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THE EFFICIENCY OF PUBLIC EXPENDITURE IN THE MUNICIPALITIES OF SANTA CATARINA, BRAZIL: AN APPROACH WITH DYNAMIC PANEL DATA MODEL

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ABSTRACT

The main objective of this study is to understand the impact that public spending, carried out by municipalities in the south of Santa Catarina (SC), has on economic growth. The study considered the efficiency of municipal spending on the region's product and productive infrastructure in its analysis. Despite the theme being relevant in matters of efficiency in public management, there was a scarcity and inexistence of studies in Brazil and Santa Catarina. The ordinary least squares method was used for comparison purposes, obtaining the panel data approach. The results show no impact of spending on GDP, despite the municipality region. On the other hand, the type of productive activity in each municipality seems to influence the efficiency of public spending on the product of Santa Catarina cities. Public spending on health brought higher returns than education, and legislation and special charges were also significant.

INTRODUCTION

Taxes raised by public management aims to improve the well-being of citizens and increase the accumulation of physical and human capital. A significant part of the literature shows a positive relationship between economic growth and public spending. (BOGONI *et al*., 2011; DIVINO and SILVA JUNIOR, 2012; DEGENHART *et al*., 2016). In this context, the present work's hypothesis is to analyze this correlation in the municipalities of Santa Catarina. Public spending is related to consumption, investment and government transfer payments. These expenses stem from taxes, rents, sale of goods, provision of services, sale of securities at the national level, receipt of indemnities, among other things (BRASIL, 2021). Since Keynesian models spread the idea of public spending to generate economic growth, the topic has become much studied and with numerous disagreements about the allocation of public spending and which the prioritized sectors are. Even though the topic is of general interest, there is a gap in the literature regarding the municipalities of Santa Catarina.Therefore the study is justified. Marques Junior *et al*. (2006) states that empirical evidence is sensitive to changes in control variables when done with countries.

For cities, this would not happen. The heterogeneity of factors that explain economic growth in countries is not applicable in cities. This would justify the lack of articles investigating cities' economic growth. For Marques Junior *et al*. (2006), the role of fiscal policy on economic growth is a discussion that divides economists' opinions. A good part of the arguments is between the Keynesian and neoclassical strands. However, there is still an aspect that classifies public spending into productive and unproductive. Keynesian models of aggregate demand point to positive relationships between government spending and the level of economic activity. In this context, Ram (1986) developed a study that pointed out that the size of the government would positively affect economic performance and growth for the rest of the economy. As a result, public spending could boost economic growth through private sector productivity. In the same sense, the studies by Barro (1990), Cashin (1995), and Aschauer (1989) presented a view that public spending could stimulate economic growth and thus raise the productivity of the private sector. For Barro (1990), the behavior of government spending defines the relationship with the product. The relevance of economic policy comes from its ability to directly or indirectly encourage the accumulation of determinants for economic growth. The author also states that if public spending does not affect the productivity of the private sector, economic growth will be null.

Unproductive public spending would occur when the public sector invests resources in areas that rival the private sector. This allocation is inefficient because of the speed of the public sector or the appropriation of benefits by personal interests. Productive public expenditures would be those introduced in consumers' local production or utility functions. Aschauer (1989) discusses that an increase in public investment expenditure would lead to an increase in private investment. Pereira (2000) followed the same reasoning and conducted a study in the United States from 1956 to 1997, where he pointed out that public investment positively affects production and attracts private investment. Thus, investments of US$1 would increase private production by US$4.46. The most significant returns were in electricity, gas, transit system, airfield, etc., with 16.1%. In the same sense, Pereira (2001), Pereira and Andraz (2007), Kamps (2005), Afonso and Aubyn (2008) and Hyder (2001) developed their work. On the other hand, Rocha and Giuberti (2007) emphasize that models based on Keynesian ideas are not always consistent with reality, with cases in which the reduction in government spending leads to expansions rather than contractions, especially in the medium term. In this direction, Marques Junior *et al.* (2006) highlights that this debate was limited to the short term for a long time; however, in the 1950s, studies began to discuss the effects that economic growth can cause in the short and long term. In other words, studies on countries' long-term economic growth began using neoclassical growth models.

Solow (1956) pioneered developing a model capable of explaining part of the differences observed in the per capita income of different countries. According to the author, economic growth, in a steady state, is determined by exogenous factors, such as population growth and technological progress. That is, the effects of fiscal policy would only work during the transition from one steady state to another. In this context, government spending and taxation changes would have temporary effects, as they affect the output level in the short term but not the long-term growth rate (Marques Junior *et al.*, 2006; Firme and Filho, 2014). Based on Solow's model, the model by Mankiw *et al.* (1992) considers the importance of human capital as an income-generating input. The updates brought in the model by Mankiw *et al.* (1992) revealed that small changes in the resources available for accumulating physical and human capital could generate significant variations in the per capita product. These changes can explain the differences in income between regions. Aschauer and Greenwood (1985) and Barro (1990) warn of the need to distinguish public goods and services in the utility function and those that complement the private sector's production. In the first case, the authors point out that growth may have adverse effects due to increased taxes, reducing the return on private investments. Grier and Tullock (1989) proved a negative and statistically significant relationship between the actual growth rate of the product and the participation of government consumption in GDP. In the second case, spending would provide an environment that stimulates growth. This proposal is similar to a theory by the English economist David Ricardo, the so-called Ricardian equivalence, where he claims that an expansion of unduly financed public spending would outweigh the positive effects and generate negative externalities. Robert Barro and other authors continued their work, developing a theory distinguishing which public expenditures are productive and unproductive. Feldstein (1982) points out that increasing government spending or taxes without a tax counterpart could cause a contraction in the economic cycle. This increase would occur because consumers would react to a fiscal change by altering subjective probability distributions on account of taxation and future government spending. In Feldstein's (1982) analysis, the reaction to a change in fiscal conduct would depend on the expectations formed by this change. The empirical studies by Alesina and Perotti (1995), Alesina and Perotti (1997), and Alesina and Ardagna (1998) confirm that fiscal contractions occur, and the conditions under which the economy can grow with fiscal responsibility were also analyzed. Two determinants are: a) fiscal adjustment based on cuts in spending, namely transfers, social security, government wages and employment; b) adjustment based on tax increases.

In spending, almost all cuts are in public investment. The results showed that spending of the first type would be more likely to be successful, as it signals that the government has promoted regime change and generates a wave of optimism. With the works of Romer (1986) and Lucas Jr. (1988), endogenous growth models emerged, and the discussion of the role of fiscal policy in economic growth became richer. These models point out that taxation on income could adversely affect economic growth by reducing consumption and savings, resulting in less capital accumulation. Some empirical studies have projected a link between particular government spending components, private sector productivity, and economic growth. The works of Aschauer (1989), Morrison and Schwartz (1996), and Holtz-Eakin (1992) stand out, based on theoretical models which analyzed the productivity of public spending in the United States. Devarajan *et al.* (1996) developed a theoretical framework linking the composition of public spending with economic growth, focusing on developing countries. For Barro and Sala-iMartin (1995), productive expenditure can take three forms: a) as a typical public good, which all citizens and companies can use at the same time; b) private good, goods offered by the government that is rivals or exclusive; c) partially excluding public good, subject to the phenomenon of congestion as in the case of roads, airports, among others. For Barro (1990), the third case would be the best, as it provides for productive spending on education, infrastructure, research, and technology. Thus, endogenous economic growth models conclude that the economic growth rate depends positively on productive expenditures and negatively on distorting taxes. Some authors, such as Srinivasan (1985), Buchanan (1980), and Bhagwati (1982), argue that public spending is unproductive and does not bring any additional production, serving only the interest of some groups.

Continuing with Barro's presentation, Abbas (2000) states that human capital correlates with physical and significant capital. Abbas and Foreman-Peck (2007) show that human capital plays a significant role in economic growth. Qadri and Waheed (2011) also claim that human capital positively affects economic growth. Lucas Jr. (1988) points out that an increase in spending on education would promote an increase in the rate of economic growth due to the accumulation of human capital. Nevertheless, Easterly and Rebelo (1993) note that sizeable public spending on education correlates with high levels of inequality in distribution, and thus, the relationship between economic growth and education would not be robust. For Basu and Bhattarai (1999), there is a positive relationship between economic growth and non-public costs in education, indicating a linear U-shaped relationship between the variables. In developed countries, public spending on promotional education would, at first, have a positive effect on economic growth, and in poorer nations, education costs would bring growth in the long term. In the studies by Fan *et al.* (2002) made in China between 1970 and 1997, the results show that investments in education have the highest marginal productivity among all public investments. Kahn (2005) studied 72 low- and middle-income countries between 1970 and 1990. His results indicate that education and health positively affect per capita economic growth. In the same vein, the work of Maitra and Mukhopadhyay (2012) concludes that health and education positively impact economic growth, but education impacts are higher. In the works of Kormendi and Meguire (1985), Grier and Tullock (1989), and Summers and Heston (1988), expenditures on defense and education classifies as unproductive. However, Barro (1991) considered the same expenditures as productive. For the author, spending on public education represents an investment in human capital. And so, would security spending as it helps protect property rights, which leads to investment and growth. Acosta-Ormaechea and Morozumi (2013) found no significant relationship between reallocations in defense, infrastructure, health, and social protection spending and long-term GDP growth. The compositional reallocation occurs through increased education spending, with a robust association. It becomes even more apparent when spending on education increases at the expense of social spending. Public spending on infrastructure is another subject without consensus. Dabla-Norris *et al.* (2011) stated that not all investment in infrastructure is directly linked to economic growth since there is a dependence on efficiency and quality of

expenditure. Agénor and Neanidis (2006) and Agénor (2010) developed a long-term model with public spending on infrastructure being essential for economic growth, concluding that when spending efficiency is high, a reallocation of spending towards infrastructure would be productive. Aschauer (1989) found evidence of the positive impact of public investment in roads, streets, and water systems on economic growth from 1949-1985. Subsequently, the studies by Ferreira (1996) found a positive effect of investment in infrastructure on economic growth between 1970 and 1993. In another study, Ferreira and Malliagros (1998) expanded this concept by including expenses with the road sector in the infrastructure. Furthermore, found a positive relationship between infrastructure spending and long-term growth. Murty and Soumya (2006) analyzed India (1979-2003) and found that increasing infrastructure investments lead to economic growth and poverty reduction. Another significant sector is health. It is one of the promoters of the increase in the productivity of individuals (WEIL, 2014; BHARGAVA *et al.*, 2001; BLOOM *et al.*, 2004; BLOOM and CANNING, 2005). Neduziak and Correia (2017) highlight that health impacts the economy when it increases people's physical and mental vigor and extends healthy working days and human capital. Agénor (2010) and Alderman *et al.* (2003) see public spending on health impacting individual productivity and economic growth.

Health expenditures also contribute to the quality of education, improving the cognitive aspect related to learning ability and school attendance. For Akram *et al.* (2008), Pakistan's health expenditures cause long-term growth, but in the short term, they are negligible. For Kneller *et al.* (1999), productive expenditures are expenditures on general public services, defense, education, health, transport, and communication. Moreover, the unproductive would be social security, recreation, financial services, and other expenditures. In line with this, the work by Easterly and Rebelo (1993) with sets of cross-section regressions found evidence that public spending on transport and communication for developing countries would lead to more significant economic growth. Gemmell *et al.* (2014) and Agénor (2010) state that public spending on social protection has a counterproductive behavior to production. Social spending has passed an inflection point in the productivity curve. Barro (2004) and Acosta-Ormaechea and Morozumi (2013) did not find a direct relationship between economic growth in defense spending. Devarajan *et al.* (1996) sought to determine the components of public spending that can be productive in developing countries. In his model, the author did not a priori classify public spending as productive or unproductive. The data indicate which components would meet the definition of productive expenditure. In addition, their empirical results for developing countries over 20 years indicate that, in excess, productive expenditures can become unproductive. Recent studies by Marjit *et al.* (2020) analyzed the composition of public expenditures and the impact they bring to the leading states of India. In the analyzed period, the expenses with revenues increased in India and the states, signaling that the government started spending more in less productive or unproductive areas.

The results showed that revenue expenditures harm per capita income, while capital expenditures positively affect growth. It is also worth noting that private capital on per capita income strongly impacted positively. Public spending proved positive on per capita income, infrastructure, the share of the service sector in the state's net domestic product, and productivity in agriculture. Laboure and Taugourdeau (2018) investigated 147 countries of different income levels between 1970 and 2008. The study finds that public spending on education should be the focus at any income level (low, medium, and high). Education, health, and defense significantly and positively correlate with low-income countries' economic growth. However, the positive effects of education are much more significant than spending on health and defense. In high-income countries, these expenditures are all unproductive. Population growth has a significant positive impact on the economic growth of all countries. For Všetičková (2017, p. 2), "The role of government is to provide goods and services, guarantee security, the rule of law and redistribute income. One of its long-term goals is to promote the country's economic growth." The author presents public spending as an instrument to

achieve this objective. Economic growth through public spending occurs when public finances flow into productive areas, so their composition is fundamental. Among the few Brazilian works that exist are the works of Degenhart *et al.* (2016), Firme and Filho (2014), and Bogoni *et al.* (2011). Degenhart *et al.* (2016) investigated the influence of public spending on the economic growth of municipalities in the Southeast Region of Brazil, analyzing mainly the sectors of social assistance, health, education, and culture for 2010. The research was descriptive with a quantitative and cut-off approach cross-sectional. The mathematical model chosen was multivariate non-linear regression. The mathematical model inferred that public spending boosted municipal and state GDP, suggesting that public spending positively influences regional economic growth. Furthermore, Bogoni *et al.* (2011) investigated the relationship between economic growth and public spending variables in the largest cities in the southern region of Brazil. The research used descriptive research with a quantitative approach and a cross-sectional. The mathematical model chosen was the non-linear multivariable. The objective was to estimate the GDP values of the cities and compare them with the absolute values. The conclusion pointed out that local government spending plays a vital role in economic growth.

MATERIALS AND METHODS

The variables used in work refer to public expenditures and the gross domestic product (GDP) of the 295 municipalities of Santa Catarina. The municipal expenditures and expenses paid data were obtained from the National Treasury Secretariat. The Gross Domestic Product is from the Brazilian Institute of Geography and Statistics (IBGE). The data series refers to the period from 2013 to 2018. The estimators used to calculate the $\beta's$ related to the reference model presented below, refer to the panel data method. Furthermore, the ordinary least squares method was used for comparison purposes. The choice of panel data estimation method, related to fixed and random effect estimators, was performed using the Hausman test. Furthermore, the reference model was log-linearized, and the variables were standardized. The panel for the application of the reference model is unbalanced because some municipalities did not present data in the years 2013, 2014, and 2018. Devarajan *et al.* (1996), Bogoni *et al.* (2011), and Firm and Son (2014) were the reference model used in the study presented below.

$$Y_{it} = \beta_{it} Leg_{it}{}^{\beta_1} Adm_{it}{}^{\beta_2} AS_{it}{}^{\beta_3} Sau_{it}{}^{\beta_4} Educ_{it}{}^{\beta_5} Urb_{it}{}^{\beta_6} Agri_{it}{}^{\beta_7} Esp_{it}{}^{\beta_8} EnEsp_{it}{}^{\beta_9} e^{\beta_{10} \sum R_i \sum S_i} \omega_{it} \quad (1)$$

Where: Y_{it} is the Gross Domestic Product of municipality i at a determined time t; Leg_{it} represents the Legislative Expenses of municipality i at time t; Adm_{it} are the expenses related to the Public Administration of municipality i at time t; AS_{it} represents the Social Assistance Expenses of municipality i at time t; Sau_{it} are the Health Expenses of municipality i at time t; $Educ_{it}$ represents the value of Education Expenses of municipality i at time t; Urb_{it} refers to Urban Planning Expenses of municipality i at time t; $Agri_{it}$ are the Agricultural Expenses incurred by municipality i at time t; Esp_{it} are Sports Expenses; $EnEsp_{it}$ represents Special Charge Expenses[1]; $\sum R_i \sum S_i$ are the dummies representing the six meso regions of the state of Santa Catarina $(\sum_{i=1}^{n=6} R_i)$ and the 10 sectors of the economy of Santa Catarina, $(\sum_{i=1}^{n=10} S_i)$, according to the classification of the National Classification of Economic Activities (CNAE) with 6 digits; $\beta's$ are the parameters to be estimated; and, finally, ω_{it} refers to the stochastic error term.

RESULTS AND DISCUSSION

Descriptive statistics, referring to the participation of each variable in total expenses, are presented in Table 01 It is noteworthy that the

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[1]Among the budgetary sub-functions of the Special Charges are refinancing internal and external debt, domestic and foreign debt service; other transfers; other special charges; and transfers to primary education.

Table 01. Share of total expenses for all municipalities between 2013 and 2018

Variable	Observation	Average	Standard Deviation	Minimum	Maximum
Legislative	1,709	3.66	1.13	0.26	15.28
Administrative	1,721	12.18	3.77	0.04	35.32
Public security	1,491	0.66	0.74	0.001	7.77
Social assistance	1,724	3.83	1.49	0.16	12.18
Health	1,724	23.25	3.71	14.09	41.36
Education	1,724	26.89	5.41	13.01	44.56
Culture	1,635	0.78	0.80	0.00007	11.91
Urbanism	1,684	7.87	5.12	0.003	28.53
Agriculture	1,696	4.61	3.34	0.004	20.50
Sports	1,695	1.21	0.87	0.003	9.38
Special Charges	1,541	3.06	1.78	0.0002	12.72

Source: Brazilian National Treasury Secretariat and adapted by the authors

Table 02. Total and per capita expenditures in Santa Catarina

Variable	Observation	Average	Standard Deviation	Minimum	Maximum
Total Expenses	295	682.00.000	168.000.000	9.964.719	1.530.000.000
Total Expenses per capita	295	3590,939	1338,527	1681,993	8533,3

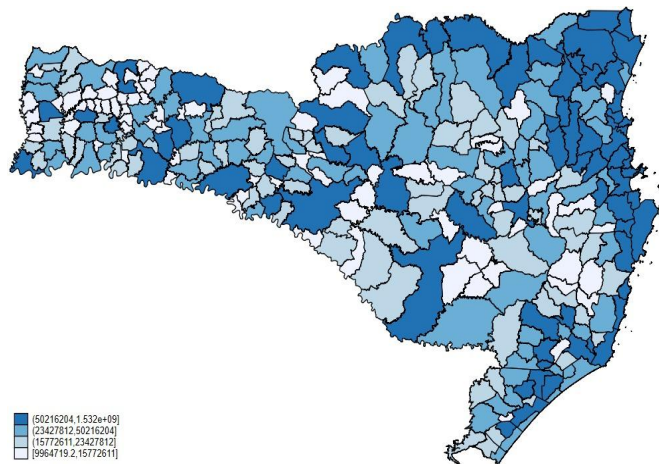Source: Brazilian National Treasury Secretariat and adapted by the authors

Table 03. Results OLS Panel Date Reference and Complete

	(1) GDP	(2) GDP	(3) GDP	(4) GDP
Legislative	0.117*** (0.034)	0.148*** (0.037)	0.116*** (0.034)	0.148*** (0.037)
Administrative	0.035 (0.031)	0.008 (0.034)	0.037 (0.031)	0.008 (0.034)
Social Assistance	0.005 (0.031)	0.007 (0.034)	0.009 (0.031)	0.007 (0.034)
Health	0.330*** (0.046)	0.316*** (0.052)	0.329*** (0.047)	0.316*** (0.052)
Education	0.200*** (0.042)	0.190*** (0.048)	0.201*** (0.043)	0.189*** (0.048)
Urbanism	0.009 (0.022)	0.018 (0.024)	0.009 (0.022)	0.018 (0.024)
Agriculture	-0.007 (0.022)	0.008 (0.024)	-0.005 (0.022)	0.008 (0.024)
Special Charges	0.077*** (0.020)	0.078*** (0.022)	0.078*** (0.020)	0.078*** (0.022)
Public security		0.003 (0.025)		0.003 (0.025)
Culture		0.017 (0.023)		0.017 (0.023)
Sports		-0.033 (0.023)		-0.033 (0.023)
_cons			0.004 (0.01)	-0.003 (0.020)
N	1472	1225	1458	1225
R-sq	0.430	0.424		
adj. R-sq	0.427	0.419		
AIC	3077.313	2565.328	.	.
BIC	3119.668	2621.546	.	.
F	138.246	81.206		
Hausman			0.7066	0.7143
R-Sq				
within			0.4231	0.4248
between			0.6446	0.4840
overall			0.4254	0.4238

Source: Brazilian National Treasury Secretariat and adapted by the authors Standard error in parentheses, * 10% significance, ** 5% significance, *** 1% significance

most significant expenditures are in the areas of Education, around 27%, Health, around 23%, and Administrative expenses, around 12%. On the other hand, the smallest share of total expenditure refers to expenditures, with Public Security and Culture, with 0.66% and 0.78%, respectively. Table 02 shows expenditures in nominal and per capita terms for 2017. Regarding nominal expenditures, the only municipalities in the state that spent more than one billion were Florianópolis, with R$ 1.5 billion, Joinville with R$ $1.4 billion, and Blumenau, with R$1.2 billion. The municipality with the lowest nominal expenditures was São Miguel da Boa Vista, with almost R$ 10 million. Figure 01 shows the map related to the expenses paid for each of the municipalities of Santa Catarina. The municipality with the highest value of expenses per inhabitant was Santiago do Sul, with about R$ 8,533. The second largest refers to the municipality of Lajeado Grande, with approximate values of R$ 7,968. The municipality with the lowest value per inhabitant was Caçador, with R$ 1,681. Table 03 shows four different models, the first two estimated by ordinary least squares methods and the last two estimated from panel data. Model 3 refers to the reference model without including dummies related to regions and economic sectors. The odd models refer to the most parsimonious results, including expenses with a share above one percent of total expenses.

On the other hand, the pair models include all the variables related to the expenses used in the proposed analysis. A variation of 1 percent in the standard deviation of health expenditures, increases GDP's standard deviation by approximately 0.329 percent, as shown in model 3. Table 04 shows the results of the reference model, model 1, estimated from panel data, including region dummies, model 2, and dummies related to sectors, model 3. When the models include region dummies, it is possible to observe statistical insignificance, suggesting that location does not seem to be a determining factor in explaining the differences in the GDP of municipalities in the state of Santa Catarina. It is worth noting that the Itajaí Valley region was considered a reference. On the other hand, the dummies related to the sectors are significant, except for livestock, suggesting that the productive structure matters to explain the difference in the GDP of the municipalities over time. The results showed that municipal public spending on health is the one that brings the most return through economic growth, in agreement with the results of the works by Kneller *et al*. (1999), Weil (2014), Bhargava *et al*. (2001), Bloom *et al*. (2004), Bloom and Canning (2005), Neduziak and Correia (2017), Agénor (2010), Alderman *et al*. (2003), Kahn (2005), Maitra and Mukhopadhyay (2012) and Laboure and Taugourdeau (2018).

Source: Brazilian National Treasury Secretariat and adapted by the authors

Figure 1. Expenses effectively paid by the municipalities of Santa Catarina for 2017
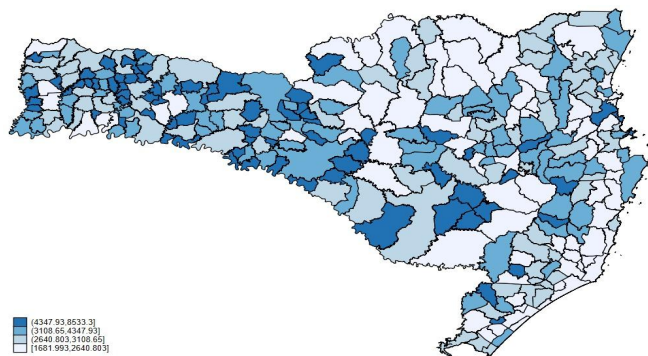
Source: Brazilian National Treasury Secretariat and adapted by the authors

Figure 2. Expenses per inhabitant of Santa Catarina municipalities in 2017

For Acosta-Ormaechea and Morozumi (2013), expenditure is productive but not significant in the long term. The opposite is explained in work by Akram *et al.* (2008), which considers health expenditures insignificant in the short term and effective in the long term. It is also worth noting that spending on health brings returns in education through the increase of healthy days in society. In the case of education, spending in the area is the second most positive for economic growth. When compared with the literature, there is a specific division, Kneller *et al.* (1999); Barro (1991); Lucas Jr. (1988); Kahn (2005); Maitra and Mukhopadhyay (2012); Acosta-Ormaechea and Morozumi (2013) presented corroborating results. There are also works by Fan *et al.* (2002) and Labore and Taugourdeau (2018), who consider public spending on education to be the most productive. In contrast, studies by Basu and Bhattarai (1999) point to a weak relationship between education and economic growth. The work of Kormendi and Meguire (1985), Grier and Tullock (1989), and Summers and Heston (1988) classified education spending as unproductive. Easterly and Rebelo (1993) stated that the relationship between investment in education and economic growth is not robust. The Legislative and Special Charges areas were also significant. However, the literature did not consider expenditures with the Legislature as significant. The same happened with Special Charges, the literature does not talk about this expense, but it is observable that among the items that compose it are transfers to primary education, and education proved to be significant in the models. Other expenditures proved unproductive, and, as a result, no further allocations to these areas are justified.

CONCLUSION

The study aimed to verify a relationship between municipal public spending in Santa Catarina and economic growth. The results prove the hypothesis through spending on health, education, legislation, and special charges, proving to be significant. The work points out that the municipality's region does not influence its economic growth. This lack of impact is because the values vary very little between regions. The dummy of reference is the Vale region. In the sectors, public administration spending stands out negatively. The livestock sector proved to be unproductive. It highlighted the expenses of the transformation and extractive industry as the most influential sectors. Various trade and services also stood out. Forest production was the reference dummy. It concludes that the public expenditures of Santa Catarina would bring the greatest return to the population of Santa Catarina, exposing the sectors and areas where the money invested would strongly influence GDP growth. This study is a pioneer in developing a methodology for Santa Catarina and surveying previous works. It is possible to use this study as a reference for the other Brazilian states. However, the results may be biased related to the problem of endogeny. As a suggestion, future works expand the research methodology using instrumental variables or applying dynamic panel data models.

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