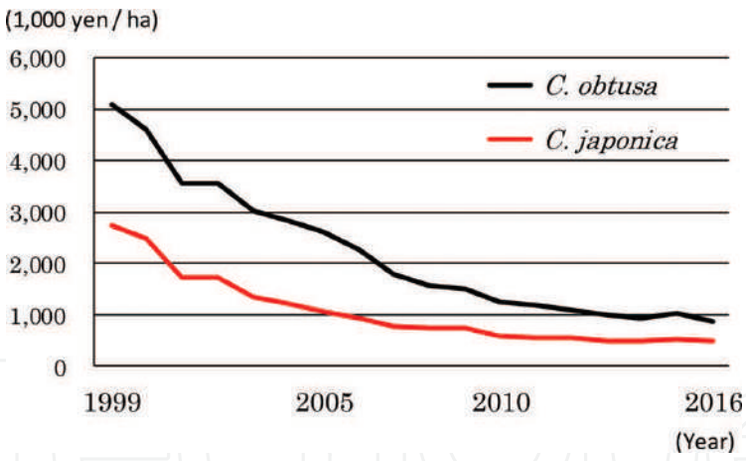

Figure 2. The standard value of standing trees at the standard final cutting age. Source: National Tax Agency. Note: Example in the Yoshino forestry area. As data are lacking for 2002, values for 2002 are the same as those for the previous year.

[12]In the example in **Figure 1**, the standard values per ha at the standard final cutting age, 60 years, in 2001 and 2005 were 2,500,000 and 480,000 yen, respectively. Calculated from the 2% compound interest rate until two times the standard final cutting age, the value of a 120-year-old tree would be 8,203,000 and 1,575,000 yen, respectively.

[13]This rule is based on the circular notice from the Director General of the National Tax Agency.

[14]Some individuals who elected to postpone payment of the forest inheritance tax expressed their opinion on the reduction of the payment related to the decrease in the standing value because both the stumpage price and standard value at the standard final cutting age decreased ([13], p. 128).

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(1,000 yen, %)

Prefecture	Forestry area	1999	2016	Change
Miyagi	North part of Miyagi	1,530	560	-63.4
Tochigi	Watarasegawa	1,860	710	-61.8
Tokyo	Tama	1,750	390	-77.7
Shizuoka	Tenryu	1,710	480	-71.9
Fukui	Echizen	2,140	550	-74.3
Nara	Yoshino	2,750	480	-82.5
Shimane	Hiigawa	1,440	470	-67.4
Ehime	Imabari and Matsuyama	1,400	480	-65.7
Fukuoka	Chikugogawa and Yabegawa	1,110	330	-70.3
Kumamoto	Kumagawa	1,020	440	-56.9

Source: National Tax Agency.

Table 2. Standard value at the standard final cutting age of *C. japonica*.

the forest land and standing trees is reduced by 30–80% according to the cutting method allowed (**Table 3**). In forests where cutting activities are completely prohibited, the reduction rate is 80%.

If a forest falls under a forest management plan in the Forest Act, a 5% reduction has been applied to the evaluation values of the forest land and standing trees since 2002.[15]

A 15% reduction is applied to the evaluation value of standing trees. For example, if an inheritor takes possession of a 20-year-old plantation forest and sells the forest when the trees are 50 years old, the forest income tax on 50-year-old trees will be applied. However, because the forest was inherited, ancestor(s) owned from the planting year until they were 20 years old. Thus, the 15% reduction rule[16] was introduced for standing trees across the board to cancel out future income tax related to the first 20 years of ownership by ancestor(s).

Category	Rate (%)
Clear cutting	30
Selective cutting	50
Single tree selective cutting	70
Cutting is prohibited	80

Table 3. Value reduction rate of protected forests.

[15]The forest management plan in the Forest Act changed in the fiscal year of 2012. In the former system, the total area under the forest management plan was generally high, for example, around 75% in 1997. However, the percentage of forest under the new forest management plan decreased. Correspondingly, the area of forest eligible for the 5% reduction rule decreased.

[16]The rule was introduced to the Inheritance Tax Act (Act No. 73 of 1950) in the amendment of 1954 ([12], p. 3).

3.4. Number of ancestors and evaluation value of forest property

Table 4 summarizes the land characteristics of all properties in 2014. In 2014, there were 56,329 ancestors, and 93% (52,327) of ancestors had land property. The inheritance tax is necessary in cases when the total evaluation of properties exceeds the value of several exemptions. However, the inheritance tax tends to be applicable when there is land included as property.

Of the 52,327 ancestors with land property, 51,513 cases included housing land, meaning that in most cases, including forest land, the land property included housing land. This is in agreement with the results of the 2013 Housing and Land Statistics conducted by the Statistics Bureau of the Ministry of Internal Affairs and Communications, which estimated that 2,673,000 households owned forest land, of which 2,569,400 households (96.1%) had their own house. Therefore, only a small percentage of cases included inherited land property that was only forest land.

In total, 20.9% of ancestors had land properties that included forest land. However, these properties only accounted for 1.4% of the total value of properties. The average value of forest land per ancestor was 6.8 million yen, much less than the values of housing land, farmland, and rice fields.

Figure 3 shows the number of ancestors with property that included forested land and the value of forest land per ancestor from 1988 to 2014.

About 10,000 inheritances that included forested land were required to pay inheritance tax. The evaluated value of forest land per inheritance has decreased since 1992. For example, when the value in 1992 is fixed to 100, the value in 2014 is 17.4. The reason for this decrease is the decrease in the value of forest land, since the values of both forest land and housing land have decreased. **Figure 4** shows the number of ancestors and value of housing land. The pattern of the graph is similar to that of forest land, and when the peak value in 1992 is fixed to 100, the value in 2014 is 36.1.

Category	Number of ancestors (number)	Percentage (%)	Value of properties (million yen)	Percentage (%)	Average per ancestor (million yen)
Rice field	11,133	21.3	263,646	5.1	23.7
Farm land	14,358	27.4	593,975	11.5	41.4
Housing land	51,513	98.4	3,781,938	73.5	73.4
Forest land	10,929	20.9	74,034	1.4	6.8
Other land	14,863	28.4	487,309	9.5	32.8
Total	52,327	100.0	5,146,902	100.0	98.4

Source: National Tax Agency Annual Statistics Report.
Note: The total of number of ancestors is the actual number of ancestors. In cases of rice fields and farmland, cultivation rights and perennial tenant rights are included. In the case of housing land, leaseholding is included.

Table 4. Land property in 2014.

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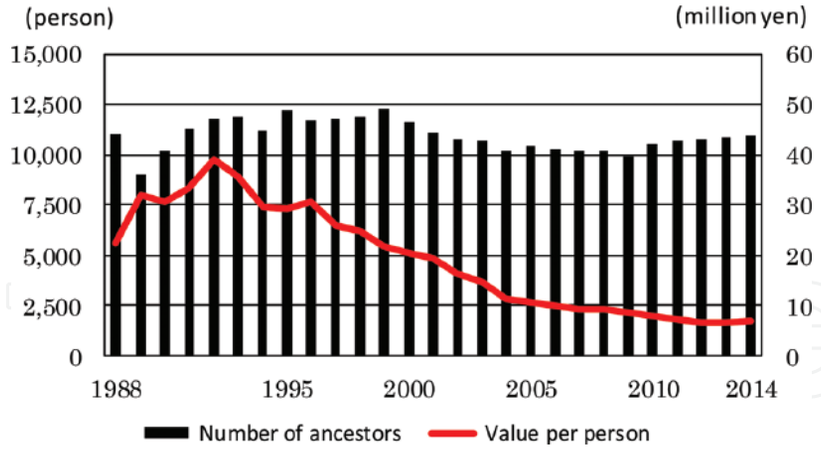

Figure 3. Number of ancestors and value of forest land. Source: National Tax Agency Annual Statistics Report.

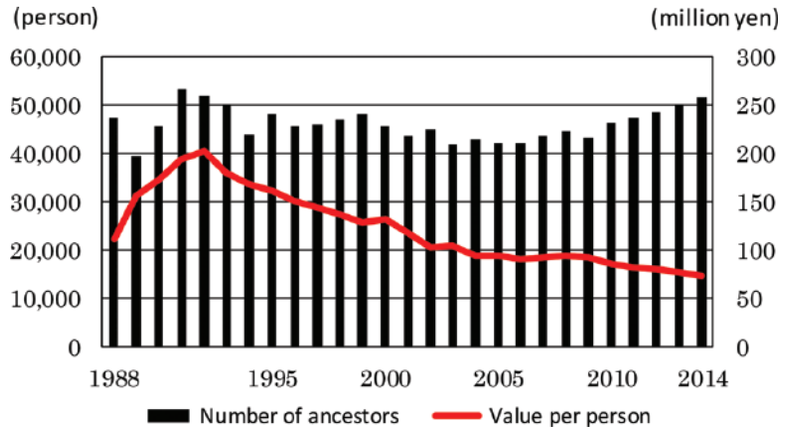

Figure 4. Number of ancestors and value of housing land. Source: National Tax Agency Annual Statistics Report.

Figure 5 shows the number of ancestors and value of the inherited property when only standing trees are considered and forest land is excluded, both of which are decreasing.

3.5. Decrease in the value of forest and stumpage price

The value of forest land per ancestor has decreased since 1992 (**Figure 3**). The value in the peak year (1992) was 39 million yen, which decreased to 6.8 million yen in 2014. The reason for this decrease is a decrease in the standard value at the standard final cutting age due to decreases in both forest land and stumpage prices (**Figure 6**).

The stumpage prices of *C. japonica* and *C. obtusa* peaked in 1980, and have been decreasing since. Setting the stumpage price in 1980 to 100, the stumpage price in 2016 was 12.3 for *C. japonica* and 14.4 for *C. obtusa*. Compared to the stumpage prices in 1960, 7,148 yen and 7,966 yen for *C. japonica* and *C. obtusa*, respectively, the stumpage prices in 2016 were 39.2 and 77.2% of those in 1960, respectively. Since this represents the nominal price, a long-term increase in prices should be considered. Using the Corporate Goods Price Index of 2005 by the Bank of Japan, the index was 50.8 and 105.0 in 1960 and 2011, respectively. Using the Consumer Price Index of 2010 by the

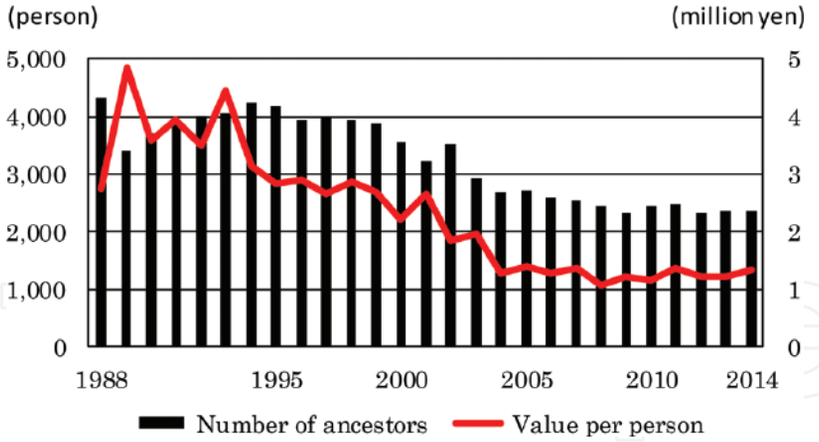

Figure 5. Number of ancestors and value of standing trees. Source: National Tax Agency Annual Statistics Report.

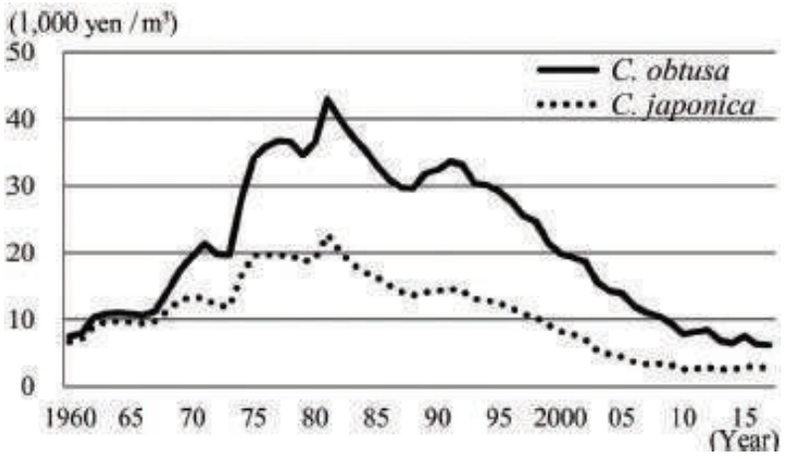

Figure 6. Stumpage price. Source: Forestry Agency, Annual Statistics of Forestry, Annual Statistics of Forest and Forestry; original source is the Japan Real Estate Institute. Note: As of March 31.

Bank of Japan, the index was 19.1 and 99.7 in 1960 and 2011, respectively. In other words, between 1960 and 2011, the Corporate Goods Price Index increased twofold and the Consumer Price Index increased fivefold. Under such long-term increases in the price index, the nominal prices of 2016 were 39.2 and 77.2% of those in 1960, showing a decrease in price.

The large decrease in stumpage price has affected the value of forests during evaluations for inheritance tax. Since the area of inherited forest is not included in the National Tax Agency Annual Statistics Report, further statistical analysis is difficult, and analyses related to on-site surveys is a topic of future research.

Given the large decreases in stumpage price, it is possible that the stumpage price will decrease beyond the break-even point. When forest owners cannot expect any income from cutting after inheritance, the inheritance tax is only a burden to the inheritor. This would create a scenario where there is a probability that some forest owners would cut standing trees to

reduce the standing tree value before their death.[17] Since many plantation forests planted after World War II are now reaching the standard cutting age, and thinning has been promoted by the Forestry Agency, the value of standing trees is increasing. To reduce the burden of the inheritor further, forest owners may sell not only standing trees, but also the forest land. It has been noted that some forest owners, for example, older owners without an inheritor, have stopped managing their forest with the intent of selling their forest land along with standing trees to logging companies;[18] however, it is difficult to determine the statistics behind this trend. It should be mentioned that the reason for such action is not limited to inheritance, as the decrease in stumpage price (**Figure 6**) and decrease in log price have led to decreases in income from timber sales. **Table 5** shows statistical indexes of forest management. Net income (subtracting column (B) from column (A)) has recently decreased. The percentage of tax in

(1,000 yen)

Holding size	Year	Gross income (A)	Cost (B)	(A)-(B)	Tax	Tax / (B)	Tax / (A-B)
Total	2003	2,751	2,235	516	156	7.0	30.2
	2008	1,784	1,681	103	136	8.1	132.0
	2013	2,484	2,371	113	145	6.1	128.3
20 - 50 ha	2003	1,598	953	645	82	8.6	12.7
	2008	1,225	938	287	75	8.0	26.1
	2013	2,773	2,013	760	131	6.5	17.2
50 - 100 ha	2003	2,312	1,748	564	140	8.0	24.8
	2008	1,098	1,191	-93	108	9.1	
	2013	1,742	1,652	90	106	6.4	117.8
100 - 500 ha	2003	3,460	3,108	352	225	7.2	63.9
	2008	3,218	2,959	259	209	7.1	80.7
	2013	3,198	3,309	-111	224	6.8	
500 ha and over	2003	60,253	63,495	-3,242	2,303	3.6	
	2008	30,302	28,131	2,171	2,357	8.4	108.6
	2013	9,346	13,851	-4,505	415	3.0	

Source: Ministry of Agriculture, Forestry and Fisheries, Statistics of Forest Management.[19]
Note: In this case, tax refers to taxes, public dues, various burden charges, etc.

Table 5. Index of forest management.

[17]Sugano and Tani ([14], p. 32) introduced the following management example: a forest owner conducted clear-cutting of 40- to 50-year-old *C. japonica* and *C. obtusa*, and then planted low-value broad-leaved trees. In addition to the value of standing trees, the total value of the inherited properties decreased. As a result, the tax rate (see **Table 1**) decreased. Nagata [15] mentioned a similar problem at the time of the post-war tax reform, in that there was a large imbalance between cases in which the forest owners conducted clear-cutting and cases in which the forest owners maintained the forest without clear-cutting.

[18]Such situations have been mentioned before 2000 (e.g., [16], p. 2).

[19]Statistics Bureau, Ministry of Internal Affairs and Communications, e-Stat, http://www.e-stat.go.jp/SG1/estat/List.do?bid=000001047783&cycode=0 [Accessed: April 18, 2017] (in Japanese)

which forest inheritance tax is not included in the statistics based on the total cost is almost 6–8%; however, the amount of tax currently yields a net income. This management situation is the foundation of the current abandonment of forest management.

4. Discussion

4.1. Preferential treatment for forest inheritance tax

4.1.1. Changes in the background of preferential treatment for the forest inheritance tax

Several forest inheritance taxes have been reduced for forest land and standing trees. As a background, forests were necessary for daily life in the past, and forestry practices and maintenance were conducted mainly by the forest owner, who invested in the forest over the long-term, but with low profitability. However, this background has changed.

4.1.1.1. End of fuelwood use

As a result of the end of fuelwood use, the importance of fuelwood in forest management has decreased. **Figure 7** shows the percentage of fuelwood to the total cutting volume. At the beginning of the 1940s, the percentage was over 60%. After World War II, it decreased in a linear manner, and fell to only 3% in 1972. Because of the end of fuelwood consumption, daily use by forest owners and their family almost disappeared, except for activities such as mushroom production.

During the period when fuelwood consumption decreased, the Forestry Agency strongly promoted the planting of coniferous trees such as *C. japonica* and *C. obtusa*. **Figure 8** shows the area of plantation. In the 1950s and 1960s, the annual plantation area was approximately 300,000 ha, which began to decrease in the 1970s and is currently around 20,000 or 30,000 ha, less than 10% of the peak.

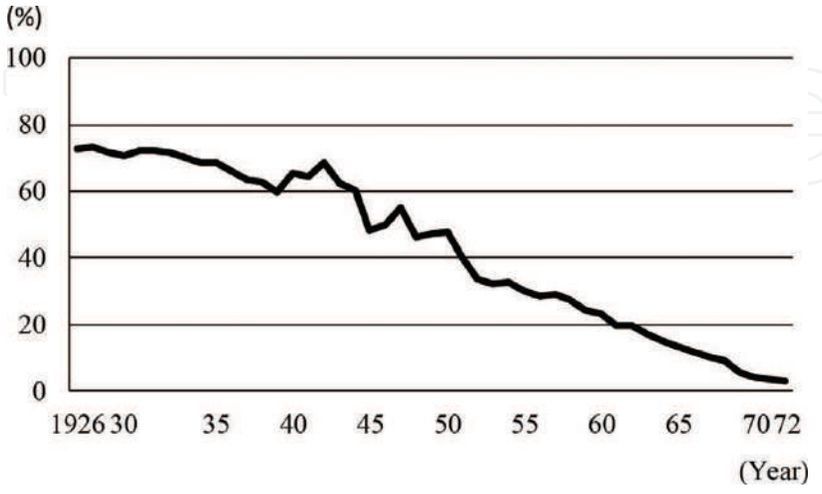

Figure 7. Percentage of fuel wood for the total cutting. Source: Forestry Agency, Division of Research [17], Forestry Agency [18–20].

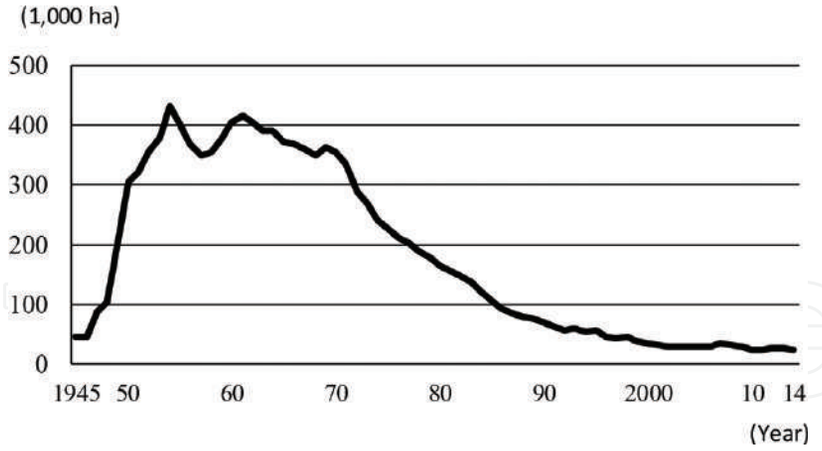

Figure 8. Area of plantation. Source: Forestry Agency, Division of Research [17], Forestry Agency [1, 18–20].

To create coniferous plantations, a large amount of labor was necessary to conduct planting and initial treatment, such as weeding. In the 1950s and 1960s, the peak period of planting, family labor within the forest owner's household and employees of forest owners' cooperatives had large roles in private forestry. The forests planted during that time are now about 50 years old, and require thinning and final cutting, but these activities are conducted by forestry companies or forest owners' cooperatives. Since most forest owners do not have the machinery necessary for such activities, it is difficult for families to conduct cutting activities.

In the past, the relationship between forest land and agriculture was considered as a role of private forest. However, of all forest owners, 58% also owned farmland based on the 2015 Census of Agriculture and Forestry.[20] Meanwhile, based on the 2013 Housing and Land Statistics, 71% of forest owners also owned farmland [21]. Just after the end of World War II, most forest owners were probably farmers, and the percentage of non-farming forest owners has increased. In addition, in the field of farm management, the relationship to forest resources has disappeared.

4.1.1.2. Increase in non-resident forest owners

The spread of depopulation and number of non-resident forest owners is increasing throughout Japan. In the 2000 Census of Agriculture and Forestry, non-resident forest owners accounted for 24.6% of total forest owners. As the number of aged owners is increasing, inheritance appears to be increasing. In some cases, the inheritor does not live in the same municipality as the ancestor. **Table 6** shows the percentage of non-resident forest owners by region, which shows regional differences. In Hokkaido, the northern-most prefecture, the percentage of non-resident forest owners reached 46.1%. In the mountainous areas of north Kanto and Kinki regions, it was ≥40%. Therefore, before discussing daily use or maintenance, it must be stressed that many owners are non-residents.

[20] From the Department of Statistics, Ministry of Agriculture, Forestry and Fisheries. The survey was conducted for forest owners with holding areas ≥1 ha.

(%)

Region	Urban area	Agricultural area			Total
		Flat land	Medium	Moutain	
Hokkaido	46.1	44.7	55.5	55.6	52.6
Tohoku	14.1	17.8	14.4	13.7	14.5
Hokuriku	11.1	13.5	16.3	23.7	17.7
Kanto and Tosan	23.1	19.3	22.5	28.8	24.6
Nort Kanto	24.9	18.3	22.1	45.0	27.9
South Kanto	28.3	22.5	28.0	30.2	27.9
Tokai	30.7	21.6	23.9	32.7	30.4
Kinki	23.3	20.8	21.3	42.9	32.6
Cyugoku	8.6	11.2	12.5	16.4	13.8
Shikoku	20.1	17.1	19.7	29.8	25.9
Kyusyu	12.8	12.2	15.2	21.2	16.6
Total	19.8	25.2	21.5	28.9	24.6

Source: Ministry of Agriculture, Forestry and Fisheries, the 2000 Census of Agriculture and Forestry.

Table 6. The percentage of non-resident forest owners in 2000.

Depopulation and aging have long been a problem in Japan, and there have been a number of discussions regarding the end of hamlets. The Ministry of Land, Infrastructure, Transport and Tourism ([22], p. 12) predicted an increase and decrease in population at a 500-m mesh resolution based on the 2010 Population Census. Comparing the number of meshes between 2010 and the 2050 prediction, 19% of meshes changed from populated areas to unpopulated areas, and 44% of meshes showed a decreasing rate of population of ≥50%. In these areas, the percentage of non-resident forest owners is likely to increase.

4.1.1.3. Forest as property

Since most Japanese private forest owners have small holding areas, forest has an important role as household property. Such areas are too small to conduct planting and periodic cutting to receive a sufficient annual income from forest products to cover the household economy. Thus, the main deciding factor of whether to cut trees is related to the large expenditure, which has long been a characteristic of the Japanese private forest sector. In addition, daily use has disappeared and the number of non-resident forest owners has increased; therefore, the consideration of forest as property is further increasing.

The current situation surrounding private forest is changing. Generally, forest owners do not manage and work in their forest on a daily basis. This is in part because the number of non-resident owners is increasing, and will likely continue to increase in the future with the expansion of unpopulated areas. Moreover, forests are becoming land estates. At the same time, both the stumpage price and value of forest property have decreased. Under these conditions, ongoing tax reductions have the potential to encourage non-resident ownership,

although it is highly possible that the increasing number of non-resident owners will abandon forest practices.

4.1.2. Final cutting in protected forest

The forest inheritance tax has been reduced and the fixed property tax is exempt in protected forest[21] where the cutting method is determined under the Forest Act. Namely, an inheritor can inherit protected forest with a low inheritance tax rate and hold the forested area without paying any property tax. Approximately 30% of non-national forest is protected.[22]

Under the Japanese protected forest system, forests in which cutting activities are completely prohibited exist in limited areas, while most protected forests can be cut for commercial purposes under some restrictions. However, under the current inheritance and fixed property tax, even if the forest reaches the final cutting age, protected forest owners can simply hold the forest. The government revised the Basic Plan on Forest and Forestry in May 2016, with the main goal of increasing timber production. In 2014, the domestic timber supply was 24 million m^3, which the government plans to increase to 32 million m^3 and 40 million m^3 in 2020 and 2025, respectively. However, under the current tax system, it is possible that cutting activities in private forests, especially under various restriction systems, such as protected forests, will not be realized as estimated.

4.2. Forest inheritance tax and forest planning system

4.2.1. Forest management of large-scale forest owners and forest inheritance problems

Some forest owners who hold large parcels are managing their forests full-time. At times, the inheritance tax has become a considerable burden for such owners. In particular, if a large part of inherited property is forest, the forest may be clear cut to pay the inheritance tax. Since the current stumpage price is generally low, the cutting area may be large. A forest income tax is imposed on the income generated from cutting the trees to pay the inheritance tax, which may be a burden for the inheritor ([23], p. 241).

The final cutting age for *C. japonica* is around 50 years, but actual cutting tends to occur at older ages.[23] To avoid clear-cutting at the scheduled cutting age, some forest owners have performed repeated thinning after the standard final cutting age. In these cases, inheritance may occur

[21]Here, protected forest refers to *Hoanrin* designated as Article 25 of the Forest Act (Act No. 249 of 1951), which exists in both national and non-national forests. In practice, protected forests provide another system applied only to national forests, where commercial purposes cannot be pursued.

[22]There were 5,224,000 ha of non-national protected forest at the end of the fiscal year of 2014. The total area of non-national forest was 17,407,000 ha at the end of the fiscal year of 2011.

[23]Takagi [13] noted that the average number of years of constituting a generation change is approximately 30 years. Therefore, a cutting rotation of 60 years is equal to two generations. At least 100 years or 150 years is needed produce large high-quality logs for use in temples, etc., meaning that forest owners must pay the inheritance tax three to five times.

more than once between planting and final cutting.[24] Therefore, the burden of the inheritance tax can influence scheduled forest practices.

To illustrate the effects of this, the following section describes the opinions of forest owners, including opinions on the inheritance tax, based on the results of the opinion survey on forestry management[25] conducted by the Forestry Agency in the fiscal year of 2009. **Figure 9** shows the responses to the question on what support or measures are necessary for forestry management to continue in the next generation. The most frequent answer was the stabilization of timber price. This response reflects the long-term decrease in stumpage price (**Figure 6**). Since forest owners cannot pay the costs associated with reforestation under low stumpage prices, the second-most frequent answer was to subsidize the full cost of reforestation. Following these, a reduction in the inheritance and gift tax, development of forest owners' cooperatives and forestry entities, and reduction in fixed property tax were also deemed important. Due to the low stumpage price, it is necessary to decrease management costs, for example, by intensifying forest practices through the development of forest owners' cooperatives, etc. After these three suggestions, improvements related to taxes were selected, because the current inheritance tax has decreased correspondingly, but the decrease in the stumpage price is severe, and it is not practical for forest owners to cut standing trees under such stumpage prices.

Figure 10 shows the percentage of respondents who selected the two tax-related responses, a reduction in inheritance and gift tax and a reduction in fixed property tax, classified by holding area of forest. The frequency of annual fixed property tax was only larger than that of

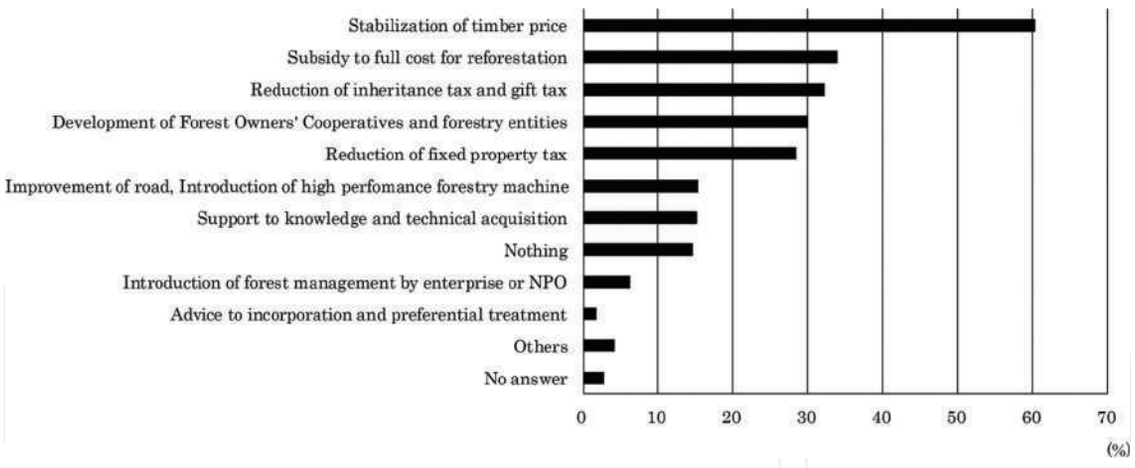

Figure 9. Forest owner opinions on strategies to support forestry management. Source: MAFF ([24], pp. 18–19). Note: Three answers were required.

[24]The basic idea of the Japanese inheritance system is that all inheritance property should be valued and paid at the time of inheritance, thus inheritance may occur more than once before final cutting. In the case of the United Kingdom, the inheritance tax is imposed only once at the time of cutting ([13], pp. 135–136).

[25]The opinion survey was conducted on March and April 2010. The survey was conducted for 1,607 forest owners selected from forest owners surveyed at the 2005 Agriculture and Forestry Census, of which 1,013 completed the survey [24].

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Figure 10. Percentage of forest owners classified by holding size who considered taxes to be an impediment to the continuation of forestry management. Source: MAFF ([24], pp. 18–19).

inheritance tax in the case of owners with <20 ha.[26] Among owners with ≥20 ha, the percentage of respondents who selected inheritance tax was larger, markedly so in the case of ≥500 ha, with 53.1% selecting inheritance tax. These results showed that the importance of inheritance tax increased according to holding size.

Figure 11 shows the same options related to taxes as **Figure 10**, but with the owners classified by management situation from the perspective of annual income. Forest owners with an annual income from timber sales more often considered the inheritance tax and gift tax to be an impediment than the property tax. Only owners holding unmanaged forested land more often selected the fixed property tax as a problem. To summarize these results, there is high demand for a reduction in the inheritance tax and gift tax among large-scale forest owners who sell timber every year.

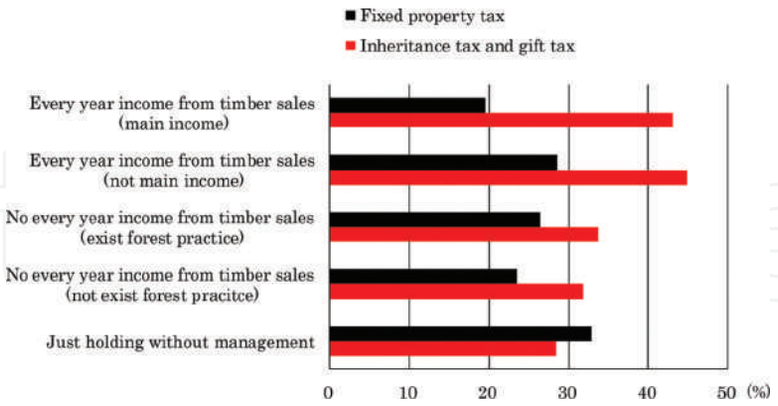

Figure 11. Percentage of forest owners classified by management situation and income who considered taxes to be an impediment to the continuation of forestry management. Source: MAFF ([24], pp. 18–19).

[26] In the case of small-scale owners, owners can obtain income from timber sold at long intervals, and must pay fixed property tax every year ([25], p. 32).

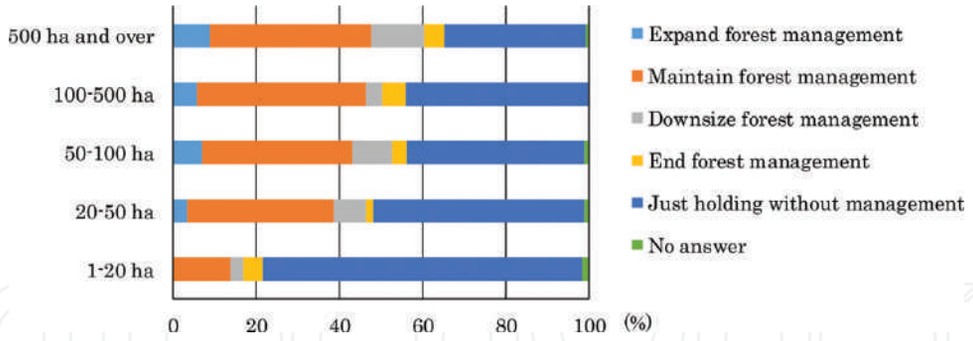

Figure 12. Forest owners intended future forestry management policy. Source: MAFF ([24], p. 11).

Figure 12 shows the results of the responses to the survey question related to future management policy. Among owners with a holding area <20 ha, approximately 80% answered that they plan to hold without management. This same response was selected by 43.9 and 33.9% of owners with holding areas of 100–500 and ≥500, respectively. Meanwhile, there was no clear relationship among owners who responded that they plan to end forestry management by holding size.[27] In addition, 4.6, 5.8, and 4.8% of owners with <20, 100–500, and ≥500 ha, respectively, responded that they plan to expand management. Finally, 35–40% of owners with ≥20 ha responded that they do not plan to make changes.

4.2.2. Postponement of inheritance tax payment by large-scale forest owners

4.2.2.1. New measures on the postponement of payment of inheritance tax in 2014

The government introduced a new system in April 2012 allowing the postponement[28] of the inheritance tax payment[29] under specific conditions for forest owners with ≥100 ha. The basic conditions are as follows.

For forest land, the forest management plan made by the ancestor must be certified. In addition, forest practices and the investment to forest road network must be conducted or planned for forests to be eligible for postponement, and the total forest area must be ≥100 ha.

[27]Sugano ([26], p. 24) conducted a questionnaire survey on forest inheritance and noted that a number of forest owners, both small- and large-scale, answered that they would dispose of their forest property if inheritance occurred.

[28]A postponement system for the delayed payment of the inheritance tax applied to all forests existed before 2012 when the new postponement for only large-scale forest owners was introduced. The main contents are as follows. The content of the postponement is equal to the payment during less than 15 years with 5.4% interest tax. For standing trees located in a forest under a forest management plan, it is an unequal payment with a reduced rate of 3.6% interest ([9], pp. 102–104). The interest tax was initially 4.8%, but decreased to 4.2% in the fiscal year of 1987, and decreased to 3.6% in the fiscal year of 1990 ([11], pp. 17–18). For forests under a special forest management plan promoting long rotation operation, the limit of the number of years for postponement was extended to 40 years in the fiscal year of 1991 ([11], p. 18).

[29]In this new measure, only inheritance tax payment can be postponed. Gift tax is not included in this new measure, which has already been introduced to farmland ([14], p. 31).

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For standing trees, the age should not have reached the standard age for final cutting, as determined in municipal forest development plans, by a specific year. The specific year is the average remaining lifetime up to 30 years.

The inheritor must inherit all of the ancestor's forest management according to the forest management plan of the ancestor. The inheritor must succeed at completing the ancestor's forest management plan, continue making a forest management plan, and conduct forest practices according to the forest management plan.

The postponement of paying inheritance tax is available until the day of the death of the inheritor for up to 80% of the amount of inheritance tax imposed on forests that satisfy the above conditions. At the time of the death of the inheritor, the total amount of postponed tax is exempted. Since the new postponement has only just been introduced, data on this postponement are not available. However, Sugano and Tani ([14], p. 32) reported that applications for this tax postponement are currently very low.

4.2.2.2. Relationship between the new postponement and forest planning systems

The new postponement system introduced in 2012 has a close relationship with the forest management planning system based on the Forest Act.[30] The current forest management planning system introduced in 2012 focuses on intensive forest management and improvements to forest road networks. When the forest owner makes a forest management plan, the forest owner can receive several benefits, such as a reduction in forest inheritance tax, reduction in forest income tax, subsidy related to reforestation, or low-interest loan on forestry from the Japan Finance Corporation. Although many coniferous plantations planted after World War II now require thinning, if a forest owner wants to conduct thinning as well as construct forest or spur roads, a forest management plan is necessary to obtain a subsidy. Ultimately, forest management plans have a close relationship with government subsidies. There are three types of forest management plans, one of which can be made by sole forest owners holding ≥100 ha of forest.[31] Under the postponement system, a one-person forest management plan is necessary. The two additional conditions related to the forest management plan necessary to obtain a postponement of inheritance tax are that within 10 years after inheritance, the forest owner should expand the management area at least 30%, up to 150 ha, and should expand forest or spur roads to a level determined by the local municipal forest development plan.

In old forests with a dense forest road network, it is not necessary for forest owners to obtain a subsidy related to forest practices; therefore, there is little merit to making a forest management plan. When there are no special benefits to obtaining a subsidy, a forest management plan may constrain forest management. For example, when forest owner wants to conduct

[30] In the case of exceptional measure in France, a forest plan is necessary ([16], p. 4). Based on the act enacted in 1963, forest owners who own ≥25 ha have an obligation to make a simplified forest management plan. When the forest owner follows the contents of the plan over 30 years, three-quarters of the inheritance tax is exempted.

[31] Under the amendment of the Forest Act in 1939, forest owners with ≥50 ha must make a forest plan, and forest owners with <50 ha must join a regional forest owners' cooperative, and the cooperative must have a forest plan. The current system has a common characteristic with the 1939 planning system in that it includes a forest management plan that targets large-scale forest owners with a specific minimum holding size.

final cutting, he/she can contact a logging company without a subsidy. Furthermore, the percentage of forest owners who want to expand forest management is generally low (see **Figure 12**). For example, a forest owner who owns ≥500 ha would have to expand the forest management by 150 ha, which is the upper limit of the conditions related to the postponement, and only a few forest owners have conducted this expansion to postpone the inheritance tax.

Large-scale forest owners often own forest in remote areas, and some investment is necessary to satisfy the forest road network density conditions. In addition, after investing in the forest road network, the value of the land will increase.[32] Regardless, an initial cash reserve is necessary to expand the holding size or increase the forest road network. Given the long-term decrease in stumpage price, the number of large-scale forest owners who want to expand forests and invest in roads is limited.

Because the postponement measure in 2012 is connected with forest management plan, when a forest owner cannot continue the forest management plan or the certification of the forest management plan is canceled, the forest owner must pay the postponed inheritance tax. Typical examples[33] of this include the case that the forest owner cannot accomplish the objectives related to the expansion of forest management area and forest road network density, or the case that the forest owner entrusts all or a part of the forest management to others. Expanding holding forest and forest road networks are straightforward obligations. However, there is another condition as follows: in a year when the forest owner does not conduct any planting, cutting, or road construction, the forest owner must pay the postponed inheritance tax. Generally, forest management does not require forest practices annually; therefore, this condition may be too strong. When the forest owner pays the postponed inheritance tax, he/she must also pay the annual interest tax of 3.6%. Considering the payment of the interest, it may be difficult to apply the postponed tax, except cases where the inheritor decisively shows continuous forest management until death.

One final comment should be made regarding the forest planning system, which has a strong connection with the inheritance tax postponement. The forest management plan is located at the bottom of the forest planning system. First, there is the Basic Plan on Forest and Forestry at the top of the forest planning system, and the current version published on May of 2016 includes the objective of increasing domestic timber production in Japan (see Section 4.1.2). The existence of the objectives of expanding management size and forest road networks in the postponement measures seems to be related to the basic policy direction of domestic timber production. However, the method for continuing forest management differs. In cases where the holding size is large and the forest area is not dispersed, the expansion of forest management area may lead to a decrease in efficiency. In addition, once the forest road network reaches a certain density, further investment may not be necessary. The current forest road volume conditions are based on logging using vehicles. While the majority of logging systems use vehicles, there are some areas where cable logging systems are used. For example, in some steep mountainous areas,

[32] After the construction of forest or spur roads, the value of the standing trees along the road increases. When inheritance occurs just after a road investment, the road investment results in an increase in the inheritance tax ([23], p. 241). This is the reverse case of clear-cutting before inheritance.

[33] Based on the webpage of the National Tax Agency. https://www.nta.go.jp/taxanswer/sozoku/4149.htm [Accessed: April 20, 2017].

there may be an advantage to using cable logging systems. Moreover, in the Yoshino forestry area, helicopter logging is used for high quality logs. Although it may seem logical that a continuous forest management model includes the expansion of management area and forest road networks, the automatic requirement of such expansive conditions in large-scale forest management should be avoided, and should allow for practical alternative measures.

4.2.3. Problems associated with the postponement measures

Some problems are inherent in this new policy. For example, this system applies only to large-scale forest owners with ≥100 ha, and many forest owners whose families manage their forest have <100 ha. Meanwhile, many non-residential forest owners with ≥100 ha have no interest in forest management. Regarding the forest management planning system, only forest owners with ≥100 ha can make forest management plans independently. Accordingly, in both the forest planning system and the postponement system of inheritance tax, the Forestry Agency has used 100 ha as the limit of the desirable holding size.

Therefore, the relevance of using 100 ha as a criterion should be examined. After checking publications by the Forestry Agency, only a small, detailed introduction was found ([27], p. 107). In potential support of the introduction of the postponement of the inheritance tax, 53% of forest owners with ≥500 ha thought that a reduction in the inheritance tax was necessary to support the continuation of forestry management in the next generation (see **Figure 10**). Judging from the results of this question in **Figure 10**, except forest owners with <20 ha, interest in a reduction in the inheritance tax tended to increase with increased holding size. The Forestry Agency [27] explained that the objective of creating the postponement of the inheritance tax was to support a smooth business succession to the main provider and effective and stable forestry management. However, there is no basis for the use of 100 ha as the inclusion criterion. In the questionnaire survey on taxes (**Figure 10**) and future plans (**Figure 12**), the responses of forest owners differed according to holding area, but a clear reason of the use of 100 ha could not be found from these survey results.

4.3. Forest inheritance tax and forest holding size

4.3.1. Small-scale family forest management and inheritance

Before World War II in Japan, inheritance operated under a family system,[34] where the eldest son inherited essentially all family estates. In addition, the inheritance tax at the time was generally

[34]The family system was abolished after World War II, which appears to have had an effect on long-term forest management, although this remains a topic for future research. Regarding the argument related to the inheritance tax, Tezuka [16] proposed the creation of exceptions for the inheritance of forest. It is worth noting that the following rule was included in his proposal. In the case that it was agreed upon among all related persons in an argument of the distribution of forest property that one inheritor inherit all forest property and succession was conducted by this agreement, the forest inheritance tax would be exempted. Although this inheritor is not limited to the first-born person or son in his proposal, in practice, his proposal resembled the family system before World War II. Takagi [13] pointed out that the German inheritance system includes an exemption whereby the tax differs based on the relation between the ancestor and inheritor, and the maximum exemption is given to the partner and children. This exemption system is not a family system, but supports inheritance by family members. In the Japanese system, there is no difference in the potential exemption among inheritors, except for partners.

low ([28], p. 74; [12], p. 2). After World War II, the family system was abolished, and any family member could inherit forest land. In the inheritance system after the war, all children had equal rights to the inherited property, which resulted in the concern that already small farms would become further segmented ([15], p. 92). Under the new inheritance system, forest land may be divided at the time of inheritance.[35] However, actual practices regarding the division of forested land at the time of inheritance are not clear due to a lack of statistical surveys.[36]

In Japan, forest holding sizes are small. In 2015, 829,000 forest owners owned ≥1 ha. **Table 7** shows the breakdown of households by forest holding size.

Based on the 2013 Housing and Land Statistics by Statistics Bureau of the Ministry of Internal Affairs and Communications, 2,673,100 households were estimated to have forest land. However, as shown in **Table 7**, there is a large discrepancy between this estimate and the number of households determined by the Census of Agriculture and Forestry, which included forest

Holding size	Number of forest owners	Percentage (%)
1-5 ha	616,687	74.4
5-10	110,944	13.4
10-20	59,650	7.2
20-30	18,617	2.2
30-50	12,713	1.5
50-100	6,715	0.8
100-500	3,316	0.4
500 ha and over	331	0.0
Total	828,973	100.0

Source: MAFF, the 2015 Census of Agriculture and Forestry.
Note: Surveyed households had ≥1 ha.

Table 7. Number of households classified by holding size (2015).

[35]Regarding forest plots, GHQ/SCAP ([6], p.65) noted that "some will be subdivided into small and inefficient units" unless there are changes to the taxation system. Based on the Forestry Agency [18, 20], which surveyed the state of forest inheritance in 10 regions during 1963 and 1964, farm households who owned a lot of forested land tended to divide the forest land. Farm households who owned less forest land tended to divide the farmland. Moreover, forest land was easier to divide because, in the case of forested land, there was no limit to holding as in the case of farmland. As a result, forest land was easier to segment than farmland during inheritance. Katayama [29] concluded that the only way to avoid segmentation of forest at the time of inheritance was incorporation of a company to hold the forest.

[36]Sadachi [11] noted that the Forestry Agency conducted a survey on inheritance in 1980 and 1988, which found that the number of forest owners almost doubled at inheritance.

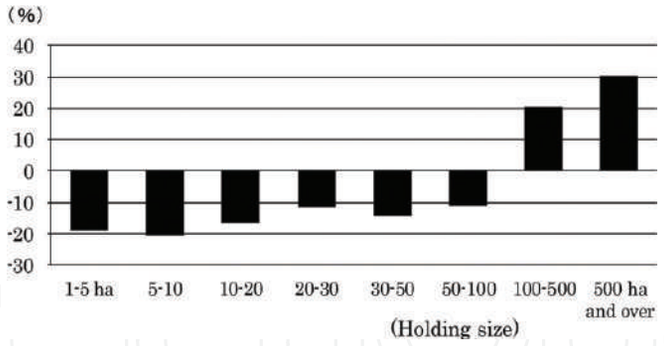

Figure 13. Change in the number of households with forest land between 2000 and 2015 classified by holding size. Source: MAFF, the 2000 and 2015 Census of Agriculture and Forestry. Note: Surveyed households had ≥1 ha.

owners with <1 ha.[37] Between 2000 and 2015, the number of households with forest land decreased by 189,779 (18.6%) (**Figure 13**).

Although there was an overall decrease of 18.6% in the number of households that owned forest land, the number of forest owners with <100 ha decreased, while the number of forest owners with ≥100 ha increased. However, because a smaller number of households had ≥100 ha, this smaller change is expressed as a large percentage. In contrast, approximately 75% of owners had <5 ha of forest land (**Table 7**).

Although there is no current survey on forest inheritance in Japan, the importance of demographics, such as depopulation and aging, is increasing. In the 2000 Census of Agriculture and Forestry, 65- to 69-year olds accounted for the largest proportion of householders who owned both farmland and forest land, but 41.0% of households had no successor for agriculture [2]. The number of aged forest owners with no successor is increasing, which could lead to an increase in inheritances at death. Under the inheritance rule created after World War II, there was some importance on gifting property before death.[38] **Table 8** shows the number of inheritances and gifts before death in the 1960s ([18, 20], p. 18).

In the case of the household successor, 31.0% of households gifted all or a part of the forest property before death. Meanwhile, in 50.5% of cases, the land was gifted before death to someone other than the successor. This shows that, at least at that time, gifting before death had some importance for the inheritance of forest, and ancestors often gifted forest to successors or other family members before death after clear-cutting. The objective was that inheritors

[37] The number of forest owners with 0.1–1 ha was 1,572,000 in the 1960 Census of Agriculture and Forestry. In 1960, there was another publication on the number of forest owners conducted by Forestry Agency [30]. Here, the number of forest owners with <1 ha is 3,033,000. It is possible that the number of forest owners with <0.1 ha was approximately 1.5 million at the time of 1960.

[38] Usui and Hayashi [4], pp. 41–42) surveyed the situation surrounding forest inheritance and classified households based on the corresponding inheritance tax as follows: (1) cutting the old, natural forest, (2) compulsory destructive cutting, (3) selling real estate, (4) borrowing money, (5) planned gift before death, and (6) a combinations of the above five patterns. The best strategy was concluded to be a combination of (1) and (5), emphasizing the role of gift before death. Yamazaki [31] pointed out that there were many cases of tax avoidance by tentative division or gifting of forest before death, concluding that this situation was the forest owners' legitimate resistance to the forest inheritance tax.

Classification	Method how to get forest land	Number of household	Percentage (%)
Successor of household	Gift before death	30	15.0
	Inheritance	130	65.0
	Both	32	16.0
	Nothing	8	4.0
	Total	200	100.0
Ohters	Gift before death	55	50.5
	Inheritance	43	39.4
	Both	11	10.1
	Total	109	100.0

Source: Forestry Agency ([18, 20] p. 18, **Table 3**).
Note: Based on 200 surveyed households.

Table 8. Gifting of forest land before death (1960s).

would not be burdened with paying the forest inheritance tax. The tax rate of the gift tax is higher than that of the inheritance tax; however, immediately after clear-cutting, the value of standing trees is negligible and only the forest land has value, which is generally low, excluding areas near cities. Even at a high gift tax rate, if the value of property is low, the ultimate amount of gift tax is low. When a forest owner conducts clear-cutting in a small area and gifts it to inheritor(s) each year, the forest inheritance tax is greatly reduced. As shown in **Table 8**, someone other than the successor received forest land in 109 (54.5%) of the surveyed households, indicative of segmentalization.

In households with both farmland and forest land, it may be possible to use both gifts before death and inheritance after death to transfer land to a successor. For example, old coniferous trees can be cut and gifted before death, while low-value broad-leaved trees are left and inherited at death to reduce the total tax. In addition to benefits to the inheritor, there is another explanation of why clear-cutting was common at that time. In the 1950s, the market share of domestic logs was high, and forest owners could sell their trees and receive income at almost any time. Therefore, both conditions, the existence of an inheritor and income from clear-cutting, were satisfied.

However, since 41% of households who owned farm and forest land in 2000 had no inheritor, many ancestors could not gift their forest before death.[39] Moreover, because of the low stumpage price, it was sometimes difficult to pay for reforestation after clear-cutting. In addition, in some areas, the deer population has increased markedly, resulting in the necessity to invest in

[39] Attention must be paid to the difference between inheritor and successor of agriculture and forestry. Forestry Agency [18, 20] showed this point already by the on-site survey in Nagano Prefecture in the 1960s. Here, the case that children was only one son, was introduced, and whether he will succeed agriculture and forestry or not was serious interest for parents. Recently, the number of children is decreasing in Japan, this is also related to the problems of successors of agriculture and forestry.

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protection against damage by deer. Without effective countermeasures for such damage, it is difficult to conduct clear-cutting and reforestation of coniferous trees such as *C. japonica* or *C. obtusa*, even in very small areas. Currently, the benefits of conducting clear-cutting to decrease the value of standing trees and gifting to successors before death seems to have decreased, especially for small-scale owners. Future research should clarify the current state of inheritance using on-site surveys.

4.3.2. Forest management intensification

One of the current main forestry policies by the Forestry Agency is cost reduction in forestry production. Concurrently, the Forestry Agency has been promoting expansion of forest management planning area, and an important objective of this policy is reducing associated costs. Article 12 of the Basic Forestry Act (Act No. 161 of 1964) determined that the expansion of forestry management was necessary for small-scale forestry. The introduction of the forest management planning system in 2012 was also related to the expansion of forest management and cost reduction; however, increases in area with forest management plans have stagnated. Although detailed figures have not been published, the Basic Forest and Forestry Plan stated in May 2016 that 28% of forests were covered by forest management plan ([32], p. 4). The reason for the lack of expansion of the area under forest management plans was not clarified due to a lack of data; however, one reason seems to be that forest management planning is closely connected to the subsidy system. This close connection is useful for forest owners who want to obtain a subsidy to conduct forest practices. For forest owners' cooperatives, such a system is beneficial, because owners in such cooperatives can work together to make and execute a plan. However, among forest owners who do not want to conduct thinning or construct forest roads, the current forest management planning system may not be attractive. Future analyses should clarify the reasons for the low percentage of planning area.

Within the scope of this study, only one relationship between aging and inheritance is discussed. Considering the relationship between householder age and the percentage of households who sold timber in the previous year based on the 2000 Census of Agriculture and Forestry, 60- to 64-year olds showed the peak percentage (5.3%). Meanwhile, 3.3 and 3.7 of 80- to 84-year olds and ≥85-year olds, respectively, sold timber in the previous year [2]. Although the current situation is unknown, because the last available data are from 2000, this trend appears to be related to the current decrease in willingness to sell timber, especially among >80-year-old forest owners. **Figure 14** shows the age of the major financial supporter of households with forest from the 2013 Housing and Land Statistics.

In Japan, 65 is the usual age of retirement. The percentage of ≥65 years old has reached 51.8% in **Figure 14**. Considering that the peak age-class of timber sales was 60- to 64-year-olds in the 2000 Census of Agriculture and Forestry, the number of forest owners who want to sell standing trees may decrease. Ultimately, the low percentage of area covered by forest management plan could be related to demographic factors.

In forests owned by aging persons, especially small-scale forests without a forest management plan, there is a high likelihood that forest roads will not be constructed and the owners will simply hold the forest without managing it. In mountainous areas, where owners have small

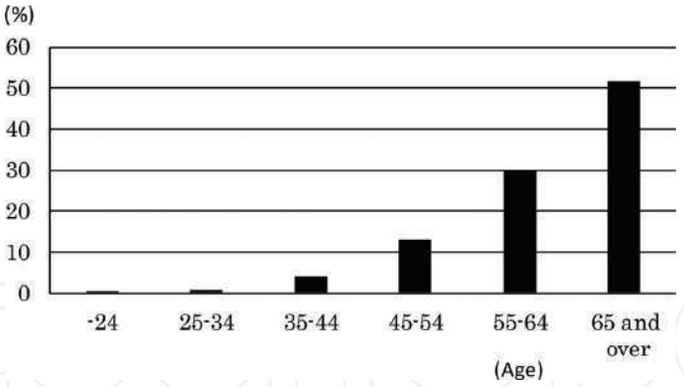

Figure 14. Age of the major financial supporter of households holding forests. Source: MIC, Statistics Bureau ([33], Table 87). Note: The major financial supporter is not the same as the householder. Generally, financial supporters are younger than householders.

areas of farmland, forest land, and housing land, the total value of the inheritance property may be less than the minimum taxable rate, and the inheritor may continue to hold the forest without paying the inheritance tax when inheriting the forest property. This ensures that the small-sized holdings will continue in the future.

The total population of Japan reached to a peak in the 2010 Population Census, but showed a decrease in the 2015 Population Census. The National Institute of Population and Social Security Research ([34], **Table A-8**) has estimated that the total population in 100 years will decrease to almost one-third based on an analysis of the 2010 Population Census. In such a situation, if the system and conditions surrounding forest management do not change, the percentage of non-resident forest owners will increase.

Immediately after the end of World War II, most forest owners were also farmers. Since the family system was abolished after the war, children other than the successor could inherit forest, and many children moved to cities when beginning school or for a job. Therefore, the percentage of non-farmer forest owners has been increasing. In the 1990 Census of Agriculture and Forestry, 36.4% of forest owners with ≥0.1 ha were non-farmers, while 42.0% with ≥1 ha forest were non-farmers in the 2015 Census of Agriculture and Forestry.[40] The situation surrounding non-farmer non-resident forest owners is unclear, and should be examined further in future research. Regarding forest owners who live in urban areas, since the value of housing land is generally high, the total value of inheritance properties may surpass the minimum value for imposing the inheritance tax, and this set of circumstances should also be examined further in future research.

5. Conclusions

The current forest inheritance tax system assumes that private forests are managed using a traditional family base. Furthermore, as a long-term production period is considered, some tax reduction measures have been applied to evaluate forest land and standing trees. Japanese forestry is facing management difficulties, particularly with the long-term decrease in

[40]Department of Statistics of the Ministry of Agriculture, Forestry and Fisheries.

stumpage prices that has occurred and the amendment of methods to evaluate forest land and standing trees. As a result, the value of forests has decreased.[41] However, the number of non-resident non-farmer inheritors is increasing, making it necessary to reconsider the forest inheritance system, including the inheritance tax,[42] because the background and assumptions for preferential treatment have changed.

A new classification for private forest owners is needed. Under the current forest inheritance tax system framework, forest owners who manage their forests continuously with a plan, do not live on the land, and have no knowledge or concern about their forest management practices are treated equally, as if they were a family working the forest. In the latter case, this is just a holding of an estate, and the number of such forest owners will likely increase in the future. Tax reduction measures for such forest owners should be reconsidered.[43] If the reduction policy were canceled for such forest owners, they could begin forest management or sell the forest to appropriate persons who could manage it. A major problem is determining how to group forest owners. For example, forest owners could be divided into resident or non-resident owners,[44] but other important factors include the existence or lack of forest management, a forest plan, investments to the forest, etc. Many technical problems are readily imagined for each of these methods, which should be examined in detail in future research.

A postponement measure for forest owners with ≥100 ha of forest was introduced in 2012, but few people have applied to this new system, because there are several inhibitory conditions related to the postponement of the inheritance tax. The situation surrounding management of forest owners with ≥100 ha of forest is varied. For example, 43.9 and 33.9% of forest owners hold 100–500 ha and ≥500 ha of forest land, respectively, without managing it; therefore, it is difficult to use the holding size as the sole criterion for the inheritance tax postponement (**Figure 12**).[45]

Under the current inheritance tax postponement system and the forest management planning system, the criterion of large-scale forest management is defined as ≥100 ha. However, there appears to be no theoretical or statistical basis for the use of 100 ha as the cut-off. Holding size should be considered as a criterion, but the 100-ha holding size criterion is not necessarily justified. Although the introduction of an appropriate minimum area may be necessary,

[41]Tezuka [16] pointed out the low inheritance tax in Germany. The value of 80–100-year-old spruce was almost equal to one fifteenth of 90-year-old *C. obtusa*. Since the value of the standing trees at the standard cutting age has decreased, as shown in **Figure 2**, the difference appears to be decreasing.

[42]As shown in **Table 5**, the total amount of various taxes or public dues is now sometimes greater than the net income from timber sales; thus, problems may exist in the taxation system beyond the forest inheritance tax; however, this was beyond the scope of this paper. Supporting this, Kim [35] noted increases in the burden of several taxes other than the inheritance tax in Japan.

[43]When non-resident forest owners want to continue just holding, the amount of inheritance tax and annual municipal fixed proper tax must be low. To maintain the low-value of standing trees, forest roads should not be developed because, after road construction, the value of the standing trees along the forest increases, resulting in higher taxes.

[44]Taxation of non-resident forest owners was discussed before World War II in Hokkaido, which had a high percentage of non-resident forest owners ([36], pp. 47–51, pp. 83–85).

[45]The current postponement of the forest inheritance tax is closely connected with the forest management plan. The period of the current plan is 5 years, and the plan focuses on forest practices and forest road construction, which are related to the subsidy system. The current management planning system appears to have problems from the perspective of the inheritance system, and should be examined further in future research.

additional measures for lower holding sizes are also needed. Furthermore, institutional redesign by including other criteria, such as area of residence and family labor force, etc. may be necessary, which is a topic for future research. Problems associated with the inheritance of private forest are not limited to Japan, but it was beyond the scope of this study to analyze the forest inheritance tax from an international perspective.[46] An increase in non-resident non-farmer forest owners and aging of forest owners can be found in various developed countries, and a comparison of international policy on the forest inheritance system, including the inheritance tax, taking this change into account is a topic for future research.

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Chapter 10

Keystones of Performing a Proper Tax Policy Design for Tax Compliance: Does Perception of Tax Compliance Develop in Persons Who Are Not Tax Payers Yet?

Fatih Saraçoğlu, Eren Çaşkurlu and Elif Pürsünlerli

Additional information is available at the end of the chapter

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Abstract

Tax compliance takes place in the scope of the efficiency of the tax implementation. Tax income operations are heavily dependent on tax compliance, while the fairness of the allocation of tax burden affects the tax payers' compliance. The situation has been studied here by dealing with university students in regard to whether or not a perception of tax compliance develops in highly educated people who are not tax payers yet and to what degree. The findings of the study briefly states that students agree that paying taxes completes the concept of being a good citizen, perceive the sensitivity submitting declarations on time and showing care in paying tax debts, and have negative perceptions on the tax administration being transparent, correct, and trustable. So for, an achievement of a proper tax policy design should be primarily considered as the perception of tax compliance of the people, who being the tax payers of any country.

Keywords: tax compliance, tax consciousness, tax ethics, tax policy design

1. Introduction

The importance of tax income within the total state income can be evaluated in numerous ways including the funding amount based on the emphasis, scope, and variety of the state's hegemonic power, and its usage as a fiscal policy tool. It is a de facto assumption for all countries that tax income cannot be gained in its entire potential (tax capacity). The same is also valid for the efforts aimed at minimizing the loss of tax revenue (tax effort). It is undeniable that applications for taxpayers both socially and psychologically are also needed in order to prevent possible loss of tax income along with the technical efforts made by tax legislators and tax offices. Thus, tax compliance takes place in the scope of the efficiency of the tax implementation such as the completeness of legislation, inspections, and sanctions.

Many high quality studies have been conducted in Turkey on tax compliance and its main indicators, i.e., tax ethics. Some of these were supported with field studies. However, due to the passing of time and changing conditions, the continuity in the research on these issues is required since empirical studies indicate that the changes in the conditions over time may give different results.

In this study, as a different approach, perception of tax compliance was tested on university students who have little or no tax implementation experience. For the government, tax income operations are heavily dependent on tax compliance, while the fairness of the allocation of tax burden affects the tax payers' compliance. The situation has been studied here by dealing with university students in regard to whether or not a perception of tax compliance develops in a highly educated people who are not tax payers yet, and to what degree. With this intention, a questionnaire related to the factors that affect the tax compliance was implemented on a sample group that includes people with similar characteristics involving the level of education, department of study, and age.

1.1. The concept of tax compliance

As stated by James and Alley, tax compliance was defined "in terms of the degree to which taxpayers comply with the tax law" [1]. Tax compliance is the tax payers' compliance with tax laws and regulations, while the concept assumes willingness of the tax payers to comply with their liabilities without being inspected, prosecuted, and without a need for a threat or a sanction [2]. The concepts of tax ethics and tax consciousness are hidden in this definition. Tax consciousness is defined as a necessary fact that helps to know the extent to which changes in people's tax burden will affect their behavior [3]. Besides that, tax moral is also defined as "taxpayers' intrinsic motivation to pay taxes" in [4]. Higher the tax consciousness happens, higher the tax morality becomes. As long as the tax consciousness occurs and increases, tax moral will increase and a perception of tax compliance will develop (**Figure 1**).

The tax compliance shaped by tax consciousness and tax ethics should be completed by the stages of taxing in terms of the tax payer. The content of tax compliance is described in four parts [5]:

- Complete declaration of the income to be taxed
- Accurate representation of the factors to be discounted from the tax
- Submitting the declaration on time
- Calculating the tax liability correctly.

In our study, the concept of tax compliance will be tested with empirical experiments on university students who are not tax payers yet, but have knowledge about these issues because of their level of education. For this paper, it is preferred to use lab experiment with undergraduate students. As referred in [6], most laboratory experiments which have been conducted by using students are very common. The reason is that in these experiments, it is realized that the responses of students are often heavily the same as the responses of other subject pools in similar lab experiments. Unlike Levitte and List (2007) and Kogler et al. [27], students as a subject pool are useful in many studies [7–10].

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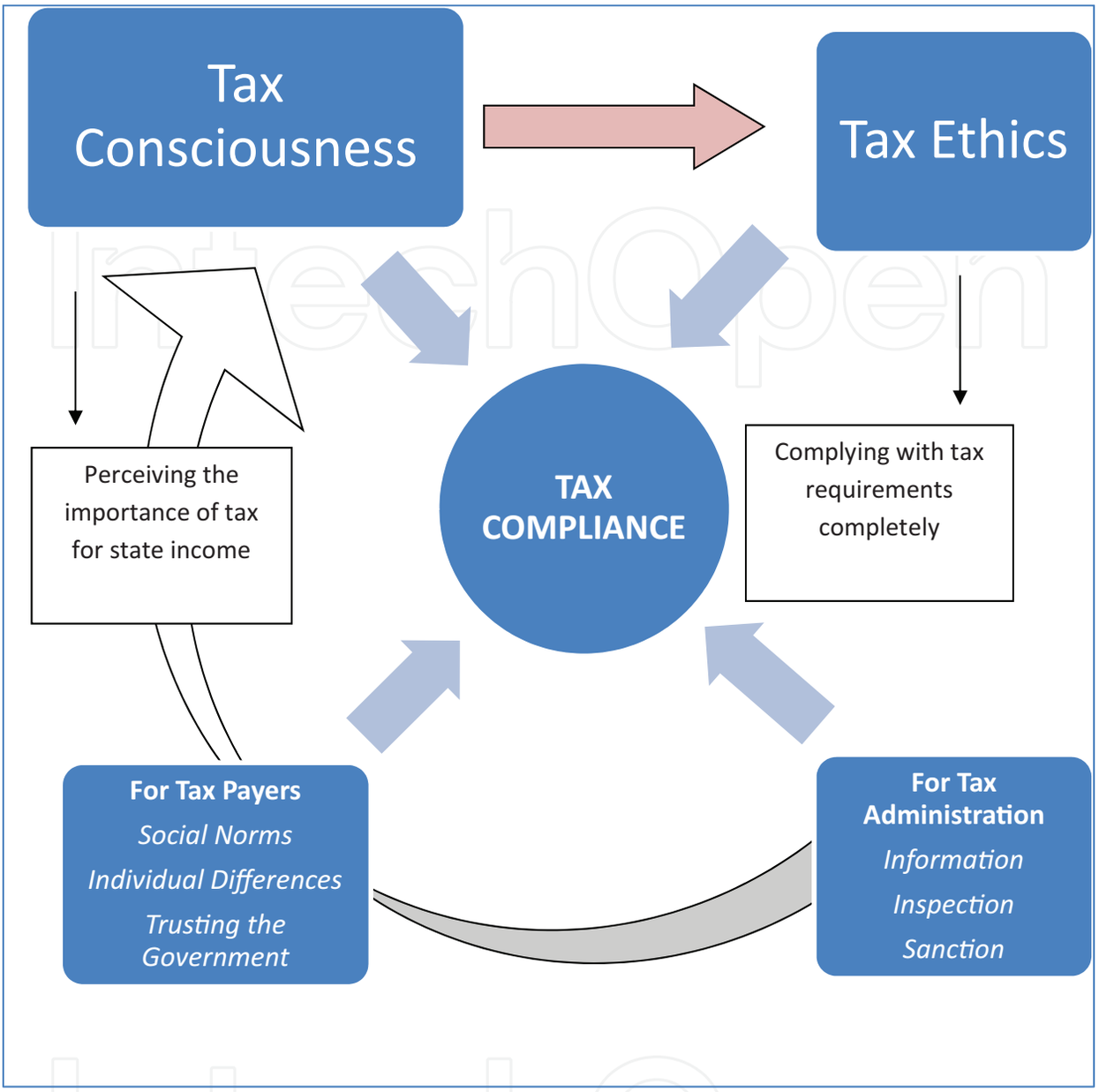

Figure 1. Forward-reverse connections of tax compliance. Source: Author's illustration.

Even though the study has its limitations, it will help in the development of a perception of tax compliance through information before tax-paying experience and efforts for the creation of social norms in terms of its novelty. Thus, it will show whether such efforts will have an impact on the efficiency of future tax income.

1.2. Types of tax compliance and effective factors

Tax compliance may be defined in two ways namely *formal compliance* and *financial compliance.* Formal compliance is the compliance with the formal requirements in terms of tax laws by the tax payers. Financial compliance is the compliance with the financial requirements by the tax payers based on the letter and spirit of tax laws. Formal tax compliance is a complementary

factor on financial compliance. The requirement of financial compliance for the tax compliance to be complete was also indicated by Pertiwi [2].

There are fundamental factors that affect formal and/or financial compliance. The following is a list of factors that affect tax compliance [11]:

- Level of income and tax ratios
- Social and demographic factors
- Sanctions, probability of inspection, previous inspections
- Subjective and objective measures/preventions
- Effects of certified public accountants and/or tax consultants
- Moral and social dynamics
- Complexity of the tax system and tax amnesty.

Among the factors stated above, the ones emphasized here are social-demographic and moral-social dynamics that affect compliance for the tax payer and inspections-sanctions and subjective-objective measures that affect tax administration implementations. The level of knowledge and social norms gained by students in the experiment up to this study is considered to be sufficient in order to test the factors mentioned before.

In addition to the factors listed above, various financial and economic indicators that affect tax compliance may lead to a change in the tax payer's perception of compliance. These factors may be ordered as follows: tax burden, tax structure, debt burden, and underground economy (**Figure 2**).

The most important macroeconomic parameter that affects the perception of tax compliance is the tax burden, which also affects tax consciousness. The higher the tax burden on an individual is, the more problematic the tax compliance becomes, especially because of the idea that the system is unjust. The idea that the tax burden is unjust may develop based on the ratio of direct and indirect taxes in the tax structure. As the tax payers know that indirect taxes are collected from everyone on goods and services and the burden is inversely proportionate to the income, they may develop opposite reactions. In direct taxes, such as ones collected according to a projected declaration, the tax payer may fail to comply with the declaration based on the amount of the burden. In withholding taxes, as there is no way to avoid the tax, there may be thoughts of overestimation against other tax payers. This situation in the direct and indirect tax structure may affect tax compliance by itself, as well as over the tax burden.

Debt burden normally leads to tax increases for the term following the term it is experienced. The tax burden is dependent on the magnitude of the debt burden. This is another way of which tax burden interferes with tax compliance. As Önder reports that any decrease or disappearance of the perception of tax compliance for any reason will bring an increase in underground economy [12]. In scope of this issue, the 2015 Action Plan to Eliminate Underground Economy by the Ministry of Development determined increasing the voluntary tax compliance as an important action plan component and stated that *"Economic, sociological, cultural, etc. factors that affect voluntary tax compliance will be analyzed, and solutions will be developed to increase the level of compliance by the tax payers"* [13].

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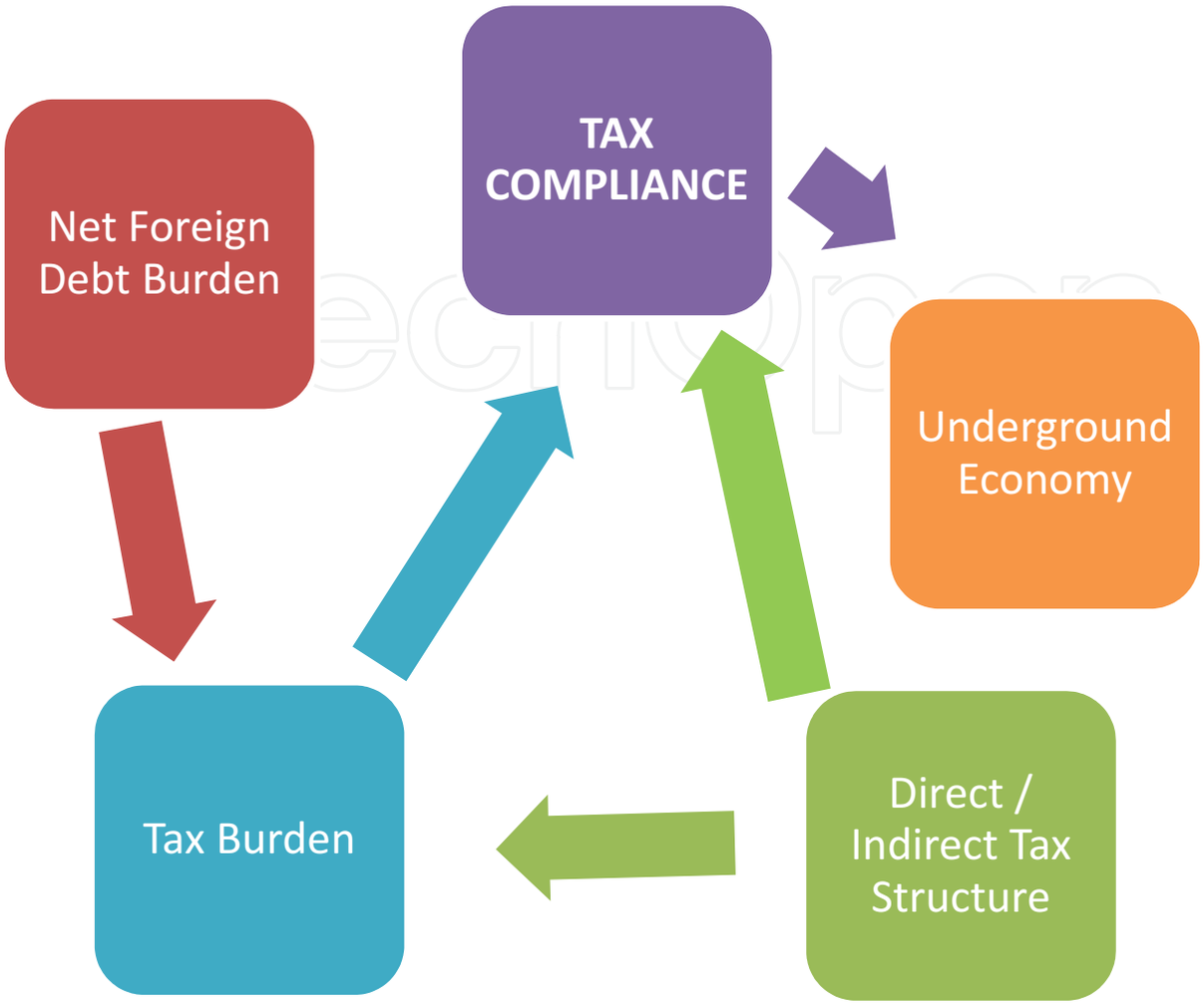

Figure 2. Influencing factors of tax compliance. Source: Author's illustration.

Table 1 shows some indicators that affect tax compliance in Turkey with numbers from the year 2013. These data not only provide numbers important to understand the concepts used in this study but also represent factors that influence real life situations. During the experimental implementation stage of the study, the students were briefed about the data that are mentioned

2013	**%**
Income tax/gross domestic product (GDP)	5.02
Corporate tax/GDP	2.01
VAT + special consumption tax/GDP	10.1
Tax burden/GDP	29.3
Net foreign debt stock/GDP	27.8
The ratio of the total tax income (including social security premiums) lost because of underground economy	16

Source: [14–16].

Table 1. Various indicators that affect the perception of tax compliance in Turkey.

above. As a group which does not carry the tax burden and/or does not completely feel it yet, university students know about these issues in terms of economics and finances, and it is important to test these parameters under these conditions in order to understand the perception of tax compliance.

2. General analysis construct and hypotheses

2.1. The construct and participatory decision structure

Experimental survey method was used for the subject of this study. The questions in the questionnaire consist of ones that were asked in a similar way in previous studies on the subject.[1] There were seven questions and they used a three-point Likert scale as in [17], which worked on "*three-point participation level determination.*" Participants were asked to assign points from 1 to 3 to statements: "1" meant "I do not agree," "2" meant "I somewhat agree," and "3" meant "I agree."

The construct of the analysis is to evaluate the level of significance for the questions in the form of hypotheses and crossexamine the related hypotheses.

2.2. Participants

In total, 287 students from three different departments at the Faculty of Economics and Administrative Sciences of Ankara Gazi University took part in the study. The mean age of students was 23 (SD: 2.1).

As seen in **Table 2**, the departments were chosen by considering the students of these departments start taking public finance, tax law, and economics classes in their first year. Taking the courses which are public finance and tax law helps students understand the place of taxes in law implementation and public finance, whereas learning economics raises awareness on the roles taxes play in the economic system and helps students understand the relationship of taxes and macroeconomic parameters, therefore affecting tax compliance. Every student who participated has taken the mentioned courses and/or is currently taking it.

	Finance department	**Labor economics and industrial relations department**	**Econometrics department**
Number of participants by department	112	102	73

Source. Author's identification.

Table 2. Number of participants by department.

[1]The questions included here are mostly the ones used by Diah Nur Pertiwi in 2013 for the dissertation work titled "the Influence of Tax Consciousness, Service Tax Authorities, and Tax Sanctions On Tax Compliance [Survey on Individual Taxpayer Conducting Business Operations and Professional Service in Jakarta]."

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As seen in **Table 3**, it is important that participants are mostly third and fourth year students, as their knowledge about taxes is above a certain level and they can answer the questions with similar awareness.

2.3. Hypotheses

In selection of the questions in the questionnaire according to Likert Scale Formation Technique (Summation Ordering Technique) described in detail in [18], hypotheses were developed in order to assess the fundamental content of the subjects of this study. The hypotheses are given in **Table 4**.

- Hypotheses H1 and H2 are for testing the tax consciousness, which fundamentally affects tax compliance. Associating paying taxes with being a good citizen and being aware of the contribution of taxes for national development will establish or improve a perception of tax compliance.
- Hypotheses H3, H4, and H5 are indicators for tax payers with established or developed perceptions of tax compliance on whether they comply with the duties of paying taxes as they must be.
- Hypotheses H6 and H7 measure the contribution of factors provided by the tax administration on the perception of tax compliance. Providing correct and fast service at the administration not only establishes/improves trust in the administration but also prevents complexities and strengthens the tax payers' perceptions of compliance.

	First year	Second year	Third year	Fourth year
Distribution of participants by levels	62	48	94	83

Source. Author's identification.

Table 3. Distribution of participants by levels of grade.

	Hypotheses
1	H1: Being a tax payer who shows the required compliance means being a good citizen
2	H2: A compliant tax payer gained this trait as they think paying taxes helps in national development
3	H3: A compliant tax payer makes their declaration on time
4	H4: A compliant tax payer calculates their debt accurately
5	H5: A compliant tax payer is sensitive about paying their tax debts
6	H6: A compliant tax payer gained this trait because the tax administration provided correct and fast service
7	H7: A compliant tax payer gained this trait because the tax administration provided correct information about calculated tax payments

Source. Author's identification.

Table 4. Hypotheses of the lab experiment.

2.4. Limitations of the study

Fundamentally, two things may be provided as limitations of the study. The first limitation is that it is difficult to collect information on tax compliance behavior as encountered in many tax compliance studies [19].

The second limitation is that, as Kogler et al. reported, problems may arise when students are selected as a sample, as they do not have sufficient experience paying taxes. Kogler et al. indicated in 2013 that students fail to concentrate especially on tax evasion scenarios because of their lack of experience [20].

3. Results of the analysis

3.1. General assessment

Frequencies and percentages of the responses to the hypotheses are given in **Table 5**.

As a general assessment, considering the percentages of the responses, the perception of tax compliance decreases for the statements about the tax administration.

Statements	Responses					
	Disagree		Somewhat agree		Agree	
	Frequency	%	Frequency	%	Frequency	%
H1: Being a tax payer who shows the required compliance means being a good citizen	32	11.1	47	16.4	198	69.0
H2: A compliant tax payer gained this trait as they think paying taxes helps in national development	49	17.1	90	31.4	147	51.2
H3: A compliant tax payer makes their declaration on time	19	6.6	38	13.2	230	80.1
H4: A compliant tax payer calculates their debt accurately	33	11.5	61	21.3	192	66.9
H5: A compliant tax payer is sensitive about paying their tax debts	26	9.1	44	15.3	216	75.3
H6: A compliant tax payer gained this trait because the tax administration provided correct and fast service	90	31.4	88	30.7	109	38.0
H7: A compliant tax payer gained this trait because the tax administration provided correct information about calculated tax payments	68	23.7	92	32.1	126	43.9

Source. Author's identification.

Table 5. Statements and the distributions of frequencies of the responses.

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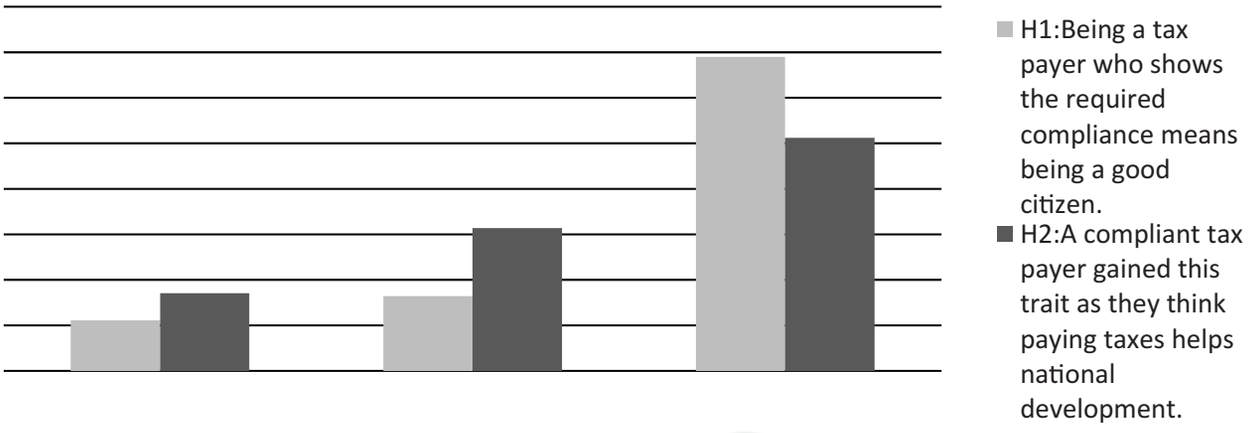
The percentage distribution of the hypotheses H1 and H2 seen in **Graph 1** that the statements are related to tax consciousness and implementations toward these may increase the perception of tax compliance.

Graph 2 shows the relationship between increases in the perception of tax compliance and compliance by tax payers who show voluntary compliance, where the tendency for the participants' responses showed a relationship in the positive direction.

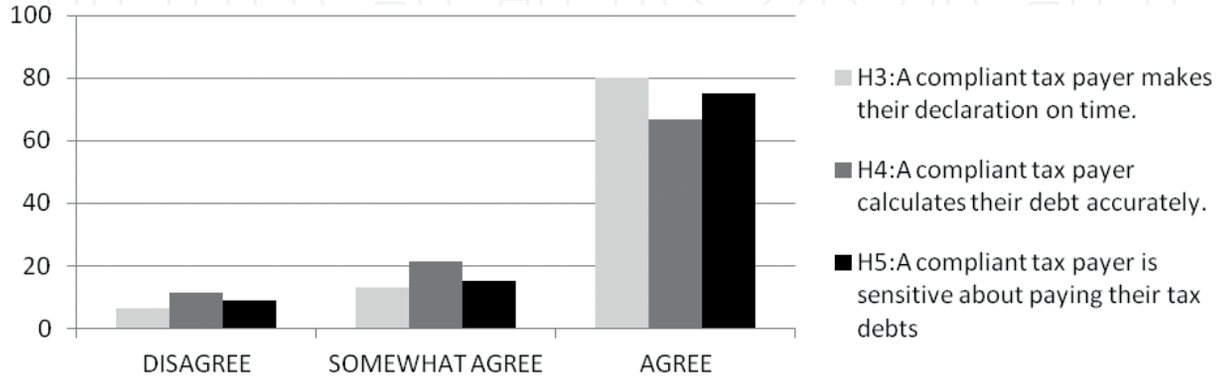
Graph 3 shows the distribution of responses to hypotheses testing effects of trusting the tax administration and the administration's operation on the perception of tax compliance. Participation percentages show that the administration is not considered to be providing a correct and fast service, and this is thought to decrease the perception of tax compliance. It can be seen on the distributions that supplying correct information will prevent complexities and increase the perception of tax compliance.

3.2. Assessment by crossexamination

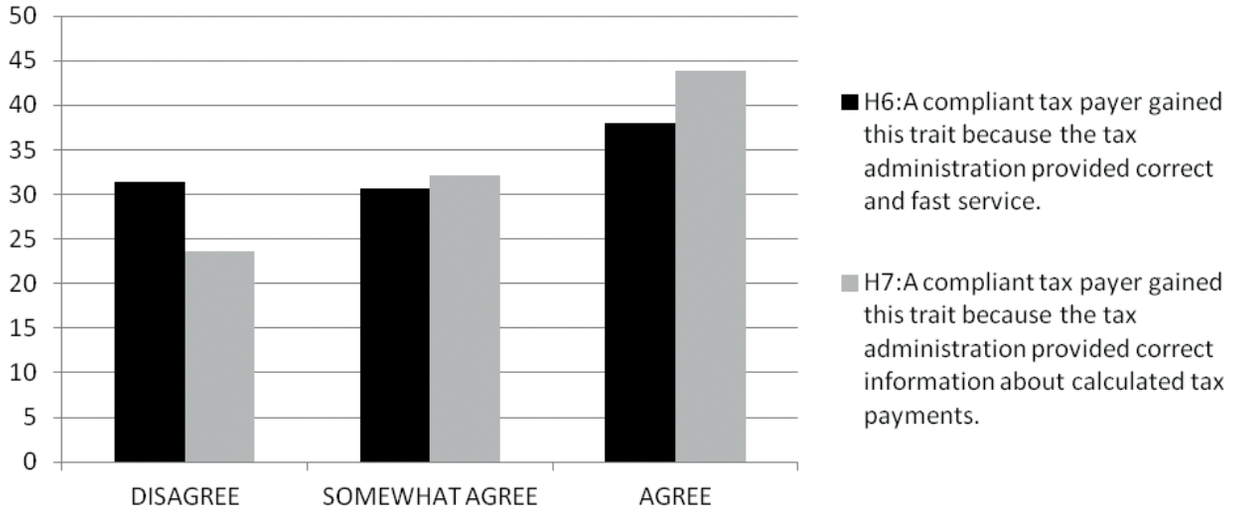
In this section, hypotheses found to be related to each other and with high levels of significance will be assessed by crossexamination. In crossexaminations and comments, three different



Graph 1. The percentage distribution of the H1 and H2 hypotheses. Source. Author's calculation.



Graph 2. The percentage distribution of the H3, H4, and H5 hypotheses. Source. Author's calculation.



Graph 3. The percentage distribution of the H6 and H7 hypotheses. Source. Author's calculation.

stages will be followed: (1) tax consciousness and tax compliance, (2) tax payer duties and tax compliance, and (3) trusting the tax administration and tax compliance.

3.2.1. Tax compliance and tax consciousness

In this stage, the hypotheses H1 and H2 will be assessed together and the tax compliance and tax consciousness relationship will be observed.

For tax compliance, the financial, economic, and social meaning of taxes must be understood by the tax payers. Leder et al. reported that information campaigns about taxes financing public goods and services increase consciousness of tax payers about the importance of taxes, strengthen their perceptions toward financial change, and increase their compliance levels [21]. Likewise, Karakostas and Zizzo also stated that especially implementations like advertisements support the concept of norm creation toward tax compliance [22].

Significance level (P) and chi-squared (χ^2) numbers indicate that the relationship is positive with a mid-sized magnitude. As **Table 6** shows, 45.3% of the participants agreed with both statements. An interesting result arose about the relationship between "being a good citizen" and "contributing to national development." In total, 6.5% of the participants agreed with being a good citizen, but disagreed with contributing to national development. Considering that participants were university students, it may be argued that even though the result covers a few people, the participants have awareness of the liability of the tax payer in terms of being a good citizen, but they do not completely grasp the economic effects of paying taxes and/or they do not think the collected taxes are used for the development.

3.2.2. Tax payer duties and tax compliance

In this stage, the hypotheses H3 and H5 will be assessed together, and the tax compliance and tax payer duties relationship will be observed. Complying with tax duties on time and in the way it must be done is closely related to efforts to create a social norm. Leder et al. stated that

			A compliant tax payer gained this trait as they think paying taxes helps national development			Total
			Disagree	Somewhat Agree	Agree	
Being a tax payer who shows the required compliance means being a good citizen	Disagree	Frequency	16	9	7	32
		%	5.8%	3.3%	2.5%	11.6%
	Somewhat Agree	Frequency	12	25	10	47
		%	4.3%	9.1%	3.6%	17.0%
	Agree	Frequency	18	54	125	197
		%	6.5%	19.6%	45.3%	71.4%
Total		Frequency	46	88	142	276
		%	16.7%	31.9%	51.4%	100.0%

$\chi^2 = 57.594$ Level of significance (P) = 0.000

Source: Author's identification.

Table 6. Tax compliance-tax consciousness relationship.

when there is a low level of tax compliance, strict policies to prevent tax evasion are not enough, but an effort to create a social norm is important [21]. Cummings et al. also stated that inspection bodies are effective on social norms about tax compliance, and these norms are dependent on the tax regime and the state's willingness to satisfy citizens' demands [23]. On the other hand, Feld and Larsen indicated that social norms and deterrence should be used simultaneously [24].

The hypothesis H3 denotes the relationship between tax compliance and making declarations on time, which is the first duty in tax responsibilities. The crossexamination here is making declarations on time and being aware of the importance of taxes in national development. Level of significance (P) and chi-squared (χ^2) numbers indicate a positive relationship with mid-sized magnitude. As it may be seen in **Table 7**, 47.6% of participants believe in the existence of this relationship. Similar to the interesting result of the previous test, 8% of the participants agreed with the timely submission of declarations, while they did not think taxes have a relationship with the national development.

Lewis et al. observed that level of inspections affects tax compliance, and high inspection rates on tax evasion increased the voluntary tax compliance [25]. However, in Kastlunger et al. (2009), it was seen that inspections without increasing and/or strengthening tax compliance lead tax payers to invent new ways to evade taxes [26].

As the sensitivity to pay tax debts, as indicated in H5, is related to being a good citizen and the importance of taxes in national development, **Tables 8** and **9** may be considered together. The levels of significance (P) and chi-squared (χ^2) numbers in both tests show that there is a

			A compliant tax payer is sensitive about paying their tax debts			Total
			Disagree	Somewhat Agree	Agree	
A compliant tax payer makes their declaration on time	Disagree	Frequency	9	9	1	19
		%	3.1%	3.1%	.3%	6.6%
	Somewhat Agree	Frequency	17	11	10	38
		%	5.9%	3.8%	3.5%	13.3%
	Agree	Frequency	23	70	136	229
		%	8.0%	24.5%	47.6%	80.1%
Total		Frequency	49	90	147	286
		%	17.1%	31.5%	51.4%	100.0%

χ^2 = 50.782 Level of significance (P) = 0.000

Source. Author's calculation

Table 7. Tax compliance-tax payer duties relationship 1.

			A compliant tax payer is sensitive about paying their tax debts			Total
			Disagree	Somewhat Agree	Agree	
Being a tax payer who shows the required compliance means being a good citizen	Disagree	Frequency	9	8	15	32
		%	3.3%	2.9%	5.4%	11.6%
	Somewhat Agree	Frequency	7	13	27	47
		%	2.5%	4.7%	9.8%	17.0%
	Agree	Frequency	9	20	168	197
		%	3.3%	7.2%	60.9%	71.4%
Total		Frequency	25	41	210	276
		%	9.1%	14.9%	76.1%	100.0%

χ^2 = 37.254 Level of significance (P) = 0.000

Source. Author's calculation

Table 8. Tax compliance-tax payer duties relationship 2.

positive relationship, while the first relationship has a small magnitude and the second has a mid-sized magnitude. Even though 60.9% participants in the first test agree with both statements in **Table 5**, the distinctive finding is that 5.4% of the participants agree with sensitivity to pay debts, while disagreeing with being a good citizen relationship. This may be explained by

			A compliant tax payer gained this trait as they think paying taxes helps national development			Total
			Disagree	Somewhat Agree	Agree	
A compliant tax payer is sensitive about paying their tax debts	Disagree	Frequency	14	7	5	26
		%	4.9%	2.5%	1.8%	9.1%
	Somewhat Agree	Frequency	16	15	13	44
		%	5.6%	5.3%	4.6%	15.4%
	Agree	Frequency	19	68	128	215
		%	6.7%	23.9%	44.9%	75.4%
Total		Frequency	49	90	146	285
		%	17.2%	31.6%	51.2%	100.0%

$\chi^2 = 50.849$ Level of significance (P) = 0.000

Source. Author's calculation.

Table 9. Tax compliance-tax payer duties relationship 3.

that the students are aware of tax as a compulsory and required liability, rather than being aware of taxes associated with being a good citizen. Kogler et al. stated that issuing feedback to tax payers in a timely manner about tax inspections creates positive effects on tax compliance [27]. Likewise, Castro and Scartascini found that tax payers who received feedback about deterrents to tax crimes had 5% higher amounts of positive behaviors than those who did not receive feedbacks [28].

Similarly, 44.9% of the participants in the test as shown in **Table 6** above agreed with both statements. However, even though 6.7% agreed with sensitivity to pay tax debts, they disagreed with the importance of paying taxes for national development or that it will increase tax compliance. The relationship has the same direction as it is stated in the previous test.

3.2.3. Trusting the tax administration and tax compliance

Hypotheses H6 and H7 were crossexamined, and the relationship between trusting the tax administration and tax compliance was investigated.

Cummings et al. (2009) found that administration's quality of management has an observable effect on tax compliance [23]. Şafaklı and Kutlay (2014) indicated that the tax administration having strategic plans toward knowledge of tax payers of tax laws will increase tax consciousness and therefore tax compliance [29].

Table 10 shows the relationship of H6, which suggests that the tax administration provides correct and fast service and this increases tax compliance and the test of submitting declarations on time, which is the first duty in tax requirements. The level of significance (P) and

			A compliant tax payer gained this trait because the tax administration provided correct and fast service			Total
			Disagree	Somewhat Agree	Agree	
A compliant tax payer makes their declaration on time	Disagree	Frequency	10	4	5	19
		%	3.5%	1.4%	1.7%	6.6%
	Somewhat Agree	Frequency	15	19	4	38
		%	5.2%	6.6%	1.4%	13.2%
	Agree	Frequency	65	65	100	230
		%	22.6%	22.6%	34.8%	80.1%
Total		Frequency	90	88	109	287
		%	31.4%	30.7%	38.0%	100.0%

χ^2 = 19.936 Level of significance (P) = 0.001

Source. Author's calculation.

Table 10. Tax compliance and trusting the tax administration relationship 1.

chi-squared (χ^2) numbers show that there is a positive relationship, while it has a small magnitude. In total, 34.8% of the participants agreed with both statements. However, even though 22.6% agreed with the importance of submitting declarations on time, they did not agree that the tax administration works fast and correctly. It may be that students who have not experienced the tax implementation are missing trust in the tax administration or they have not developed it yet.

Kogler et al. reported that the highest tax compliance and the lowest tax evasion are experienced in countries where the authority is seen trusted and effective by citizens. They argued that the state should win the citizens' trust with generally fair implementations and service-oriented behavior [20]. Verboon and Dijke stated the importance of the authorities' fair treatment of citizens in increasing tax compliance, therefore increasing the effectiveness of their sanctions [30].

When the hypotheses H6 and H7 are considered together, as shown in **Table 11**, significance level (P) and chi-squared (χ^2) numbers show a positive relationship with high magnitude. In total, 28.3% of the participants agreed with both statements. However, 15.7% of the participants disagreed with both statements. Both statements test the trust in the tax administration, and the number of people who chose to disagree is noteworthy. Leder et al. (2010) stated that if the tax administration shows transparency in disclosing final data about financial transition, it will be able to gain tax payers' trust, which is extremely important for tax compliance [21]. Litina and Palivos argued that individuals (tax payers) who believe that the tax administration is honest will have very high probability to respond to sanctions positively [31].

			A compliant tax payer gained this trait because the tax administration provided correct information about calculated tax payments			Total
			Disagree	Somewhat Agree	Agree	
A compliant tax payer gained this trait because the tax administration provided correct and fast service	Disagree	Frequency	45	29	16	90
		%	15.7%	10.1%	5.6%	31.5%
	Somewhat Agree	Frequency	14	45	29	88
		%	4.9%	15.7%	10.1%	30.8%
	Agree	Frequency	9	18	81	108
		%	3.1%	6.3%	28.3%	37.8%
Total		Frequency	68	92	126	286
		%	23.8%	32.2%	44.1%	100.0%

χ^2 = 97.107 Level of significance (P) = 0.000

Source. Author's calculation.

Table 11. Tax compliance and trusting the tax administration relationship 2.

4. Discussion

This study tests tax compliance in terms of university students, who have not yet completely experienced taxpaying implementations. The perception of tax compliance was tested on students who are expected to show high consciousness about taxes because of their qualifications and the departments they study in.

Findings of the study were listed below:

- In terms of tax consciousness and tax compliance, it was seen that students agree that paying taxes completes the concept of being a good citizen.

On the contrary, Leder et al. in which mentioned that importance of information campaigns about taxes financing public goods and services increasing the compliance level, students do not agree with the importance of taxes in national development [21]. This means that convincing information about taxes should be made.

- In terms of tax compliance and tax payer duties, students perceive the sensitivity submitting declarations on time and showing care in paying tax debts.

Feld and Larsen (2012) indicated that social norms and deterrence should be applied simultaneously and Lewis et al. (2009) observed that high inspection rates on tax evasion increase the voluntary tax compliance, and students realizing this as a civic duty tax obligation should be

inspected and audited [24, 25]. Besides that, it should be noted that on the basis of the findings of the study, students see taxes as a compulsory requirement, rather than a way for being a "good citizen."

- The situation is complicated in the relationship of the tax administration and tax compliance.

Thoughts in Cummings et al. in which mentioned that administration's quality affecting tax compliance, Kogler et al. in which reported that how trusted and effective tax authority could make possible an higher tax compliance level in many countries and Verboon and Dijke in which stated the importance of the authorities' fair treatment of citizens in increasing tax compliance are similar [20, 23, 30]. On the contrary, with these workings, in this paper, students have negative perceptions on the tax administration being transparent, correct, and trustable. They think the success in tax compliance is caused by tax payers themselves, rather than by the tax administration.

On the contrary, Litina and Palivos argued that believing in the honesty of the tax administration makes possible that the sanctions are effective, and Djawadi and Fahr mentioned that how the transparency about public expenditures effects the tax compliance in a positive way; another finding in this stage is that the tax administration does not disclose the data on where taxes are spent according to the students [32].

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Chapter 11

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

Sergio Lagunas-Puls, Julio Ramírez-Pacheco and Juan Boggio

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

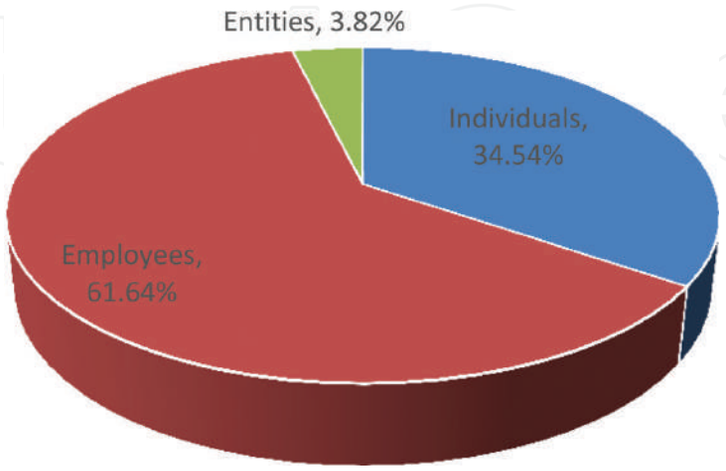

Figure 1. Composition of the active base of contributors considering general averages in 2010–2016. Source: Compiled by the authors with data from the tributary and management report up to the first quarter of 2016.

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*

(*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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Chapter 12

Tax Practitioner Compliance

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Additional information is available at the end of the chapter

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Abstract

This chapter aims to review prior literature on tax practitioner and provides insights into tax practitioner behavior that affects taxpayer compliance. For the end, I attempt to distinguish tax practitioner compliance from taxpayer compliance for a better understanding of tax compliance process. I maintain that tax practitioner compliance can be assessed in the light of tax compliance, bringing about new perspective on tax compliance literature. In order for them to ensure compliance, the tax practitioners continue to develop their professional skills. Furthermore, the tax practitioner should be responsive to the environment in terms of both what clients want and what tax laws allow. However, their ethical judgments based on professional proficiency should not be affected by client pressure. Being a constituent of tax compliance dynamics, tax practitioner compliance may as well be construed in their decisions as well as underlying attitudes toward clients, colleagues, and the tax system. As a service provider, the tax practitioner must strive to reduce inconsistencies between expectations and experiences. As a member of the professions, the tax practitioner refrains from abusive tax schemes that can stimulate institutional corruptions. As a professional, the tax practitioner should safeguard the integrity of the tax system.

Keywords: tax compliance, tax avoidance, tax practitioners, self-assessment tax system

1. Introduction

This chapter aims to review prior literature on tax practitioner and provide insights into tax practitioner behavior that affects taxpayer compliance. For the last four decades, tax compliance has been a subject matter of considerable interest to many researchers from a variety of academic disciplines including accounting, economics, history, law, psychology, political science, and sociology [1]. A great deal of studies has already contributed to the tax literature

discovering factors that shape taxpayer compliance behavior. However, most of them focus on taxpayer's behavioral responses to the tax system and fiscal policy.

Taxation is a highly structured process of institutionalized entities like taxpayers, tax practitioners, tax administration, and up to government and tax lawmakers [2]. Besides, tax compliance is a complex phenomenon in the actors in the field, and their interactions have a great impact on individual taxpayers' behavior [3]. Hence, lack of research on important entities can undermine our understanding of tax compliance behavior that is intimately intertwined [4].

In the real world, professional tax practices are highly relevant to determine taxpayer compliance. Tax practitioner can exert considerable influence on taxpayers in the tax compliance process by either helping them to enforce or exploit the tax law [5]. Many taxpayers, being helpless of overwhelming volumes and mysterious jargons in the tax laws, resort to the assistance from tax professionals who are well-informed of the complex tax rules. Moreover, having limited resources to run their business, taxpayers often defer to tax practitioners for the important decisions about their own tax matters. Therefore, it is essential to understand what makes the practitioners compliant and how they achieve compliance in taxpayer compliance process. However, scientific studies on tax practice in relation to taxpayer compliance are scarce. Furthermore, there is not a widely accepted definition of tax practitioner compliance.

The main objective of the chapter is to provide tax scholars, tax practitioners, and tax authorities with a better understanding of tax practitioner compliance in connection with taxpayers' choice of their tax position. Toward this end, I glean useful knowledge from research findings and synthesize them in order to clarify the meaning of tax compliance in relation to taxpayer and tax practitioner and their interactions. Herein, I refer to tax practitioners as private sector tax professionals who help taxpayers to prepare their tax returns and/or provide advice on tax matters including accountants, paid preparers, lawyers, etc.

Tax practitioner behavior is of great concern to taxpayers, as well as tax authorities. Shafer and Simmons [6] maintain tax advisors have abandoned concern for the public interests in favor of commercialism. The dilemma mainly arises from their dual role as a client advocate and gatekeeper safeguarding the fairness of the tax system. In other words, an aspect of tax practitioner compliance relates to the conflict of client advocacy and professional responsibilities [7]. Mason and Garrett Levy [8], p. 127, defines client advocacy as "a state of mind in which one feels one's primary loyalty belongs to the taxpayer. It is exhibited by a desire to represent the taxpayer zealously within the bounds of the law and by a desire to be a fighter on behalf of the taxpayer."

For example, a noncompliant practitioner is willing to accept overly aggressive or, in its extreme, a fraudulent tax reporting if the probability of detection and punishment is perceived to be relatively low. However, an important question still remains unresolved. Should tax practitioner aggressiveness in terms of recommending tax treatment be deemed noncompliant without any consideration whatsoever? Is tax practitioner compliance achieved if the practitioner takes too conservative a tax position in favor of the government which, arguably, represents public interests?

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This chapter attempts to discover the key to understand the puzzling concept of tax practitioner compliance by illuminating the role of tax practitioners in the self-assessment system ("SAS") in regard to income tax return reporting positions. Since most of prior studies predominantly investigate tax compliance in the frame of individual taxpayers' evasion decision under detection risk, the term tax compliance and taxpayer compliance are often used interchangeably. For the purpose of the article, however, tax compliance should be carefully distinguished from taxpayer compliance. I presume that the tax compliance refers to *ex-ante* process, rather than *ex-post* consequence of the declaration of tax liabilities, in which all the actors in the field are involved to maintain. In a similar vein, Boll [9] argues that tax compliance is a sociomaterial assemblage, and complying is a distributed action among actors in the tax system.

2. The conceptualization of tax compliances

Taxpayer noncompliance refers to any failure to meet tax obligations, and it does not necessarily require intention to pay less tax than the law demands. It may result from deliberate underreporting, inadvertent misreporting, or nonfiling of tax return. The tax gap, which is a popular measure of noncompliance in an aggregate level, is defined as the difference between actual tax collected and the potential tax collection under full compliance [10]. It consists of nonfiling, underreporting, and underpayment of tax [11], which represent filing noncompliance, reporting noncompliance, and payment noncompliance, respectively.

Tax evasion and tax avoidance consist in deliberate act of noncompliance. While tax evasion refers to intentional underpayment of taxes by deliberate nondisclosure of taxable resources [12], tax avoidance is widely considered a legal way of reducing tax dues. Tax avoidance, however, is often against the spirit of the laws, thereby has a chance to be challenged by tax authorities, which eventually falls under the category of noncompliance.

The majority of scientific studies on tax compliance address the problem of individuals' tax evasion decision in the form of underreporting taxable income or overclaiming unwarranted deductions. In particular, most of them are concerned with SAS, in which taxpayers are given opportunities to underreport, and their initial tax liabilities are determined by self-declaration, while the true income will not be observable by tax authorities unless a tax audit is conducted. Thus, tax noncompliance, in the narrowest sense, refers to taxpayers' dishonesty in their tax reporting.

However, it should be noted that, from the viewpoint of taxpayers, noncompliance problem lies not only in undercompliance but also in overcompliance: noncompliance can result not only from underreporting or underpayment but also from overreporting or overpayment. Inadvertent noncompliance may result from the errors and mistakes of taxpayers or tax practitioners. Nevertheless, the researchers and policymakers have paid little attention to the problem of overcompliance. It may be that taxpayers are assumed to be rational enough to deal with tax matters, and thus, discovering of underreporting should be deemed the consequence of their intentional misconduct. On the basis of rationality assumptions, any mistakes may be seen as not due to incompetence but to a lack of commitment to declare a correct tax return [13].

Tax laws are increasingly voluminous, and the law provisions are sometimes terribly complicated to be fully understood. It takes a lot of time and effort to meet the tax obligations, and even if they pay much attention enough to avoid inadvertent errors and mistakes, tax liabilities are often subject to uncertainty from varying interpretations of ambiguous tax situations. For a further understanding, the following section discusses the issues of tax law complexity and ambiguity.

3. Tax law complexity and ambiguity

In practice, many taxpayers are faced with the complexity of tax laws and the uncertainty of enforcement. In most developed countries, tax law is complex, and it requires a very high reading age to be correctly understood [14]. Taxation cost (taxes and compliance cost) is perceived to be much more painful loss for small business taxpayers because they lack sufficient resources to manage their business [15].

If tax laws are vague and complicated, it may be difficult to fully comply with the law even with no intention to evade. Owing to the complex nature, ordinary taxpayers cannot cope well with tax requirements. Sakurai and Braithwaite [16] showed that the most important reason that their survey respondents gave for using tax service was that the desire to avoid the risk of potential tax penalties resulting from inaccurate tax returns. The professional tax knowledge that prevents the taxpayer from unintentional overpayment as well as underpayment can be purchased from the tax practitioners. Thus, an aspect of tax practitioner compliance can be better construed in connection with professional competence that ensures correct tax reporting.

McKerchar [17] maintains that tax complexity is a double edge sword for practitioners: on one side, it induces taxpayers into the arms of practitioners facilitating the market for tax service; but sometimes, it is too much a burden even for them to juggle. Although compliance duties can be addressed more correctly by the tax practitioner, the assistance of the tax practitioner cannot eliminate the risk of inadvertent noncompliance due to the complexity inherent in the law.

Carnes and Cuccia [18] argue that complexity is a source of unintentional noncompliance, and it may represent opportunities for intentional noncompliance as well. More often, tax practitioners can only reduce the uncertainty by assessing the likelihood a tax treatment will be sustained on its merits [19]. That said, inadvertent noncompliance is in part attributable to tax law ambiguity. A tax situation is ambiguous if its proper tax treatment is not *ex-ante* deterministic. Aggressive tax treatment involves a reasonable probability that the reporting position will not be upheld in a tax audit [20]. Aggressive tax practitioners are more likely to interpret the ambiguous tax situation to the benefit of their clients.

Studies on tax practitioner behavior attempt to discover the conditions in which tax advisors would recommend more aggressive reporting position [21]. A number of studies have been conducted investigating factors that impact tax practitioners' willingness to accept aggressive reporting positions; among them are attitude toward risk [22], the threat of penalties [23], and client's risk preference [24]. In particular, Prospect theory [25] may also serve as a theoretical

basis to explain tax practitioner's behavior. According to the Prospect theory, people exhibit risk seeking tendency in a loss situation, while being risk averse in a gain situation. Newberry et al. [26] found that CAPs were more likely to sign a tax return containing a large and ambiguous deduction to retain an existing client than to gain new one.

However, tax practitioner studies tend to avoid compliance or noncompliance, directly focusing instead on aggressiveness [27]. Phillips and Sansing [28] underline that conservative and aggressive are *ex-ante* labels that characterize a reporting position when the law is ambiguous. They go on emphasizing that taxpayer compliance is an *ex-post* and hypothetical concept, because in the real world, many of the reporting positions will not be evaluated by tax inspectors. Put differently, contrary to taxpayers' common beliefs, in many cases, tax compliance is not deterministic in spite of tax practitioners being involved, but it is stochastic depending on the enforcement activities of the tax administration.

4. The work of tax practitioners

There are a variety of motives in hiring tax practitioners. As it is, the role of tax practitioners in tax compliance process can be best understood considering the multifaceted aspects of tax service. Frecknall-Hughes and Moizer [29] argue that the work of tax practitioners in its broadest way can be divided into two kinds: tax compliance and tax planning/avoidance advice; the formal relates to resolve uncertainty in which tax position can be correctly settled, and the latter is associated with ambiguous tax situations in which legitimate tax position is not deterministic. Stephenson [30] discovered four separate constructs underlying the demands for tax practice: legal compliance, time savings, money savings, and protection from the tax authority.

Many taxpayers tend to claim accuracy as their main objective in tax preparation [31]. In that case, the quality of tax service is to ensure the tax returns do not contain inadvertent errors or omissions. It is somewhat evident that taxpayers hire tax practitioners to save time and effort required to achieve compliance. They will delegate tax return preparation to the practitioner, if the opportunity cost of self-reporting exceeds the service fee. Tax practitioners are also expected by their clients to reduce the chances of audit and penalty, thereby lowering monetary and psychic costs associated with audits that would otherwise have occurred [32]. Tax practitioners may provide professional assurance of compliance by verifying and assessing acceptable tax positions in the SAS [33].

Every tax legislation, however, contains "gray" areas that produce ambiguous tax situations. Tax practitioners cannot get rid of entire uncertainty, but they can only gauge the likelihood the position not being upheld by the tax court. The tax position is subject to some uncertainty and hence may step into a process of negotiation with the tax authorities [29]. Indeed, Frecknall-Hughes and Kirchler [34] came up with negotiation theory as a conceptual framework for understanding the nature of tax practice. They argue that the tax advisor/preparer and the tax inspector (who are the employee of revenue authority) are negotiators who act respectively on behalf of a client and the tax authority. While laypersons may see the task of

trials and tax audits as revealing the truth about the matter, many practitioners approach their job as being able to negotiate the best settlement for their clients [35].

Some tax practitioners promote unacceptable tax minimization arrangements, assisting their clients in devising strategies to exploit legal ambiguities [36]. They are inclined to view testing the outer limits of the tax law as a natural and acceptable feature [37]. In recent decades, their role has become more complicated and sophisticated with the special tax knowledge required to facilitate tax avoidance [38]. For example, Sikka and Hampton [39] criticize that accountancy firms have sold tax avoidance schemes to corporations and wealthy individuals, which they refer to as tax solutions or tax strategies.

Nevertheless, it is important to distinguish legally permissible tax planning from potentially unacceptable tax scheme. Adapting motivational postures theory [40], Kang [41] coined two terms indicating differentiated features of tax avoidance: deferential avoidance and defiant avoidance, while deferential avoiders stand firm within the boundaries of the law, defiant avoiders try to push the boundaries of the law's intent by self-serving in terms of law interpretation.

The role of tax practitioners has been viewed as representative of both taxpayers and the government [42]. One might argue that they have to act as advocates for their clients and to serve as intermediaries in the tax system. Tax practitioners should be concerned not only with their client's interest but also with general publics in conducting their practices. Indeed, OECD [43] published a report highlighting the importance of trilateral relationships among tax authorities, taxpayers, and tax intermediaries in promoting taxpayer compliance. In a nutshell, tax practitioners have a legitimate and efficient function as intermediaries or "knowledge brokers" between taxpayers and revenue authorities [44]. They can provide a useful line of communication between tax inspectors and taxpayers. Furthermore, tax professionals can provide a check-and-balance function that prevents tax authorities' possible extortion or tax inspectors' harassment on the part of taxpayers, thereby safeguarding the equity of a tax system [7].

There are a variety of expectations for tax practitioner work, and sometimes an "expectation gap" arises from the misperception of each other's expectation. Expectations gap refers to the difference between client expectations and the professional's perceptions of those expectations and vice versa [20]. Christensen [45] argues that tax preparers' perceptions of what clients expect from tax service differ significantly from clients' expectations. Tax preparers may rationalize it is their clients who demand aggressive tax reporting. Schisler [24] maintains that many taxpayers insist on aggressive tax advice. In contrast, according to Tan [46], taxpayers favor conservative tax advice if the taxpayers' main objective is filing an accurate tax return. This issue is worthwhile to be explored in more depth in the following section.

5. Interactions of the taxpayer and the tax practitioner

Research on the interaction between taxpayers and tax practitioners exists much less than is required, providing the immense amount of time and money spent on tax compliance [20]. Kaplan et al. [5] emphasize the role of tax practitioners in tax compliance by demonstrating

that if a tax practitioner provides aggressive tax advice, the taxpayer is likely to take the aggressive tax position that might not be upheld in a tax audit. On the contrary, Hite and McGill [47] argue that taxpayers tended to disagree with aggressive advice and to agree instead with conservative advice. Or, there is also evidence that conservative taxpayers defer to the opinion of aggressive tax practitioners [48]. Not surprisingly, there are taxpayers who will still accept whatever types of advice their practitioners recommend.

For the tax practitioner, clients' risk preferences could influence the willingness of practitioners to recommend aggressive positions [49]. Cloyd [50], Cuccia et al. [51], and Schisler [24] indicate tax practitioners' tendency to recommend more aggressive positions when taxpayers are more aggressive (risk seeking). Notably, Duncan et al. [52] found the opposite evidence showing the more risk-averse the taxpayer, the more aggressive the tax practitioner, and the more aggressive the taxpayer, the more conservative tax position recommended by the practitioner. Furthermore, Bobek et al. [53] examined how the role of client advocacy influenced tax professionals' decision processes and outcomes and provided empirical results revealing that client characteristics influence tax professionals' advocacy attitudes. These findings suggest that taxpayers and tax practitioners' decisions are interdependent, and studies on their interaction dynamics could be a promising approach to find new insights into tax compliance.

Wurth and Braithwaite [54] underline that practitioners are responsive to influences from many sources—clients, tax authorities, professional associations, governments, international bodies, and the organizations and cultures. For example, Doyle et al. [55] investigated the moral reasoning of tax practitioners in social contexts and in tax contexts, and they found tax practitioners' significantly lower level moral reasoning than nonpractitioners in tax contexts. The study implies that client advocacy may deter tax practitioners' moral reasoning. Reckers et al. [23] pointed out that less important taxpayers are more likely to receive more conservative advice from the tax practitioners. On the contrary, Bandy et al. [56] asserted that economic importance of the taxpayer had little effect on tax practitioners' willingness to be aggressive in terms of providing advice or signing aggressive tax return. Spilker et al. [57] provide evidence that tax practitioners interpret ambiguity in the tax law differently in planning than in compliance stage because they are more vulnerable to problematic tax advice that might result in litigations and reputational loss.

In connection with taxpayer compliance, Practitioner-Client role model developed by Tan [58] recognizes two parties' expectations, and behavioral dynamics can emphasize that how taxpayers and tax practitioners interact with each others are likely to affect each other's tax decisions. Similarly, The Wheel of Social Alignments put forth by Braithwaite and Wenzel [59] synthesizes the drivers of tax compliance regarding tax practitioners as alternative authorities to tax officials.

Some taxpayers exhibit their preference of conservative advice over aggressive one. However, Sakurai and Braithwaite [60] show that some taxpayers prefer "no risk no fuss" type. As with their diverse motivational postures [40], it is natural of taxpayers to exhibit diversity in their preference over tax advice as well as tax position. It is therefore in communicating with their clients, tax practitioners should educate, persuade, and encourage taxpayers to acknowledge the responsibility for their decisions in order to reduce expectation gap [61]. In many cases, ineffective communication is attributable to the failure to achieve compliance procedures

accompanied by unintended consequences. The absence of clear communication and the failure to make reasonable enquiries when information or documentation provided by a client appears to be inaccurate or incomplete [62] tend to engender the disappointment in their tax service experienced.

Tax practitioner self-seeking behavior together with compliance cost can afford unique opportunities to explore taxpayer decision. Tax law complexity increases the cost of compliance, and compliance costs are widely regarded as high. For the part of taxpayers, it may seem unfair to hire a tax professional in order to understand the laws. Taxpayers may expect their compliance cost to be offset by the tax service. If they deem the service fee as a mere expense accompanied by no additional benefit, they will be likely to be more aggressive in order to restore equitable condition. For instance, Jackson et al. [63] well demonstrated how taxpayers and tax practitioners decisions are interrelated. Drawing on mental accounting theory, they postulate mental aggregation of preparation cost with taxes, and tax professionals may place their clients in positive prepayment positions. The concept of mental accounting derived from research on prospect theory describes the set of cognitive operations used by individuals to organize, evaluate, and keep track of financial activities [64]. Then, they provide evidence that tax return preparation fees are larger for taxpayers who receive tax refunds than for taxpayers who owe additional taxes. It is argued that compliance costs paid to the tax preparer and the expected tax refund occur in the same mental account. Thus, taxpayers who have a favorable mental representation of tax return preparation fees may be willing to pay for higher costs incurred by tax practitioners.

6. Conclusion

In this chapter, I attempt to distinguish tax practitioner compliance from taxpayer compliance for a better understanding of tax compliance process. And I maintain that tax practitioner behavior can be assessed in the light of tax compliance, bringing about new perspective on tax compliance literature. As the extent and nature of tax practice are highly relevant to tax compliance, it is worthwhile to investigate the meaning of tax compliance in relation to tax practitioner compliance behavior.

As in taxpayer compliance, tax practitioner compliance can be either inadvertent or intentional. Tax practitioner noncompliance results the lack of professional competence and objectivity. Nevertheless, it is somehow inevitable for them to make mistakes due in part to the inherent uncertainty and ambiguity of the tax legislation. In order for them to ensure compliance, the tax practitioners continue to develop their professional skills; they must stay knowledgeable about current tax issues that have impact, positively or negatively, on their clients. Furthermore, the tax practitioner should be responsive to the environment in terms of both what clients want as well as what tax laws allow. However, their ethical judgment based on professional proficiency should not be affected by client pressure.

In return for their prestige, professions have certain obligations to their clients, colleagues, and the society [65]. For the meaning of tax compliance must include both compliance with the

letter of the law and a respectful attitude toward the spirit of the law and fiscal policy [66], tax practitioner compliance may as well be construed in their decisions as well as underlying attitudes toward clients, colleagues, and the tax system. As a service provider, the tax practitioner must strive to reduce inconsistencies between expectations and experiences. As a member of the professions, the tax practitioner refrains from abusive tax schemes that can stimulate institutional corruptions. As a professional, the tax practitioner should safeguard the integrity of the tax system. In short, the tax practitioners should be carefully place themselves between tax authority and their clients as watch dogs to maintain the integrity of the tax system.

Tax practitioners' noncompliance, in its extreme, occurs when they ignore clients' legitimate right to reduce tax dues, but in its other extreme, tax practitioner noncompliance ensues from their acceptance or collusion of tax evasion. It is therefore necessary for tax authorities to acknowledge that tax practitioners play a role of effective interventions to improve taxpayer compliance. Above all, the practitioners are the ones to prevent taxpayers from taking overly aggressive or/and illegal tax positions. Furthermore, business taxpayers and their tax practitioners can be highly interdependent for tax practitioners can become business confidants [67].

There are many areas of research that have been understudied. Among them lies the conflict of interest between taxpayers and tax practitioner. Although the tax practitioner is hired by the taxpayer, they may act in accordance to their own interest rather than to the benefit of clients. This type of problem mostly arises from the information asymmetry between the taxpayer and the tax practitioner. Some practitioners may take advantage of private information to their own merit. The conflict of interest between taxpayers and tax practitioners that is worthwhile to be explored to establish a complete body of tax compliance literature.

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Chapter 13

Local Governments' Tax Burden in Brazil: Evolution and Characteristics

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Additional information is available at the end of the chapter

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Abstract

Since the establishment of the 1988 Constitution, there has been a movement of fiscal (and in terms of responsibilities) decentralisation towards local governments in Brazil. Nowadays, since the municipalities have nearly a relevant role in the federation as the states have, it has become more important to carry out a detailed study of their tax burden. From the last year before the Constitution until 2016, the municipalities' tax burden nearly doubled in terms of local taxes collected, and more than doubled in terms of available revenue. The growth even remained after 2011, when the national tax burden took a downwards turn. An assessment using the tax base reveals a regressive municipal taxation, similar to the pattern of the Brazilian tax system as a whole. An analysis by population and by region shows that the direct municipal taxation is more intense in the richer and more populous regions, while available revenue is shown to be more relevant in poorer and less populous regions. Despite the municipalities' remarkable evolution in the Federation, a comparison with other countries shows that there is still room for local governments to expand fiscally.

Keywords: tax burden, local governments, fiscal decentralisation, federalism, Brazil

1. Introduction

Throughout the 1980s and 1990s, many countries experienced state reforms based on the privatisation of the state productive sector and decentralisation of social policies. The decentralisation was established by the World Bank as a strategy that would provide more efficiency in the provision of public services, besides subjecting them to greater social control of the population [1]. Thus, a description of these policies was adopted in countries of unitary and

federalist political organisation, but only in the Brazilian federation, the local government was elevated to the condition of federative entity.

The institution of federalism in three spheres of government (Union, 26 states and the federal district and 5570 municipalities) gives everyone a broad political, administrative, legislative and financial autonomy. It is a symmetrical federalism that does not recognise its economic disparities or an unequal distribution of the population in the national territory: 70% of the municipalities aggregate only 17.1% of the Brazilian population, which is very concentrated in large cities (29.3% of the population lives in 38 municipalities with more than 500,000 inhabitants). But, almost half of the municipal tax collection is also concentrated in these municipalities [2].

Such inequality would translate into different financial autonomies between municipalities: the larger ones have more capacity to raise own revenue, but a large majority of small municipalities depend on revenues from intergovernmental transfers. Recognising territorial disparities in such a context raises major challenges for the federative cooperation in Brazil. It is about going far beyond what this chapter proposes.

Usually, in most federalist countries, the local governments have the smallest budget among the different levels of government. As this level of government is more fragmented and meets the needs of targeted segments of the population through less complex public policies, there is a natural tendency for the resources available in local governments to be lower than those of state/regional governments and the central government.

In Brazil, this scenario is no different, but there is an important aspect to be highlighted: the regular and increasing participation of the municipalities in the consolidated public sector's available income. In 2014, the municipalities directly collected about 7% of the country's tax burden and ended up with just under 20% of this amount after intergovernmental transfers [3]. In 1987, a year before the enactment of the Federal Constitution, these shares were 2.5 and 12.6%, respectively [4]. The growth trend is so consistent that nowadays the municipalities have a budget almost as important as that of the state governments, a fact that has led some authors, for example, Afonso and Araujo [5], Castro and Afonso [6] and Fernandes and Wilson [7], to classify the fiscal federalism in Brazil as a "fiscal municipalism" or "municipal federalism."

If much of this growth was due to the increase in intergovernmental transfers, the local governments' greater capacity to levy taxes was no less important. According to Serra and Afonso [8], the subnational governments' ability to levy their own taxes strengthened and consolidated from the establishment of the Constitution of 1988 and did so concomitant with the expansion of the country's total tax burden [9]. That is, the municipal participation in this burden expanded precisely at a time in which the Brazilian welfare state grew after the current constitution advanced social rights.

If the flow of resources has increased, the allocation of public policies has also been growing at an accelerated pace. During the 1990s, when faced with the new reality of reduced participation in available revenue resulting from decentralisation, coupled with the need for fiscal adjustment and macroeconomic stabilisation [10], the Union began to follow unorthodox

procedures with regard to intergovernmental relations. It became the norm for tax-collecting efforts to be concentrated in unshared revenue, such as social contributions [11] and the transfer of responsibilities to other spheres of Government [12], which was backed by the Constitution of 1988 to establish obligations common to more than one level of Government.

Despite the municipalities gaining space in the Brazilian federation, several problems relating to the implementation of public policy and tax collection and administration at local level can still be observed. Regarding expenditure, one can highlight the institutional difficulties of inter-municipal cooperation (in the case of consortia) in the provision of public services [13], which is also hindered by the federation's horizontal inequalities [14], thereby generating inefficiency in public spending. Regarding revenue, tax management is still plagued by inefficiency, and municipal tax authorities have high administrative costs, especially in places with smaller populations and less economic weight which still rely heavily on federal and state transfers [5].

This study addresses this last question. Since the public sector's fiscal space is mostly determined by its tax revenue, it is necessary to analyse municipal taxation. As Ingram and Hong [15] categorically affirmed, the importance of studying municipal finances comes from the idea of cities and their surroundings as agents of economic growth, in which the efficient provision of public services can create the correct incentives for firms and households. The inadequate supply of infrastructure and urban services (such as public transportation) by local governments tends to lead to a loss in productivity, thereby weakening the local economy [16].

The importance of this analysis goes further: few studies have chosen to do an evaluation focused on this theme in Brazil. Broadly speaking, the vast majority of the work produced in Brazil on taxation is aimed at the federal level or the consolidated public sector. At the municipal level, it is common to read articles about taxation with more specific content based exclusively on one tax or even in the form of case studies.

Therefore, the aim of this study is to analyse the tax burden of local governments in Brazil, focusing on its historical evolution, participation in the federation, size, tax base and distribution of revenue between localities according to their size and region. It is important to note, however, that the tax burden here will be assessed in a broader sense, not just restricted to direct income (direct taxation), but also to tax revenue resulting from other spheres of government destined for municipalities—that is, the available revenue. To achieve this objective, a descriptive analysis of data—always obtained from official sources—will be carried out, supported by bibliographic references related to the topic.

In addition to this introduction, five more sections are presented: Section 2 presents the evolution of municipal taxes, relating it to the trajectory of the total tax burden; Section 3 examines how municipal taxation impacts on the economy, once more, in contrast to the consolidated public sector's tax base; Section 4 presents data broken down by population and region; therefore, attempting to understand how taxation behaves according to the size and location of municipalities; Section 5 presents a brief international comparison of the size of local governments in fiscal federalism and finally, Section 6 presents final considerations on the topic.

2. Historical evolution of municipal taxation

The tax burden, in its strictest sense, is nothing more than the simple relationship between the volume of resources collected via taxes and the gross domestic product (GDP) of a given location over a given period of time. Usually, the tax burden is calculated at a national level, considering the total fiscal collection that occurred in the country in a given year. This common and broad approach to the tax burden will not be used in this study; instead, it will restrict itself only to taxes levied by local governments. In other words, the analysis will focus only on taxes that fall within the scope of municipalities and on the intergovernmental transfers they receive—not withstanding eventual comparisons of this type in other levels of government.

The basic source for consultation on municipal revenue is the publication Brazil's Finance (Finbra) from the Brazilian National Treasury (STN). The GDP is obtained by the System of National Accounts (SCN) with the Brazilian Institute of Geography and Statistics (IBGE). For the other areas of government, some other official sources were consulted: Union Balance Sheet (BGU) and Budget Execution of the States (EOE), STN; System S Transfer Report, from the Brazilian Internal Revenue Service (RFB), and the Workers' Severance Guarantee Fund (FGTS) Report, a service of the Federal Social Bank (CEF). Furthermore, information was also obtained from the STN, National Petroleum Regulatory Agency (ANP) and National Electrical Energy Regulatory Agency (Aneel) to compose the database regarding transfers between governments.[1]

The tax burden of municipalities—from the standpoint of direct collection—is estimated at 2.37% of Brazil's GDP in 2016, which represents approximately 7.2% of the same year's total tax burden. With a clear upward trajectory since the Constitution of 1988, the municipal tax burden of 2016 was the largest ever achieved in the history of the country, surpassing by 1.77 pp., the GDP of 1987, the first year of the National Constitutional Assembly that gave rise to Brazil's current "magna carta." **Table 1** presents the evolution of each sphere of Brazilian Government's tax burden, from the viewpoint of direct collection and available revenue, since 1960.

At the same time as their own collected revenue increased, the municipalities experienced a substantial rise in intergovernmental transfers: an increase in transfers from the Municipal Participation Fund (FPM), the creation of the Fund for Maintenance and Development of Basic Education and Valorisation of Education Professionals (Fundeb), as well as the expansion of municipal participation from 20 to 25% of the state Tax on the Circulation of Goods and Services (ICMS) collected, were the main events to have contributed to such scenario.

The increase in transfers from the Union and the states made the municipalities' available revenue (direct collection plus transfers) increase from 2.98% of GDP in 1987 to 6.67% of GDP in 2016—a growth not as intense (in relative terms) as in the case of direct collection, but still very expressive and unparalleled in the Brazilian federation. To have a basis for comparison, in the same period, state governments increased their available revenue by 2.86 pp. of GDP, below the 3.68 pp. of local governments. Municipal participation in federal and state revenue

[1]The entire procedure of calculating the tax burden adopted in this chapter follows the "broad" methodology of calculation, which considers all public revenue extracted compulsorily from society by part of the government (federal, state and municipal). In this way, the method used here differs from most of the tax burden estimates by including items such as royalties, economic contributions, tax fines, revenue from active tax debt and others. For more details, see [1].

Year	Tax Burden (% of GDP)				Composition (% of Total)			
	Union	States	Municipalities	Total	Union	States	Municipalities	Total
DIRECT COLLECTION								
1960	11,14	5,45	0,82	17,41	64,0	31,3	4,7	100,0
1970	17,33	7,95	0,70	25,98	66,7	30,6	2,7	100,0
1980	18,31	5,31	0,90	24,52	74,7	21,6	3,7	100,0
1990	19,29	8,52	0,97	28,78	67,0	29,6	3,4	100,0
2000	20,38	8,45	1,73	30,56	66,7	27,6	5,7	100,0
2010	22,36	8,81	2,07	33,23	67,3	26,5	6,2	100,0
2015	21,65	8,80	2,36	32,80	66,0	26,8	7,2	100,0
2016	21,37	8,95	2,37	32,69	65,4	27,4	7,2	100,0
AVAILABLE REVENUE								
1960	10,37	5,94	1,11	17,41	59,5	34,1	6,4	100,0
1970	15,79	7,59	2,60	25,98	60,8	29,2	10,0	100,0
1980	16,71	5,70	2,10	24,52	68,2	23,3	8,6	100,0
1990	16,95	7,94	3,89	28,78	58,9	27,6	13,5	100,0
2000	17,07	8,16	5,33	30,56	55,9	26,7	17,5	100,0
2010	18,76	8,34	6,13	33,23	56,5	25,1	18,4	100,0
2015	18,10	8,22	6,48	32,80	55,2	25,1	19,8	100,0
2016	17,61	8,41	6,67	32,69	53,9	25,7	20,4	100,0

Elaborated by the authors. Primary sources: Varsano et al (1998), Afonso and Castro (2016), STN, RFB, CEF, ANP, Aneel and IBGE.
Broad methodology: includes taxes, fees and contributions, including FGTS, royalties, revenue from fines and active debt.
Available revenue = tax collection plus/minus constitutional sharing of tax revenue and other compulsory transfers.

Table 1. Evolution of the Tax Burden's Federal Share by level of government, 1960/2016.

is fundamental for understanding the strong growth of local governments' role in the Brazilian federation—not only through increased revenue, but also due to the fact that local governments have become responsible for implementing much of the country's social policies.

The significant participation of the municipalities in the public sector's available revenue (around 20%) was achieved due to two decentralising movements provided by the Constitution of 1988: granting tax autonomy (their own revenue) and intensification of intergovernmental transfers. This aspect is important in the Brazilian Federal debate because, as indicated by Afonso and Araujo [5], the idea that the municipalities' revenue has grown since the 1980s exclusively due to federal and state transfers is not unusual.

The municipalities' own resources were and have been such important factors to the "fiscal municipalism" in Brazil that in recent years, it is possible to identify an interesting aspect about the direct collection of local governments: the continuing tendency of an expanding tax burden even with the economic crisis that took hold of the country from 2014 [17]. The country's total tax burden has been showing a pattern of contraction since 2011, leading Ribeiro [18] to point out the existence of a structural break in Brazilian tax elasticity with respect to economic performance from the subprime crisis of 2008. Apparently, this break applies to the public sector as a whole, but not specifically for local governments.

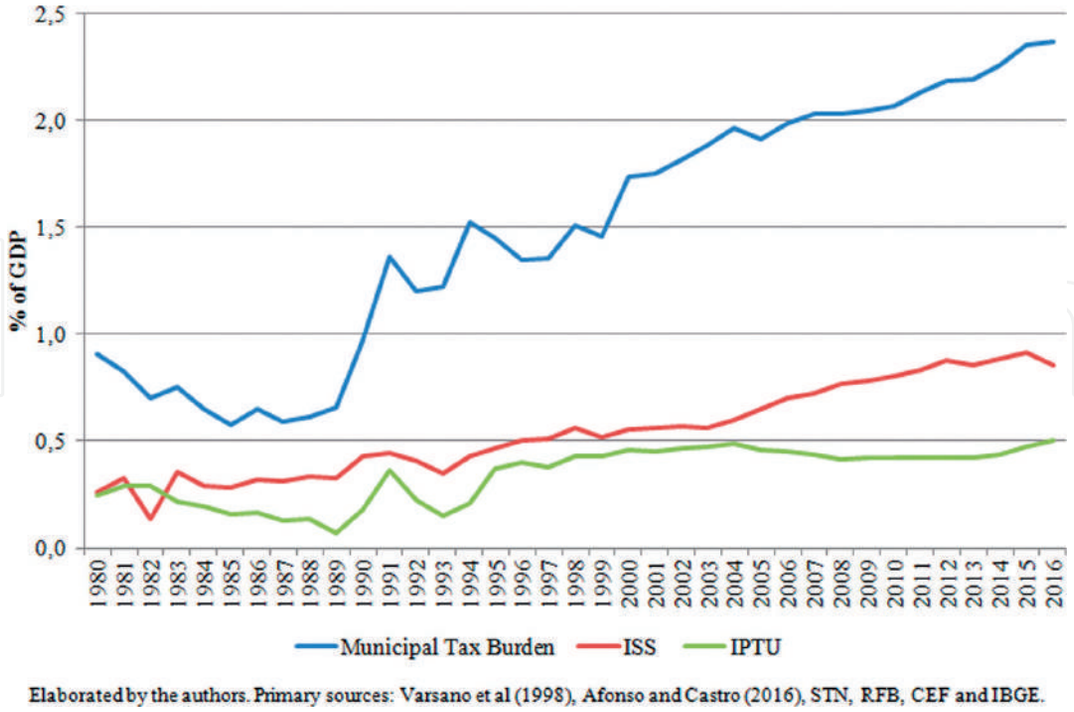

Figure 1. Evolution of the municipal tax burden and its main components, 1980/2016.

Breaking down the municipal tax burden, one can see that it is determined primarily by two taxes: the Tax on Services of any Nature (ISS) and the Property Tax (IPTU). While the first is an indirect tax, levied on the service sector's production, the second is a direct tax on urban real estate. Between 1980 and 2016, these two taxes accounted for, on average, more than 60% of the municipal tax burden. In 2016, this participation was 57.7%. **Figure 1** shows the trajectory of the municipal tax burden and its main components since 1980.

Although both taxes present an expansionary trend from a historical perspective, this is most evident in the case of the ISS, especially from 2003 onwards. Some explanations may be suggested in this case: First, the modern economy is leaning increasingly towards the service sector, especially those services of higher added value, related to innovation and technology [19], and, in Brazil's case, especially in metropolitan areas [20]; second, the enactment of Amendment No. 116 in 2003, which increased the activities subject to the ISS; third, the advent of the electronic invoice in local governments, which modernised tax management and supervision [21] and consequently, the revenue collected [22, 23] and fourth, the relatively low IPTU collection in light of its potential [24–27].

3. Tax burden by tax base

Assessing the tax burden by tax base intends to identify which economic categories underpin the tax wedge, thus being able to make some inferences about the characteristics of the tax system studied such as fairness and distributive efficiency.

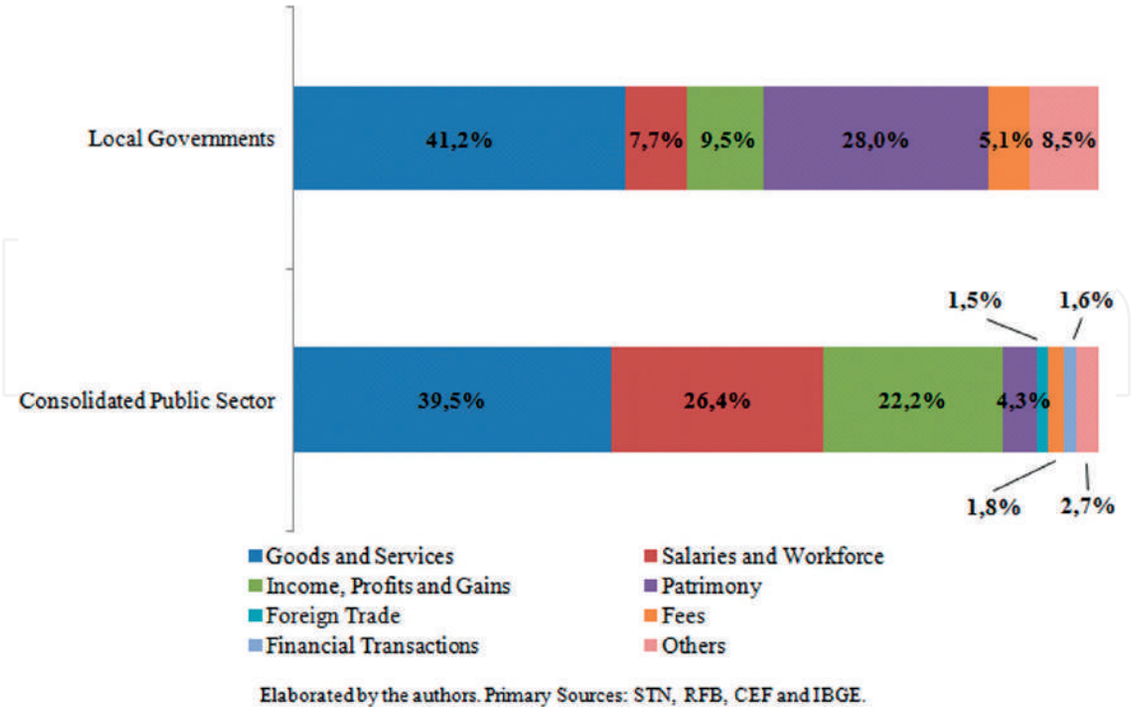

Figure 2. Composition of the tax burden by tax base, 2016.

According to Afonso and Castro [3], the Brazilian tax burden (total) is markedly characterised by a high incidence of taxes on the sale of goods and services. In fact, the data from the 2016 tax burden point in this direction, as evidenced in **Figure 2**. However, the picture is significantly different when the municipal taxation is examined separately.

Despite the taxation on goods and services being pretty close in both cases, the way in which the taxes are levied (direct and indirect) acts slightly differently in the two cases. Adding the base of goods and services to taxation on foreign trade, financial fees and transactions (plus "others"), makes up the framework of indirect taxation in the country—which is usually regressive [28, 29], helping to accentuate social inequalities.

> *The burden of indirect taxation […] is high in Brazil. The so-called indirect taxes, included in the prices of goods and services are collected by third parties, responsible for charging, but effectively borne by final consumers. Such taxes, by their nature, affect consumers indiscriminately, regardless of their level of income. Therefore, mainly the poorest, who spend their entire income on consumption, are encumbered. The ultimate effect of this taxation is highly regressive and concentrating [30], p. 85.*[2]

As **Figure 3** shows, this indirect base has greater importance in the municipal taxation (50.6%) than in the consolidated public sector taxation (45.7%), which could indicate a worse tax structure in the municipal scope.

[2]Translation made by the authors.

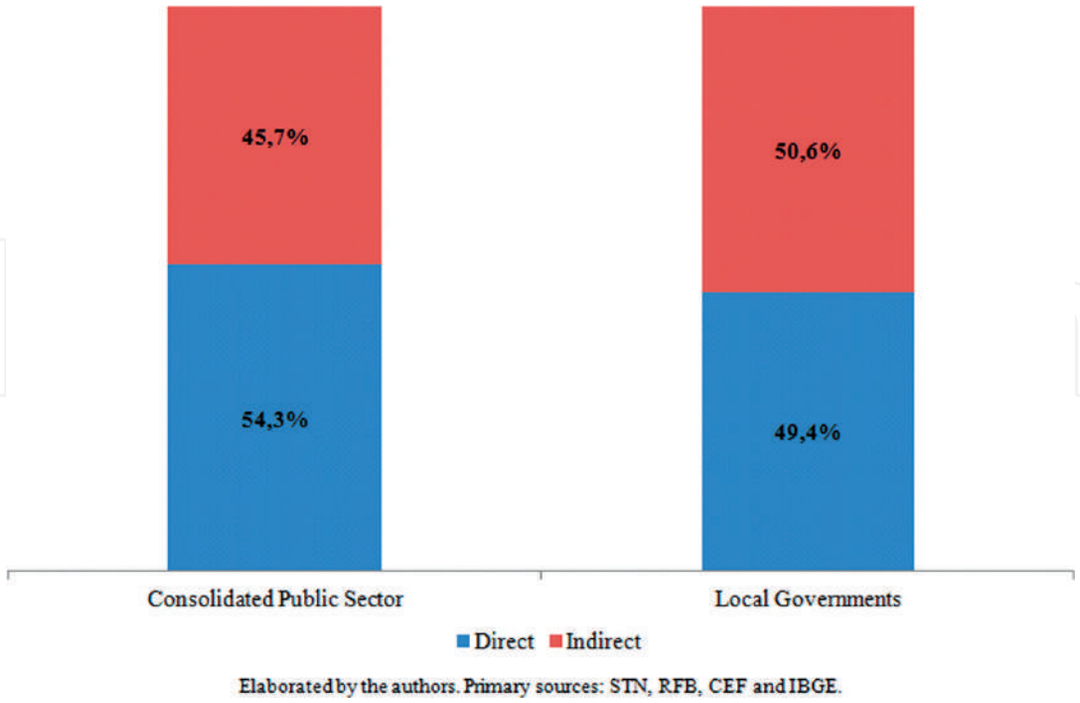

Figure 3. Tax burden of the consolidated public sector and local governments by type of taxation, 2016.

However, classifying taxes by how they are levied is not enough to make such an assertion. This is because, even among direct taxes, there is evidence of low levels of progressiveness or even regressiveness. For example, Carvalho Jr. [31] is categorical in stating that IPTU—despite being a direct asset tax—is regressive, within the realm of real contributors (taxpayers). Another case is that of the social security contribution (tax base "salary and labour") which, "[…] by virtue of the upper limit of contribution, acts regressively" [32], p. 13.[3] In the same sense, Mélo and Campos [33] point to a historical process of deterioration in progressiveness of taxation on income and patrimony.

In this way, considering indirect taxation's greater weight in the tax authorities of local governments, along with the fact that IPTU (the second largest municipal tax) also presents regressive characteristics, it is reasonable to assume that the municipal taxation contributes to accentuating social inequality in Brazil, following a characteristic which is inherent in the Brazilian tax system as a whole [9].

4. Taxation by size of municipality and region

Following the evaluation of the municipal tax burden, this section aims to breakdown municipalities into groups by population and region of the country. An analysis focused on this is important to see how the tax burden of local governments behaves as the socioeconomic

[3]Translation made by the authors.

profile of the localities is changed, allowing questions such as: "do bigger cities have a higher tax burden?" or "what is the profile of a municipality that receives relatively more transfers?" to be asked.

Due to the information that is presented in this section being in greater detail, it has not been possible to present data as recent (2016) as that of the two previous sections. Since the last GDP for municipalities released by the IBGE refers to 2014, this section is related to 2014. Therefore, the main base of information (Finbra) was also from that year. This on the other hand was reedited to remove major errors such as zero or negative values, but providing a final sample of 4866 municipalities—87.4% of the total number of municipalities in Brazil (5570) in 2014. To calculate the burden, the municipalities were divided into six bands of populations[4] and five regions.[5]

Given these brief methodological considerations, **Figure 4** presents the municipal tax burden (% of GDP) in terms of direct taxation and available revenue in each of the six population bands and the general average.

Figure 4 presents two clear movements when the data are observed from the smaller to the higher population range: first, the local governments' own direct collection grows in relation to the size of the municipality in terms of population and second, the available

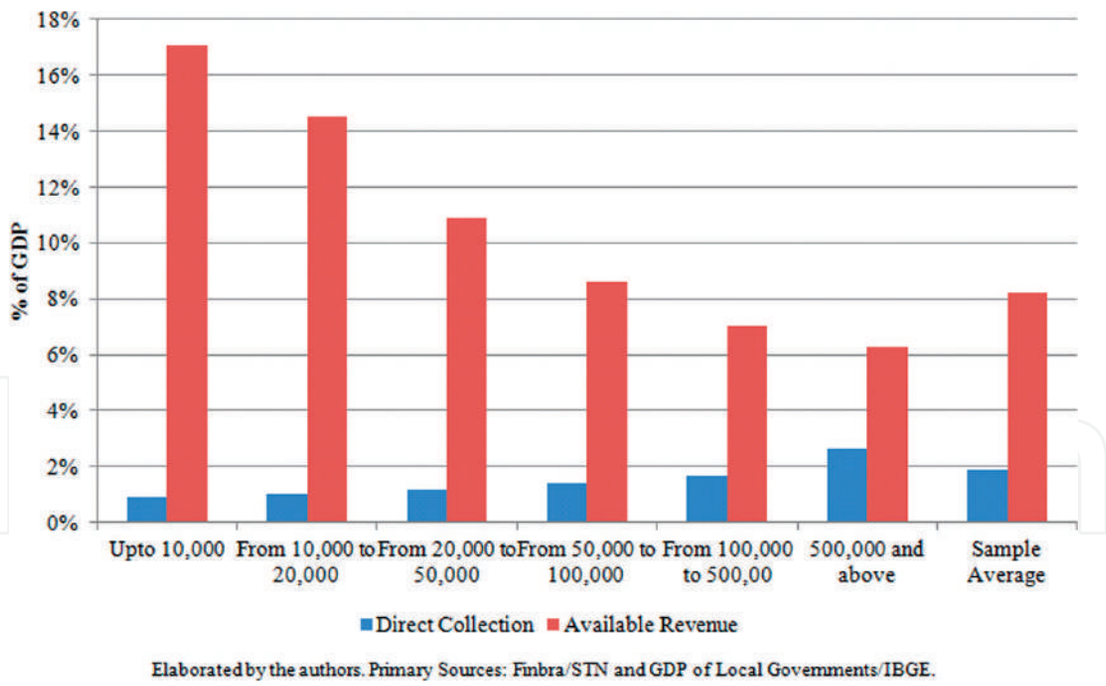

Figure 4. Direct collection and available municipal revenue by band of population, 2014.

[4]The population bands are as follows: up to 10,000 inhabitants; from 10,000 to 20,000 inhabitants; from 20,000 to 50,000 inhabitants; from 50,000 to 100,000 inhabitants; from 100,000 to 500,000 inhabitants and 500,000 inhabitants and above.
[5]The regions are according to the national geographic division: North, Northeast, Southeast, South and Central West.

revenue (including transfers) presents an opposite trend, having an inverse relationship with the size of the municipality in terms of population.

A few observations can be made from these results. Firstly, regarding the relatively higher tax burden in the larger cities, the evidence is consistent with the literature that points to a tendency of service agglomeration in major urban centres [34, 35], especially the more sophisticated services which are connected to industrial activity [36]. Therefore, considering it is the municipality's responsibility to levy tax on the services sector, it is expected that the municipal tax burden would tend to be larger in larger cities. Furthermore, the concentration of these services and population in a limited area of the region raises the value of the urban properties, providing greater potential for revenue gained from tax levied on real estate assets [37] such as IPTU.

Secondly, a big distortion can be seen when analysing the resources actually available to local governments after transfers from other spheres of government. As there is a clear difference in cities' abilities to levy taxes, intergovernmental transfers—notably those with unconditional redistributive characteristics such as the FPM—come into play to reduce horizontal inequalities between localities. However, as shown by the data, in fact, this does not happen. This had already been demonstrated by other authors such as Prado [38] in stating "[…] the Brazilian federation has a tax system which lacks an efficient and dynamic method for reducing disparities" [38], p. 41.[6]

In fact, intergovernmental transfers—especially the FPM and the State Participation Fund (FPE)—tend to accentuate the horizontal inequalities by prioritising the allocation of resources to locations with less population. **Figure 5** shows the relationship between transfers distributed to municipalities per capita and the size of the municipalities' population, in which a negative relationship between the volume of resources received and the size of the population can be seen.

Once the Union and state transfers represent a relatively larger portion of the municipalities' disposable income than the local taxes levied, it is established that an unbalanced distribution of resources via intergovernmental transfers distributed horizontally (between municipalities), as shown in **Figure 5**, goes hand in hand with a lack of equality in available revenue. **Figure 6** shows that even adding their own revenue to transfers, available revenue per capita tends to be higher in the municipalities with smaller populations.

In an ideal scenario, the trend line in **Figure 6** should be completely horizontal: that is, the available revenue per capita should be exactly the same for all municipalities. This ideal scenario would use as a criteria only the population (number of residents) as a proxy for the level of demand for public goods in municipalities.

However, the scenario is a little more complex: the most populated cities require a greater volume of resources to meet the population's needs, due to the population density, the higher rates of urban problems (violence, traffic, etc.) and the greater complexity of services demanded (better informed voters with higher levels of education). At the same time, the less

[6]Translation made by the authors.

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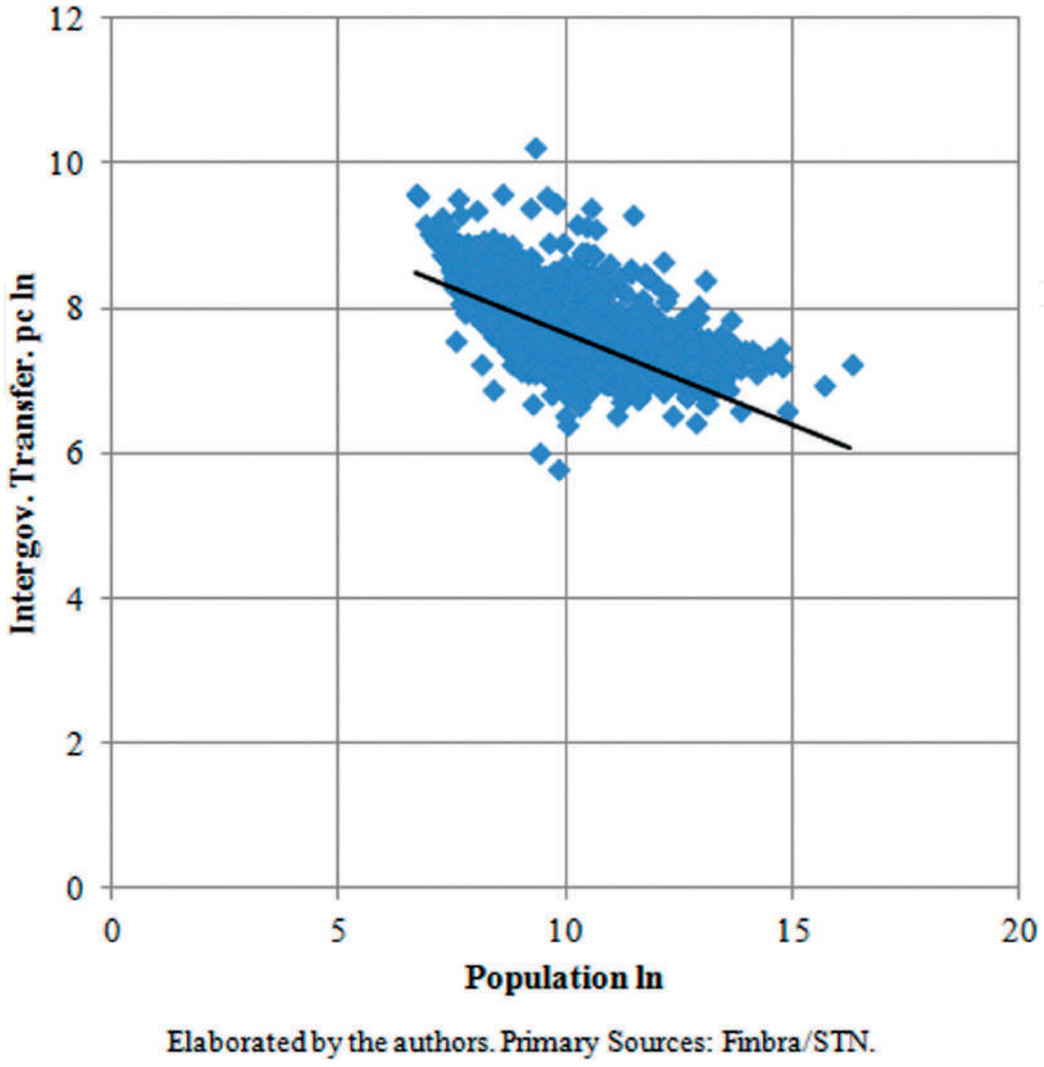

Figure 5. Intergovernmental transfers per capita × population, 2014.

populated locations have fewer resources to co-finance a growing number of policies formulated by the federal government and assigned to local governments. A significant part of municipal spending on social policies is protected by the Constitution, which makes the allocation of fixed percentages in state and municipal budgets for the health and education sectors mandatory [39]. In 2016, the governmental level which showed the bulk of spending on health and education, approximately 50% of the spending that year, was the municipal governments, according to STN [40].

Another way to observe the inequality between the different locations, from both of the aforementioned points of view of the municipal tax burden, is separating by region, as shown in **Figure 7**.

Here, there is a pattern quite similar to that obtained in **Figure 4**, in which regions with lower socioeconomic development (with less populous cities) collect less tax themselves (direct collection) and have more available revenue. This is exactly the case of the North and Northeast.

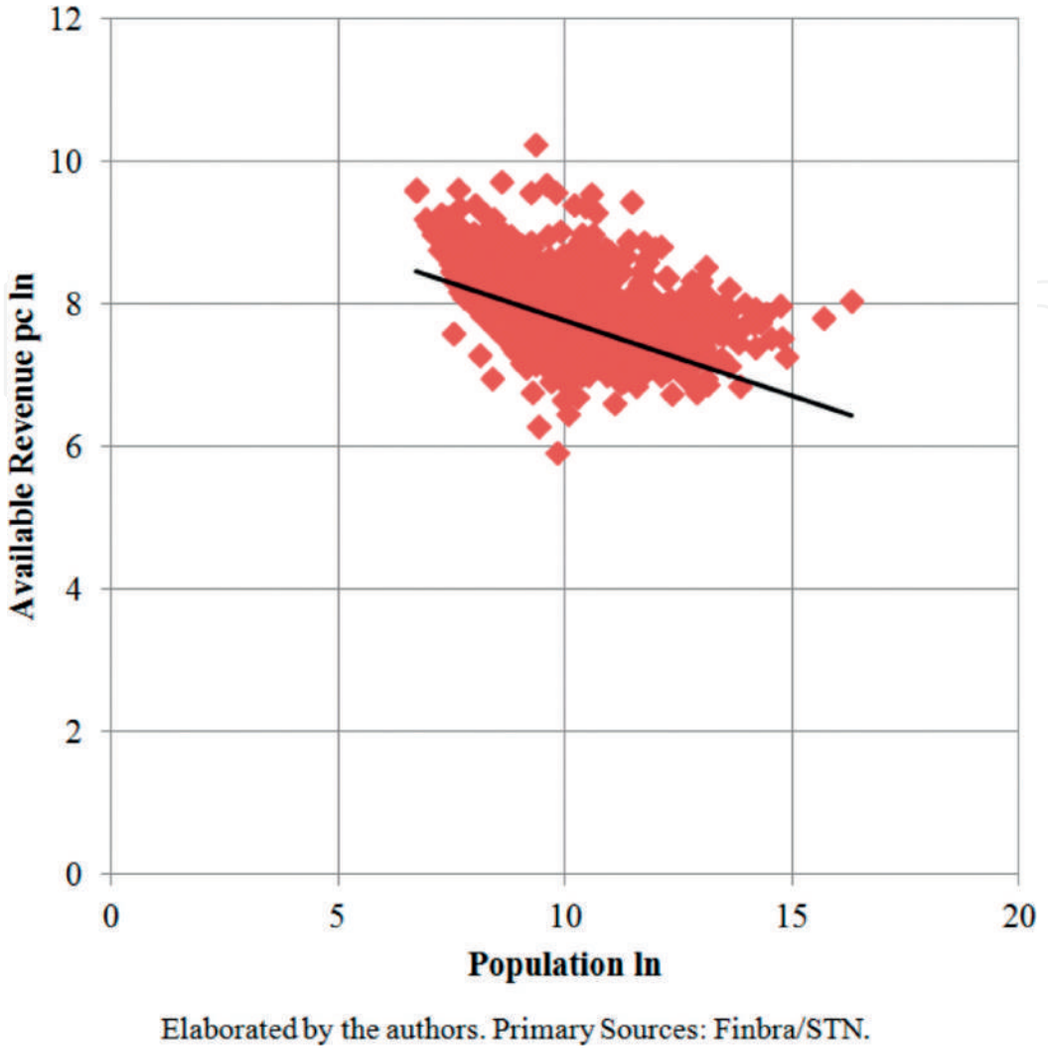

Figure 6. Available revenue per capita × population, 2014.

On the other hand, the Southeastern, which is known to be more advanced economically and in terms of population, has a higher municipal tax burden from the perspective of direct collection and a lower available revenue from the standpoint of local governments.

This pattern of a smaller tax burden in poorer and less populated regions is directly related to a more restricted taxable base, in addition to the costs and administrative difficulties of the collection procedure in small municipalities [5]. Nevertheless, it is possible to affirm that with the arrival of the Public Digital Bookkeeping System (SPED)[7] and dissemination of the use of Electronic Invoices, these barriers should be reduced.

Besides the economic and administrative aspects, it is possible to point out yet another contributing factor to the lower municipal tax burden in less affluent locations: the incentive

[7]Established by Decree No. 6022, of 22 January 2007, the SPED is to modernise the current performance of ancillary obligations, provided by taxpayers to the tax administrations and oversight agencies, using the digital certificate for signing electronic documents, ensuring the legal validity of those only in digital form.

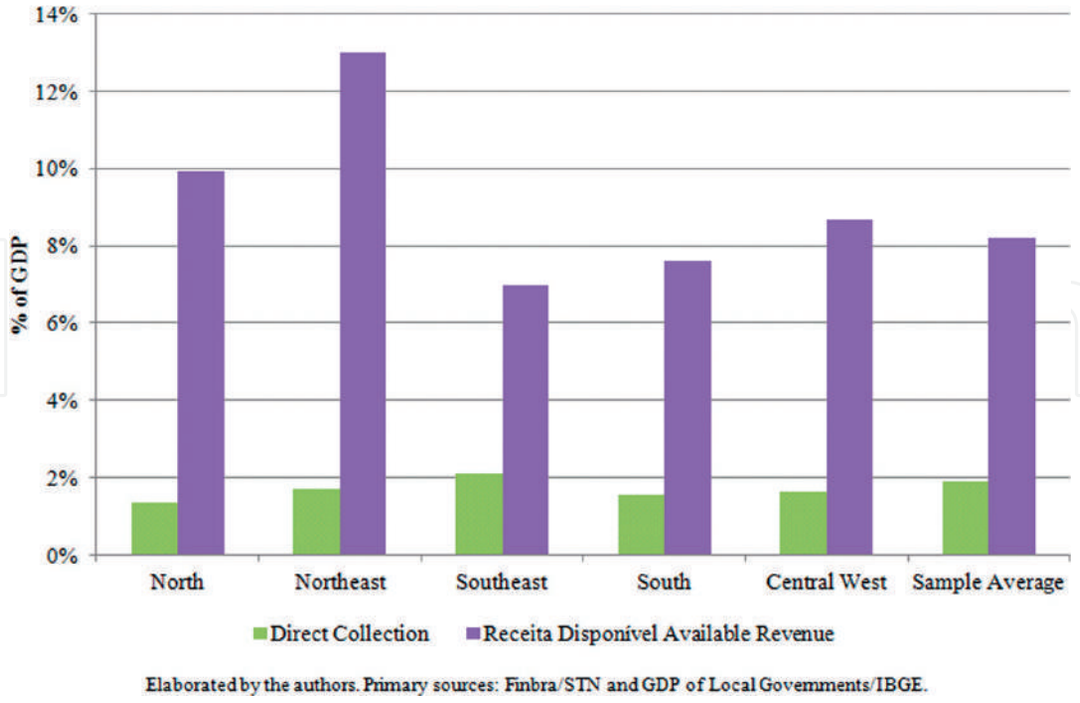

Figure 7. Direct collection and available municipal revenue by region, 2014.

(reverse) given by intergovernmental transfers. Empirical evidence shows that, if a city receives resources from a third-party above what is required and without having to incur the administrative and political cost itself, there is a tendency for the beneficiary government to decrease in fiscal responsibility in the following ways: over-proportionately increased spending by the local government, which is known as the flypaper effect [41]; a drop in the quality of local public spending, such as a decrease in investments and an increase in running expenditure [42] and, finally, the disincentive to raise their own revenue [43].

5. International comparison

Section 2 of this chapter shows, through official statistics and other authors, that municipalities have had an expressively increased participation in the fiscal federalism in Brazil, especially after the 1988 Constitution, which raised local governments to the level of a federated entity and made them responsible for implementing much of the social policies.

Despite the intense development of municipalities with regard to the decentralisation of resources, the current position of local governments in the national tax burden can expand even more. At least, this is the evidence that emerges from a quick comparison of Brazilian data with the position of countries in the Organisation for Economic Cooperation and Development (OECD), as can be seen in **Figure 8**.

It can be noted that Brazil's position in the ranking of local governments' participation in the national tax burden is intermediate. With a participation of approximately 6.9% in 2014, the

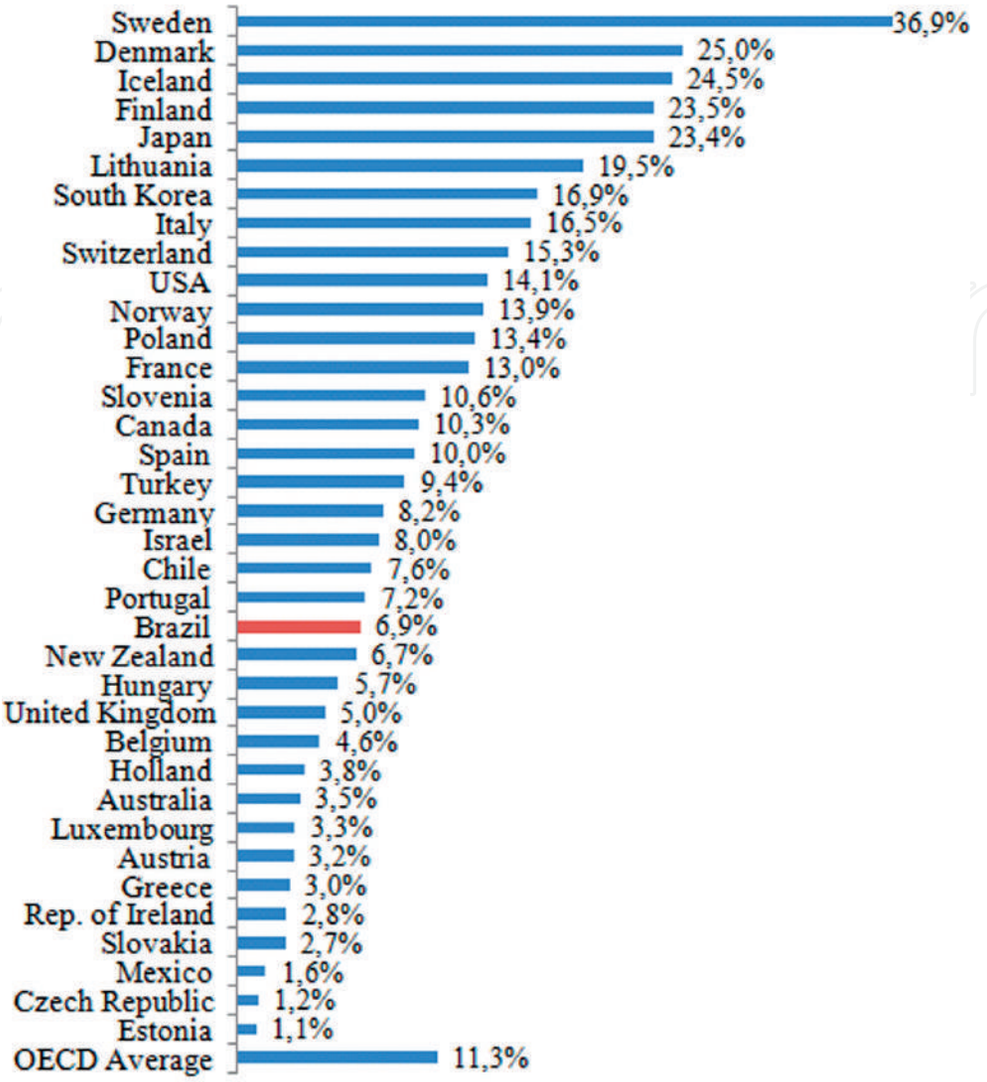

Figure 8. Local governments' participation in the National Tax Burden (% of the total), 2014.

country was considerably lower than the OECD average and behind countries that adopt a federal system such as Germany, Canada, USA and Switzerland. The comparison with OECD countries is justified for two reasons: first, the total tax burden of Brazil is compatible with the average of this group [3] and second, the Brazilian government has recently applied to the OECD for membership.

6. Final considerations

This study sought to introduce, concisely and with different approaches, local governments' tax burden in Brazil. Based on the analysis of official statistics, backed up by the previous

literature, it was possible to identify that the fiscal decentralisation that has occurred since the Constitution of 1988 has been very favourable to the municipalities, which experienced an increase in direct taxation simultaneously with increased transfers from other levels of government, providing a fiscal autonomy and a role in the federation never seen before in the history of the country.

Despite gaining ground, there is a debate which highlights that such reallocation of resources in favour of municipalities is not necessarily in line with the elevation of their responsibilities of implementing the growing social policies defined by the federal government.

Currently, the municipalities' available revenue is roughly one-fifth of all taxes collected in the country and is a direct consequence of taxes that have great potential for expansion—as they are founded on the intensification of urban features, more and better services (ISS) and increased value of land (IPTU)—as well as increasing transfers.

The broken down data on the municipal tax burden show some of its undesirable characteristics. First, the analysis of the tax base showed that the municipal taxes follow a pattern similar to the Brazilian tax system as a whole, leaning towards highly regressive taxation, which accentuates social inequalities in the country. Second, the analysis of the burden by population shows unbalanced available revenue in favour of the less populous locations, constraining the budget of major centres, which deal with a high demand for public goods and services. A similar feature is noted when the burden is studied by dividing the country into regions. At the same time, the smaller and poorer municipalities have more difficulties to comply with the growing responsibilities of social policies determined vertically.

When dealing with municipalities as federal entities without acknowledging the strong heterogeneity among them (70% of the 5570 municipalities have a population of less than 20,000 inhabitants), the Brazilian fiscal federalism is crying out for adjustments so that there is a suitable balance between the sources of funding and the responsibilities that the local governments have been taking on.

Finally, it has been shown, based on an international comparison using OECD data, that despite local governments in Brazil having gained plenty of ground in the last 30 years, it is still possible to improve the participation of municipalities in the total tax burden, given their intermediate position in this index's ranking.

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