SOCIAL INEQUALITY AND ELECTION FINANCING IN BRAZILIAN MUNICIPALITIES

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Abstract: Recent political economy literature suggests that high income inequality causes different social classes to increase their contributions to electoral campaigns. This study examines the impact of inequality on the costs of municipal elections in Brazil. Econometric fixed effects models estimated with panel data for Brazilian municipal elections from 2004 to 2016 confirm that more unequal municipalities tend to have more expensive elections for both mayoral and local representatives.

Keywords: Campaign Financing; Income Inequality; Lobby; Elections; Brazil.

1 Introduction

One of the fundamental characteristics of income distribution in Brazil is its deep inequality. Despite having dropped in the country until 2014, the Gini[3] index started to rise again as the income of the poorest fell and that of the richest increased from the end of that year (NERI, 2019). The relationship between social inequality and other economic variables has been the subject of study by economists at least since the mid-20th century. Kuznets (1955), for instance, proposed an inverted-U relationship between inequality and economic growth. For Kuznets, inequality would increase as a country develops, and after a certain point, it would start to decrease.

However, it is also possible to reverse Kuznets' reasoning and question how inequality affects economic growth. Empirical and theoretical studies indicate that very high levels of inequality tend to negatively affect economic growth (PERSSON; TABELLINI, 1994; ALESINA; RODRIK, 1994; CINGANO, 2014).

Inequality, however, is related to other factors. Engerman and Sokoloff (2002) show how inequality can influence the quality of institutions. Acemoglu and Robinson (2000), for example, propose a political economy model linking inequality to political participation, showing that the extension of voting rights to more humble layers of society in 19th-century Europe would be at the origin of the subsequent reduction of inequality.

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[3] The Gini Index is a commonly used coefficient to measure income inequality. The index ranges from 0 to 1, where 0 corresponds to complete income equality and 1 to complete inequality.

Acemoglu and Robinson's (2000) work draws attention to the importance of elections for economic balance. However, understanding the role of social inequality in the electoral process is not as simple as counting votes. The financing of elections and the ability of interest groups to form lobbies play a central role in the outcomes of elections. Baron (1994) and Roemer (2003) are some examples of studies in which campaign contributions are used as a way to attract votes through political campaigns.

In Brazil, electoral campaigns, besides being extremely expensive, were heavily financed by corporations until 2016, which hindered a more equal representation in democratic institutions (SAMUELS, 2001). Moreover, Downs (1957) had already observed that, in a world with imperfect information, lobbies have power to influence voters. In this regard, income inequality and the divergent preferences for redistribution of resources that its increase may cause gain importance in the context of electoral campaign financing. On the other hand, the country is also a young democracy, which implies that confidence in the electoral process is fundamental to maintaining the democratic system (MOISÉS, 2010).

More recent literature seeks to understand the relationship between income inequality and electoral financing. Bugarin et al. (2011) developed a political economy model and showed how income inequality can affect election financing, predicting that more unequal societies tend to have more expensive campaigns. This is because more inequality implies differences in preferences between individuals from different social classes. For example, rich people tend to want lean governments with a low tax burden, while poor people prefer more government intervention with more social spending, even if this increases taxes in the country. Therefore, lobbyists from a certain class, fearful that a very bad policy for them may be implemented if the party representing the other class wins the elections, are more willing to finance electoral campaigns for the parties that represent them, thus increasing electoral expenditure.

Bugarin (2015) and Bugarin and Tanaka (2018) tested this hypothesis, respectively, for the 2004 Brazilian municipal elections and the House of Councilors elections in Japan, and for the 2012 Brazilian municipal elections. In all cases, a positive relationship of election spending was found by the Gini Index, reinforcing that the more unequal a society is, the higher the per-capita cost of elections tends to be.

As regards the studies using Brazilian data, as highlighted above, only the cross-section methodology was used, which leaves the relationship between inequality and election campaign costs over time open. The main unanswered question is whether the property found is a peculiarity of the specific elections studied (those of 2004 and 2018), or whether it is a stylized fact that is maintained over time. This study aims to answer that question in order to fill that gap in the literature.

Therefore, this study is the first in this line of research to use a data panel (from 2004 to 2016) for Brazilian municipal elections. The main results confirm the findings of previously conducted studies, and point to a positive relationship between income inequality and electoral spending. That is, the higher the inequality in a municipality, the higher the (per-capita) cost of electoral campaigns. The remainder of this study is organized as follows: section 2 briefly discusses the political economy model that justifies the positive relationship between inequality and electoral financing. Section 3 contains the methodology and a description of the econometric models used. Sections 4 and 5 describe the panel data for municipal elections. Sections 6 and 7 present the results for the estimations with electoral data for mayoral and city-council candidates. Section 8 discusses the results obtained and section 9 concludes the study by presenting some public policy implications.

2 Electoral Competition Model

The electoral competition model between parties, lobbyists, and voters on which this study is based can be found in Bugarin et al. (2011) and Bugarin (2015). Appendix A contains a detailed description of the model.

Briefly, 2 political parties representing 2 social classes, rich and poor, announce a certain amount (per capita) of a public asset g to be provided if their party wins the election. Each party has a preferred provision of g, which is the same as that of the social class it represents. The model assumes that the rich prefer a smaller provision of g than the poor because they pay more for such an asset. Prior to elections, parties announce the provision of g that they intend to implement. Initially, parties may announce platforms that are close to those preferred by their respective classes, but there is the possibility of winning votes from the other social class by influencing voters through political propaganda or by deviating from the party's original platform, moving toward the opponent's platform. In other words, there is a trade-off between ideology and votes. The greater the income inequality, the greater the difference between the parties' preferred platforms because the greater the difference is in the preference for the public asset g.

Lobbyists on both sides predict that should the other party win the election, a very different policy from their ideal one may be implemented. Therefore, the greater the income inequality, the more lobbyists will be willing to contribute to the campaign financing of their own parties. Thus, greater social inequality implies more electoral spending.

3 Methodology

This study uses panel data to estimate the relationship between social inequality and electoral spending in Brazilian municipalities. All estimates were done using the STATA 14 software. Here, the period is four years (2004-2016), so there are four observations for each municipality. Panels allow for eliminating the bias caused by an individual unobservable time invariant factor. The correlation of such a factor with the other explanatory variables determines the most appropriate panel model. It is possible to ignore the panel structure and estimate the model as a cross-section (pooled OLS). However, if the factor is correlated with the other explanatory variables, fixed effects is the most appropriate model. If there is no correlation between the unobservable factor and the other variables, the choice is usually the random effects model. (PARK, 2011). All models presented below are variations of the following specification, which is similar to the one utilized by Bugarin (2015), who also used a panel for the Japanese case.

$$y_{i,t} = \alpha + \beta Gini_{i,t} + \Gamma_1 CON_{i,t} + \Gamma_2 Y_{i,t} + \mu_i + \epsilon_{i,t}$$

Where $y_{i,t}$ is the log of campaign spending or revenue in municipality i in year t. $Gini_{i,t}$ is the Gini Index in municipality i in year t and β is the coefficient of interest, whose expected sign is positive. $CON_{i,t}$ is the vector of control variables described above, and $Y_{i,t}$ is a vector with year dummies. Both vectors have their corresponding coefficient vectors Γ_1, and Γ_2. μi is the time invariant individual effect; α is the constant, and $\epsilon_{i,t}$ is the error term.

The main hypothesis is:

$$\begin{cases} H_0: \beta > 0 \\ H_1: \beta \leq 0 \end{cases}$$

Where β is the coefficient for the Gini index variable.

To choose the most suitable model, pooled OLS, random effects and fixed effects specifications were tested, but only the results for fixed effects are shown, since the Chow, Breusch-Pagan and Hausman tests (tests for choosing panel models) indicated that the most suitable model is the fixed effects one. The results for such tests can be seen in Table 1.

Another concern with the models presented here refers to the estimation of standard errors. In fact, the Wald test for heteroscedasticity (Table 1) in fixed effects models indicated the presence of heteroscedastic errors. This does not affect the size of the estimators, but it does have an impact on the variance of the estimators, which invalidates the hypothesis tests. Therefore, this study clusters the error term at the municipal level, which makes the errors asymptotically robust to heteroscedasticity and serial correlation (WHITE, 1980; ALLERANO, 1987).

Table 1 – P-Values and statistics for the Chow, Breusch-Pagan, Hausman, year dummies and Wald tests.

	Chow		Breusch-Pagan		Hausman		Year Dummies		Wald	
Model	P-Value	Statistic	P-Value	Statistic	P-Value	Statistic	P-Value	Statistic	P-Value	Statistic
1	0	2.12	0	1326.65	0	13.55	0	233.30	0	1.7e+08
2	0	2.17	0	1390.06	0	66.22	0	268.11	0	4.5e+07
3	0	1.84	0	625.42	0	13.87	0	437.33	0	1.4E+09
4	0	1.87	0	625.42	0	15.48	0	484.31	0	2.8E+09
5	0	2.43	0	1918.15	0	82.86	0	371.7	0	3.70E+07
6	0	2.43	0	1903.40	0	25.93	0	372.99	0	2.10E+07
7	0	2.50	0	2029.78	0	95.16	0	410.19	0	3.20E+07
8	0	2.28	0	1265.84	0	13.23	0	323.67	0	7.30E+10
9	0	2.53	0	1610.75	0	14.70	0	415.93	0	2.40E+09
10	0	2.30	0	1265.84	0	18.12	0	368.21	0	2.40E+10

Source: Designed by the authors, 2021.

Note: The tests used for choosing the best panel model were Chow, Breusch-Pagan and Hausman. The statistics and P-values shown in Table 1 are, respectively, F for the Chow test, chibar2 (Stata) for Breusch-Pagan and F for Hausman. In all cases, the best model was the fixed effects model. The table also contains an F-test for the year dummies and the Wald test for heteroscedasticity. In this case, the statistic is Chi square.

Another potential problem concerns the normality of the errors. Non-normal errors do not affect MQO estimators (WILLIANS et al., 2013), but they do affect the hypothesis tests. However, the central limit theorem guarantees that, in large samples, the errors are asymptotically normally distributed, which implies that the t and F tests will be correct even in the presence of non-normal errors (ALI; SHARMA, 1996; LUMLEY et al., 2002; KNIEF; FORSTMEIER, 2018).

Multicollinearity (that is, very high correlations between explanatory variables) can also be present in the sample. This is another problem that does not affect the estimators, but inflates their standard errors, thus reducing the statistical significance of the variables (ALIN, 2010). In the econometric literature, there is a discussion concerning the real problem caused by multicollinearity. Goldberger (1991), for example, argues that researchers should not be concerned about multicollinearity, but should pay attention to the variances of the estimators, which must be of a reasonable size for the estimates to be useful. Even so, the VIFs (variance inflation factors) are reported in Table 10 in Appendix C. VIFs larger than 10 may pose a problem (JAMES et al., 2013). In the case of the models in this study, with the exception of interactions, VIFs are less than 10, except for the urban and voter variables. As a robustness test, the regressions without the urban variable are presented in Appendix C. The main results remain unchanged.

Finally, the BACON algorithm was used for outlier detection (BILLOR et al., 2000). Depending on the model, 60 to 110 observations can be classified as outliers, consisting of capital cities and other large cities. Removing the outliers from the sample results in slightly smaller estimated coefficients, but it does not change the main conclusions. However, removing them may not be the best option, as important municipalities in the sample are excluded. Thus, we chose to present the results with the full sample.

4 Dependent Variables

The data regarding election spending for municipal elections were collected from the website of the Superior Electoral Court (TSE)[4]. TSE records contain individual expenditure and revenue data for each candidate. Thus, each entry corresponds to a declared expenditure (or revenue) of a candidate in a given municipality. The values used here were obtained by aggregating the candidates' expenditures per municipality per election, deflated to 2012 Brazilian R$[5]. Thus, the value for electoral revenues for councilors in the city of São Paulo in 2012, for example, is the sum of all the revenues declared by all the candidates for councilor in the city of São Paulo in the said year.

Election campaigns in Brazil receive both public and private resources. The Partisan Fund is one of the main sources of public funding for campaigns, and it gained even more importance in 2016, when new rules for electoral funding, which prohibited donations from legal entities, came into effect. In this study, private funding is defined as the sum of the values of donations from individuals (including donations from the candidate himself) and from legal entities (until 2012). From 2004 to 2016, private financing accounted for 84%, 67%, 30%, and 39% of the sum of all electoral resources of candidates in our sample, respectively.

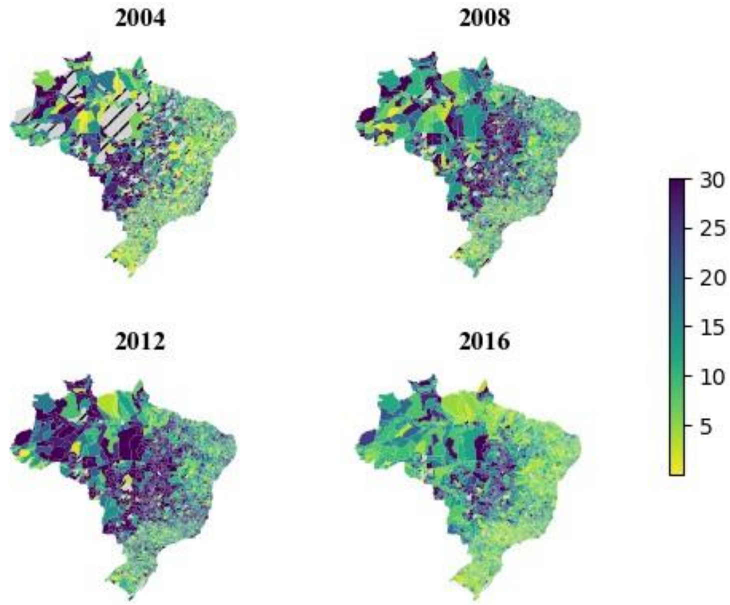
This study uses two different panels covering municipal elections from 2004 to 2016. The first panel covers private campaign revenues for mayors, and the second for councilors. In addition to private revenues, we also used the values of estimated resource write-offs, which are not cash donations, but estimates in monetary values of goods and services donated to candidates. This variable is important because it represents an expense (and not an income) financed entirely by private resources.

Figure 1 plots total aggregate election spending per voter in each municipality for mayors and councilors. Figure 2 plots aggregate private donations per voter in each municipality. Both graphs suggest that spending per voter in the Midwestern and Northern regions was higher. It is also possible to note that elections for mayors demand more resources.

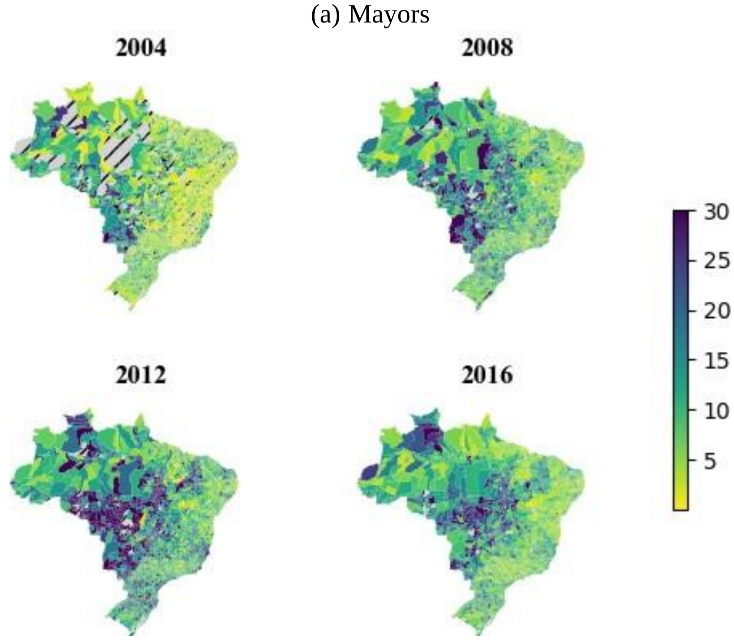
[4] Available at https://www.tse.jus.br/hotsites/pesquisas-eleitorais/prestacao_contas.html

[5] It is important that all monetary values be at constant values so that the effect of inflation is disregarded. The year for which the values will be deflated is arbitrary. However, it is more convenient to deflate for a sample year.

Figure 1 – Total campaign spending per voter (in thousands of 2012 R$).



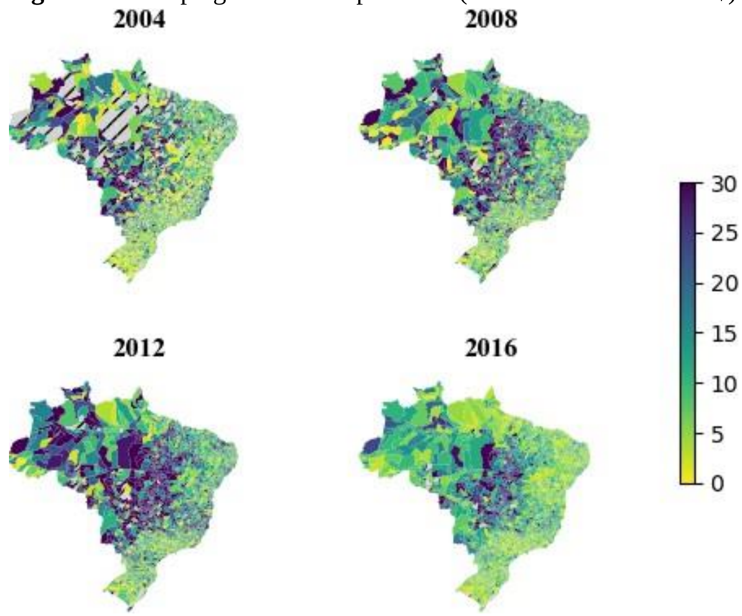
(a) Mayors



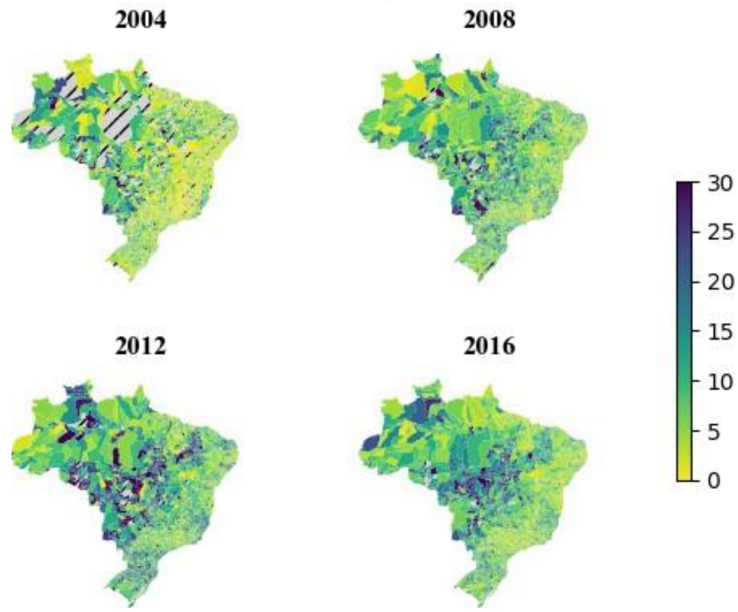
(b) Councilmen

Source: Designed by the authors based on TSE data, 2021.

Figure 2 – Campaign donations per voter (in thousands of 2012 R$).



(a) Mayors



(b) Councilmen

Source: Designed by the authors based on TSE data, 2021.

The aggregate private campaign revenues for mayors and councilors were divided by the population and the number of voters in each municipality (in thousands), thus forming the variables **Pref/Hab**, **Pref/Ele**, **Ver/Hab** and **Ver/Ele**. For councilors, the last variable was further divided by the number of seats in dispute, forming the variable **Ver/Ele/Vag**. The population estimates for each municipality were obtained from IBGE[6], and the number of voters and seats from TSE. The dependent variables used in this study are the base-10 logarithm of the above variables and the addition of number 1 in order to avoid the loss of observations due to municipalities with no private donations. Table 2 contains the description of the calculation of such variables.

Table 2 – Transformations in the dependent variables with campaign donations.

Variable	Transformation
Pref/Hab	$log_{10}\left[\left(\sum_{p} D_i\right)/(1000 * H_i) + 1\right]$
Pref/Ele	$log_{10}\left[\left(\sum_{p} D_i\right)/(1000 * E_i) + 1\right]$
Ver/Hab	$log_{10}\left[\left(\sum_{v} D_i\right)/(1000 * H_i) + 1\right]$
Ver/Ele	$log_{10}\left[\left(\sum_{v} D_i\right)/(1000 * E_i) + 1\right]$
Ver/Ele/Vag	$log_{10}\left[\left(\sum_{v} D_i\right)/(1000 * E_i * V_i) + 1\right]$

Source: Designed by the authors, 2021.
Note: i: municipality, p: mayoral candidates, v: candidates for councilor, D_i: campaign donatins in municipality i, H_i: residents in municipality i, E_i: voters in municipality i, V_i: seats for councilor in municipality i.

Resources from write-offs are not a large share of mayoral election expenditures (only 19%), but they represent approximately 44% of the campaign expenditures of city councilors. Figure 3 shows the proportions of spending types (write-offs *v.s.* ordinary spending) for 6 sizes of municipalities. Until 2012, city council candidates in small towns were highly dependent on write-offs.

The variables based on write-off resources were calculated exactly as described above and are the base-10 logarithm of the following transformations: **Be-Pref/Ele** and **Be-Pref/Hab** are the write-offs for mayoral candidates by voters and residents. **Be-Ver/Ele**, **Be-Ver/Ele/Vag**, and **Be-Ver/Hab** are the write-offs for city-council candidates by voters, voters per seat, and residents. Thus, this study takes into account two periods: from 2004 to 2016 for variables **Pref/Hab**, **Pref/Ele**, **Ver/Hab**, **Ver/Ele** and **Ver/Ele/Vag**, and from 2008 to 2016 for variables **Be-Pref/Ele**, **Be-Pref/Hab**, **Be-Ver/Ele**, **Be-Ver/Ele/Vag** and **Be-Ver/Hab**. Note that these variables are only available for the period after 2008.

[6] Available at https://www.ibge.gov.br/estatisticas/sociais/populacao/9103-estimativas-de -populacao.html?=&t=downloads

Table 3 describes the calculation of these variables, and Table 4 contains the descriptive statistics for all dependent variables used in the study before the logarithm was applied.

Table 3 – Transformations in the dependent variables with write-offs.

Variable	Transformation
Be-Pref/Hab	$log_{10}\left[\left(\sum_{p} BE_i\right)/(1000 * H_i) + 1\right]$
Be-Pref/Ele	$log_{10}\left[\left(\sum_{p} BE_i\right)/(1000 * E_i) + 1\right]$
Be-Ver/Hab	$log_{10}\left[\left(\sum_{v} BE_i\right)/(1000 * H_i) + 1\right]$
Be-Ver/Ele	$log_{10}\left[\left(\sum_{v} BE_i\right)/(1000 * E_i) + 1\right]$
Be-Ver/Ele/Vag	$log_{10}\left[\left(\sum_{v} BE_i\right)/(1000 * E_i * V_i) + 1\right]$

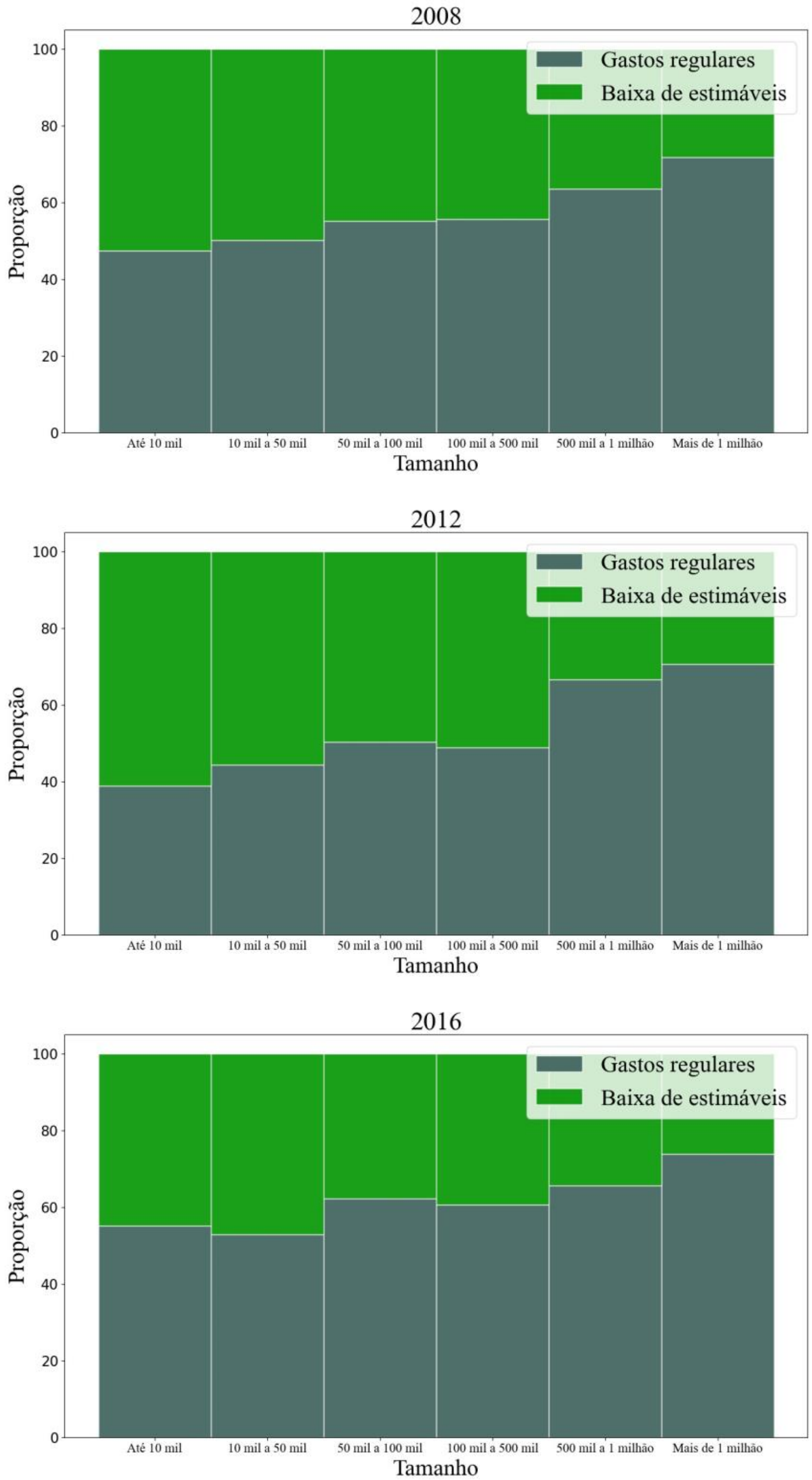
Source: Designed by the authors, 2021.
Note: i: municipality, p: mayoral candidates, v: candidates for councilman, BE_i: write-offs in municipality i. H_i: residentes in municipality i, E_i: voters in municipality i, V_i: seats for councilmen in municipality i.

Table 4 – Descriptive statistics for dependent variables.

	Obs.	Mean	Standard Deviation	Min	25%	50%	75%	Max
Pref/Ele	20044	13261.5	15135.27	0	5161.51	9358.86	16443.43	964483
Pref/Hab	20044	10279.71	12209.22	0	3846.08	7093.57	12688.01	689084.4
Ver/Ele	20044	9316.31	14523.36	0	3925.25	6771.97	11567.27	1384005
Ver/Ele/Vag	20044	985.59	1567.28	0	386.92	691.27	1229.85	153778.3
Ver/Hab	20044	7329.3	11374.02	0	2871.66	5064.91	8929.43	960563
Be-Pref/Ele	15033	4003.81	9291.91	0	887.94	2278	4934.02	956359.5
Be-Pref/Hab	15033	3146.71	6933.44	0	671.51	1757.2	3852.27	683280.5
Be-Ver/Ele	15033	6521.31	11267.69	0	1942.21	3971.08	7969.91	838652.4
Be-Ver/Ele/Vag	15033	686.67	1156.32	0	188.49	403.77	837.62	76241.13
Be-Ver/Hab	15033	5198.3	9625.44	0	1460.99	3043.47	6229.57	670105.6

Source: Designed by the authors, 2021.
Note: Private campaign revenues and write-ffs per capita, per voter, and per voter per mayoral and city-council seat (before the application of the logarithm and in constant 2012 R$). Write-off spending is only available from 2008 onwards.

Figure 3 – Proportion of election spending for councilmen: write-offs v.s. ordinary spending per year.



Source: Designed by the authors, 2021.

Proporção = Proportion
Gastos regulares = Regular spending
Baixa de estimáveis = Write-offs
Tamanho = Size
Até 10 mil = Up to 10 thousand
10 mil a 50 mil = From 10 thousand to 50 thousand
50 mil a 100 mil = From 50 thousand to 100 thousand
100 a 500 mil = From 100 thousand to 500 thousand
500 mil a 1 milhão = From 500 thousand to 1 million
Mais de 1 milhão = More than 1 million

5 Independent Variables

The main explanatory variable is the Gini Index. According to the model developed in Bugarin (2015), there should be a positive relationship between Gini and the cost of elections[7]. However, the Gini Index for Brazilian municipalities is not released in the same year when municipal elections occur. For this reason, this study uses data from RAIS to estimate the Gini coefficients for the years of interest. Details can be found in Appendix B. RAIS contains data on formal work in all Brazilian municipalities. Given the size of the informal economy in Brazil, the Gini coefficient estimated for formal income may not be an accurate measure of income inequality in the country. However, given the limitations imposed by the available data, it is used here as a proxy. Figure 4 shows the Gini indexes estimated from RAIS. It suggests a higher income inequality in the Northern region, despite the fact that the whole country is quite unequal. Tables 5 and 6 contain the description of the explanatory variables and the descriptive statistics.

Table 5 – Description of explanatory variables.

Variable	Description
Gini	Gini Index obtained from the strata of average income available in RAIS. The index varies from 0 to 1 (0 represents total equality and 1 total inequality).
Income	The base-10 logarithm of municipal per-capita income in constant 2012 R$. Municipal GDP was obtained from IBGE.
GiniIncome	The Gini-municipal income log interaction. This variable controls by the effect of inequality on election spending as the municipality grows. Interactions are common in econometric models, and they describe the relationship between the independent and dependent variables in conditional terms (FRIEDRICH, 1982).

[7] In the sample, the simple correlation between the Gini coefficient and private income per thousand voters is 0.1035 for mayors and 0.0306 for councilors.

Frag Educ	The educational fragmentation index. This variable is a proxy for how heterogeneous the electorate is in terms of education. The index is calculated as $1-\sum_{j=1}^{8}\epsilon_j$, where ϵ_j is the proportion of voters in class j of 8 different levels of education. The educational levels were retrieved from TSE, which contains the educational level of a voter at the time when he/she first registers or when he/she updates his/her registration. If all voters have the same educational level, the index should be 0. On the other hand, the variable takes on high values if all educational levels are well represented throughout the voters.
Young	The percentage of 16- and 17-year-olds among voters. For this age group, voting is optional.
Senior	The percentage of elderly people over the age of 70 among voters. For this age group, voting is optional. Both the Young and Senior variables were obtained from the TSE databases.
Frag Age	The age fragmentation index. This is a proxy for how heterogeneous the electorate is in terms of age. The index is calculated as $1-\sum_{j=1}^{11}v_j^2$, where v_j^2 is the proportion of voters in class j of 11 different age categories. Similarly to the education fragmentation index, the higher the index the more heterogeneous the electorate is in terms of age groups.
Urban	The municipality's urban population (in thousands).
Candidates	The number of candidates running for mayor or councilor (according to the model) and their squares.
Voters	The municipality's number of voters (in thousands).
Seats	The number of seats in dispute in elections for councilors. This variable applies only to models for councilors.
Sec Round	A dummy that takes value 1 if there is a second round of elections for mayor. Second rounds lengthen election campaigns, possibly increasing their costs.
ExecReelection	A dummy that takes value 1 if a mayoral candidate is running for re-election.
LegReelection	Number of councilor candidates running for reelection.
ExecReelected	A Dummy that takes value 1 if the mayoral candidate is re-elected.
LegReelected	Number of re-elected councilor candidates.

Source: Designed by the authors, 2021.

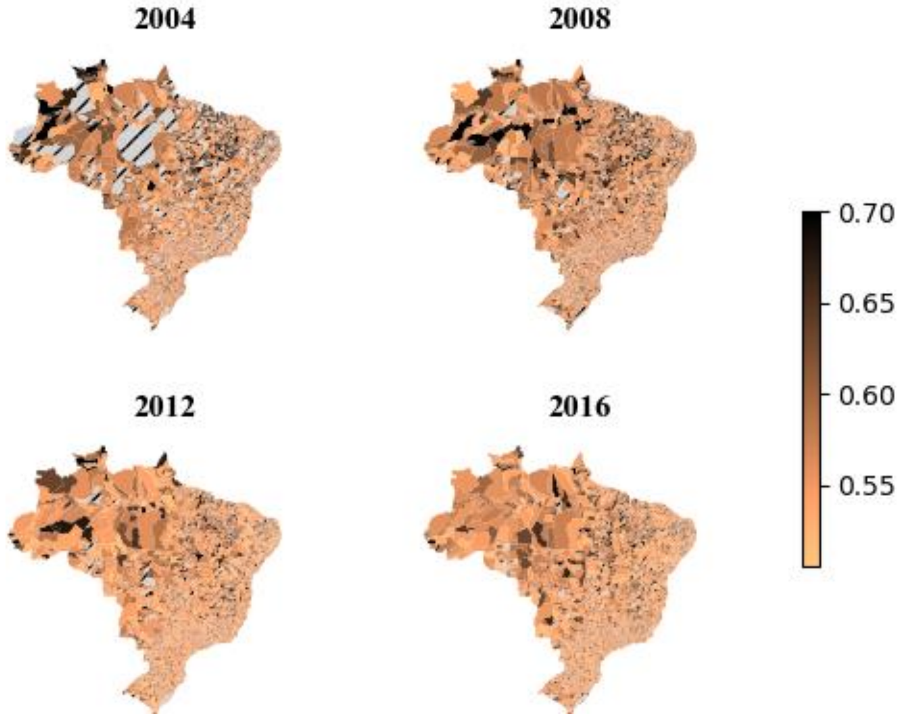
The controls are a set of demographic and electoral variables customarily used in the literature, and they are the same as those used by Bugarin (2015) and Bugarin and Tanaka (2018). The educational and age-structure variables capture the variation in demand for government services (ALMEIDA; SAKURAI, 2018). Because district size and the presence of incumbents can influence campaign financing (CURRY et al., 2013, WEINSCHENK; HOLBROOK, 2013), the number of candidates, seats, and voters, as well as re-election and those re-elected were also included. Income and urbanization variables are used by Bugarin (2015) and Bugarin and Tanaka (2018) to control for the size of the municipality's economy and its urban population, which are possibly correlated with election spending.

Table 6 – Descriptive statistics for explanatory variables (2004 - 2016).

	Obs.	Mean	Standard Deviation	Min	25%	50%	75%	Max
Gini	20044	0.58	0.05	0.5	0.55	0.56	0.59	0.92
Income	20044	1.02	0.32	0.24	0.76	1.02	1.24	2.89
GiniIncome	20044	2.94	0.35	2.09	2.69	2.87	3.14	5.02
Frag Educ	20044	0.75	0.04	0.45	0.73	0.76	0.78	0.86
Young	20044	0.04	0.01	0	0.02	0.03	0.04	0.1
Senior	20044	0.07	0.02	0.01	0.06	0.07	0.08	0.2
Frag Age	20044	0.84	0.01	0.78	0.83	0.84	0.84	0.87
Urban	20044	3035.06	21050.56	16.83	288.41	650.16	1630.47	1192983
ExecCandidates	20044	2.94	1.29	1	2	3	3	16
ExecCandidates2	20044	10.31	11.65	1	4	9	9	256
LegCandidates	20044	74.4	80.03	9	34	53	85	1714
LegCandidates2	20044	11939.95	64217.67	81	1156	2809	7225	2937796
Voters	20044	24.98	153.14	0.83	4.32	8.35	17.31	8886.32
Seats	20044	9.88	2.56	9	9	9	9	55
Sec Round	20044	0.01	0.09	0	0	0	0	1
ExecReelection	20044	0.49	0.5	0	0	0	1	1
LegReelection	20044	7.34	2.79	0	6	7	8	45
ExecReelected	20044	0.27	0.45	0	0	0	1	1
LegReelected	20044	3.71	1.97	0	2	4	5	33

Source: Designed by the authors, 2021.

Figure 4 – Gini coefficients for Brazilian municipalities 2004 - 2016.



Source: Designed by the authors, 2021.

6 Mayors - Results

Table 7 shows the results for the estimations with private campaign revenue and write-offs for mayors. In parentheses, below the estimated coefficients, are the standard errors. The dependent variables for regressions 1, 2, 3, and 4 are private revenues per voter, private revenues per resident, write-offs per voter, and write-offs per resident, respectively. In all cases, an F-test for the year dummies indicated that the year fixed effects should be maintained (Table 1).

As expected, the coefficient estimated for the Gini coefficient is positive and significant in all cases, indicating that income inequality affects campaign expenditures and revenues positively. This effect seems to be larger in terms of population than in terms of voters, since models 2 and 4 exhibit larger coefficients than models 1 and 3. Since the dependent variable is the base-10 logarithm (and not the natural logarithm) of a monetary value, the coefficients cannot be interpreted as percentage change. In fact, the 1.81 coefficient in regression 1 tells us that by setting all the other variables to their mean value in the sample, a 0.01 increase in the Gini coefficient implies a 0.0015 increase in the log of private revenues per voter for mayors in 2004. This difference seems small, but it implies that a 0.25-point drop in the Gini coefficient reduces private revenues by approximately R$ 0.65 per voter. It is noteworthy that, in this case, there is no reason to prefer the natural-basis logarithm over any other basis, since the percentage change interpretation of log-linear regressions is an approximation that is applicable only to small coefficients[8]. Although the specification in this study is not exactly the same as the one used in previous studies, given the panel structure of the data (all previous studies for Brazil were cross-sections), the main results go in the same direction as Bugarin (2015) and Bugarin and Tanaka (2018).

$GiniIncome$ has a negative coefficient and $Income$ has a positive coefficient, suggesting not only that candidates receive more donations in richer municipalities, but that the effect of income inequality tends to gradually decrease as a municipality gets richer. $FragEduc$ also has a positive coefficient, suggesting that citizens in municipalities with more heterogeneous educational levels tend to donate more. This tends to reinforce the results, since income inequality and educational fragmentation are expected to be highly correlated. It is also interesting to note that $Young$ and $Senior$ are positively correlated with private contributions. Since youngsters and seniors over 70 are not required to vote, candidates may have to spend more resources to attract votes from voters in such age groups. The number of candidates is also positively correlated with campaign costs. This is expected, since more candidates generate more competition, increasing the costs of elections. This effect, however, decreases as the number of candidates increases greatly, since the estimated coefficient for $Candidates2$ is negative.

Variables $Reelection$ e $Reelected$ show different signs. It was expected that the presence of candidates running for re-election would tend to reduce campaign costs due to the advantages that being in office provides. However, this was not the case for regressions 1 and 2. One possible explanation is that a candidate for re-election increases competition, since one more candidate represents a significant increase in the number of competitors (at least 75% of all municipalities had up to 3 mayoral candidates). In the case of those who do manage to get re-elected, the advantages of being in office may actually reduce the need for donations. Another explanation is that some candidates for re-election anticipate that they may lose the elections and tend to spend more on their campaigns, causing their bases to increase the volume of donations. In this case, the effect for non-re-elected mayors dominates that of re-elected ones in terms of private contributions.

[8] The relationship between log_10 (x) and ln(x) is that log_10 (x)=ln(x)/ln(10) =ln(x)/2.3. Thus, if regression 1 were estimated with ln(ExecPerVot) as the dependent variable, the estimated coefficient for the Gini variable would be 1.81*2.3=4.16, with the same t-statistics and P-Values. The advantage of using log_10 (x) is that the base 10 makes it easier to interpret predicted values. Suppose that by substituting numerical values into the explanatory variables in model 1, we get log_10 (ExecPerVot) = 4.5. If we know that log_10 (10000) = 4 and that log_10 (100000)=5 , it is easy to note that ExecPerVot ≈30000.

Table 7 – Estimation results for mayoral elections - fixed effects.

	(1) Pref/Ele	*(2)* Pref/Hab	*(3)* BE-Pref/Ele	*(4)* BE-Pref/Hab
Gini	1.81***	4.07***	4.31***	5.83***
	(0.67)	(0.66)	(1.30)	(1.28)
GiniIncome	-0.33**	-0.81***	-0.85***	-1.16***
	(0.14)	(0.14)	(0.27)	(0.26)
Income	0.18**	0.55***	0.66***	0.89***
	(0.09)	(0.09)	(0.17)	(0.17)
Frag Educ	0.85***	0.93***	4.08***	3.91***
	(0.30)	(0.30)	(0.59)	(0.57)
Young	3.55***	3.20***	2.87	2.81
	(1.02)	(1.01)	(1.86)	(1.82)
Senior	1.52***	2.44***	2.45**	3.30***
	(0.56)	(0.55)	(1.05)	(1.03)
Frag Age	-1.01	-0.02	3.41	4.12
	(1.54)	(1.52)	(2.91)	(2.86)
Urban	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.13***	0.13***	0.19***	0.18***
	(0.01)	(0.01)	(0.02)	(0.02)
Candidates2	-0.01***	-0.01***	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	-0.00***	-0.00***	-0.01***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Sec Round	0.08	0.07	-0.01	-0.02
	(0.05)	(0.05)	(0.08)	(0.08)
Reelection	0.03***	0.04***	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.01)
Reelected	-0.05***	-0.05***	-0.09***	-0.09***
	(0.01)	(0.01)	(0.02)	(0.02)
Constant	3.28**	1.96	-3.80	-4.61*
	(1.27)	(1.25)	(2.42)	(2.38)
Obs.	20044	20044	15033	15033
r^2 ***adjusted***	0.06	0.08	0.15	0.16
r^2***within***	0.06	0.08	0.15	0.16
r^2***overall***	0.05	0.07	0.03	0.04
r^2***between***	0.06	0.10	0.02	0.03
σ_u	0.37	0.43	0.93	0.97
σ_e	0.44	0.43	0.60	0.59
ρ	0.42	0.50	0.71	0.73
Year Dummies	Yes	Yes	Yes	Yes

Source: Designed by the authors, 2021.
Note: Models for mayoral elections - coefficients estimated by fixed effects. Dependent variables are: Pref/Ele - mayors' private revenues per voter, Pref/Hab - mayors' private revenues per resident, Be-Pref/Ele - mayors' write-offs per voter and Be-Pref/Hab - mayors' write-offs per resident. Robust standard errors in parentheses, *p < 0.1, **p < 0.05, ***p < 0.01.

7 Councilor - Results

Table 8 shows the results of the fixed effects estimations for councilor elections. The dependent variables for regressions 5 through 10 are respectively the base-10 logarithm of private donations per voter, private donations per voter per seat, private donations per resident, write-offs per voter, write-offs per voter per seat, and write-offs per resident. In all cases, the estimated coefficient for the Gini variable is positive and significant at 1% level, reinforcing the results obtained for mayors. The 1.86 coefficient in regression 5 tells us that when setting all other variables to their mean value in the sample, a 0.01 increase in the Gini coefficient implies a 0.00092 increase in the log of private revenues per voter for councilors in 2004. Thus, a 0.25 decrease in the Gini coefficient implies a 0.28 log decrease in private revenues per voter for councilors.

For the control variables, the signs of controls are quite similar to those in Table 7, with some differences. For the case of city councilors, reelection candidates tend to increase the volume of private donations, but reduce the volume of write-offs. As city council candidates tend to rely more on write-offs than mayoral candidates, direct donations of goods or services may be more accessible resources for those candidates that cannot count on the advantages of being in office. Finally, the number of seats in dispute affects the volume of private donations and write-offs negatively. This can be explained in terms of competition: the more seats, the less fierce the competition among candidates.

Table 8 – Estimation results for city council elections - fixed effects.

	(5) Ver/Ele	(6) Ver/Ele/Vag	(7) Ver/Hab	(8) Be-Ver/Ele	(9) Be-Ver/Ele/Vag	(10) Be-Ver/Hab
Gini	1.861***	1.901***	4.160***	3.669***	3.193***	5.244***
	(0.586)	(0.586)	(0.583)	(1.047)	(0.922)	(1.038)
GiniIncome	-0.345***	-0.354***	-0.834***	-0.729***	-0.639***	-1.055***
	(0.118)	(0.118)	(0.117)	(0.210)	(0.187)	(0.209)
Income	0.316***	0.320***	0.688***	0.467***	0.418***	0.701***
	(0.078)	(0.078)	(0.077)	(0.135)	(0.120)	(0.133)
Frag Educ	0.967***	0.941***	1.032***	3.635***	3.228***	3.441***
	(0.259)	(0.259)	(0.254)	(0.503)	(0.430)	(0.494)
Young	0.986	0.938	0.652	1.257	1.249	1.231
	(0.968)	(0.968)	(0.954)	(1.632)	(1.391)	(1.610)
Senior	-0.982*	-0.983*	-0.082	1.791**	1.284*	2.429***
	(0.535)	(0.536)	(0.528)	(0.855)	(0.739)	(0.840)
Frag Age	1.014	1.030	1.959	3.017	2.786	3.688
	(1.356)	(1.356)	(1.342)	(2.375)	(2.070)	(2.346)
Urban	0.000	0.000	-0.001**	0.001	0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Candidates	0.001***	0.001***	0.001***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Candidates2	-0.000***	-0.000***	-0.000***	-0.000**	-0.000	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Voters	-0.001**	-0.001**	-0.000	-0.011***	-0.010***	-0.007***
	(0.001)	(0.001)	(0.000)	(0.002)	(0.002)	(0.002)
Sec Round	-0.012***	-0.047***	-0.014***	-0.027***	-0.061***	-0.031***
	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)	(0.005)
Reelection	0.047**	0.050**	0.051***	-0.069*	-0.060*	-0.072**
	(0.020)	(0.020)	(0.019)	(0.037)	(0.032)	(0.037)
Reelected	0.051**	0.053**	0.058***	0.093**	0.082**	0.107***
	(0.023)	(0.023)	(0.022)	(0.038)	(0.033)	(0.038)
Constant	1.649	1.010	0.388	-2.053	-2.104	-2.819
	(1.109)	(1.110)	(1.099)	(1.974)	(1.720)	(1.950)
Obs.	20044	20044	20044	14945	14945	14945
r^2 ***adjusted***	0.180	0.167	0.214	0.092	0.116	0.108
r^2***within***	0.181	0.168	0.214	0.093	0.117	0.109
r^2***overall***	0.076	0.109	0.096	0.019	0.065	0.035
r^2***between***	0.026	0.095	0.071	0.013	0.071	0.031
σ_u	0.346	0.348	0.405	0.643	0.575	0.676
σ_e	0.374	0.374	0.369	0.482	0.418	0.476
ρ	0.461	0.464	0.547	0.641	0.654	0.669
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes

Source: Designed by the authors, 2021
Note: Models for councilor elections - coefficients estimated by fixed effects. Dependent variables are: Ver/Ele - private councilor revenues per voter, Ver/Ele/Vag - private councilor revenues per voter per seat, Ver/Hab - private councilor revenues per resident, Be-Ver/Ele - councilor write-offs per voter, Be-Ver/Ele/Vag - councilor write-offs per voter per seat, and Be-Ver/Hab - councilor write-offs per resident. Robust standard errors in parentheses, *p < 0.1, **p < 0.05, ***p < 0.01..

8 Discussion

Figures 5 and 6 show the mean expenditure per voter and private revenue per voter for the 100 least unequal municipalities and the 100 most unequal municipalities for each year in the sample. It can be observed that, in all cases, the mean expenditure/income is always higher for the municipalities with higher income inequality. This is not causal evidence, but it is indicative of the positive relationship between income inequality and election spending.

Using the coefficients obtained in the estimations above, Table 9 shows the effect of increasing Gini by 0.1 of a point, on the absolute value of the dependent variables for each regression[9] in 2012 R$. The values were obtained by placing all other variables at their mean values. The value of 0.25 in row (1) and column 2004, for example, indicates that, in 2004, an increase/decrease of 0.1 in Gini would imply an increase/decrease of $0.25 in the mayors' private revenue per voter. Note that the effect is possibly negative, since the coefficient of the interaction of the Gini Index with per-capita income is negative.

Table 9 – Effects of a 0.1 increase in Gini on the absolute value of dependent variables.

Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2004	0.25	0.01			0.11	0.01	-0.02			
2008	0.35	0.01	0.06	0	0.22	0.02	-0.03	0.02	0	-0.03
2012	0.41	0.01	0.06	0.01	0.28	0.03	-0.04	0.03	0	-0.05
2016	0.28	0.01	0.02	0	0.22	0.02	-0.03	0.01	0	-0.02

Source: Designed by the authors, 2021

Note: Effects of a 0.1 point increase in Gini on the level (in units) of the explanatory variables for each regression.

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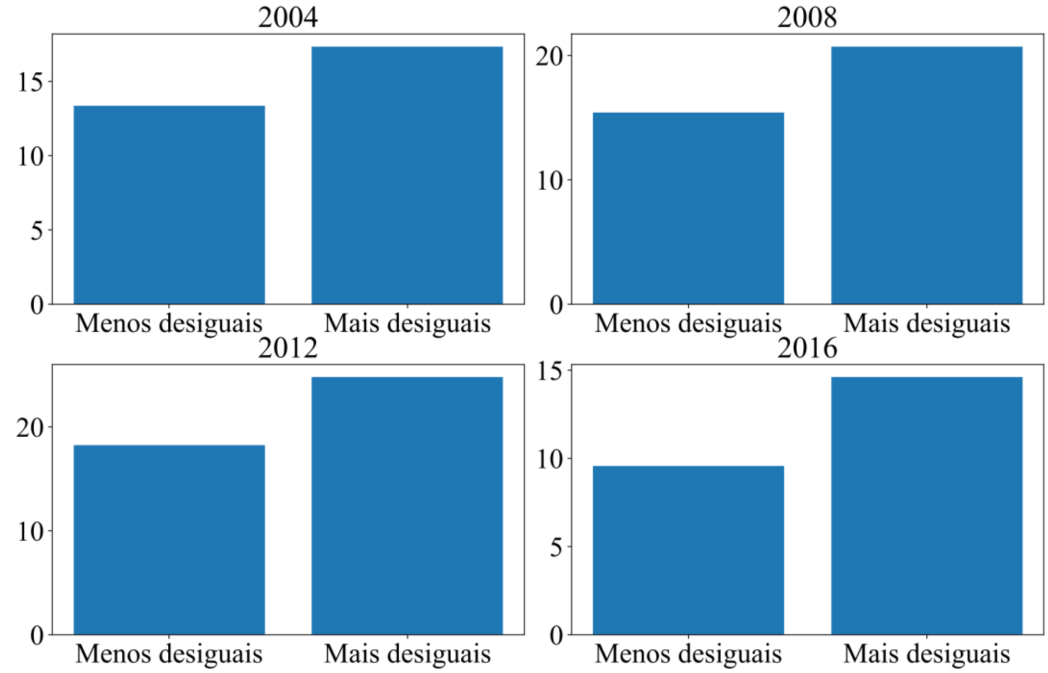
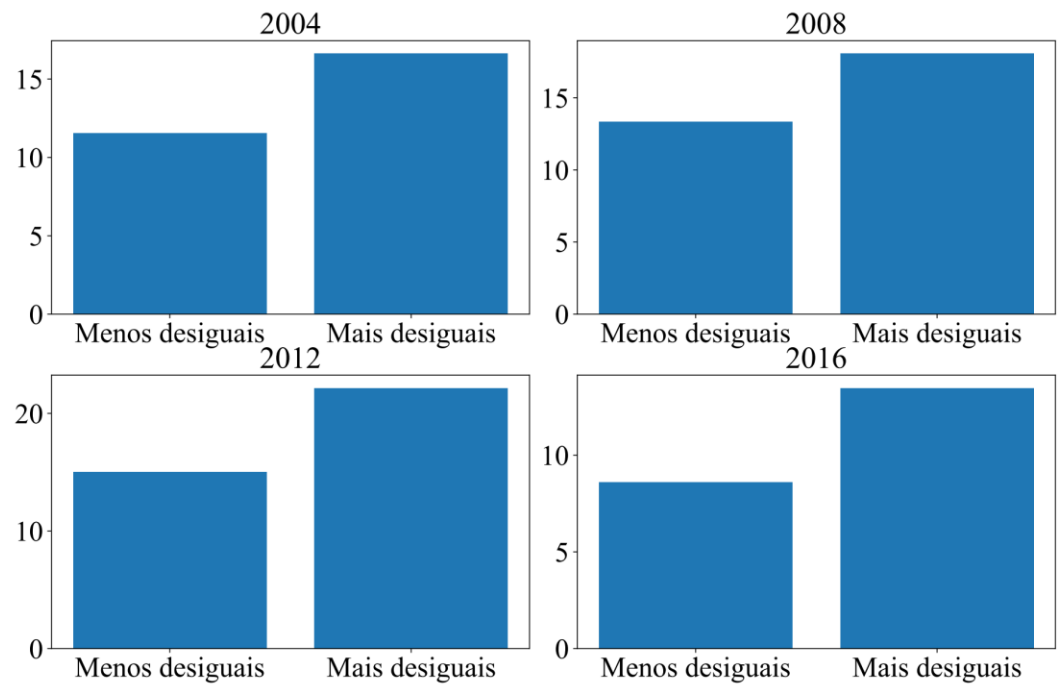
[9] In model (1), for example, the dependent variable is the logarithm of private income per thousand voters. Suppose that by substituting numerical values on the right-hand side of regression (1) we get the value x. Therefore, effect on the level of private revenue per voter is: log_10=revenue/(voters/1000)=x→〚10〛^x=(1000*revenue)/electors→revenue/electors=〚10〛^x/1000. Suppose, now, that x_((+0.1)) is the value obtained by substituting the same values on the right-hand side of regression (1), except that the Gini Index is 0.1 points higher than before. The impact of the change in the Gini Index on the level of private revenue per voter is then: 〚10〛^(x_((+0.1)))/1000-〚10〛^x/1000.

Figure 5 – Mayors - mean private expenditure and revenue per voter for the 100 most/least unequal municipalities.



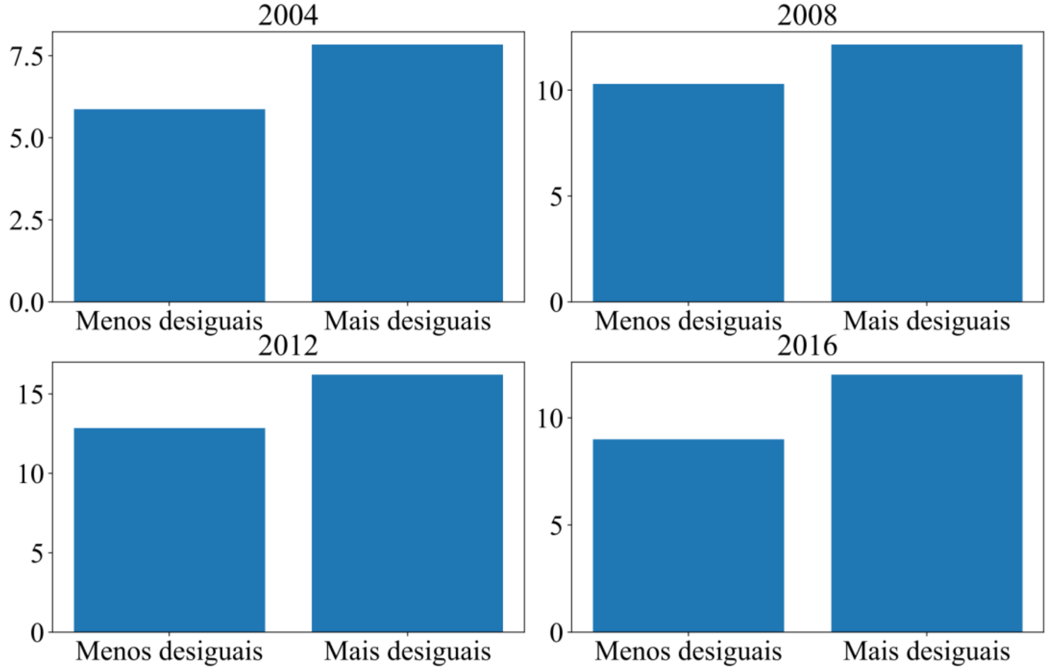
(a) Total expenditure per voter



(b) Private expenditure per voter

Source: Designed by the authors, based on TSE data, 2021.

Figure 6 – Councilors - mean private expenditure and revenue per voter for the 100 most/least unequal municipalities.



(a) Total expenditure per voter

(b) Private expenditure per voter

Source: Designed by the authors, based on TSE data, 2021.

Menos desiguais = Least unequal
Mais desiguais = Most unequal

9 Conclusion

This study was motivated by a strand of literature concerned with the financing of election spending. We show how income inequality in Brazilian municipalities may be one of the possible causes for the high cost of elections in Brazil. For this purpose, we used a panel from 2004 to 2016 that covers 4 municipal elections and that contains private revenues and write-off spending (estimates in R$ of goods and services donated to candidates) aggregated by municipality and by seats in dispute (councilors and mayors).

The Fixed Effects models showed that the Gini Index of formal income, estimated from RAIS data, is positively correlated with private campaign donations and write-off spending. A possible criticism to this study is the lack of an explanatory variable that controls for the effect of the *Bolsa Família* Program, which has strongly contributed to inequality reduction in the country (BARROS 2007). In preliminary estimations, the number of *Bolsa Família* beneficiaries was used as a control variable, but its inclusion entailed the loss of many observations. For this reason, the results presented here did not include that variable.

The evidence found here contributes to the debate on income inequality in Brazil and other young democracies. Campaigns that demand more resources create environments that favor candidates whose electoral bases have more means to contribute but ask for a smaller provision of public assets in return, thus stimulating the creation of less distributive public policies. Especially in a country with historically high income inequality rates like Brazil, maintaining institutional stability and citizens' trust in the electoral process involves reducing income inequality.

This econometric study used electoral expenditures and revenues of Brazilian municipal elections. However, elections in other spheres of government, especially for the national government, were left out. Furthermore, similar studies for established democracies can also provide new evidence on the relationship between inequality and electoral spending. These are suggestions that we make for further research.

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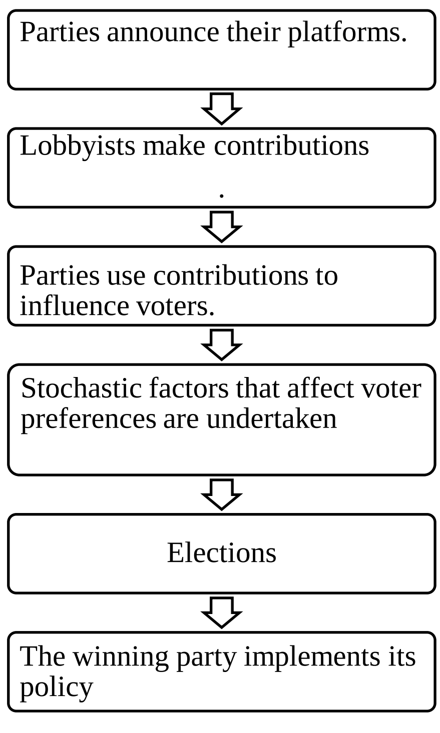
Appendix A: Model

This section shows the model for electoral competition between parties, lobbyists, and voters on which this study is based. Figure 7 describes the implementation of the game. Political parties announce their political platforms and, based on them, lobbyists make campaign contributions. The parties use the contributions to persuade voters, who are also influenced by stochastic factors that determine their preferences. After elections, parties win the number of seats in proportion to the number of votes received, so that the party with the most seats implements its platform. The game is solved by backward induction.

Figure 7 – Electoral competition model.



Source: Authors.

Suppose there is a continuum of voters $\Omega = [0.1]$, and that each voter belongs to only two social classes ($J = P, R$) based on income: R represents the voters in the "Rich" class, and P those in the "Poor" class. Let y^R be the rich voters' income and y^P be the poor voters' income. Naturally, $y^R > y^P$. A social class J has a mass α^J such that $\alpha^P + \alpha^R = 1$. In the model, there are more poor than rich voters ($\alpha^P > \alpha^R$). Two parties ($P = A, B$) compete by declaring a *per-capita* number of public assests g, which is financed by a tax τ that is common to all voters.

Let c be the *per-capita* income financing. The government's budgetary constraint is then $\alpha^P \tau y^P + \alpha^R \tau y^R = \tau y = g + c$, where $y = \alpha^P y^P + \alpha^R y^R$.

The voters' utility function consists of two parts. The first depends on the consumption of a private asset and of the public asset. A voter's net after-tax income is $(1-\tau)y^J \rightarrow \frac{y}{y}(1-\tau)y^J = (y-g-c)\frac{y^J}{y}$, which is normalized as the utility of private consumption. The utility with respect to the public asset is $H(g)$, where H is a strictly increasing and concave function. Let $(H')^{-1}$ be the inverse of the derivative of H. Then, $(H')^{-1}$ and $H \circ (H')^{-1}$ are strictly convex functions. Equation 1 shows the first part of a voter's utility.

$$W^J(g) = (y-g-c)\frac{y^J}{y} + H(g) \qquad (1)$$

By maximizing equation 1 to obtain the optimal provision of g for each class..

$$g_J^* = (H')^{-1}\left(\frac{y^J}{y}\right), \qquad J \in R, P$$

It follows that $g_P^* > g_R^*$. This means that the Poor prefer a larger supply of g than do the Rich. Intuitively, the Rich pay more for g, implying a smaller preference for such an asset.

The second part of a voter's utility depends on his or her ideology. It depends on the influence of campaign spending on the voter and on two stochastic variables that determine his or her bias towards party *B*. The first stochastic variable δ is common to the entire population, and it is associated with the realization of the state of nature (crises, wars, etc.). For simplicity, δ is assumed to be uniformly distributed over $\left[-\frac{1}{2\psi}, \frac{1}{2\psi}\right]$, where $\psi > 0$ measures the sensitivity of society to shocks. The larger ψ is, the lower the sensitivity.

The second stochastic variable, σ^{iJ}, reflects a voter's bias toward party$B$. It is assumed to be uniformly distributed at $\left[-\frac{1}{2\Psi^J}, \frac{1}{2\Psi^J}\right]$. $\Psi^J > 0$ measures homogeneity among voters in the same class. The smaller Ψ^J, the more heterogeneous the class. Assume that $\Psi^J = \Psi,\ J = R, P$. Note that positive values of δ and σ^iJ indicate positive bias toward party B.

Campaign spending affects a voter's utility linearly, which enables lobbyists to influence voters' preferences by donating funds to parties. Let C_A and C_B be the campaign expenditures of parties A and B. The popularity of B increases if $C_B > C_A$. If the effectiveness of campaign spending is represented by $h > 0$, then if B wins the election, the total utility of voter i of class J is represented by equation 2:

$$W^J(g_b) + \delta + \sigma^{iJ} + h(C_B - C_A) \qquad (2)$$

Voters choose their parties after the platforms are announced. Voter i of class J will chosse A if:

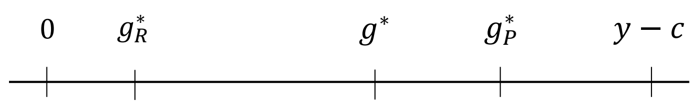
$$W^J(g_A) > W^J(g_B) + \delta + \sigma^{iJ} + h(C_B - C_A) \qquad (3)$$

Where g_A and g_B are platforms announced by the parties.

Calculating the socially optimal policy g^* provides a parameter for comparing welfare outcomes. Note that stochastic variables have an expected value of zero, and they can be removed from the utilities. Campaign spending is a party decision, and it can be removed. Thus, the ex-ante utility of voters is $W^J(g) = (y - g - c)\frac{y^J}{y} + H(g)$.

Maximizing the voters' social welfare function ($W(g) = \sum_J \sigma^J W^J(g)$) results in $g^* = (H')^{-1}$, which is the socially optimal policy. Figure 8 illustrates the social optimum and the preferences of each class for g. Note that $g_R^* < g^* < g_P^*$.

Figure 8: Preferred policies of each class and socially optimal policy.



Source: Authors.

For each class J, swing voter σ^J is the indifferent voter between the two parties. From equation 3, it can be seen that: $\sigma^J = W^J(g_A) - W^J(g_B) - h(C_B - C_A) - \delta \qquad (4)$

It can be shown that the number of votes for party A is $\frac{1}{2}$ added to the sum of the mass of swing voters in each class.

$$\pi^A = \sum_J \alpha^J \Psi \left[\sigma^J + \frac{1}{2\Psi}\right]$$

$$= \sum_J \alpha^J \sigma^J \Psi + \sum_J \frac{\alpha^J \Psi}{2\Psi}$$

$$= \frac{1}{2} + \Psi \sum_J \alpha^J \sigma^J \qquad (5)$$

Since $\sum_J \alpha^J = 1$, the likelihood of party A's winning the election is the likelihood of $\pi^A > \frac{1}{2}$. From equation 4, this occurs if σ^J is greater than 0. Since ψ gives the distribution of δ, write $W(g_A) = \sum_J \sigma^J W^J(g_A)$ and $W(g_B) = \sum_J \sigma^J W^J(g_B)$. Using equation 4, the likelihood of A's winning the elections is:

$$p_A = Prob\left[\pi^A > \frac{1}{2}\right]$$

$$= Prob[\delta < W^J(g_A) - W^J(g_B) - h(C_B - C_A)]$$

$$= \frac{1}{2} + \psi[W^J(g_A) - W^J(g_B) - h(C_B - C_A)] \qquad (6)$$

By symmetry:

$$p_B = \frac{1}{2} - \psi[W^J(g_A) - W^J(g_B) - h(C_B - C_A)] = 1 - p_A \qquad (7)$$

To determine C_A and C_B, consider that parties receive public and private funding. The public share is proportional to the number of seats obtained by the party in the previous legislature: $\beta_A + \beta_B = 1$, where β_P is the representation of party P. Let c be the per capita distribution of public funding. Then each party receives $\beta_P * c$ in public funding.

Lobbyists make private contributions denoted by C_P^J, where $J = P, R$ and $P = A, B$. The utility function of lobbyists depends on the implementation of the policy and the amount of resources donated:

$$p_A W^J(g_A) + (1 - p_A) W^J(g_B) - \frac{1}{2}\left(C_A^J + C_B^J\right)^2$$

The problem of lobbyists for class J is:

$$\max_{C_A^J, C_B^J \geq 0} p_A W^J(g_A) + (1 - p_A) W^J(g_B) - \frac{1}{2}\left(C_A^J + C_B^J\right)^2$$

The solution of which is:

$$\begin{aligned} C_A^J &= max\{0, \Psi h \alpha^J [W^J(g_A) - W^J(g_B)]\} \\ C_B^J &= max\{0, \Psi h \alpha^J [W^J(g_B) - W^J(g_A)]\} \end{aligned} \qquad (8)$$

Total donation to party P is $\sum_J \alpha^J C_P^J$. Therefore, total contribution is $C_P = \beta_P c + \sum_J \alpha^j C_P^J$.

Parties anticipate the contributions that will be received from lobbyists, from equation 8

$$C_A^J - C_B^J = \Psi h \alpha^J [W^J(g_A) - W^J(g_B)]$$

$$= \Psi h \sum_J (\alpha^J)^2 [W^J(g_A) - W^J(g_B)] + (\beta_A + \beta_B) c \qquad (9)$$

Now, from equation 6:

$$p_A(g_A, g_B) = \frac{1}{2} + \Psi h^2 \sum_J (\alpha^J)^2 [W^J(g_A) - W^J(g_B)] + (\beta_A + \beta_B) hc \qquad (10)$$

Like voters, political parties also have preferences for g. Party A strictly prefers $\overline{g_A}$ and B strictly prefers$\overline{g_B}$. Assume that A represents the Rich, and B represents the Poor, so that $\overline{g_A} = g_R^*$ e $\overline{g_B} = g_P^*$. Deviating from the preferred policy causes utility loss, but there is a trade-off: parties can deviate from their preferred policies to attract votes from the other social class. There is a cost associated with such a deviation:

$$U_P(p_A, p_B) = p_P(g_A, g_B) - \gamma_P|\overline{g_P} - g_P|, \;\; P = \{A, B\} \qquad (11)$$

The first part of equation 11 represents the utility that is obtained when a majority of the legislature is achieved. The second part represents the cost of implementing a policy other than the one preferred by the party. The higher $\gamma_P$is, the higher such cost is.

Since A represents the Rich class, their preferred policyg_A^* is to the left of g^*, which implies that a deviation to gain more votes implies an increase with respect to g_A^*. The opposite occurs for B. Thus, equation 11 can be rewritten as:

$$\begin{aligned} U_A(p_A, p_B) = p_A(g_A, g_B) - \gamma_A(g_A - g_R^*) \\ U_B(p_A, p_B) = p_B(g_A, g_B) - \gamma_B(g_P^* - g_B) \end{aligned} \qquad (12)$$

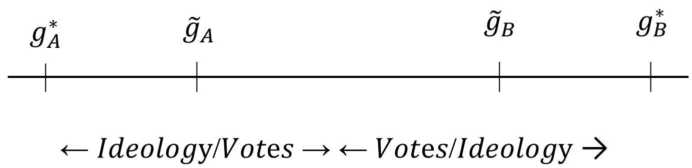
After the parties announce their platforms, sequential rationality reduces the extensive form of the game to the normal form, so that the utilities of parties A and B are given by equation 12. The dominant Nash equilibrium is:

$$\begin{aligned} \tilde{g}_A = (H)^{-1}\left(\frac{\hat{y}}{y} + \frac{\gamma_A}{\Psi\hat{\alpha}}\right) \\ \tilde{g}_B = (H)^{-1}\left(\frac{\hat{y}}{y} - \frac{\gamma_B}{\Psi\hat{\alpha}}\right) \end{aligned} \qquad (13)$$

Where $\hat{y} = \frac{y+\Psi h^2\left[(\alpha^P)^2 y^R + (\alpha^R)^2 y^P\right]}{\hat{\alpha}}$ and $\hat{\alpha} = \alpha^P(1 + \Psi h^2\alpha^P) + \alpha^R(1 + \Psi h^2\alpha^R)$. In equation 13, note that public funding does not affect party action, since c is not part of the equation. Note also that without lobbying or ideology ($h = 0$ e $\gamma_P = 0$), both parties would announce the same policy $\tilde{g}_A = \tilde{g}_B < g^*$. If there are ideology and contributions from lobbyists,, ($h > 0$ e $\gamma_P > 0$), the parties will try to differentiate themselves: $\tilde{g}_A < g^L < \tilde{g}_B$. In this case, private contributions will influence the likelihood of a party's victory.

Note that differences in $\tilde{g}_A$ and $\tilde{g}_B$ allow for differences in campaign contributions. The Rich will fund A and the Poor will fund B. Here, parties face a trade-off: they can choose a policy that is similar to their preferences and receive more votes from their "native" classes or try to influence the other class through campaigns financed with funds donated by lobbyists. Figure 9 illustrates the two forces acting on parties' policy choice.

Figure 9 – Announcement of platforms.



Source: Authors.

From equations 8 and 13, it can be seen that party A will receive campaign contributions from class R and party B will receive them from class P. For each party $P = A, B$, the total contributions will be:

$$C_A = \beta_A c + \alpha^R C_A^R = \beta_A c + \Psi h(\alpha^R)^2 [W^R(\tilde{g}_A) - W^R(\tilde{g}_B)]$$
$$C_B = \beta_B c + \alpha^P C_P^R = \beta_B c + \Psi h(\alpha^P)^2 [W^P(\tilde{g}_B) - W^P(\tilde{g}_A)]$$

Where the last term in both equations is the private contribution to parties A and B. The main variable is the total donation, given by:

$$C = \Psi h(\alpha^R)^2 [W^R(\tilde{g}_A) - W^R(\tilde{g}_B)] + \Psi h(\alpha^P)^2 [W^P(\tilde{g}_B) - W^P(\tilde{g}_A)]$$
$$= \Psi h\{(\alpha^R)^2 [W^R(\tilde{g}_A) - W^R(\tilde{g}_B)] + (\alpha^P)^2 [W^P(\tilde{g}_B) - W^P(\tilde{g}_A)]\} \quad (14)$$

In the model, an increase in inequality corresponds to an increase in the percentage of total income held by the Rich class. The mean income is given by: $y = \alpha^P y^P + \alpha^R y^R \rightarrow \frac{\alpha^P y^P}{y} + \frac{\alpha^R y^R}{y} = 1$. Therefore, a decrease in $\frac{\alpha^P y^P}{y}$ ou an increase in $\frac{\alpha^R y^R}{y}$ increases inequality.

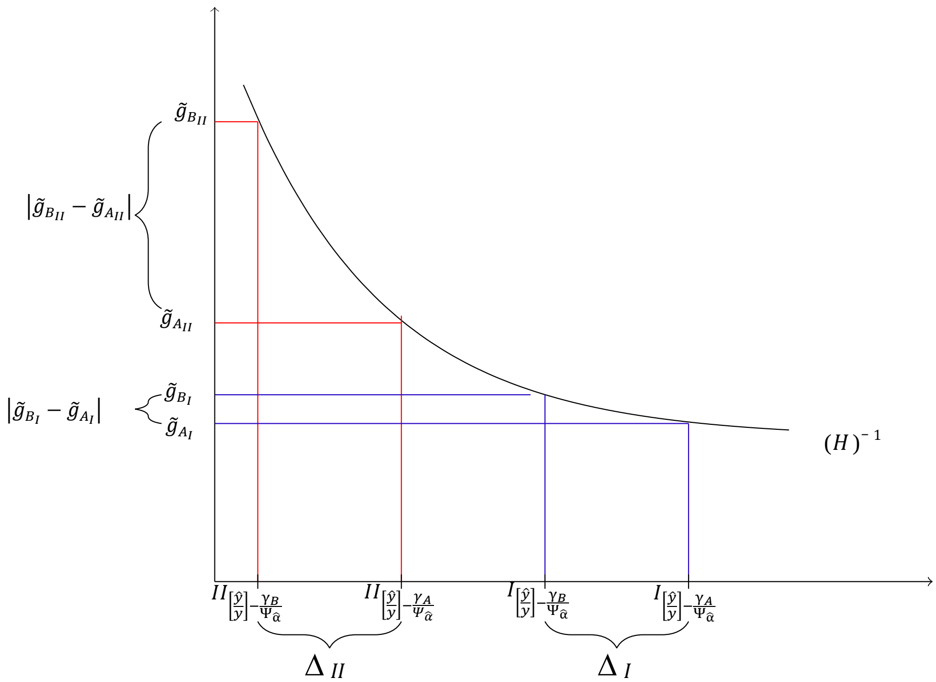
Now, define $\beta = \frac{(\alpha^P)^2 y^P}{y} + \frac{(\alpha^R)^2 y^R}{y}$. By writing $\alpha = \alpha^R$ e $x = \frac{\alpha^R y^R}{y}$, we have:

$$\beta = (1-\alpha)(1-x) + \alpha x = (1-\alpha) - (1-2\alpha)x$$

But $\alpha = \alpha^R < \frac{1}{2} \rightarrow 1 - 2\alpha > 0$. Therefore, as β decreases, inequality increases. Furthermore, using the expression for $\hat{y}$ in equation 13, β can be substituted to write $\frac{\hat{y}}{y} = \frac{1+\Psi h^2 \beta}{\hat{\alpha}}$. Note that $\frac{\gamma_A}{\Psi\hat{\alpha}}$ and $\frac{\gamma_A}{\Psi\hat{\alpha}}$ do not depend on income. Thus, an increase in inequality results in a decrease in β, and $\frac{\hat{y}}{y}$ decreases.

Figure 10 shows how $\frac{\hat{y}}{y} + \frac{\gamma_A}{\Psi\hat{\alpha}}$ and $\frac{\hat{y}}{y} - \frac{\gamma_B}{\Psi\hat{\alpha}}$ move to the left as inequality increases. Since $(H)^{-1}$ is decreasing and convex, $\tilde{g}_A$ and $\tilde{g}_B$ increase.

Figure 10 – The effect of inequality on policies announced by parties.



Source: Authors.

In Figure 10, subscript (or superscript) I refers to the previous case before the inequality increase, and II refers to the later case. As inequality increases, $\frac{\hat{y}}{y} + \frac{\gamma_A}{\Psi\hat{\alpha}}$ and $\frac{\hat{y}}{y} - \frac{\gamma_B}{\Psi\hat{\alpha}}$ shift to the left, but Δ_I and Δ_{II} remain the same. However, given the format of $(H)^{-1}$, $|\tilde{g}_{B_{II}} - \tilde{g}_{A_{II}}| > |\tilde{g}_{B_I} - \tilde{g}_{A_{II}}|$

. The greater the inequality, the greater the difference between the utilities that voters get of the public assets corresponding to the platforms' announcements, $H(\tilde{g}_B) - H(\tilde{g}_A)$. Using equation 13, note that$H(\tilde{g}_B) - H(\tilde{g}_A) = (H \circ (H')^{-1})\left(\frac{\hat{y}}{y} - \frac{\gamma_B}{\Psi\hat{\alpha}}\right) - (H \circ (H')^{-1})\left(\frac{\hat{y}}{y} - \frac{\gamma_A}{\Psi\hat{\alpha}}\right)$. Since $H \circ (H')^{-1}$ is convex and since $\left(\frac{\hat{y}}{y} - \frac{\gamma_P}{\Psi\hat{\alpha}}\right), P = \{A, B\}$ moves to the left, $H(\tilde{g}_B) - H(\tilde{g}_A)$ increases.

It can now be shown that an increase in inequality leads to an increase in campaign spending. From equation 1, the utility difference between voters in class J is $W^J(\tilde{g}_B) - W^J(\tilde{g}_A) = (\tilde{g}_B - \tilde{g}_A)\frac{y^J}{y} + [H(\tilde{g}_B) - H(\tilde{g}_A)]$. Substituting that expression into equation 14 gives:

$$\frac{c}{\Psi h} = \underbrace{[\tilde{g}_B - \tilde{g}_A]}_{I} \underbrace{\left[(\alpha^P)^2 \frac{y^P}{y} - (\alpha^R)^2 \frac{y^R}{y}\right]}_{II} + \underbrace{[H(\tilde{g}_B) - H(\tilde{g}_A)]}_{III} \underbrace{[(\alpha^P)^2 - (\alpha^R)^2]}_{IV}$$

Notice that *I*, *II* and *III* increase with inequality, whereas *IV* is greater than 0, because $\alpha^P > \frac{1}{2} > \alpha^R > 0$.

Therefore an increase in inequality implies an increase in resources used in election campaigns. Intuitively, more inequality means that the Rich and the Poor have very different preferences for g, which means that $\tilde{g}_A$ and $\tilde{g}_B$ are very far apart. Lobbyists, however, predict that a very different policy from their preferred ones may be implemented if the party on the other political spectrum wins the election. As a result, they become more willing to fund their own parties, thereby increasing election spending.

Appendix B: Gini coefficient of Brazilian municipalities

The Gini coefficients for Brazilian municipalities were estimated by the relative mean difference for ordered data, as in Glasser (1962) and Dixon et al. (1987):

$$G = \frac{\sum_{i=1}^{n}(21 - n - 1)x_i}{n\sum_{i=1}^{n} x_i}$$

Where G is the Gini coefficient, x is an observed income value, n is the number of values, and i the ranking of values in ascending order. To obtain an unbiased estimator, the values were multiplied by $n/(n-1)$.

Appendix C: Tests

Table 10 contains the variable VIFs for all the estimated models. Tables 11 and 12 contain the results for the estimates without the *Urban* variable.

Table 10 – VIFs

	Mayors - Donations	Mayors - Write-offs	Councilors - Donations	Councilors - Write-offs
Gini	2.18	2.07	3.02	2.88
GiniIncome	3.22	3.27	5.65	5.77
Income	2.42	2.26	2.91	2.72
Frag Educ	1.5	1.34	1.51	1.35
Young	8.32	7.49	8.39	7.57
Senior	5.97	5.64	5.97	5.64
Frag Age	7.77	7.59	7.82	7.65
Urban	239.69	260.04	269.78	303.68
Candidates	11.47	11.5	11.45	11.64
Candidates2	11.71	11.46	7.41	7.41
Voters	233.56	255.07	251.24	282.86
Sec Round	1.39	1.38	5.86	5.78
Reelection	1.69	1.66	1.73	1.49
Reelected	1.72	1.71	1.48	1.5
2008	1.7		1.78	
2012	2.15	1.59	2.43	1.85
2016	2.82	2.06	3.07	2.3

Source: Authors.

Table 11 – Estimation results for the mayor election without the *Urban* variable - fixed effects.

	(1)	***(2)***	***(3)***	***(4)***
	Pref/Ele	***Pref/Hab***	***BE-Pref/Ele***	***BE-Pref/Hab***
Gini	1.75***	4.07***	4.25***	5.82***
	(0.66)	(0.66)	(1.30)	(1.27)
GiniIncome	-0.32**	-0.81***	-0.83***	-1.16***
	(0.14)	(0.14)	(0.27)	(0.26)
Income	0.17*	0.55***	0.65***	0.89***
	(0.09)	(0.09)	(0.17)	(0.17)
Frag Educ	0.84***	0.93***	4.07***	3.90***
	(0.30)	(0.30)	(0.59)	(0.57)
Young	3.54***	3.20***	2.87	2.81
	(1.02)	(1.01)	(1.86)	(1.82)
Senior	1.47***	2.43***	2.40**	3.29***

	(0.55)	(0.55)	(1.05)	(1.03)
Frag Age	-1.04	-0.02	3.35	4.11
	(1.54)	(1.52)	(2.91)	(2.86)
Candidates	0.13***	0.13***	0.19***	0.18***
	(0.01)	(0.01)	(0.02)	(0.02)
Candidates2	-0.01***	-0.01***	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	-0.00**	-0.00**	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Sec Round	0.08	0.07	-0.01	-0.02
	(0.05)	(0.05)	(0.08)	(0.08)
Reelection	0.03***	0.04***	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.01)
Reelected	-0.05***	-0.05***	-0.09***	-0.09***
	(0.01)	(0.01)	(0.02)	(0.02)
Constant	3.32***	1.97	-3.73	-4.60*
	(1.27)	(1.25)	(2.41)	(2.37)
Obs.	20044	20044	15033	15033
r^2 adjusted	0.06	0.08	0.15	0.16
r^2within	0.06	0.08	0.15	0.16
r^2overall	0.04	0.07	0.03	0.04
r^2between	0.05	0.10	0.02	0.03
σ_u	0.40	0.43	0.95	0.97
σ_e	0.44	0.43	0.60	0.59
ρ	0.46	0.50	0.72	0.73
Year Dummies	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, *p < 0.1, **p < 0.05, ***p < 0.01.
Source: Authors.

Table 12 – Estimation results for the elections for councilors without the *Urban* variable - fixed effects.

	(5)	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
	Ver/Ele	**Ver/Ele/Vag**	**Ver/Hab**	**Be-Ver/Ele**	**Be-Ver/Ele/Vag**	**Be-Ver/Hab**
Gini	1.846***	1.884***	4.203***	3.729***	3.288***	5.385***
	(0.584)	(0.584)	(0.581)	(1.029)	(0.907)	(1.020)
GiniIncome	-0.342***	-0.351***	-0.843***	-0.739***	-0.657***	-1.082***
	(0.117)	(0.117)	(0.117)	(0.207)	(0.184)	(0.205)
Income	0.313***	0.317***	0.695***	0.479***	0.434***	0.727***
	(0.078)	(0.078)	(0.077)	(0.131)	(0.117)	(0.130)
Frag Educ	0.965***	0.937***	1.040***	3.788***	3.363***	3.613***
	(0.259)	(0.259)	(0.253)	(0.491)	(0.420)	(0.481)
Young	0.984	0.936	0.658	1.459	1.397	1.438

	(0.968)	(0.968)	(0.954)	(1.630)	(1.390)	(1.607)
Senior	-0.995*	-0.998*	-0.044	1.703**	1.209*	2.529***
	(0.533)	(0.533)	(0.526)	(0.830)	(0.719)	(0.816)
Frag Age	1.008	1.023	1.977	1.917	1.822	2.806
	(1.356)	(1.356)	(1.342)	(2.344)	(2.045)	(2.313)
Candidates	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Candidates2	-0.000***	-0.000***	-0.000***	-0.000**	-0.000**	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Voters	-0.001**	-0.001**	-0.001***	-0.002**	-0.002**	-0.002***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Sec Round	-0.012***	-0.047***	-0.014***	-0.033***	-0.065***	-0.036***
	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)	(0.005)
Reelection	0.047**	0.050**	0.051***	-0.073*	-0.063**	-0.076**
	(0.020)	(0.020)	(0.019)	(0.037)	(0.032)	(0.037)
Reelected	0.051**	0.053**	0.059***	0.084**	0.075**	0.098***
	(0.023)	(0.023)	(0.022)	(0.038)	(0.033)	(0.037)
Constant	1.660	1.023	0.356	-1.286	-1.451	-2.259
	(1.109)	(1.109)	(1.099)	(1.948)	(1.699)	(1.923)
Obs.	20044	20044	20044	15033	15033	15033
r^2 ***adjusted***	0.180	0.167	0.214	0.091	0.115	0.107
r^2***within***	0.181	0.168	0.214	0.092	0.116	0.108
r^2***overall***	0.071	0.104	0.107	0.019	0.063	0.034
r^2***between***	0.023	0.091	0.081	0.014	0.072	0.034
σ_u	0.353	0.356	0.384	0.610	0.558	0.637
σ_e	0.374	0.374	0.369	0.481	0.417	0.475
ρ	0.471	0.476	0.520	0.617	0.641	0.642
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors
Note: Robust standard errors in parentheses, *p < 0.1, **p < 0.05, ***p < 0.01.

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