

Ferreira, Jorge; Alves, Alexandre; Caldeira, Emilie

**Conference Paper**

## Elections and externalities of health expenditures: Spatial patterns and opportunism in the local budget allocation

56th Congress of the European Regional Science Association: "Cities & Regions: Smart, Sustainable, Inclusive?", 23-26 August 2016, Vienna, Austria

**Provided in Cooperation with:**

European Regional Science Association (ERSA)

*Suggested Citation:* Ferreira, Jorge; Alves, Alexandre; Caldeira, Emilie (2016) : Elections and externalities of health expenditures: Spatial patterns and opportunism in the local budget allocation, 56th Congress of the European Regional Science Association: "Cities & Regions: Smart, Sustainable, Inclusive?", 23-26 August 2016, Vienna, Austria, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/174694>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# **Elections and Externalities of Health Expenditures: Spatial Patterns and Opportunism in the Local Budget Allocation**

## **Abstract:**

We examine the determinants of local public health expenditure in a decentralized health system. We take into account the electoral calendar and the effect of central elections and local elections, besides spatial interaction among municipalities. We state that the expenditure in public health at the local level is positively influenced by vicinity and by elections years. Using data from 399 Brazilian municipalities from Paraná's State from 2005 to 2012, we found evidence of electoral impacts on the allocation of public health spent. Our empirical contribution lies in three issues: first, we demonstrate a positive spatial effect in the public health expenditure. Second, the estimations show that election-year public spent shifts, as a response for vote-seeking incumbents' behavior, and population density inverts its influence in the level of spent. Thirdly, central and local elections impact in different ways the local health spent, and demographic issues (aged and young population) are the main channels to this increase in expenditure.

**Keywords:** Health expenditure. Local Expenditures. Elections. Spatial econometrics.

**JEL Classification:** H72. H75. I18. C31. C33.

## **1. INTRODUCTION**

In recent decades, the literature on fiscal federalism has improved our understanding of the relationship among governments, both in the same layer or between different government tiers. Many of these studies emphasize the issue of externalities in decentralized governmental layers, when jurisdictions may choose the level of expenditure as well as taxation or regulation and this choice may (positively or negatively) affect the fiscal choices of other governments. Although this effect may induce lower efficiency in public expenditures (Akin, Hutchinson, & Strumpf, 2005), decentralization is usually prescribed as a powerful tool to provide citizens with more accountability about governments (Costa-Font & Moscone, 2008), even if centralization offers equality to unequal jurisdictions in terms of preferences or spillovers (Besley & Coate, 2003). One of the main channels for accountability is the emulation induced in same-level jurisdictions, in a yardstick competition (Besley & Case, 1995) or in a modified model of yardstick from the top (Caldeira, 2012).

The literature provides a taxonomy for the relationship among governments, naming vertical externalities in the interactions of two or more different government tiers and horizontal externalities if they involve the same layer of government. According to Foucault, Madies, & Paty (2008), most of the recent studies focus on horizontal externalities, implying mobility of taxpayers and information asymmetries between voters and incumbents (since those incumbents, politicians, usually do not behave cooperatively). By competing in taxation, the fiscal games that result from this interaction usually imply inefficient taxation. Moreover, this competition may

occur in public goods too. When a local government provides more public services (especially public goods that non-residents may absorb), it may result in their neighborhood jurisdictions benefiting from those services and/or competition in the level of public goods supply to maintain their citizens and enterprises' tax bases. This is the case of health services. Bigger cities attract a part of the demand for health services from their neighbor municipalities and simultaneously may raise the local level of health expenditures. However, even if in the short run, decentralization increases local health expenditures, there is evidence of expenditure cuts and strong spatial interactions of spending on public health in the long run (Costa-Font & Moscone, 2008). The institutional differences are important to explain the spatial effect in health expenditure; even if sharing borders, the spatial interactions may be lower if the institutional cluster of two regions differs and the within effect is stronger than the between effect (Atella, Belotti, Depalo, & Mortari, 2014).

On the other hand, a vote-seeking orientation usually provides incentives for the political agent's attempt to obtain desirable economic effects (even if not necessarily sustainable) in periods close to elections to reap electoral gains from such strategy (Rogoff, 1990; Ferreira & Bugarin, 2007; Drazen & Eslava, 2010). This effect is enlarged because voters usually make their choices according to the incumbents' retrospective evaluation and the prospective selection between the incumbent and his opponents (Crisp, Olivella, Potter, & Mishler, 2014). Nordhaus (1975) has explained this kind of incumbent behavior, which he called political business cycle.

One of those opportunistic behaviors manifests in an increase in expenditures in areas that are more visible and may seduce voters (Sakurai & Menezes-Filho, 2008; Drazen & Eslava, 2010), to re-elect the local incumbents and/or to elect the candidates supported by them both in other levels (deputies, governors, president) or in the same level (their successors). Because of this electoral bias, efficiency criteria play a limited role in the geographical distribution of investment and regional demands, leaving political factors with strong explanatory power (Castells & Solé-Ollé, 2005).

We investigate the spatial spillover effect on local public health expenditures in electoral and non-electoral years. Many scholars have found spatial positive or negative effects on the local level of public health expenditures (Moscone, Knapp, & Tosetti, 2007; Baltagi & Moscone, 2010; Videira & Mattos, 2011; Atella et al., 2014). However, the effects of an electoral calendar are not clear in these studies. Using data on public health expenditures in 399

municipalities of Paraná,<sup>1</sup> from 2005 to 2012, we examine if there is an electoral effect and a spatial pattern in this expenditure.

Among the main empirical investigations in health economics in Brazil, many of them focused on public health issues. Although they have discussed public policies (Andrade et al., 2015; Ferreira, Magalhães, Corrêa, Rodrigues, & Viegas, 2014; Andrade, Chein, Souza, & Puig-Junoy, 2012; Cherchiglia et al., 2010), they do not address issues of spatial interaction. However, by using exploratory spatial data analysis, Rodrigues, Amaral, & Simões (2007) found that Brazilian public health network is superposed and poorly distributed among regions.

To answer our question about the spatial spillover effect and about electoral issues in the allocation of public health spending, we first estimate the hypothesis of spatial autocorrelation in the allocation of public health expenditure at the local level, taking the electoral calendar as a determinant of public spending in municipalities. As elections have a significant effect on public spending, we separately treat electoral and non-electoral years (differentiating between central and local elections), to check for spatial effects.

We structure this study as follows. The next section provides a brief overview of the literature on spatial interactions in health spending. Section 4.3 presents our general model and its implications. We also present and discuss the results of our estimations. Section 4.5 concludes the paper.

## **2. SPATIAL INTERACTIONS IN PUBLIC HEALTH SPENDITURE**

The models that hypothesize spatial interactions basically state that the behavioral features of a group affects each individual's choice (Manski, 1993). One of the main assumptions in these models is that the proximity may help understand the nature and intensity of interactions between two individuals in an application of the first Tobler's Law<sup>2</sup> (Almeida, 2012). Owing to this interaction, collective behavior or an aggregate pattern may emerge and produce a significant spatial correlation for the empirical data (Anselin, 2010).

Many scholars offer theoretical propositions and empirical evidence about neighborhood effects on the local level of public expenditure (Besley & Case, 1995; Bivand & Szymanski, 1997; Baicker, 2005; Costa-Font & Moscone, 2008; Baltagi & Moscone, 2010; Yu,

---

<sup>1</sup> Paraná State is one of 27 Brazilian regional jurisdictions. We chose this sample because of data availability and lack of municipality splitting in the period studied.

<sup>2</sup> The first Tobler's Law (also known as the first Law of Geography) posits that everything is related to everything else, but near things are more related to each other (Tobler, 1979).

Zhang, Li, & Zheng, 2013; Costa, Veiga, & Portela, 2015). Usually, the literature on spatial fiscal competition refers to three channels to explain how local governments interact fiscally: yardstick competition, expenditure externalities, and fiscal competition (Granado, Martinez-vazquez, & Simatupang, 2008).

The formal yardstick competition relies on the assumption that voters do not have perfect information about the ideal level of public services that a government should offer and compare expenditures and taxes in neighboring jurisdictions (Besley & Case, 1995). By comparing the local government's performance (measured by job opportunities, public health services, educational facilities, taxation level, etc.) the voter may move to another jurisdiction, in a process called *voting with their feet* (Tiebout, 1956). However, in Brazil, when a voter moves to another jurisdiction, he may keep his original electoral domicile, and this may smooth the yardstick competition effect.

The tax competition mechanism's main idea is that local governments compete with neighboring jurisdictions for increasing the tax base. The main theoretical issues can be found in Wilson (1999). The hypothesis of tax competition are related to two points: the legal framework of taxation and the intensity of tax base mobility and arbitrage across jurisdictions (Genschel & Schwarz, 2011). In Brazil, less than 5% of the tax burden, on average, is in the local layer,<sup>3</sup> but several metropolitan areas show that both citizens and firms choose to move to neighboring municipalities following tax competition.

The expenditure externalities hypothesis posits that provision of public goods (health, education facilities, public transportation, infrastructure, housing) in one jurisdiction may affect its neighbors. The literature provides empirical evidence of both positive and negative effects in spatial interactions of local health expenditures. Yu et al. (2013) found that Chinese provincial governments decrease their own health spending when their neighboring provinces increase theirs, but this result is affected by low citizen mobility (Caldeira, 2012). On the other hand, Moscone, Knapp, & Tosetti (2007) found positive spatial effects in specific health expenditures even with alternative contiguity spatial matrices (by population, population density, and political party). Although the cooperation effects at the municipal level may be not significant at the level of public spending, the benefit spillovers are strong, even for municipalities outside inter-

---

<sup>3</sup> According to Brazilian National Treasury (2015), since 2000, the Federal Government has the main share in tax burden (69.2% on average), regional governments have 26.1% and the municipalities have only 4.7% of the public revenues sourced by taxes.

municipal communities (Frère, Leprince, & Paty, 2014) and incumbents may behave opportunistically, increasing public expenditures in pre-electoral periods (Foucault et al., 2008).

Another taxonomy suggested in the literature explains economic interaction by using a triple categorization: endogenous, exogenous, and correlated effects (Manski, 1993; Brock & Durlauf, 2001). The neighbors' influence determines endogenous effects, which means that individual behavior is to some degree the result of other group members' influence. The exogenous effects are an issue of belongings as a feature or attribute of the individuals that belong to the group. The correlated effect hypothesis posits that neighbors behave similarly because their opportunities, trends, features, and constraints are quite similar (Moscone et al., 2007).

It is reasonable to believe that those three categories of interactions may occur in local public health expenditures. Moscone & Knapp (2005) identify some drivers of those spatial interactions: a key actor may influence his pairs by his good (bad) performance, resulting in a mimicking (endogenous) effect; some municipalities may share an (exogenous) resource, e.g., a regional hospital; an entire group may have to observe specific laws (Brazil) or attend to upper-tier authority policies (exogenous factor). Some feature that is common to part of a group (a river, political alignment, or an airport) may generate common opportunities, challenges, or threats (correlated effects).

In general, both approaches (the yardstick, externalities, and tax competition approach and the endogenous, exogenous, and correlated view) suggest that interactions among neighboring jurisdictions may influence individual choices in terms of the overall budget allocation and level of public health expenditures.

In the next section, we describe the empirical model developed in this study before moving on to a discussion of the results.

### 3. THE GENERAL EMPIRICAL MODEL

We use a simple model in which public health is treated as a local public good with spillovers (Levaggi, 2010), in keeping with the decentralization of a public good's provision in fiscal federalism (Besley & Coate, 2003). We represent the citizen  $c$  utility function by:

$$U_c = u(h_c, (1 - k)f(z_i) + kf(z_j)), \quad 0 < k < \frac{1}{2} \quad (1)$$

Where  $h_c$  is the demand for the public health good,  $z_i$  is the provision of this public good in  $i$ ,  $z_j$  is the provision in  $j$ , and  $k$  is the spillover parameter. Depending on the extent to

which  $k \rightarrow \frac{1}{2}$ , the public good's spillover increases. The reason for  $k < \frac{1}{2}$  is that residents prefer to consume more public goods in their jurisdiction than those outside (Solé-Ollé, 2006).

**Proposition 3.a:** *Policymakers increase health spending in electoral years (both in central as well as in local elections), to influence voters.*

The local government has a budget funded by taxpayers (the citizens) to allocate to local expenditures. It tries to maximize both citizen's goodwill and political capital, based on the electoral perspectives. Political capital is key to the voter's decision in the elections. Thus, local governments will have incentives both to reduce expenses that may be supported by their neighboring municipalities and to provide more money for visible expenditures (especially in election years), which are directly absorbable by voters. In a budget model developed from Dembour & Wauthy (2009), the incumbent's budget in region  $i$  is given by

$$B_i = t_i C_i - [s_i C_i + k l_i s_i C_j] + [k l_j s_j C_i] \quad (2)$$

where the budget is the result of tax revenues from citizens ( $t_i C_i$ ), the public goods spending ( $s_i$ ) on his citizens and neighboring citizens ( $C_i, C_j$ ), and the spending on his citizens by neighboring jurisdictions ( $s_j C_i$ ), according to the level  $l$  of public goods provided by the jurisdictions. Higher levels of  $l$  in neighbors reduce the spending in a community. Although, with political capital being important in the elections and  $k < \frac{1}{2}$ , the incumbent tries to raise  $l$  to enhance his electoral chances of winning. However, two undesirable effects result when he does that: he attracts more neighbors (that will share the budget but are not voters in the incumbent's municipality) and simultaneously reduces the neighboring incumbent's political capital.

**Proposition 3.b:** *Policymakers respond positively to changes in the level of health spending in neighboring jurisdictions, by increasing expenditures on local public health.*

Even if raising expenditures on health brings undesirable effects, the local incumbents know that they will be evaluated and compared against politicians' decisions in time and space. Equation 3 captures the sense of this perception.

$$l_{i t} = \delta l_{i, t-1} + \gamma l_{j t} \quad (3)$$

The voter considers two issues when it comes to the level of public goods; he compares the historical level in his jurisdiction with the current level in neighboring jurisdictions.

Given this spatial relation and the incumbent's political orientation, the general equation given below explains the budget allocation for providing public health goods:

$$H = \alpha + \rho W_1 H + \beta_1 Elec + \beta_n X + \xi, \quad \xi = \lambda W_2 + \xi \quad (4).$$

where the allocation in health is related to neighboring allocations, electoral calendar, current  $X_t$  variables (demographic issues, income, urbanization, and so on), and a spatial error distribution.

## 4. ESTIMATION RESULTS AND DISCUSSION

### 4.1. ESTIMATION RESULTS

We performed estimations under six different models. We built the models according to the general equation,

$$Y_{it} = \alpha_i + \rho W Y_{it} + \beta_1 Elec_{it} + \beta_2 HFac_{it} + \beta_3 Loc_{it} + \beta_4 Dem_{it} + \xi_{it} \quad (5)$$

$$\xi = \lambda W \xi_{it} + \varepsilon_{it}$$

In the equation above,  $Y_{it}$  is the natural logarithm of the real per-capita municipal expenditure. According to the Hausman test, we use a fixed effects model, where the variable  $\alpha_i$  represents the local heterogeneity. The second term on the right-hand side is the spatial lagged dependent variable, subject to the spatial matrix  $W$ . The third group of variables ( $Elec_{it}$ ) is dummies for election years, and they control both for the occurrence of elections as well as for the election type: local elections (to choose mayors and municipal council) and central elections (voting for executive and legislative seats at the federal as well as the regional level).

In the fourth term,  $HFac_{it}$ , we control for the public provision of health goods by adapting the model proposed by Atella, Belotti, Depalo, & Piano Mortari (2014), using two variables as a proxy of healthcare infrastructure and facilities. The first is the number of public health facilities per thousand inhabitants provided by regional governments. Considering that the Paraná state drives public health policies by sub regions, we clustered data according to regional health facilities. The second variable we used was the local health infrastructure; by using factorial analysis, we built a factor for local public health, based on human resources, equipment and installations by municipality<sup>4</sup>.

Additionally, in the term  $Loc_{it}$  we control for local features such as population density (following Baicker, 2005) and per capita FPM.<sup>5</sup> In the last set of controls ( $Dem_{it}$ ), we gather

---

<sup>4</sup> The factor we generated provide the following values for statistical tests: determinant of correlation matrix of 0.568; Bartlett test of sphericity with  $\chi^2$  of 1801.889 and p-value of 0.000 and Kaiser-Meyer-Olkin measure of sample adequacy (KMO) of 0.684.

<sup>5</sup> FPM, or Municipalities Participation Fund, is a *per capita* federal transfer to Brazilian municipalities.



demographic data usually mentioned in the literature (Baltagi & Moscone, 2010) as having a role in determining healthcare expenditure: the dependency rates for old and young inhabitants<sup>6</sup> and the proportion of women and of rural people, related to total population. We changed all variables into natural logarithm, except the dummies. This log–log form allows us to interpret the coefficients as elasticities. Table 1 describes the variables for each category listed above, as well as the expected effect for them.

**Table 1 - Determinants of per capita public health spent in local level.**

Category	Variable	Type	Description	Expected Effect	
Elec	Elections' Years	Elec	Dummy	Elections performed in $Year_t$ (both local or central)	Positive
		L_elec	Dummy	Local elections performed in $Year_t$	Positive
		C_elec	Dummy	Central elections performed in $Year_t$	Positive
HFac	Health Facilities	L_infra	Log	Public health infrastructure provided by the local government	Positive
		R_facil	Log	Public health facilities provided by the regional government	Negative
Loc	Local features	DPop	Log	Municipal population density in $Year_t$	Negative
		FPM	Log	FPM per capita in $Year_t$	Positive
Dem	Demo-graphic controls	Old	Log	Dependency rate for population over 60 years old.	Positive
		Young	Log	Dependency rate for population below 15 years old.	Negative
		Fem	Log	Proportion of women in the total population	Positive
		Rur	Log	Proportion of rural inhabitants in the total population	Positive

*Source:* the author.

*Notes:* Details about features of all variables are available under demand.

Our Models 1 and 2 consider the electoral calendar as explanatory variables for per capita local spending on public health during the entire period of eight years. In the first model, we consider just the occurrence of elections and in the second, we differentiate between local and central elections. In Model 3, we do not consider all the years, but only those four years were elections did not happen. On the contrary, in Model 4, we consider exclusively the four election' years. Models 5 and 6 were split from Model 4 and they consider, by each turn, two periods: only central elections (Model 5) or only local election years (Model 6). We chose to estimate various spatial models instead of only one to avoid the incidental parameter problem<sup>7</sup> and reduce the

---

From 2005 to 2012, it represented 39.7% of the entire municipalities' budget revenues, according to National Treasury data. Its rules favor smaller municipalities (whose fiscal power is low), working as a proxy for equity policies.

<sup>6</sup> We define dependency rates for old and young people as the population of interest (aged over 60 and below 15) divided by the population aged 15–60 years.

<sup>7</sup> For short panels, where  $T$  is fixed and  $N \rightarrow \infty$ , it is not possible to estimate consistently the coefficients of the spatial fixed effects, because each  $n$  must have a dummy. There are several ways to overcome this limitation, and usually this problem does not matter when the coefficients of interest are  $\beta$  instead of the spatial fixed effects (Elhorst, 2003).

estimation time. We conduct all econometric analyses using Stata and GeoDa. Before the estimations with spatial techniques, we perform statistical tests to better fit the panel estimation (Breusch–Pagan, Hausman and Modified Wald Tests). The results of these tests (available in the appendix) suggest the most suitable estimation method is to use the fixed effects panel.

For the spatial estimation we use the adapted specific-to-general approach (Elhorst, 2010): first, we estimate the plain panel model (with no spatial treatment and according to the statistical test results mentioned above) and test for spatial correlation in the residuals by measuring Moran's I and Geary's C (Anselin, 1988). In all six models, those indexes were significant. Then we use spatial lag (SAR) and spatial error models (SEM) for all years in the range and separately for electoral and non-electoral years, comparing the Akaike and Schwarz criteria and adopting the most suitable. For central and local election estimations, we use the same model as for election years (because the data is available for only two years for both local and central elections and a four-year lagged variable would not be representative enough).

To select the best spatial weight matrix, we follow Almeida (2012). We test several matrices (queen, rook, distance, inverted distance, binary distance, and binary inverted distance).<sup>8</sup> The matrix that provided the bigger Moran's I and the further from 1 Geary's C for the residuals (in the fixed effects panel regression, without spatial instruments) was the binary distance<sup>9</sup> (binary means that we limit the municipalities considered neighbors to those that distance  $x$  or less kilometers ( $W^x$ ), with  $x = 41$ ). Then we perform the estimations with this matrix (adapted according to the size of  $T$  in each model).

We also cluster the data in the estimations (as done in Frère et al., 2014), according to the distribution of regional facilities in the entire period and considering the occurrence of regionalization in public health services. Figure 1 shows the distribution of those structures in 2005 and 2012. We see that the health facilities saw no significant changes in the state from the first to the last year in the data. Moreover, even if the facilities' amount or location changes

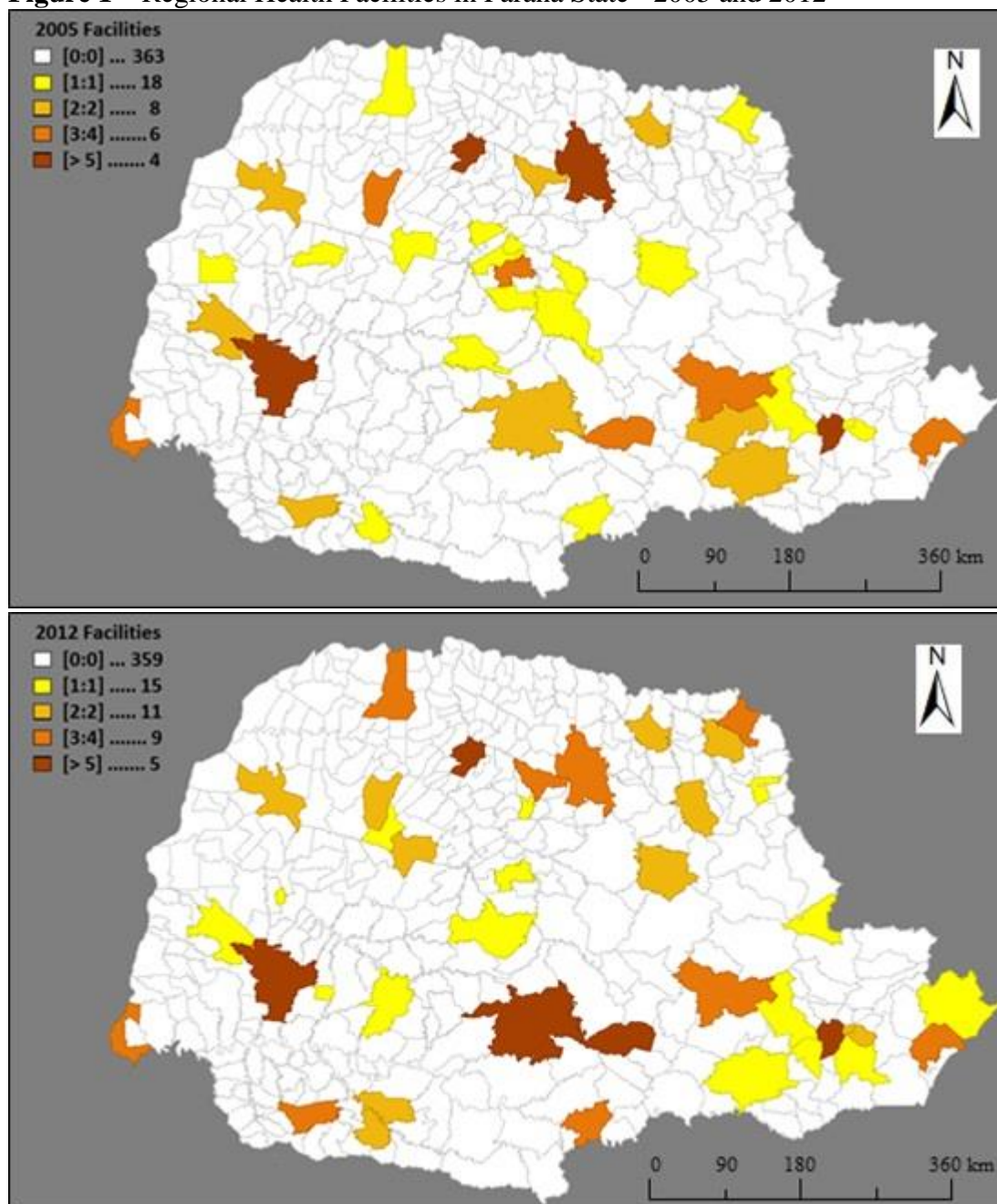
---

<sup>8</sup> For distance-based matrices, we test three distance specifications: 41 kilometers (the greatest distance between two observations), 100 kilometers (as a placebo matrix, i.e., a matrix that includes a high level of spatial autocorrelation), and 50 kilometers, that is the generally used limit in empirical literature on spillovers between local governments (Costa et al., 2015).

<sup>9</sup> When testing the residual's spatial autocorrelation (after panel regression), we find high levels of Moran's I and Geary's C, are both significant at a 1% level in most cases. We list the statistics for these two spatial correlation indicators in Table 2, recalling that those coefficients were obtained before spatial correction.

slightly, the spatial distribution suggests that the policy of regionalization in public health facilities does not appear to have been replaced by other policies.

**Figure 1** – Regional Health Facilities in Paraná State - 2005 and 2012



Notes: Mapped with Geoda software.

Based on panel estimation outputs, the spatial error regression model (SEM) is the most appropriate way to describe the data for all six models. We represent this in the equation below, by excluding the rho in (5) and changing the meaning of  $t$ .

$$Y_{it} = \alpha_i + \beta_1 Elec_{it} + \beta_2 HFac_{it} + \beta_3 Loc_{it} + \beta_4 Dem_{it} + \xi_{it}, \quad \xi = \lambda W \xi_{it} + \varepsilon_{it} \quad (6)$$

$$t = \begin{cases} \text{election year} \\ \text{non - election year} \\ \text{central election year} \\ \text{local election year} \end{cases}$$

Table 2 present estimations outputs for all six models, as well as the tests coefficients for spatial correlation (Moran's I and Geary's C values, significance level and standard deviation without spatial correction).

## 4.2. DISCUSSION

The first question has to be whether there is a spatial pattern in the allocation of public health spending. The spatial indicators Moran's I and Geary's C suggest that there exists both global as well as local spatial autocorrelation, and the estimations should consider spatial effects. Moreover, Geary's C values lower than 1 (ranging from 0.570 to 0.765) suggest that the spatial effect is positive. The estimated lambda confirms that the spatial effect is positive at a 1% significance level. All models show the same coefficient for the lambda (0.099), suggesting that the spatial correlation in the errors affects both electoral and non-electoral year's expenditures, in central and local elections. In other words, we found a positive spillover effect in public health spending at the local level. A similar spatial pattern was also found in Moscone et al. (2007), but it differs from the negative correlation reported by Akin et al. (2005).

Applying the taxonomy proposed by Manski (1993), a possible explanation for the contrast is the exogenous and the correlated effects. In the former case, the Brazilian Federal Constitution establishes a minimum spending level in health (as well as in education) for each government layer. The law seems to exert a normative power (when it comes to the level of expenditure in each municipality), and this role can be labeled as an exogenous pressure. We can explain the correlated effects by looking at the coefficient of the local health facilities' effect. The local health infrastructure increases the health spending level in all models. For the entire period, its effect is between 0.015 and 0.016 at 1% significance level, except for electoral years' models. In Model 5 (Central Elections Years), its effect is lower (0.007), but its significance remains at 1% level. On the other hand, in Model 6 (Local Elections Years) its importance increases to 0.032.

**Table 2** – Estimations outputs

	<b>Model (1)</b> <b>All Years</b>	<b>Model (2)</b> <b>Elections</b> <b>Type</b>	<b>Model (3)</b> <b>No Election</b> <b>Years</b>	<b>Model (4)</b> <b>Election</b> <b>Years</b>	<b>Model (5)</b> <b>Central</b> <b>Elections</b>	<b>Model (6)</b> <b>Local</b> <b>Elections</b>
<b>MAIN:</b>						
Fixed Effects	3.633	3.807	4.057	2.282	2.039	2.042
Elec	0.040 *** (0.001)					
L_elec		0.052 *** (0.002)				
C_elec		0.030 *** (0.001)				
Loc_health	0.016 *** (0.002)	0.015 *** (0.002)	0.015 *** (0.002)	0.016 *** (0.004)	0.007 *** (0.003)	0.032 *** (0.005)
Reg_health	-0.054 *** (0.013)	-0.053 *** (0.014)	-0.089 *** (0.021)	-0.032 *** (0.009)	-0.076 *** (0.017)	0.067 ** (0.031)
DPop	-0.163 *** (0.020)	-0.179 *** (0.020)	-0.295 *** (0.017)	0.403 *** (0.050)	0.491 *** (0.077)	0.611 *** (0.075)
FPM	0.442 *** (0.010)	0.426 *** (0.011)	0.443 *** (0.027)	0.421 *** (0.008)	0.492 *** (0.025)	0.293 *** (0.034)
Old	0.393 *** (0.030)	0.397 *** (0.031)	0.335 *** (0.018)	0.648 *** (0.061)	0.590 *** (0.099)	0.765 *** (0.090)
Young	-1.000 *** (0.038)	-0.989 *** (0.038)	-1.036 *** (0.035)	-0.879 *** (0.085)	-0.617 *** (0.028)	-1.033 *** (0.144)
fem	0.478 ** (0.214)	0.477 ** (0.213)	0.633 *** (0.200)	0.241 (0.210)	0.715 *** (0.167)	-0.359 ** (0.141)
rur	-0.018 ** (0.007)	-0.017 ** (0.007)	-0.015 (0.009)	-0.016 * (0.008)	-0.001 (0.013)	-0.007 (0.008)
<b>SPATIAL:</b>						
lambda	0.099 *** (0.000)	0.099 *** (0.000)	0.099 *** (0.000)	0.099 *** (0.000)	0.099 *** (0.000)	0.099 *** (0.000)
Moran's I	0.373 *** (-0.003)	0.374 *** (-0.003)	0.366 *** (-0.003)	0.330 *** (-0.003)	0.316 *** (-0.003)	0.313 *** (-0.003)
Geary's C	0.736 *** (-0.014)	0.736 *** (-0.014)	0.765 *** (-0.016)	0.570 *** (-0.013)	0.595 *** (-0.012)	0.646 *** (-0.022)
<b>VARIANCE:</b>						
sigma2_e	0.023 *** (0.000)	0.023 *** (0.000)	0.019 *** (0.000)	0.021 *** (0.000)	0.009 *** (0.000)	0.022 *** (0.001)
N	3192	3192	1596	1596	798	798
Groups	399	399	399	399	399	399
Panel Length	8	8	4	4	2	2
R-squared						
Within	0.584	0.583	0.616	0.569	0.683	0.482
Between	0.335	0.330	0.310	0.043	0.030	0.000
Overall	0.363	0.358	0.332	0.089	0.061	0.003

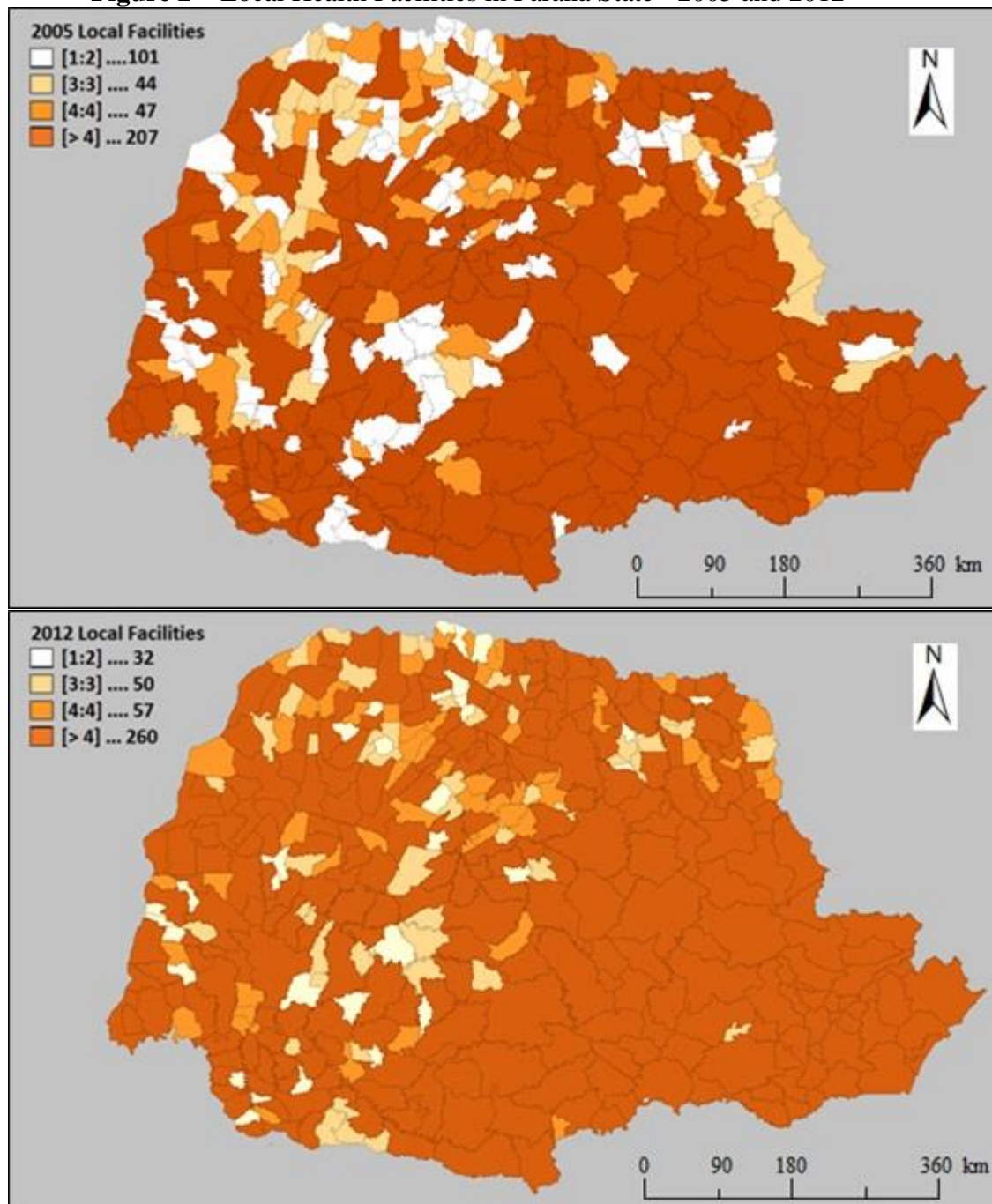
**Notes:** Estimations performed with Stata SE 12.0. All estimations include unit fixed effects. Standard errors in parentheses. Spatial correlation indicator Moran's I and Geary's C shows the spatial autocorrelation before spatial estimations. Significance levels: \* p<0.10, \*\* p<0.05, \*\*\* p<0.01.

Seemingly, incumbents use local health facilities as a channel to spend more in election years, mainly during local elections, and this constitutes a correlated effect.<sup>10</sup> Figure 2 shows that such facilities are widely spread in all municipalities (in the first year of our panel there

<sup>10</sup> The politicians use the anticipation effect as an *electoral tool* to intensify health spending, considering that they are visible enough to seduce voters.

was no municipalities without local health facilities and in 2012 only one of the 399 local jurisdictions had less than two local facilities for public health), and this feature explains the use of them as a tool to intensify budget allocations for health.

**Figure 2 – Local Health Facilities in Paraná State - 2005 and 2012**



**Notes:** Mapped with Geoda software.

The second issue to address is whether elections as a whole affect health expenditure. According to the estimations, we can say at a 1% significance level that elections increase local spending with a coefficient of 0.040. When we split this effect according to the election type

(local or central), we see that the former has a higher effect (0.052) than the latter (0.030),<sup>11</sup> which means that local elections affect almost twice the health expenditures at the municipal level.

As verified before in capital and current expenditures (Sakurai & Menezes-Filho, 2008) or in grants (Ferreira & Bugarin, 2007), elections are strong enough to change the allocation pattern in local governments. Health spending seems to have a politically motivated component, stronger in local elections (considering an incumbent's re-election and/or his goal of electing the supported successor), but still significant at the 1% level when it comes to coaxing voters to support his allies in central elections. The relevance of central elections for mayors is probably tied to grants access (remember that municipalities shoulder less than 5% of the Brazilian tax burden).

More than discussing if elections change the allocation of public resources, we should check how the electoral calendar exerts pressure on every variable in our models. In other words, a third important question to answer is how local and central elections indirectly affect the health budget allocation. Although we began an answer earlier, the most interesting revelation of the estimations is that the variables' effects differ, according to election type (local or central), especially in the coefficient's values for age variables and population density. Even if the revenue variable (FPM) coefficient does not change much in the first five models (ranging from 0.419 to 0.491, with a 1% significance level), the main channels to explain the *per capita* health expenditure level in municipalities, according to all models, are demographic issues related to age and gender: old people exert a strong positive pressure (with a 1% significance level in all models). However, more young inhabitants in the total population tend to reduce this spending (with a 1% significance level). Moreover, the coefficients' values vary greatly in election years. Contrasting electoral and non-electoral years (models 3 and 4), the weight of aged people becomes stronger (from 0.342 to 0.666) and the negative effect of young people becomes weaker (from -1.036 to -0.879). The results related to age are not the same as Atella et al. (2014), but they also found that young people strongly reduce the local public health spending. A feature of the Brazilian public health system, namely, distribution of medication with no charges, may help to understand this, as it specially benefits the aged population).

The population density variable exhibits an interesting variation in the models. In the first models (all years' models and the non-electoral one), the concentration reduces the

---

<sup>11</sup> The Wald Test results ( $\chi^2 = 42.32$ ) confirm that the coefficients are different for local and for central elections.

spending (the coefficient values were -0.163, -0.179 and -0.295, respectively). This result does not fit the British case (Moscone et al., 2007) but is similar to the Spanish pattern (Costa-Font & Moscone, 2008). However, in the last models (election years, central elections, and local elections years), the sign of this variable changes (0.403, 0.491 and 0.611) and its significance level still remain at 1%. One possible explanation is that the more densely populated a municipality is, the more the central government wants to entice voters because this feature reduces the unit cost of acquiring a vote (Cox, 2010), and this increases the level of public health expenditure in central election years, probably through grants from the central government to the local incumbents.

## 5. CONCLUSION

In this study, we tested the hypothesis that policymakers' choices with regard to health spending at the local level are spatially correlated and electorally oriented. We check the influence of a set of demographic, electoral, and economic determinants of public health activity. We performed a spatial panel data analysis encompassing 399 municipalities from 2005 to 2012, estimating six models, namely, all years, all years controlling by election type, non-electoral years, electoral years, central election years, and local election years. Our contribution to the literature lies in the following three findings:

First, we show that health spending is driven by (global and local) positive spatial autocorrelation and is persistent, meaning that spatial effects in the allocation of spending exist, independent of an electoral calendar. The parametric estimation that best fit the data was the spatial error model estimation (SEM), and the lambda value for all models were the same (0.099), indicating that the spatial correlation affects both electoral and non-electoral year's expenditures, in central and local elections. In other words, we found a positive spillover effect in public health spending at the local level. Policymakers pay attention in their neighbors before decide how much to spent in health. However, they do not maximize the spent but increase it in the same direction other municipalities do. Exogenous effects (normative power of the law when it comes to minimum values of health spending in the municipalities) and correlated effects (the role of local health infrastructure, particularly in local election years) help understand the channels of this spatial dependence.

A second issue is that elections are strong enough to change the allocation pattern in local governments, probably as a political strategy to entice voters. Health spending seems to



have a politically motivated component, stronger in local elections (considering an incumbent's re-election and/or his goal of electing the supported successor) but still significant in central elections. Considering that less than 5% of the Brazilian tax burden is shouldered at the local level, the relevance of central elections is probably tied to grants access. Once again, we observe here that budget allocation's decisions are tied to electoral race prospective.

The last point is the difference between central and local election effects. The main channels to explain the per capita health expenditure level in municipalities, according to all models, are demographic issues related to aged people (positive effect) and young people (negative effect). Moreover, in election years, the positive aged-people effect increases and the negative young-people effect levels off. Another important issue is that the population density variable changes from a negative effect (in all years and non-electoral year models) to a positive effect in election year models. This suggests that the more densely populated a municipality is, the more efficient will be the campaign to entice voters, and one effective instrument to do that is to increase public health expenditure in election years.

## 6. REFERENCES

- Akin, J., Hutchinson, P., & Strumpf, K. (2005). Decentralisation and government provision of public goods: The public health sector in Uganda. *Journal of Development Studies*, 41(8), 1417–1443. <http://doi.org/10.1080/00220380500187075>
- Almeida, E. (2012). *Econometria Espacial Aplicada*. Campinas: Alínea.
- Andrade, M. V., Chein, F., Souza, L. R. De, & Puig-Junoy, J. (2012). Income transfer policies and the impacts on the immunization of children: the Bolsa Família Program. *Cadernos de Saúde Pública*, 28(7), 1347–1358. <http://doi.org/10.1590/S0102-311X2012000700013>
- Andrade, M. V., Noronha, K., Barbosa, A. C. Q., Rocha, T. A. H., Silva, N. C. da, Calazans, J. A., ... Souza, A. (2015). A equidade na cobertura da Estratégia Saúde da Família em Minas Gerais, Brasil. *Cadernos de Saúde Pública*, 31(6), 1175–1187. <http://doi.org/10.1590/0102-311X00130414>
- Anselin, L. (1988). *Spatial Econometrics: Methods and Models* (Vol. 4). Dordrecht: Springer Netherlands. <http://doi.org/10.1007/978-94-015-7799-1>
- Anselin, L. (2010). Thirty years of spatial econometrics. *Papers in Regional Science*, 89(1), 3–25. <http://doi.org/10.1111/j.1435-5957.2010.00279.x>
- Atella, V., Belotti, F., Depalo, D., & Mortari, A. P. (2014). Measuring spatial effects in the presence of institutional constraints: The case of Italian Local Health Authority expenditure. *Regional Science and Urban Economics*, 49, 232–241. <http://doi.org/10.1016/j.regsciurbeco.2014.07.007>
- Baicker, K. (2005). The spillover effects of state spending. *Journal of Public Economics*, 89(2-3), 529–544. <http://doi.org/10.1016/j.jpubeco.2003.11.003>
- Baltagi, B. H., & Moscone, F. (2010). Health care expenditure and income in the OECD reconsidered: Evidence from panel data. *Economic Modelling*, 27(4), 804–811. <http://doi.org/10.1016/j.econmod.2009.12.001>
- Besley, T., & Case, A. (1995). Incumbent Behavior: Vote-Seeking, Tax-Setting, and Yardstick Competition. *The American Economic Review*, 85(1), 25–45. <http://doi.org/10.2307/2117994>
- Besley, T., & Coate, S. (2003). Centralized versus decentralized provision of local public goods: A political economy approach. *Journal of Public Economics*, 87(12), 2611–2637. [http://doi.org/10.1016/S0047-2727\(02\)00141-X](http://doi.org/10.1016/S0047-2727(02)00141-X)
- Bivand, R., & Szymanski, S. (1997). Spatial dependence through local yardstick competition: *Economics Letters*, 55(2), 257–265. [http://doi.org/10.1016/S0165-1765\(97\)00077-3](http://doi.org/10.1016/S0165-1765(97)00077-3)
- Brock, W. A., & Durlauf, S. N. (2001). Interactions-Based Models. In J. J. Heckman & E. Leamer (Eds.), *Handbook of Econometrics* (pp. 3297–3380). [http://doi.org/10.1016/S1573-4412\(01\)05007-3](http://doi.org/10.1016/S1573-4412(01)05007-3)
- Caldeira, E. (2012). Yardstick competition in a federation: Theory and evidence from China. *China Economic Review*, 23(4), 878–897. <http://doi.org/10.1016/j.chieco.2012.04.011>
- Castells, A., & Solé-Ollé, A. (2005). The regional allocation of infrastructure investment: The role of equity, efficiency and political factors. *European Economic Review*, 49(5), 1165–1205. <http://doi.org/10.1016/j.euroecorev.2003.07.002>

- Cherchiglia, M. L., Gomes, I. C., Alvares, J., Guerra Junior, A., Acúrcio, F. de A., Andrade, E. I. G., ... Queiroz, O. V. (2010). Determinantes dos gastos com diálises no Sistema Único de Saúde, Brasil, 2000 a 2004. *Cadernos de Saúde Pública*, 26(8), 1627–1641.
- Costa, H., Veiga, L. G., & Portela, M. (2015). Interactions in Local Governments' Spending Decisions: Evidence from Portugal. *Regional Studies*, 49(9), 1441–1456. <http://doi.org/10.1080/00343404.2013.835798>
- Costa-Font, J., & Moscone, F. (2008). The impact of decentralization and inter-territorial interactions on Spanish health expenditure. *Empirical Economics*, 34(1), 167–184. <http://doi.org/10.1007/s00181-007-0166-x>
- Cox, G. W. (2010). Swing voters, core voters, and distributive politics. In I. Shapiro, S. C. Stokes, E. J. Wood, & A. S. Kirshner (Eds.), *Political Representation* (pp. 342–357). Cambridge: Cambridge University Press. Retrieved from <http://books.google.com/books?hl=en&lr=&id=Ajl-1Fa-vgsC&pgis=1>
- Crisp, B. F., Olivella, S., Potter, J. D., & Mishler, W. (2014). Elections as instruments for punishing bad representatives and selecting good ones. *Electoral Studies*, 34, 1–15. <http://doi.org/10.1016/j.electstud.2013.08.017>
- Dembour, C., & Wauthy, X. (2009). Investment in public infrastructure with spillovers and tax competition between contiguous regions. *Regional Science and Urban Economics*, 39(6), 679–687. <http://doi.org/10.1016/j.regsciurbeco.2009.02.007>
- Drazen, A., & Eslava, M. (2010). Electoral manipulation via voter-friendly spending: Theory and evidence. *Journal of Development Economics*, 92(1), 39–52. <http://doi.org/10.1016/j.jdeveco.2009.01.001>
- Elhorst, J. P. (2003). Specification and Estimation of Spatial Panel Data Models. *International Regional Science Review*, 26(3), 244–268. <http://doi.org/10.1177/0160017603253791>
- Elhorst, J. P. (2010). Applied Spatial Econometrics: Raising the Bar. *Spatial Economic Analysis*, 5(1), 9–28. <http://doi.org/10.1080/17421770903541772>
- Ferreira, A. L., Magalhães, A. C. F., Corrrêa, L. P., Rodrigues, M. da C., & Viegas, S. M. da F. (2014). A aplicabilidade dos indicadores de saúde no contexto da atenção primária à saúde. *Revista de APS*, 17(2), 134–142. <http://doi.org/10.4025/reveducfis.v20i4>.
- Ferreira, I. F. S., & Bugarin, M. S. (2007). Transferências voluntárias e ciclo político-orçamentário no federalismo fiscal brasileiro. *Revista Brasileira de Economia*, 61(3), 271–300. <http://doi.org/10.1590/S0034-71402007000300001>
- Foucault, M., Madies, T., & Paty, S. (2008). Public spending interactions and local politics. Empirical evidence from French municipalities. *Public Choice*, 137(1-2), 57–80. <http://doi.org/10.1007/s11127-008-9312-z>
- Frère, Q., Leprince, M., & Paty, S. (2014). The Impact of Intermunicipal Cooperation on Local Public Spending. *Urban Studies*, 51(8), 1741–1760. <http://doi.org/10.1177/0042098013499080>
- Genschel, P., & Schwarz, P. (2011). Tax competition: a literature review. *Socio-Economic Review*, 9(2), 339–370. <http://doi.org/10.1093/ser/mwr004>
- Granado, F. J. A. del, Martinez-vazquez, J., & Simatupang, R. R. (2008). Local Government Fiscal Competition in Developing Countries: the case of Indonesia. *Urban Public Economics Review*, (8), 13–45.

- Levaggi, R. (2010). From local to global public goods: How should externalities be represented? *Economic Modelling*, 27(5), 1040–1042. <http://doi.org/10.1016/j.econmod.2010.04.006>
- Manski, C. F. (1993). Identification of Endogenous Social Effects: The Reflection Problem. *The Review of Economic Studies*, 60(3), 531. <http://doi.org/10.2307/2298123>
- Moscone, F., & Knapp, M. (2005). Exploring the spatial pattern of mental health expenditure. *The Journal of Mental Health Policy and Economics*, 8(4), 205–217.
- Moscone, F., Knapp, M., & Tosetti, E. (2007). Mental health expenditure in England: A spatial panel approach. *Journal of Health Economics*, 26(4), 842–864. <http://doi.org/10.1016/j.jhealeco.2006.12.008>
- Nordhaus, W. D. (1975). The Political Business Cycle. *The Review of Economic Studies*, 42(2), 169–190. <http://doi.org/10.2307/2296528>
- Rodrigues, C. G., Amaral, P. V. M. do, & Simões, R. F. (2007). Rede Urbana da Oferta de Serviços de Saúde: uma análise multivariada macro regional - Brasil , 2002. *Revista de Desenvolvimento Econômico*, 9(16), 83–92. Retrieved from <http://www.revistas.unifacs.br/index.php/rde/article/view/1018/796>
- Rogoff, K. (1990). Equilibrium Political Budget Cycles. *The American Economic Review*, 80(1), 21–36. Retrieved from <http://www.jstor.org/stable/2006731>
- Sakurai, S. N., & Menezes-Filho, N. A. (2008). Fiscal policy and reelection in Brazilian municipalities. *Public Choice*, 137(1-2), 301–314. <http://doi.org/10.1007/s11127-008-9329-3>
- Solé-Ollé, A. (2006). Expenditure spillovers and fiscal interactions: Empirical evidence from local governments in Spain. *Journal of Urban Economics*, 59(1), 32–53. <http://doi.org/10.1016/j.jue.2005.08.007>
- Tiebout, C. M. (1956). A Pure Theory of Local Expenditures. *Journal of Political Economy*, 64(5), 416–424.
- Tobler, W. R. (1979). Smooth Pycnophylactic Interpolation for Geographical Regions. *Journal of the American Statistical Association*, 74(367), 519. <http://doi.org/10.2307/2286968>
- Videira, R. A., & Mattos, E. (2011). Ciclos políticos eleitorais e a interação espacial de políticas fiscais entre os municípios brasileiros. *Economia Aplicada*, 15(2), 259–286. <http://doi.org/10.1590/S1413-80502011000200005>
- Wilson, J. D. (1999). Theories of Tax Competition. *National Tax Journal*, 52(2), 269–304. Retrieved from <http://socserv.mcmaster.ca/cuffk/wilson.pdf>
- Yu, Y., Zhang, L., Li, F., & Zheng, X. (2013). Strategic interaction and the determinants of public health expenditures in China: A spatial panel perspective. *Annals of Regional Science*, 50(1), 203–221. <http://doi.org/10.1007/s00168-011-0488-7>

## 7. APENDICES

### Appendix 7.1 - Statistical tests coefficients

Tests	Model 1 All Years	Model 2 All Years - Election's Type	Model 3 Non- Election Years	Model 4 Election Years	Model 5 Central Election Years	Model 6 Local Election Years
Breusch-Pagan $\chi^2$ Prob > $\chi^2$	5483.71 (0.0000)	5481.59 (0.0000)	1193.42 (0.0000)	1054.31 (0.0000)	199.92 (0.0000)	116.58 (0.0000)
Hausman $\chi^2$ Prob > $\chi^2$	188.94 (0.0000)	184.37 (0.0000)	96.25 (0.0000)	166.10 (0.0000)	93.05 (0.0000)	97.22 (0.0000)
AIC - SEM Model	-2582.100	-2581.918	-1566.496	-1382.602	-1355.484	-674.898
AIC - SAR Model	-1850.262	-1853.962	-1218.439	-963.586	Not feasible	Not feasible
BIC - SEM Model	-2515.347	-2509.097	-1512.743	-1328.849	-1308.663	-628.077
BIC - SAR Model	-1779.044	-1776.809	-1162.476	-907.622	Not feasible	Not feasible

### Appendix 7.2 – Data Descriptive Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
Health	overall	5.936581	.4390776	1.810152	7.435058	N = 3192
	between		.3765779	2.575073	6.957425	n = 399
	within		.2264716	2.890888	6.793344	T = 8
Reg_ health	overall	.0631281	.2930255	0	2.564949	N = 3192
	between		.2799936	0	2.371122	n = 399
	within		.0874044	-.8687119	1.016205	T = 8
Loc_ health	overall	1.661268	.8772308	0	5.214936	N = 3192
	between		.8520379	0	5.039746	n = 399
	within		.212504	.4922877	3.047562	T = 8
DPop	overall	3.355769	.8812257	1.170271	8.355924	N = 3192
	between		.8810135	1.210232	8.320662	n = 399
	within		.045569	2.606341	3.776077	T = 8
FPM	overall	6.414672	.5890808	4.150872	8.229517	N = 3192
	between		.5732814	4.367048	8.073168	n = 399
	within		.1381508	5.820819	7.049802	T = 8
Old	overall	-1.669181	.2259521	-2.505926	-1.107149	N = 3192
	between		.2170519	-2.415738	-1.182632	n = 399
	within		.0636093	-1.872506	-1.439783	T = 8
Young	overall	-.9660084	.1585308	-1.492989	-.4340189	N = 3192
	between		.1383126	-1.326489	-.5398076	n = 399
	within		.0777407	-1.171562	-.7843351	T = 8
Fem	overall	-.7011681	.0244664	-.9108326	-.6349159	N = 3192
	between		.021926	-.7873892	-.6451296	n = 399
	within		.0109044	-.8246115	-.5858592	T = 8
Rur	overall	-1.358863	.8527182	-8.011628	0	N = 3192
	between		.8355637	-5.168531	0	n = 399
	within		.174623	-4.643323	-.1795649	T = 8