Tax Expenditures and Economic Growth in Brazil: an empirical analysis from 2003 to 2015

Caique Corcelli

Abstract

During Lula administrations and the first Dilma administration the Brazilian economy witnessed a significant increase in federal tax expenditures which gained prominence alongside a broad set of economic policy actions aimed at stimulating GDP growth. That fact has thrown controversy over the real effects of tax expenditures to foster growth rates in Brazil. The objective of the paper is to provide subsidies to this controversy on the quantitative side estimating a model that captures the effects of tax expenditures on the long-term growth rate of *per capita* GDP. A model of Dynamic Panel Data is constructed using data from the "Demonstrativos dos Gastos Tributários". The main results show negative and near-zero effects of tax expenditures on the economy's long-term growth rate. When raised to extreme values tax expenditures maintains the negative effect and close to zero effect suggesting a linear relationship. The results suggest the revision of the shape and the counterparts of the current fiscal incentive programs.

Keywords: tax expenditures, fiscal policy, economic growth.

Introduction

Federal tax expenditures were an important fiscal policy instrument between 2003 and 2014 in Brazil. One of its basic purposes was foster economy growth, in addition to encouraging the development of specific sectors and reduce the strong regional disparities in the country. As said by Lopreato (2013, p. 230) "tax exemptions took on a relevant role during the Lula and Dilma governments not only as an anti-cyclical instrument in the face of the effects of the international financial crisis in 2008 but also as an active element in the development policy of the period: to tax exemptions ample scope for action, especially as an active element of development policy".

Federal tax expenditures have grown significantly. Between 2003 and 2006, for instance, they grew by an average of 7.2% per year compared to 3.5% of GDP. Between 2011 and 2014, tax expenditures grew by an average of 13% per year compared to just 2.6% of GDP.

The reasons for that expansion are numerous. We can point out some central causes: i) tax expenditures takes the role of public investment as a way to stimulate aggregate demand; ii) tax expenditures comes as a easier way to counterbalance the negative effects of the complexity and regressiveness of the tax structure in Brazil, trying to foster industrial competitiveness, which occurs in the absence of a structural tax reform, expanding exemptions to various sectors and companies; and iii) the launch of industrial policies that presupposed, among other measures, a set of tax incentives (GENTIL and HERMANN, 2017; WERNECK, 2012).

The apparent disconnection between tax expenditures and economic growth has drawn the attention of several analysts. Serrano and Summa (2015), Cagnin, Prates and Freitas (2013) associate the low effect of tax exemptions on the economy's growth capacity to the lack of counterparts required by the programs in terms of investments or job creation, in addition to punctuating the difficulties of this isolated instrument, since private investment is a complex variable. Others, such as Werneck (2012) and Lisboa (2014) pointed to the indirect effects of tax incentives on the reference tax system, alleging that it is negative because the effects of disfigurement increase in tax complexity.

The supposed positive character of tax expenditures, combined with the observed low GDP growth data, raises a controversy regarding its effectiveness. Authors who have looked specifically at the analysis of the data from the Demonstratives of Tax Expenses (ANDREAZZI and OCKÉ-REIS, 2007; MACIEL, 2010; IPEA, 2011; CURADO and CURADO, 2016) pointed out the need to measure some of their implications for the economy as a whole, including the dimension of growth. Thus, the hypothesis that we intend to verify is whether federal tax expenditures, together, have any effect on economic growth. This hypothesis is evaluated based on the estimation of a dynamic panel based on the literature of endogenous growth and adapted to Brazil. Due to the low number of observations, regional data are used.

The work is organized as follows: the next section conceptualizes and presents the methodology for calculating tax expenditures from the reports of the Federal Revenue; the second section makes a brief descriptive analysis of the data, in addition to an international comparison and points out the criteria observed in the total set of programs; the third, reviews the literature on tax expenditures and on the relationship between the public sector (taxation and public expenditures) and endogenous economic growth; the fourth and fifth sections refer to the model, describe the data used in the growth equation, the econometric methodology and the results. Finally, conclusions are drawn.

1. Tax expenditures: some concepts and calculation method in Brazil

The concept of a tax relief – not tax expenditures - is broad and there is no consensus in the literature regarding its definition. From the Internal Revenue Service point of view, exemptions are defined as any and all situations that promote "credit presumptions, exemptions, amnesties, tax reductions, deductions, rebates and deferrals of tax obligations". In turn, these situations must clearly have the purpose of:

a) simplify and / or decrease administration costs;

b) promote equity;

c) correct deviations;

d) offsetting expenses incurred by taxpayers with services not served by the government;

e) compensate for actions complementary to the typical State functions carried out by civil entities;

f) promote the equalization of rents between regions; and / or,

g) encourage a certain sector of the economy (RECEITA, 2017)

The concept of tax expenditure derives from the definition of exemptions above, since tax expenditures take on themselves the objectives represented by items d, e, f and g. Tax expenditures are a type of tax relief that aim to offset expenditures made by taxpayers with services not served by the government, to compensate for actions complementary to the functions of the State, to promote equalization of income between regions (to reduce regional inequality) and to encourage sectors of the economy.

Such exemptions that define tax spending are also actions that could be replaced by direct public spending, according to the IRS. In a synthetic way, tax expenses can be defined and expressed as:

> [...] indirect government spending made through the tax system, in order to meet economic and social objectives. They are explained in the standard that references the tax, constituting an exception to the tax system of reference, reducing the potential collection and, consequently, increasing the economic availability of the taxpayer. They have a compensatory character, when the government does not adequately serve the population as to the services under their responsibility, or have an incentive character, when the government intends to develop a certain sector or region (RECEITA, 2017, p. 10).

The methodology for calculating the amounts of tax expenses started to be disclosed by the Internal Revenue Service only in the year of 2017. The method for estimating follows the principle of loss of collection. Roughly, this principle consists in confronting two basic situations: one in which the amounts would be collected under normal conditions, that is, in the absence of the tax benefit with other where the amounts expected to be collected with the incentives (RECEITA, 2017).

For the projection of these situations - the expected collection – the Internal Revenue Service uses macroeconomic indices representative of the price variation and the quantity produced expected for the following period. The calculation is based on information released by the Secretariat for Economic Policy (SPE), a part of Ministry of Finance's. The amount of

the tax expense presented in the Tax Expense Demonstratives, therefore, represents an estimate of the loss of revenue from the Federal Government for the following year.[1]

Some limitations of this calculation method are evident. For example, they don't consider the possibilities of changing the taxpayer's behavior after receiving the fiscal stimulus, which could affect the projected collection. The indirect effects that a tax exempt segment may cause to others sectors are also disregarded, a fact that, if positive, could reduce the negative effect for collection, since it increases the payment of *ex-post* taxes[2].

2. The growth of tax expenditures: a brief descriptive analysis

Before starting to analyze the data for Brazil, it is advisable to present statistics from Latin American countries using data from the Inter-American Center of Administraciones Tributarias (CIAT) in order to provide reference parameters for the dimension of tax expenditure in the Brazil and to contextualize it.

Table 1 consolidates the ratio of tax expenditure to GDP of countries in the region (according to availability of the figures). It is noted that Brazil is above the average of the selected countries with 4.3% of GDP. The similarity with Chile is noteworthy, since this country expected less participation in tax incentives. Mexico, which has a productive structure and dimensions closer to the Brazilian economy, presented a tax expenditure to GDP ratio of 2.9% in 2016. It is noted that tax expenditures in Brazil are above the average of the countries that had data, even though this statement is not valid for the period before 2012. The difference after 2012 for Brazil in relation to the others results, to a large extent, is explained by the effect

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[1] The indices that the Internal Revenue Service specifically refers to designing the calculation bases are not disclosed.

[2] These values are available in several reports on the Internal Revenue Service website. The "Tax Expense Demonstratives" show the projections of loss of revenue from tax expenditures. The "Tax Exemptions" series presents the amounts of exemptions not included in the concept of tax expense. The series "Payroll exemption" presents the collection losses and more details associated with the tax impacts of the law that exempted the payroll (BRASIL, 2011; BRASIL, 2015) despite the amounts also being represented in the Tax Expense Demonstratives. Finally, the series "Programs, Events and other tax benefits" and "Reintegra" show the collection losses of specific programs and the program of tax credits for exporting companies (Reintegra).

of two programs: the payroll tax exemption program and changes in the rules of Simples Nacional – a great tax expenditure program for small business companies.

TABELA 1 – GASTOS TRIBUTÁRIOS EM % DO PIB – PAÍSES SELECIONADOS DA AMÉRICA LATINA, 2008-16

Country/Year	2008	2009	2010	2011	2012	2013	2014	2015	2016
Argentina	2,1	2,0	2,3	2,5	2,6	1,9	2,5	2,9	2,8
Brazil	**2,5**	**3,1**	**3,0**	**2,8**	**3,3**	**3,4**	**4,8**	**4,9**	**4,3**
Chile	5,0	4,8	4,7	5,0	4,5	-	4,3	4,5	4,3
Colombia	3,1	3,2	3,2	-	-	3,2	0,7	-	-
Costa Rica	-	-	5,5	5,5	5,6	5,3	5,1	5,2	5,1
Equador	-	4,2	4,2	4,7	4,9	4,7	4,1	-	-
Guatemala	8,0	7,9	7,8	7,5	8,4	2,6	2,5	2,5	-
Honduras	-	-	-	6,2	6,5	-	-	-	-
Mexico	4,7	3,8	3,6	3,9	3,8	3,3	2,9	2,9	2,9
Paraguai	1,9	1,8	1,9	-	-	1,7	1,9	1,7	1,7
Peru	2,0	1,9	2,1	1,8	1,9	2,0	2,2	2,3	2,2
Uruguai	5,7	5,7	6,3	6,3	6,4	6,4	6,3	-	-
Mean	**3,9**	**3,9**	**4,1**	**4,6**	**4,8**	**3,4**	**3,4**	**3,4**	**3,3**

Source: own elaboration based on data from CIAT (Inter-American Center of Administraciones Tributarias) - Dirección de Estudios e Investigaciones Tributarias.

Tax expenditures in Brazil have undergone considerable growth in the past 18 years according to Figure 1. The ratio of GDP went from 1.7% in 1997 to 4.9% in 2015. The average rate of growth of tax expenditures reached 8.2% per year compared to only 2.2% of GDP. The growth path of tax expenditures which began during Lula governments was intensified during the first Dilma administration.

FIGURE 1 - TAX EXPENDITURE IN PROPORTION OF GDP, IN R$ BILLION * - BRAZIL, 1997-2018
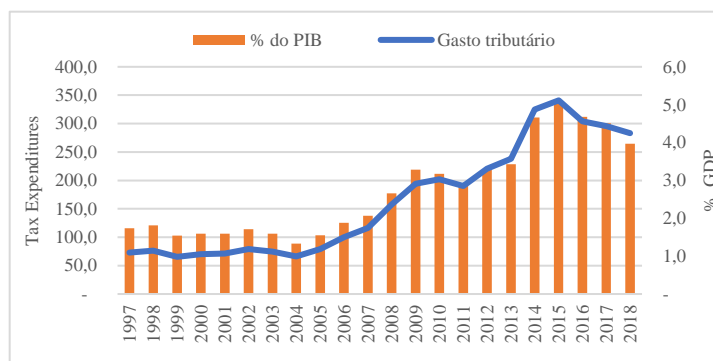
Source: own elaboration based on data from the Tax Expense Statements (several years). * Values deflated by the 2017 GDP deflator. The value for 2018 GDP is an estimate from the Internal Revenue Service.

It can be seen in Figure 1 that tax expenditure exhibits a procyclical character. With the 2008 crisis, which affected the Brazilian economy in 2009, the growth of tax expenditures decelerates, a movement also observed after 2015 in a scenario of contraction in activity.

Between 2003 and 2006 tax expenditures grew by an average of 7.2% per year compared to 3.5% of GDP in that period and between 2007 and 2010, the average rate of growth in tax expenditures reached 5.4% vis-à-vis -vis average 4.6% of GDP. This result is a function of the programs: Simples Nacional, Non-taxable income, Manaus Free Trade Zone (ZFM) and Free Trade Areas, Exemption from Basic Food Basket and Export of Rural Production, Non-Profit Entities - Exempt/Immune, Deductions from Taxable Income, according to Table 2.

Between 2011 and 2014, the growth of tax expenditures reached an average of 13.7% against only 2.4% of GDP growth. This result is strongly influenced by the exemption from payroll, despite the renewal and changes in other programs[3].

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[3] It can be seen that the drop in the average of -3.1% of total tax expenditure between 2015 and 2018 is due, albeit not exclusively, to the: exemption of payroll that fell -38.6%, to the benefits to the Zone Franca de Manaus which fell by -3% and the incentives linked to regional development which fell by -11%.

Table 2 – Accumulated Growth of the 13 main programs, % – Brazil, 2006/2018

Program/Year	2006-2010	2010-2014	2014-2018
Total	168,3	119,3	13,5
Simples Nacional (Small Business Incentives)	286,6	99,1	30,5
Exempts and Non-Taxable Income	118,0	183,0	39,0
Manus Free Trade Zone and others Free Trade Areas	129,9	64,1	-3,0
Exempt from Basic Food Basket and Export of Rural Production	57,70	221,2	7,1
Non-Profit Entities	123,8	60,8	21,5
Deductions from Taxable Income	55,1	213,1	17,8
Exempt of Payroll*	-	2176,1	-38,6
Benefits to Workers	451,8	17,0	45,1
Medicines	46,8	99,2	102,0
Savings and guaranteed real estate	-	-	64,9
Regional Development	173,9	4,6	-11,3
Computing	108,2	39,6	25,4
Cientific Tecnological Research and Inovation	260,4	6,2	28,0

Source: own elaboration based on data from the Tax Expense Statements (several years).* Data from 2012.

Another way to observe the evolution of tax expenditures is by segmentation by sector. The evolution by functional (Figure 3) highlights the expressive growth of incentives aimed at "Commerce and service", a segment that represents the largest part of tax expenditure under the influence of "Simples Nacional", which has gained expressiveness since 2006.

From 2013 there was a strong growth in tax expenditures for "Labor", which considers the payroll tax relief program, and also for "Agriculture".

Figure 3 – TAX EXPENDITURE OF THE 5 MAIN AGGREGATE FUNCTIONALS, IN R$ BILLION - BRAZIL, 2004-18
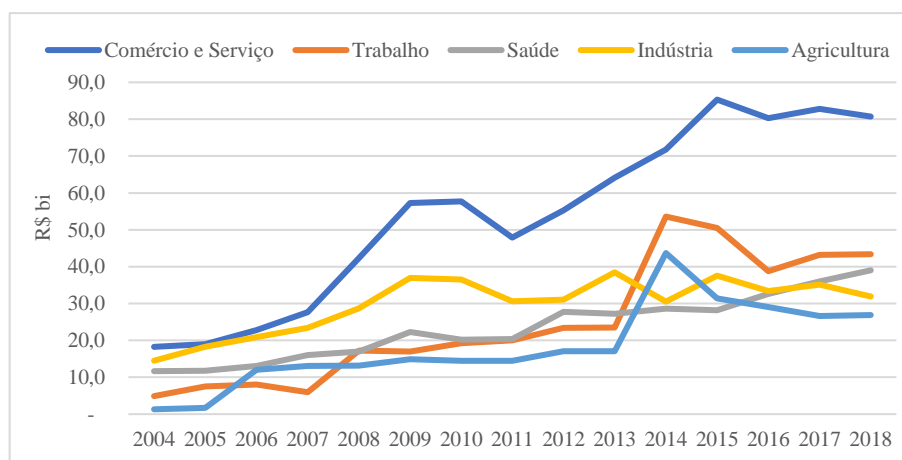
Source: own elaboration based on data from the Tax Expense Statements (several years). *Values deflated by the 2017 GDP deflator.

In order to list the programs criteria, a selection was made from the 2018 report that indicates the proportion of the programs that exempt the following expenses: i) investments; ii) technological research; iii) import of goods and sales in the domestic market, iv) export and v) acquisition of national products.

Table 6 highlights that 43% of tax expenditures programs consist of incentives for import of goods and sales in the domestic market. We observe that the exemptions are, in general, little concentrated in incentives for the export of goods and services, acquisition of nationally produced goods or technological research and investments.

TABLE 6 - COUNTERPARTIES OF TAX INCENTIVE PROGRAMS BASED ON THE TAX EXPENDITURES DEMONSTRATIVE FOR 2018

Counterparts	% over total of tax expenditures
New investments, construction, conservation, modernization, expansion, repair, application in projects for regional development, real estate development.	15,9
Technological research, acquisition of goods specifically for scientific and technological research (imported or national) or exclusion of expenses related to personnel for the development of IT software / services	11,1
Imports of goods (raw materials, intermediate products, machines, equipment, software) and / or sales on the domestic market	42,9
Export and promotion of Brazilian products and services abroad	4,8
Acquisition of national products	15,9
Others/don't have any counterpart	9,5

Source: own elaboration based on data from the Tax Expenses Demonstrative.

Most programs that generate tax expenditures encourage the import of goods in general - raw materials, intermediate goods, machinery and equipment - and sales in the domestic market. This direct reflects Manaus Free Trade Zone and Free Trade Areas.

The number of programs related to the export of goods and services or the acquisition of national products is small and reaches only 20% of the total. Even more important is the fact that only a small part of tax expenditures is directly associated with the requirement for new investments or investments in research, product development and technological innovation - 26% of the total. This fact is relevant from the perspective of long-term growth, since investment and technological innovation are important determinants of the rate of capital accumulation.

3. Literature Review

3.1. Tax Expenditures in Brazil

Andreazzi and Ocké-Reis (2007) and Ocké-Reis (2013) analyzed tax expenditures oriented exclusively to the areas of health, education and social assistance. In area of health tax expenditures consists in large extent by deductions of expenses with private health insurance services from the payment of income tax of individuals and companies. It reached the equivalent of 22.5% of the total federal public expenditure on public health in 2011 (OCKÉ-REIS, 2013, p. 4). According to the author, the increase in the share of this expenditure in the total of tax incentives between 2003 and 2011 shows the expansion of the distributive conflict in the sphere of health concomitantly the mischaracterization of the role of the State in this sphere, since the use of public resources for abatement of private health insurance expenditures compromises the financing of the Public Health System (SUS). In this sense, given the context of underfunding of the public health system, Ocké-reis (2013) points to the need for a general review of these incentives.

Paes (2014a) seeks to find a relationship between tax expenditures and indicators of inequality (Gini Index) and quality of life (HDI), illiteracy rates, education, child mortality and life expectancy considering other countries besides Brazil. The author finds that, despite an expressive volume of fiscal incentives, Latin American countries exhibit worse performances in these indicators compared to OECD member countries arguing for a hypothesis of low effectiveness of tax expenditures in concerns the improvement of the indicators evaluated.

Maciel (2010) highlights the increase in incentives to the Manaus Free Trade Zone (ZFM) but also the implications of changes in the legislation of "Simples Nacional" to explain the growth of tax expenditures. "Simples Nacional" (BRAZIL, 2006) came into effect in 2006 and consists of exemption from several federal taxes and social contributions for small business companies, in addition States and Municipalities tax, in exchange for a single rate on gross revenue.

Paes (2014b) argues that the simplified regime is important for small companies since it creates a situation of greater equity in relation to larger companies. The author argues that, however, despite the benefits of the regime, its cost is high. Since its effectiveness, the Simples

Nacional regime has undergone changes in the direction of expanding the revenue limits and the sectors covered. In 2011, the limits of annual gross revenue were increased to fit the regime and reduced general rates (BRASIL, 2011a) and, in 2014, new sectors were included (BRASIL, 2014).

Curado and Curado (2016) sought to measure tax expenditures related to industrial policies launched since 2004. In the period between 2004 and 2011, one of the hallmarks of the federal government's economic policy was the launch of a set of industrial policies represented by the launch of the Industrial, Technological and Foreign Trade Policy (PITCE), the Productive Development Policy (PDP), launched in 2008 as an offshoot of PITCE and the Brasil Maior Plan (PBM) launched in late 2011.

As the authors said (p.23) "The new industrial policy, inaugurated in 2004, it occurred concurrently with the validity and permanence of a wide range of exemptions inherited from the past". Authors' calculations estimated that tax expenditures effectively earmarked for industrial policy went from 0.45% of GDP to 0.73% of GDP between 2004 and 2009. In 2013, therefore, after the international crisis, these stabilize at 1% of GDP compared to 4% of GDP that represented total tax expenditures. That is, despite the launch of several programs aimed at stimulating competitiveness and technological development, incentives effectively linked to industrial policy accounted for only 25% of the total exemptions (CURADO and CURADO, 2016, p. 18).

The expansion of tax expenditures as a proportion of industrial GDP points to a deepening of the industrial sector's dependence on government tax exemptions. If a well-designed industrial policy is one that gives conditions for the activity to move independently, the movement observed since 2008 does not bring the most favorable assessment.

The authors observe in this period a strong increase in tax benefits directed to the Free Trade Areas (LAC) and the Manaus Free Trade Zone (ZFM), regions that exhibit a certain productive concentration and for companies in the automotive sector or some "maquila industries". In this sense, they argue that the tax expenditures that increased the most between the period of 2003 to 2014 were oriented to traditional sectors, little intensive in technology and

that do not fit in a conception of "modern" industrial policy, which goes beyond the sector perspective.

3.2. *Long-term economic growth: endogenous growth theory and other contributions*

Harrod (1939), Solow (1956) and Romer (1986, 1990) argued that the growth of per capita income in the long run is the result of the accumulation of factors of production - capital and labor. Technological innovations, incorporated into the production process, assume a central role in generating returns to scale in production, a fact that is at the root of the increase in productivity and, therefore, the level of income. Thus, the search for returns to scale in production constitutes a guide for obtaining higher growth rates and raising the level of per capita income.

Barro (1991) states that capital investment and the qualification of the workforce explain a good part of the income differentials between countries based on the empirical analysis of the causes of per capita growth in 98 countries between 1960 and 1985. That means that investing in physical capital and qualifying human capital are two ways to obtain returns to scale.

Sala-I-Martin (1997) compiled several empirical studies on the causes of economic growth, published between the 1980s and 1990s, to assess the robustness of 60 variables used in the literature. They note that, for a sample of developed and developing countries, investment in machinery and equipment and human capital are central. In addition, the countries' export basket, degrees of openness, exchange rate and various elements of social and political organization showed statistical robustness in affecting productivity rates. Although physical and human capital are indispensable and in general, the point of consensus, other variables that may affect the marginal productivity of these factors vary from study to study.

At the end of the 1980s, with the New Economic Geography (NGE), the endogenous growth model enshrined in Solow (1956) received criticism that the factors of production would not be subject to full mobility in view of the existence of costs transport. Krugman (1991) points out that the degree of productive concentration in certain regions assumes a relevant role in explaining income differentials and must be incorporated into the analysis of growth. The concentration, in turn, is associated with the cost of transportation. The agglomeration of activities acts as a "centripetal" force, since it attracts new activities, unlike the cost of

transportation. The link between a greater concentration of productive activities and higher growth rates is in the gains in scale given by the proximity between activities[4].

There is an extensive literature on the relationship between industry and product and aggregate productivity growth which points to the importance of the industrial sector due to its particularity (HIRSCHMAN, 1958; KALDOR, 1957). The industrial sector incorporates and disseminates technical progress and, therefore, exhibits high rates of productivity; as a result, it also has higher average wages and, thirdly, it produces spillovers for other sectors, boosting the sophisticated services sector - with higher wages - and increasing productivity in the agricultural sector. From the point of view of the empirical studies that evaluated this effect, considering samples with several countries and long historical series, which go through the industrialization period (RODRIK, 2009; VIERA, AVELLAR and VERÍSSIMO, 2013; COSTA et al., 2014), using dynamic panel model, showed positive influences of the industry on the long-term growth rate per capita, due to the mentioned points.

In Brazil, Bresser-Pereira and Marconi (2008), Oreiro and Feijó (2010) criticize the loss of industry's share of GDP and the reprimanding of the Brazilian export basket. According to the authors, the fall in the industry-to-GDP ratio is due to the appreciated exchange rate, high interest rates and the dizzying growth in commodity prices between 2003 and 2010. The price boom, despite raising agricultural and mining production, did not affect the industrial sector as a whole, leading to a drop in industry participation combined with higher GDP growth.

3.2. Taxation and Growth

As seen, capital accumulation plays a central role in determining the long-term growth rate per capita. The relationship between taxation and growth was also explored by a set of studies with endogenous growth models and the results show, as well as those that explored the side of public spending, great variability, difficulties in interpretation and comparison of results.

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[4]The concentration also contributes to attracting specialized labor and activities from interconnected sectors, which reduces overall operating costs in the region and, in turn, would encourage a cycle of attraction of new activities. On the other hand, there may be negative effects of industrial concentration for growth linked, for example, to an increase in population density, pollution, excessive traffic, crime and an increase in the cost of housing in central regions.

Lucas (1990) estimates for the USA that the reduction of taxes on income - "capital income" - would have as a counterpart the increase in capital stocks and greater per capita growth in the long run. This relationship is in line with Kneller et al (1999), but was not observed in other works, such as Easterly and Rebelo (1993), Stokey and Rebelo (1995) and Mendoza et al. (1997) which found null effects for growth arising from the reduction of taxation on capital income

Arnold et al. (2011) investigates the effects of changes in the ratio between direct and indirect or distorting and non-distorting taxes on growth from a panel with 21 OECD countries between 1971 and 2004. The author divides between short and long growth term. The tax burden is divided into four spheres, taxes that are levied on labor income, capital, consumption and property. Despite the same significant and positive results for reductions in taxation on income from work and capital, which is based on the logic of Ricardian equivalence, it concludes for the positive effects of tax exemptions in the short term. In the long run, when oriented to innovation and investment in production, they increase aggregate supply. In short, the work points to a functioning of exemptions in the short term, as an anti-cyclical instrument, but, in the long term, they are effective when oriented to investment so that there is a shift in the supply curve[5].

Baiardi et al. (2018) contradicts some of the results found by Arnold et. al (2011) using a sample of 34 OECD member countries from 1995 to 2014. They estimate that a generalized reduction in the tax burden is capable of raising long-term GDP growth per capita, but a change in the composition of the composition of the burden via reduced taxes on capital and labor income and increased consumption taxes has no significant effect. These results would point to the difference between directly stimulating investment and technological innovation and a simple reduction of taxation on income, a fact that does not guarantee the displacement of the

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[5] The distortionary tax directly affects the return on the accumulation of physical capital. Due to the implicit difficulty of separating the taxation that directly affects investment and the one levying on capital income, this literature roughly separates taxes linked to income from capital / labor, taxes linked to consumption and taxes linked to property. The distortion is a consequence of the logic of Solow's growth model, since capital accumulates as a result of the savings rate (of capital and labor), thus, taxation on income will reduce the volume of physical and human capital, whereas the opposite is observed when taxation moves to consumption or property.

available income for productive investment and, therefore, does not alter the supply in the long run.

3.3. Public Expenditure and Growth

Barro (1990) formalizes the relationship between public spending and growth, with the public sector inserted in the production function of the private sector as a positive externality with the capacity to raise the productivity of capital and labor factors. In this sense, the effectiveness of public spending is in generating gains of scale for the private sector, therefore, public capital is an element that acts on growth through supply by generating positive externalities. To the author, public productive expenditure is linked a priori to the expansion of physical social capital or capital expenditure in the public sector. On the other hand, current expenses are necessarily unproductive, reducing aggregate productivity.

Devarajan et al. (1996) proposes a theoretical model without incurring a priori assumptions about the productivity of each expenditure, unlike Barro (1990; 1991), evaluating the effects of the composition of public expenditure - share of current and capital expenditures on the total of expenditure - on the per capita growth rate. Decomposing public expenditures between current and capital expenditures, the author evaluate from which level certain expenditures, initially thought as productive, would become unproductive. According to the model, the productivity of each type of expenditure is subject to the law of decreasing marginal returns: the smaller the share of a certain expenditure in the total, the greater its marginal increments for per capita growth. Therefore, both capital expenditures and current expenditures can be productive, because they depend on your initial stakes. The purpose of the model is to consider the relative share of the existing expenditure, which would allow to point to possible excesses of resources in a given area, a fact that, in other words, would contribute to a marginally smaller effect on the activity.

From a panel with 43 emerging countries between 1970 and 1990, Devarajan et al. (1996) concludes that capital expenditures, which would be expected to have a positive effect on productivity, were found to be unproductive in this set of countries. The result below what would be expected a priori is explained by the diminishing marginal returns. On the other hand, the expenses that proved to be productive were the consumption of the public administration, which is part of the current expenses.

In Brazil, Rocha and Giuberti (2007) evaluate which expenditure is productive and unproductive for the growth rate of GDP per capita in the long term of Brazilian states between the period 1986 to 2003. Based on Devarajan et al. (1996) the impact of fiscal policy was conditioned to the initial composition of each expenditure. Through a Panel data model, authors assess the contribution of expenses by economic category - current and capital - and four other large functional ones like Defense, Education, Health, Transport and Education. Spending in these areas was productive and statistically significant, except for Health, which, although positive, did not find statistical significance. Current expenditure was found to be unproductive. The results are associated with the improvement of the business environment with the guarantee of better infrastructure and security; the supply of public goods and positive externalities.

Specifying the model in a non-linear form in order to capture a limit from which expense where they would start to show decreasing returns to scale, Rocha and Giuberti (2007) conclude for the limit of approximately 61% of current expenses and 36% for expenses of capital. In most states, capital expenditure was far from the limit, which explains the initially estimated positive results.

Neduziak and Correia (2017) evaluated the effect of state public spending on the growth of states considering a period between 1995 to 2011 and considering the effect of a broader set of current expenditures. In terms of contribution to growth, expenses with Administration, Judiciary, Urban Planning, Housing and Social Assistance were the most productive while, contradictorily, expenses with Transport and Security were not significant, contradicting some results found by Rocha and Giuberti (2007). Spending on Education and Culture has a negative effect. Some of these controversial results are explained by elements not captured in the model, such as issues related to quality and the lack of adequate transmission mechanisms.

Still regarding studies related to the composition of public spending and long-term growth, Divino and Silva Junior (2012) studied the effects of the composition of spending at the municipal level with a similar methodology. Like the studies reviewed so far, based on Devarajan et al. (1996) the authors seek to identify the optimal composition between capital expenditures and current expenditures capable of maximizing the effect for growth. In line with studies for other geographic levels, they conclude that in poor municipalities current spending is more effective than that of capital explained, among others, by the fact that the social

expenditure responsible for reducing income inequality is included in current expenditure. Marginally, the productivity of this expenditure in general (capital and current) is higher for a very low level of income.

4. Model

The empirical test seeks to verify whether tax expenditures contribute to economic growth per capita in the long and short term. In a second step, we seek to verify whether this contribution depends on the volume of incentives, that is, whether its effects for growth would change in the event of a significant increase in the volume (quantity) of tax incentives. From this last question, in case of different effects from the current and extreme values, it is possible to verify whether the current tax expenditure would be at a low, adequate or exaggerated level.

Given the sample size restrictions of tax expenditures and other variables considered for the estimation, only available on an annual basis, it's consider the total incentives for the North, Northeast, Central-West, Southeast and South between 2003 and 2015. Thus, as a way of circumventing the database restriction, was chosen a regional segmentation.

The Panel model was built using Devarajan et al. (1996) in the sense that the dependent variables are moving averages of GDP growth per capita for periods ahead. Given the sample limitation, the period considered as long term was four years ahead. Devarajan et al (1996, p. 322) points out that this specification allows considering the period necessary for variations in spending, in this case, on tax benefits, to have concrete effects in terms of GDP growth.

As with direct public spending, tax breaks take a while to complete the impact on aggregate GDP growth - if incentives have the ability to affect the productive sector effectively. The use of averages for GDP growth per capita years ahead allows to capture this temporal effect. In terms of the advantages of using moving averages, it is possible to highlight the possibility of reducing the effects of short-term fluctuations in GDP and it is advantageous in to the extent that the endogeneity of the variables is avoided.

It is possible to derive two problems of endogeneity. First, if we assume that the capacity to carry out tax incentives in is a function of the collection in this period or in the previous period. In this sense, as it is a function of tax collection, the tax expenditure is also a function of GDP growth. However, even in scenarios of contraction of growth, in which revenues fall,

tax expenditures continue to grow indicating that the tax benefits granted at present are little dependent on current or past revenue[6].

Another source of endogeneity comes from the calculation of the amounts associated with tax expenses. They are projections dependent on the growth estimate of the sectors covered by the incentives. If in the moment of projection there was a higher expectation of growth, tax expenditure values for the period ahead would rise. However, the figures are not influenced by the GDP of four or more years ahead, except in the case of an exact government's ability to forecast growth variation ahead. However it is difficult to assume that there is such information at present in the case of a long period ahead.

4. Generalized Method of Moments (GMM) and model description

For the estimation was chosen the GMM system which is the method most used in dynamic growth equations - which incorporate the lag of the time-dependent variable. The inclusion of the lag causes bias and inconsistency in the parameter estimates if the estimation is performed using the Ordinary Least Squares (OLS) method, as it produces autocorrelation between the cutting units (individuals) and between the model's random error terms.

The Arellano and Bond (1991) method estimates parameters by GMM and eliminates the correlation between the random terms and between the cutting units from the creation of instrumental variables represented by lags of the explanatory variables themselves in each period[7].

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[6] Since tax expenditures have an incentive character, in addition to being easily approved, it is natural to expect that in recessive periods there will be greater pressure to expand these benefits and broad resistance to cuts.

[7] In order to clarify the idea of the estimator Arellano and Bond (1991), consider that a dynamic model is specified as follows: $y_{it} = \beta y_{it-1} + \mu_{it} + v_{it}$, onde $i = 1, ..., N$; $t = 1, ..., T$; v_{it} and μ_{it} são IID $(0, \sigma^2{}_v)$. In order to obtain a consistent estimator of β, differences apply in the original series, which eliminates μ_{it}, resulting in $(y_{it} - y_{i,t-1}) = \beta(y_{it-1} - y_{i,t-2}) + (v_{it} - v_{it-1})$. In this case, $y_{i,t-2}$ is a possible instrumental variable, as it is correlated only with $\beta(y_{it-1} - y_{i,t-2})$, since there is no serial autocorrelation in terms of error. As the period progresses, the set of valid instruments becomes $W = (y_{it1}, y_{i,t2}, y_{i,t3}, ..., y_{i,tT})$. For a moment condition in which $E(W'_i \Delta v_i) = 0$, the estimator Arellano and Bond will be given by: $\hat{\delta}_2 = [(\Delta y_{-1})' W \hat{V}_N^{-1} W' (\Delta y_{-1})]^{-1}[(\Delta y_{-1})' W \hat{V}_N^{-1} W' (\Delta y)]$, where $V_N = \sum_{i=1}^N W_i (\Delta v_i)(\Delta v_i)'W_i$. This estimator produces consistent parameters for the variables. See more details in Baltagi (2005, p. 136-138).

As a counterpart to the method, however, there is a reduction in the degrees of freedom and the possibility of over parameterization. Thus, the relevant test for verifying the quality of the dynamic model, linked to the over identification and validity of the instruments, is the Hansen test, under the null hypothesis that the instruments are valid (BALTAGI, 2005, p.138)

The standard model, with linear specification, being dynamic, assumes the following functional form:

$$g_{it} = \Delta y_{it} = \beta_1 g_{it-1} + \beta_2 (Gtrib/PIB)_{it} + \varphi_{it} + \theta_t + u_{it}$$

Where g_{it} is the average GDP growth per capita for each region i in the period t years ahead. In order to capture possible changes in the parameter as the short term approaches, effects for growth at t + 4, t + 3, t + 2 and t + 1 years were tested.

g_{it-1} it is the GDP growth per capita in the year before the reference year.

$Gtrib/PIB_{it}$ are the values of total federal tax expenditures directed to each region i as a share of the region's respective GDP;

φ_{it} it is a set of explanatory variables described below;

θ_t it is a vector of dummy variables that assumes a value of 1 for the year 2009 and 2015 because, in these two years, the GDP growth rate was negative.

$$u_{it} = \mu_i + v_{it}$$

Where v_{it} the random error term and μi is the specificity of each cutting unit.

3. Non linear form

In order to identify a non-linear relationship, a model in this format was specified following the method proposed in Rocha and Giuberti (2007) that adds the square of the relationship $Gtrib/PIB$ in the original equation, obtaining a new parameter β_3, as:

$$g_{it} = \Delta y_{it} = \beta_1 g_{it-1} + \beta_2 (Gtrib/PIB)_{it} + \beta_3 (Gtrib/PIB)^2_{it} + \varphi_{it} + \theta_t + u_{it}$$

Only in the case of opposite signs between β_2 and β_3, that is, for cases of $\beta_2 > 0\ e\ \beta_3 < 0$ or $\beta_2 < 0\ e\ \beta_3 > 0$, the $Gtrib/PIB$ optimun, that is, the point from which the effect becomes the inverse, will be given at the relative maximum, that is, when $\frac{\partial g_{it}}{\partial (Gtrib/PIB)} = 0$. Thus, at the relative maximum, the optimal reason for $\frac{Gtrib}{PIB}$ can be given by $-\beta_2/2\beta_3$.

5. Data and sources

The list of variables that make up the model, their average values and information are described below.

TABLE 7 - VARIABLES THAT COMPOSE THE MODEL: AVERAGES FOR THE PERIOD 2003 TO 2015,% - SELECTED VARIABLES

Variables	Average values between 2003 to 2015 (%)				
	North	Northest	Midwest	Southeast	South
GDP growth per capita per year	2,1	2,5	2,0	1,5	2,3
Tax Expenses / GDP of the region	10,2	2,7	2,4	2,7	2,6
Demographic growth	2,0	1,1	1,9	1,1	1,0
Growth of National Investiment	1,2	1,0	1,4	1,9	1,1
Current Expenditure of States / GDP of the region	18,3	17,9	8,9	12,1	11,6
Capital Expenditure of States / GDP of the region	3,6	2,9	1,5	1,6	1,3
Current Expenditure of Municipalities / GDP of the region	9,4	12,7	5,4	7,5	7,7
Capital Expenditure of Municipalities / GDP of the region	1,5	1,5	1,1	1,1	1,1
Industry / GDP of the region	18,9	11,9	8,2	20,9	20,1
Credit / GDP of the region	14,7	19,4	20,3	28,4	26,9

Fonte: elaboração própria.

The unavailability of some data led to the use of approximations and other variables linked to what was initially sought, especially in the case of the variable representing the physical capital of the model, since data on gross capital formation are non-existent at the regional level.

The explanatory variables and their sources, in addition to the lag of the dependent variable, two dummies for 2009 and 2015 and tax expenditure, as described in the previous section, are:

Demographic Growth: growth of the total population, in each region i, in each period, as an approximation to human capital (BARRO, 1991) collected from the population series available on the IBGE website (Brazilian Institute of Geography and Statistics).

Growth of Gross National Physical Capital Formation (investiment) per capita: growth of Gross Fixed Capital Formation at national level - given by the unavailability of the variable at regional level - divided by the population of each region i. The division by population aims to control the level of the variable in order to obtain different values for each region. Thus, physical capital is represented by the Investment of Brazil, which was divided by the population of each cutting unit. The data was collected in the Time Series Management System of the Central Bank of Brazil.

The reference model was estimated considering the growth of Investment at the national level as a variable representing capital, but a test was carried out with another approach given by the balance of credit operations directed to the regions as described below.

In this case, Credit / GDP: comprises the balance at the end of the period of loan, financing, advance and leasing operations, granted by the institutions that make up the National Financial System (SFN) for legal entities, by units of the federation. The data were obtained from the Central Bank of Brazil, taking December values of each year, deflated by the GDP deflator based on 2017 and divided by the region's GDP. The second proxy for capital is the volume of credit granted to the private sector for both short- and long-term operations - which includes, although not exclusively, investments. The relationship between credit and investment is well known in the literature (MELO and RODRIGUES JÚNIOR, 1998; RIBEIRO and TEIXEIRA, 2001; LUPORINI and ALVES, 2010).

Still regarding the physical capital proxies, given the absence of Investment by region, Galeano and Mata (2005) suggested the use of industrial and residential electricity consumption, which would be directly associated with the increase in physical capital. In addition to being unavailable at the regional level for the most recent period, this variable has

some problems. The logic is that the greater the consumption of electricity is due to greater production, so some association appears between energy consumption and expansion of productive capacity (investment). However, the increase in investment can be accompanied by energy efficiency reducing its impact on energy consumption. Still, it must be considered that energy consumption may reflect the growth of the activity itself, reversing causality, as pointed out by Hondroyiannis et al. (2002) and Shiu and Lam (2004).

Current and capital expenditures of States and Municipalities over GDP: as state and municipal public expenditures are relevant variables for the GDP growth rate, as indicated in the literature, current and capital expenditures of States and Municipalities in each region were aggregated this way. Based on data from the SIAFI (Integrated Financial Administration System of the Federal Government), current expenses and capital expenditures of states and municipalities in the country were selected. Then, the States and Municipalities were separated by region and added their current and capital expenditures. In this way, an aggregate of total current expenditure and total capital expenditure of States and Municipalities in each region was obtained and divided by the region's GDP. The objective is to incorporate the effect of public sector spending on growth. The literature considers that public spending by States and Municipalities is more likely to affect the growth rate compared to federal spending in the regions, so that disregarding the latter, although relevant, does not result in a large omission of information.

Industry to GDP: industry to GDP ratio in each region i. As highlighted in the literature review, the industrial structure has a relevant role in growth. The data were obtained from IBGE.

5. Results

In this section, some results obtained with the estimation of the econometric model are presented and discussed. In a first model, the per capita growth rate is explained by a set of variables with the exception of state and municipal public spending. It is noticed that the relevant variable (tax expenditures/GDP) is not significant in this specification, but it is negative and close to zero. As it is analyzed from t + 4 to t + 1, a change in the sign of the parameter is also observed. It is important to remember that the more in the short term the greater the effect

of endogeneity. Since the variable of interest does not reveal statistical significance, this model is poorly specified.

TABLE 8 - DYNAMIC PANEL ESTIMATION RESULTS I

Dependent variable: moving average of real GDP growth per capita in:	t + 4	t + 3	t + 2	t + 1
Explanatory variables[1]	a	b	c	d
Average GDP growth per capita (previous years)	0,649***	0,618***	0,324**	-0,056
	(0,166)	(0,115)	(0,111)	(0,126)
log Tax Expenditure/ GDP	-0,001	-0,008	0,002	0,023
	(0,005)	(0,005)	(0,009)	(0,015)
Demographic growth	-1,177***	-1,164	-1,143***	-1,015***
	(0,467)	(0,306)	(0,303)	(0,282)
Growth of Investiment	0,172*	0,075	0,141*	0,166**
	(0,067)	(0,066)	(0,067)	(0,061)
log Industry/PIB	-0,070*	-0,044*	-0,030	0,071
	(0,026)	(0,022)	(0,038)	(0,058)
Dummy (2009 e 2015)	-0,002*	-0,005*	-0,016*	-0,020
	(0,004)	(0,004)	(0,008)	(0,016)
R²	0,287	0,224	0,427	0,395
Hansen's J-statistic	0,075	0,0173	0,070	0,635
N	35	40	45	50

[1] Values are the coefficients and, in parentheses, the average standard error.
***, ** and * indicate, respectively, statistical significance in the 99%, 95% and 90% confidence interval.

The parameter for tax expenditure and the result in general improve with the increase in the expenses of States and Municipalities (Table 9). It is clear that the effect of tax expenditures on long-term growth is negative, but close to zero. For each 1% increase in the tax expenditure / GDP ratio, the average GDP growth per capita for the next four years is reduced by 0.013%. The 1% increase in the ratio of tax expenditures to GDP also leads to a reduction in average GDP growth per capita of three years ahead by 0.024% per year. For the average of the two and for the year immediately ahead, the effect is statistically insignificant.

TABLE 9 - DYNAMIC PANEL ESTIMATION RESULTS II

Dependent variable: moving average of real GDP growth per capita in:	t + 4	t + 3	t + 2	t + 1
Explanatory variables [1]	a	b	c	d
Average GDP growth per capita (previous years)	0,563***	0,669***	0,378***	0,084
	(0,129)	(0,111)	(0,100)	(0,122)
log Tax Expenditures/GDP	-0,013**	-0,024***	-0,021	0,026
	(0,005)	(0,007)	(0,012)	(0,017)
Demographic Growth	-1,885***	-1,259***	-1,272***	-1,045***
	(0,352)	(0,284)	(0,337)	(0,268)
Growth of Investiments	0,155**	0,012	0,071	0,134***
	(0,051)	(0,063)	(0,062)	(0,060)
log Current State Expenses/GDP	0,188***	0,161**	0,230**	0,322***
	(0,040)	(0,049)	(0,078)	(0,124)
log Capital Expenditure of Estates/GDP	-0,003	0,0002	-0,015	0,033

	a	b	c	d
	(0,008)	(0,010)	(0,021)	(0,027)
log Current Municipalities Expenses/GDP	0,015	0,009	0,090	-0,064
	(0,034)	(0,041)	(0,072)	(0,105)
log Capital Expenditures of Municipalities/GDP	0,008*	0,015*	0,004	-0,065
	(0,004)	(0,005)	(0,008)	(0,105)
log Industry/GDP	-0,066**	-0,042*	-0,022	0,077
	(0,022)	(0,022)	(0,038)	(0,053)
Dummy (2009 e 2015)	-0,001*	-0,008*	-0,020*	-0,025
	(0,003)	(0,004)	(0,008)	(0,014)
R²	0,56	0,32	0,56	0,49
Hansen's J-statistic (p-valor)	0,087	0,156	0,028	0,254
N	35	40	45	50

[1] Values are the coefficients and, in parentheses, the average standard error.
***, ** and * indicate, respectively, statistical significance in the 99%, 95% and 90% confidence interval.

As for the quality of the model, the Hansen test did not point to overparameterization at the 5% significance level - on this test it is ideal to accept the null hypothesis, which occurs at the 5% significance level except for the average of two years ahead.

In a third model, the credit/GDP variable was tested as a proxy for physical capital. Table 10 shows that when the credit/GDP variable is used as an approximation for physical capital, the effect of tax expenditures on GDP remains negative and close to zero, despite a small variation. For every 1% increase in the tax expense / GDP ratio, there is a reduction of 0.015% in the average GDP growth per capita of four years ahead. An unexpected result occurred for the credit / GDP ratio itself, which found a negative sign.

TABLE 10 - DYNAMIC PANEL ESTIMATION RESULTS III

Dependent variable: moving average of real GDP growth per capita in:	t + 4	t + 3	t + 2	t + 1
Explanatory variables [1]	a	b	c	d
Average GDP growth per capita (previous years)	0,133	0,394*	0,211**	0,132
	(0,126)	(0,137)	(0,078)	(0,127)
log Tax Expenditures/PIB	-0,015***	-0,015*	-0,002	0,029
	(0,004)	(0,007)	(0,118)	(0,022)
Demographic Growth	-1,274***	-0,952***	-0,470	-0,720**
	(0,005)	(0,246)	(0,313)	(0,303
log Credit/GDP	-0,082***	-0,068**	-0,118***	-0,106**
	(0,016)	(0,020)	(0,021)	(0,035)
log Current Expenditures of Estates/GDP	0,107***	0,102*	0,074	0,214
	(0,040)	(0,049)	(0,072)	(0,141)
log Capital Expenditures of Estates/GDP	0,0035	0,0173	0,015	0,056*
	(0,007)	(0,010)	(0,018)	(0,028)
log Current Expenditures of Municipalities/GDP	0,045	0,113*	0,281***	0,168
	(0,052)	(0,057)	(0,078)	(0,153)
log Capital Expenditures of Municipalities/GDP	0,001	-0,002	-0,025*	-0,034*
	(0,005)	(0,007)	(0,008)	(0,169)
log Industry/GDP	-0,084***	-0,043*	-0,006	0,048
	(0,021)	(0,239)	(0,038)	(0,068)
Dummy (2009 e 2015)	-0,015***	-0,012***	-0,032***	-0,048***
	(0,016)	(0,002)	(0,005)	(0,068)

R²	0,73	0,43	0,63	0,51
Hansen's J-statistic (p-valor)	0,013	0,124	0,047	0,431
N	30	35	40	45

[1] Values are the coefficients and, in parentheses, the average standard error.

***, ** and * indicate, respectively, statistical significance in the 99%, 95% and 90% confidence interval.

Finally, the results for tax expenditure raised to extreme values are presented. It is noticed that both the current level of tax expenditures and its increase to extreme values have a similar effect in terms of long-term growth. An increase of 1% in extreme values of the tax expense to GDP ratio leads to a reduction of 0.005% in the growth of GDP per capita of four years ahead. The result suggests that the relationship between exemptions and growth is linear, since the values in levels have the same meaning as the extreme values, which suggests that the increase in the amount of tax expenditures, without changing its structure of criteria and current characteristics , as contemplated sectors, for example, maintains a negative effect on long-term growth. In other words, a more positive effect of tax expenditures on GDP should not be pursued by expanding the amount of these expenditures in their recent configuration.

TABLE 11 - RESULTS OF THE DYNAMIC PANEL IV ESTIMATION

Dependent variable: moving average of real GDP growth per capita in:	t + 4	t + 3	t + 2	t + 1
Explanatory variables [1]	a	b	c	d
GDP growth per capita in the previous period	0,563*** (0,129)	0,679** (0,114)	0,378** (0,100)	0,085 (0,123)
log Tax Expenditures/GDP	-0,003** (0,001)	-0,005** (0,001)	-0,004 (0,002)	0,005 (0,004)
log Tax Expenditures/GDP²	-0,005** (0,002)	-0,009** (0,002)	-0,008 (0,005)	0,011 (0,007)
Demographic Growth	-1,885*** (0,351)	-1,297*** (0,030)	-1,272*** (0,034)	-1,045*** (0,268)
Growth of Investiment	0,155* (0,051)	0,008 (0,063)	0,072 -0,063	0,134** (0,060)
log Current Estate Expenditures/GDP	0,188** (0,040)	0,158** (0,050)	0,230* (0,078)	0,323* (0,124)
log Capital Estate Expenditures/GDP	-0,003 (0,008)	-0,000 (0,011)	-0,015 (0,021)	0,033 (0,027)
log Current Expenditures of Municipalities/GDP	0,015 (0,0345)	0,010 (0,041)	0,090 (0,072)	-0,065 (0,105)
log Capital Expenditures of Municipalities/GDP	0,008* (0,004)	0,015*** (0,005)	0,042 (0,009)	-0,015 (0,013)
log Industry/GDP	-0,066* (0,022)	-0,045* (0,025)	-0,023 (0,038)	0,077 (0,053)
Dummy (2009 e 2015)	-0,0012 (0,003)	-0,008 (0,063)	-0,020* (0,008)	-0,025 (0,014)
R²	0,55	0,32	0,56	0,49
Hansen's J-statistic (p-valor)	0,087	0,159	0,028	0,254
N	35	40	45	50

¹ Values are the coefficients and, in parentheses, the average standard error.
***, ** and * indicate, respectively, statistical significance in the 99%, 95% and 90% confidence interval.

Some considerations must be made regarding the results in general and the limitations of the models. First, the sample is small, with the number of observations ranging from 30 to 50 depending on the period ahead and the explanatory power of the models (R^2) is not as high, ranging from 0.3 to 0.7 , depending on the specification.

From the results presented, dynamic panel II (Table 9) presented more coherent results. Although the national Investment has the expected, positive and significant effect, since it represents capital investment, the credit / GDP ratio showed a negative sign, in contradiction with what was expected. This was because the ratio grew despite a drop in the GDP growth rate per capita in the regions - it should also be noted that the credit considered includes working capital and not only credit for the acquisition of machinery and equipment or expansion of capacity.

The variable of productive concentration (industry / GDP) had a different signal than expected since the effect of industrial concentration depends on issues related to internal linkages, important for the increase in productive concentration to be reflected in increased growth per capita in the long run.

Finally, the variables created from the consolidation of current public expenditure and capital from States and Municipalities that would represent important contributions to regional growth, as highlighted in the literature, had results that varied according to the specification, but according to the literature.

In summary, it can be said that: i) tax expenditures have almost zero, statistically significant, albeit negative, effects on long-term per capita income growth; ii) for extreme values, the effect is still close to zero and remains negative.

These two findings support the hypothesis that suggests that tax expenditures made up of programs launched from 2003 to 2015, despite increasing, were not in themselves capable of sustaining GDP growth. As a whole, tax expenditures are not positively related to growth,

although this is not the same as stating that specific programs show the same result. The total effect of tax expenditures on long-term growth per capita is close to zero and negative.

Since the growth equation is equivalent to a production function and the incorporation of tax expenditures is similar to the incorporation of public expenditures, expenditures that act on the productivity of the private sector, it is interpreted that the tax benefits for certain sectors productive would be linked to some expenditure that contributes positively to the increase of the sector's productivity and would bring externalities to the system as a whole. Although public spending, in another perspective of analysis, also constitutes aggregate demand, tax expenditures do not allow interpretation as multipliers.

As seen, the criteria for exemption programs are little associated with spending on R&D and technological innovation. In section 5, it was observed that only 11% of total tax expenditures are incentives for technological research, acquisition of goods specifically for scientific and technological research or exclusion of expenses related to personnel for the development of software / IT services. Only 15% are linked to new investments, construction, conservation, modernization, expansion, repair, application in projects for regional development or real estate development.

These investments in innovation have a relevant role for gains in scale and, in the perspective of endogenous growth, they affect the rate of capital accumulation and productivity levels. Therefore, the results observed suggest that about a quarter of the total tax exemptions in investments, R&D and technological innovation are due to the small emphasis. In addition to the design of the programs, a second point linked to the low effectiveness of tax benefits may refer to the effects of their significant growth on the complexity of the tax system, which acts in a negative sense for the productivity of the private sector.

Conclusion

The work tried to analyze and estimate the effect of tax expenditures on Brazil's long-term growth. It was found in the analysis of the Tax Expense Statements the expressive growth of tax expenditures between 2003 and 2015 and also that a large part of the programs are linked to tax benefits for the importation of goods, services and sales in the domestic market while only a small part is directly linked to the counterpart in new investments, product research and

development or technological innovation. It was argued that this fact conditions the results for long-term growth since in this perspective investment and technological innovation are determinants of the rate of capital accumulation and productivity.

From the empirical analysis it was possible to conclude that the tax expenditures between 2003 and 2015 had a negative association, but close to zero with the growth rate of the economy - for each 1 pp of increase in the tax expenses to GDP ratio there is a reduction of -0.013% pp long-term GDP growth per capita.

There was also a linear relationship between tax expenditures and growth: when elevated to extreme values, the effect of exemptions on GDP is a little more intense, but still negative and close to zero, which suggests that the relationship between tax spending and growth is linear . In this line, tax expenses have, in their totality, little capacity to affect the economic growth rate. Finally, the results reinforced the idea of revising the designs of incentive programs for them to focus more on the issue of productive investment and technological innovation.

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