BBR
BRAZILIAN BUSINESS REVIEW

ARTICLE

Effects of Tax Exemption on Economic Growth

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ABSTRACT

Faced with economic crisis and stagnation, the Brazilian government, in the fiscal realm, has been characterized by the adoption of exemption tax policies. In this scenario, the present study aimed to investigate the behavior of some dimensions of industrial activity, having as its central focus the effect that the Tax on Industrialized Products exemptions has on the economic growth of Brazilian municipalities. The empirical strategy employed used statistical models in panel data and quantile regression, taking the period between 2007 and 2017. The main results indicated that, even with the positive behavior of industrial activity, especially between 2009 and 2013, the exemptions did not contribute to the economic growth of Brazilian municipalities.

KEYWORDS

Crisis, Municipalities, Exemptions, Growth

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Received: 01/22/2021.
Revised: 07/05/2021.
Accepted: 07/26/2021.
Published Online: 02/16/2022.
DOI: https://doi.org/10.15728/bbr.2021.19.2.4

1. INTRODUCTION

The State's political, social, and economic functions demand financial resources obtained through the production of currency, loans, and taxes (Martins, 2011). As for taxation, the Brazilian tax code, article 3, defines that it must take place through law, and collection must happen through fully linked administrative activity. In addition to the National Tax Code (*Código Tributário Nacional*), the constitutional text bestows common and individual prerogatives and powers to federal entities to institute and collect taxes within their competence. Such attributions refer to the competencies of each governmental entity concerning the collection of the various existing taxes and responsibility for providing public services (Mendes, 2004).

The Tax on Industrialized Products (*Imposto sobre os Produtos Industrializados*) (IPI), due to its extra-fiscal characteristic, can potentially intervene in the productive sector as a regulator or stimulator of the production of goods (Miranda, Abrantes & Rocha, 2020). The extra-fiscal aspect of the IPI originates from its taxation, varying according to how the government chooses to subsidize specific sectors (Oliveira, 2007). The IPI's extra-fiscal function exists because of regulations elaborated by the State. In addition, it is worth emphasizing its interventionist-stabilizing role within the economic sector in the search for sustained growth. In the assumptions of Musgrave's (1959) seminal study, the state's performance, through inflation control, price stability, and employment levels, is understood as a stabilizing one.

The economic crisis of 2008, which was kick-started by the bankruptcy of the Lehman Brothers investment bank, generated an exogenous shock that hit Brazil's banking sector (Martins, 2010). Therefore, the Federal Government, faced with economic deceleration, issued multiple normative measures expecting to overturn the scenario and soothe the potential effects of the crisis (Miranda, Abrantes & Rocha, 2020; Araujo & Gentil, 2011; Freitas, 2009).

The Federal Government, based on the IPI's stabilizing quality, intervened in some productive sectors of the economy by reducing the tax rates through fiscal exemptions, aiming to avoid a decrease in the consumption of industrialized products and raise the levels of investment, income, and employment (Miranda, Abrantes & Rocha, 2020). The automotive industry was the first one benefited, followed by the electric home appliances one; the building materials and furniture industries were also favored (Miranda, Abrantes & Rocha, 2020).

However, as the fiscal policies concerning the IPI can potentially contain economic crises and benefit the private sector, they can also generate negative externalities on the public sector. Part of the financial resources collected via IPI is then transferred to the states and municipalities through constitutional transferences, such as the States Participation Fund (*Fundo de Participação dos Estados*) (FPE) and the Municipalities Participation Fund (*Fundo de Participação dos Municípios*) (FPM). Sharing revenues from tax collections among the federative entities promote the socioeconomic balance between the states and municipalities (Brasil, 1988).

At the core of the fiscal decentralization theory, taken as support for this investigation, tax mechanisms used by the State, such as tax exemptions, can influence government transfers to subnational entities, interfering in their finances. Thus, in the light of the presented problem, it is asked: have IPI exemption policies contributed to the economic growth of Brazilian municipalities and the maintenance of employment level?

Considering the IPI exemptions carried out by the Brazilian Federal Government between 2009 and 2013, this study analyzed the behavior of industrial activity within the private sector and the economic growth of Brazilian municipalities. Specifically, the study aimed to: i) Analyze the behavior of some variables related to the industrial activity; ii) Identify the effect of IPI exemptions on the economic growth of Brazilian municipalities.

Several national studies have sought to verify, empirically, the effects of IPI tax exemptions. These studies analyzed, specifically, the private sector, identifying the effects of the exemptions on the revenues of publicly traded automotive companies, the growth of the construction sector, and the sales of automobiles in Brazil (Abrantes, Barbosa, Almeida & Oliveira, 2017; Serrano, Campos, Oliveira, Wilbert & Damasceno, 2018; Wilbert, Serrano, Gonçalves & Alves 2014). Concerning the public sector, the effects of IPI exemption on the tax gap, tobacco control in public health, Brazilian municipalities' tax collection, and energy taxation for environmental protection were analyzed (Barbosa, Abrantes, Brunozi Júnior & Almeida, 2020; Blanchet & Oliveira, 2014; Correia & Teixeira, 2017; Paes, 2012).

There is a lack of international empirical studies on the fiscal effects of the IPI. One of the reasons is the distinct fiscal characteristics among countries; a tax of the exact nature and incidence of the IPI is unusual. Nevertheless, various empirical works have cast light on the effects of tax exemptions which are aimed at economic growth and maintenance of employment levels within the private sector. Overall, such studies sought to uncover elements that would enable one to identify the effects of the exemptions on economic sectors, e.g., real estate financing, income, public finances, financial market, industry, and environment (Aničić, Jelić & Đurović, 2016; Drucker, Funderburg, Merriman & Weber, 2020, Giovanniello, Perroni, Scharf & Slivinski, 2019; Hamid, Jailani, Noor & Yahya, 2016; Miller, Nikaj, & Lee, 2019).

Thus, for analyzing whether or not the IPI exemptions carried out by the federal government generated economic growth in Brazilian municipalities and increased the level of employment in the private sector, this work is relevant and pushes the study of tax policies forward. Although such exemptions may cause positive economic changes in the private sector, in the public sphere, on the other hand, they can accentuate the distortions existing in the municipalities. In terms of practical contributions, the empirical results of this study indicate positive numbers concerning the level of employment for the industrial sector between 2009 and 2013. However, the estimations suggest that IPI exemptions did not contribute to the economic growth of Brazilian municipalities.

Therefore, this work is justified by the importance of analyzing the consequences of government interventions on the IPI, in the public and private spheres. As the country has been facing economic stagnation since 2014, tax exemption measures have been adopted to heat up the economy (Barbosa Filho, 2017). However, tax waivers can cause a decrease in the Union's tax collection, reduce intergovernmental transfers to subnational entities, and have negative consequences on the economic growth of Brazilian municipalities.

2. FISCAL DECENTRALIZATION AND ECONOMIC GROWTH

In conceptual terms, tax decentralization concerns the cooperation of subnational entities in government finances and expenditures under a federalist regime (Musgrave & Musgrave, 1989). Thus, it encompasses tax duties, tax prerogatives, and government transfers, in addition to the coordination led by the central government (Silva, 2005).

The theory of fiscal decentralization has fostered discussions and questions among researchers in the field. Bahl e Linn (2016) report that fiscal decentralization maximizes the allocative efficiency of the public sector, inhibiting state interference in the economy. Brennan and Buchanan (1980) argue that it promotes competition in the provision of local public services, positively affecting public management. However, the literature also points out the failures of decentralization by advocating that it widens regional differences, hinders macroeconomic control, increases public spending, and hampers the fight against corruption (Prud'homme, 1995).

International empirical studies also discuss whether fiscal decentralization promotes economic growth. Overall, they analyze the effects of decentralization on growth through the Gross Domestic Product (GDP), as well as industrial activity and regional inequalities (Akai & Sakata, 2002; Canavire-Bacarreza, Martinez-Vazquez & Yedgenov, 2020; Di Novi, Piacenza, Robone & Turati, 2019; Gnap & Konečný, 2015).

Ding et al. (2019) analyzed the tax-sharing system mechanism in China, highlighting that fiscal decentralization was positivly associated with economic growth and increased government revenues. In a study on OECD countries, the results presented by Mauro, Pigliaru and Carmeci (2018) suggest that the effect of fiscal decentralization on economic growth in the short and long term depends directly on the size of each country's political reform. In an empirical analysis of Russian regions between 2005 and 2012, Yushkov (2015) indicates that excessive fiscal decentralization, not followed by the same level of revenue decentralization, has had a significantly negative effect on economic growth.

Yang (2016) analyzed the changes in fiscal decentralization policy associated with tax reform in 29 provinces of China between 1990 and 2012. The results have shown that the effect of decentralization on economic growth varies among the three main sectors of the economy, with the most significant impact on the secondary sector. The results have also indicated an inverted U-shaped relationship between the degree of decentralization and the growth of the secondary sector (Yang, 2016).

Concerning Brazil, Rodrigues and Teixeira (2010) highlighted that fiscal decentralization provides states with a greater capacity to boost economic growth. Moreover, in countries such as Brazil, the fiscal crisis of federal entities only grows, becoming a snowball (Miranda, Abrantes & Rocha, 2020). The explanation is that fiscal disobedience due to decentralization causes systemic financial crises that harm economic growth (Rodden, 2003). One of the consequences of fiscal decentralization in Brazil, especially in smaller and poorly industrialized municipalities, is the lack of effort to collect taxes from their jurisdiction due to the high rates of revenue stemming from intergovernmental transfers (Massardi & Abrantes, 2015). In addition, Brazilian citizens faced with fiscal decentralization, assumed a higher level of responsibility before society. "It must be understood, however, that there are expenses that will be exclusively at the expense of municipal coffers" (Suzart, Zuccolotto & Rocha, 2018, p. 134).

It is worth highlighting that fiscal decentralization in Brazil has given the Union the highest share of tax revenues. This fact implies an increased dependence of subnational entities on intergovernmental transfers, aggravated by the structural difference between them and the level of economic dependence.

This study presupposes that the balance between competence, revenue, and expenses, and the maintenance of public policies themselves, is not sustained, considering the constant fluctuations in the collection of taxes over which the municipalities have no control. In addition, municipalities are subject to the implementation of fiscal policies without taking any part in their elaboration, which can hinder their economic growth. Among these policies is the tax exemption of the IPI, which lifts, partially or in total, the level of tax incidence on industrialized products. Therefore, this work aimed to empirically investigate whether this policy, in the light of Brazilian fiscal decentralization, contributed to the economic growth of the municipalities. Thus, the following hypothesis was outlined:

- **H1:** IPI tax exemptions have had no positive effects on the economic growth of Brazilian municipalities.

3. IPI FISCAL EXEMPTIONS AND THE LEVEL OF EMPLOYMENT

By intervening in the economy through taxes, the States holds power to induce taxpayers to take or not take economic decisions, channeling socioeconomic behaviors, encouraging or discouraging citizen's decision-making by making it more or less costly. (Folloni, 2014; Miranda, Abrantes & Rocha, 2020). The IPI, among other taxes capable of economic intervention, is a non-cumulative consumption tax, sensitive to the good's essentiality and paid by the final consumer (Vieira, Oliveira & De Ávila, 2021; Brasil, 1988). Its collection, moreover, has no link with the state counter provision, which facilitates its management according to the intentions of the tax authorities (Martins, 2011).

In the face of the 2008 global financial crisis, the Federal Government carried out many IPI exemption measures, especially between 2009 and 2013. These fiscal exemptions were held by issuing norms, such as provisional measures and decrees, to stimulate specific economic sectors (Assunção, 2011).

Due to each country's fiscal peculiarities, international studies aimed at a tax similar to the Brazilian IPI are rare. Under the perspective of fiscal exemptions, the literature generally investigates economic growth and employment within the private sector. These works examine the consequences of the exemptions in many economic sectors, such as real estate financing, income, public finances, financial market, industry, and environment (Benczúr, Kátay & Kiss, 2018; Bhattarai et al., 2018; Drucker et al., 2020; Giovanniello et al., 2019; Kalcheva, Plečnik, Tran & Turkiela, 2020; Miller et al., 2019). Ku, Schönberg and Schreiner (2020) also discussed local job creation in Norway in the face of payroll tax exemptions. The results indicated that this type of tax incentive could effectively stimulate local employment (Ku et al., 2020).

In Brazil, specifically, many studies have analyzed IPI exemptions. These works address the revenue of industry, the constitutionality of exemptions from the legal point of view, Brazilian fiscal federalism, economic development, and municipal revenue (Blanchet & Oliveira, 2014; De Souza, Cardoso & Domingues, 2016; Ferreira, Subeldia Junior & Schneider, 2016; Gentil & Hermann, 2017; Nelson, 2018; Soares, 2013).

However, the lack of empirical studies on the effects of IPI exemptions on economic growth and the level of employment is noticeable. Among the few published works, Ferreira et al. (2016) analyzed the Brazilian industrial policies as of 2000. Their research highlights the fiscal exemption during the Rousseff administration, explaining that it secured internal consumption, and avoided the extinction of jobs.

In a study on the use of tax policies to stimulate the economy, Geracy, Corseuil e Silveira (2019), utilizied data from the Annual Report of Social Information (*Relação Anual de Informações Sociais*) (RAIS), to analyze the impact of IPI exemption on the labor market between 2007 and 2012. The result showed that the exemptions had no effect concerning the level of employment throughout the analyzed period. Porsse and Madruga (2014) have found, through a quantitative approach, the effects of IPI exemptions on the automotive sector. Their results indicated that the exemptions were positive in regards to production and employment, as unemployment was reduced.

Presented with this context, this research analyzes the behavior of some variables related to industrial activity, especially employment, which represents one of the most important indicators of economic growth. According to Todaro and Smith (2012), a stronger job creation stimulus enables fast economic growth.

4. METHODOLOGY

4.1. Characterization of analysis unit, data source, and description of variables

The analysis unit encompassed the 5,570 Brazilian municipalities that, for being very socioeconomically heterogeneous, enabled a broad and diversified analysis. Annual data related to the economic growth of the industrial sector and intergovernmental transfers of the Municipalities Participation Fund (Fundo de Participação dos Municípios) (FPM) was used. The variables analyzed in the study are presented in Table 1.

Table 1
Variables used in the research

Variable	Description	Source	Literature
VABind	Industrial sector gross added value	IBGE	Suri et al. (2011); Todaro & Smith, (2012)
License plates	Number of annual licensing of new cars for the entire country	FENABRAVE	Brue (2006)
Employment	The ratio between the annual number of admissions and formal layoffs per Brazilian municipality	CAGED	Todaro & Smith (2012); Aglietta (1979)
Establishments	Number of establishments in the industrial sector per municipality for each studied year	CAGED	Brue (2006)
exIPIxFPM	IPI exemptions divided by the FPM	Lesgislation Portal and FINBRA	Musgrave (1959)
IFGF	Firjan Tax Management Index for each Brazilian municipality	FIRJAN	Jorge & Martins (2013)
exIPI	Dummy indicating IPI exemption between 2009 and 2013	Legislation Portal	–

Source: Prepared by the authors.

The variable Industrial Gross Added Value (Valor Adicionado Bruto Industrial) (VABind) measured economic growth, representing Brazilian municipalities' industrial economic capacity. VABind composes the GDP,reflects an increase in a country's real production and is an important driver of economic growth due to the relationship with employment and income of the population (Suri, Boozer, Ranis & Stewart, 2011; Todaro & Smith, 2012). On the other hand, the employment variable is an economic indicator of development, casting light on the economic growth, once an increase in unemployment significantly interferes with growth (Aglietta, 1979). In addition, stronger stimulus in job creation creates conditions for faster economic growth (Todaro & Smith, 2012).

According to Brue (2006), economic growth is characterized by an increase in a country's production through its GDP over time. Thus, variables related to the number of license plates of new vehicles and establishments are good growth indicators once "it results from (1) a greater amount of natural resources, human resources, and capital, (2) improvements in the quality of resources and (3) technological advances that boost productivity" (Brue, 2006, p. 459).

Concerning the Firjan Fiscal Management Index (Índice Firjan de Gestão Fiscal) (IFGF) for each Brazilian municipality, fiscal management is an essential aspect in determining the dynamics of the monetary economies of production (Jorge & Martins, 2013, p. 5). Fiscal policy, in this context, has effects on aggregate demand through various channels, like taxes, expenditures, and currency transfers, as well as public investments and the multiplier effect on private consumption and investment (Jorge & Martins, 2013). Thus, fiscal policy can influence economic growth (Jorge & Martins, 2013, p 5). Finally, the variable exIPI represents a temporal dummy with 0 for years without exemptions and 1 for the years with exemptions. The norms issued by the Federal Government enabled the identification of the years that the exemptions took place.

Data was collected for 11 periods between 2007 and 2017, making it possible to capture the effects of the different IPI tax exemption measures adopted by the Federal Government from 2009 to 2013. This temporal amplitude enabled the analysis of the behavior of economic growth indicators before, during, and after the period of exemptions. The year 2017 was set as the time limit due to the lack of data regarding the industrial gross added value for later years.

As for the source, the secondary data was extracted from the databases of the *Finanças do Brasil* (FINBRA) website, which belongs to the Treasury Department; from the National Federation of Motor Vehicles Distribution (*Federação Nacional da Distribuição de Veículos Automotores*) (FENABRAVE); from the General Record of the Employed and Unemployed (*Cadastro Geral de Empregados e Desempregados*) (CAGED); from the Federation of Industries of Rio de Janeiro (*Federação das Indústrias do Rio de Janeiro*) (FIRJAN), from the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*) (IBGE); and from the Legislation Portal, to consult the norms that created the exemptions. Finally, the monetary values were deflated by the General Price Index (*Indice Geral de Preços*) (IGP-DI), of the Getúlio Vargas foundation – FGV in Portuguese, on the date of 12/31/2017, in thousands of reais and weighted by the population (*per capita*).

4.2. Empirical Model and Data Processing

The article was developed in two phases. In the first one, descriptive statistics were used based on measures of position (arithmetic mean) and dispersion (standard deviation). Thus, the behavior of economic growth indicators was analyzed from the year of 2007 to 2017.

The method for the variables associated with economic growth - VABind, Employment, and Establishments - consisted of summing the values corresponding to all Brazilian municipalities and dividing them by the number of municipalities per studied year, thus calculating the simple annual arithmetic mean. The variable Employment was created through the ratio between the number of formal admissions and dismissals for each municipality, posteriorly; the annual arithmetic mean of this quotient was calculated. The variable license plates was not manipulated, the annual absolute values of new cars license plates in Brazil were used.

The second stage analyzed the effects of IPI exemptions on economic growth in Brazilian municipalities. It was hypothesized that the IPI exemptions affected the FPM transfers and, consequently, the economic growth of the municipalities. In this sense, four econometric regression models were estimated for panel data, having the VABind as the response variable and the exIPI and exIPIxFPM as explanatory variables. Also aiming to infer on the economic growth of Brazilian municipalities, employment, establishments, and IFGF were used as control variables.

In the panel data econometric models estimated in this study, i refers to each Brazilian municipality, and t represents each year from 2007 to 2017. The F test showed all models were significant at 5% probability level. This confirms a linear relationship between the variables, given the null hypothesis for the model, H0: stability of the parameters (Doane & Seward, 2008), at 5% probability level.

The best model to estimate the parameters was chosen through the statistical tests of Chow, Hausman, and Breush-Pagan (Gujarati & Porter, 2011). In this sense, the null hypotheses were established: H_0: restricted model (Pooled); H_0: random effects model; H_0: restricted model (Pooled), in counterpoint, respectively, to the alternative hypotheses: H_a: unrestricted model (fixed effects); H_a: unrestricted model (fixed effects); $H_{a:}$ random effects model (Gujarati & Porter, 2011).

After the tests, the Method of Ordinary Least Squares (OLS) was used to estimate the parameters for the data structure of each model with fixed effects. Costa (2013) reports that this method produces consistent and non-biased estimates, presupposing about errors, normality, homoscedasticity, and absence of correlation. The robustness of the model was verified through a quantile regression in the quantiles 0.25; 0,50; 0.75. Quantile regression estimation considers unobserved heterogeneity, and panel data with fixed effects enables the control of unobserved covariates (Canay, 2011). Moreover, the VABind response variable used in the model presents significant heterogeneity linked to the diverse characteristics of Brazilian municipalities. Thus, the response of each quantile is observed through the conditional median, making the regression more robust in response to outliers concerning estimates by OLS, justifying the use of quantile regression (Duarte, Girão & Paulo, 2017; Marioni, Vale, Perobellin & Freguglia, 2016).

Finally, to verify whether the difference in the estimated coefficients in the quantiles is significant, the Wald test was applied for null hypothesis H_0: $\beta 1(t) = \beta 1(\theta)$ *e* $\beta 2(t) = \beta 2(\theta)$ *e* … *e* $\beta j(t) = \beta j(\theta)$ (Wald, 1943). It is feasible to test multiple coefficients simultaneously and verify if the function of the τ-th e θ-th conditional quantile differs from each other (Souza, Silva, Cavalcante, Lima, & De Souza, 2019).

5. RESULTS AND DISCUSSIONS

5.1. Descriptive analysis of industrial activity indicators

Table 2 presents the descriptive analysis of industrial activity indicators between 2007 and 2017. VABind's behavior can be divided into two moments. From 2007 to 2014, the first moment has an average per capita growth of approximately 53.0%, starting at R$ 3,689.37 in 2007, reaching

R$ 5,650.85 in 2014. These percentages might indicate that IPI exemptions between 2009 and 2013 helped to maintain industrial activity; the average increase was approximately 21.0% for the period. The second moment is from 2015 to 2017. This period is marked by a decrease in the industrial VAB of roughly 13.0%, from R$ 5,650.85 in 2014 down to R$ 4,914.89 in 2016.

Table 2
The average behavior of industrial activity indicators - 2007 to 2017

Year	VABind *per capita*		Employment		Establishments	
	Mean	stand. dev.	Mean	stand. dev.	Mean	stand. dev.
2007	3,689.37	10,780.29	1.34	1.55	86.32	611.10
2008	3,762.80	10,94.36	1.27	1.75	89.48	627.58
2009	3,793.13	10,631.34	1.26	1.70	91.59	937.83
2010	3,939.69	11,466.56	1.35	1.91	94.13	651.13
2011	4,100.82	12,781.24	1.22	1.09	97.10	667.30
2012	4,217.85	13,773.48	1.18	1.10	99.83	683.23
2013	4,595.47	16,343.00	1.19	1.14	11.20	773.62
2014	5,650.85	40,045.21	1.14	1.05	120.04	780.94
2015	5,044.40	27,332.93	0.97	1.15	117.71	751.38
2016	4,914.89	21,527.92	1.02	1.18	110.92	709.57
2017	5,080.08	27,208.96	1.12	1.17	108.25	679.90

Source: Research data.

Brazil underwent two economic crises during the analyzed period: a global one in 2008 and a national one in 2014. The results above may indicate that the IPI exemptions between 2009 and 2013 contributed to the growth of industrial activity, at least until 2014, when the economic recession began, lasting until present (Barbosa Filho, 2017; Lara & Black, 2016; Oreiro, 2017; Rossi & Mello, 2017).

The number of jobs generated by the industrial sectors benefited from IPI exemptions, considering the average ratio between the number of admissions and the number of formal dismissals between 2007 and 2014, which present a certain oscillation, although positive at all times. However, such a result does not enable one to infer the effects of the tax exemptions on the level of employment, only indicating that there were more admissions than dismissals, given the higher than 1 ratio. It is to be noted that in 2015, probably due to the recession that began in 2014, the numbers were much worse, with a ratio of 0.97, indicating that the number of layoffs exceeded that of formal admissions, signaling an increase in the unemployment rate in the sector.

The number of industrial establishments for the analyzed period showed, on average, a percentage growth of approximately 25.0%, from about 86 establishments in 2007 to 108.25 in 2017. The year 2015 stands out, representing the beginning of the sector retraction (Oreiro, 2017), and, as consequence, the average of establishments went down from 120,04 in 2014 to 108.25 in 2017, a decrease of 10.0% approximately.

Overall, on average, the descriptive percentages of the economic indicators were positive for the industrial VAB and employment, and moderate for the number of establishments. However, it is noteworthy that these results do not enable inference of the effects of IPI exemptions concerning the analyzed variables, only indicating the data behavior in the face of exemptions.

Specifically, concerning the automotive industry, which directly benefited from the IPI exemptions between 2009 and 2013, the results related that license plates for new vehicles in Brazil revealed a significant increase between 2009 and 2013, as illustrated in Figure 1.

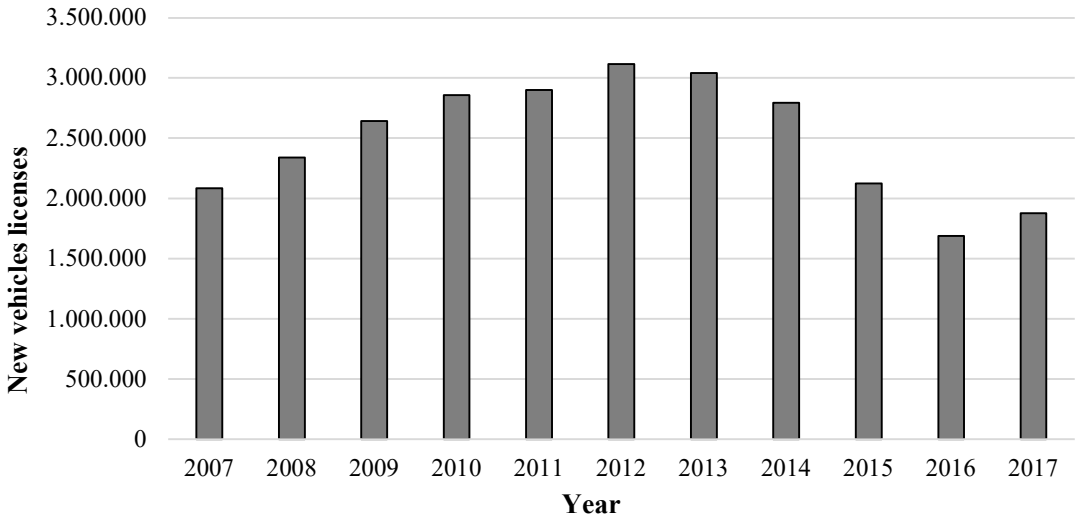

Figure 1. The behavior of licensing of new cars in Brazil from 2007 to 2017.
Source: FENABRAVE.

The percentages show that the number of new cars sold in the country increased around 15.0% between 2009 and 2013, peaking in 2012, with about 3,115,056 vehicles licensed in the national territory. After this period, the results showed a decrease of approximately 45.0% in sales, down from 3,041,863 new licenses in 2013 to 1,688,149 in 2016. The numbers increased again in 2017 – 1,875,874 new licenses – but even so, below those presented during IPI exemptions.

The numbers related to the variable license plates indicate that the IPI exemptions were important for the automotive sector since they directly affected car prices. However, Abrantes et al. (2017) argue that IPI exemptions did not contribute to automotive companies increasing their revenues.

Given the accuracy required by such analysis, the following section presents the inferential results on the effects of IPI tax exemptions on the economic growth of Brazilian municipalities. After all, one of the central intergovernmental transfers to municipalities, the FPM, consists mainly of the revenues from the tax. However, most small municipalities in Brazil are predominantly rural in less economically favored regions, weak in their economic foundation, and depend considerably on intergovernmental transfers (Massardi & Abrantes, 2014; Silva, Quintela & Vieira, 2018; Suzart et al., 2018).

5.2. Effects of IPI exemptions on economic growth in Brazilian municipalities

The regression models for panel data coefficients, estimated to determine the effect of IPI exemptions on economic growth in Brazilian municipalities, are presented in Table 3. Four models were estimated to verify the robustness of the results. All were significant at 5% probability for the fixed effects of errors through the Chow, Hausman, and Breush-Pagan tests.

Table 3
Estimated coefficients for the studied variables

Variables	Model 1	Model 2	Model 3	Model 4
exIPI	- 526.17*	- 769.94*	- 783.38*	- 896.93*
exIPIxFPM	0.2659*	0.4692*	0.4819*	0.5718*
Employment		- 9.3097	- 4.3460	- 26.4228
Establishments			7.6850*	8.4572*
IFGF				1,117.7**
Nº of observations	61,235	52,549	51,832	49,349
F test	0.0156*	0.0148*	0.0000*	0.0000*

Note: * Significant at 1% probability level; ** Significant at 10% probability level.
Source: Research result

In model 1, the dependent variable VABind linked to economic growth was estimated only according to the variables of interest, exIPI, and exIPIxFPM, which were significant at 5% probability. In this model, the negative value of the estimated coefficient for exemptions allows one to conclude that this policy did not produce economic growth for Brazilian municipalities.

As the variable exIPIxFPM was constructed through the product of the exemption dummy times the FPM, the estimate of its effect is given by the sum of the coefficients of the respective variables. Thus, when the estimated coefficients for the variables exIPI and exIPIxFPM are totaled, the result is also negative, i.e., the FPM during the IPI exemption period also did not contribute to the economic growth of the municipalities.

When the control variable, related to employment, was inserted in model 2, the variables of interest in model 1 remained stable, indicating the robustness of their results. However, the employment variable was not statistically significant.

In model 3, although another control variable – establishments – is added, it is observed that the explanatory variables remain stable. In addition, establishments is a significant variable in the model at 5% probability level. The positive coefficient estimated for the number of industrial establishments that benefited from the exemption indicates that the number of establishments has a positive effect on the economic growth of the municipalities.

As for model 4, another control variable is added, the IFGF. The estimates of the explanatory variables exIPI and exIPIxFPM remain stable and significant at 5% significance. Concerning the IFGF, its estimate was positive and significant at 10% probability level. As described in its methodology, the IFGF is composed of four indicators assuming the same weight (25%) for the calculation of the general index: Autonomy, Personnel Expenses, Liquidity, and Investments (Firjan, 2019). Thus, such a result indicates that good municipal fiscal management positively affects economic growth.

In a broader sense, public management, including fiscal management, strengthens the State, expands the legitimacy of the democratic regime, and favors economic growth (Bresser-Pereira, 2008).

After estimating the four models, the results have shown that in all of them, the explanatory variables exIPI and exIPIxFPM were significant at 5% probability level and had a negative effect on the economic growth of Brazilian municipalities. In light of the Theory of Fiscal Decentralization, these results may indicate a possible negative externality of IPI exemptions in subnational entities. Decentralization can increase regional disparities and undermine macroeconomic control (Prud'homme, 1995).

The results confirm this study's hypothesis, outlined based on the Theory of Fiscal Decentralization; IPI exemptions did not contribute to the economic growth of Brazilian municipalities. As the Union centralizes revenues, the dependence of subnational entities in on intergovernmental transfers increases, making municipalities subject to the implementation of tax policies, such as IPI exemptions. The results of this study also corroborate the conclusions of Massardi and Abrantes (2015), who drew attention to the need for a reformulation of the criteria for apportionment of the FPM, either through tax reform or division of competencies.

Employment, a control variable in this study, was not significant for the economic growth of the municipalities in any of the analyzed models. Therefore, even though Table 3 presented positive numbers related to the level of employment in the industrial sector, it cannot be inferred that the exemptions contributed to the economic growth of the municipalities. To increase the robustness of the analysis, Table 4 illustrates the results of the coefficients for the quantile regression model estimated in quantiles 0.25; 0,50; 0.75, with VABind as the dependent variable.

Table 4
Estimated coefficients for quantile regression

Variables	Quantiles		
	0.25	0.50	0.75
exIPIxFPM	-0.0303*	-0.0833*	-0.3125*
	(0.0058)	(0.0071)	(0.0298)
Employment	-25.5472*	-56.9323*	-97.4825*
	(1.0534)	(1.4489)	(10.8867)
Estabelishments	1.2314*	3.9428*	8.0102*
	(0.1750)	(0.3069)	(0.6008)
IFGF	1,980.16*	3,799.01*	8,788.10*
	(29.8138)	(57.0329)	(148.2966)
Wald Test: 0.0000*; Nº of observations: 49,349			

Note: * Significant at 5% probability level; ( ) Robust standard error in parentheses
Source: Research results.

In the model in question, the values found for the effect of IPI exemptions on economic growth, represented by the variable VABind, reinforce the results obtained through the panel data regression. Thus, in the three analyzed quantiles, estimates indicate that the exemptions did not promote economic growth in Brazilian municipalities. Therefore, the results strengthen the role of tax policies and shed light on the importance of exemptions on economic activity at the municipal level.

6. FINAL CONSIDERATIONS

This research aimed to investigate the behavior of some dimensions of industrial activity, having as its central motto the effect of IPI exemptions on the economic growth of Brazilian municipalities. Among the main results is that the exemptions did not contribute to the economic growth of the municipalities. It reveals the importance of analyzing the consequences of government interventions in the IPI. Tax waivers can lead to a drop in the Union's tax collection, reduction of intergovernmental transfers to subnational entities, and negative consequences on the economic growth of Brazilian municipalities.

Under the Theory of Fiscal Decentralization perspective, the results have confirmed this work's hypothesis. The centralization of revenues in the Union implies an increase in subnational entities' dependence on intergovernmental transfers, aggravated by structural differences between them and the level of economic dependence. Therefore, the centralization of revenues reflects on the financial autonomy of municipalities and makes them dependent on government transfers. The balance between competence, revenues, expenses, and the maintenance of public policies itself is not supported by the constant fluctuations in the collection of taxes, over which municipalities have no control and are also subject to the implementation of tax policies without participation in their elaboration.

However, it is noted that the average descriptive behavior of the indicators of the industrial sector benefited by the IPI exemptions showed that, overall, the sector's activity remained on the rise during the period under analysis. The average increase in the gross added value of the sector corroborated this statement. In terms of employment, the exemptions served to maintain jobs, at least until 2011. From 2012 on, the results showed a sharp drop in employment rates, which worsened in 2015, probably due to the recession that began the previous year.

More pointedly, the data related to the automotive industry, due to the significant number of new vehicles license plates, enables one to understand that IPI exemptions not only maintained the industrial activity of the sector during the 2008 crisis but also leveraged it.

In this context, in terms of theoretical and empirical advances, this work shows that the policies of tax exemptions adopted by the federal government need to be better analyzed. After all, such exemptions can cause positive changes in the private sector's industrial activity, but in the public sphere, they can accentuate economic distortions, not contributing to the economic growth of Brazilian municipalities.

Given the complexity of the theme and the limitation of the method, it is essential to understand national tax policies better. For future studies, a suggestion would be the analysis of the IPI exemptions on the growth and economic development of Brazilian municipalities, through an impact assessment, with pairing by propensity score matching and estimates by the method of differences in differences, comparing an industry sector that did not benefit from the exemptions with one that was benefited.

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