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CAN PRIVATE PROVISION OF PUBLIC GOODS BE EFFECTIVE? CORRUPTION COMBAT IN BRAZILIAN MUNICIPALITIES AND THE BRAZILIAN SOCIAL OBSERVATORY NETWORK

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Can Private Provision of Public Goods be Effective? Corruption Combat in Brazilian Municipalities and the Brazilian Social Observatory Network

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Abstract: This paper aims to evaluate the effectiveness of private initiative in monitoring public administration and in combating corruption. Specifically, we estimate the impact of the introduction of the units of the Observatório Social do Brasil on several categories of per capita public expenditures of municipalities in the southern region of Brazil. Using information in the 2002-2017 period, we implement a differences in differences strategy based on the gradual introduction of OSBs in a set of municipalities over the period of analysis. The results show weak statistical significance for public expenditure, indicating limited effectiveness of OSB's operation. For smaller municipalities (with less than 50,000 inhabitants), we find statistically significant savings for two groups of expenditure: "freely distributed materials" and "services from individuals". This is consistent with the oversight of the OSB units being more effective in municipalities that attract less attention from centralized state supervision agencies (TCEs).

Keywords: public goods, corruption, fiscal management
JEL: D0, H0,H1, H4

Resumo: Este artigo tem como objetivo avaliar a eficácia da iniciativa privada no monitoramento da administração pública e no combate à corrupção. Especificamente, estimamos o impacto da introdução das unidades do Observatório Social do Brasil em várias categorias de gastos públicos per capita de municípios da região sul do Brasil. Utilizando informações no período 2002-2017, implementamos uma estratégia de diferenças de diferenças com base na introdução gradual de OSBs em um conjunto de municípios durante o período de análise. Os resultados mostram significância estatística fraca para as despesas públicas, indicando eficácia limitada da operação da OSB. Para municípios menores (com menos de 50.000 habitantes), encontramos economias estatisticamente significativas para dois grupos de despesas: "materiais distribuídos gratuitamente" e "serviços de indivíduos". Esse resultado é consistente com a supervisão das unidades OSB ser mais eficaz em municípios que atraem menos atenção das agências de supervisão centralizada do estado (TCEs).

Palavras-chave: bens públicos, corrupção, transparência

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1. Introduction

Corruption is an evil that has awaken growing concern of authorities and civil society at the global level. In Brazil, in particular, there are recurring cases of blatant cases involving all spheres of power: executive, legislative and judiciary. As a consequence, Brazil has had captive place in the lower positions of international rankings of corruption perception. In the most recent edition of the Corruption Perceptions Index[1], prepared by Transparency International, Brazil ranks 106th among a total of 180 countries evaluated, the worst result since 2012.

In the sub-national level, corruption in the 5,570 Brazilian municipalities is particularly worrisome due to the great decentralization of resources under the responsibility of local administrators, subject to different degrees of supervision. In a recent report[2], it is estimated that the total resources diverted from municipalities between 2015 and 2017 have reached the figure of R$10 billion. These are deviations that, despite not being reported by the mainstream press, reach a more vulnerable part of the population by concentrating in regions of lower level of economic and social development.

From the economics standpoint, corruption has gained increasing attention both for the way it causes real losses with the diversion of resources and for the mechanisms favoring its emergence and combat implemented by society (Olken & Pande, 2012; Banerjee, et al., 2013). Both in the more traditional view of corruption, analyzed from the moral hazard perspective (Becker & Stigler, 1974), and in more recent approaches (Banerjee, et al., 2013), monitoring of public activity is considered one of the pillars the fight against corruption. Due to the public good character of this activity (Olken, 2007), private provision is expected to be lower than the social optimum (Samuelson, 1954; Bergstrom, et al., 1986). Therefore, its execution is often left to public agencies, which are subject to their own incentive problems.

This paper seeks to investigate the effectiveness of private initiatives of public administration monitoring aimed at combating corruption in a developing country. In particular, we investigated the impact of the "Observatório Social do Brazil" (OSB) network on different categories of per capita expenditures of municipalities in the southern region of Brazil, comprised by the states of Paraná (PR), Rio Grande do Sul (RS) and Santa Catarina (SC). In order to identify the causal effect of the presence of OSB units in municipalities, we make use of the gradual introduction of these units at different points in time in the period 2006-2017. We restrict our analysis to those states for two main reasons. First, they form a more homogeneous set of municipalities in terms of higher levels of social and economic development compared to the rest of Brazil[3]. Secondly, this is the region where the OSB network originated and with the largest number of units in operation.

The results show negative effects for some expenditure items (consumer material and free distribution material), indicating some savings, but with little statistical significance. For smaller municipalities, with less than 50,000 inhabitants, we find statistically significant savings for two groups of expenditure: "freely distributed materials" and "construction and installations". Because it is a national institution and in a context of a relatively developed country in terms of institutions of control, we consider that this result makes an important contribution in the literature on the effectiveness of decentralized instruments and social participation in the monitoring of public administration (Besley, et al., 2005; Olken, 2007; Björkman & Svensson, 2009).

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[1] https://ipc.transparenciainternacional.org.br/

[2] http://www.uol/noticias/especiais/cidade-pequena-corrupcao-grande---norte.htm

[3] This difference is rooted in the different type of colonization that those states experienced (settlements) as compared to other regions of Brazil (Furtado, 1963)

The remaining of the paper is organized as follows. Section two gives a description of the OSB network and its operation. Section three describes the data used in the analysis. Section four discusses the empirical strategy. Section five discusses the results of the estimates and section six summarizes the main conclusions.

2. The Brazilian Social Observatory [4]

The OSB network is a non-governmental, non-profit and non-partisan institution, which started in 2008 in the state of Paraná, when it consolidated the Social Observatory created in 2004 in the city of Maringá, Paraná. The entity works as an association of Municipal Social Observatories (OS) and uses its own methodology, developed through training with official control agencies, for monitoring public accounts and instruments provided by the "access to information" law (Michener, et al., 2018) to monitor public procurement processes from the publication of bidding notices to the delivery of final products.

Besides monitoring procurement processes, the OSB also has the following lines of action: fiscal education[5], stimulating the participation of micro and small companies in bidding processes and consolidating and disseminating public management indicators[6]. OSB enables and supports local OS by establishing state and national partnerships. Currently the OSB network has 140 observatories affiliated in 17 states and over 3,000 volunteers.

The constitution of a municipal OS starts from the initiative of the citizens who make the first contact with the OSB network. After an initial stage of interviews and initial instructions, the unit's installation and registration process begins, as well as its membership in the OSB network that provides visual identity standard, procedures manuals, computerized systems, initial training and permanent technical support[7].

The municipal OSs play an important role in overseeing municipal public administration. According to the "Tribunal de Contas da União" (TCU) [8], the responsibility for supervising municipal public accounts is shared by different public agencies. The Controladoria Geral da União (CGU) and the TCU oversee the allocation of federal resources transferred to municipalities. The Tribunais de Contas dos Estados (TCE) oversee all municipal accounts and impose civil sanctions to public administrators and civil servants that are found guilty of misconduct. Two municipalities, Rio de Janeiro and São Paulo, have their own Tribunal de Contas do Município (TCM), which are responsible for overseeing their accounts. Since the 1988 Constitution, the creation of new TCMs has been forbidden, although it has not prevented the maintenance of those already created.

However, the capillarity of the more than 5,000 Brazilian municipalities often means that such oversight process by centralized agencies is not effective. The reasons might be the limited amounts of resources of TCEs that may not be enough to exercise due control of all municipalities located in their respective territories. Other factors such as high distances between municipalities and the state capital, low territorial extension and little economic relevance to the state are elements that may weaken the effectiveness of official supervision of municipal fiscal management. This situation suggests that there may be scope for the performance of other civil society entities in the oversight of municipal public accounts. In this way, the formation and performance of OSBs offices in municipalities can fill the lack of supervision in them.

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[4] Information taken from the website: http://osbrasil.org.br/ .

[5] http://escoladacidadania.osbrasil.org.br/

[6] http://osbrasil.org.br/indicadores-de-gestao-publica/

[7] http://osbrasil.org.br/como-constituir-um-os/

[8] https://portal.tcu.gov.br/ouvidoria/duvidas-frequentes/fiscalizacao-das-prefeituras.htm

3. Data

The paper makes use of data for the municipalities of southern Brazil from different sources. In order to estimate the impact of OSBs on municipal expenditure, we use information consolidated by the National Treasury Department of the Ministry of Economy[9]. The period considered in the analysis goes from 2002 to 2017 for all municipalities. After excluding the ones with missing observations, we are left with a dataset comprising 313 municipalities and 16 years. Total expenditures are divided into "Primary" and "Capital" expenditures. The first group is divided in: “Staff”, “Interest” and “Other” primary expenditures. Within the “Other” group, we look at the subgroups “Consumption Material”, “Freely Distributed Material”, “Third Party Services from Individuals” and “Third Party Services from Legal Persons” and “Stipends”. The reason for using more disaggregated categories is to capture effects of the OSB on expenditure items subject to bidding processes, which are the subject of the main oversight work of OSBs. All values were adjusted for inflation using the annual IGP-M, produced by Fundação Getúlio Vargas (FGV), and divided by the estimated population of municipalities in each year produced by Instituto Brasileiro de Geografia e Estatística (IBGE).

The list of municipalities with OSB units was obtained in the last report of the institution's accounts[10]. The report does not include the starting date of each unit. However, the OSB website makes available phone and e-mail contacts for each unit. This information allowed us to map when each one of them came into operation[11]. Tables one, two and three show the gradual implementation of OSBs in the municipalities of Paraná, Rio Grande do Sul and Santa Catarina, respectively, over the period 2006 - 2018. Figure one exhibits the location of OSB units in each state. OSB is present in 36 municipalities of Paraná, 16 municipalities of Rio Grande do Sul and 31 municipalities of Santa Catarina.

In addition to those variables, the estimated models include controls for municipal administrations and mayor’s political affiliation during the period of analysis. Specifically, the period 2002 - 2017 covers five terms: 2001-2004, 2005-2008, 2009-2012 and 2013-2016 and 2017-2020. The information about mayors in office and political affiliation was obtained by the result of the municipal elections made available by the Tribunal Superior Eleitoral.

Finally, we used socio-economic information to compare the profile of municipalities with OSB units (treated) with municipalities without OSB (control). For this, we use the following information: municipal GDP, population, value-added distribution by economic activity (agriculture, industry, services and public administration), tax revenue and Human Development Index for municipalities (total and education, longevity and income components).

4. Empirical Strategy

The estimation of the causal effect of the presence of OSBs units on municipal expenditures should take into account the non-experimental process of the introduction of OSB units in municipalities. For this reason, the simple comparison between the average expenditure of municipalities with OSB and without OSB units will result in biased estimates of the true effect (Inbens & Wooldridge, 2009). Since the constitution of an observatory unit in a municipality must start from the initiative of its citizens and their interest in promoting activities of control of the public administration, unobservable characteristics of municipalities can influence both the creation of an OSB unit and the quality of the

[9] Retrieved from the website: http://comparabrasil.com/ .

[10] http://osbrasil.org.br/wp-content/uploads/2019/04/OSB_AGO_Presta%C3%A7%C3%A3o-de-Contas-2018.pdf. Accessed in 01/29/2020.

[11] This information was later validated by the head unit of the OSB system.

municipality's fiscal management. For example, if the population of a particular municipality has political preferences that favor rigorous conduct of public administration, this can positively influence both the choice of more competent administrators and the mobilization of a group of people interested in implementing an OSB unit. In this case, this omitted variable would result in a downward bias in the comparison between the averages of expenditures: fiscal management would tend to be better in resource savings ("doing more with less") in the municipalities with OSB units, partly in response to the political preferences of the population of the municipality. Hence, the existence of this and other omitted variables introduces biases in simple comparison of municipalities with and without OSB units.

Since it is not possible to conduct a controlled experiment that randomly assigns OSB units among municipalities, thus eliminating the selection bias of the municipalities selected to have OSB (treated) and not having OSB (controls), it is necessary to use a strategy that can isolate other observable and unobservable effects that may confound the effect we seek to be estimated. In this paper, we take advantage of the staggered implementation of OSB units in municipalities to implement a difference-in-differences strategy (Inbens & Wooldridge, 2009). The estimated econometric model can be written as follows:

$$y_{it} = \alpha + \delta OSB_{\text{it}} + \theta X_{it} + \sum_{i=1}^{N} \beta_i Municipality_i + \sum_{t=1}^{T} \gamma_t Year_t + \sum_{i=1}^{N} \theta_i (Municipality_i \times t) + u_{it}. \text{ eq. 1}$$

In this equation, each dependent variable (y_{it}) in municipality *i* in year *t* is related to a dummy variable that indicates the presence of OSB in the municipality and year (OSB_{it}), fixed effects for municipalities, fixed effects for years, one linear trend specific to each municipality and a vector of control variables (X_{it}) that varies by municipality and year. The coefficient δ, represents an estimate of the effect of the introduction of a OSB unit on the dependent variable. The inclusion of fixed effects and linear trends allows controlling the effects of variables that are not observed and correlated with the implementation of the program and with the dependent variables. In this way, we can attenuate the bias caused by the omission of these variables on the coefficient of interest.

The control variables included correspond to fixed effects for the administration of each municipality in each term corresponding to the period of analysis. In the period 2004-2016 we had three municipal terms. Therefore, we have included in vector X_{it} a dummy variable for each mayor, for the mayor's party, and an interaction between the mayor and the specific term. The mayors' dummy captures the effects of the managerial capacity of each admin in the municipality. The second variable captures effects deriving from the ideological orientation of each party. The interaction between mayor and term captures distinct incentives that mayors in first term and second term may have in the management of municipalities (Ferraz & Finan, 2011).

In order to lower the computational burden of estimating equation one for a total of 956 municipalities we combine the difference-in-difference with a propensity score matching strategy (Rosenbaum & Rubin, 1983; Heckman, et al., 1999). Specifically, for each treated municipality, we select the three nearest neighbors based on a propensity score estimated by a probit model that estimates the probability of being treated as a function of several socioeconomic variables for the year of 2002, before the start of the first OSB unit[12]. Hence,

[12] The independent variables used in the estimation of the probit model for the propensity score were: municipal GDP (total and per capita), tax revenue (total and per capita), population, value added in agriculture, industry, services and public administration (total and sectoral shares), life expectancy, share of population older than 65, illiteracy rate of population older than 25, share of population older than 25 that completed primary education, share of population older than 25 with secondary education, share of population older than 25 with college education, Gini coefficient, share of poor people, share of male population, share of population older than 25, share of urban population, HDI (total and education, longevity and income components) and state dummies. We also employed the following variables for municipal expenditure: total spending, primary spending, interests,

our estimating sample comprises 264 municipalities (66 in the treated group and 198 in the control group).

We also estimate equation 1 using more flexible forms for the effect of OSB units. The first alternative specification considers the number of years the OSB is in the municipality. Thus, the total effect depends on how many years the OSB is present in the municipality. A second alternative specification specifies the OSB variable as a set of dummy variables indicating the number of years the OSB is present in the municipality. For the second alternative specification we have the following equation:

$$y_{it} = \alpha + \sum_{j=1}^{12} \delta_j OSB_{it}^{j} + \theta X_{it} + \sum_{i=1}^{N} \beta_i Municipality_i + \sum_{t=1}^{T} \gamma_t Year_t + \sum_{i=1}^{N} \theta_i (Municipality_i \times t) + u_{it}.$$

eq. 2 .

All specifications use robust standard deviations (Arellano, 1987) clustered by municipality (Bertrand, et al., 2004). If the oversight activities performed by the OSB units are effective, we expect to find negative coefficients for the variable indicating the presence of OSB in a given municipality, after controlling for other effects that determine public expenditure. That would mean the OSB units are effective in improving the efficiency of public expenditure in the form of savings of resources compared to municipalities without OSB units.

5. Results

Descriptive Analysis

Table 4 shows descriptive statistics of socioeconomic indicators of the 956 municipalities of the sample in the year of 2017. The indicators of share of value-added by economic activity show a higher share in agriculture and services, with industry behind public administration. Regarding the indicators of municipal human development, the figures show a medium level of development, according to the criteria of the Atlas of Development in Brazil (UNDP, IPEA, FJP, 2013), but with great dispersion.

Table 5 compares indicators between municipalities with OSB units (treated) and without OSB units (control) for the years prior to the institution's inception (2006). The indicators show a great deal of heterogeneity in the profile of municipalities in each group. Treated municipalities have a larger GDP (total and per capita), tax revenue (total and per capita), population, and share of industry and services in value added. The municipalities of the control group have greater share of value added in agriculture and public administration. Regarding human development indicators, treated municipalities have greater indicators for HDI (total and components), life expectancy, years of schooling and Gini coefficient. We also notice that the treated municipalities have lower levels of per capita public expenditures in almost all categories. Exception is interest, for which the treated group spends more than the control group. Those findings are consistent with the selection process to the treatment being biased towards municipalities that are more efficient, perhaps due to the preferences of the electorate for better administrators in these municipalities.

Those differences indicate a great potential for the occurrence of bias in the comparison of the quality of fiscal management between the two groups of municipalities related to omitted variables. Table 6 reproduces the same comparison as table 5 for municipalities in the matched sample. Although some indicators now show no statistical

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personnel, other primary spending, consumption material, freely distributed material, third party services (individuals and legal persons), stipends, staff, capital spending, amortization, permanent materials and infrastructure.

differences (years of schooling, Gini coefficient, primary, capital and staff spending), most of them are still statistically different, which means that estimates based on the matching sample might still be biased because of the selection process. Thus, the strategy of differences-in-differences becomes even more justified.

Finally, we also check for the presence of parallel trends in the outcomes of interest for both groups of municipalities before the beginning of the OSB network. Figure 2 plots yearly average municipal expenditures in three categories: "total", "primary" and "consumption". The three categories display very similar upward trends, although they are clearly at different levels of expenditure. Most of the expenditure categories follow this similar pattern, which indicates that the difference in difference strategy can work well to identify the effect of the introduction of the OSB.[13]

Econometric Results

Tables 7, 8 and 9 summarize the results found for the three specifications of the econometric model.[14] Most of the results for OSB presence (table 7) show a negative sign, indicating that the OSB units might have the capacity to generate some savings for the municipalities, but weakly (total, primary and other) or not statistically significant. In the model with OSB years in each municipality (table 8), the only statistically significant coefficient is the one corresponding to the payment of interest. However, this component of expenditures is not subject to the activity of the OSB units, which does not allow us to conclude that there is any effect of the OSB on this variable. In the specifications corresponding to the number of years that the OSB is present in the municipalities (table 9), there are no negative and significant coefficients. In fact, some of the significant coefficients, for the interest component of expenditure, have positive sign.

In order to verify if the negative results obtained are a result of the level of aggregation of the municipal expenditure items, we proceed the analysis using more disaggregated items that represent expenses more directly affected by bidding processes. Thus, we estimate models for the items "Consumption Material", "Free Distribution Material", "Third Party Services from Individuals", "Third Party Services from Legal Entities" and "Stipends", components of primary expenditures. The results are summarized in Tables 10, 11 and 12.

Again, OSB's presence in the municipality (table 10) does not present statistically significant coefficients, although some coefficients (consumption material, free distribution material, legal entities services) are negative as expected. In the models for number of years present (table 11), all coefficients are not statistically significant, although they have the expected negative sign (except for consumption and stipends). In the model with the number of OSB years of presence (table 12), we also have few negative and weakly significant results (in bold) and indicate resource savings.

In order to check for heterogeneity of effects, we also estimated the models using the 184 municipalities with less than 50,000 inhabitants in the sample. As we already argued, smaller and distant municipalities might be less subject to oversight from the TCE that centralizes the control and monitoring of municipal accounts. This slackness of supervision might be a result of limited resources available for the TCEs coupled with less economic or political importance of smaller municipalities. Hence, one might expect that the OSB units could be more effective in controlling of accounts of these municipalities.

[13] All econometric specifications include municipal specific time trends to capture possible departures from the parallel trends assumption in some expenditure categories.

[14] All dependent variables are measured in per capita terms.

Tables 13 to 18 summarize the results for those smaller municipalities. The model for presence of OSB unit (table 13) shows negative and weakly significant results for total, other primary and capital expenditures. The more disaggregated analysis (table 16) shows that the larger saving happens in the expenditures in "Freely Distributed Materials". The models with number of years of presence (tables 14 and 17) show non-significant results for all headings. For the models with the number of years coded as dummy variables (tables 15 and 18), we find a few weakly significant results (in bold), for total and capital expenditures (table 15) and for freely distributed materials and services from individuals (table 18). Hence, for the smaller municipalities the results, although still weak in terms of statistical significance, are more in line with what we would expect as a signal of effectiveness of the oversight service provided by OSB units in municipalities that attract less attention from centralized TCEs.[15]

Our results can be compared to other studies that have focused on the same issue. In an experimental analysis conducted in Indonesia (Olken, 2007), no significant effects of local community inspection on public works projects were found. Another experimental analysis conducted in Uganda (Björkman & Svensson, 2009) encouraged participation in community settings to increase the involvement of the population with the state of provision of health services and the capacity to hold local providers accountable for their performance. The results document an increase in the use of health services, a reduction in infant mortality and an increase in the weight of children. Finally, another study involving community gatherings convened by representatives of local government in India documents a greater participation in these meetings of members of underprivileged social groups and a better focus of social programs in places where these meetings are held (Besley, et al., 2005). Thus, the evidence on the effectiveness of public oversight by the public is mixed, with positive and negative results.

The results obtained in this paper are in the same line: we find evidence of some savings of resources with the oversight promoted by the citizens, but with little or no statistical significance. This negative result can be due to the small size of resources available to the OSB units in face of the volume and complexity of the work it proposes. Since oversight of public administration is a public good, the coordination problems involved in its provision by the private sector are well known (Bergstrom, et al., 1986). Hence, private provision of this kind of public serve tends to be below the socially efficient level.

One striking difference between our study and the others is the context in which management monitoring initiatives occur. While other studies look at experimental interventions in small poor communities, our study examines an organization of great reach and performance in municipalities with a higher level of economic and institutional development. Thus, our study makes a relevant contribution to the literature dealing with the private monitoring of public administration.

6. Conclusion

In this paper, we examine the issue of the effectiveness of private initiative in monitoring fiscal management of municipalities in the Brazilian state of Paraná. Specifically, we study the OSB case and evaluate the impact of the implementation of local units in municipal expenditures, total and disaggregated by different headings.

To identify the causal effect of OSB units on the quality of fiscal management and on municipal expenditure, we explored the staggered introduction of OSB units in municipalities in the period 2006 - 2017. During this period, OSB settled in 34 municipalities in different years, which allows us to use a difference-in-differences strategy to isolate the effect of the

[15] Additionally, we also looked for differential effects by state and road distance of the municipality towards the state capital. Nevertheless, those specifications did not find any significant results.

OSB from other unobservable characteristics of the municipalities that affect both the installation and the quality of administration.

The OSB activities are focused on combating corruption by monitoring the bidding processes of municipalities and other fronts. The results for public expenditure measures show that some items respond negatively, indicating some economy of resources, but with little or no statistical significance. The analysis for municipalities with less than 50,000 inhabitants show statistically significant savings for expenditures on freely distributed materials and services from individuals. This is consistent with the argument that the OSB oversight might be more effective for municipalities that attract less interest from the centralized TCEs.

Those results are consistent with the literature examining the effect of grassroots initiatives on monitoring and accountability of public officials in conducting management activities. They are also consistent with the literature that points to the insufficiency of the supply of public goods by private initiative. Our study advances in relation to existing literature insofar as it applies to a context of superior economic and institutional development, being the first to quantitatively estimate the impact of OSBs specifically.

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Tables

Table 1: Implementation of OSBs in the State of Paraná (2006 - 2018)

Municipality	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Maringá													
Campo Mourão													
Apucarana													
Cascavel													
Francisco Beltrão													
Toledo													
Foz do Iguaçu													
Goioerê													
Guarapuava													
Londrina													
Paranavaí													
Umuarama													
Mal. Cândido Rondon													
Ponta Grossa*													
Assis Chateaubriand													
Medianeira													
Campo Largo													
Cianorte													
Curitiba													
Irati													
Palmas													
Arapongas													
Mandaguari													
Laranjeiras do Sul													
Paranaguá													
São José dos Pinhais													
Araucária													
Faxinal													
Matinhos													
Nova Esperança													
Palmeira*													
Palotina													
União da Vitória													
Pato Branco													
Jandaia do Sul													
Prudentópolis													

Source: own elaboration

* Part of the “Campos Gerais” unit.

Table 2: Implementation of OSBs in the State of Rio Grande do Sul (2010 - 2018)

Municipality	2010	2011	2012	2013	2014	2015	2016	2017	2018
Santa Maria									
Lajeado									
Cruz Alta									
Erechim									
Pelotas									
Porto Alegre									
Caxias do Sul									
Cachoeirinha									
Glorinha									
Gravataí									
Novo Hamburgo									
Santa Rosa									
Bento Gonçalves									
Guaíba									
São Leopoldo									
Farroupilha									

Source: own elaboration

Table 3: Implementation of OSBs in the State of Santa Catarina (2009 - 2018)

Municipality	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Florianópolis										
Itajaí										
Itapema										
Blumenau										
Brusque										
São Joaquim										
Lages										
Tubarão										
Balneário Camboriú										
Caçador										
Imbituba										
São Bento do Sul										
Criciúma										
Indaial										
Navegantes										
Rio do Sul										
Chapecó										
Concórdia										
Palhoça										
Xaxim										
Forquilhinha										
Joinville										
Morro da Fumaça										
Pinhalzinho										

Municipality	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Pomerode										
São Francisco do Sul										
Biguaçu										
Içara										
Mafra										
Rio Negrinho										
Timbó										

Source: own elaboration

Figure 1: OSB Presence in Southern Brazil (Paraná (L), Rio Grande do Sul (C) and Santa Catarina (R))

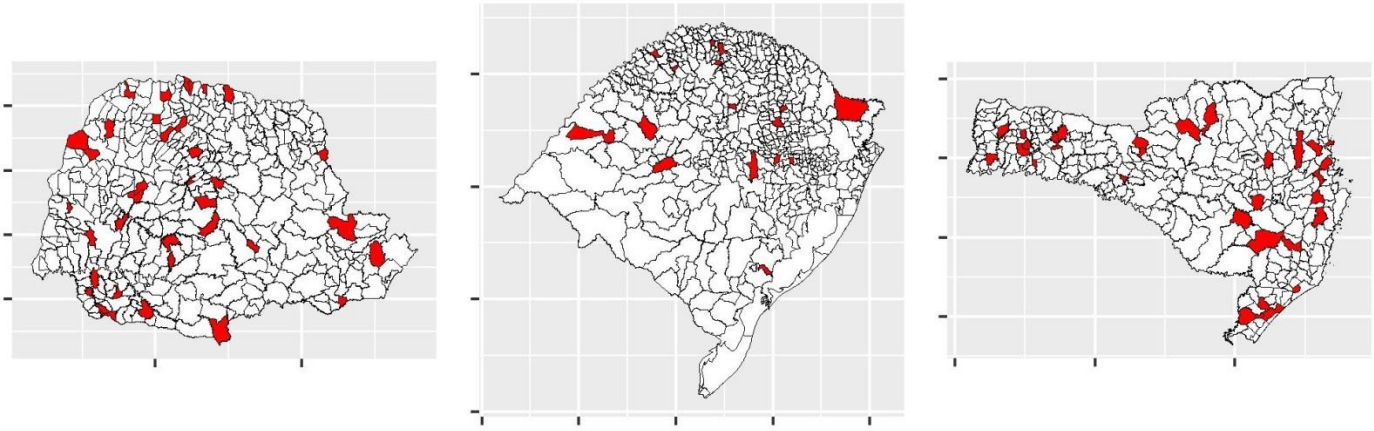

Table 4: Descriptive Statistics (2017)

Statistic	N	Mean	Min	Max	St. Dev.
GDP (R$ millions)	956	1.117,56	32,76	91.086,27	4.688,57
GDP Per Capita (R$ 1000)	956	34,92	12,20	177,51	16,74
Taxes (R$ millions)	956	155,96	0,81	16.435,41	821,37
Taxes Per Capita (R$ 1000)	956	2,99	0,29	39,55	3,02
Population (1000 hab.)	956	26,98	1,31	1.908,36	94,87
VA Agriculture (%)	956	27,88	0,01	72,29	17,03
VA Industry (%)	956	16,54	2,44	88,03	15,04
VA Services (%)	956	35,61	3,73	80,60	13,21
VA Administration (%)	956	19,97	4,55	45,19	6,98
Total Spending (R$/hab.)	956	4.084,78	1.471,53	9.799,45	1.493,16
Primary Spending (R$/hab.)	954	4.024,35	57,22	161.302,30	6.212,66
Interests (R$/hab.)	956	12,30	0,00	113,28	15,87
Other Primary Spending (R$/hab.)	954	1.659,27	25,56	80.784,94	2.801,19
Consumption Material (R$/hab.)	954	434,02	0,00	7.644,55	349,26
Freely Distributed Material (R$/hab.)	954	63,83	0,00	1.277,66	79,39
Third Party Services: Individuals (R$/hab.)	954	37,18	0,00	425,79	44,15
Third Party Services: Legal Persons (R$/hab.)	954	770,79	0,00	52.001,52	1.764,06
Stipends (R$/hab.)	954	19,80	0,00	183,32	19,77
Staff (R$/hab.)	954	2.350,44	31,57	78.606,92	3.500,70
Capital Spending (R$/hab.)	954	378,89	4,75	12.506,90	508,06
Municipal HDI	956	0,72	0,55	0,85	0,04
Municipal HDI-Education	956	0,62	0,36	0,80	0,07
Municipal HDI-Longevity	956	0,84	0,76	0,89	0,03
Municipal HDI-Income	956	0,72	0,57	0,87	0,04
Life Expectancy	956	75,12	70,91	78,64	1,54
Years of Schooling Expectancy	956	10,35	7,35	12,83	0,86
Gini Coefficient	956	0,46	0,28	0,72	0,06

Source: own elaboration.

Table 5: Comparison of Municipalities (Treated vs. Control)

Variable	Treated	Control	t	p-value
GDP (R$ millions)	5,319.51	297.83	-8.24	0.00
GDP Per Capita (R$ 1000)	27.77	21.4	-8.08	0.00
Taxes (R$ millions)	846.51	34.66	-7.56	0.00
Taxes Per Capita (R$ 1000)	4.01	1.68	-11.92	0.00
Population (1000 hab.)	170.04	13.12	-9.38	0.00
VA Agriculture (%)	7.09	35.16	46.7	0.00
VA Industry (%)	30.41	16.05	-15.83	0.00
VA Services (%)	49.42	30.64	-25.21	0.00
VA Administration (%)	13.08	18.15	19.63	0.00
Municipal HDI	0.68	0.6	-13.31	0.00
Municipal HDI-Education	0.54	0.44	-11.39	0.00
Municipal HDI-Longevity	0.81	0.78	-8.61	0.00
Municipal HDI-Income	0.71	0.64	-12.79	0.00
Life Expectancy	73.4	71.54	-8.59	0.00
Years of Schooling Expectancy	10.31	10.09	-2.35	0.02
Gini Coef.	0.54	0.52	-2.98	0.00
Total Spending (R$/hab.)	1,803.85	2,300.6	11.65	0.00
Primary Spending (R$/hab.)	1,507.02	2,128.23	9	0.00
Interests (R$/hab.)	16.01	8.18	-8.35	0.00
Other Primary Spending (R$/hab.)	729.97	1,098.62	9.85	0.00
Consumption Material (R$/hab.)	151.97	373.2	31.1	0.00
Freely Distributed Material (R$/hab.)	16.3	31.59	11.65	0.00
Third Party Services: Individuals (R$/hab.)	31.69	50.03	8.55	0.00
Third Party Services: Legal Persons (R$/hab.)	394.34	435.31	1.83	0.07
Stipends (R$/hab.)	3.11	13.27	27.52	0.00
Staff (R$/hab.)	761.39	1,020.08	7.78	0.00
Capital Spending (R$/hab.)	254.71	359.8	7.98	0.00
Distance (Km)	265.91	308.25	3.37	0.00

Source: own elaboration.

Table 6: Comparison of Municipalities (Treated vs. Control: matched sample)

Variable	Treated	Control	t	p-value
GDP (R$ millions)	5,319.51	800.49	-7.39	0.00
GDP Per Capita (R$ 1000)	27.77	22.98	-5.79	0.00
Taxes (R$ millions)	846.51	114.13	-6.79	0.00
Taxes Per Capita (R$ 1000)	4.01	2.72	-6.14	0.00
Population (1000 hab.)	170.04	33.18	-8.15	0.00
VA Agriculture (%)	7.09	18.28	15.58	0.00
VA Industry (%)	30.41	25.18	-5.08	0.00
VA Services (%)	49.42	41.19	-10.01	0.00
VA Administration (%)	13.08	15.35	7.59	0.00
Municipal HDI	0.68	0.64	-6.15	0.00
Municipal HDI-Education	0.54	0.49	-5.43	0.00
Municipal HDI-Longevity	0.81	0.79	-4.02	0.00
Municipal HDI-Income	0.71	0.68	-5.74	0.00
Life Expectancy	73.4	72.38	-4.01	0.00
Years of Schooling Expectancy	**10.31**	**10.19**	**-1.23**	**0.22**
Gini Coef.	**0.54**	**0.54**	**-0.49**	**0.62**
Total Spending (R$/hab.)	1,803.85	1,695.42	-2.34	0.02
Primary Spending (R$/hab.)	**1,507.02**	**1,480.8**	**-0.55**	**0.58**
Interests (R$/hab.)	16.01	7.3	-9.01	0.00
Other Primary Spending (R$/hab.)	**729.97**	**707.97**	**-0.84**	**0.40**
Consumption Material (R$/hab.)	151.97	217.57	10.2	0.00
Freely Distributed Material (R$/hab.)	16.3	20.29	2.63	0.01
Third Party Services: Individuals (R$/hab.)	31.69	38.63	2.51	0.01
Third Party Services: Legal Persons (R$/hab.)	394.34	305.56	-5.4	0.00
Stipends (R$/hab.)	3.11	6.01	8.51	0.00
Staff (R$/hab.)	**761.39**	**765.55**	**0.17**	**0.86**
Capital Spending (R$/hab.)	254.71	242.75	-1.02	0.31
Distance (Km)	265.91	308.25	3.37	0.00

Source: own elaboration.

Figure 2: Parallel Trends in Per Capita Expenditures (R$)

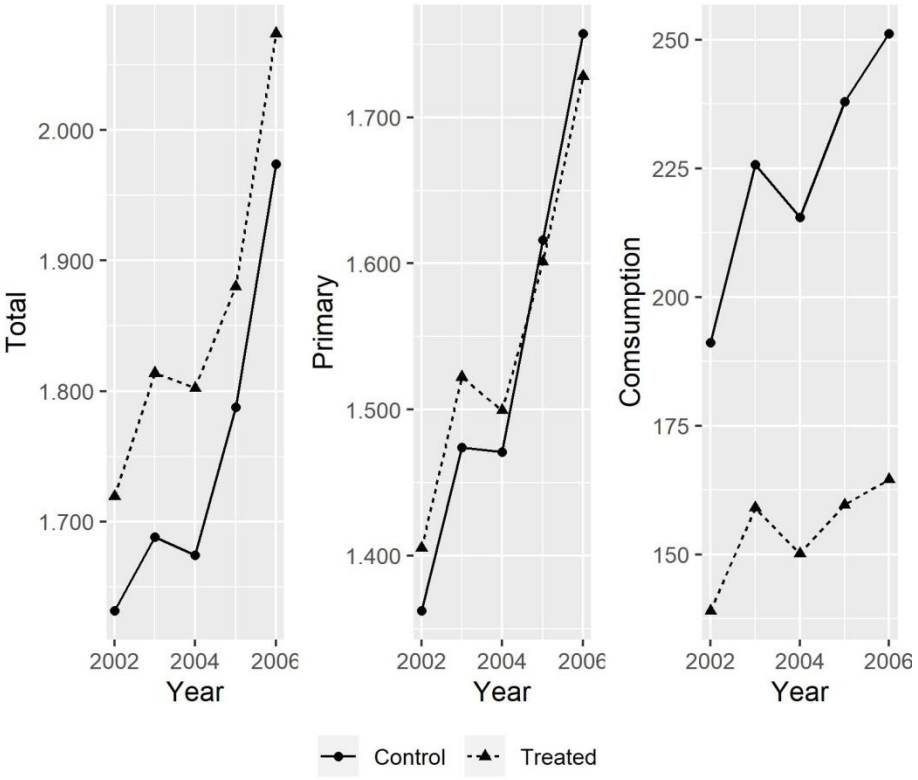

Table 7: OSB Impact on Municipal Expenditures (1)

	Total	Primary	Interest	Other	Staff	Capital
OSB	-123.78*	-99.17*	1.57	-65.14*	-35.06	-15.98
	(65.85)	(54.08)	(1.55)	(35.28)	(27.95)	(23.90)
N	4,224	4,224	4,224	4,224	4,224	4,224
R^2	0.74	0.87	0.67	0.74	0.90	0.53

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Standard errors clustered by municipality.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 8: OSB Impact on Municipal Expenditures (2)

	Total	Primary	Interest	Other	Staff	Capital
OSB (#years)	-9.47	-10.89	1.71*	-4.59	-7.92	3.19
	(31.25)	(25.03)	(0.97)	(17.29)	(14.05)	(12.56)
N	4,224	4,224	4,224	4,224	4,224	4,224
R^2	0.74	0.87	0.67	0.74	0.90	0.53

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Standard errors clustered by municipality.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 9: OSB Impact on Municipal Expenditures (3)

	Total	Primary	Interest	Other	Staff	Capital
OSB 1 year	-91.76	-68.98	2.66*	-51.07	-20.04	-12.97
	(63.79)	(50.79)	(1.46)	(31.33)	(50.79)	(25.13)
OSB 2 years	-132.36	-113.65	3.21	-63.24	-53.04	-8.80
	(111.47)	(95.37)	(2.58)	(64.57)	(95.37)	(30.04)
OSB 3 years	-143.69	-148.48	4.28	-83.16	-68.98	8.16
	(114.04)	(97.57)	(3.38)	(65.27)	(97.57)	(48.28)
OSB 4 years	-142.24	-117.63	5.06	-57.82	-64.24	-12.96
	(135.19)	(109.70)	(4.06)	(77.74)	(109.70)	(56.76)
OSB 5 years	-103.34	-108.60	7.63*	-61.08	-54.38	13.89
	(163.81)	(130.61)	(4.41)	(89.08)	(130.61)	(69.94)
OSB 6 years	-80.13	-71.98	8.88*	-40.72	-39.62	8.28
	(191.41)	(148.99)	(5.19)	(104.28)	(148.99)	(78.68)
OSB 7 years	-18.81	-6.54	12.24*	5.61	-24.13	7.67
	(225.72)	(173.24)	(6.58)	(113.85)	(173.24)	(93.67)
OSB 8 years	56.81	26.28	19.70**	21.71	-14.69	44.03
	(254.10)	(193.04)	(8.86)	(135.81)	(193.04)	(109.46)
OSB 9 years	272.24	177.61	21.83**	102.06	54.12	109.39
	(284.44)	(209.18)	(8.69)	(152.89)	(209.18)	(134.74)
OSB 10 years	306.49	269.32	26.33***	159.97	83.55	64.03
	(309.86)	(233.88)	(9.78)	(164.16)	(233.88)	(133.83)
OSB 11 years	383.18	352.44	32.63***	241.16	78.99	44.86
	(344.03)	(260.06)	(11.00)	(181.10)	(260.06)	(150.61)
OSB 12 years	-3.37	285.66	36.22***	-179.34	430.60	-258.52
	(427.57)	(340.99)	(11.11)	(223.69)	(340.99)	(168.50)
N	4,224	4,224	4,224	4,224	4,224	4,224
R2	0.74	0.87	0.67	0.74	0.90	0.53

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Standard errors clustered by municipality.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 10: OSB Impact on Municipal Expenditures (4)

	Consp.	Free Dist.	Services. Individuals	Services. Legal Entities	Stipends
OSB	-8.11	-6.22*	1.82	-54.07*	3.32
	(8.65)	(3.48)	(2.91)	(28.21)	(4.04)
N	4,224	4,224	4,224	4,224	4,224
R^2	0.68	0.74	0.33	0.68	0.66

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.
Standard errors clustered by municipality.
Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 11: OSB Impact on Municipal Expenditures (5)

	Consp.	Free Dist.	Services. Individuals	Services. Legal Entities	Stipends
OSB (# years)	0.74	-1.42	-0.57	-10.84	1.15*
	(3.03)	(1.92)	(1.37)	(13.02)	(0.68)
N	4,224	4,224	4,224	4,224	4,224
R2	0.68	0.74	0.33	0.68	0.66

Notes: ***Significant at 1 %.
**Significant at 5 %.
*Significant at 10 %.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 12: OSB Impact on Municipal Expenditures (6)

	Consumption	Free Dist.	Services. Individuals	Services. Legal Entities	Stipends
OSB 1 year	-7.67	-5.63	0.54	-44.21*	4.19
	(9.24)	(3.49)	(2.81)	(23.54)	(4.59)
OSB 2 years	-1.82	-7.53	2.32	-69.81	3.40
	(9.62)	(5.78)	(3.54)	(53.91)	(3.18)
OSB 3 years	-8.12	-10.22	0.10	-72.55	4.17
	(11.26)	(7.29)	(3.91)	(50.96)	(3.58)
OSB 4 years	0.53	-8.77	-0.02	-58.94	4.91
	(13.76)	(8.33)	(5.22)	(60.83)	(4.04)
OSB 5 years	4.45	-7.35	-5.09	-67.34	6.62
	(16.51)	(9.27)	(7.69)	(70.13)	(4.70)
OSB 6 years	-6.21	-6.35	-5.20	-60.88	7.80
	(20.28)	(11.61)	(9.25)	(78.35)	(4.88)
OSB 7 years	5.34	-6.59	-4.24	-44.33	9.27*
	(22.16)	(14.03)	(9.84)	(84.55)	(5.06)
OSB 8 years	8.87	-8.04	-5.71	-122.02	10.01*
	(25.58)	(14.48)	(11.75)	(105.33)	(5.14)
OSB 9 years	21.53	-11.62	-4.37	14.26	12.29**
	(29.58)	(17.20)	(13.96)	(114.36)	(6.00)
OSB 10 years	13.61	-18.75	-12.74	-6.42	14.17**
	(36.44)	(18.67)	(17.66)	(123.75)	(6.49)
OSB 11 years	52.08	-18.67	-7.63	30.78	15.78**
	(37.92)	(21.08)	(17.79)	(126.55)	(6.59)
OSB 12 years	-13.45	-79.34***	-35.91*	-128.84	24.07*
	(45.26)	(24.96)	(20.05)	(181.12)	(13.98)
N	4,224	4,224	4,224	4,224	4,224
R2	0.68	0.74	0.33	0.68	0.66

Notes: ***Significant at 1 %.
**Significant at 5 %.
*Significant at 10 %.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 13: OSB Impact on Municipal (< 50,000 hab.) Expenditures (7)

	Total	Primary	Interest	Other	Staff	Capital
OSB	-187.53*	-113.17	2.09	-100.10*	-15.22	-81.69*
	(107.54)	(99.93)	(2.11)	(54.98)	(60.58)	(42.35)
N	2,944	2,944	2,944	2,944	2,944	2,944
R^2	0.75	0.88	0.65	0.75	0.91	0.53

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Standard errors clustered by municipality.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 14: OSB Impact on Municipal (< 50,000 hab.) Expenditures (8)

	Total	Primary	Interest	Other	Staff	Capital
OSB (#years)	39.21	10.41	0.39	16.78	-6.76	25.31
	(60.82)	(51.79)	(1.43)	(28.26)	(30.87)	(24.02)
N	2,944	2,944	2,944	2,944	2,944	2,944
R^2	0.75	0.88	0.65	0.74	0.91	0.53

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Standard errors clustered by municipality.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 15: OSB Impact on Municipal (< 50,000 hab.) Expenditures (9)

	Total	Primary	Interest	Other	Staff	Capital
OSB 1 year	-173.87	-90.53	2.19	-97.58*	4.77	-92.21*
	(120.58)	(103.81)	(1.94)	(55.96)	(65.50)	(51.13)
OSB 2 years	-84.54	-71.56	3.98	-40.60	-34.90	-20.09
	(146.77)	(127.41)	(2.93)	(68.30)	(75.02)	(61.11)
OSB 3 years	-22.32	-83.09	-1.19	-22.25	-59.59	50.90
	(172.22)	(186.31)	(6.23)	(98.86)	(107.15)	(96.90)
OSB 4 years	134.94	-3.28	-0.56	70.85	-73.64	121.04
	(206.06)	(192.14)	(5.99)	(117.20)	(103.20)	(100.23)
OSB 5 years	355.32	89.31	1.36	104.98	-16.97	249.72**
	(234.74)	(217.92)	(6.28)	(120.93)	(133.94)	(126.61)
OSB 6 years	389.36	176.72	3.65	189.53	-16.36	193.21
	(311.03)	(273.95)	(7.58)	(152.57)	(174.04)	(137.48)
OSB 7 years	367.73	226.57	0.83	184.93	40.70	110.50
	(594.04)	(466.81)	(8.63)	(220.38)	(275.59)	(176.94)
OSB 8 years	-1.191.33***	-579.28	-10.26	-167.13	-401.85*	-632.18***
	(450.88)	(381.24)	(7.44)	(177.54)	(226.32)	(140.85)
N	2,944	2,944	2,944	2,944	2,944	2,944
R2	0.75	0.88	0.65	0.75	0.91	0.53

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Standard errors clustered by municipality.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 16: OSB Impact on Municipal (< 50,000 hab.) Expenditures (10)

	Consp.	Free Dist.	Services. Individuals	Services. Legal Entities	Stipends
OSB	-18.04	-16.86**	8.51	-42.88	10.13
	(22.19)	(8.43)	(7.54)	(31.98)	(11.70)
N	2,944	2,944	2,944	2,944	2,944
R^2	0.68	0.74	0.33	0.67	0.66

Notes: ***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.
Standard errors clustered by municipality.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 17: OSB Impact on Municipal (< 50,000 hab.) Expenditures (11)

	Consp.	Free Dist.	Services. Individuals	Services. Legal Entities	Stipends
OSB (# years)	-0.98	-1.86	-0.14	18.95	2.46
	(7.04)	(5.24)	(3.58)	(19.44)	(2.64)
N	2,928	2,928	2,928	2,928	2,928
R2	0.68	0.74	0.33	0.67	0.66

Notes: ***Significant at 1 %.
**Significant at 5 %.
*Significant at 10 %.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.

Table 18: OSB Impact on Municipal (< 50,000 hab.) Expenditures (12)

	Consumption	Free Dist.	Services. Individuals	Services. Legal Entities	Stipends
OSB 1 year	-18.31	-15.62*	5.46	-49.82*	11.96
	(25.38)	(8.15)	(7.20)	(29.08)	(13.38)
OSB 2 years	-6.25	-16.39	12.25	-3.43	8.08
	(20.04)	(14.53)	(9.49)	(45.97)	(8.45)
OSB 3 years	-25.02	-12.45	4.87	44.97	8.05
	(22.91)	(16.76)	(9.78)	(64.21)	(9.15)
OSB 4 years	6.19	-10.11	-2.94	102.29	7.91
	(36.30)	(19.03)	(16.21)	(66.27)	(10.40)
OSB 5 years	0.72	-1.53	-11.25	116.70	11.46
	(32.91)	(20.94)	(24.35)	(89.95)	(12.00)
OSB 6 years	5.14	1.75	-6.86	149.84	13.68
	(40.78)	(27.89)	(26.63)	(107.06)	(13.02)
OSB 7 years	12.82	-10.72	-11.98	109.93	15.95
	(47.58)	(41.46)	(25.52)	(128.90)	(13.17)
OSB 8 years	-4.32	-53.59	-48.89***	-36.68	26.30*
	(36.67)	(34.78)	(14.55)	(110.17)	(13.81)
N	2,928	2,928	2,928	2,928	2,928
R2	0.68	0.74	0.33	0.67	0.67

Notes: ***Significant at 1 %.
**Significant at 5 %.
*Significant at 10 %.

Controls: fixed effects for municipalities, years, mayors, political parties of the mayor, linear trends by municipality and interactions between mayors and terms.