STATE VALUE-ADDED TAX COLLECTION EFFICIENCY IN BRAZIL

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Abstract
The objective of tax administrations is to ensure compliance with tax laws, trying to collect as most tax revenues as possible. The effectiveness with which tax agencies fulfill their mission has always been a high priority of governments. Moreover, the majority of taxes in Brazil is derived from a tax system based on taxation of consumption. Considering this scenario, the purpose of this paper was to determine the relative efficiency of Brazilian state value-added tax (VAT – called ICMS - Imposto de Circulação de Mercadorias e Serviços - Brazilian tax on the circulation of goods and services) collection. To accomplish this objective we used a three-step Data Envelopment Analysis (DEA) and stochastic frontier analyses (SFA) method to rank states based on the relative efficiency of their respective tax agencies used by Alm and Duncan study (2014). The sample was composed by 23 states, as well as the Federal District; and the data from the period over 2011-2014. The results indicate that Brazil, in general and in average, does not have an efficient ICMS collection, and the states have a large difference in collection efficiency. The most efficient states were Minas Gerais, followed by São Paulo and Rio Grande do Sul, and the poorest efficient states were Roraíma, followed by Piauí and Sergipe. This result reflects the performance of the region. North region has an average of 0,329, Northeast 0,490, Midwest 0,585, South 0,796 and Southeast 0,899. Most part of these differences can be explained by the urbanization, share GDP and openness, like Aizenman and Jinjarak (2008) study. These results can contribute for states to establish management polices to improve their ICMS collection. For the tax literature in Brazil, this study fills in a gap, because there is no study about this issue with this approach.

Key-words: tax administration, tax efficiency, VAT.

1. Introduction

Tax is a product of interaction between many economic agents in a society, as a result of social policies and economic regulations. Companies and the govern are the two agents inserted in this context, but the first is exposed to tax burden and to the complexity of tax legislation established by the Govern; and the second oversees companies for tax collection in accordance with the legislation. According to Alm and Duncan (2014): "Tax administrations exist largely to ensure compliance with the tax laws, and the effectiveness with which tax agencies fulfill their mission has always been a high priority for governments".

Brazil has one of the largest tax rates on the value added in the world, from where derives a significant part of the tax collection from the tax system based on the consumption. Brazilian tax rates on consumption vary from 7% to 29.8%, with the world average in 3.88% and 7.25% (OCDE, 2012).

There are economic incentives by state treasuries to invest and introduce new legislation to increase fiscal compliance and tax collection. It is worth noting that the average of the highest rates considering the various continents, with Brazil having the highest tax rate of 28.9%, Latin America is 20.58%; North America and Europe is 19.36%, Asia is 7.25%, which produces a global average aliquot of 15.77%, considering the average rates of the continents (OCDE 2012; Delloite, 2003).

For the government to have an efficient tax collection it is necessary operational structure and people, and, according to Bird and Jantscher (1992, p. 1), a good tax administration is not the one that collects the most revenue, but the quality of this collection must be considered. The authors assert: "accurate measure is the size of the 'compliance gap', that is, the gap between actual and potential tax revenues, and how that gap varies among the different sectors of the taxpaying population". However, this estimation of the "compliance gap" it is not easy to measure to pursue. Alm and Duncan (2014) confirm this assert mentioning that: "tax administrators have limited control over such variables as a country's tax capacity, its tax laws, and the willingness of taxpayers to participate in the formal versus the informal sector." Thus, it is possible to affirm that the tax agency efficiency can be measured with variables that are available for the agency.

The revenues are on one side tax collection efficiency; on the other side, the costs. According to Alm and Duncan (2014) apud Sandford (1995): "the budget cost of collecting individual income, business income, **and sales taxes is generally in excess of 1 percent of the revenues from these taxes**, and can sometimes be substantially higher". Thus, to determine an efficiency tax collection it is necessary revenues and cost information. However, it is not easy to have information of tax administration cost like administrative information "inputs" (e.g., personnel, materials, information, laws, procedures) to generate "outputs" like tax revenues (Alm & Duncan, 2014). This study has a detailed law information, per state in period over 2011-2014, used a database of company called Systax Fiscal Intelligence[1], and to have other information it was used public information and the "law of access to information"; a law that obliges public agency to provide information.

It was founded few studies that show estimates of tax collection efficiency (Alm & Duncan, 2014; Aizenman & Jinjarak, 2008; Bird, Martinez-Vazquez & Togler, 2012) using tax revenues and cost information as variables. All studies are based in cross-country comparison. The research of Bird and Jantscher (1992) does not bring estimation of tax collection efficiency, but has a theoretical approach.

[1] Systax Fiscal Intelligence, it is a private company that maintains an updated database of all legal devices of the ICMS of all Brazilian states.

Most part of Brazilian studies about ICMS - Imposto de Circulação de Mercadorias e Serviços (ICMS - Brazilian tax on the circulation of goods and services[2]) collection efficiency is focused on tax distribution, "fiscal war" and tax incentive. It was not found any Brazilian research trying to show the ICMS collection efficiency considering the tax administration, in others words, the efficiency of the public machine. Thus, this study tries to fill in a gap in tax and public finance studies in Brazil.

Tax burden in Brazil is heavy, complex and dynamic. In 2015, tax burden reached 32.66% of the gross domestic product (GDP) (Receita Federal do Brasil[3], 2016). There are 92 types of tax in Brazil and the Brazilian tax legislation suffers constant modifications. ICMS represented 20.84% of total amount raised in the year of 2015 (Receita Federal do Brasil, 2016), being the one with the greatest representation in relation to all other taxes. The ICMS, specifically, is administrated by 27 different taxes legislation, due to the fact of being a state and Federal District (FD) tax. It is to be considered, as well, the dynamism which these rules are altered, making it difficult for companies to follow these rules, and for the govern to reach an efficient collection.

In the presented scenario, the purpose of this paper is to determine the relative efficiency of Brazilian state value-added tax collection. The results can contribute to help the states in the development of public polices and internal polices trying to be more efficient. Brazil is going through a deep economic crisis, so any study that tries to indicate some efficiency is important.

To accomplish this objective we used a three-step Data Envelopment Analysis (DEA) and stochastic frontier analyses (SFA) method to rank states based on the relative efficiency of their respective tax agencies used by Alm and Duncan study (2014).

2. Background

The literature approach about tax collection, tax system and efficiency in collection mention the relationship between government and taxpayer, asserting that public trust is affected by tax administration, in other words, depending on how the tax administration is conducted, the taxpayer will have public trust or not (Bird & Jantscher, 1992). Considering value-added tax (VAT) approach, Aizenman and Jinjarak (2008) study shows that greater political instability and polarization tend to reduce tax efficiency. Similarly, economic structures that increase the cost of enforcement, like less urbanization, less trade openness, and higher share of agriculture, reduce the collection efficiency of the VAT. Thus, confirms the theory which suggests that:

> […] the enforceability of taxes is impacted by political economy considerations – greater polarization and political instability would tend to reduce the efficiency of tax collection, reducing the resources devoted to tax enforcement. In addition, collection is impacted by structural factors that

[2] It is a kind of Value Added Tax (VAT). The current Brazilian taxation system was introduced by the 1988 Constitution, which granted power to Federal, State and Municipal Governments to collect taxes. Due to the several regulations enacted by each of these governmental instances, Brazilian taxation system is very complex, leading to an environment in which taxpayers are required to comply with many obligations, both comprising tax collection and reporting (accessory obligations). Thus, the States are responsible for collecting one of the taxes of Value-Added Tax, which represents the main source of funds collected from states, and of the amount collected, 25% must be distributed to the municipalities of the states themselves (DELLOITE, 2010).

> affect the ease of tax evasion, like the urbanization level, the share of agriculture, and trade openness. (AIZENMAN & JINJARAK, 2008, p. 3)

The Aizenman and Jinjarak (2008) study measures VAT efficiency in 44 countries over the period 1970-1999. However, in the study, VAT collection efficiency was measured not considering the cost of tax administration or administrative variables, it was used two measures of VAT: (a) C-efficiency (the ratio of the VAT revenue to aggregate consumption, divided by the standard VAT rate) and (b) Efficiency (ratio of VAT revenue to GDP, divided by the standard VAT rate) - crossing with explanatory variables: (a) measures of economic development; (b) composition of GDP and population; (c) measures of political instability and fluidity of political participation. Therefore, it was possible to affirm how this variables influence VAT collection efficiency.

Alm and Duncan (2014) research 28 countries members of OECD, over the period 2007-2011, trying to determine the relative efficiency of tax agencies in their use of inputs. It was used in the study a three-step method which combines data envelopment analysis (DEA) and stochastic frontier analysis (SFA). The variables selected were salary and information technology (IT) administrative costs related to tax functions as inputs; and as our outputs, it was used the total tax revenues, and corporate income tax (CIT), personal income tax (PIT), and value-added tax (VAT) revenues separately and in various combinations. The results indicate that 13 of the 28 countries are relatively efficient in tax collecting any of the three types of tax revenues. Overall, the average efficiency scores range from 0.838 to 0.904 across the various tax revenue measures. According to the authors, these results imply that, on average, countries should be able to collect their current level of revenues with approximately 10 to 16 percent less inputs.

The Bird, Martinez-Vazquez and Togler (2008) study about Latin America countries tried to observe the impact of Corruption and voice/accountability in tax performance. They use tax effort as a depend variable and corruption and voice/accountability as independent variable. These empirical results strongly suggest that corruption and voice/accountability play a significant role in the determination of the level of tax effort in developing and transition countries.

This study, differently from Aizenman and Jinjarak (2008), Alm and Duncan (2014) and Bird, Martinez-Vazquez and Togler (2008) research, considers only the VAT revenues and uses other variables to determine the relative efficiency of VAT tax collection. Another difference is that they analyze a roll country efficiency and this study is focused in states collection in a country with a continental extension, where are large differences in: (a) economy; (b) GDP participation; (c) urbanization; (d) share of agriculture, etc.

Other study that uses the same methodology is the Adam, Delis and Kammas (2011), but their study focuses on public sector efficiency. Specifically in tax research, it was not found others studies.

3. Sample and Research Design

3.1 Sample and variables

The initial sample consists in 27 public agencies, composed by 26 Brazilian states, as well as the FD. However, the state of Amapá, Tocantins and Espírito Santo did not provide all information requested. Thus, the final sample consists of 24 public agencies, composed by 23 states, as well as the FD divided by region as Table 1.

Table 1. Sample – Brazilian States

STATES	INITIALS	STATES	INITIALS

Midwest		**Southeast**	
Mato-Grosso	MT	Minas Gerais	MG
Mato Grosso do Sul	MS	Rio de Janeiro	RJ
Goiás	GO	São Paulo	SP
Distrito Federal	DF	**South**	
Northeast		Paraná	PR
Maranhão	MA	Santa Catarina	SC
Piauí	PI	Rio Grande do Sul	RS
Ceará	CE	**North**	
Rio Grande do Norte	RN	Acre	AC
Paraíba	PB	Amazonas	AM
Pernambuco	PE	Pará	PA
Alagoas	AL	Rondônia	RO
Sergipe	SE	Roraíma	RR
Bahia	BA		

It was selected ICMS revenues (REV) as output variable and the following input variables per state, as well as FD over the period 2011-2014. The variables used in the model are described in the table below.

Table 2. Variables selected

Variables	**Initials**	**Measure**	**Position**
Input	EMP	Number of tax administration employees (Alm & Duncan, 2014)	Position in the end of December
Input	INI	Number of infraction notice issued	Sum of the year
Input	LD	Number of legal devices (Alm & Duncan, 2014)	Position in the end of December
EV	COM	Number of companies	Position in the end of December
EV	GPD	Share of states in the GPD (Bahl, 1971; Bird, Martinez-Vazquez & Torgler 2008)	All year
EV	OPE	Openness (Bahl, 1971; Bird, Martinez-Vazquez & Torgler 2008) – measured as exports divided by the sum of exports and imports	All year

Note: EV refers to external variables

One of the contributions of this research is the insertion of two new variables for the development of the evaluation model VAT collection efficiency. The variables "number of companies" (COM) and "number of infraction notice issued" (INI) were selected because they can contribute to ICMS collection and can show the differences between the states.

The ICMS revenues[4] were collected in the website of Conselho Nacional de Política Fazendária (CONFAZ - National Council of Finance Policy). The number of companies and share of states in the GPD were collected in the website of Instituto Brasileiro de Geografia e Estatística (IBGE - Brazilian Institute of Geography and Statistics). The number of legal

[4] Since the collection of this tax is under state responsibility, each of the Brazilian states has specific regulations concerning ICMS calculation, rates, payments and accessory obligations. Therefore, companies that operate in different states are subject to several different compliance requirements. The ICMS is collected by most states at the rate of 17%, except for the states of São Paulo and Minas Gerais, whose tax rate is 18%, and Rio de Janeiro, whose tax rate is 19% - special rates apply to interstate sales (DELLOITE, 2010).

devices were handed over by Systax Fiscal Intelligence, it is a private company that maintains an updated database of all legal devices of the ICMS of all Brazilian states. The variable openness was collected in the website of Federal Ministry of Industry, Foreign Trade and Services; and, lastly, the number of tax administration employees and number of infraction notice issued were collected requesting (over period November 2016 to January 2017) for all states by the "law of access to information".

It was selected the period of the last five years, trying to seek the efficiency in the period of pre-crises and crises period (last year – 2014). However, it was not possible to collect data from 2015 from IBGE. They claimed that not all companies are compiled in the system. Thus, it was used the period of 2011 to 2014 (4 years).

3.2 Research Design

It was used a three-step DEA/SFA method to rank states based on the relative efficiency of their respective tax agencies adapted from Alm and Duncan (2014) study. This methodology was developed by Fried et al. (2002).

In the first stage, it was used DEA (CRS approach) to measure the relative efficiency of ICMS collection efficiency. Alm and Duncan (2014, p. 6) assert that: "this approach is favored because it can deal with production processes that have multiple inputs and outputs, and it imposes no parametric assumptions on the data"; and they complete: "for these reasons, DEA has been used in public finance studies and taxation". According to the authors, DEA was chosen for the first stage because it is better than SFA, because it is well suited for estimating efficiency scores in small sample, such as this research.

Nevertheless, because DEA eliminates non-discriminatory variables, a second stage regression analysis is needed to identify key variables that may affect a unit's ability to carry out its mandatory function. These variables define the environment within which each unit must operate and are outside of the tax agency's control. The second stage results allow to repeat the first stage using the adjusted inputs in a third stage estimation, where the adjustments are determined by the second stage estimates. (Alm & Duncan, 2014)

In the first stage, it was used the variables LD, EMP and INI. These variables represent intern variable and are controlled by the tax agencies, called "decision making units" (DMU). According to Alm and Duncan (2014), the variables of the first stage must represent operating conditions of the agencies and the minimum variable must be selected as input and output, because many inputs and outputs reduce discriminatory power (considering small sample).

It was used the input oriented CRS (Constant Returns to Scale) model. In the case, the inputs are considered as fixed and the targets for the path to efficiency.

The model can be, in a simple way, described as follows:

$$\text{Max } \theta_o = \sum_{j=1}^{s} u_j y_{jo} \qquad (01)$$

Subject to

$$\sum_{i=1}^{r} v_i x_{io} = 1$$

$$\sum_{j=1}^{s} u_j y_{jo} + \sum_{i=1}^{r} v_i x_{ik} \leq 0, \forall k$$

$$v_i, u_j \geq 0, \forall i, j$$

where θ is the efficiency of DMU *o*; v_i and u_j are the inputs and outputs weights of *i,i=1,...,r,* and *j, j=1,...,s;* x_{ik} and y_{jk} are *i* inputs and *j* outputs of DMU *k, k=1,...,n; x* and *y* are *i* inputs and *j* output of DMU *o*.

In the second stage, the external variables COM, GDP and OPE were used to create adjusted inputs to the third stage. This step is needed because the environment can distort the real efficiency. Alm and Duncan (2014) present the contribution of the second stage:

> The DEA procedure estimates relative efficiency scores that do not account for nondiscriminatory factors, mainly factors that define the operating "environment" of tax agencies and that are largely outside of their direct control. This makes the use of DEA score comparisons across countries misleading since a country with, say, a favorable environment is more likely to outperform a country with a less favorable environment, all else equal. We address this issue by using the first stage results to estimate a stochastic frontier analysis (SFA) model that allows us to adjust for factors outside the control of the DMUs. (Alm & Duncan, 2014, p. 9-10)

As it was discussed previously, the difference of this research from Alm and Duncan (2014) is the sample (countries and states), however, considering the territorial extension of Brazil and their differences, environmental variables are required.

The SFA model is expressed as follow:

$$\theta_{oj} = f(z_j,\beta) + e_{oj} \qquad (02)$$

where θ_{oj} is the efficiency score of DMU *o* obtained in the first stage, $f(z_j,\beta)$ is the stochastic frontier with the external variables, e_{oj} is the composite error structure ($v_{oj} + u_{oj}$). It was assumed the Cobb Douglas function, $v_{oj} \sim (N, \sigma_{vj}^2)$ reflects the statistical noise and $u_{oj}>0$ reflects the inefficiency term.

The adjusted inputs are constructed from the results of SFA as follow:

$$x_{oj}^A = x_{oj} + [\max_j\{z_j,\hat{\beta}\} - z_j,\hat{\beta}] + [\max_j\{\hat{v}_{oj}\} - \hat{v}_{oj}]$$

where x_{oj}^A is adjusted input, x_{oj} is observed input.

In the third stage estimation, using the adjusted inputs from stage 2, it was determined the relative tax collection efficiency in the agencies (Brazilian states tax administration). The relative efficiency scores, obtained in this stage, reproduce pure managerial efficiency. This comparison is possible because the inputs have been adjusted for both environmental factors and statistical noise (Alm & Duncan, 2014).

4. Empirical Results

Table 3 (in the appendix list) reveals the summary statistic. In Table 3, it is possible to observe a great dispersion in the variables revealing the big differences between Brazilian states.

Considering that stage 1 does not reveal the real efficiency, because the environment is not considered, and the stage 2 is a procedure of adjustment, the discussion is focused on stage 3. Table 4 reveals the relative efficiency measured in stage 3.

Table 4. Efficiency Third Stage

States	2011	2012	2013	2014	Average

	Stand	Comp	Stand	Comp	Stand	Comp	Stand	Comp	Stand	Comp
Acre	0,128	0,162	0,163	0,264	0,286	0,299	0,305	0,296	0,221	0,255
Amazonas	0,502	0,692	0,492	0,692	0,692	0,812	0,710	0,815	0,599	0,753
Pará	0,207	0,302	0,234	0,232	0,229	0,322	0,245	0,335	0,229	0,298
Rondônia	0,174	0,278	0,169	0,326	0,151	0,281	0,154	0,270	0,162	0,289
Roraima	0,093	0,048	0,089	0,046	0,100	0,052	0,115	0,060	0,099	0,052
Maranhão	0,333	0,537	0,592	0,679	0,374	0,578	0,399	0,581	0,425	0,593
Piauí	0,118	0,140	0,123	0,185	0,128	0,183	0,141	0,173	0,128	0,170
Ceará	0,239	0,460	0,237	0,483	0,305	0,520	0,316	0,518	0,274	0,495
Rio Grande do Norte	0,316	0,542	0,326	0,580	0,447	0,647	0,465	0,652	0,388	0,605
Paraíba	0,275	0,408	0,181	0,373	0,225	0,410	0,258	0,428	0,235	0,405
Pernambuco	0,392	0,615	0,337	0,589	0,519	0,697	0,548	0,708	0,449	0,652
Alagoas	0,202	0,355	0,179	0,357	0,204	0,376	0,217	0,363	0,201	0,363
Sergipe	0,094	0,140	0,092	0,190	0,144	0,244	0,150	0,220	0,120	0,199
Bahia	1,000	0,959	1,000	0,904	1,000	0,922	1,000	0,915	1,000	0,925
Minas Gerais	1,000	**1,000**	1,000	**1,000**	1,000	0,996	1,000	0,996	1,000	**0,998**
Rio de Janeiro	0,585	0,685	0,520	0,691	0,591	0,746	0,576	0,728	0,568	0,712
São Paulo	1,000	0,985	1,000	0,980	1,000	0,996	1,000	0,991	1,000	0,988
Paraná	0,432	0,633	0,440	0,650	0,570	0,733	0,613	0,753	0,514	0,692
Santa Catarina	0,518	0,713	0,501	0,697	0,560	0,731	0,588	0,747	0,542	0,722
Rio Grande do Sul	0,881	0,930	0,953	0,964	1,000	**1,000**	1,000	**1,000**	0,959	0,973
Mato Grosso	0,476	0,610	0,867	0,827	1,000	0,905	1,000	0,897	0,836	0,810
Mato Grosso do Sul	0,464	0,652	0,492	0,672	0,545	0,714	0,586	0,731	0,522	0,692
Goiás	0,674	0,350	0,720	0,371	0,663	0,348	0,679	0,357	0,684	0,356
Distrito Federal	0,259	0,469	0,273	0,486	0,277	0,483	0,305	0,493	0,279	0,483
Average	**0,432**	**0,528**	**0,458**	**0,552**	**0,501**	**0,583**	**0,515**	**0,584**	**0,476**	**0,562**

Observing the average of all country (0,562) it is possible to assert that Brazil is not an efficient ICMS collector, or the Brazilian states, in average, have roughly 50 per cent of ICMS collection efficiency.

Minas Gerais, in average (0,998) considering all years, is the most efficient in ICMS collection considering all states researched, followed by São Paulo (0,988) and Rio Grande do Sul (0,973). Minas Gerais and Rio Grande do Sul were the only states that reached two years with 100% of efficiency. However, Rio Grande do Sul was third in the ranking, considering the average of all years. On the other hand, the poorest states in ICMS collection efficiency, in average, is Roraima (0,052), followed by Piauí (0,170) and Sergipe (0,199). Table 5 established a ranking according to Table 4`s average compose results.

Table 5. Ranking of ICMS Collection Efficiency in Brazil

States	Average Comp	States	Average Comp
Minas Gerais	0.998	Maranhão	0.593
São Paulo	0.988	Ceará	0.495
Rio Grande do Sul	0.973	Distrito Federal	0.483
Bahia	0.925	Paraíba	0.405

Mato Grosso	0.81	Alagoas	0.363
Amazonas	0.753	Goiás	0.356
Santa Catarina	0.722	Pará	0.298
Rio de Janeiro	0.712	Rondônia	0.289
Mato Grosso do Sul	0.692	Acre	0.255
Paraná	0.692	Sergipe	0.199
Pernambuco	0.652	Piauí	0.17
Rio Grande do Norte	0.605	Roraima	0.052

Considering the average of the region in all years, it is possible to observe the poorest and the greatest states per region in ICMS collection efficiency in Table 6.

Table 6. Poorest and Greatest States in ICMS collection efficiency per region

Region	Poorest	Greatest
North	Roraima	Amazonas
Northeast	Piauí	Rio Grande do Norte
Southeast	Rio de Janeiro	Minas Gerais
South	Paraná	Rio Grande do Sul
Midwest	Goiás	Mato Grosso

It is important to highlight that Espírito Santo, Amapá and Tocantins states are not on the sample.

In the Alm and Duncan (2014) study, Brazil was not considered in the sample and they consider three types of tax revenues as output (corporate income tax, personal income tax and value-added tax), so it is not possible to establish any kind of comparison. However, the results are consistent with Aizenman and Jinjarak (2008) study, because the states which have lowest trade openness and share GDP have had the poorest results.

Other interesting results that are aligned with Aizenman and Jinjarak (2008) study, can be observed in the averages per region. North region has an average of 0,329, Northeast 0,490, Midwest 0,585, South 0,796 and Southeast 0,899. The urbanization, trade openness and share GDP are lower in the North and Northeast region and higher in Southeast and South region, although this study did not consider urbanization as an environmental variable.

The reason of this low efficiency, considering the average of the entire country, can probably be addressed to the results of Bird, Martinez-Vazquez and Togler (2008) study, in other words, the high level of corruption and low accountability can contribute to a bad efficiency in collection. However, the study of Bird, Martinez-Vazquez and Togler (2008) focuses in income tax, and maybe these variables do not reflect in VAT collection.

5. Conclusion

The purpose of this paper was to determine the relative efficiency of ICMS tax collection in the Brazilian states. The results indicate that Brazil in general and in average, does not have an efficient ICMS collection, and the states have a large difference in collection efficiency. The most part of these differences can be explained by the urbanization, share GDP and openness, as in Aizenman and Jinjarak (2008) study.

The most efficient states were Minas Gerais, followed by São Paulo and Rio Grande do Sul, and the poorest efficient states were Roraima, followed by Piauí and Sergipe. This result reflects the performance of the region.

These results can contribute to states to establish management polices to improve their ICMS collection. For the tax literature in Brazil, this study fills in a gap, because there is no study about this issue with this approach.

The limitation of this study was in not considering the use of cost variable such as salaries and investments in technology as in Alm and Duncan (2014) study. Considering this, a suggestion for future studies, trying to continue this research, is cross-country comparison using some cost variables, other environmental variables and socioeconomic variables such as: health, education, security, transportation and housing, indicators that represent the "end stage" of taxes, a way to verify the association between and the level of efficiency in the collection of taxes and the level of effectiveness in the application of it.

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APPENDIX

Table 1. Summary Statistics

	2011		2012		2013		2014	
	Mean (Stand. Desv.)	**Max. (Min.)**	**Mean (Stand. Desv.)**	**Max. (Min.)**	**Mean (Stand. Desv.)**	**Max. (Min.)**	**Mean (Stand. Desv.)**	**Max. (Min.)**
Inputs								
Nº of Legal Devices	372472 (36247)	500059 (333040)	406973 (35778)	534397 (363182)	491750 (42394)	626882 (389166)	498616 (47042)	633705 (377417)
Nº of Employees	1630 (1780)	9409 (351)	1576 (1669)	8791 (361)	1536 (1591)	8348 (356)	1495 (1509)	7861 (357)
Nº Infraction Notice Issue	17874 (36761)	173799 (644)	27669 (72645)	346508 (539)	25494 (62698)	306462 (336)	18960 (33874)	150492 (413)
Outputs								
Total of Revenue (R$ thousand)	12,743,583.79 (21,777,842.00)	107,726,893.00 (421,493.00)	13,285,075.87 (22,514,766.00)	111,853,239.00 (460,232.00)	14,896,300.87 (24,676,325.00)	121,912,221.00 (522,973.00)	15,680,568.25 (24,890,505.00)	22,836,142.00 (606,923.00)
Environmental Variables								
Nº of companies	134572 (212815)	1020651 (4574)	134929 (209676)	1006296 (4608)	137061 (212956)	1022359 (4772)	113365 (181247)	885610 (3748)
GDP share	4.05% (6.72%)	32.6% (0.20%)	4.05% (6.63%)	32.1% (0.20%)	4.07% (6.58%)	31.9% (0.20%)	4.1% (6.62%)	32.2% (0.20%)
Openess	49.48% (22.87%)	93.17% (6.70%)	49.87% (22.03%)	91.54% (6.87%)	47.99% (23.06%)	93.45% (6.97%)	46.32% (21.92%)	93.65% (6.80%)