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A comparison of fiscal illusion for brazilain states generated by tax structure complexity

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ABSTRACT

Construction of an index that presents the distortions in the fiscal reality in Brazil caused by the complexity of the tax structure (fiscal illusion) per federation units. Method based on data from 2004 to 2020 from 27 states, through aggregate data from 5,568 municipalities, a ranking of fiscal illusion was elaborated through the Multiple Indicator and Multiple Cause Model (MIMIC). The results indicated: i) the schooling level presented the highest coefficient among the causes, being the most representative in the index, with a strong correlation between the index and the level of wealth and poverty of a society; ii) fiscal simplicity, composed of the Herfindahl-Hirschman index weighted by the tax visibility index, proved to be significant and with an expected effect on the fiscal illusion index. Therefore, extensive evidence of fiscal illusion was identified among the federation units. This study contributes to the discussion of the dynamics of Brazilian government spending based on three approaches: fiscal illusion, mill hypothesis and causal link with deficits. We corroborated the theory of fiscal illusion in Brazil, since we found evidence that the government creates distortions on the taxpayers' fiscal reality, making it difficult to perceive the price of public services (Mill's hypothesis).

KEYWORDS: Flypaper Effect. Tax Structure. Index. States. Brazilian Cities.

1 INTRODUCTION

One of the strategies most often used by tax authorities to promote or exploit illusion is the proportion of indirect - or "less visible" - taxes in tax revenue. It is assumed that the higher the proportion of indirect taxes in relation to the total tax paid, the more likely the taxpayer is to underestimate the burden. Thus, one of the factors pointed out in the literature as a potential source of fiscal illusion is the use of indirect taxes, given their low visibility when compared to the direct or lump-sum tax. According to Mill's (1848) approach, taxpayers underestimate the true tax burden generated from indirect taxes, and therefore oppose less resistance to their implementation when compared to other alternatives (Sausgruber & Tyran, 2005).

Although the initial concepts were presented by Mill, in 1848, the origin of the theory of fiscal illusion is marked by the work of Puviani (1903), which aims to answer how politicians can use their powers to conduct their political projects. The illusion generated by policymakers can be based on both the administration of tax collection and the management of government spending, and this aspect is what relates the population to decision makers, in the terms of the illusion theory (Gérard & Nganghé, 2015).

The theory's main premise is to argue that the way organizations are structured impacts taxpayers' perceptions of the prices of public goods provided by the government, so that allocative decisions between baskets of public goods and services and those provided by the market are distorted. Thus, policymakers create illusions for the general population, who tend to believe that taxes are less burdensome and that the benefits provided by the government are more valuable than they actually are (Buchanan, 1967; Dell'Anno & Mourão, 2012).

In the literature, fiscal illusion is identified as one of the means by which decision makers and interest groups seek to minimize resistance and modify the behavior of taxpayers and voters. To do this, they prioritize the construction of certain tax mechanisms that make it difficult for individuals to obtain and process information, amplifying the information asymmetry between the policymakers and the general population. Examples of this practice are the degree of complexity of the tax system (number of taxes); tax visibility (usually referred to as the percentage of indirect taxes); indebtedness (due to the greater difficulty of individuals to recognize costs not paid in the present); and unbudgeted public spending, among others (Mourão, 2009).

Few studies have verified the state environment (Vegh & Vuletim, 2016), and the literature lacks evidence that the tax structure of the states causes illusory effects on taxpayers. Thus, it is relevant to include state information for studies that show the fiscal illusion in Brazil, adding value also regarding the expansion of empirical evidence of the phenomenon in the country. Based on the above, the following research questions arise: Is there evidence of fiscal illusion in Brazil, analyzing aggregate data from states and municipalities? What is the level of fiscal illusion per federation unit, considering aggregate data from Brazilian states and municipalities?

The research aimed to quantify fiscal illusion through a ranking based on data from 2004 to 2020 aggregated by Brazilian federation unit (states), considering 5,568 municipalities and using the Multiple Indicator and Multiple Causes Model

(MIMIC). To calculate the fiscal illusion index, the value of state Net Consolidated Debt for the period was used as a proxy for indebtedness.

The study consists of this introduction, followed by a section with a brief discussion about fiscal illusion and its types, as well as the fiscal structure of Brazilian states and municipalities. Section 3 verifies the relationship between illusion variables by means of the Multiple Indicator and Multiple Causes Model (MIMIC) and estimates fiscal illusion indices for the states. Section 4 presents the results of the research, and the last section emphasizes the main conclusions of the study.

2 LITERATURE REVIEW

In the economic literature, the fiscal illusion hypothesis holds that in real-world democratic politics, the benefits and costs of government activities can be misinterpreted by citizens, who will typically underestimate the costs involved. Although the genesis of this proposition goes back to McCulloch (1845), who in his treatise on the practical influence of taxation and the system of financing, inferred the very traditional approach of fiscal illusion, which was developed by other scholars, most notably Buchanan (1967) and Wagner (1976).

Several social scholars have suggested in their research that the inability to perceive the extent of tax burdens may lead taxpayers to fail to recognize the true cost of public services (Banzhaf & Oates, 2013; Dell'anno & Mourão, 2012). Taxpayers' lack of understanding is complemented by a lack of awareness about aspects of public spending, such as the amounts involved, the scope of services, and the short- and medium-term benefits of spending (Ferrari & Randisi, 2013).

As pointed out by Mourão (2009), the definition that comes closest to the intentions of the pioneer of the phenomenon analysis is the one that states that fiscal illusion is the phenomenon by which taxpayers and voters are unaware of the real value of the price of taxes. Still as to the forms of manifestation of the illusion, on the public revenue side there is: (a) decreased perception of taxpayer participation in spending; (b) taking advantage of more pleasant moments for tax collection through the existence of planned payment; (c) softening of taxation through fees with services provided in relevant events for agents; (d) increasing the burden of taxation using fear-provoking speeches; (e) derogatory tactics of taxation alternatives; (e) fragmentation of the tax burden into several elements with lower average collection; (f) opacity of the final incidence of taxes. On the side of public spending, the complexity of the budget and the lack of accounting systems and budgeting techniques.

In addition to the manifestation of illusion on both the revenue and expenditure sides, one can infer the understanding that there is both optimistic and pessimistic illusion. Mourão (2008) considers positive illusion as that generated by withholding tax on income, because its non-existence would force the taxpayer to pay the full amount annually, which could generate a pessimistic illusion regarding the government's cost, which could be deemed excessive. This author suggests that the policymaker asks, "in order to minimize taxpayer resistance to any level of revenue collected, how should the tax system be organized?"

The answer to the questioning falls on both sides of the budget, that is, illusions are created through revenues and government spending, with the revenue part being the most significant (Buchanan, 1967; Mourão, 2008; Heyndels & Smolders, 1994; Mattos, Rocha & Arvate, 2011), which is why the tax revenue variable is theoretically justified in the calculation of fiscal illusion ranking. Current transfers also deserve attention because they are directly linked to the flypaper effect phenomenon, which is one of the forms of fiscal illusion (Hines & Thaler, 1995). In this phenomenon, money stays where it "hits", that is, the transfers to public entities remain withheld by them, not being compensated to taxpayers in the form of a reduction in local taxation, thus balancing the consumption equation, according to the classical theory (Inman, 2008).

Even if there is identification by the taxpayer as to the number of tax sources, the costs of obtaining information may outweigh the benefits. Thus, the revenue complexity hypothesis states that the more complex the structure, the higher the level of public spending (Dollery & Worthington, 1996). Wagner (1976) uses a sample of the 50 largest U.S. cities, with data from 1970, including the revenue concentration Herfindahl-Hirschman index (HHI) as a variable of structure simplicity, which provides information on how pulverized the tax burden is. Although Dollery and Worthington (1996) pointed out that the choice of the index was perhaps one of Wagner's greatest contributions, the author himself recognizes that the index is not a perfect measure of simplicity (Wagner, 1976).

In this sense, as Araújo (2014) states, although a higher concentration indicated by the HHI may represent simplicity, there are situations in which it can occur via taxes that reinforce the illusion; that is, through indirect taxes, a factor that is not captured by the HHI. Other authors suggest that the index be weighted by some variable that indicates the weight of indirect or direct taxes. Therefore, theoretically, the relation between indirect and direct taxes is a relevant variable to be considered when calculating a ranking of fiscal illusion. (Pommerehne & Scheider, 1978; Dollery & Worthington, 1996; Araújo, 2014; Araújo & Siqueira, 2016).

Dell'Anno and Mourão (2012) also make use of the elaboration of an index to quantify fiscal illusion in 47 countries, in the period from 2000 to 2008. The methodology applied refers to a specific structural equation model (SEM), called Multiple Indicator and Multiple Causes Model (MIMIC) and the results confirm that HHI and IIID are, respectively, negatively and positively related to the calculated index (Dell'Anno, 2007).

Finally, the context of fiscal illusion, public debt, budget surplus or deficit are also related, because the more indebted the public entity, the greater the probability of occurrence of fiscal illusion, because the lack of knowledge of the true cost of public services by citizens is better for the policymaker from an expenditure perspective (Dell'anno & Mourão, 2012; Dollery & Worthington, 1995; Dollery & Worthington, 1996; Dollery & Worthington, 1999; Oates, 1988).

3 METHODOLOGY

Structural Equation Models (SEM) are based on statistical relationships between unobservable (latent) and observable variables. SEM is an extension of the general linear model that simultaneously estimates relationships between independent, dependent and latent variables, including factor analysis and multivariate regression as special cases, and integrates two relevant aspects of economic analysis: measurability and observability of variables; and the causal relationship between them. A particular case of SEM models is the MIMIC model, used in the presence of latent variables, which are unobserved and cannot be measured directly, which provides an ideal scenario to analyze the phenomenon of fiscal illusion. Thus, hypotheses will be outlined for indicators of fiscal illusion according to Dell'Anno & Dollery, 2014; Vitorino, 2016.

Basically, the model consists of two parts: measurement or measurement equation and structural equation. The former refers to the relationships between latent variables and their indicators, and the latter concerns the relationship between latent variables and their causes. In the present research, the latent variable is fiscal illusion (FI) itself, relating to its indicators according to the measurement equation below:

$$Y_j = \lambda_j IF + \varepsilon_j \qquad (1)$$

In which: IF is the latent variable fiscal illusion, Y_j represents the endogenous indicators in quantity j, λ_j is the parameter of the quantity measurement model j, ε_j are the quantification errors of the quantity measurement equations j. As for the relationship between the latent variable fiscal illusion and its causes, the structural equation below is described:

$$IF = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \mu \qquad (2)$$

In which: IF is the latent variable fiscal illusion, X represents the exogenous causes, β are the parameters of the structural equation, μ is the random disturbance or quantification error of the structural model, representing the unexplained part of the latent variable by the other variables of the structural equation.

Without loss of generality, all variables are considered to offer zero expectations: E (F) = E (x) = E (y) = 0], and the variance of the structural disturbance term (ζ) is abbreviated by. The MIMIC model also assumes that (a) E (ζ) = E (ε) = 0, the error terms do not correlate with the causes [E (xζ) = 0]; (b) the error terms in the measurement model also does not correlate with the causes [E (xε) = 0] or with the latent variable [E (Fε) = 0]; and, finally, measurement errors do not correlate with structural disturbances [E (εζ) = 0]. From Eqs. (2) and (3) and using the MIMIC model definitions can be solved for the reduced form as a function of the observable variables x and y, as shown in (3)

$$y = \prod\nolimits'_{x+z} \qquad (3)$$

As such, there is an expansive literature on empirical analysis of strategies to distort taxpayers' perceptions of the tax burden (Dollery and Worthington 1996).

Combining this literature with data availability, we specify the MIMIC model. The rationale behind the observed variable selection is an important one for the approach. As stated by Dell'anno& Mourão (2012), the significance of the latent variable, concerning the reliability of the estimates of the fiscal illusion index, is how broadly the causal and indicator variables correspond to the object intended through the latent variable. In particular, taking into account data availability, three main structural causes that increase the effectiveness of fiscal illusion, and five main categories of policies capable of distorting taxpayers' perceptions of their tax burden. The table below presents the relationship of the observable variables, the hypotheses, and the expected signs.

Table 1 - List of variables applied to the calculation of fiscal illusion in Brazilian states

Variables	Description	Relation	Source	Hypothesis	Signal
CAE	Schooling level	Cause	IBGE	H1: $\beta cae < 0$	< 0
CRT	Tax revenue / PIB	Cause	STN/BCB	H2: $\beta crt > 0$	> 0
CCP	Self-employed worker rate	Cause	IBGE	H3: $\beta ccp > 0$	> 0
IDP	Public debt (DCL) / PIB	Indicator	STN/BCB	H4: $\beta idp > 0$	> 0
ISFIS	Tax Simplicity Index	Indicator	STN	H5: $\beta sfis < 0$	< 0
IIID	Indirect/Direct Taxes	Indicator	STN	H6: $\beta iiid > 0$	> 0
IHH	Herfindahl-Hirschman Concentration Index	Indicator	STN	H7: $\beta ihh < 0$	> 0
ISDO	Budget Surplus or Deficit / PIB	Indicator	STN/BCB	H8: $\beta isdo < 0$	< 0
ITC	Current transfers / PIB	Indicator	STN/BCB	H9: $\beta itc > 0$	> 0

Notes: Variables chosen based on Dell'Anno and Mourão (2012); Dell'Anno e Dollery (2014); Vitorino (2016); Oates (1988); Dollery and Worthington (1996); Gemmel, Morrissey e Pinar (1999); Abbott e Jones (2016). Abbreviations: STN: Secretaria do Tesouro Nacional; IBGE: Instituto Brasileiro de Geografia e Estatística; BCB: Banco Central do Brasil.

Source: Made by the researchers.

With regard to possible "causes", they are postulated to make it easier for a policy to more effectively exploit the mechanisms of fiscal illusion. In particular, the structural model includes the relationships between fiscal illusion (FI) and the following variables: schooling level (x1); tax revenue (x2); self-employed rate (x3). With regard to the structural model, the potential causes characterize the socioeconomic aspects of the federation units. Thus, these causes are variables that intend to demonstrate certain existing conditions that enable political agents to further exploit illusion mechanisms .

The first potential cause is the level of schooling. It is assumed that individuals with a higher level of education have a more correct perception than individuals with a lower level of education. It is expected that the level of education is negatively related to fiscal illusion.

H1: A negative correlation is expected between the schooling level (CAE) and the Fiscal illusion index (IF) (βcae < 0).

The second potential cause is the tax burden. The tax burden is expected to be positively related to fiscal illusion, since a higher tax burden creates incentives in the government to use mechanisms to increase fiscal illusion.

H2: A positive correlation is expected between the tax burden (CRT) and the Fiscal Illusion Index (IF) (βcrt > 0).

The third potential cause is the rate of self-employment. The higher the self-employment rate, the more incentives are expected by policy makers to distort perceptions regarding the tax burden.

H3: A positive correlation is expected between the self-employed worker rate (CCP) and the Fiscal illusion index (IF) (βccp > 0)

Following Fasiani (1941), the higher the ratio, the more visible the tax burden, because, ceteris paribus, more "active" tax compliance is required for these workers than for employees. Another reason to support a positive sign for this ratio is related to the underground economy. Self-employed workers are involved in tax evasion and underground economic activities more than employees (see, for example, Dell'Anno et al. 2007). Thus, in countries with a higher share of self-employment, as is the case in Brazil, the government has greater incentives to create equivocations in the tax burden in order to reduce tax evasion and/or bring these economic activities back into the official economy (i.e., by reducing official operating costs).

The first indicator in the model analyzed is public debt as a percentage of gross domestic product. Taxpayers will be able to better recognize the costs of public programs if they pay for them through taxes in the present, as opposed to taxes deferred over time.

H4: A positive correlation is expected between public debt (PDI) and the Fiscal Illusion Index (IF) (βidp > 0).

The second Herfindahl index of tax revenues measures the level of tax complexity of the revenue, based on the weight of taxes in relation to total tax revenue. Moreover, the fiscal simplicity indicator (SFIS), qualifies the Herfindahl-Hirschman index (HHI), being weighted by a tax visibility index, achieving greater quality of information in relation to the IHH.

H5: A negative correlation is expected between Fiscal Simplicity (SFIS) and the Fiscal Illusion index (IF) (βisfis < 0).

H6: A negative correlation is expected between the Herfindahl-Hirschman index (HHI) and the Fiscal illusion index (IF) (βihh < 0).

The third indicator is the ratio of indirect taxes to direct taxes. The tax burden through indirect taxes is underestimated, since indirect taxes are less "visible" than direct taxes.

H7: The ratio of indirect to direct taxes (IIID) is expected to correlate positively with the Fiscal illusion index (IF) (βiiid > 0).

Another variable used as an indicator refers to the government surplus or deficit. The sum of the primary results of the states and municipalities made available by the Central Bank as of 2008, represented by the Public Sector Borrowing Requirements, was considered as a proxy for this variable. (NFSP).

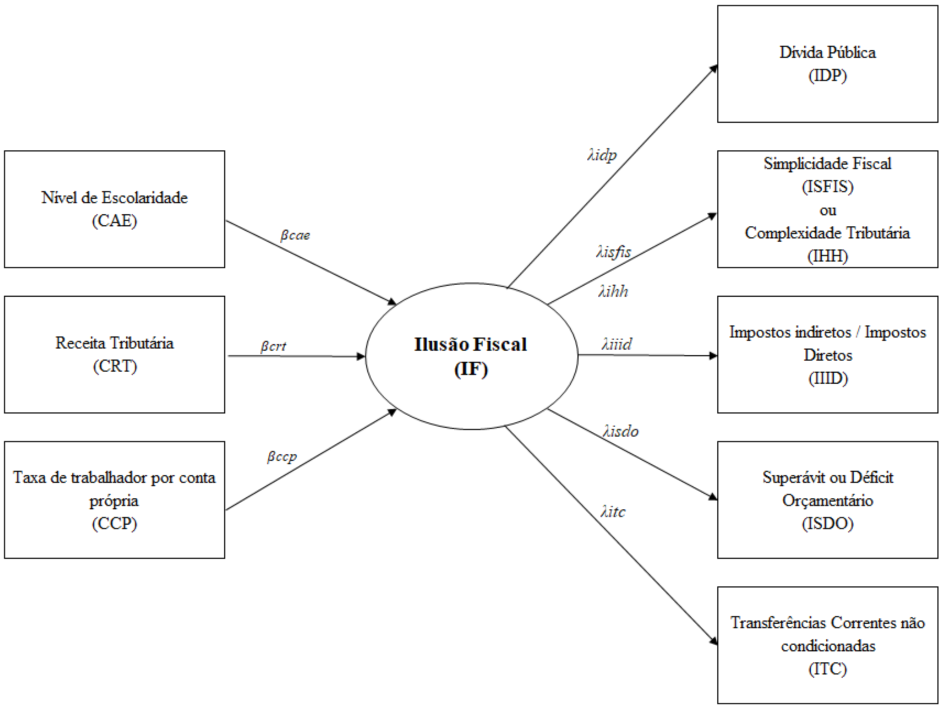
H8: A negative correlation is expected between the Budget Execution Outcome over GDP (BFI) and the Fiscal Illusion Index (IF) (βisdo < 0).

Finally, it is proposed to include a current transfers lump sum (ITC) variable as an indicator of fiscal illusion. Considering that an increase in transfers can reduce taxpayers' perception of the true price of public services.

H9: A positive correlation is expected between current transfers lump sum over GDP (ITC) and the Fiscal illusion index (IF) (βitc > 0)

The structural model is presented according to Figure 1, which synthesizes the previous information about the causes, the indicators and the expectation about the sign of its coefficients.

Illustration 1: MIMIC 3-1-5 Model



Source: Prepared in-house

The sample used by the research covers the period from 2004 to 2020, considering that the data of social indicators made available by IBGE. The total of 5,568 municipalities were considered, but were aggregated into the 27 federative units due to the limitations of the availability and continuity of municipal data.

After specifying the model according to economic theory, the second step was to test for the presence of unit roots in the data. Following Granger and Newbold (1974), it is well established that non-stationarity of variables can lead to spurious regressions. As a result, unit root tests were performed on variables to establish whether they were stationary or not. According to Levin and Lin (1993), testing the unit root in the panel structure is found to be more powerful compared to running a unit root test for each individual time series. We apply the Levin- Lin-Chu (LLC) test (Levin et al. 2002), the Fisher-ADF test and the Fisher-PP test (Maddala and Wu 1999; Choi 2001). Tests for stationarity will be performed. These tests will equalize the mean for all states (zero).

$$x_{jit}^{*} = (x_{jit} - \bar{x}_{jit});\ y_{jit}^{*} = (y_{jit} - \bar{y}_{jit}); \quad (4)$$

where: x represents the values of each observation of the causes and y of the indicators; j = cae, crt, ccp, idp, isfis, iiid, ihh, isdo, itc identifies the cause variable or indicator; i = 1, 2,...,27 points to the states; and t = 2004, 2005,...,2020 specifies the period. With the variables transformed into deviations from the mean, individual and multivariate normality tests were performed. We considered 60 possible models, given that the tests considered, at first, the use of the CRT variable in first difference (d.CRT) with the other variables in level, in line with the stationarity results observed in the LLC test. In the second moment, the models were estimated with the HHI and ISDO variables in first difference, in view of the results of the ADF and PP unit root tests (Granger & Newbold, 1974). The models were estimated without transforming the variables to first difference. Finally, the coefficients obtained for the structural equation (equation 3) are applied to calculate the fiscal illusion index:

$$IF_{it} = \beta_{cae}cae_{it} + \beta_{crt}crt_{it} + \beta_{ccp}ccp_{it} \qquad (5)$$

In which: IF_{it} is the fiscal illusion index for each state in each period, β is the parameter calculated for each variable and x_{it} ($x = cae, crt, ccp$) represents each observation for the variables, by individual (FU) and period. Next, the index is normalized to range from 0 to 10 by subtracting IF_{it} by the minimum value obtained in the index, in order to obtain IF_{it}^{*}, according to equation:

$$IF_{it}^{*} = 10 * \frac{IF_{it} - \min(IF_{it})}{\max(IF_{it}) - \min(IF_{it})} \qquad (6)$$

3 RESULTS

According to SEM theory the presence of multicollinearity could be a problem that is exacerbated with the use of latent variable. However, this research sought to minimize the problem due to the presence of a single latent variable, although this is not a concern of previous authors (Dell'Anno & Mourão, 2012). Through further tests, it was possible to confirm the suitability of the proposed model.

In specifying the MIMIC model, a 3-1-5 model (3 causes, 1 latent variable, and 5 indicators) was used as the basis. Unit root tests were performed (Table 2) and the variables CRT, IHH and ISDO presented unit root, which is common in economic series. For this reason, they were calculated in first difference from fiscal year 2003 (Dickey & Fuller, 1979), and are identified as d.CRT, d.IHH and d.ISDO, respectively.

Table 1 reports the results of the panel unit root tests. Based on the Levin-Lin-Chu tests (Levin et al. 2002), we conclude that these series do not have a common unit root. The final step in making the SEM approach fit the panel structure of the data set is to transform the observed variables as deviations from the mean values of the respective units of the federation calculated over the sample period. This manipulation checks the hypothesis that all variables have zero expectations. [E (F) = E (x) = E (y) = 0], since the variables have the same mean (zero) for each state. This method makes SEM amenable to heterogeneity analysis in cross-section units in MIMIC mode.

Chart 1 – Unit Root Tests of the MIMIC model variables

Variables	Lags (specification)	Levin Lin and Chu t-statistic	ADF-Fisher Chi-squared	PP-Fisher Chi-squared
Causes				
CAE	0 – 1 (trend + intercept)	-8.03*** (0.000)	90.07*** (0.002)	138.55*** (0.000)
CRT	0 – 1 (trend + intercept)	6.96 (1.000)	9.20 (1.000)	10.33 (1.000)
d.CRT	0 – 1 (intercept)	-9.97*** (0.000)	163.27 (0.000)	190.31*** (0.000)
CCP	0 – 1 (intercepto)	-4.84*** (0.000)	89.08*** (0.002)	79.39** (0.014)
Indicators				
IDP	0 – 1 (intercept)	-9.19*** (0.000)	97.70*** (0.000)	120.48*** (0.000)
ISFIS	0 – 1 (intercept)	-5.46*** (0.000)	79.36** (0.014)	94.49*** (0.001)
IIID	0 – 1 (intercept)	-5.57*** (0.000)	67.35 (0.105)	71.76* (0.053)
IHH	0 – 1 (intercept)	-4.65*** (0.000)	66.13 (0.125)	63.69 (0.172)
d.IHH	0 – 1 (intercept)	-16.21*** (0.000)	217.60*** (0.000)	276.92*** (0.000)
ISDO	0 – 1 (intercept)	-2.94*** (0.002)	58.83 (0.303)	56.69 (0.375)
d.ISDO	0 – 1 (intercept)	-15.56*** (0.000)	224.78*** (0.000)	316.41*** (0.000)
ITC	0 – 1 (intercept)	-11.82*** (0.000)	146.96*** (0.000)	158.49*** (0.000)

Notes: 1. STATA Specification: Lag Lenght: Akaike Info Criterion; Kernel: Bartlett; Bandwidth Selection: Newey-West; 2. *, ** and *** H0 rejection to 10%, 5% and 1%, significance levels, respectively. 3. H0 (LLC): the variable presents an unitary root (assumes a common unit root); H0 (ADF and PP variable has a unit root (assumes a single unit root). Abbreviations: CAE: schooling level (15 years or more); CRT: tax revenue on GDP; CCP: self-employed worker rate; IDP: Net Consolidated Debt on GDP; ISFIS: tax simplicity; IIID: indirect and direct tax ratio; IHH: Herfindahl-Hirschman revenue concentration index; ISDO: budget execution surplus or deficit; ITC: current transfers on GDP; d.: first differnce.

Source: Prepared in-house.

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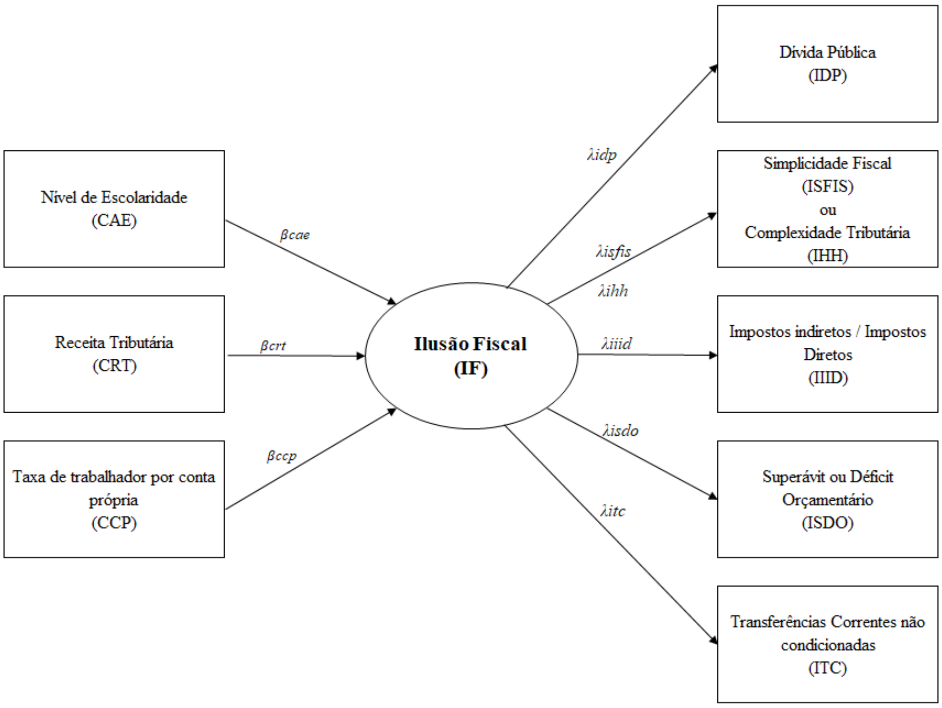

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After specifying the model according to economic theory, the second step was to test for the presence of unit roots in the data. Following Granger and Newbold (1974), it is well established that non-stationarity of variables can lead to spurious regressions. As a result, unit root tests were performed on variables to establish whether they were stationary or not. According to Levin and Lin (1993), testing the unit root in the panel structure is found to be more powerful compared to running a unit root test for each individual time series. We apply the Levin- Lin-Chu (LLC) test (Levin et al. 2002), the Fisher-ADF test and the Fisher-PP test (Maddala and Wu 1999; Choi 2001). Tests for stationarity will be performed. These tests will equalize the mean for all states (zero).

$$x_{jit}^{*} = (x_{jit} - \bar{x}_{jit});\ y_{jit}^{*} = (y_{jit} - \bar{y}_{jit}); \quad (4)$$

where: x represents the values of each observation of the causes and y of the indicators; *j* = cae, crt, ccp, idp, isfis, iiid, ihh, isdo, itc identifies the cause variable or indicator; i = 1, 2,...,27 points to the states; and t = 2004, 2005,...,2020 specifies the period. With the variables transformed into deviations from the mean, individual and multivariate normality tests were performed. We considered 60 possible models, given that the tests considered, at first, the use of the CRT variable in first difference (d.CRT) with the other variables in level, in line with the stationarity results observed in the LLC test. In the second moment, the models were estimated with the HHI and ISDO variables in first difference, in view of the results of the ADF and PP unit root tests (Granger & Newbold, 1974). The models were estimated without transforming the variables to first difference. Finally, the coefficients obtained for the structural equation (equation 3) are applied to calculate the fiscal illusion index:

$$IF_{it} = \beta_{cae} cae_{it} + \beta_{crt} crt_{it} + \beta_{ccp} ccp_{it} \quad (5)$$

In which: IF_{it} is the fiscal illusion index for each state in each period, β is the parameter calculated for each variable and x_{it} $(x = cae, crt, ccp)$ represents each observation for the variables, by individual (FU) and period. Next, the index is normalized to range from 0 to 10 by subtracting IF_{it} by the minimum value obtained in the index, in order to obtain IF_{it}^{*}, according to equation:

$$IF_{it}^{*} = 10 * \frac{IF_{it} - \min(IF_{it})}{\max(IF_{it}) - \min(IF_{it})} \quad (6)$$

3 RESULTS

According to SEM theory the presence of multicollinearity could be a problem that is exacerbated with the use of latent variable. However, this research sought to minimize the problem due to the presence of a single latent variable, although this is not a concern of previous authors (Dell'Anno & Mourão, 2012). Through further tests, it was possible to confirm the suitability of the proposed model.

In specifying the MIMIC model, a 3-1-5 model (3 causes, 1 latent variable, and 5 indicators) was used as the basis. Unit root tests were performed (Table 2) and the variables CRT, IHH and ISDO presented unit root, which is common in economic series. For this reason, they were calculated in first difference from fiscal year 2003 (Dickey & Fuller, 1979), and are identified as d.CRT, d.IHH and d.ISDO, respectively.

Table 1 reports the results of the panel unit root tests. Based on the Levin-Lin-Chu tests (Levin et al. 2002), we conclude that these series do not have a common unit root. The final step in making the SEM approach fit the panel structure of the data set is to transform the observed variables as deviations from the mean values of the respective units of the federation calculated over the sample period. This manipulation checks the hypothesis that all variables have zero expectations. [E (F) = E (x) = E (y) = 0], since the variables have the same mean (zero) for each state. This method makes SEM amenable to heterogeneity analysis in cross-section units in MIMIC mode.

Chart 1 – Unit Root Tests of the MIMIC model variables

Variables	Lags (specification)	Levin Lin and Chu t-statistic	ADF-Fisher Chi-squared	PP-Fisher Chi-squared
Causes				
CAE	0 – 1 (trend + intercept)	-8.03*** (0.000)	90.07*** (0.002)	138.55*** (0.000)
CRT	0 – 1 (trend + intercept)	6.96 (1.000)	9.20 (1.000)	10.33 (1.000)
d.CRT	0 – 1 (intercept)	-9.97*** (0.000)	163.27 (0.000)	190.31*** (0.000)
CCP	0 – 1 (intercepto)	-4.84*** (0.000)	89.08*** (0.002)	79.39** (0.014)
Indicators				
IDP	0 – 1 (intercept)	-9.19*** (0.000)	97.70*** (0.000)	120.48*** (0.000)
ISFIS	0 – 1 (intercept)	-5.46*** (0.000)	79.36** (0.014)	94.49*** (0.001)
IIID	0 – 1 (intercept)	-5.57*** (0.000)	67.35 (0.105)	71.76* (0.053)
IHH	0 – 1 (intercept)	-4.65*** (0.000)	66.13 (0.125)	63.69 (0.172)
d.IHH	0 – 1 (intercept)	-16.21*** (0.000)	217.60*** (0.000)	276.92*** (0.000)
ISDO	0 – 1 (intercept)	-2.94*** (0.002)	58.83 (0.303)	56.69 (0.375)
d.ISDO	0 – 1 (intercept)	-15.56*** (0.000)	224.78*** (0.000)	316.41*** (0.000)
ITC	0 – 1 (intercept)	-11.82*** (0.000)	146.96*** (0.000)	158.49*** (0.000)

Notes: 1. STATA Specification: Lag Lenght: Akaike Info Criterion; Kernel: Bartlett; Bandwidth Selection: Newey-West; 2. *, ** and *** H0 rejection to 10%, 5% and 1%, significance levels, respectively. 3. H0 (LLC): the variable presents an unitary root (assumes a common unit root); H0 (ADF and PP variable has a unit root (assumes a single unit root). Abbreviations: CAE: schooling level (15 years or more); CRT: tax revenue on GDP; CCP: self-employed worker rate; IDP: Net Consolidated Debt on GDP; ISFIS: tax simplicity; IIID: indirect and direct tax ratio; IHH: Herfindahl-Hirschman revenue concentration index; ISDO: budget execution surplus or deficit; ITC: current transfers on GDP; d.: first differnce.

Source: Prepared in-house.

After the stationarity tests, the variables were transformed into deviations from the mean for each state to fit the structure of the SEM models. In the three individual normality tests (Jarque Bera, Shapiro Francia and Shapiro Wilk), only the variables CAE and IHH showed results indicating that the variables follow a normal distribution. Multivariate normality was verified under the Skewness and Kurtosis tests (Mardia, 1970), Henze-Zirkler consistency test (Henze & Zirkler, 1990) and omnibus test (Doornik & Hansen, 2008) for the set of variables in each model (Individualized Normality Test of the MIMIC Model variables). There was no result to support the multivariate normality hypothesis for any of the tests performed, since in all cases p-value = 0.0000 was observed, allowing the rejection of the null hypothesis of normality (Statacorp, 2015).

In cases where normality is not observed, it is not recommended to use the maximum likelihood (ML) method in model estimations (Dell'Anno & Dollery, 2014). The method that would initially correct the problems of non-normality would be Weighted Least Squares (WLS). However, according to Olsson et al. (2000), Muthén and Kaplan (1992), the method is only suitable for samples considered large (n>1000). Considering that the present study uses a sample with 324 observations, the estimation method used was the robust maximum likelihood (RML). It should be noted that the method is also robust in relation to heteroscedasticity and independence of errors (Statacorp, 2015). Therefore, after the 60 models were determined, they were run with the inclusion of the covariances provided in the Modification Indices Stata 15 software, generating a total of 453 trials for the estimations. The covariances were excluded one by one until results were presented in the software, which indicates that the model has reached convergence.

Among the remaining models, 15 presented adjustment index above that recommended in the literature (SRMR > 0.08), i.e., they did not present adequate adjustments. We also observed 7 models that, despite having returns with adequate adjustment indexes (SRMR ≤ 0.08), did not present statistical significance. Thus, 18 models presented results that could be analyzed and used to calculate the fiscal illusion index, since the SRMR adjustment index proved to be adequate. Table 2. The models are numbered from 1 to 81, and only the adequate models were considered for the calculation of the fiscal illusion index.

Table 2 – Suitable models for calculating the fiscal illusion index

Model		Causes	Indicators	Covariancies
22	3-1-5	CAE - d.CRT - CCP	IDP - ISFIS - IIID - ISDO - ITC	ISFIS/IIID; IIID/ITC
23	3-1-5	CAE - d.CRT - CCP	IDP - IIID - IHH - ISDO - ITC	IIID/IHH; IHH/ISDO; ITC/IF
24	3-1-4	CAE - d.CRT - CCP	IDP - ISFIS - IIID – ISDO	ISFIS/IIID; IIID/ISDO
25	3-1-4	CAE - d.CRT - CCP	IDP - ISFIS - IIID – ITC	ISFIS/IIID; IIID/ITC
27	3-1-4	CAE - d.CRT - CCP	IDP - IIID - ISDO – ITC	IDP/ITC; IIID/ITC
30	3-1-4	CAE - d.CRT - CCP	IDP - IIID - IHH – ITC	IIID/IHH; ITC/IF
32	3-1-4	CAE - d.CRT - CCP	IIID - IHH - ISDO – ITC	ISDO/ITC; ISDO/IF; ITC/IF
36	3-1-3	CAE - d.CRT - CCP	IDP - IIID – ITC	ITC/IF
36.1	3-1-3	CAE - d.CRT - CCP	IDP - IIID – ITC	ITC/IF
40	3-1-3	CAE - d.CRT - CCP	IDP - IHH – ISDO	IHH/ISDO
41	3-1-3	CAE - d.CRT - CCP	IDP - IHH – ITC	ITC/IF
43	3-1-5	CAE - d.CRT - CCP	IDP - ISFIS - IIID - d.ISDO - ITC	ISFIS/IIID; ITC/IF
47	3-1-4	CAE - d.CRT - CCP	IDP - IIID - d.ISDO – ITC	ITC/IF
48	3-1-4	CAE - d.CRT - CCP	ISFIS - IIID - d.ISDO – ITC	ISFIS/IIID; IIID/ITC
54	3-1-3	CAE - d.CRT - CCP	IDP - IIID - d.ISDO	
64	3-1-4	CAE - CRT - CCP	IDP - ISFIS - IIID – ITC	ISFIS/IIID; IIID/ITC
69	3-1-4	CAE - CRT - CCP	IDP - IIID - IHH – ITC	IIID/IHH; ITC/IF
75	3-1-3	CAE - CRT - CCP	IDP - IIID – ITC	ITC/IF
80	3-1-3	CAE - CRT - CCP	IDP - IHH – ITC	ITC/IF

Note: the model is identified with number and specification (causes-latent variable-indicators)
Abbreviations: CAE: schooling level (15 years or more); CRT: tax revenue on GDP; CCP: self-employed worker rate; IDP: Net Consolidated Debt on GDP; ISFIS: tax simplicity; IIID: indirect and direct tax ratio; IHH: Herfindahl-Hirschman index of revenue concentration; ISDO: budget surplus or deficit; ITC: current transfers on GDP; IF: Fiscal Illusion Index; d.: first difference.

Source: Prepared in-house

The results are presented in Table 3, where models 22 to 42 are those in which only the variable CRT was considered in first difference (d.CRT), in view of the results of the LLC unit root test. On the other hand, in models 43 to 60, in addition to d.CRT, the HHI and ISDO variables were considered in first difference, in line with the results observed in the ADF and PP tests. Finally, models 61 to 81 consider all variables in level.

Model 36.1 is a replication of 36, with the replacement of the variable IDP (λidp = 1) as the reference variable among the indicators by IIID (λiiid = 1). As will be mentioned below, model 36 was the one that presented the most adequate results and thus was selected to report the fiscal illusion indices. The replacement of the reference variable has two objectives: to verify the behavior of the IDP variable; and to test the robustness of the model, since both should return identical fiscal illusion indexes as a result.

With the exception of models 36.1 and 48, all models feature IDP as the reference variable in the measurement equation. For both variables, the expected sign of the correlation with the latent variable IF is positive. Model 48, on the other hand, was calculated with SFIS as the reference variable, whose expected relationship with the index of fiscal illusion is negative. Including it as a reference variable (λisfis = 1), its sign automatically becomes positive.

Comparing the predicted behavior, the schooling level variable (CAE) returned the predicted negative sign, indicating that the higher the educational level of a population, the lower the incentives to use tax avoidance mechanisms. As for the tax revenue variable (CRT), a positive relationship was observed confirming the hypothesis raised that fiscal illusion tends to be greater in environments with a higher tax burden. The variable CCP, referring to the percentage of self-employed workers or employers in the total number of people working, also showed the expected positive sign, indicating that environments where there is a greater representation of self-employed workers are more likely for governments to resort to mechanisms of fiscal illusion.

As for the indicator variables, only the Herfindahl-Hirschman index (HHI) presented results divergent from those expected based on the literature. Hypothesis H4 states that a positive relationship is expected between the public debt variable (PDI) and the fiscal illusion variable (FI), given that taxpayers would have a greater perception of the real public spending if there was no deferral of spending through debt. The results presented in the models converge to the hypothesis. Moreover, it was confirmed that the higher the public debt, the greater the fiscal illusion (hypothesis 4) and the higher the level of transfers (flypaper effects), the greater the possibility of reducing taxpayers' perception of the real price of public services.

It is worth noting that the results show perfect or near-perfect correlation in all models. The model used for reporting the indices was chosen based on the criteria of Dell'Anno and Dollery (2014). The first criterion is the verification of the model fit. As a measure of fit, the index SRMR (Standardized Root Mean Squared), for being reported by Software Stata (Statacorp, 2015b) after applying the robust maximum likelihood model (RML). As mentioned, all the selected models presented SRMR of at most 0.08. It is worth remembering that the closer the SRMR value is to 0, the better the model fit is considered to be. If the SRMR presented is between 0.00 and 0.05, the fit is considered excellent, while if it presents an SRMR above 0.05, limited to 0.08, the fit is considered good (Hancock & Mueller, 2006).

Based on this criterion, the most adequate models are 30, 36, 41, 47, 48 and 54. As a robustness test, these models were also run with the variable CAE without the trend component, since in the stationarity tests, the null hypothesis of unit root presence can only be rejected with the inclusion of trend in the test specification for this variable. Comparing the indices of each original model with the models composed by CAE without trend component, a practically perfect correlation was verified in all cases, exceeding the index of 0.996 for the 6 situations.

The second criterion is the verification of the signs presented by the variables in the selected models and the hypotheses raised based on the literature. All variables in models 36, 47 and 54 presented the expected sign. The third criterion concerns the statistical significance for the variables in the models. Of the three remaining models, 47 and 54 presented an indicator variable without statistical significance.

Thus, model 36 was chosen to report the fiscal illusion indices for the states. Model fit was also analyzed using the CD index, which represents the coefficient of determination of the model as a whole, with a perfect fit corresponding to 1. The coefficient of determination has the same function as the R^2 (Statacorp, 2015). In the case of model 36, the CD index presented was 0.664, indicating that a large part of the variations of the latent variable is explained by the set of variables in the model.

Chart 2 – Selected estimates from the MIMIC model

Modelos / Variáveis	22	23	24	25	27	30	32	**36**	36.1	40
	3-1-5	**3-1-5**	**3-1-4**	**3-1-4**	**3-1-4**	**3-1-4**	**3-1-4**	**3-1-3**	**3-1-3**	**3-1-3**
Causas										
CAE	-1.12 ***	-1.13 ***	-1.11 ***	-1.11 ***	-1.15 ***	-1.09 ***	-15.26 ***	**-1.12 *****	-15.36 ***	-1.11 ***
CRT	0.32 **	0.37 ***	0.30 *	0.48 ***	0.34 **	0.46 ***	5.10 *	**0.39 *****	5.34 ***	0.36 **
CCP	0.26 ***	0.29 ***	0.30 **	0.30 ***	0.31 ***	0.32 ***	1.82 **	**0.31 *****	4.30 ***	0.34 ***
Indicadores										
IDP	1.00	1.00	1.00	1.00	1.00	1.00		**1.00**	0.07 ***	1.00
ISFIS	-0.06 ***		-0.06 ***	-0.06 ***						
IIID	14.29 ***	13.89 ***	14.57 ***	15.01 ***	13.87 ***	14.10 ***	1.00	**13.69 *****	1.00	
IHH		1.22 ***				1.24 ***	0.09 ***			1.20 ***
ISDO	-0.50 ***	-0.37 ***	-0.45 ***		-0.37 ***		-0.04 ***			-0.42 ***
ITC	0.26 ***	0.25 ***		0.23 ***	0.23 ***	0.25 ***	0.02 ***	**0.25 *****	0.02 ***	
Estatísticas										
SRMR	0.080	0.075	0.072	0.066	0.074	0.046	0.065	**0.043**	0.043	0.080
CD	0.953	0.763	0.624	0.822	0.663	0.713	0.483	**0.664**	0.664	0.628

Modelos / Variáveis	41	43	47	48	54	64	69	75	80
	3-1-3	**3-1-5**	**3-1-4**	**3-1-4**	**3-1-3**	**3-1-4**	**3-1-4**	**3-1-3**	**3-1-3**
Causas									
CAE	-1.09 ***	-1.09 ***	-1.12 ***	0.06 ***	-1.09 ***	-1.17 ***	-1.15 ***	-1.19 ***	-1.14 ***
CRT	0.46 ***	0.40 ***	0.37 ***	-0.03 ***	0.42 ***	0.67 ***	0.67 ***	0.49 ***	0.67 ***
CCP	0.32 ***	0.31 ***	0.32 ***	-0.01 **	0.42 ***	0.23 ***	0.25 ***	0.27 ***	0.25 ***
Indicadores									
IDP	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
ISFIS		-0.04 **		1.00		-0.06 ***			
IIID		14.02 ***	13.50 ***	-267.00 ***	13.21 ***	17.16 ***	16.41 ***	15.19 ***	
IHH	1.24 ***						1.48 ***		1.48 ***

ISDO		-0.11	-0.12	-1.85	-0.08				
ITC	0.25 ***	0.26 ***	0.25 ***	-4.87 ***		0.21 ***	0.23 ***	0.23 ***	0.23 ***
Estatísticas									
SRMR	0.046	0.059	0.050	0.039	0.042	0.075	0.069	0.062	0.073
CD	0.721	0.723	0.660	0.365	0.543	0.817	0.767	0.700	0.769

Abbreviation: CAE: schooling level (15 years or more); CRT: tax revenue on GDP; CCP: self-employed worker rate; IDP: Net Consolidated Debt on GDP; ISFIS: tax simplicity; IIID: indirect and direct tax ratio; IHH: Herfindahl-Hirschman revenue concentration index; ISDO: budget execution surplus or deficit; ITC: current transfers on GDP; SRMR: *Standardized Root Mean Squared;* CD: Coefficient of Determination

Source: Prepared in-house.

Comparing the predicted behavior, the schooling level variable (CAE) returned the predicted negative signal indicating that the higher the educational level of a population, the lower the incentives to use tax avoidance mechanisms. As for the tax revenue variable (CRT), a positive relationship was observed confirming the hypothesis raised that fiscal illusion tends to be greater in environments with a higher tax burden. The variable CCP, referring to the percentage of self-employed workers or employers in the total number of people working, also showed the expected positive sign, indicating that environments where there is a greater representation of self-employed workers are more likely for governments to resort to mechanisms of fiscal illusion.

As for the indicator variables, only the Herfindahl-Hirschman revenue concentration index (HHI) presented results divergent from the expected ones. However, the index is not necessarily the most adequate to represent the degree of complexity of a tax structure. In this sense, we considered the tax simplicity index (ISFIS), represented by the HHI weighted by the tax visibility index, which measures the relation between direct taxes and tax collection. For ISFIS, the results converged to the hypothesis that the simpler the tax structure, the less likely the taxpayer is to underestimate the tax burden, i.e., the lower the incentives for tax evasion. The IIID variable, which measures the relationship between indirect and direct taxes, also converged to the expected results, presenting a negative sign in the models reported.

Table 3 – Summary of the results of the coefficients of causes and indicators of tax evasion

Variables	Description	Relation	Hypothesis	Signal	Conclusion
CAE	Schooling level	Cause	H1: $\beta cae < 0$	< 0	Convergent
CRT	Tax revenue / GDP	Cause	H2: $\beta crt > 0$	> 0	Convergent
CCP	Self-employed worker rate	Cause	H3: $\beta ccp > 0$	> 0	Convergent
IDP	Public debt / GDP	Indicator	H4: $\beta idp > 0$	> 0	Convergent
ISFIS	Tax Simplicity Index	Indicator	H5: $\beta sfis < 0$	< 0	Convergent
IIID	Indirect / Direct Taxes	Indicator	H6: $\beta iiid > 0$	> 0	Convergent
IHH	Herfindahl-Hirschman concentration index	Indicator	H7: $\beta ihh < 0$	> 0	Divergent
ISDO	Budget surplus or deficit index	Indicator	H8: $\beta isdo < 0$	< 0	Convergent
ITC	Current transfers / GDP	Indicator	H9: $\beta itc > 0$	> 0	Convergent

Source: Prepared in-house.

From the coefficients of the three causal variables (CAE, CRT and CCP), the indexes shown in Table 4 were obtained, calculated by year for the country's federation units. Each Federal State's position per year is also shown. The table was sorted by the average for the whole period, and the higher the Fiscal Illusion index, the worse the ranking.

There is also a ranking of each Federal State by year. The Federal District appears in first place in all the years in the index results and in addition to a level of education higher than that observed in the other units of the federation, it presents a lower rate of self-employment.

Finally, in the calculation of the fiscal illusion index, a strong correlation was observed between the fiscal illusion index and the level of schooling. Strong correlations should be carefully analyzed, but the result points out that, considering the variables used, there is a greater effect of the variable that represents society's ability to correctly evaluate the costs and benefits of public services. That is, high levels of education would tend to reduce fiscal illusion, since taxpayers would obtain less distorted fiscal information or would tend to have greater interpretive capacity.

As shown in Table 3 below, the Federal District appears in first place in all years in the index results and in addition to a higher level of education than that observed in the other units of the federation, it has a lower rate of self-employment. From position 12 to 27, there are only states from the North and Northeast regions. The states of the Southeast, South and Center-West, which together represent almost the totality of the geo-economic region called Center-South, occupy the first 11 positions in the ranking. Despite not being the object of study of this work, this observation raises suspicion about the index being related to the level of poverty or wealth of the locations and can be the object of specific future studies.

The IIID variable was calculated based on the ratio between indirect taxes and total tax revenue. In relation to the IDP variable, it is verified that the behavior does not follow the fiscal illusion index, showing low correlation. The IIID variable presents little dispersion in the comparison between the averages of the states. But it is possible to observe lower values at the beginning of the line and higher ones at the end, demonstrating the positive relationship between it and the calculated IF index, coherent with the hypothesis that indirect taxes, for being less visible, make illusory measures possible. As for the unconditioned current transfers (ITC) variable, despite the higher values observed in the intermediate positions in the fiscal illusion index, the line presents a tendency to follow the index, demonstrating the positive relationship, convergent to the flypaper effect.

Chart 3 – Fiscal Illusion per year and State - Model 36 (3-1-3)

State	2004		2006		2008		2010		2012		2014		2015		2016		2017		2018		2019		2020		Average	
	Pos.	IF	Pos.	IF	Pos.	IF	Pos.	IF	Pos.	IF	Pos.	IF	Pos.	IF	Pos.	IF	Pos.	IF	Pos.	IF	Pos.	IF	Pos.	IF	Pos.	IF
DF	1st	4.0	1st	3.7	1st	3.4	1st	2.8	1st	3.1	1st	1.9	1st	1.6	1st	1.4	1st	1.6	1st	1.2	1st	0.7	1st	0.0	1st	2.1
SP	2nd	6.0	2nd	5.9	3rd	5.6	2nd	5.3	4th	5.5	2nd	4.9	2nd	4.7	2nd	4.4	2nd	4.3	2nd	4.2	2nd	3.8	2nd	3.8	2nd	4.9
RJ	3th	6.2	3rd	6.1	2nd	5.5	3rd	5.5	2nd	5.3	3rd	5.1	3rd	4.7	3rd	4.8	3rd	4.5	3rd	4.3	3rd	4.1	3rd	4.5	3th	5.1
SC	7th	7.0	4th	6.7	4th	6.2	4th	5.9	3rd	5.5	5th	5.8	4th	5.6	4th	5.0	6th	5.4	5th	5.4	4th	4.9	5th	5.2	7th	5.7
PR	4th	6.8	6th	6.9	6th	6.7	5th	6.3	5th	5.8	4th	5.7	6th	5.8	6th	5.8	5th	5.3	4th	5.2	5th	5.0	4th	5.0	4th	5.9
MS	10th	7.4	7th	7.2	9th	7.5	8th	6.7	11th	6.7	13th	6.8	5th	5.8	5th	5.7	4th	5.3	6th	5.5	6th	5.1	7th	5.3	10th	6.3
RS	6th	6.9	8th	7.2	7th	6.9	7th	6.7	7th	6.4	8th	6.4	11th	6.6	9th	6.1	7th	5.8	7th	5.8	7th	5.3	6th	5.3	6th	6.3
ES	5th	6.9	5th	6.9	5th	6.6	6th	6.4	9th	6.7	6th	6.0	7th	6.1	7th	6.0	10th	6.2	10th	6.0	10th	5.9	12th	6.2	5th	6.3
MG	8th	7.3	9th	7.5	8th	7.1	9th	6.9	10th	6.7	7th	6.3	8th	6.2	10th	6.3	9th	6.0	8th	5.9	9th	5.8	10th	6.0	8th	6.5
MT	9th	7.3	10th	7.5	11th	7.6	12th	7.1	12th	7.0	9th	6.4	9th	6.3	12th	6.4	8th	5.9	9th	5.9	8th	5.7	13th	6.3	9th	6.6
GO	11th	7.8	11th	7.7	10th	7.6	11th	7.1	13th	7.2	12th	6.8	10th	6.5	8th	6.0	13th	6.5	11th	6.2	11th	6.0	11th	6.1	11th	6.8
TO	14th	8.1	14th	8.1	16th	8.2	10th	7.1	8th	6.6	10th	6.5	12th	6.6	14th	6.7	12th	6.3	12th	6.5	14th	6.4	8th	5.7	14th	6.9
PB	13th	7.9	13th	8.1	13th	7.9	17th	7.8	14th	7.4	16th	7.3	15th	6.7	11th	6.4	16th	7.1	13th	6.7	13th	6.4	14th	6.8	13th	7.2
AC	19th	8.6	21th	8.7	15th	8.1	13th	7.3	15th	7.5	11th	6.7	14th	6.6	17th	7.2	14th	6.5	15th	6.9	19th	7.0	18th	7.0	19th	7.3
RR	17th	8.4	19th	8.5	24th	8.9	26th	8.6	18th	8.0	19th	7.5	13th	6.6	13th	6.5	11th	6.2	18th	7.1	18th	6.9	9th	5.8	17th	7.4
AP	25th	9.1	20th	8.6	19th	8.3	14th	7.5	6th	6.3	15th	7.1	18th	7.3	19th	7.5	21th	7.5	14th	6.8	12th	6.3	17th	7.0	25th	7.4
PE	12th	7.9	12th	8.0	20th	8.4	15th	7.5	20th	8.0	21th	7.9	17th	7.2	16th	7.1	18th	7.3	16th	7.0	15th	6.6	16th	7.0	12th	7.5
RN	18th	8.5	16th	8.3	18th	8.3	18th	7.8	21th	8.0	20th	7.6	16th	6.9	15th	7.0	15th	6.7	17th	7.1	20th	7.0	19th	7.2	18th	7.5
RO	15th	8.2	17th	8.4	17th	8.3	19th	7.8	17th	7.9	14th	6.9	19th	7.4	18th	7.4	20th	7.3	21th	7.4	16th	6.7	15th	6.9	15th	7.5
AL	20th	8.7	15th	8.2	12th	7.8	20th	8.1	16th	7.8	17th	7.4	20th	7.4	20th	7.7	19th	7.3	19th	7.2	21th	7.1	20th	7.4	20th	7.7
SE	16th	8.4	18th	8.4	14th	8.0	16th	7.7	19th	8.0	18th	7.5	23th	7.5	24th	8.0	17th	7.2	23th	7.6	25th	7.9	24th	8.2	16th	7.9
AM	21th	8.8	25th	9.2	23th	8.8	21th	8.3	23th	8.5	24th	8.1	24th	7.7	21th	7.7	24th	7.9	20th	7.3	17th	6.8	21th	7.4	21th	8.0
CE	22th	8.8	23th	8.8	21th	8.7	25th	8.6	24th	8.5	22th	7.9	21th	7.4	22th	7.8	22th	7.5	22th	7.6	22th	7.3	23th	7.8	22th	8.1
BA	23th	8.9	22th	8.8	22th	8.7	22th	8.5	22th	8.4	23th	8.0	25th	7.7	23th	8.0	23th	7.9	25th	7.9	24th	7.7	22th	7.7	23th	8.2

PI	26th	9.9	26th	9.5	25th	9.1	24th	8.5	27th	9.0	25th	8.8	22th	7.5	25th	8.1	26th	8.7	26th	7.9	23th	7.4	25th	8.3	26th	8.6
PA	24th	9.0	24th	9.1	26th	9.1	27th	8.9	26th	8.9	26th	9.0	26th	8.6	27th	8.7	27th	8.7	27th	8.6	27th	8.6	26th	8.7	24th	8.8
MA	27th	9.9	27th	10.0	27th	9.6	23th	8.5	25th	8.6	27th	9.2	27th	8.6	26th	8.6	25th	8.5	24th	7.8	26th	8.5	27th	9.5	27th	8.9

Source: Prepared in-house. Pos.: Position. IF: Fiscal Illus

Finally, in calculating the fiscal illusion index, a strong correlation was observed between this index and the level of education. Strong correlations should be carefully analyzed, but the result indicates that, considering the variables used, there is a greater effect of the variable that represents society's ability to correctly evaluate the costs and benefits of public services. That is, high levels of education would tend to reduce fiscal illusion, since taxpayers would obtain less distorted tax information or would tend to have a greater ability to interpret tax information.

4 FINAL CONSIDERATIONS

This paper sought to extend the fledgling empirical literature on fiscal illusion indexes measurement by extending the work of Dell'Anno and Mourão (2012). The results of this statistical research applied to Brazil, presented an optic on the fiscal crisis in the federation units of the Brazilian state. In this regard, it can be argued that the perceptions stemming from the theory of fiscal illusion are useful to understand how serious levels of national debt, and were found in most Brazilian states, consequently leading to misperceptions around the burden and benefits regarding public spending, but these perceptions can assist in prescribing normative policies. For example, the fiscal illusion index developed in this paper can explain the observed pattern of debt in all the states of Brazil, a continental sized country. It seems that excessive public debt and elastic forms of income taxation rank high in terms of our fiscal illusion index.

The research aimed to quantify fiscal illusion through a ranking based on data from 2004 to 2020 aggregated by Brazilian federation unit. MIMIC was used to calculate a latent (unobserved) variable of fiscal illusion. The model relates causes and indicators of fiscal illusion, and the variables were chosen based on the literature on the subject, with the proposed inclusion of the variable relating to unconditional transfers. Based on the model's results, fiscal illusion indices were estimated for the Brazilian states, based on aggregate data from state and local governments.

The fiscal simplicity variable, composed by the Herfindahl-Hirschman index weighted by the tax visibility index, proved to be significant and with an expected effect on the fiscal illusion index. The same was observed in relation to the inclusion of the unconditional transfers variable, having presented results consistent with the theory that the increase in transfers converges to the possibility of adopting fiscal illusion measures. Additionally, the identification of the characteristics of the tax structure of states and municipalities showed that the weight of indirect taxes significantly exceeds that of direct taxes.

Considering the results obtained and the characteristics pointed out, we foresee the possibility of future studies to calculate a fiscal illusion index based on the identification and inclusion of other variables, especially those that represent causes. In the present study three cause variables were considered, whereas in the literature three to six are used. The limitation stems from the lack of available and applicable information for states and municipalities since the reference works carried out comparative calculations between countries. In addition, it may develop analysis of evidence of fiscal illusion without the data aggregation used in this paper, in order to increase the number of observations. Furthermore, the MIMIC model used in this research highlighted the complexity of the relationships between causes and indicators that appear to affect fiscal illusion. In a more general sense, this highlights the need for statistics with systematic approaches, such as MIMIC modeling techniques, to be used in investigating the nature of latent phenomena in public finance

From a public policy perspective, efficient "tax prices" should reflect the "true costs" of government activity so that citizens can make rational judgments about the effectiveness of government programs, including regulatory programs. Moreover, fiscal illusion involves public taxation, public spending, and public regulation. Therefore, fiscal illusion indexes and other measures of fiscal illusion can aid policymaking by determining the extent to which fiscal illusion obscures public perception.

Future research should be based on the methodology used, considering the importance of increasing the sample data, for example at the time period level, in order to overcome certain limitations in the choice of estimation methods and in order to make it possible to obtain models with better adjustment values. It would also be interesting to increase the number of hypotheses (causes and/or indicators), which not only could further increase the sample size, but most and foremost, allow to advance the knowledge about this quantitative dimension of the tax evasion phenomenon, even though it requires further research.

Uma comparação da ilusão fiscal para os estados brasileiros gerada pela complexidade da estrutura tributária

RESUMO

Construção de um índice que apresente as distorções da realidade fiscal no Brasil causadas pela complexidade da estrutura tributária (ilusão fiscal) por unidades da federação. Método baseado em dados de 2004 a 2020 de 27 estados, por meio de dados agregados de 5.568 municípios, foi elaborado um ranking de ilusão fiscal por meio do Modelo de Indicadores Múltiplos e Causas Múltiplas (MIMIC). Os resultados indicaram: i) o nível de escolaridade apresentou o maior coeficiente entre as causas, sendo o mais representativo no índice, com forte correlação entre o índice e o nível de riqueza e pobreza de uma sociedade; ii) a simplicidade fiscal, composta pelo índice Herfindahl-Hirschman ponderado pelo índice de visibilidade fiscal, revelou-se significativa e com efeito esperado no índice de ilusão fiscal. Portanto, foram identificadas amplas evidências de ilusão fiscal entre as unidades da federação. Este estudo contribui para a discussão da dinâmica dos gastos do governo brasileiro a partir de três abordagens: ilusão fiscal, hipótese mill e nexo causal com déficits. Corroboramos a teoria da ilusão fiscal no Brasil, pois encontramos evidências de que o governo cria distorções na realidade fiscal dos contribuintes, dificultando a percepção do preço dos serviços públicos (hipótese de Mill).

KEYWORDS: Efeito Flypaper. Estrutura Tributária. Índice. Estados. Cidades Brasileiras.

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