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Income Inequality and Elections' Funding: Evidence From Brazil and Japan

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Dissertação apresentada à Faculdade de Administração, Contabilidade e Economia da Universidade de Brasília para obtenção do título de Mestre em Ciências Econômicas pelo Programa de Pós-Graduação em Economia.

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Abstract

Theoretical political economy models suggest that in more heterogeneous societies, political parties representing different income groups tend to support different policies. As a result, lobbyists are more willing to contribute to political campaigns to avoid the risk of an unfavorable policy being implemented if the opposing party wins. Therefore, higher income inequality increases private contributions to electoral campaigns. This study examines the impact of income inequality on election costs in Brazil and Japan. It also explores three different aspects of the effect of income inequality on campaign costs: how inequality affects campaign donations as electoral competition grows, inequality's spillover effects on campaign donations and its effect on different types of electoral expenditures. We use panel data from the Brazilian local elections from 2002 to 2016 and from the Japanese House of Councillor's prefectural-tier elections from 1977 to 2016. All results suggest that more unequal societies tend to have more expensive elections. In Brazil, the impact of income inequality on campaign donations was stronger in municipalities with more electoral competition. The results are also robust to spatial spillover effects.

Key-words: Campaign Financing; Income Inequality; Lobby; Elections; Brazil; Japan.
JEL Codes: D31; D72

Resumo

Modelos de economia política sugerem que em sociedades mais heterogêneas, partidos políticos representando diferentes grupos de renda tendem a apoiar políticas públicas diferentes. Como resultado, lobistas ficam mais dispostos a contribuir com campanhas políticas a fim de evitar que uma política desfavorável seja implementada caso o partido rival ganhe as eleições. Portanto, o aumento da desigualdade social causa um aumento nas contribuições de campanhas eleitorais. Este estudo examina o impacto da desigualdade de renda em gastos eleitorais no Brasil e no Japão. Também são explorados três aspectos do efeito da desigualdade em gastos eleitorais: como desigualdade afeta doações de campanha a medida que as eleições se tornam mais competitivas, os efeitos de *spillover* da desigualdade em doações de campanha e seus efeitos em diferentes tipos de gastos eleitorais. Usamos dados de painéis das eleições municipais brasileiras de 2004 à 2016 e das eleições para a Casa dos Conselheiros do Japão de 1977 à 2016. Todos os resultados sugerem que sociedades mais desiguais tendem a ter eleições mais caras. No Brasil, o impacto da desigualdade em doações de campanha parece ser mais forte em municípios onde a competição eleitoral foi mais intensa. O resultado também é robusto a efeitos de *spillover* espaciais.

Palavras-chave: Financiamento de Campanha; Desigualdade de Renda; Lobby; Eleições; Brasil; Japão.
Códigos Jel: D31; D72

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Chapter 1
Introduction

In most OECD countries, income inequality has reached record levels (CINGANO, 2014). Lakner and Milanovic (2013) show that global inequality has slightly decreased between 1988 and 2008, but when under-reported top-incomes are included, the decline almost disappears. Furthermore, whereas the Gini index between countries remained stable, inequality within countries has increased. Nevertheless, inequality has risen in developed countries and has been historically high in Latin American countries like Brazil.

Income inequality can affect social outcomes through several mechanisms. Mattos and Rocha (2008) show how it can positively affect the size of states in Brazil, and Buonanno and Vargas (2019) investigate how high inequality levels increase crime rates in Colombia. Mainly in the 90s, economists have tried to investigate how inequality affects economic growth[1]. Some find positive effects (FORBES, 2000), some find mixed effects, depending on one's country level of development (BARRO, 1999), but a majority find negative effects (PERSSON; TABELLINI, 1994; ALESINA; RODRIK, 1994; BENABOU, 1996; AGHION; CAROLI; GARCIA-PENALOSA, 1999; CINGANO, 2014). Although the results are mixed, it became clear that inequality is an important variable for better understanding economic and social phenomena.

There is also a vast literature linking income inequality and institutions. Acemoglu and Robinson (2000, 2002) propose a political economy model relating inequality to political enfranchisement. Rogowski and MacRae (2004) develops a model to describe how inequality and institutions can be affected by exogenous changes. Engerman and Sokoloff (2002) and Chong and Gradstein (2007) are a few examples of how inequality can affect institutional quality. Finally, Kawanaka, Hazama et al. (2016) shows how in young democracies, factors such as multiple social cleavages, information constraints and weak state capacity can dampen the effects of democratization on inequality.

Economists became well aware that income inequality is important for the rise and well functioning of democratic systems. However, once democracies are established, understanding how the government is chosen and how inequality can affect people's

[1] In a seminal paper, Kuznets (1955) proposed the symmetrical question and suggested an inverted U shaped relation between inequality and economic development. According to Kuznets, income inequality levels would increase as a country developed economically and decrease latter on.

choices is not as simple as just counting votes. Institutional quality is associated with the electoral process, which in turn is connected to electoral campaigns and campaign financing. Furthermore, Lobbies and their ability to influence voters and those in power play a central role in all democracies. Downs (1957) had already observed that in a world of imperfect information, interest groups can persuade voters. Influencing beliefs and ideas in elections, however, would not be as we know them without campaign financing. Hence, campaign donations are a key component to understand how democracies work. If the number of votes a candidate receives depends on his political position relative to his opponents and if voters had perfect information, contributions should have no effect on electoral results. However, because the vote of a single individual is not decisive, the costs of being informed surpasses the benefits, meaning that voters have little incentive to learn a candidate's real political ideology. If a majority of voters form their opinions based on readily available information, candidates can use campaign contributions to manipulate public opinion.

In elections, money matters for several reasons. Mainly, it helps to attract uninformed voters. Baron (1994a) and Roemer (2003) are a few examples of studies that model campaign contributions as a way of attracting the uninformed voter by providing information through political campaigns. The former model also considers campaign contributions to be part of the intra-party competition process, as party-members can gain influence in the party by making donations.

Although it seems plausible, can money really affect electoral outcomes? Estimating the effect of electoral spending on votes can be tricky, as spending is an endogenous variable: candidates who receive more contributions tend to persuade more voters, but the ones who are expected to get more votes are also the ones who tend to receive more donations. To avoid this simultaneity problem, the empirical literature frequently uses panel data and instrumental variables techniques. The effects for incumbents and challengers are frequently assumed to be different, since incumbency advantage may play an important role on election outcomes. Still, the results are mixed. Jacobson (1990) uses panel data and shows that challengers benefit more from campaign spending than incumbents. Levitt (1994) also uses panel data for the U.S. Congress, and finds that campaign spending has a very small effect for both incumbents and challengers. Gerber (1998) uses instrumental variables and data from the American Senate elections to show that the marginal effect of campaign spending is roughly the same for challengers and incumbents. Some argue that the campaign spending effect depends on the relative advantages between challengers and incumbents. That would depend on the political system, meaning that studies for elections outside the US can yield different results, especially when one considers countries with open list proportional representation systems. A few examples are Samuels (2001), Maddens et al. (2006) and Benoit and Marsh (2008), who find a positive relationship between spending and electoral performance in Brazil, Belgium and Ireland.

The impact of campaign contributions on electoral outcomes might be dubious and hard to estimate, but electoral spending has other effects. The first one is that money can affect public policies. Stratmann (1991) shows that campaign contributions can not only affect the ballots voters cast for candidates, but can also affect the votes of congressmen in favor of interest groups. Grossman and Helpman (1996a) develops a model where contributions can be used to influence the results of elections and public policies: political parties face a trade-off between granting favors to interest groups and receiving more donations at the cost of losing votes among the well informed electorate.

The second effect is that campaign finance is directly related to the trade-off between freedom of speech and equality. Campaign contributions can be viewed as a way of conveying ideas, but can also increase inequalities, as interest groups tend to finance their preferred policies. Grant and Rudolph (2003) show that when facing this trade-off in the campaign finance system, citizens tend to change their opinions based on whether their rights seem to threatened. In other words, when addressing the issue of the trade-off between expression and inequality in the context of campaign financing, citizens are more willing to accept the freedom of speech view when it is applied to the groups they prefer.

Campaign finance laws can also alter election results. Theoretical and empirical studies show that contribution caps and public finance can improve welfare when compared to purely private finance. Coate (2004) develops a model in which voters know candidates' affiliation, but not if they are well qualified or not. In the model, political campaigns can help swing voters to make a decision. The absence of contribution caps does not benefit qualified candidates because interest groups are willing to donate to whoever implements their favorite policies. Therefore, candidates can be advertised not because of their qualities, but because of their willingness to cooperate with donors. Including contribution caps in the model helps advertising qualified candidates by reducing total donations, which in turn reduces the incentive to exchange political favors for money. Another model developed by Ashworth (2006) shows that the benefits obtained with public finance may depend on incumbency advantages. Low contribution caps and public finance may improve the chances of a challenger to emerge because it dampens incumbency advantage (HAMM; HOGAN, 2008). On the other hand, high contribution caps might induce less close elections, less candidates and lower voter turnout (MILLIGAN; REKKAS, 2008). Finally, Potter and Tavits (2015) show how campaign regulation, including donation caps, expenditure caps and public campaign finance can lead to more political competition by increasing the number of political parties.

Baron (1989) models candidates as agents who offer services (interventions) in exchange for campaign contributions. In the model, interest groups can support candidates by simply casting a ballot for them, but vote secrecy allows for voters to deviate. Therefore, campaign donations are one of the means of showing candidate support. In this sense, the transparency of campaign donations is another important factor to understand how money can affect elections. Fang, Shapiro and Zillante (2011) and Shapiro and Zillante (2017) experimentally compare three different levels of transparency: in the first level, voters' preferences and donations are not observed by the candidates and by the public, for the second level, voters' preferences and donations are observed by the candidates but not by the public. The third level is completely transparent, meaning that voters' preferences and donations are observed by the candidates and by the public. They conclude that donors are less willing to donate and candidates deviate less from their political preferences under the first level. Furthermore, combining contribution limits with full transparency can limit donors' influence on policy choice. These findings suggest that full anonymity, as well as contribution limits, might be a useful tool to improve social welfare.

In short, campaign finance can have effects not only on election results, but also on many aspects of democratic systems, making them an attractive tool for interest groups to manipulate public policies. Several models seek to introduce interest group action attempting to explain how those groups can use campaign donations to influence voters, candidates and the policies they support (BARON, 1994b; GROSSMAN; HELPMAN, 1996b; PERSSON; TABELLINI, 2000). An extension of the last model can be found in Portugal and Bugarin (2007).

Although inequality and campaign financing are important factors that determine institutional quality, there is a lack of evidence on the relationship between both variables. More recently, a new literature has been trying to investigate the relationship between inequality and the cost of electoral campaigns considering the effects of interest groups.

Bugarin, Portugal and Sakurai (2011) present a political model and show how inequality can affect election costs. The model predicts that more unequal societies tend to have more expensive electoral campaigns. They test this hypothesis for Brazil's local and national legislative elections and find a positive relationship between the Gini index and campaign expenditures. Bugarin (2012) and Bugarin (2015) test the same hypothesis for Japan's Upper House elections and the results confirm the theoretical predictions. Finally, Bugarin and Tanaka (2018) explore the impacts of income inequality on electoral campaign financing for Brazil's 2012 local elections. Again, they find a positive relationship between the Gini index and campaign costs.

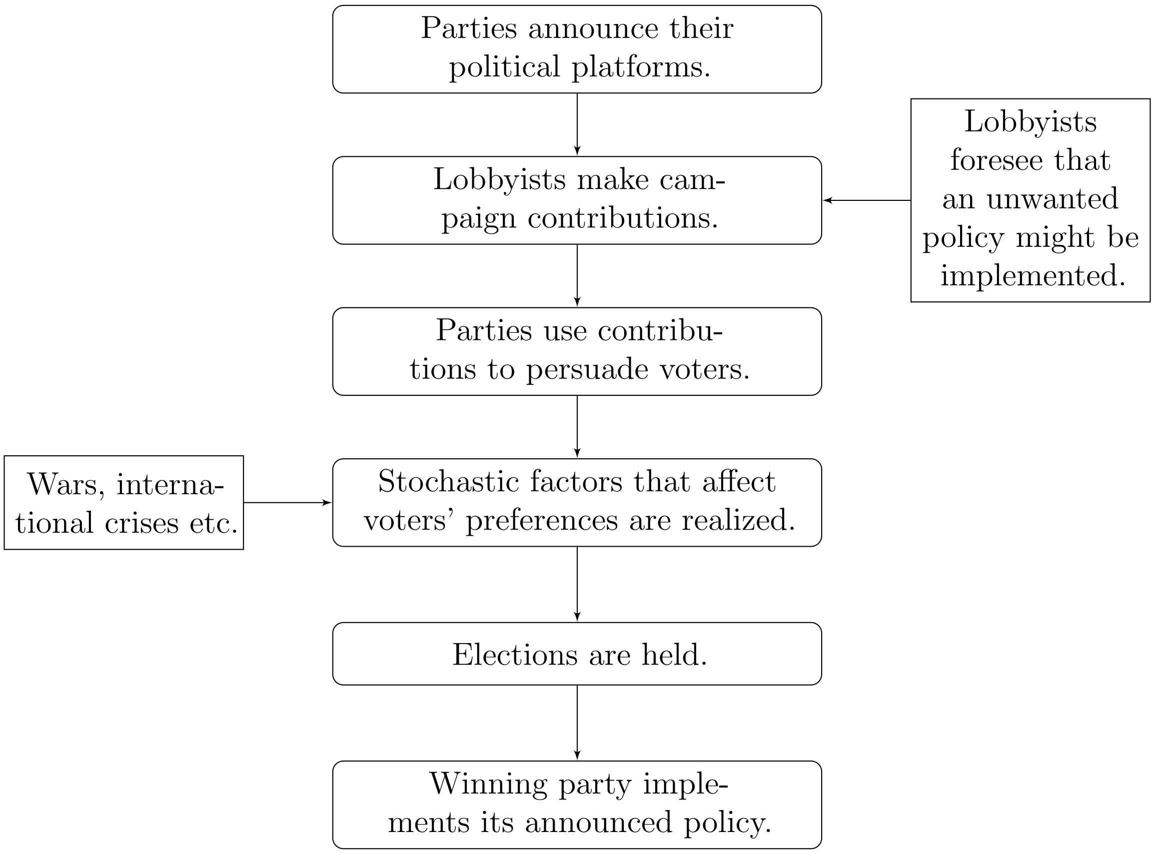
This study extends the work of Bugarin (2012) and Bugarin (2015) by using updated data for Japan's Upper House elections and introducing for the first time panel data for the Brazilian local elections. Besides confirming the effects previously found, we bring three novelty findings to the literature. For Brazil, we consider the effect of income inequality on campaign donations in municipalities with different levels of electoral competition, and we find that in more competitive elections, the impact of income inequality on campaign donations is bigger. For Japan, we explore a new database to investigate how income inequality can affect different types of campaign expenditures. More precisely, we use the Japanese Upper House elections data, which can be divided in 11 categories, and check for types of expenditure that are more correlated to inequality. We find that expenditures in the category "Election Office" seem to be driving the results. Finally, we consider how spillover effects (i.e. income inequality in neighbouring municipalities/prefectures) can affect campaign costs in a specific municipality/prefecture. Our findings suggest that spillover effects are important to explain electoral expenditures. All calculations were made using the software STATA 14.

The rest of this thesis is organized as it follows. Chapter 2 describes the political model developed by Bugarin (2012) and the theory in which this study is based on. Chapter 3 describes the panel used for the Brazilian elections for both mayors and local representatives and presents the fixed effects estimations results, confirming the positive impact of income inequality on electoral expenses. Chapter 4 describes the updated data for Japan and outlines the new database containing expenditures per category and presents the estimation results for Japan. Our findings suggest a positive relation between the Gini coefficient and electoral costs. In chapter 5 we try to address the possible spillover effect of campaign costs. Finally, chapter 6 concludes by summarizing the main results and discussing some key implications for future policy.

Chapter 2
The Model

This section builds a stochastic model between political parties lobbyists and voters. The model used here is the same one developed by Bugarin, Portugal and Sakurai (2011), Bugarin (2012) and Bugarin (2015). Figure 1 describes how the game is implemented.

Figure 1 – Electoral competition game.



Source: author.

Political parties first announce their policies, and based on the announced policies, lobbyists make campaign contributions. Parties then use private funding[1] to persuade voters, who also are affected by stochastic signals that determine their preferences. Voters observe the political platforms, take into account the effect of campaign spending, and vote based on their preferences. For legislative elections, parties are assigned the amount

[1] Public funding can be included in the model without loss of generality.

of seats corresponding to the percentage of received votes. The party with the majority of seats implements its platform. The Game is solved by backwards induction.

- **Voters**

Suppose that there is a continuum of voters $\Omega = [0, 1]$ and that each voter belongs to one of two different social classes ($J = P, R$) based on their incomes: R stands for "Rich" and P stands for "Poor". Voters with high-income (y^R) belong to the Rich class, while voters with low-income (y^P) belong to the Poor class. Naturally, $y^R > y^P$. A social class J has mass α^J, so that $\alpha^P + \alpha^R = 1$. As one would expect, the model assumes that there are more poor voters that rich voters: $\alpha^P > \alpha^R$. Two political parties $P = A, B$ compete declaring a certain *per capita* amount of a public good g, that is financed by an income tax τ, which is the same for all voters.

The government budget constraint is $\alpha^P \tau y^P + \alpha^R \tau y^R = \tau y = g$, where $y = \alpha^P y^P + \alpha^R y^R$.

A voter's utility function is comprised of two parts. The first part depends on the consumption of a private good and on the consumption of the public good. An agent's income net of taxes can be expressed as $(1 - \tau)y^J \rightarrow \frac{y}{y}(1 - \tau)y^J = (y - g)\frac{y^J}{y}$, which is normalized as the agent's private consumption utility. Furthermore, the agent's utility for the public good g is $H(g)$, where H is a strictly increasing and concave function. Let $(H')^{-1}$ be the inverse function of the derivative of H. Therefore $(H')^{-1}$ and $H \circ (H')^{-1}$ are strictly convex functions (functions such $H(g) = g^\beta$, $\beta \in (0, 1)$ follow these properties). Equation 1 shows the first part of a voter's utility.

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

For each class, the optimal policy for the public good provision can be obtained by maximizing equation 1:

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

It follows that $g_P^* > g_R^*$. In other words, the Poor prefer a higher provision of g than the Rich. Intuitively the rich pay relatively more for g. Therefore, they prefer lower public output than the poor.

The second part a voter's utility depends on the voter's ideology. This component is composed of the campaign contributions influence on one voter's preferences and two stochastic variables that determine a voter's bias towards the political party B. The first stochastic variable, δ, is common to the entire population and is associated with the realization of a state of nature (wars, crisis and weather hazards are examples). It is assumed that δ is uniformly distributed on $\left[-\frac{1}{2\psi}, \frac{1}{2\psi}\right]$, where $\psi > 0$ measures the society's sensibility to shocks. The higher ψ, the less these shocks affect society.

The second stochastic variable, σ^{iJ}, reflects a voter's personal bias towards party B. It is uniformly distributed on $\left[-\frac{1}{2\Psi^J}, \frac{1}{2\Psi^J}\right]$. $\Psi^J > 0$ measures how homogeneous voters from the same class are. The lower Ψ^J, the greater the dispersion in preferences among voters from the same class. Here, we assume that $\Psi^J = \Psi, J = R, P$ for simplicity.

Note that positive values for δ and σ^{iJ} suggest a positive bias toward party B, and negative values suggest a positive bias towards party A.

Finally, campaign contributions affect a voter's utility linearly, making it possible for lobbyists to influence voters' preferences by donating to political parties. Let C_A and C_B be the parties A and B campaign expenditures. Party B gains more popularity during elections if $C_B > C_A$. Furthermore, let the campaign spending effectiveness be represented by the parameter $h > 0$. Therefore, if party B wins the elections, the total utility of voter i from class J will be represented by equation 2.

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

Voters choose which party to vote on after the announcement of the platforms. Voter i in group J will choose party A over B if:

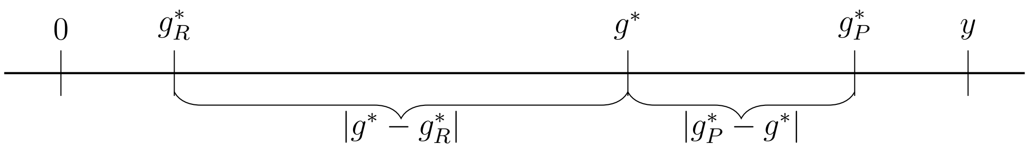
$$W^J(g_A) > W^J(g_B) + \delta + \sigma^{iJ} + h(C_B - C_A) \tag{3}$$

Where g_A and g_B are the platforms announced by parties A and B.

In order to obtain a benchmark to compare welfare outcomes, we need to calculate the social optimum policy g^*. Note that the stochastic variables have an expected value of zero, and can be removed from the voter's utilities. Furthermore, campaign expenditures are a decision taken by the parties, and not the voters, meaning that a voter's ex-ante utility can be written as $W^J(g) = (y - g)\frac{y^J}{y} + H(g)$.

We can calculate g^* by maximizing the sum of all voters' utility functions. For that, we maximize the aggregate welfare function $W(g) = \sum_J \sigma^J W^J(g)$ to obtain $g^* = (H')^{-1}$. Figure 2 illustrates the social optimum and the classes' preferred supply of g, that we obtained previously by maximizing equation 1. Note that $g_R^* < g^* < g_P^*$, meaning that the social optimum lies between the quantity preferred by the Rich and the Poor.

Figure 2 – Classes' preferred and socially optimal policies.



Source: author.

- **Lobbyists**

For each class J, the *swing voter*, σ^J, is defined as the voter who in indifferent between party A or B. From equation 3, it is easy to see that:

$$\sigma^J = W^J(g_A) - W^J(g_B) - h(C_B - C_A) - \delta \tag{4}$$

It is possible to show that the number of votes on party A is $\frac{1}{2}$ plus the sum of the mass of the *swing voters* in each class.

$$\begin{aligned} \pi^A &= \sum_J \alpha^J \left[\sigma^J + \frac{1}{2\Psi}\right] \Psi \\ &= \sum_J \alpha^J \sigma^J \Psi + \sum_J \frac{\alpha^J \Psi}{2\Psi} \\ &= \frac{1}{2} + \Psi \sum_J \alpha^J \sigma^J \end{aligned} \tag{5}$$

As $\sum_J \alpha^J = 1$, the probability of party A winning the elections is the probability of $\pi^A > \frac{1}{2}$. From equation 4, that will happen if σ^J is greater than 0. Remember that ψ gives the distribution of δ and 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 probability of party A winning the elections is:

$$\begin{aligned} p_A = Prob\left[\pi^A > \frac{1}{2}\right] &= Prob\left[\delta < W^J(g_A) - W^J(g_B) - h(C_B - C_A)\right] \\ &= \frac{1}{2} + \psi\left[W^J(g_A) - W^J(g_B) - h(C_B - C_A)\right] \end{aligned} \tag{6}$$

By symmetry:

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

To determine C_A and C_B, consider that parties receive both public and private resources. The public resources received by a party are proportional to that party's representation in congress in the previous legislature: $\beta_A + \beta_B = 1$, where β_P is party P's representation. Let c be the *per capita* distribution of the public funds. Then each party receives $\beta_P * c$ in public funds.

Lobbyists make private contributions per capita C_P^J, where $J = P, R$ and $P = A, B$. The lobbyists utility function depends on the implemented policy and on the amount of resources donated to campaigns:

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

Lobbyists from class J's problem is:

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

The solution for this problem is:

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

Lobbyists will contribute to the party that announces the better platform. Note that if both platforms are the same, lobbyists will not be willing to make any contributions ($C_A^J = C_B^J$). The total amount of private contributions to party P is $\sum_J \alpha^J C_P^J$. Therefore, total contributions are:

$$C_P = \sum_J \alpha^j C_P^J$$

- **Parties**

Parties anticipate the contributions they receive from lobbyists. From equation 8:

$$\begin{aligned} C_A^J - C_B^J &= \Psi h\alpha^J[W^J(g_A) - W^J(g_B)] \\ &= \Psi h \sum_J \left(\alpha^J\right)^2 \left[W^J(g_A) - W^J(g_B)\right] + (\beta_A + \beta_B)c \end{aligned} \tag{9}$$

Now using equation 6, we get:

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

Like voters, political parties also have preferred policies for g. Party A strictly prefers $\bar{g}_A$ and party B strictly prefers $\bar{g}_B$. Here, we assume that party A represents the rich and party B represents the poor, so that $\bar{g}_A = g_R^*$ and $\bar{g}_B = g_P^*$. Moving away from the preferred policy results in utility loss. However, there is a trade-off: parties might be willing to deviate from their preferred policies in order to obtain more votes and increase their chances to win the elections. There is a cost when a party announces a policy different from its preferred one:

$$U_P(p_A, p_B) = p_P(g_A, g_B) - \gamma_P|\bar{g}_P - g_P|, \quad P = \{A, B\} \tag{11}$$

The first part of equation 11 represents the utility a party gets when it achieves the majority in the legislature. The second part represents the cost of implementing a policy different from the party's preferred one. The bigger γ_P, the greater this cost is.

Because party A represents the rich, its preferred policy g_A^* is on the left of g^*, meaning that any deviation from g_A^* in order to attract more votes will increase g_A^*. The opposite happens for party B. Therefore, we can rewrite equation 11 as:

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

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

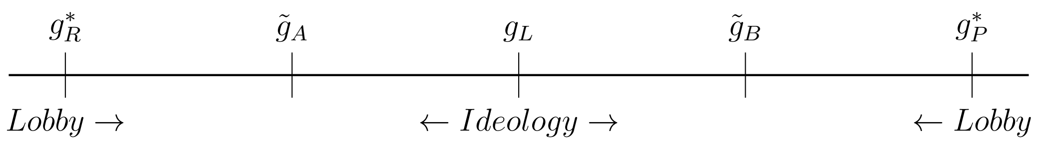
$$\begin{aligned} \tilde{g}_A &= (H)^{-1}\left(\frac{\hat{y}}{y} + \frac{\gamma_A}{\Psi\hat{\alpha}}\right) \\ \tilde{g}_B &= (H)^{-1}\left(\frac{\hat{y}}{y} - \frac{\gamma_B}{\Psi\hat{\alpha}}\right) \end{aligned} \tag{13}$$

Where $\hat{y} = \frac{y + \Psi h^2\left[\left(\alpha^P\right)^2 y^R + \left(\alpha^R\right)^2 y^P\right]}{\hat{\alpha}}$ 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, as c is not part of the equation. Also note that with no lobby and no ideology ($h = 0$ and $\gamma_P = 0$), both parties would adopt the same policy announcement $\tilde{g}_A = \tilde{g}_B < g^*$

If parties did not have ideology, but lobbyists still made contributions ($h > 0$ and $\gamma_P = 0$), both would announce the same policy. Let g_L be this policy. Then: $\tilde{g}_A = \tilde{g}_B = g_L = (H)^{-1}\left(\frac{\hat{y}}{y}\right) \neq g^*$. Finally, introducing both ideology and lobbyists contributions ($h > 0$ and $\gamma_P > 0$), parties will try to differentiate themselves: $\tilde{g}_A < g^L < \tilde{g}_B$. In this case, private contributions will affect the probability of a party winning the elections.

Note that differences in $\tilde{g}_A$ and $\tilde{g}_B$ allow for divergence in campaign contributions. The rich will finance A and the poor will finance B. Parties face a trade-off: they can choose a platform that is more similar to their ideological preferences and receive more votes from their "native" classes. However, they can also influence the other social class through electoral campaigns using funds obtained from lobbies. Figure 3 illustrates the two forces acting upon policy choice.

Figure 3 – Two Forces acting upon g.



Source: author

- **Inequality**

From equations 8 and 13, it is possible to see that party A will receive campaign contributions from class R, and that party B will receive campaign contributions from class P. For each party $P = A, B$, total campaign contributions will be:

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

Where the last term in both equations above is the private contribution for parties A and B. Our main concern is the total private contribution, given by:

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

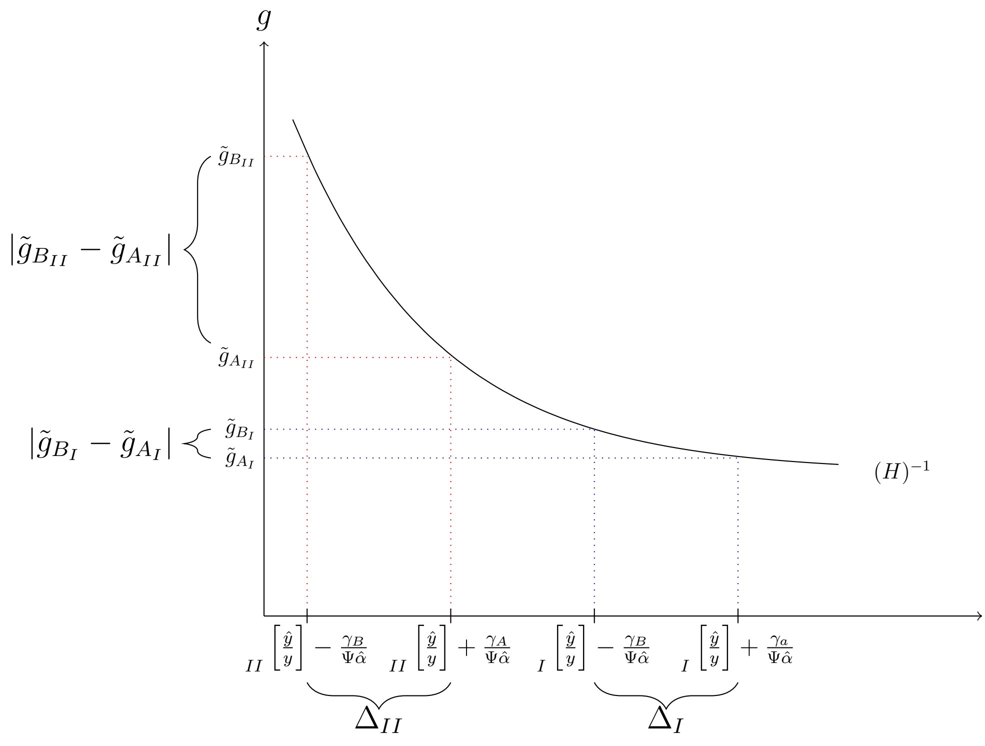
In the model, an increase in inequality corresponds to an increase in the income share of the rich class. The average income is $y = \alpha^P y^P + \alpha^R y^R \rightarrow \frac{\alpha^P y^P}{y} + \frac{\alpha^R y^R}{y} = 1$. Therefore, a reduction in $\frac{\alpha^P y^P}{y}$ or an increase in $\frac{\alpha^R y^R}{y}$ increases inequality.

Now define $\beta = \frac{(\alpha^P)^2 y^P}{y} + \frac{(\alpha^R)^2 y^R}{y}$. Writing $\alpha = \alpha^R$ and $x = \frac{\alpha^R y^R}{y}$, then:

$$\begin{aligned}\beta &= (1-\alpha)(1-x) + \alpha x \\ &= (1-\alpha) - (1-2\alpha)x\end{aligned}$$

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, we can plug in β and 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. Therefore, as inequality increases, β decreases, and the $\frac{\hat{y}}{y}$ gets smaller. Figure 4 shows how $\frac{\hat{y}}{y} + \frac{\gamma_A}{\Psi\hat{\alpha}}$ and $\frac{\hat{y}}{y} - \frac{\gamma_B}{\Psi\hat{\alpha}}$ shift to the left as inequality increases. As $(H)^{-1}$ is decreasing and convex, the distance between $\tilde{g}_A$ and $\tilde{g}_B$ increases.

Figure 4 – The effect of inequality on the difference between parties' announced policies



Source: author

In figure 4, I refers to the case before an increase in income inequality, and II to the case after. As inequality grows, it shifts $\frac{\hat{y}}{y} + \frac{\gamma_A}{\Psi\hat{\alpha}}$ and $\frac{\hat{y}}{y} - \frac{\gamma_B}{\Psi\hat{\alpha}}$ to the left, but distances Δ_I and Δ_{II} remain the same. However, given the shape of $(H)^{-1}$, $|\tilde{g}_{B_{II}} - \tilde{g}_{A_{II}}| > |\tilde{g}_{B_I} - \tilde{g}_{A_I}|$.

The higher the inequality, the higher the difference between the utilities voters derive from the public goods corresponding to the announced platforms, $H(\tilde{g}_B) - H(\tilde{g}_A)$. Using equation 13, note that $H(\tilde{g}_B) - H(\tilde{g}_A) = \left(H \circ (H')^{-1}\right)\left(\frac{\hat{y}}{y} - \frac{\gamma_B}{\Psi\hat{\alpha}}\right) - \left(H \circ (H')^{-1}\right)\left(\frac{\hat{y}}{y} - \frac{\gamma_A}{\Psi\hat{\alpha}}\right)$.

Because $H \circ (H')^{-1}$ is convex and because $\left(\frac{\hat{y}}{y} - \frac{\gamma_P}{\Psi\hat{\alpha}}\right), P = \{A, B\}$ shifts to the right, $H(\tilde{g}_B) - H(\tilde{g}_A)$ increases.

We can now show that the higher the inequality the higher the cost of electoral campaigns. From equation 1, the difference in a voter from class J's utility is $W^J(\tilde{g}_B) - W^J(\tilde{g}_A) = (\tilde{g}_B - \tilde{g}_A)\frac{y^J}{y} + [H(\tilde{g}_B) - H(\tilde{g}_A)]$. By plugging this expression in equation 14, we obtain:

$$\frac{c}{\Psi h} = \underbrace{[\tilde{g}_B - \tilde{g}_A]}_{\substack{\text{Increases} \\ \text{with inequality}}} \underbrace{\left[\left(\alpha^P\right)^2 \frac{y^P}{y} - \left(\alpha^R\right)^2 \frac{y^R}{y}\right]}_{\substack{\text{Increases} \\ \text{with inequality}}} + \underbrace{[H(\tilde{g}_B) - H(\tilde{g}_A)]}_{\substack{\text{Increases} \\ \text{with inequality}}} \underbrace{\left[\left(\alpha^P\right)^2 - \left(\alpha^R\right)^2\right]}_{\substack{\alpha^P > \frac{1}{2} > \alpha^R \rightarrow \\ > 0}}$$

Intuitively, more inequality means that the rich and the poor have different preferences for g, which in turn allows for $\tilde{g}_A$ and $\tilde{g}_B$ to be distant from each other. Lobbyists, however, foresee the risk that a policy very different from their preferred one might be implemented if the other party wins the elections. As a result, lobbyists become more willing to finance their own party, resulting in more expensive campaigns.

Chapter 3
Brazil

Throughout its history, Brazil has experienced a vast range of political systems. The country began as a Portuguese colony in 1500, gained independence as a constitutional monarchy in 1822 and finally became a republic in 1889. The republican period itself can be divided in many periods of alternation between democracy and dictatorship. The current Brazilian constitution was written in 1988 and re-established democracy after 20 years of military rule.

Brazil is currently a federal republic composed of 26 states and one federal district. Each stated is composed of municipalities (5570 in total) that are also considered members of the federation. They have autonomy to legislate and to implement public policies by their own, meaning that both states and municipalities have executive and legislative branches.

The executive branch of a municipality is represented by a mayor, whereas the legislative is represented by a unicameral local chamber. Every four years, voters have to choose one mayor and a number of local representatives[1]. For small municipalities, mayors are elected using a simple majority system. However, for municipalities with a population bigger than 200.000 people, a second-round system is used, meaning that if one candidate does not receive more than 50% of the valid votes, a second round is held between the top two candidates. Mayors can run for re-election, but not for three consecutive terms. Local representatives are elected using single voter proportional system and there are no term limits.

Campaigns are privately and publicly financed. Public resources mainly include transfers from the Campaign Party Fund (*Fundo Partidário*) and private resources include donations from individuals and from private companies. Donations from the latter were prohibited from 2016 on. That was compensated by an increase on the amount of public funding.

This study uses two distinct data-sets from two panels covering 4 Brazilian municipal elections (2004 to 2016). One contains aggregate electoral contributions and expenditures for candidates running for mayors and the other for candidates running for municipal

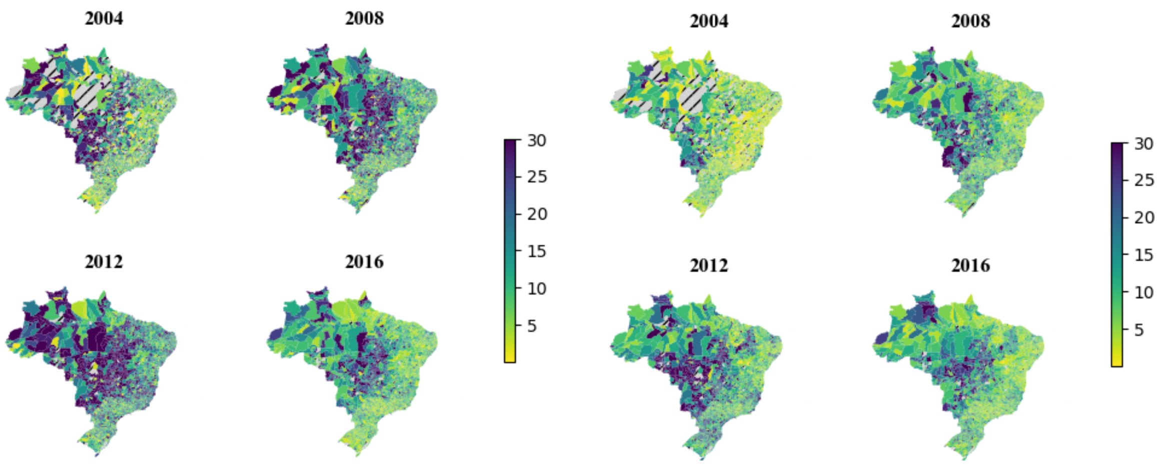
[1] From 9 to 55, depending on the municipality's population.

assembly representatives (local representatives). Each candidate is required the declare his or her electoral revenue and expenditure to the Brazilian Electoral Management Body (TSE - *Tribunal Superior Eleitoral*), where the data was taken from. To the best of our knowledge, this is the first time panel data for Brazilians municipalities is used to estimate the relationship between income inequality and campaign financing.

3.1 Dependent Variables

To obtain the dependent variables, the per-candidate data was aggregated by municipality according to the year an election was held and to the type of election (for mayors or for local representatives) to form the variable total private donations per municipality. Private donations include resources from the own candidate and donations from individuals and companies. The monetary values where then deflated to Brazilian Reais of 2012.

Figure 5 – Aggregate total campaign expenditure per voter - Brazil

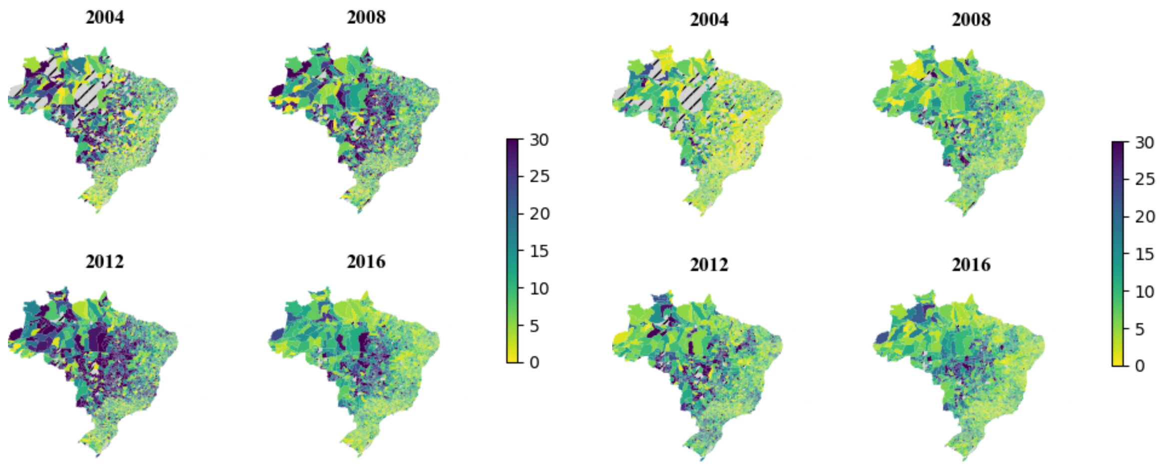


(a) Mayor Elections (b) Local Representative Elections

Source: TSE.

Figure 5 plots the total aggregate expenditure per voter by municipality and Figure 6 plots the aggregate private donations per voter by city in constant 2012 Brazilian Reais. Both graphs suggest that elections in the Northern and Center Western regions where more expensive in per voter terms. Mayor elections also seem to cost more than local representative elections.

Figure 6 – Aggregate total private donations per voter - Brazil



(a) Mayor Elections (b) Local Representative Elections

Source: TSE.

For the mayor elections, we divided the total private donations by the municipality's population and the number of voters in the municipality (in thousands) and took the natural logarithm to form the variables **Don/Hab** (Exec) and **Don/Vot** (Exec). Similarly, we divided the legislative total private donations by the city population and the number of voters in the city (in thousands) and took the natural logarithm to form the variables **Don/Hab** (Leg) and **Don/Vot** (Leg). The demographic data was taken from the population estimates calculated by the Brazilian Institute of Geography and Statistics (IBGE - Instituto Brasileiro de Geografia e Estatística), while the number of voters and seats were obtained from the TSE. Table 1 contains the summary statistics for these variables. To avoid loss of observations due to municipalities with no private donations, we added 1 to all previous variables.

Table 1 – Summary statistics for the dependent variables

	Obs.	Mean	Std	Min	25%	50%	75%	Max
Don/Vot(Exec)	21526	9.04	1.22	0	8.56	9.15	9.72	13.78
Don/Hab(Exec)	21526	8.76	1.23	0	8.27	8.88	9.45	13.44
Don/Vot(Leg)	21526	8.74	1.09	0	8.28	8.83	9.36	14.14
Don/Hab(Leg)	21526	8.46	1.11	0	7.97	8.54	9.1	13.78

Source: author.

In addition to private donations, this thesis is the first one to use estimated deduction values (*baixa de recursos estimáveis*) as an alternative measurement for campaign expenditure. Estimated deduction values are part of one candidate's total expenditure, but unlike regular costs, they represent estimated values of goods and services donated by a natural or a juridical person. An example would be offering printing services for a candidate but not charging for it. This variable is of great interest, because it reflects expenditures (and not revenue) financed entirely by private resources.

Estimated deduction based variables were calculated exactly as described above and were based on the natural logarithm of the following transformations: **EV/Vot** (Exec) and **EV/Hab** (Exec) represent estimated deduction values per voters and per citizens (in thousands) for mayor elections. **EV/Vot** (Leg) and **EV/Hab** (Leg) represent estimated deduction values per voters and per citizens (in thousands) for local representative elections. Table 2 contains the summary statistics. Note that this variable is only available from 2008 on.

Table 2 – Summary statistics for estimated deduction values

	Obs.	Mean	Std	Min	25%	50%	75%	Max
EV/Vot(Exec)	16483	7.48	1.71	0	6.81	7.75	8.52	13.77
EV/Hab(Exec)	16483	7.22	1.69	0	6.53	7.49	8.27	13.43
EV/Vot(Leg)	16483	8.16	1.4	0	7.57	8.29	8.99	13.64
EV/Hab(Leg)	16483	7.9	1.4	0	7.29	8.02	8.74	13.42

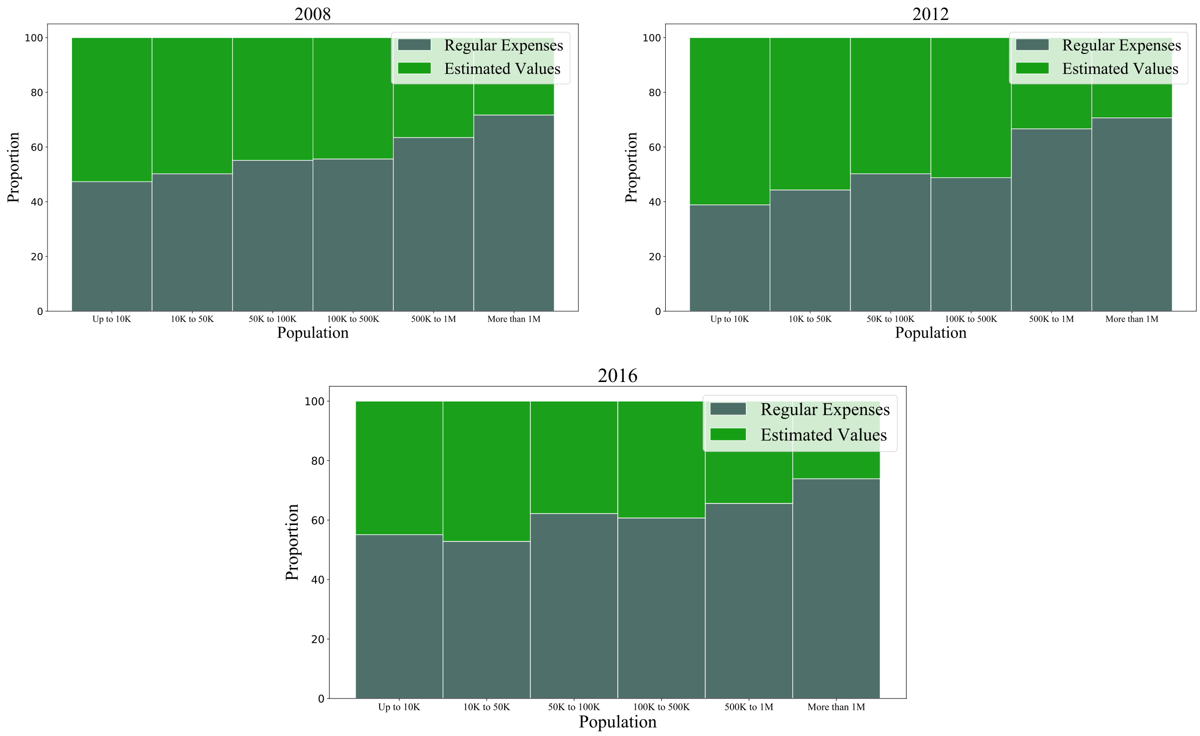
Source: author.

Estimated deduction values are not a large portion of mayors' elections expenditures (only 19%). However, for local representatives, it represents 44% of the total expenditure. Figure 7 plots the proportions of the type of expenditure for 6 city sizes to illustrate how up until 2016, local representative candidates relied heavily on this type of expenditure, especially in small municipalities.

3.2 Explanatory Variables

The main explanatory variable is the Gini coefficient. According to the theoretical model developed by Bugarin (2012), there should be a positive relationship between the

Figure 7 – Proportion of expenditure by type - local representative elections

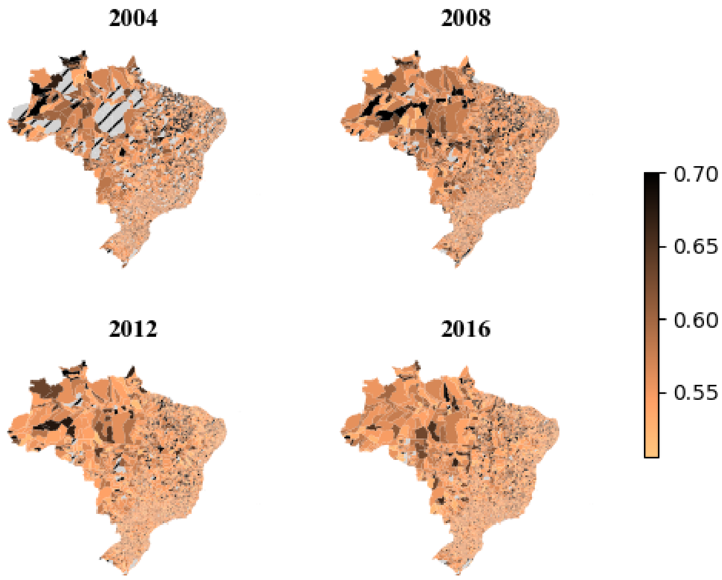


Source: TSE

Gini and the cost of elections. However, the Gini index for Brazilian municipalities does not match the municipal election years. Hence, this thesis uses income data from the RAIS database to calculate the Gini coefficients. The details of the calculation can be found in appendix A. RAIS is a database that covers all municipalities in Brazil and contains detailed data on formal workers. Given the size of the informal economy in Brazil, the Gini coefficient based on the formal sector might not be an exact measurement of the real income inequality. Nevertheless, given the limitations imposed by the data available, it is used here as a proxy. Figure 8 shows the calculated Gini coefficients for Brazilian municipalities for the election years. It suggests greater income inequality in the Northern region, although Brazil is quite unequal in general.

Because this study uses fixed effects, time invariant variables could not be used. Therefore not all the remaining explanatory variables described below are the same used by Bugarin (2012), Bugarin (2015) and Bugarin and Tanaka (2018), who performed OLS regressions for Brazil's municipalities. Table 3 contains the description for all independent variables. Table 4 contains summary statistics for all explanatory variables.

Figure 8 – Gini coefficients for Brazilian municipalities



Source: RAIS and author's calculations.

The controls are a set of demographic and electoral variables. The number of candidates, seats, voters and incumbents was included, as district size and incumbents can affect campaign financing Taylor, Herrnson and Curry (2017), Weinschenk and Holbrook (2014). Bugarin (2012), Bugarin (2015) and Bugarin and Tanaka (2018) also include a municipality's GDP and urban population. Cox and McCubbins (1986) supports that campaigns can be viewed as promises for welfare redistribution, and that politicians will prioritize their support groups. Kitsos and Proestakis (2021) and Livert and Gainza (2017) find evidence that intergovernmental transfers between national and local governments might play a role in pork-barrel activities: transfers are higher for municipalities politically aligned with the central government. Because more resources for public spending in an election year might affect campaign costs, we also include political alignment control variables.

Table 3 – Explanatory Variables

Variable	**Description**
Gini	The natural logarithm of the Gini coefficient obtained from the RAIS database.

Continued on next page

Table 3 – *Continued from previous page*

Variable	Description
Income	The natural logarithm of the per capita municipal income in constant 2012 Brazilian Reais. The municipalities' incomes where obtained from the Brazilian Institute of Geography and Statistics.
GiniIncome	The product of the Gini and the log of the municipality income. It controls for the effect of inequality on electoral expenditures as the municipality grows.
Education Frag	The population educational fragmentation index. This variable is a proxy for how heterogeneous the electorate is in educational terms. The index is calculated as $1 - \sum_{j=1}^{8} \varepsilon_j^2$ where ε_j is the proportion of voters in class j of 8 different educational levels. The educational levels were taken from the TSE. This variable indicates the educational level of voters at the moment they register for the first time or when they update their registration. If all voters have the same level of instruction, the educational frag index should be 0. On the other hand, the variable takes high values if all educational levels are well represented among voters.
Young	The percentage of voters between 16 and 17 years old in the municipality. Voting is compulsory in Brazil for all citizens 18 years old or older. However, it is optional for teenagers between 16 and 17 years old.
Senior	The percentage of senior voters, above 70 years old in the municipality. Senior citizens are not obligated to vote in Brazil. Both the Young and Senior variables were collected from the TSE.
AgeFrag	The age fragmentation index of the voters. It is a proxy for how heterogeneous the electorate is in terms of age span. The index is calculated as $1 - \sum_{j=1}^{11} v_j^2$ where v_j is the proportion of voters in age class j, of 11 different age classes. Like the education fragmentation index, the higher the index, the more heterogeneous the voters are in terms of age groups.

Continued on next page

Table 3 – *Continued from previous page*

Variable	Description
Urban	The urban population (in thousands) of the municipality.
Candidates	The number of candidates running for mayors or local representatives (according to the type of election) and their squares.
Voters	The number of voters (in thousands) in the municipality.
Seats	The number of local representative legislature seats under dispute. This variable is only applicable for local representative elections.
Runoff	A dummy that takes the value 1 if a second round was held in the municipality. Second rounds happen in municipalities with population above 200,000 people when one candidate does not achieve more than 50% of the valid votes. In that case, the two candidates who received more votes compete in a second round. It is expected that second rounds increase the cost of elections. Note that this variable is only available for mayors' elections.
Incumbent	For mayors, it is a dummy that takes the value 1 if there is one incumbent among the candidates. For local representatives, it is the number of representatives running for reelection. It is expected that incumbents would reduce the cost of elections due to incumbency advantages.
Pres Alignment	A dummy that takes the value 1 if the mayor at the time of the elections is from the same party as the president.
Gov Alignment	A dummy that takes the value 1 if the mayor at the time of the elections is from the same party as the state governor.
PresGov Alignment	A dummy that takes the value 1 if the mayor at the time of the elections is from the same party as the president and the state governor.

Source: author.

Table 4 – Summary statistics for Explanatory Variables

	Count	Mean	Std	Min	25%	50%	75%	Max
Gini	21526	-0.47	0.08	-0.6	-0.52	-0.49	-0.44	0
Income	21526	14.07	16.41	-1.46	5.74	10.23	17.05	777.1
GiniIncome	21526	-6.75	8.25	-419.81	-8.37	-4.85	-2.61	0.74
EducationFrag	21526	0.75	0.04	0.45	0.73	0.76	0.78	0.86
Young	21526	0.04	0.01	0	0.02	0.03	0.04	0.1
Senior	21526	0.07	0.02	0.01	0.06	0.07	0.08	0.2
AgeFrag	21526	0.84	0.01	0.78	0.83	0.84	0.84	0.87
Urban	21526	29.29	203.57	0.17	2.87	6.37	15.86	11929.83
Candidates	21526	2.93	1.28	1	2	3	3	16
Candidates2	21526	10.09	10.86	-112	4	9	9	121
Voters	21526	24.24	148.01	0.83	4.29	8.24	17.02	8886.32
Runoff	21526	0.01	0.09	0	0	0	0	1
Incumbent	21526	0.49	0.5	0	0	0	1	1
PresAlignment	21499	0.08	0.27	0	0	0	0	1
GovAlignment	21499	0.19	0.39	0	0	0	0	1
PresGovAlignment	21499	0.02	0.15	0	0	0	0	1

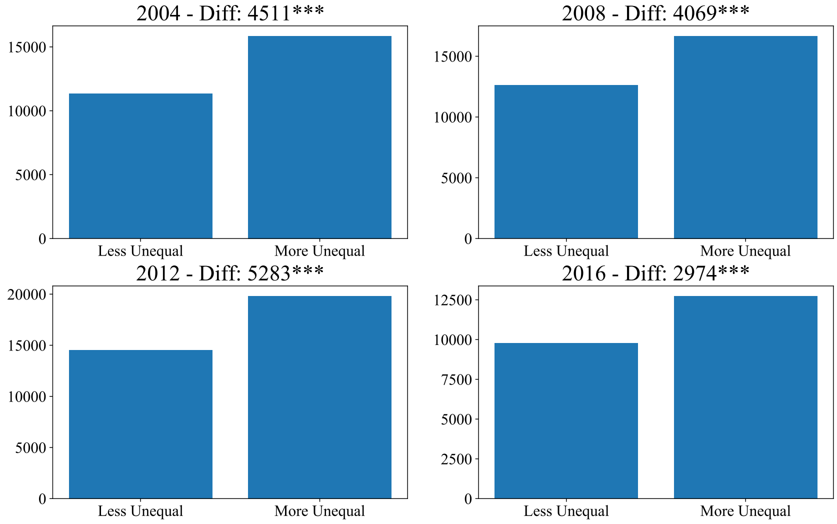
Source: author.

Figures 9 and 10 show the average private campaign donations for the 1000 most unequal and the 1000 less unequal municipalities. A visual analysis indicated that more unequal municipalities have on average higher electoral contributions. The differences in averages are shown on the top part of each graph. We also performed a t test to test for the null hypothesis that the averages are the same. In most cases, the hypothesis is rejected at the 1% level. This result should not be interpreted as a causal association, but rather, it is an indicative that the relationship between income inequality and electoral costs is likely to be positive.

3.3 Econometric Specification and Results

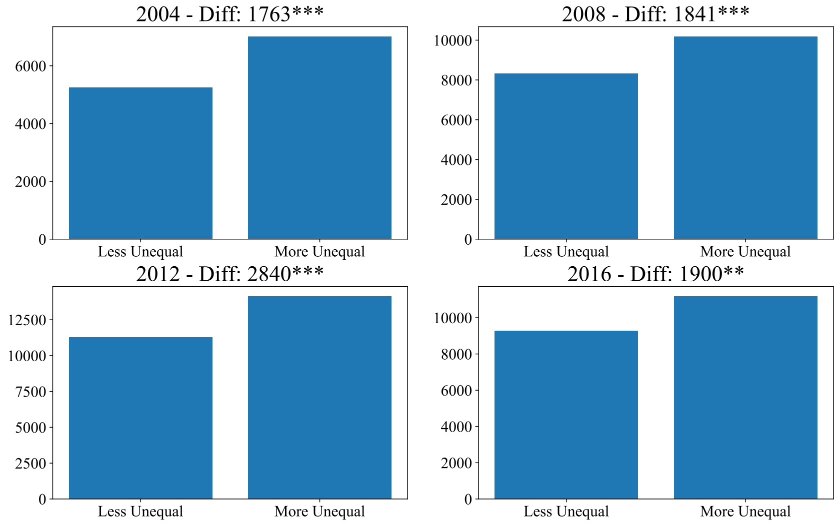
This section presents the results for Brazil's local elections for mayors and local representatives. POLS, random effects and fixed effects specifications were tested. However, only the fixed effects models are shown, as the Chow test, the Breusch-Pagan test and the Hausman test indicated that the best fitting model was the fixed-effects specification.

Figure 9 – Most and least unequal municipalities average donations - Mayors



*p < 0.1, **p < 0.05, ***p < 0.01. Source: TSE.

Figure 10 – Most and least unequal municipalities average donations - Local Representatives



*p < 0.1, **p < 0.05, ***p < 0.01. Source: TSE.

Furthermore, the error term was clustered at the municipality level, as the modified Wald test for groupwise heteroskedasticity in fixed effects models suggested the presence of heteroskedastic errors. The tests' statistics and P-values can be found in table 33 in appendix G.

All models for Brazil are variations of the following econometric specification:

$$y_{i,t} = \alpha + \beta Gini_{i,t} + \Gamma_1 CON_{i,t} + \Gamma_2 Y_{i,t} + \mu_i + \epsilon_{i,t} \tag{15}$$

Where $y_{i,t}$ denotes either an aggregate campaign expenditure or revenue variable in municipality i in the year t. $Gini_{i,t}$ is the Gini index in municipality i in the year t and β is the coefficient of interest, which we expect to be positive. $CON_{i,t}$ is a vector of control variables and $Y_{i,t}$ is a vector of year dummies. Both vectors have its corresponding coefficient vectors Γ_1 and Γ_2. μ_i captures a time-invariant individual effect, α is the constant and $\epsilon_{i,t}$ the error term.

The main hypothesis is:

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

3.3.1 Mayors

Table 5 shows the main results for the mayoral elections. The dependent variables for regressions 1, 2, 3 and 4 are respectively: private donations per voter, private donations per citizen, estimated deduction values per voter and estimated deduction values per citizen. In all cases, an F test for the year dummies indicated that the year fixed effects should the kept in the models (see table 33 in appendix G). Furthermore, alternative specifications (with the inclusion of municipal investment and the number of citizens who receive money transfers from the government as controls) and estimates with the inclusion of electoral data from the 2020 municipal elections can be found in appendix B.

As expected, the estimated coefficient for the Gini index is positive and statistically significant when the dependent variable is the logarithm of private donations, meaning that inequality affects campaign donations positively. This effect seems to be stronger in per citizen terms, as regressions 2 exhibits bigger coefficients than regressions 1. In our specification, both the *Gini* variable and the dependent variable are in natural logs, meaning that it is possible to interpret the estimated coefficients as coefficients of elasticity. An increase of 10% in the Gini index represents a $1.1^{0.62-0.01*ln(Income)}$% change in private donations per thousand voters. Using the average value of $ln(Income)$ (14), an increase of 10% in the Gini index increases private donations by 4.6%.

The estimated coefficients for the Gini index for models (3) and (4), which use the natural log of estimated values as the dependent variable, are not statistically significant. Initially, we would expect them to be positive. However, this result is consistent with the fact that estimated values are not the main type of expenditure for candidates running for mayors.

Although the specification used here is not exactly the same used in previous studies due to the use of panel data (all previous studies for Brazil were cross-sectional analysis), the main results are in line with Bugarin (2015) and Bugarin and Tanaka (2018).

$GiniIncome$ has a negative coefficient and $Income$ has a positive one, meaning that the effect of the Gini index tends to diminish slowly as municipalities become richer. $EducationFrag$ also has a positive coefficient, suggesting that citizens from less educationally homogeneous municipalities tend to donate more. We believe that this reinforces our main results, as income inequality and educational fragmentation are highly related. It is also interesting to note that $Young$ and Old are positively correlated with private donations. This might due to the fact that voting is not mandatory for teenagers and senior citizens in Brazil. Thus, candidates have to spend more to attract votes from these two age groups. The number of candidates is also positively correlated with campaign costs. This is expected, as more candidates represent more competition, increasing the cost of elections, although this effect slowly decreases, as $Candidates2$ has a negative coefficient.

The variable, $Incumbent$ has a negative sign for models (3) and (4). This is expected, as incumbency can reduce campaign costs due to incumbency advantages. However, that is not the case for regressions 1 and 2. One explanation is that incumbency might be increasing competition, as 1 extra candidate is quite a large addition to most municipalities (at least 75% of all municipalities had only 3 candidates for mayor). Another possibility is that some incumbents foresee that they might lose and tend to spend more on their campaigns, causing supporters to increase their donations. In this case, non-reelected mayors dominate the reelected in terms of private contributions.

As for the political alignment variables, $PresAlignment$ is positive in all cases and $PresGovAlignment$ is negative only for regressions (3) and (4). Initially, we would expect that if the current mayor is from the same party as the state governor or the president, campaign costs would be reduced, as the president or governor can transfer public resources to his or her allies in municipalities. That happens in regressions (3) and (4). However, the estimated coefficient for the variable *PresAlignment* is positive in all cases. A possible explanation is that *PresAlignment* is a dummy that is equal to 1 if the mayor is from the same party as the president. Between 2004 and 2016, all presidents were from the same party (the Worker's Party, or PT). Therefore, *PresAlignment* is also a dummy that indicates whether the mayor is from the worker's party or not. In other words, *PresAlignment* captures not only political alignment with Brazil's president, but is also captures whether the mayor is from the Worker's Part.

Table 5 – Mayor Elections - Fixed Effects

	(1)	(2)	(3)	(4)
	Don/Vot	Don/Hab	EV/Vot	EV/Hab
Gini	0.62***	0.52***	0.35	0.32
	(0.16)	(0.16)	(0.27)	(0.26)
GiniIncome	−0.03**	−0.02*	0.00	0.01
	(0.01)	(0.01)	(0.02)	(0.02)
Income	−0.01**	−0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
EducationFrag	2.00***	2.17***	8.66***	8.31***
	(0.69)	(0.68)	(1.29)	(1.26)
Young	8.34***	7.72***	8.11**	8.00**
	(2.27)	(2.24)	(4.11)	(4.04)
Senior	4.19***	6.77***	6.73***	8.87***
	(1.27)	(1.26)	(2.33)	(2.29)
AgeFrag	−2.80	−0.68	4.15	5.48
	(3.48)	(3.42)	(6.37)	(6.26)
Urban	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.15***	0.14***	0.24***	0.23***
	(0.02)	(0.02)	(0.03)	(0.03)
Candidates2	0.00**	0.00*	−0.01**	−0.01**

Continued on next page

Table 5 – *Continued from previous page*

	(1) Don/Vot	(2) Don/Hab	(3) EV/Vot	(4) EV/Hab
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	0.00**	0.00	−0.01***	−0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Runoff	0.05	0.04	−0.24	−0.25
	(0.13)	(0.13)	(0.20)	(0.20)
Incumbent	0.00	0.01	−0.10***	−0.10***
	(0.01)	(0.01)	(0.02)	(0.02)
PresAlignment	0.07**	0.07**	0.17***	0.17***
	(0.04)	(0.04)	(0.06)	(0.06)
GovAlignment	−0.02	−0.03	0.06	0.05
	(0.03)	(0.03)	(0.04)	(0.04)
PresGovAlignment	−0.03	−0.02	−0.33***	−0.31***
	(0.06)	(0.06)	(0.10)	(0.10)
Constant	9.03***	6.66**	−3.27	−4.56
	(2.87)	(2.83)	(5.26)	(5.18)
Obs.	21499	21499	16462	16462
$R^2 within$	0.056	0.069	0.145	0.151
$R^2 overall$	0.047	0.036	0.024	0.023
$R^2 between$	0.040	0.021	0.010	0.011
σu	0.818	0.866	1.739	1.776
σe	1.011	0.996	1.376	1.352
ρ	0.396	0.431	0.614	0.633
Year FE	Yes	Yes	Yes	Yes

Models for mayor elections - Fixed Effects. The dependent variables are: Don/Vot - donations per voter, Don/Hab - donations per citizen, EV/Vot - estimated values per voter e EV/Hab - estimated values per citizen. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

3.3.2 Local Representatives

Table 6 shows the fixed effects estimations results for the local representative elections. The dependent variables for regressions 5 to 8 are respectively the natural logarithm of the private donations per voters, private donations per citizen, estimated deduction values per voter, and estimated deduction values per citizen. The estimated coefficient for the Gini coefficient is positive and significant in all cases, reinforcing the results obtained for mayors and the ones previously observed in the literature.

For the control variables, the coefficients' signs are largely similar to the ones estimated for the mayor's case, but it is worth noting some differences. For local representatives, incumbents seem to increase private donations, but have no effect on estimated values. As stated previously, local representative candidates rely on estimated values more than mayors. Direct goods and services donations might be more accessible resources for candidates who can rely on incumbency advantages. Finally, the number of seats under dispute affects private donations and estimated values negatively. This result can be explained in terms of competition: the more seats the less competition between candidates.

Table 6 – Local representative Elections. Results - Fixed Effects

	(5)	(6)	(7)	(8)
	Don/Vot	Don/Hab	EV/Vot	EV/Hab
Gini	0.40**	0.30*	0.46**	0.45*
	(0.16)	(0.16)	(0.23)	(0.23)
GiniIncome	−0.01	0.00	−0.02	−0.02
	(0.01)	(0.01)	(0.01)	(0.01)
Income	0.00	0.00	−0.01	−0.01
	(0.01)	(0.01)	(0.01)	(0.01)
EducationFrag	2.20***	2.34***	8.15***	7.80***
	(0.57)	(0.56)	(1.08)	(1.06)
Young	2.95	2.41	4.11	4.14
	(2.15)	(2.12)	(3.55)	(3.51)
Senior	−1.71	0.83	4.45**	6.47***
	(1.18)	(1.17)	(1.83)	(1.80)

Continued on next page

Table 6 – *Continued from previous page*

	(5) Don/Vot	(6) Don/Hab	(7) EV/Vot	(8) EV/Hab
AgeFrag	1.99	4.10	4.06	5.58
	(3.01)	(3.00)	(5.13)	(5.07)
Urban	0.00	0.00**	0.00**	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.00**	0.00**	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates2	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	0.00**	0.00	−0.01***	−0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Seats	−0.04**	−0.05***	−0.13***	−0.14***
	(0.02)	(0.02)	(0.03)	(0.03)
Seats2	0.00	0.00	0.00**	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Incumbent	0.14***	0.15***	−0.03	−0.02
	(0.04)	(0.04)	(0.07)	(0.07)
PresAlignment	−0.01	−0.01	0.06	0.06
	(0.03)	(0.03)	(0.05)	(0.05)
GovAlignment	0.00	0.00	0.09***	0.09***
	(0.02)	(0.02)	(0.03)	(0.03)
PresGovAlignment	0.14***	0.15***	−0.06	−0.04
	(0.05)	(0.05)	(0.08)	(0.08)
Constant	5.25**	2.96	−0.69	−2.08
	(2.47)	(2.46)	(4.26)	(4.21)
Obs.	21499	21499	16462	16462
$R^2 within$	0.173	0.203	0.087	0.102
$R^2 overall$	0.048	0.044	0.012	0.015
$R^2 between$	0.004	0.004	0.005	0.006
σu	0.834	0.919	1.292	1.311

Continued on next page

Table 6 – *Continued from previous page*

	(5) Don/Vot	(6) Don/Hab	(7) EV/Vot	(8) EV/Hab
σe	0.854	0.845	1.111	1.100
ρ	0.487	0.542	0.574	0.587
Year FE	Yes	Yes	Yes	Yes

Models for local representatives elections - Fixed Effects. The dependent variables are: Don/Vot - donations per voter, Don/Hab - donations per citizen, EV/Vot - estimated values per voter e EV/Hab - estimated values per citizen. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

3.4 Electoral Competition

In municipalities with low electoral competition, candidates might not have the need to spend a lot of resources on campaigns. On the other hand, as electoral competition increases, the effect of income inequality on campaign donations might also increase, as candidates might have to deviate further from their preferred policies in order to obtain more votes, which in turn increases the amount of money lobbyists have to donate to political campaigns. In this section, as a robustness check, we calculate 6 different indexes of electoral competition to explore the combined effect of electoral competition and income inequality on electoral expenditures. To the extent of our knowledge, this study is the first to attempt to estimate this effect. For mayors, all indexes described below are based on the number (or percentage) of votes received by one candidate in a municipality. For the Local representatives elections, an open list proportional representation system is used, meaning that the indexes were calculated based on the number (or percentage) of votes in party coalitions. Appendix C contains a detailed description of the indexes.

The first index of electoral competition is the difference (in percentage) between the first and the second most voted candidates (Diff). The greater this difference, the lower the electoral competition. The second index is the Gini coefficient (Gini) of the distribution of votes among the candidates in a municipality. The Gini coefficient is a measurement of inequality, meaning that the more unequal the distribution of votes, the lower the electoral competition. Next, we calculate the Herfindahl-Hirschman index (a common index used to measure market fragmentation) and normalize it in two different ways (HHin and HHIb). The more fragmented the distribution of votes, the lower the electoral competition.

The fifth index is the Entropy[2] (H). Entropy comes from the Theory of Information, and measures uncertainty. In our case, the more uncertainty, the stronger the electoral competition. The last index is the square root of the Jensen-Shanon Divergence (JSD), which can be interpreted as a measurement of distance between two distributions of probability. Here, we compute the Jensen-Shanon Divergence between the real distribution of votes in a municipality and a uniform distribution. The greater the Divergence, the lower the competition. Table 7 contains a description of all indexes used. Table 8 contains summary statistics for the electoral competition indexes.

Table 7 – Electoral Competition Indexes

Index	**Candidates used in computation**	**Relationship with electoral competition**
Diff	1^{st} and 2^{nd}	Inverse
Gini	All	Inverse
HHIn	All	Inverse
HHIb	All	Inverse
H	All	Direct
JSD	All	Inverse

Source: author.

Ideally, the electoral competition indexes should be used as explanatory variables and should be interacted with the Gini coefficient in order to check if in municipalities with more competition, the impact of the Gini on donations is bigger. However, electoral competition is likely to be an endogenous variable: more electoral competition increases the amount of donations, but more donations have a positive impact on electoral competition. To solve this problem, an instrumental variables is needed, but because we are using a panel, no instrumental variables could be found for all years in our sample.

Here, we use the electoral competition indexes to select the municipalities where the elections were more competitive. We then re-run regressions 1 and 5 using sub-samples of municipalities with more electoral competition, and expect that the estimated coefficient for the Gini index in those regressions to get bigger as competition increases. In other

[2] Not to be mistaken for the concept of entropy in thermodynamics.

Table 8 – Electoral Competition Indexes - Summary Statistics

	Obs.	Mean	Std.	Min	25%	50%	75%	Max
				Mayors				
Diff	21436	0.24	0.28	0	0.06	0.13	0.27	1
Gini	21436	0.37	0.29	0	0.11	0.32	0.55	1
HHIn	21436	0.2	0.28	0	0.01	0.09	0.23	1
HHIb	21436	0.22	0.28	0	0.02	0.11	0.29	1
H	21436	0.8	0.28	0	0.71	0.92	0.99	1
JSD	21436	0.25	0.27	0	0.05	0.17	0.38	1
				Local Representatives				
Diff	21521	0.12	0.15	0	0.03	0.08	0.16	1
Gini	21521	0.3	0.17	0	0.18	0.29	0.4	1
HHIn	21521	0.08	0.12	0	0.02	0.05	0.09	1
HHIb	21521	0.11	0.13	0	0.03	0.07	0.13	1
H	21521	0.91	0.12	0	0.88	0.94	0.98	1
JSD	21521	0.2	0.13	0	0.1	0.18	0.28	1

Source: author.

words, we expect the Gini index to have a greated impact on donations per voter in municipalities with more electoral competition. Because our panel has 4 years, we have 6 different electoral competition indexes for each year for each municipality. To select the municipalities with more competition, we average each competition index for each municipality along the 4 years to obtain 6 unique competition indexes for each municipality. We then order the sample in six different ways based on the six averaged competition indexes.

In total, we select five sub-samples. Table 9 shows the results for the Mayor elections. Each cell shows the estimated coefficient for the *Gini* variable when the dependent variable is the logarithm of donations per voters (all other controls were added, but the results are omitted). Columns contain the competition index used to select the sub-sample, and rows show the size of the ordered sample (the first row contains the whole sample, and it is the same for all columns). For example, cell (JSD, 33%) means that the criteria used to select the 33% of municipalities whose elections were more competitive was the Jensen-Shannon Divergence. Furthermore, the 0.55* is the estimated coefficient for the Gini index for this regression. In other words, the rows at the bottom contain the estimations with the most competitive municipalities.

Looking at table 9 from top to bottom, one can identify a trend in the estimated coefficient for the Gini index. The greater the electoral competition (the further down we

Table 9 – Combined effect of electoral competition and inequality on campaign donations - Mayors .

	Dif	Gini	HHIn	HHIb	JSD	H
100%	0.62***	0.62***	0.62***	0.62***	0.62***	0.62***
66%	0.56***	0.51**	0.54***	0.51**	0.42*	0.52**
50%	0.76***	0.50**	0.62***	0.60***	0.42*	0.59***
33%	0.96***	0.61**	0.77***	0.73***	0.55*	0.61**
20%	1.07***	0.91**	0.91**	0.67*	0.89**	0.77*
10%	1.29***	1.22***	0.84*	1.07**	1.12**	1.22***

Model 1 - estimations with sub-samples based on electoral competition. Only coefficients for the *Gini* variable are shown. Criteria: Dif - Difference between top two candidates. Gini - Gini of the distribution of votes. HHIn and HHIb - Normalized Herfindahl-Hirschman Indexes. JSD - Jensen-Shannon Divergence. H - Entropy. *p < 0.1, **p < 0.05, ***p < 0.01. Source: author

look at the table), the greater the impact of income inequality on campaign donations. No matter the criteria used, the estimated coefficient at 66% is always smaller that at 10%. Although sub-sampling might lead to bias (especially selection bias), we believe that our results indicate that in municipalities whose mayor elections are more competitive, income inequality plays a more important role in explaining campaign donations.

Table 10 shows the estimated coefficients for the Gini index using donations for local representatives as the dependent variable. The results seem to be the opposite of the ones found for the mayor elections: the lower the electoral competition, the greater the impact of income inequality on campaign donations. One possible explanation is that as competition rises, the factors that influence campaign donations change for mayors and local representatives. Competitive elections for mayors, that receive more attention from the public and the media, might cause factors related to income distribution (taxation, radical changes in public policies, etc) to be even more relevant to political campaigns. On the other hand, legislative elections, that draw less attention, competition might be related to other aspects other than income distribution, such as civil rights, religion etc.

Table 10 – Combined effect of electoral competition and inequality on campaign donations - Local Representatives.

	Dif	Gini	HHIn	HHIb	JSD	H
100%	0.40**	0.40**	0.40**	0.40**	0.40**	0.40**
66%	0.42**	0.47**	0.45**	0.39**	0.47**	0.46**
50%	0.49**	0.39*	0.26	0.28	0.34	0.27
33%	0.17	0.28	0.12	0.12	0.27	0.27
20%	0.41	0.18	0.05	0.43	−0.22	−0.17
10%	0.66	−0.33	0.20	0.55	−0.19	−0.71

Model 5 - estimations with sub-samples based on electoral competition. Only coefficients for the *Gini* variable are shown. Criteria: Dif - Difference between top two candidates. Gini - Gini of the distribution of votes. HHIn and HHIb - Normalized Herfindahl-Hirschman Indexes. JSD - Jensen-Shannon Divergence. H - Entropy. *p < 0.1, **p < 0.05, ***p < 0.01. Source: author

Chapter 4
Japan

The National Diet, Japan's postwar parliamentary monarchy highest organ, is formed by a Lower House (the House of Representatives) and an Upper House (the House of Councillors)[1]. Despite the similarities with the British parliamentary system, Japan has its own particularities, making Japanese politics quite peculiar. This section briefly discusses postwar Japanese government and politics and sets the background for Japan's Upper House elections' estimations.

Perhaps one of the most noteworthy aspects of Japanese elections is its strong candidate-centred traits. Regardless of its parliamentary system, candidates, especially the ones running for the Lower House, have strong incentives to develop personal vote. Most scholars attribute this individual-centred feature to the electoral system. Throughout their history, both houses had very different rules for electing its members. Since 1925, the House of Representatives adopted a single nontransferable vote multimember district (SNTV-MMD). In that system. candidates on each district where ranked based on the number of votes they got and the ones ranked within the number of seats assigned to the district were elected. That meant every party seeking a majority in the Lower House had to elect more than one candidate in each district, which forced candidates from the same party to compete against each other.

Another trait of Japan's politics throughout most part of the second half of the twentieth century was the Liberal Democratic Party (LDP) political hegemony. The SNTV-MMD system strongly encouraged LDP members to form or enter personal support organizations. These organizations, known as *kōenkai*, supported its members providing various services, including fund raising and personal favours. As a result, elections where expensive and the LDP's decentralized structure provided a fertile environment for recurring scandals.

In 1993, the LDP lost the general elections for the first time, allowing for deep reforms in the Lower House's election system. The SNTV-MMD was substituted for a mixed electoral system of Single-Member Districts (SMD) and closed list proportional

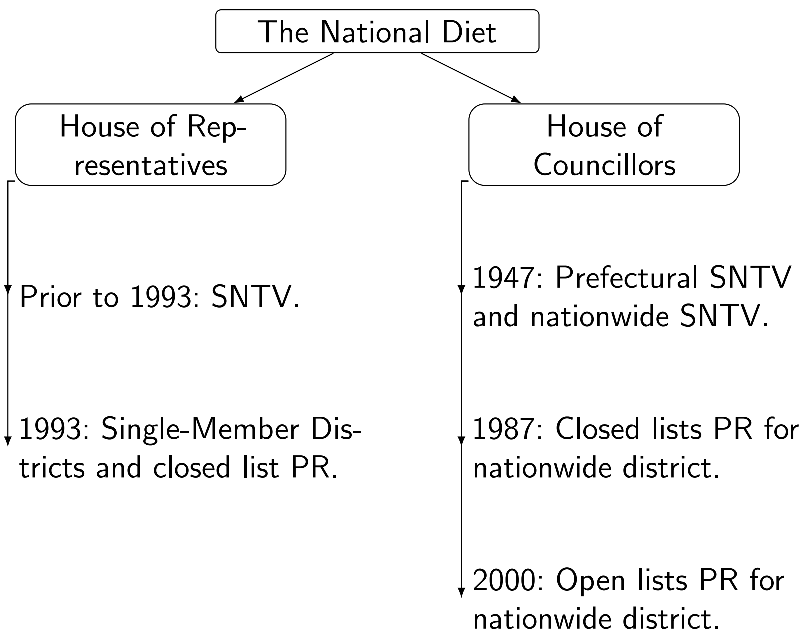
[1] In a rough comparison with the British Parliament, the House of Representatives and the House of Councillors would be equivalent to the House of Commons and the House of Lords, respectively.

representatives (PR). The reform was extensively studied and it has been shown to reduce intraparty competition and weaken the *kōenkai* (CATALINAC, 2018; COX; THIES, 1998; COX; THIES, 2000).

The Upper House was created in 1947 as a substitute for the House of Peers (*kizokuin*), and election rules for its members have gone through several changes since it was founded. The House holds elections every 3 years and members serve six-year terms, so that half of the seats are renovated every election. Voters cast two votes: one for a local prefectural district and other for a national district. Since it was established, about 60% of its members have been elected from Japan's forty-seven prefectures by the SNTV rule[2]. The remaining seats were disputed in a single national district under SNTV.

In 1982, the SNTV rule for the national district was substituted for a proportional representation rule from closed party lists. Finally, in 2000, open lists were introduced. In 2016, 73 candidates were elected from prefectural districts and 48 from PR lists in the nationwide district. Figure 11 summarizes the main changes in Japan's electoral rules.

Figure 11 – The National Diet main electoral changes



Source: author.

Due to the earlier introduction of PR list for the nationwide district and fewer candidates in the prefectural districts, members of the Upper House had to deal with less

2 The number of seats under dispute in each prefecture varies with its size. For exemple, in 2016, Tōkyo elected 6 representatives, but Kyōto elected only 2.

intraparty competition. However, that did not mean that the House of Councillors was entirely free of political factions (COX; ROSENBLUTH; THIES, 2000).

Since 1994, parties are both publicly and privately funded. Public funds are provided directly to parties (and not to candidates), but can only be used for day-to-day expenses, not for electoral campaigns. Furthermore, candidates have a limit on how much they can spend on campaigns, and have to report on their campaign finances.

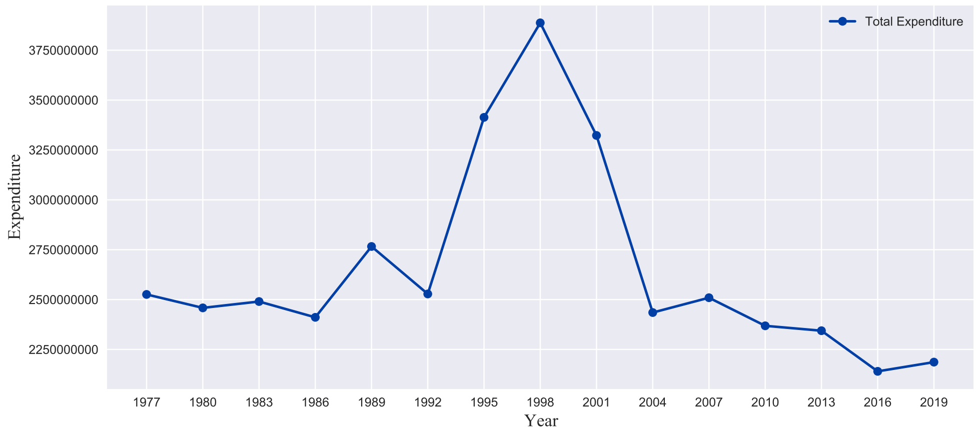
In accordance with Bugarin (2012) and Bugarin (2015), this study uses updated campaign expenditure data from 1977 to 2016, covering most changes in the election systems of both houses. However, the database only contains information from the House of Councillors' SNTV prefectural elections, whose rules remained stable throughout the period. The Gini coefficients are calculated by the Ministry of Internal Affairs and Communications through the National Survey of Family Income and Expenditure. Overall, the data covers 14 elections. Because each prefecture represents one entity, the full data set contains 658 observations. Furthermore, this is the first study to estimate the impact of income inequality on different categories of electoral costs.

4.1 Dependent Variables

The main variable is the House of Councillors' elections electoral expenditure aggregated by prefecture (*todoufuken*) from 1977 to 2016. The data is provided by the Report on the Result of the Elections for the House of Councillors (RRE, *Sangiin tsujō senkyo kekka shirabe*), published by the Japan Statistics Bureau, Ministry of Home Affairs and Communication. It contains information on each candidate's electoral campaign expenditure in Japanese yen. The individual expenditures were aggregated by prefecture for each electoral year and deflated to constant yens of 2005 using the Consumer Price Index calculated by the Statistics Bureau of the Government of Japan (JSB). Figure 12 plots the constant total campaign expenditure for the Japanese Upper House elections from 1977 to 2016.

Figure 12 indicates that excluding the period between 1995 and 2001, campaign expenditures exhibit a fairly stable behavior in constant yens. Figure 13 presents the total campaign expenditure per prefecture from 1977 to 2016. In 2016, the prefectures of Tottori and Shimane and the prefectures of Tokushima and Kōchi held combined

Figure 12 – Total campaign expenditure for the Japanese Upper House elections.



Constant Japanese yens of 2005. Local constituencies, 1977-2016. Source: Report on the Result of the Elections for the House of Councillors.

elections for the Upper House. That means Tottori and Shimane formed one at-large district (Tottori-Shimane at-large district) and the election was held as if both prefectures were only one. The same applies for Tokushima and Kōchi. For this reason, this study excluded these four prefectures from the main estimations. However, appendix F contains models with the inclusion of these four prefectures.

Three different dependent variables were used for the regressions. They are the same used by Bugarin (2012), Bugarin (2015) and were all based on the base 10 logarithm of campaign expenditures in constant yens of the following variables.

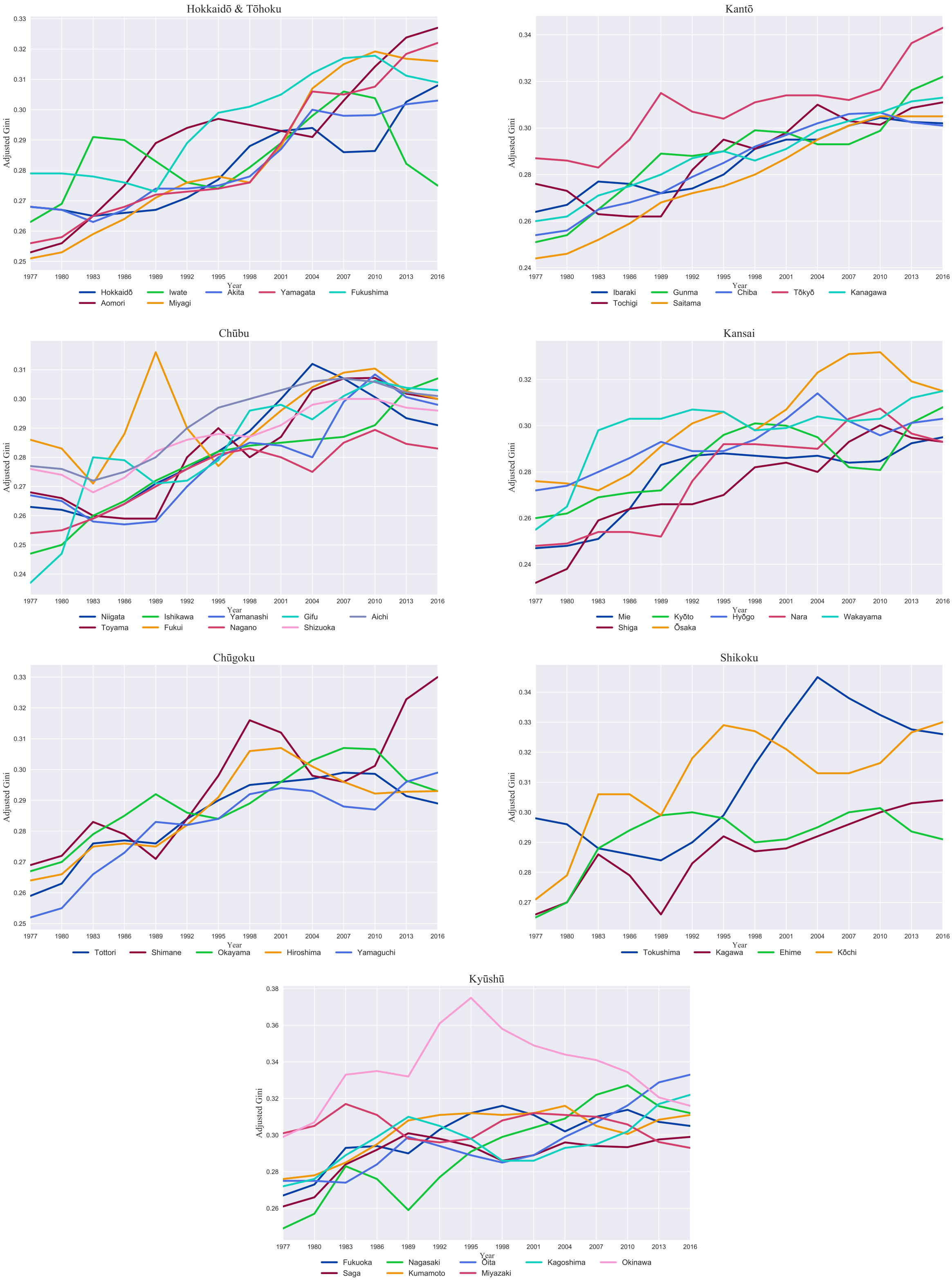
Exp: the constant expenditure divided by the prefecture population in thousands at the same election year. The populational data was collected from the Japan Statistical Yearbook (JSB).

ExpV: the constant expenditure divided by the number of elective voters in thousands in the prefecture at the election year. The number of elective voters was collected from the Japan Statistical Yearbook (JSB) and from the Report on the Result of the Elections for the House of Councillors.

ExpVS: the ExpV divided by the number of seats available in the election for each prefecture. The number of seats available in each election for each prefecture was collected from the Japan Statistical Yearbook (JSB) and from the Report on the Result of the Elections for the House of Councillors.

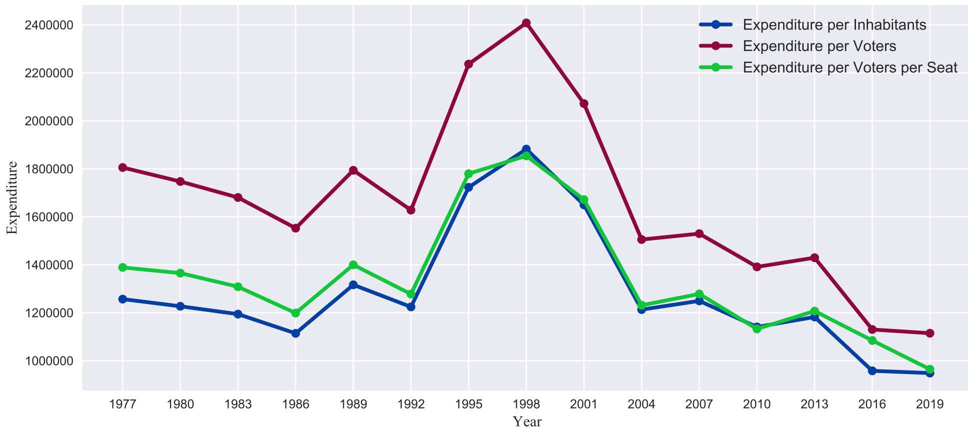
Figure 14 presents the variables described above. Table 11 contains the summary statistics for the campaign expenditures.

Figure 13 – Campaign expenditure for the Japanese Upper House.



Expenditure by prefecture in constant 2005 Japanese yen (1977-2016). Source: Report on the Result of the Elections for the House of Councillors.

Figure 14 – Campaign expenditure for the Japanese Upper House.



Local constituencies, 1977-2016 in constant 2005 Japanese yen. Source: Report on the Result of the Elections for the House of Councillors

Table 11 – Summary statistics - dependent variables

	Obs.	Mean	Std	Min	25%	50%	75%	Max
Exp	602	10.05	0.41	8.56	9.77	10.07	10.3	11.25
ExpV	602	10.31	0.42	8.78	10.03	10.35	10.58	11.51
ExpVS	602	9.93	0.74	7.98	9.42	10.06	10.48	11.51

Source: author.

4.2 Explanatory Variables

The main explanatory variable is the Gini coefficient. According to the theoretic model described in section 2, we expect to see a positive relationship between the Gini coefficient and the electoral campaign expenditures, meaning that the more unequal a prefecture is, the more expensive campaigns should be. The Prefectural Gini coefficient is calculated by the Ministry of Internal Affairs and Communications through the National Survey of Family Income and Expenditure every five years. However, the House of Councillors elections are held every three years. That means there is no perfect match between the Gini coefficients and the electoral data. Therefore, this thesis calculates the weighted average for the Gini coefficients (Adjusted Gini) for the years in between the release of the National Survey of Family Income and Expenditure. Table 12 demonstrates the procedure used for obtaining the Adjusted Gini. Figure 15 displays the Adjusted Gini coefficients for every prefecture from 1977 to 2016. The data suggests a continuous deterioration of income equality in Japan over the last 40 years.

Table 12 – Adjusted Gini formulas

Electoral Year	Gini Year	Adjusted Gini
1977	1979	1979
1980		0.8(1979)+0.2(1984)
1983	1984	0.2(1979)+0.8(1984)
1986		0.6(1984)+0.4(1989)
1989	1989	1989
1992	1994	0.4(1989)+0.6(1994)
1995		0.8(1994)+0.2(1999)
1998	1999	0.2(1995)+0.8(1999)
2001		0.6(1999)+0.4(2004)
2004	2004	2004
2007	2009	0.4(2004)+0.6(2009)
2010		0.8(2009)+0.2(2014)
2013	2014	0.2(2009)+0.8(2014)
2016		2014

Source: author based on the National Survey of Family Income and Expenditure.

All explanatory variables are described in table 13 and are exactly the same used by Bugarin (2012), Bugarin (2015). Table 14 contains descriptive statistics for all the explanatory variables.

Table 13 – Explanatory Variables

Variable	**Description**
Gini	The natural logarithm of the prefecture's adjusted Gini coefficient.
GDP	The natural logarithm of the prefecture's GDP in constant 2005 billion yens.

Continued on next page

Table 13 – *Continued from previous page*

Variable	Description
Inv	The natural logarithm of the prefecture investment in constant 2005 billion yen. This variable was included to confirm the hypothesis that private owned companies that benefit from prefectural investments are more willing to donate to political campaigns the higher the investment is.
Unemp	Unemployment rate in the prefecture. This variable controls for the possibility that elections in prefectures with higher unemployment rates are more costly. The prefectural unemployment rates are calculated and released by the JBS every 5 years. For this reason, like the Gini coefficients, there is no match between the electoral data and the unemployment rates. Therefore, weighted averages were calculated for the intermediate years.
Aid	Number of people receiving public livelihood assistance per 1000 prefecture inhabitants. It controls for the likelihood that the amount of people receiving public aid might affect the election's cost. The data was calculated based on the Japan Statistical Yearbook.
Pop	Prefecture's population in thousands.
Farm	Percentage of farmer households over total population. From the end of the Second World War to the 90s, LDP members typically offered protection to small farmers in return of electoral support. Therefore, farmers' incomes have been especially vulnerable to changes in politics.
Urban	Percentage of urban area over total prefecture area. This variable is used as a proxy for urban population.
Voters	The number of voters (in thousands) in the prefecture.
Candidates	Number of candidates running for an Upper House Seat in each prefecture and its square.

Continued on next page

Table 13 – *Continued from previous page*

Variable	Description
Seats	Number of seats up for election in each prefecture and its square. Note that the number of seats varies for prefectures over time (otherwise it would not be possible to include this variable in the fixed-effects regressions).

Source: author.

Table 14 – Summary statistics for explanatory variables

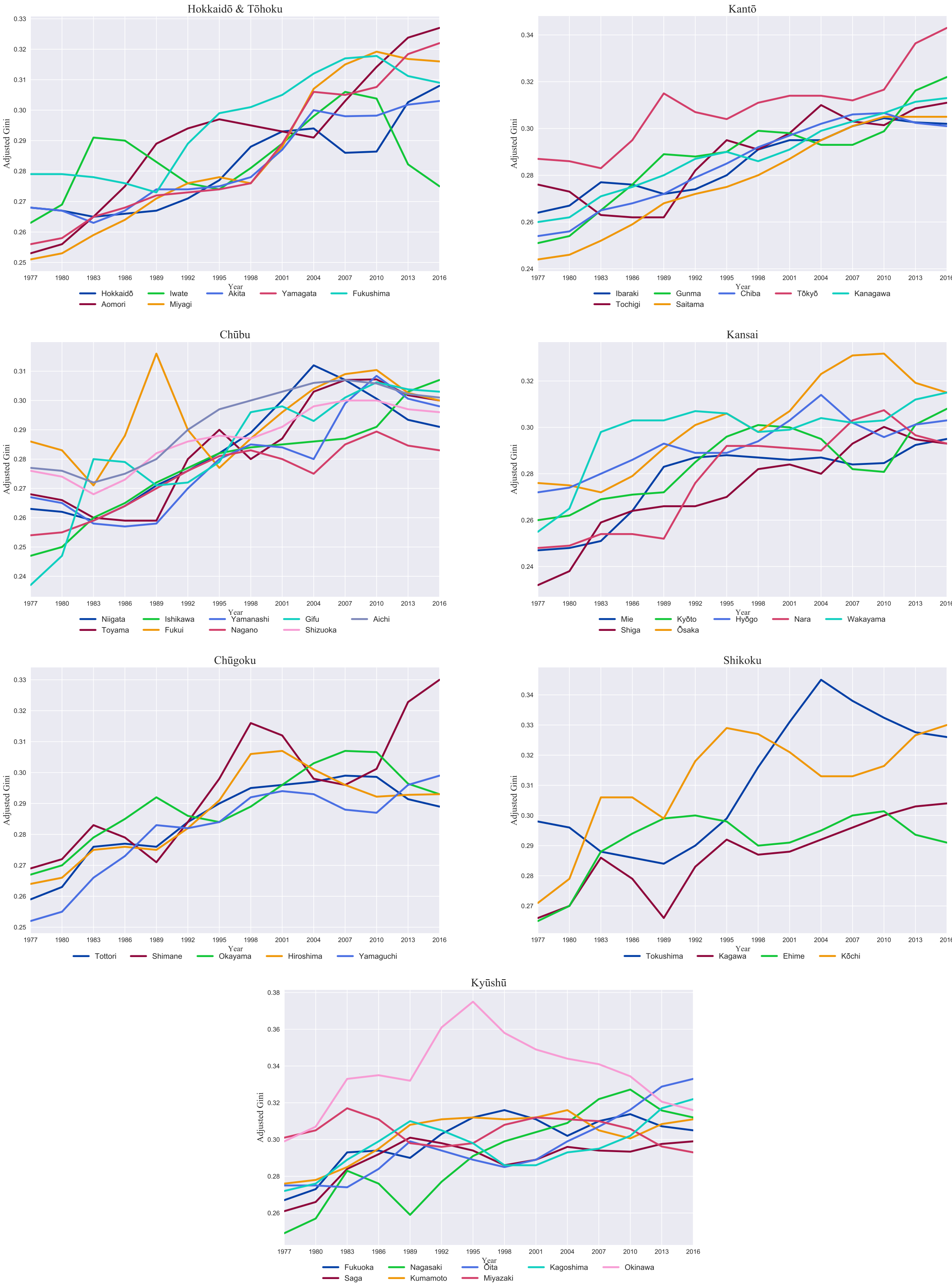
	Obs.	Mean	Std	Min	25%	50%	75%	Max
Gini	602	-1.24	0.07	-1.46	-1.29	-1.23	-1.2	-0.98
GDP	602	8.8	0.83	7.18	8.2	8.61	9.24	11.53
Inv	602	6.38	0.64	5.01	5.92	6.28	6.75	8.61
Unemp	602	3.94	1.9	0.5	2.5	3.7	5.16	12.5
Aid	602	10.03	6.36	1.59	5.24	8.56	12.98	39.5
Pop	602	2816.69	2511.12	782.41	1235	1841.5	2881.25	13623.94
Farm	602	15.29	10.6	0.14	6.91	12.84	22.41	58.35
Urban	602	42.67	21.44	10.52	26.59	36.81	59.27	93.72
Voters	602	1259.56	1070.65	283	605.25	849.25	1301.5	6415.55
Cand	602	5.14	3.3	2	3	4	6	31
Cand2	602	37.25	76.32	4	9	16	36	961
Seats	602	1.65	0.85	1	1	1	2	6
Seats2	602	3.44	3.99	1	1	1	4	36

Source: author

4.2.1 Expenditure per Category

This thesis also run regressions for campaign costs according to their uses. In Japan, campaign expenditures can be divided in 11 categories. **Personnel** expenses include payment for office personnel, sign language interpreters and other workers involved in one candidate's campaign. **Election Office** includes the cost of renting office space and furniture. **Convention** costs comprise costs related to conventions in the campaign period. **Communication** expenses include postal rates, phone, FAX and internet bills.

Figure 15 – Adjusted Gini - Japan



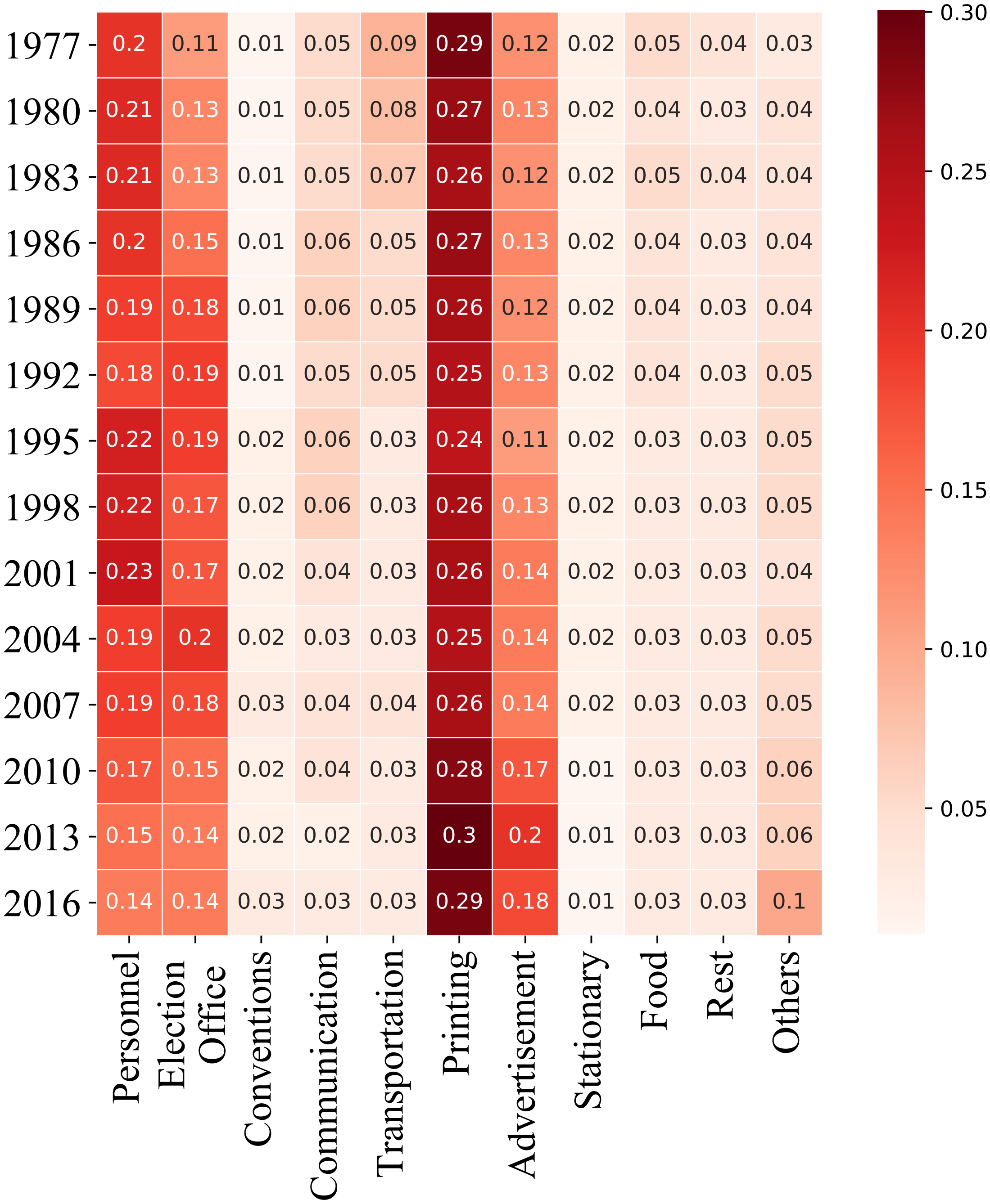
Adjusted Gini per prefecture - 1977-2016. Source: author based on the National Survey of Family Income and Expenditure.

Transportation includes rental car costs and train tickets. **Printing** comprises posters and postcards printing fees. **Advertisement** includes campaign advertising in media, such as newspapers and billboards. **Stationary** includes office supplies. Snacks and lunch costs (bentō) are categorized as **Food** expenses. **Rest** includes accommodation costs. Finally, the category **Other** comprises every expense that cannot be classified in the described categories, such as electricity, water bills, gas bills etc. Figure 16 plots the distribution of campaign costs according the the categories above.

The distribution of campaign expenditures remained relatively stable over the years, although Advertisement and Others gained more importance in detriment of Transportation, Communication and Food. Overall, most part of one candidate's budget goes to Personnel, Election Office, Printing and Advertisement, while other categories have a smaller share in the total expenditure.

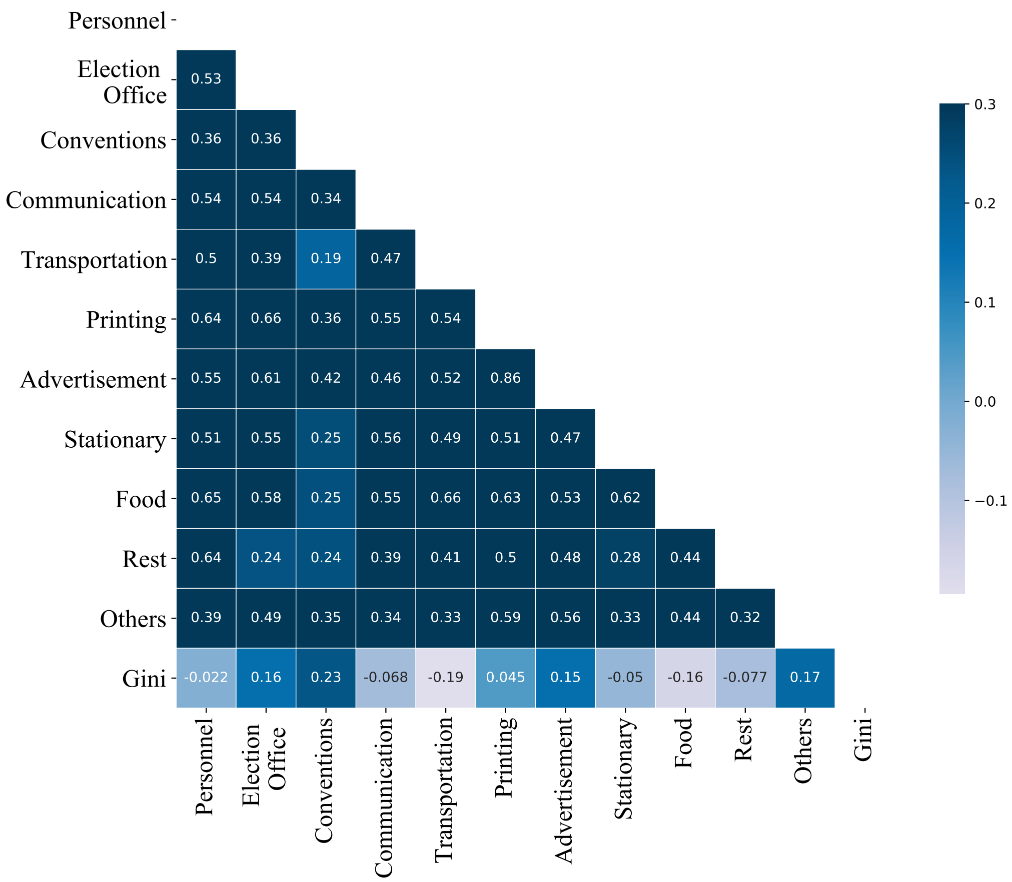
Figure 17 displays simple correlations between the various categories of campaign costs and the Adjusted Gini. While types of expenditure are highly correlated between each other, the Adjusted Gini seems to be more correlated with Election Office, Conventions, Advertisement and Others. Clearly, simple correlations should not be interpreted as causative. Nevertheless, it illustrates the possibility that one type of expenditure might be driving the results. Suppose a certain variable X is created by linearly combining two variables y and z: $X = y + z$. Now take a forth variable w. Even if w is correlated to X, that does not tell much about the correlation between w and y or w and z. If we regress y (or z) against w and the coefficient is significant, we say that y (or z) is driving the results. By regressing the different types of expenditure against the Adjusted Gini and the other controls, we expect to find at least one cost category to be driving the results.

Figure 16 – Campaign expenditure distribution for the Japanese Upper House elections.



Local constituencies - 1977-2016. Source: Report on the Result of the Elections for the House of Councillors.

Figure 17 – Campaign expenditure simple correlations for the Japanese Upper House elections.



Local constituencies - 1977-2016. Source: author.

4.3 Econometric Specification and Results

This section presents the fixed-effects estimations for Japan's Upper House elections and for each type of expenditure. POLS, random effects and fixed effects specifications were tested. However, only the fixed effects models are shown, as the Chow test, the Breusch-Pagan test and the Hausman test indicated that the best fitting model was the fixed-effects specification. Furthermore, the error term was clustered at the prefectural level, as the modified Wald test for groupwise heteroskedasticity in fixed effects models suggested the presence of heteroskedastic errors. The tests' statistics and P-values can be found in table 33 in appendix G.

All models for Japan are variations of the following econometric specification:

$$y_{i,t} = \alpha + \beta Gini_{i,t} + \Gamma_1 CON_{i,t} + \Gamma_2 Y_{i,t} + \mu_i + \epsilon_{i,t} \tag{16}$$

Where $y_{i,t}$ denotes an aggregate campaign expenditure variable in prefecture i in the year t. β is the coefficient of interest. $CON_{i,t}$ is a vector of control variables and $Y_{i,t}$ is a vector of year dummies. Both vectors have its corresponding coefficients vectors Γ_1 and Γ_2. μ_i captures a time-invariant individual effect, α is the constant and $\epsilon_{i,t}$ the error term.

The main hypothesis is:

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

4.3.1 Upper House

The results for the Japanese Upper House elections are shown in table 15. Regression 9 uses the natural logarithm of the constant campaign expenditure in constant 2005 Japanese yen as the dependent variable. The remaining regressions use the same dependent variable, but divide it by the number of voters (regression 10) or the number of voters per seat (regression 11). All regressions include year dummies for all years except 1977. As the prefectures of Tottori & Shimane and Tokushima & Kōchi held combined elections in 2016, the models exclude these prefectures, but the results are not greatly affected if the same regressions are estimated by averaging the dependent and independent variable values for both pairs of prefectures (see appendix F). All regressions had their errors clustered at the prefectural level.

The specifications used here slightly differs from the one used in Bugarin (2015) in the sense that both the *Gini* variable and the dependent variables are in natural logs. That makes it possible to interpret the estimated coefficients as elasticities. Regression 9's coefficient of 0.69 tells us that an increase of 1% in the Gini index represents a 0.69% change in electoral expenditure by a thousand inhabitants. Overall, the results are similar to the ones found previously in the literature. The Adjusted Gini estimated coefficient is positive and significant for all cases even when including time fixed effects.

Table 15 – Japanese Upper House Elections - Fixed Effects

	(9) Exp	(10) ExpV	(11) ExpVS
Gini	0.69**	0.67**	0.66**
	(0.27)	(0.27)	(0.26)
GDP	−0.26	−0.27	−0.25
	(0.19)	(0.19)	(0.19)
Inv	0.05	0.04	0.03
	(0.06)	(0.06)	(0.06)
Unemp	0.00	0.00	0.00
	(0.02)	(0.02)	(0.02)
Aid	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Pop	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
Farm	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Urban	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Voters	0.00*	0.00**	0.00*
	(0.00)	(0.00)	(0.00)
Cand	0.17***	0.17***	0.17***
	(0.02)	(0.02)	(0.02)
Cand2	0.00***	0.00***	−0.01***
	(0.00)	(0.00)	(0.00)
Seats	−0.17*	−0.20**	−1.13***
	(0.10)	(0.10)	(0.11)
Seats2	0.07***	0.07***	0.16***
	(0.02)	(0.02)	(0.02)
Constant	12.87***	13.41***	14.18***
	(1.69)	(1.69)	(1.68)

Continued on next page

Table 15 – *Continued from previous page*

	(9)	(10)	(11)
	Exp	ExpV	ExpVS
obs.	602	602	602
R_a^2	0.555	0.594	0.601
$R^2 within$	0.574	0.611	0.629
$R^2 overall$	0.615	0.610	0.880
$R^2 between$	0.738	0.734	0.937
σ_u	0.282	0.313	0.293
σ_e	0.193	0.194	0.194
ρ	0.681	0.722	0.697
Year FE	Yes	Yes	Yes

Models for the House of Councillors - Fixed Effects. The dependent variables are: Exp - constant expenditure per citizen, ExpV - constant expenditure per voter, ExpVS - constant expenditure per voter per seat. Robust standard errors in parenthesis, *p $<$ 0.1, **p $<$ 0.05, ***p $<$ 0.01. Source: author.

The insignificance of the unemployment rate may result from the use of linear estimators (weighted averages) for the unemployment rates in years where no data was available. It also may suggest that electoral campaigns for the Upper House are only slightly sensitive to a prefecture's unemployment rate. However, it is important to restate that the dependent variables are electoral costs for the House of Councillors' SNTV prefectural elections, and not for the National District elections. Fighting unemployment is typically considered a nationwide policy, and SNTV prefectural candidates have to compete for votes locally.

$Voters$ and $Cand$ increase the cost of of elections, and $Seats$ decreases it, although both $Cand$ and $farm$ have inverse quadratic effects. The insignificance of the variable Farmer for most regressions and the negative sign for regression 16 might due to the fact that the LDP is traditionally stronger in rural areas, making the competition there less intense.

4.3.2 Expenditure Type

The results for the regressions by expenditure type are presented in table 16. The table contains 33 different models, though there are only three variations for the dependent variables. Models 12a to 21a have the natural log of the constant expenditure in one given category as the dependent variable. For example, model 15a's dependent variable is the log of the constant expenditure in Transportation. Models in row *b* have the log of the constant expenditure per voter in one given category, and models in row *c* have the log of constant expenditure per vote per seat as the dependent variable. The only coefficients shown are the ones for the adjusted *Gini* variable. Estimated coefficients for the other control variables are omitted and all models have clustered standard errors at the prefectural level. From models 12 to 21, the abbreviations refer respectively to the categories Personnel, Election Office, Conventions, Communications, Transportation, Printing, Advertisement, Stationary, Food, Rest and Others.

As figure 16 shows that the main components of the total expenditure are Personnel, Election Office, Printing and Advertisement, one could expect that one of those four categories are likely to be driving the results. Only models 13a, 13b and 13c show a consistent positive and significant coefficient between the Adjusted Gini and the expenditure. Therefore, we say that Election Office expenditures are driving the results, as it is the category that is most correlated with the Gini coefficient once we control for other variables.

Table 16 – Japanese Upper House Elections. Expenditure per Category - Fixed Effects

	(12) PRSNL	(13) E OFC	(17) CON	(14) COM	(15) TRANS	(16) PRINT	(17) ADV	(18) STAT	(19) FOOD	(20) REST	(21) OTHER
(a) Exp	0.57	2.03 ***	−0.55	1.46 *	−0.74	−0.15	0.19	1.30	0.27	0.11	1.43
	(0.53)	(0.74)	(2.15)	(0.86)	(1.30)	(0.31)	(0.53)	(1.06)	(0.50)	(1.19)	(0.86)
(b) ExpV	0.55	2.00 **	−0.58	1.44	−0.76	−0.17	0.17	1.27	0.25	0.09	1.41
	(0.53)	(0.74)	(2.15)	(0.86)	(1.30)	(0.31)	(0.53)	(1.06)	(0.50)	(1.19)	(0.85)
(c) ExpVS	0.54	1.99 **	−0.59	1.43	−0.77	−0.18	0.16	1.26	0.24	0.08	1.39
	(0.53)	(0.74)	(2.15)	(0.86)	(1.30)	(0.31)	(0.53)	(1.06)	(0.49)	(1.19)	(0.85)
Obs.	602	602	571	602	600	602	602	602	602	594	602
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Regressions per type of expenditure for the Japanese Upper House elections. Only estimated coefficients for the Gini variable are shown. Expenditure categories are: PRSNLS - Personnel, E OFC - Election Office, CON - Conventions, COM - Communications, TRANS - Transportation, PRINT - Printing, ADV - Advertisement, STAT - Stationary, FOOD - Food, REST - Rest, OTHER - Others. Standard errors in parentheses, *p < 0.1, **p < 0.05, ***p < 0.01

Chapter 5
Addressing Spatial Correlation

A visual analysis of figures 5 and 6 in chapter 3 suggests that candidates in municipalities that are next to each other spend a similar amount of resources in political campaigns. In particular, elections seem to be more expensive (in per voter terms) in the North and Center-Western regions.

The literature has already documented spillover effects among Brazilian administrative entities. Mattos and Rocha (2008), for example, finds evidence that income inequality can affect positively the size of Brazilian states in terms of public spending. Furthermore, they find evidence that for a given state, neighboring states' public expenditures are a substitute of that state's public spending. In a study for England's local administrations, Revelli (2002) finds that neighbor's tax increases have a negative impact on incumbent's popularity, whereas own tax increases have a negative effect.

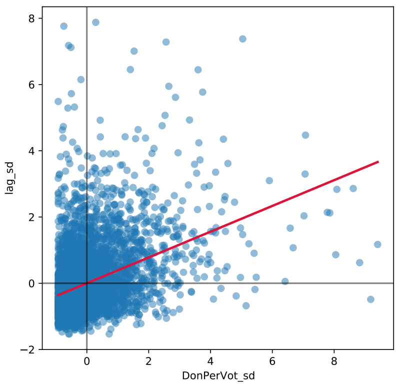
In this chapter we hypothesize that there might exist a spillover effect (spatial effect) in electoral costs. In particular, we take into account the possibility that candidates in municipalities surrounded by other municipalities whose candidates tend to spend more on electoral campaigns also have high campaign costs. We used the software STATA 14 and the package `xsmle`, which is capable to estimate spatial econometric models and perform model selection tests. A quick overview of spatial econometrics for panel data can be found in appendix 5.

5.1 Brazil

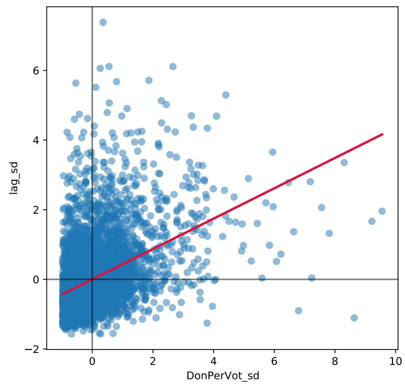
We start our analysis of the potential spatial effects on electoral costs in Brazilian municipalities by plotting a Moran's Diagram. This is a tool used to visually access the spatial auto-correlation between a specific unit and its neighbors. In our case, we expect to find positive spatial auto-correlation, meaning that neighboring municipalities should exhibit similar electoral costs per voter. A Moran's Diagram plots a variable (usually centered) against its spatial lag (the values for neighboring municipalities). Observations in the first and third quadrant of the diagram point towards positive spatial auto-correlation.

Figure 18 plots 4 Moran's Diagrams (one for each year of the panel) for the variable donations per voter in the case of candidates for mayors. A regression line is added for reference and outliers are removed for better visualization. A quick analysis suggest that donations per voter are positively auto-correlated in spatial terms. Figure 19 plots 4 Moran's Diagrams for local representative elections, and leads to similar conclusions.

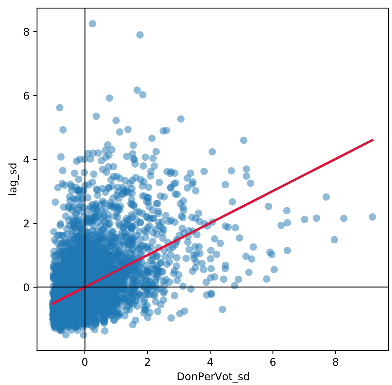
Figure 18 – Moran's Diagram - Mayor Elections.



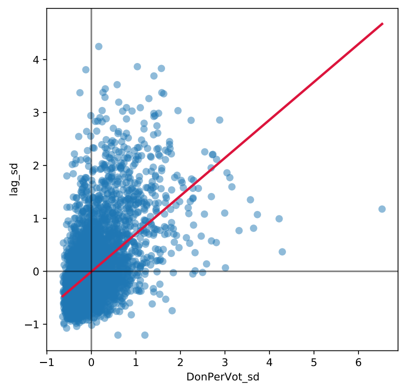
(a) 2004



(b) 2008



(c) 2012

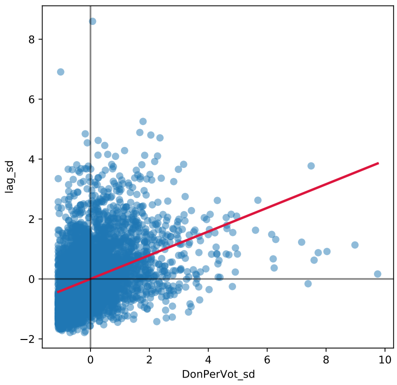


(d) 2016

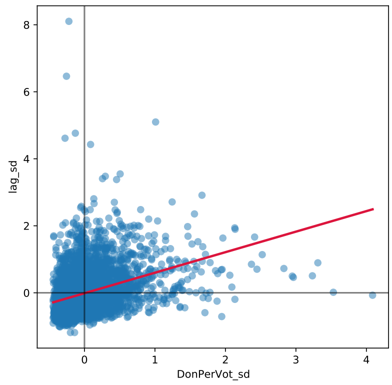
Moran's Diagram for donation per voter - mayoral elections. Source: author.

A traditional way to test for spatial auto-correlation is by calculating the Moran's I (CLIFF; ORD, 1981). If positive and significant, it indicates that the variable of interest is positively auto-correlated in space. There is no simple way to report a single Moran's I for panel data. Beenstock and Felsenstein (2019) suggests that the values of the statistic for each cross section should be averaged and then tested. Bivand, Millo and Piras (2021),

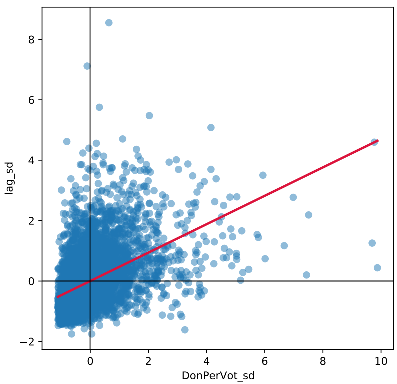
Figure 19 – Moran's Diagram - Local Representatives Elections.



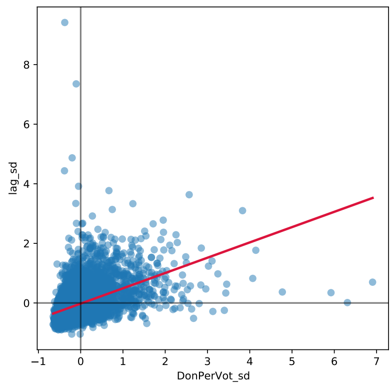
(a) 2004



(b) 2008



(c) 2012



(d) 2016

Moran's Diagram for donation per voter - local representatives elections. Source: author.

on the other hand, argues that one could compute the Moran's I for panel data by making a pooling assumption, which is not always desirable. Here, we follow the same strategy as in Santos and Faria (2012) and report one Moran's I for each cross section[1].

Table 17 shows the estimated Moran's I for 2 different variables (private donations per voter and estimated values per voters) for mayors and local representatives. For all years, the Moran's I is positive and significant, indicating that municipalities with high campaign donations are surrounded by municipalities with high campaign donations and vice-versa. It is worth noting that although it remains significant, the Moran's I is substantially

[1] We use the *Queen* approach as the contiguity criterion.

smaller in 2016. This might be an indication that prohibiting campaign donations from private companies might have reduced the spatial spillover effect in campaign spending.

Table 17 – Moran's I - Brazilian Municipalities

		2004	2008	2012	2016
Mayors	Don/Vot	0.21***	0.24***	0.32***	0.1***
	EV/Vot		0.2***	0.23***	0.01**
Local Representatives	Don/Vot	0.23***	0.03***	0.28***	0.09***
	EV/Vot		0.15***	0.27***	0.03***

Moran's I for each cross-section. Variables are donations per voter and estimated values per voter for mayors and local representatives. *p < 0.1, **p < 0.05, ***p < 0.01. Source: author

To address the spillover effect on campaign donations and estimated values, we estimate 4 different models using spatial econometrics. In this study, we consider three different types of spatial models: Spatial Auto-regressive (SAR), Spatial Error (SEM) and Spatial Durbin Models (SDM) model. We then test for the best specification (rows $SAR\chi^2$ and $SEM\chi^2$, whose null hypothesis is that SDM is the better fitting model) and for fixed and random effects variants. Details can be fount in appendix 5.

Figure 18 contains the results for the SDM models. Only estimated coefficients for the Gini index are shown and control variables are omitted. Appendix H contains the full models. The parameter ρ, that reflects the strength of the spatial dependence, is positive and significant. Furthermore, the estimated coefficients for the Gini index are positive for the $Main$ and for the Wx matrices, meaning that a municipality's Gini and the neighboring municipality's Gini affect campaign donations and estimated values positively.

The positive estimated coefficients for the Gini index in regressions 22, 24 and 25 points towards a positive effect of income inequality on campaign donations of mayors and local representatives even when controlling for spillover effects. This effect seems to hold for neighboring municipality's and own municipality's income inequality. In a typical OLS model, the effect of changes in independent variables in the dependent variable can be interpreted as a partial derivative (i.e., the effect of a change in x_i in y is the partial derivative of y with respect to x_i. However, in an SDM model, neighboring observations also affect y, meaning that the usual interpretation is not valid. It is still possible to calculate direct, indirect (the effect of neighboring units on a specific unit) and total (the sum of direct and indirect effects) marginal effects using Monte Carlo simulations

(LESAGE; PACE, 2009). These effects are shown under the *Direct*, *Indirect* and *Total* effects Monte Carlo estimates, and are all positive and significant in all cases, except for regression 23. This suggests that in Brazil, income inequality from a certain municipality and income inequality from its neighbors affect campaign expenditures positively.

Table 18 – SDM Fixed Effects - Brazilian Municipalities

	Mayors		Local Representatives	
	(22)	(23)	(24)	(25)
	Don/Vot	EV/Vot	Don/Vot	EV/Vot
Main				
Gini	0.51***	0.38	0.26*	0.41*
	(0.16)	(0.27)	(0.16)	(0.23)
GiniIncome	−0.02	0.00	0.00	−0.02
	(0.01)	(0.02)	(0.01)	(0.01)
Wx				
Gini	1.38***	0.52	0.75**	0.76
	(0.34)	(0.76)	(0.29)	(0.54)
GiniIncome	−0.07***	−0.01	−0.03	−0.03
	(0.03)	(0.06)	(0.02)	(0.03)
Spatial				
ρ	0.16***	0.19***	0.26***	0.34***
	(0.01)	(0.01)	(0.01)	(0.02)
Variance				
σ_e^2	0.76***	1.23***	0.53***	0.76***
	(0.03)	(0.04)	(0.02)	(0.03)
Direct				
Gini	0.56***	0.42	0.31*	0.48**
	(0.16)	(0.28)	(0.17)	(0.24)
GiniIncome	−0.02**	0.00	0.00	−0.02
	(0.01)	(0.02)	(0.01)	(0.01)

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Table 18 – *Continued from previous page*

	Mayors		Local Representatives	
	(22)	(23)	(24)	(25)
	Don/Vot	EV/Vot	Don/Vot	EV/Vot
Indirect				
Gini	1.73***	0.82	1.05***	1.27
	(0.41)	(0.93)	(0.39)	(0.80)
GiniIncome	−0.09***	−0.02	−0.04	−0.05
	(0.03)	(0.07)	(0.02)	(0.05)
Total				
Gini	2.29***	1.24	1.37***	1.75**
	(0.46)	(1.02)	(0.44)	(0.88)
GiniIncome	−0.11***	−0.02	−0.04	−0.07
	(0.03)	(0.07)	(0.03)	(0.06)
Obs.	19968	16287	19968	16287
$R^2 within$	0.02	0.00	0.05	0.01
$R^2 overall$	0.00	0.00	0.00	0.00
$R^2 between$	0.02	0.01	0.01	0.00
$SAR\chi^2$	50.95	46.06	69.92	88.55
$SEM\chi^2$	52.36	60.83	81.51	108.96
$hau\chi^2$	702.06	668.11	1144.72	995.10
Time FE	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes

SDM models for Brazilian municipalities - Fixed Effects. The dependent variables are: Don/Vot - donations per voter and EV/Vot - estimated values per voter. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

5.2 Japan

Table 19 contains the estimated Moran's I for 3 different variables using a Queen spatial matrix constructed from Japanese prefectures. The statistics are only significant for 1986, 2004 and 2010, suggesting that, differently from Brazil, spillover effects in campaign expenditures for candidates running for the Japanese Upper House are a lot less strong. This result, however, takes into account the spatial auto-correlation for electoral costs, and ignores other variables. Therefore, we use the same approach and estimate an SDM model for Japanese prefectures. The results can be seen in table 20. Again, the estimated coefficients for the controls are omitted.

Table 19 – Moran's I - Japanese Prefectures

Year	Exp	ExpV	ExpVS
1977	−0.04	0.01	0.08
1980	−0.07	−0.06	0.07
1983	0.02	0.03	0.06
1986	0.19**	0.19**	0.17*
1989	0.02	0.01	0.02
1992	0.07	0.07	0.08
1995	−0.07	−0.08	−0.04
1998	0.15	0.14*	0.04
2001	0.05	0.05	0.07
2004	0.24**	0.23**	0.18**
2007	−0.14	−0.14	−0.07
2010	0.15*	0.14*	0.09
2013	−0.02	−0.04	−0.03
2016	−0.07	−0.07	−0.01

Moran's I for each cross-section. Exp - constant expenditure per citizen, ExpV - constant expenditure per voter, ExpVS - constant expenditure per voter per seat. *p < 0.1, **p < 0.05, ***p < 0.01. Source: author

The estimated coefficients for the Gini index are positive for the $Main$ matrix, but negative for the Wx matrix. This suggests that a prefecture's own income inequality affects campaign costs positively, but neighboring prefectures' income inequality affect it negatively. Looking at the marginal effects, the direct effect of a prefecture's income inequality on electoral costs is positive and significant as expected. However, the indirect impact - i.e., the impact of neighboring prefecture's income inequality on a specific prefecture - is negative and significant. This is the opposite of what was fount for the Brazilian case. The direct and indirect effects have similar magnitudes, meaning that the total effect is small, but non-significant. This might due to the differences in data granularity between our samples for Brazil and Japan. While in Brazil we have data at the municipal level, the sample for Japan contains observations aggregated at the prefectural level.

Table 20 – SDM Fixed Effects - Japanese Prefectures

	(26) Exp	(27) ExpV	(28) ExpVS
Main			
Gini	0.69**	0.60**	0.59**
	(0.29)	(0.27)	(0.27)
Wx			
Gini	−0.66*	−0.82**	−0.85**
	(0.36)	(0.35)	(0.35)
Spatial			
ρ	0.05	0.03	0.02
	(0.05)	(0.05)	(0.05)
Variance			
σ_e^2	0.04***	0.04***	0.04***
	(0.00)	(0.00)	(0.00)
Direct			
Gini	0.69**	0.61**	0.60**
	(0.30)	(0.28)	(0.28)
Indirect			
Gini	−0.64*	−0.81**	−0.83**
	(0.37)	(0.36)	(0.36)
Total			
Gini	0.05	−0.20	−0.24
	(0.53)	(0.49)	(0.49)
Obs.	602	602	602

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Table 20 – *Continued from previous page*

	(26) Exp	(27) ExpV	(28) ExpVS
$R^2 within$	0.53	0.58	0.59
$R^2 overall$	0.60		
$R^2 between$	0.73	0.72	0.93
$SAR\chi^2$	30.52	44.50	44.38
$SER\chi^2$	31.16	44.96	41.92
$hau\chi^2$	123.85	88.76	105.79
Time FE	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes

SDM models for Japanese prefectures - Fixed Effects. The dependent variables are: Exp - constant expenditure per citizen, ExpV - constant expenditure per voter, ExpVS - constant expenditure per voter per seat. Robust standard errors in parenthesis, *p $<$ 0.1, **p $<$ 0.05, ***p $<$ 0.01. Source: author.

It is important to state that the results found here largely depend on the specification of the spatial weight matrix. In Brazil, especially in the Northern region, big municipalities are separated by large distances, meaning that a distance based spatial weight matrix might be a better approach.

Chapter 6
Conclusion

The present study aims at further investigating the relationship between income inequality and electoral campaign financing by focusing in two very different countries. Japan and Brazil clearly occupy opposite ends in terms of global inequality indices. Brazil is a fairy young democracy and is remarkably unequal, whereas Japan is a mature democracy and has low income inequality levels. The empirical approach consisted of fixed effects estimations for both Brazil and Japan.

In the Brazilian case, a 4 year panel on local elections from 2004 to 2016 containing about 20.000 observations for mayors and local assemblies showed that income inequality affects electoral costs positively: campaign donations are higher in municipalities where the Gini coefficient is higher. This effect was observed both in the mayor and in the local representatives elections. Furthermore, the study brings three new findings for Brazilian municipalities: first, income inequality also affects estimated deduction values for candidates to local representatives. Second, the effect of income inequality on campaign donations seems to increase as electoral competition rises: in municipalities where candidates had to deal with more competition, income inequality was more relevant to explain campaign donations. Finally, the main results also remain unchanged when spatial spillover effects are controlled for. Our findings are also robust alternative specifications, including the use of municipal investment, the conditional cash transfer program *bolsa família* as explanatory variables and when data from the 2020 elections are used.

For Japan, the panel covering 13 elections for the House of Councillors again demonstrated the positive relation between electoral campaign costs and income inequality. Furthermore, the estimations per cost category showed that for 11 different types of expenditure, Election Office expenses were driving the results. Similarly to the Brazilian case, the result is robust to spatial spillover effects, but income inequality in neighboring prefectures have negative effects on own prefecture's campaign costs.

Although econometric evidence and formal modelling are far from being unquestionable tools for analyzing social phenomena, we believe our results not only bring new insights concerning electoral campaigns, but confirm what has been found so far by the literature. For Brazil, we use the Gini Index estimated from the RAIS database, but different approaches that take into account informal workers are important extensions. Moreover, better accessing the effects of the spillover effects on campaign expenditures and using different spatial weight matrices are a few suggestions we leave for future research.

Nonetheless our results are especially relevant for countries that are experiencing a rise in income inequality levels and for countries that have experienced persistent high income inequality, like Japan and Brazil. They also have important policy implications, the main one being that reducing inequality is a key policy in order to maintain a reliable and fair electoral system.

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Appendix A

Brazilian municipalities Gini Index

The Gini Indexes for Brazil's municipalities were estimated using relative mean difference for ordered data (GLASSER, 1962; DIXON et al., 1987; DAMGAARD; WEINER, 2000).

$$G = \frac{\sum_{i=1}^{n}(2i - n - 1)x_i}{n\sum_{i=1}^{n} x_i} \tag{17}$$

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

Appendix B
Brazil - Alternative Specifications

Tables 21 and 22 control for municipal population size. Income transfers from a government to its citizens might affect income inequality. In Brazil, low-income families can receive conditional cash transfers through a program called *bolsa família*. Barros (2007) shows how *bolsa família* reduced income inequality in Brazil, as the program is specially focused on low-income families with children.

In tables 23 and 24 we show the results for the fixed effects models with the inclusion of the variable $BolsaFam$, which is the number of people who receive the *bolsa família* benefit in a municipality divided by the municipality's population. The estimated coefficient is small and are not statistically significant. Furthermore, the main results remain unchanged.

Another variable that might be important to explain electoral costs is public investment. Instead of spending money in electoral campaigns, an incumbent might increase public investment in order to attract more votes. Therefore, there is a chance that and not taking public investment into account might lead to omitted variable bias. Tables 25 and 26 show fixed effects model estimations with the variable $Investment$, which is the public investment made by the municipality in the municipality divided by the municipality's GDP. The data on municipal investment was taken from the FINBRA database. The estimated coefficients for $Investment$ are only significant when the dependent variables are estimated values for mayors. The negative sign implies that more investments lead to less estimated values expenditures. That makes sense as mayors have more control over the municipal budget to allocate investments (and attract more votes) than local representatives. The main results remain the same.

Finally, table 27 shows the results when data from the 2020 municipal elections are added to the sample. It is worth noting that although the TSE made the data from 2020 available, some control variables were not available for the same year. Here, we use the municipality's GDP from 2018 and the Gini Index based on the RAIS database from 2019. For both mayors and local representatives, the results remain largely unchanged. Notice that the TSE does not inform the value of estimated values for the 2020 elections, meaning that it was not possible to re-estimate the regressions with estimated values as the dependent variable.

Table 21 – Results for mayor elections including population - fixed effects

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
Gini	0.62***	0.51***	0.32	0.29
	(0.16)	(0.16)	(0.27)	(0.26)
GiniIncome	−0.03**	−0.02*	0.00	0.01
	(0.01)	(0.01)	(0.02)	(0.02)
Income	−0.01**	−0.01*	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Hab	−0.02*	−0.06***	−0.10***	−0.13***
	(0.01)	(0.01)	(0.02)	(0.03)
EducationFrag	1.96***	2.07***	8.40***	7.97***
	(0.68)	(0.67)	(1.28)	(1.26)
Young	8.30***	7.62***	8.01*	7.87*
	(2.27)	(2.24)	(4.10)	(4.02)
Senior	3.84***	5.86***	5.41**	7.17***
	(1.28)	(1.27)	(2.34)	(2.29)
AgeFrag	−2.64	−0.26	5.40	7.10
	(3.47)	(3.42)	(6.37)	(6.26)
Urban	0.02**	0.06***	0.10***	0.13***
	(0.01)	(0.01)	(0.02)	(0.03)
Candidates	0.15***	0.15***	0.24***	0.23***
	(0.02)	(0.02)	(0.04)	(0.03)
Candidates2	0.00**	0.00**	−0.01**	−0.01**
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	0.00**	0.00	−0.01***	−0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Runoff	0.05	0.05	−0.24	−0.26
	(0.13)	(0.13)	(0.20)	(0.20)
Incumbent	0.00	0.01	−0.10***	−0.10***

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Table 21 – *Continued from previous page*

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
	(0.01)	(0.01)	(0.02)	(0.02)
PresAlignment	0.07**	0.07**	0.17***	0.17***
	(0.04)	(0.04)	(0.06)	(0.06)
GovAlignment	−0.02	−0.03	0.06	0.05
	(0.03)	(0.03)	(0.04)	(0.04)
PresGovAlignment	−0.04	−0.02	−0.35***	−0.33***
	(0.06)	(0.06)	(0.10)	(0.10)
Constant	9.04***	6.70**	−3.57	−4.94
	(2.87)	(2.83)	(5.26)	(5.18)
Obs.	21 499	21 499	16 462	16 462
$R^2 within$	0.06	0.07	0.15	0.15
$R^2 overall$	0.06	0.05	0.03	0.04
$R^2 between$	0.06	0.05	0.02	0.03
σu	0.81	0.86	1.72	1.76
σe	1.01	1.00	1.38	1.35
ρ	0.39	0.43	0.61	0.63
Year FE	Yes	Yes	Yes	Yes

Models for mayor elections including population - Fixed Effects. The dependent variables are: Don/Vot - donations per voter, Don/Hab - donations per citizen, EV/Vot - estimated values per voter e EV/Hab - estimated values per citizen. Robust standard errors in parenthesis, *p $<$ 0.1, **p $<$ 0.05, ***p $<$ 0.01. Source: author.

Table 22 – Results for local representative elections including population - fixed effects

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
Gini	0.39**	0.28*	0.45*	0.42*
	(0.16)	(0.16)	(0.23)	(0.23)
GiniIncome	−0.01	0.00	−0.02	−0.02

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Table 22 – *Continued from previous page*

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
	(0.01)	(0.01)	(0.01)	(0.01)
Income	0.00	0.00	−0.01	−0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Hab	−0.03***	−0.06***	−0.04***	−0.07***
	(0.01)	(0.01)	(0.01)	(0.02)
EducationFrag	2.19***	2.32***	8.11***	7.72***
	(0.57)	(0.56)	(1.08)	(1.06)
Young	2.88	2.24	4.01	3.97
	(2.15)	(2.12)	(3.56)	(3.51)
Senior	−2.05*	0.06	4.06**	5.80***
	(1.19)	(1.17)	(1.84)	(1.81)
AgeFrag	2.16	4.50	4.52	6.37
	(3.01)	(2.99)	(5.14)	(5.08)
Urban	0.03***	0.06***	0.04***	0.07***
	(0.01)	(0.01)	(0.01)	(0.02)
Candidates	0.00**	0.00**	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates2	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	0.00**	0.00	−0.01***	−0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Seats	−0.03*	−0.03	−0.12***	−0.12***
	(0.02)	(0.02)	(0.03)	(0.03)
Seats2	0.00	0.00	0.00**	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Incumbent	0.14***	0.15***	−0.02	−0.01
	(0.04)	(0.04)	(0.07)	(0.07)
PresAlignment	−0.01	−0.01	0.06	0.06
	(0.03)	(0.03)	(0.05)	(0.05)
GovAlignment	0.00	0.00	0.09***	0.09***

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Table 22 – *Continued from previous page*

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
	(0.02)	(0.02)	(0.03)	(0.03)
PresGovAlignment	0.13***	0.15***	−0.07	−0.05
	(0.05)	(0.05)	(0.08)	(0.08)
Constant	5.19**	2.82	−0.90	−2.44
	(2.46)	(2.45)	(4.27)	(4.21)
Obs.	21 499	21 499	16 462	16 462
$R^2 within$	0.17	0.21	0.09	0.10
$R^2 overall$	0.06	0.07	0.02	0.03
$R^2 between$	0.01	0.03	0.01	0.02
σu	0.82	0.90	1.28	1.31
σe	0.85	0.84	1.11	1.10
ρ	0.48	0.53	0.57	0.59
Year FE	Yes	Yes	Yes	Yes

Models for local representative elections including population - Fixed Effects. The dependent variables are: Don/Vot - donations per voter, Don/Hab - donations per citizen, EV/Vot - estimated values per voter e EV/Hab - estimated values per citizen. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

Table 23 – Results for mayor elections with *bolsa família* - fixed effects

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
Gini	0.62***	0.52***	0.35	0.32
	(0.16)	(0.16)	(0.27)	(0.26)
BolsaFam	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
GiniIncome	−0.03**	−0.02*	0.00	0.01
	(0.01)	(0.01)	(0.02)	(0.02)
Income	−0.01**	−0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)

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Table 23 – *Continued from previous page*

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
EducationFrag	1.98***	2.15***	8.64***	8.29***
	(0.69)	(0.68)	(1.29)	(1.26)
Young	8.46***	7.82***	8.02*	7.91*
	(2.27)	(2.25)	(4.11)	(4.04)
Senior	4.32***	6.89***	6.67***	8.80***
	(1.27)	(1.26)	(2.33)	(2.29)
AgeFrag	−3.42	−1.24	4.32	5.68
	(3.43)	(3.39)	(6.37)	(6.26)
Urban	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.15***	0.14***	0.24***	0.23***
	(0.02)	(0.02)	(0.03)	(0.03)
Candidates2	0.00**	0.00*	−0.01**	−0.01**
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	0.00**	0.00	−0.01***	−0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Runoff	0.05	0.05	−0.24	−0.25
	(0.13)	(0.13)	(0.20)	(0.20)
Incumbent	0.00	0.01	−0.10***	−0.10***
	(0.01)	(0.01)	(0.02)	(0.02)
PresAlignment	0.07**	0.07**	0.17***	0.17***
	(0.04)	(0.04)	(0.06)	(0.06)
GovAlignment	−0.02	−0.03	0.05	0.05
	(0.03)	(0.03)	(0.04)	(0.04)
PresGovAlignment	−0.03	−0.02	−0.33***	−0.30***
	(0.06)	(0.06)	(0.10)	(0.10)
Constant	9.55***	7.14**	−3.39	−4.70
	(2.84)	(2.80)	(5.26)	(5.18)
Obs.	21472	21472	16462	16462
$R^2 within$	0.06	0.07	0.15	0.15

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Table 23 – *Continued from previous page*

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
$R^2 overall$	0.05	0.04	0.02	0.02
$R^2 between$	0.04	0.02	0.01	0.01
σu	0.82	0.87	1.74	1.77
σe	1.01	0.99	1.38	1.35
ρ	0.40	0.43	0.61	0.63
Year FE	Yes	Yes	Yes	Yes

Models for mayor elections with *bolsa família* - Fixed Effects. The dependent variables are: Don/Vot - donations per voter, Don/Hab - donations per citizen, EV/Vot - estimated values per voter e EV/Hab - estimated values per citizen. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

Table 24 – Results for local representative elections with *bolsa família* - fixed effects

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
Gini	0.39**	0.29*	0.46**	0.45*
	(0.16)	(0.16)	(0.23)	(0.23)
BolsaFam	0.00	0.00	0.00	0.00*
	(0.00)	(0.00)	(0.00)	(0.00)
GiniIncome	−0.01	0.00	−0.02	−0.02
	(0.01)	(0.01)	(0.01)	(0.01)
Income	0.00	0.00	−0.01	−0.01
	(0.01)	(0.01)	(0.01)	(0.01)
EducationFrag	2.19***	2.32***	8.14***	7.79***
	(0.57)	(0.56)	(1.08)	(1.06)
Young	2.96	2.39	4.05	4.07
	(2.15)	(2.13)	(3.55)	(3.51)
Senior	−1.68	0.85	4.42**	6.43***
	(1.18)	(1.17)	(1.83)	(1.80)
AgeFrag	1.85	4.00	4.17	5.71

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Table 24 – *Continued from previous page*

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
	(3.02)	(3.00)	(5.13)	(5.07)
Urban	0.00	0.00**	0.00**	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.00**	0.00**	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates2	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	0.00**	0.00	−0.01***	−0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Seats	−0.04**	−0.05***	−0.13***	−0.14***
	(0.02)	(0.02)	(0.03)	(0.03)
Seats2	0.00	0.00	0.00**	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Incumbent	0.14***	0.15***	−0.03	−0.02
	(0.04)	(0.04)	(0.07)	(0.07)
PresAlignment	−0.01	−0.01	0.06	0.06
	(0.03)	(0.03)	(0.05)	(0.05)
GovAlignment	0.00	0.00	0.09***	0.08***
	(0.02)	(0.02)	(0.03)	(0.03)
PresGovAlignment	0.14***	0.15***	−0.06	−0.04
	(0.05)	(0.05)	(0.08)	(0.08)
Constant	5.38**	3.05	−0.78	−2.18
	(2.47)	(2.46)	(4.26)	(4.21)
Obs.	21472	21472	16462	16462
$R^2 within$	0.17	0.20	0.09	0.10
$R^2 overall$	0.05	0.04	0.01	0.02
$R^2 between$	0.00	0.00	0.00	0.01
σu	0.83	0.92	1.29	1.31
σe	0.85	0.85	1.11	1.10

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Table 24 – *Continued from previous page*

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
ρ	0.49	0.54	0.57	0.59
Year FE	Yes	Yes	Yes	Yes

Models for local representative elections with *bolsa família* - Fixed Effects. The dependent variables are: Don/Vot - donations per voter, Don/Hab - donations per citizen, EV/Vot - estimated values per voter e EV/Hab - estimated values per citizen. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

Table 25 – Results for mayor elections with investment - fixed effects.

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
Gini	0.62***	0.52***	0.44	0.43
	(0.18)	(0.18)	(0.31)	(0.30)
Investment	0.00	0.00	−0.01***	−0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
GiniIncome	−0.03**	−0.02	0.00	0.00
	(0.01)	(0.01)	(0.02)	(0.02)
Income	−0.01**	−0.01	0.00	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
EducationFrag	2.52***	2.68***	9.37***	9.01***
	(0.77)	(0.76)	(1.44)	(1.41)
Young	7.18***	6.52***	6.67	6.54
	(2.52)	(2.48)	(4.61)	(4.53)
Senior	3.33**	6.05***	7.74***	9.95***
	(1.41)	(1.40)	(2.59)	(2.54)
AgeFrag	−1.24	0.90	5.54	6.80
	(3.84)	(3.79)	(7.27)	(7.15)
Urban	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.17***	0.16***	0.27***	0.26***

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Table 25 – *Continued from previous page*

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
	(0.03)	(0.03)	(0.05)	(0.05)
Candidates2	−0.01**	−0.01**	−0.01*	−0.01*
	(0.00)	(0.00)	(0.01)	(0.01)
Voters	0.00**	0.00	−0.01***	−0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Runoff	0.07	0.06	−0.26	−0.27
	(0.13)	(0.13)	(0.20)	(0.20)
Incumbent	0.00	0.01	−0.10***	−0.10***
	(0.02)	(0.02)	(0.03)	(0.03)
PresAlignment	0.08**	0.08**	0.21***	0.21***
	(0.04)	(0.04)	(0.06)	(0.06)
GovAlignment	−0.02	−0.02	0.03	0.03
	(0.03)	(0.03)	(0.04)	(0.04)
PresGovAlignment	−0.10	−0.08	−0.30***	−0.27**
	(0.07)	(0.07)	(0.11)	(0.11)
Constant	7.38**	4.99	−5.00	−6.20
	(3.17)	(3.12)	(5.98)	(5.89)
Obs.	19596	19596	14757	14757
$R^2 within$	0.06	0.07	0.14	0.14
$R^2 overall$	0.05	0.04	0.02	0.02
$R^2 between$	0.04	0.02	0.01	0.01
σu	0.85	0.88	1.67	1.71
σe	1.04	1.03	1.40	1.38
ρ	0.40	0.43	0.59	0.61
Year FE	Yes	Yes	Yes	Yes

Models for mayor elections with investment - Fixed Effects. The dependent variables are: Don/Vot - donations per voter, Don/Hab - donations per citizen, EV/Vot - estimated values per voter e EV/Hab - estimated values per citizen. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

Table 26 – Results for local representative elections with investment - fixed effects.

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
Gini	0.39**	0.29*	0.56**	0.55**
	(0.17)	(0.17)	(0.27)	(0.27)
Investment	0.00	0.00**	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
GiniIncome	-0.00	0.00	-0.02	-0.02
	(0.01)	(0.01)	(0.02)	(0.02)
Income	0.00	0.00	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
EducationFrag	2.18***	2.31***	9.28***	8.91***
	(0.63)	(0.62)	(1.23)	(1.21)
Young	2.68	2.10	3.16	3.17
	(2.35)	(2.32)	(4.01)	(3.96)
Senior	-2.04	0.62	5.34**	7.44***
	(1.30)	(1.29)	(2.09)	(2.06)
AgeFrag	1.67	3.80	5.33	6.84
	(3.32)	(3.30)	(5.91)	(5.83)
Urban	-0.00	-0.00**	0.00**	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.00*	0.00*	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates2	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	-0.00**	-0.00	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Seats	-0.04**	-0.05***	-0.13***	-0.14***
	(0.02)	(0.02)	(0.03)	(0.03)
Seats2	0.00	0.00	0.00**	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Incumbent	0.14***	0.15***	-0.02	-0.01

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Table 26 – *Continued from previous page*

	Don/Vot	Don/Hab	EV/Vot	EV/Hab
	(0.04)	(0.04)	(0.08)	(0.08)
PresAlignment	-0.01	-0.01	0.05	0.05
	(0.03)	(0.03)	(0.05)	(0.05)
GovAlignment	-0.00	-0.00	0.08**	0.07**
	(0.02)	(0.02)	(0.03)	(0.03)
PresGovAlignment	0.14***	0.16***	0.05	0.07
	(0.05)	(0.05)	(0.10)	(0.09)
Constant	5.53**	3.23	-2.61	-3.96
	(2.72)	(2.70)	(4.88)	(4.81)
Obs.	19596	19596	14757	14757
$R^2 within$	0.18	0.21	0.09	0.11
$R^2 overall$	0.05	0.05	0.01	0.01
between	0.01	0.01	0.01	0.01
σu	0.85	0.92	1.31	1.33
σe	0.87	0.86	1.13	1.12
ρ	0.49	0.54	0.57	0.58
Year FE	Yes	Yes	Yes	Yes

Models for local representative elections with investment - Fixed Effects. The dependent variables are: Don/Vot - donations per voter, Don/Hab - donations per citizen, EV/Vot - estimated values per voter e EV/Hab - estimated values per citizen. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

Table 27 – Results for mayor and local representative elections 2004-2020 - fixed effects.

	Mayors Don/Vot	Mayors Don/Hab	Loc. Repr. EV/Vot	Loc. Repr. EV/Hab
Gini	0.87***	0.79***	0.44***	0.36***
	(0.14)	(0.14)	(0.13)	(0.12)

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Table 27 – *Continued from previous page*

	Mayors Don/Vot	Mayors Don/Hab	Loc. Repr. EV/Vot	Loc. Repr. EV/Hab
GiniIncome	-0.05***	-0.05***	-0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Income	-0.03***	-0.02***	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
EducationFrag	0.90	1.13**	1.80***	2.04***
	(0.56)	(0.55)	(0.42)	(0.41)
Young	15.84***	14.75***	5.50***	4.44***
	(1.89)	(1.87)	(1.64)	(1.62)
Senior	7.13***	9.03***	0.47	2.34***
	(1.06)	(1.04)	(0.87)	(0.86)
AgeFrag	-9.89***	-7.78***	-3.10	-0.93
	(3.01)	(2.96)	(2.50)	(2.49)
Urban	0.00*	0.00	0.00	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.18***	0.17***	0.00***	0.00***
	(0.02)	(0.02)	(0.00)	(0.00)
Candidates2	-0.01***	-0.01***	0.00**	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	-0.01***	-0.00*	-0.00***	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Runoff	0.09	0.09		
	(0.12)	(0.12)		
Incumbent	-0.01	-0.01	0.19***	0.20***
	(0.01)	(0.01)	(0.03)	(0.03)
PresAlignment	0.04	0.04	-0.01	-0.00
	(0.03)	(0.03)	(0.02)	(0.02)
GovAlignment	-0.07***	-0.07***	-0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)
PresGovAlignment	0.10*	0.10*	0.15***	0.15***

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Table 27 – *Continued from previous page*

	Mayors Don/Vot	Mayors Don/Hab	Loc. Repr. EV/Vot	Loc. Repr. EV/Hab
	(0.06)	(0.06)	(0.05)	(0.04)
Seats			-0.01	-0.01
			(0.01)	(0.01)
Seats2			-0.00	0.00
			(0.00)	(0.00)
Constant	15.36***	13.02***	9.27***	6.91***
	(2.41)	(2.38)	(2.05)	(2.04)
Obs.	26996	26996	26975	26975
$R^2 within$	0.06	0.07	0.16	0.19
$R^2 overall$	0.05	0.05	0.04	0.04
$R^2 between$	0.04	0.03	0.00	0.00
σ_u	0.76	0.80	0.83	0.90
σ_e	1.01	0.99	0.84	0.83
ρ	0.36	0.39	0.49	0.54
Year FE	Yes	Yes	Yes	Yes

Models for mayor local representative elections 2004-2020 - Fixed Effects. The dependent variables are: Don/Vot - donations per voter, Don/Hab - donations per citizen, EV/Vot - estimated values per voter e EV/Hab - estimated values per citizen. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

Appendix C
Electoral Competition Indexes

This section presents the electoral competition indexes used in section 3.4. Six different indexes were used to measure electoral competition between candidates for mayors and local representatives. We illustrate how to calculate the indexes based on two hypothetical municipalities, one with high electoral competition (HC), and the other with low electoral competition (LC). In both municipalities, three candidates run for the municipal office. In the municipality LC, with low electoral competition, one candidate has a large share of the total votes. In municipality HC, candidates receive a similar amount of votes.

Table 28 – Distribution of votes - Low Electoral Competition

Candidate	A	B	C
Votes	2500	300	200

Source: author.

Table 29 – Distribution of votes - High Electoral Competition

Candidates	A	B	C
Votes	1010	1000	990

Source: author.

- **Difference between the most voted candidates (Diff)**

This is the most simple of all indexes. It is the difference in percentage between the two most voted candidates. Let F be the share of votes received by the most voted candidate and let S be the share of votes received by the second most voted candidate. The index is:

$$Diff = F - S \tag{18}$$

In the low competition municipality the index is:

$$Diff_{LC} = \frac{2500}{3000} - \frac{300}{3000} = 0.73$$

In the high competition municipality the index is:

$$Diff_{HC} = \frac{1010}{3000} - \frac{1000}{3000} = 0.003$$

This index is easy to calculate, but only takes into account the competition between the top two candidates. The smaller the index, the stronger the electoral competition.

- **Gini Coefficient (Gini)**

The Gini coefficient is commonly used to measure income inequality. However, it can be used as a measurement of inequality in general. (DAMGAARD; WEINER, 2000), for example, uses the Gini coefficient to measure inequality in plant size. In our case, we are interested in vote inequality: an unequal vote distribution (Gini close to 1) is an indicative that one candidate received a large amount of votes, resulting in low electoral competition. Equality (Gini close to 0) means that the number of votes was well distributed among the candidates, leading to high electoral competition. The Gini coefficients for electoral competition were obtained using relative mean difference for ordered data (DIXON et al., 1987; GLASSER, 1962):

$$G = \frac{\sum_{i=1}^{n}(2i - n - 1)x_i}{(n-1)\sum_{i=1}^{n} x_i} \tag{19}$$

Where G is the Gini coefficient, x is an observed value for the number of votes received by a candidate, n is the number of candidates in a municipality and i is the ranking of the values in ascending order. For the municipality with low competition, the Gini coefficient is $Gini_{LC} = 0.76$ and for the municipality with high competition it is $Gini_{HC} = 0.006$.

The bigger the Gini coefficient of the number of votes, the weaker the electoral competition. This index is different from the previous one as it takes into account all candidates.

- **Herfindahl-Hirschman Index (HHIn and HHIb)**

The Herfindahl-Hirschman Index (HHI) was originally created to imports and exports concentration. It is also used to measure market concentration: the bigger the index, the more concentrated a market is, meaning that a single firm produces a large amount of output (HERFINDAHL, 1950). A simplified version of this index was used to calculate the educational and age fragmentation indexes that were used as controls in regressions (1) to (4). Here, we wish to calculate such index using the share of votes for each candidate to obtain a measurement for vote concentration. The index is calculate as:

$$HHI = \sum_{i=1}^{n} \left(\frac{x_i}{X}\right) \tag{20}$$

Where x_i is the number of votes in candidate i, X is the total amount of ballots that were cast in the municipality and n is the number of candidates in the municipality. It is possible to show that $1/n \leq HHI \leq 1$, meaning that the number of candidates determines the lower bound of the index. In order compare this index for municipalities with a different number of candidates running for the office, we normalize the index in two different ways (CRACAU; LIMA, 2016):

$$HHIn = \frac{HHI - 1/n}{1 - 1/n} \tag{21}$$

$$HHIb = \frac{\sqrt{HHI} - \sqrt{1/n}}{1 - \sqrt{1/n}} \tag{22}$$

In the case there is only one candidate running, the index is set to 1. For the hypothetical municipalities, the indexes are: $HHIn_{LC} = 0.56$ and $HHIb_{LC} = 0.62$ for the municipality with low electoral competition and $HHIn_{HC} = 3.3 * 10^{-5}$ and $HHIb_{HC} = 4.5 * 10^{-5}$ for the municipality with high electoral competition. Note that the bigger the index, the weaker the electoral competition (the more concentrated are the votes).

- **Entropy (H)**

In information theory, the Shannon Entropy (SHANNON, 1948) (not to be mistaken for the concept of entropy in thermodynamics) measures the uncertainty inherent to a random variable. Suppose we have a set of n events with probabilities p_1, p_2, ..., p_n to occur. Entropy measures the uncertainty associated with the possible outcomes of the variables. It is defined as:

$$H = -K \sum_{i=1}^{n} p_i * log\,(p_i) \tag{23}$$

Where K is a constant and p_i is the probability that an event occurs. It is possible to show that if all p_i are equal, the entropy reaches its maximum value $log(n)$. Intuitively, it is hard to make predictions in the case where all probabilities are the same, meaning that equal probabilities maximize uncertainty.

Entropy has its origins in information theory, but it can also be used in economics (ESFANDIAR, 1993). Here, we use the Shannon Entropy to measure the uncertainty related to electoral outcome. Computing the entropy using the percentage of votes received by each candidate in a municipality, we obtain a measurement of "uncertainty" for the election's outcome. Therefore, we use Entropy as a measurement for diversity. If the distribution of votes in a municipality is relatively uniform (strong electoral competition), there is a lot of diversity (uncertainty), resulting in high Entropy. If the share of votes is concentrated on few candidates, there is less diversity (less uncertainty), leading to low values of Entropy.

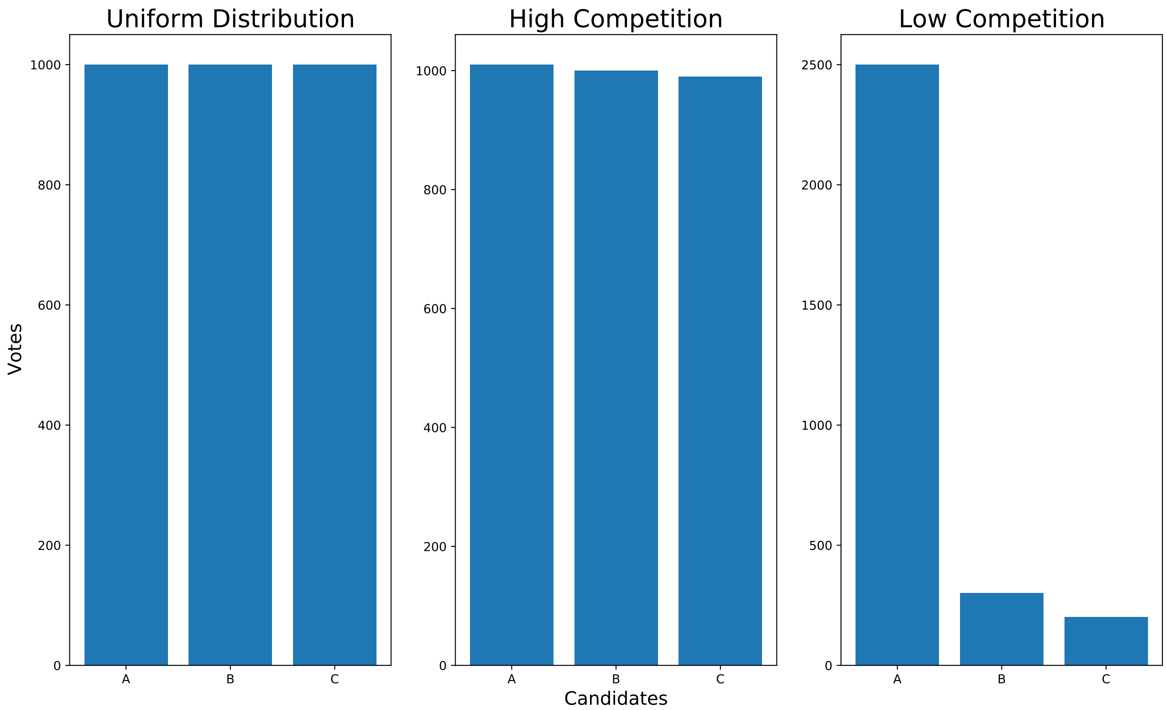
Because $0 \leq H \leq log(n)$, the lower bound of the Shannon Entropy depends on the number of events (the number of candidates in each municipality). Therefore, we normalize the Entropy by dividing it by $log(n)$ (MASISI; NELWAMONDO; MARWALA, 2008). Furthermore, we use natural logs and set $K = 1$. In municipalities with only one candidate, the Entropy was set to 1.

For both of our hypothetical municipalities, the values for the Shanon Entropy are $H_{LC} = 0.51$ e $H_{HC} = 0.99$. This is the only index used that has a direct relationship with electoral competition

- **Jensen–Shannon Divergence (JSD)**

In elections with maximum electoral competition, all candidates should receive the same number of votes. In this case, the distribution of votes should be the same as a discrete uniform distribution, where the number of values of the distribution is the same as as the number of candidates. Figure 20 illustrates this situation by comparing three different possibilities for vote distribution. The first is a hypothetical perfect electoral competition case. Each candidate (A, B and C) receives exactly the same amount of votes, meaning that the vote distribution is identical to the corresponding discrete uniform distribution. The graph on the center is the case of the municipality with high electoral competition. Finally, the third graph plots the distribution of votes in the municipality with low electoral competition. Notice that the graph from the municipality with high electoral competition is much more similar to a uniform distribution than the graph from the municipality with low electoral competition.

Figure 20 – Votes distribution



Source: author.

By measuring the difference between the real distribution of votes in a municipality and a discrete uniform distribution with the same number of bins, we can obtain a measurement for electoral competition. The greater the similarity between the real vote distribution and a uniform distribution, the stronger the electoral competition in that municipality is. In order to do that, we need to measure the distance between probability distributions.

The Kullback–Leibler Divergence (KULLBACK; LEIBLER, 1951), also known as Relative Entropy is one of the possible candidates. Like the Shannon Entropy, it also comes from information theory, and can be calculated as:

$$D(p||q) = \sum_{x \in X} p(x)\left[log\left(p(x)\right) - log\left(q(x)\right)\right]$$

Where $p(x)$ and $q(x)$ are discrete probability distributions and $X = \{x_1, ..., x_n\}$ is a set of events. If the Divergence is equal to 0, that means that both distributions have the same amount of information. However, Kullback–Leibler Divergence is not a true metric, once $D(p||q) \neq D(q||p)$. To solve this problem, this study uses the Jensen-Shannon Divergence (RAO; NAYAK, 1985; LIN, 1991). It is based on the Kullback–Leibler Divergence and can be calculated as:

$$JSD(p||q) = \frac{D\left(p(x)||m\right) + D\left(q(x)||m\right)}{2} \tag{24}$$

Where $m = \frac{1}{2}\left(p(x) + q(x)\right)$ and D is the Kullback-Leibler Divergence. It is also possible to show that $0 \leq JSD(p||q) \leq 1$ when base 2 logarithms are used.

In order to calculate the Jensen-Shannon Divergence, one of the distributions used was the real distribution of votes in one municipality. The other was a discrete uniform distribution whose numbers of bins is equal to the number of candidates in that municipality. If only 1 candidate was running for the office, the Divergence was set to 1. Furthermore, we use the square root of the Divergence, which does not affect our results, as square root is a monotonic transformation. We also use base 2 logarithms.

For the two hypothetical municipalities, the values for the Jensen-Shannon Divergence are $JSD_{LC} = 0.44$ and $JSD_{HC} = 0.003$. Therefore, the smaller the Divergence, the stronger the electoral competition.

Appendix D
Spatial Panel Models

This chapter relies heavily on Belotti, Hughes and Mortari (2017) and Ardilly et al. (2018), and briefly describes the spatial econometric models for panel data and the model selection approach used in this study. Spatial econometric models allow for spatial dependence between observations: sample data for one observation depends on the values observed for neighboring (or near) ones, meaning that they are not independent. Thus, spatial econometrics accounts for spatial auto-correlation.

Before dealing with spatial auto-correlation, it is necessary to define a neighboring structure between observations. This is done by defining a *spatial weight matrix*, usually called $\mathbf{W}$. To understand how a spatial weight matrix is build, consider a surface that is divided into n different areas. The spatial structure of the n observations can be used to define several neighboring structures. In a Cartesian setting, for example, the Euclidean Distance between the observations can be used as a neighboring criteria. The shape and the position of each observation can also define neighboring structures based on contiguity (i.e. two units are neighbors if they share a common border). We focus on contiguity based weight matrices, as this study uses this criterion to define neighboring municipalities/prefectures.

We define contiguity in the *Queen* sense. That is, two spatial units are considered to be neighbors if they have at least on common contact point[1]. In figure 21, each square is a spatial unit. By the Queen definition of contiguity, the neighboring structure is defined as in table 30[2].

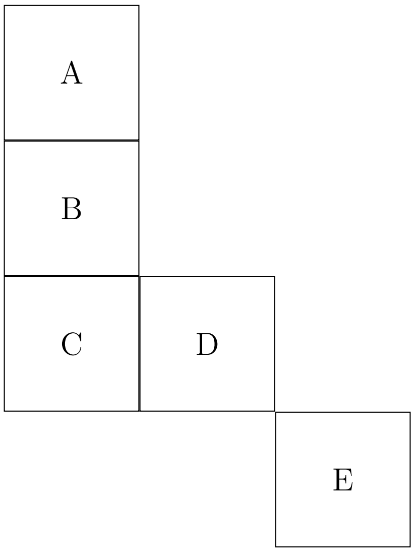
Using the information from table 30, we can define the spatial weight matrix. Let $\mathbf{W}$ be a $n \times n$ matrix with binary entries w_{ij} defined as:

$$w_{ij} = \begin{cases} 1 & \text{if } i \text{ shares a border with } j \\ 0 & \text{otherwise} \end{cases}$$

[1] There are other definitions of contiguity. Rook contiguity considers two observations to be neighbors if they share at least two common boundary points. Rook and Queen contiguity are references to the moves of rooks and queens in chess.

[2] Note that using Rook contiguity, B,D and D,E would not be neighbors.

Figure 21 – Map



Source: author

Table 30 – Neighboring structure

Unit	Neighbors
A	B
B	A, C, D
C	B, D
D	B, C, E
E	D

Source: author.

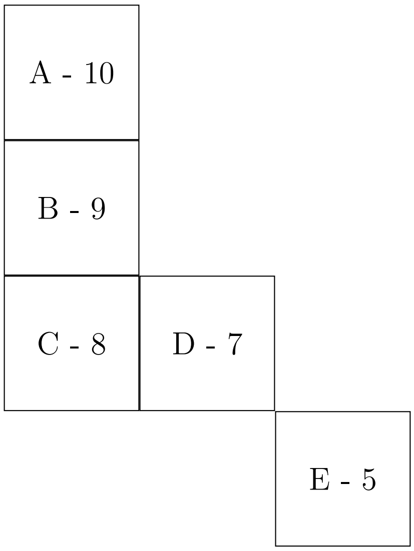
Then, **W** is the $n \times n$ matrix that describes the spatial structure of the observations. In our example, **W** would be as in equation 25. Generally, **W** is normalized so that each rows adds up to 1. In this study, we give equal weights to each observation, although alternative normalization methods are used in the literature[3].

$$W_{(n\times n)} = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{pmatrix} 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{pmatrix} \end{array} \tag{25}$$

3 It is also possible to use the distance between observations to normalize **W**.

Now that we have defined **W**, one might be interested in measuring the spatial dependence between different units in space. In figure 22, we assign a value to each unit of figure 21. It is easy to see that the further south, the smaller this value gets, which might be an indication of spatial dependence between observations.

Figure 22 – Map With Values



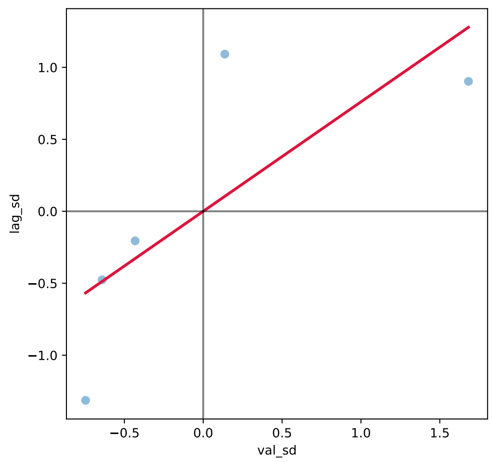
Source: author

A simple method to evaluate spatial structures is by plotting a Moran's Diagram. For a variable y, we plot its centered values (subtract its average and divide by the standard deviation) on the x-axis and the values for the neighboring observations on the y-axis. Those values are known as spatial lag, and can be defined as $\mathbf{Wy}$, where $\mathbf{W}$ is a normalized spatial weigh matrix. Sometimes, a regression line in included to emphasize the linear relationship. Figure 23 is a Moran's Diagram based on the values assigned to each observation in figure 22. Observations at the top right indicate high spatial auto-correlation: the observation has values that are higher than its neighbors. Observations at the bottom left also have positive spatial auto-correlation, but its values are lower than the neighboring units. Finally, observations in the remaining quadrants indicate negative auto-correlation.

The visual analysis of the Moran's Diagram provides insights on the spatial structure of the data. However, in order to measure the spatial auto-correlation between units, spatial auto-correlation indexes are used. Several approaches can be used, but we focus on the Moran's I. For a given spatial weigh matrix $\mathbf{W}$, its statistic is written as:

$$I = \frac{n}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij}(y_i - \bar{y})(y_j - \bar{y})}{\sum_i (y_i - \bar{y})^2} \qquad i \neq j$$

Figure 23 – Moran's Diagram



Source: author.

Where w_{ij} is the weight for observations i and j. When $\mathbf{W}$ is normalized, it is possible to show that I ranges from -1 to 1 (1 being positive spatial auto-correlation and -1 negative spatial auto-correlation). Furthermore, we can test the null hypothesis $H_0 : I = 0$ by comparing the statistic to the distribution of a random rearrangement of the data. In our case, $I = 0.27$ and its P-value is 0.028, suggesting that we should reject the null hypothesis that the map is generated from a random distribution.

Let us now describe the statistical models and model selection approaches. For each period $t = 1, ..., T$, $\mathbf{y_t}$ is the $n \times 1$ vector of the dependent variable and $\mathbf{X_t}$ is the $n \times k$ matrix of independent variables. $\mathbf{W}$ is the spatial weights matrix that is time invariant, meaning that the neighboring structure of the observations is the same for all periods. In this study, we consider 3 specifications, with fixed effects and random affects variants:

- **SDM**

The equation for the Spatial Durbin model (SDM) is

$$\mathbf{y_t} = \rho \mathbf{W} \mathbf{y_t} + \mathbf{X_t} \beta + \mathbf{W} \mathbf{X_t} \theta + \mu + \epsilon_\mathbf{t} \qquad t = 1, ..., T$$

Where μ is a vector to be estimated in the fixed-effects variant and is normally distributed in the random-effects case. It is assumed that $\epsilon_\mathbf{t} \sim N(0, \sigma_\mu^2)$ and $E[\epsilon_{it}\epsilon_{jt}] = 0$ for $i \neq j$. Because $\mathbf{Wy}$ is the spacial lag, ρ is a scalar that accounts for endogenous effects. i.e., it captures the strength of the spatial effect that a variable y in neighboring units has on a particular unit (e.g. the price of a house might depend on the price of the nearby houses). Finally, θ is a vector that captures the effect that the independent variables from surrounding observations have on the dependent variable.

- **SAR**

The Spatial auto-regressive model (SAR) is a special case of the SDM model and its equation can be written as:

$$\mathbf{y_t} = \rho \mathbf{W} \mathbf{y_t} + \mathbf{X_t}\beta + \mu + \epsilon_\mathbf{t} \qquad t = 1, ..., T$$

Note that the SAR model lacks the weighted independent variables term $\mathbf{WX_t}\theta$.

- **SEM**

The Spatial error model includes a spatial auto-correlation term in the error:

$$\begin{aligned} \mathbf{y_t} &= \mathbf{X_t}\beta + \mu + \nu_\mathbf{t} \\ \nu_\mathbf{t} &= \lambda \mathbf{W} \nu_\mathbf{t} + \epsilon_\mathbf{t} \end{aligned} \qquad t = 1, ..., T$$

It controls for spatially auto-correlated errors due to non-observable factors related to geographical location (e.g. the decision to renovate the exterior of a house might depend on the decision of the neighboring houses). It is possible to show that the SEM model is a special case of the SDM model.

The literature also considers different models, including a Spatial Auto-correlation Model (SAC), also known as Kelejian-Prucha or SARAR:

$$\begin{aligned} \mathbf{y_t} &= \rho \mathbf{W} \mathbf{y_t} \mathbf{X_t}\beta + \mu + \nu_\mathbf{t} \\ \nu_\mathbf{t} &= \lambda \mathbf{W} \nu_\mathbf{t} + \epsilon_\mathbf{t} \end{aligned} \qquad t = 1, ..., T$$

The SAC model, however, is biased and non-convergent when the real model includes the independent variables of the neighboring units $\mathbf{WX_t}$, whereas the SDM model is more robust to poor specification choices (ARDILLY et al., 2018). We therefore consider only the SDM, SAR and SEM models in our estimations.

As for model selection, following LeSage and Pace (2009) and Belotti, Hughes and Mortari (2017), we start with the SDM model and test for the parameters. If $\theta = 0$ and $\rho \neq 0$, the model can be written as a SAR, whereas if $\theta = -\beta\rho$, the model is a SEM. Otherwise, we use SDM. We also test for fixed or random effects using the Hausman test.

Appendix E

Japan unemployment rates weighted averages

Table 31 – Adjusted Unemployment Rate Formulas

Electoral Year	Unemployment Year	Adjusted Unemployment Rate
1977	1975	0.6(1975)+0.4(1980)
1980	1980	1980
1983	1985	0.4(1980)+0.6(1985)
1986	1990	0.8(1985)+0.2(1990)
1989		0.2(1985)+0.9(1990)
1992	1995	0.6(1990)+0.4(1995)
1995		1995
1998	2000	0.4(1995)+0.6(2000)
2001	2005	0.8(2000)+0.2(2005)
2004		0.2(2000)+0.8(2005)
2007	2010	0.6(2005)+0.4(2010)
2010		2010
2013	2015	0.4(2010)+0.6(2015)
2016		2015

Source: author.

Appendix F
Models including at-large districts

Table 32 contains fixed effects estimations for Japanese prefectures with the inclusion of Tottori-Shimane and Tokushima-Kōchi at-large districts. The values for the dependent variables and explanatory variables were averaged for Tottori-Shimane and Tokushima-Kōchi for all years of our sample. The main results remain unchanged from our main estimations.

Table 32 – Japanese Upper House Elections with Tottori-Shimane and Tokushima-Kōchi - Fixed Effects

	Exp	ExpV	ExpVS
Gini	0.64**	0.62**	0.61**
	(0.26)	(0.25)	(0.25)
GDP	−0.25	−0.26	−0.25
	(0.18)	(0.18)	(0.18)
Inv	0.04	0.03	0.02
	(0.06)	(0.05)	(0.05)
Unemp	0.01	0.00	0.00
	(0.01)	(0.02)	(0.02)
Aid	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Pop	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
Farm	0.00	0.00	−0.01
	(0.00)	(0.00)	(0.00)
Urban	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Voters	0.00**	0.00**	0.00*
	(0.00)	(0.00)	(0.00)
Cand	0.16***	0.16***	0.17***

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Table 32 – *Continued from previous page*

	Exp	ExpV	ExpVS
	(0.02)	(0.02)	(0.02)
Cand2	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
Seats	−0.17*	−0.20**	−1.13***
	(0.09)	(0.09)	(0.11)
Seats2	0.07***	0.07***	0.16***
	(0.02)	(0.02)	(0.02)
Constant	12.81***	13.38***	14.16***
	(1.62)	(1.62)	(1.60)
Obs.	630	630	630
R^2_a	0.56	0.60	0.60
$R^2 within$	0.58	0.62	0.62
$R^2 overall$	0.64	0.63	0.88
$R^2 between$	0.76	0.75	0.94
σ_u	0.27	0.30	0.29
σ_e	0.19	0.19	0.19
ρ	0.67	0.72	0.69
Year FE	Yes	Yes	Yes

Models for the House of Councillors with Tottori-Shimane and Tokushima-Kōchi - Fixed Effects. The dependent variables are: Exp - constant expenditure per citizen, ExpV - constant expenditure per voter, ExpVS - constant expenditure per voter per seat. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

Appendix G

Panel Tests

The Chow test, the Breusch-Pagan test and a robust Hausman test were conducted in order to test for the best panel model. The statistics shown in table 33 are: F for Chow, Stata's chibar2 for Breusch-Pagan and F for robust Hausman. In all cases, fixed effects were the winning model. The table also shows an F test for the year fixed effects and the modified Wald test for groupwise heteroskedasticity in fixed effects models. The statistics presented are the Chi squared for the Wald test and F for the year fixed effects test.

Table 33 – P-values and statistics for 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	2.19	0	1536.01	0	325.65	0	265.42	0	1.7e+35
2	0	2.34	0	1770.15	0	450.71	0	316.64	0	3.9e+33
3	0	1.91	0	804.53	0	225.32	0	496.80	0	1.3e+35
4	0	1.99	0	913.97	0	260.23	0	559.38	0	9.8e+36
5	0	2.50	0	2213.57	0	273.68	0	419.20	0	1.1e+33
6	0	2.63	0	2422.50	0	353.71	0	471.46	0	2.5e+34
7	0	2.33	0	1484.15	0	127.57	0	390.19	0	6.5e+33
8	0	2.41	0	1594.75	0	153.71	0	455.71	0	1.3e+36
9	0	5.97	0	205.37	0	23.09	0	11.80	0	596.78
10	0	6.21	0	231.47	0	20.70	0	10.47	0	636.68
11	0	6.47	0	243.17	0	21.77	0	10.07	0	679.57

Source: author.

Appendix H
SDM Full Models

Table 34 – SDM Fixed Effects - Brazilian Municipalities

	Mayors		Local Representatives	
	(22)	(23)	(24)	(25)
	Don/Vot	EV/Vot	Don/Vot	EV/Vot
Main				
Gini	0.51***	0.38	0.26*	0.41*
	(0.16)	(0.27)	(0.16)	(0.23)
GiniIncome	−0.02	0.00	0.00	−0.02
	(0.01)	(0.02)	(0.01)	(0.01)
Income	−0.01	0.00	0.00	−0.01
	(0.01)	(0.01)	(0.01)	(0.01)
EducationFrag	2.47***	6.03***	3.41***	5.69***
	(0.82)	(1.45)	(0.71)	(1.17)
Young	6.95***	9.15**	1.10	2.32
	(2.49)	(4.31)	(2.34)	(3.64)
Senior	2.02	5.42*	−2.06	2.71
	(1.52)	(2.78)	(1.40)	(2.13)
AgeFrag	0.31	−4.62	3.73	−0.43
	(4.31)	(7.61)	(3.69)	(5.95)
Urban	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.14***	0.24***	0.00**	0.00***
	(0.02)	(0.03)	(0.00)	(0.00)
Candidates2	0.00	−0.01**	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	0.00	−0.01**	0.00*	0.00**

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Table 34 – *Continued from previous page*

	Mayors		Local Representatives	
	(22)	(23)	(24)	(25)
	Don/Vot	EV/Vot	Don/Vot	EV/Vot
	(0.00)	(0.00)	(0.00)	(0.00)
Seats			−0.01	−0.08***
			(0.02)	(0.03)
Seats2			0.00	0.00
			(0.00)	(0.00)
Runoff	0.10	−0.15		
	(0.12)	(0.21)		
Incumbent	0.00	−0.10***	0.12***	−0.01
	(0.02)	(0.02)	(0.04)	(0.07)
PresAlignment	0.08**	0.16***	0.02	0.03
	(0.04)	(0.06)	(0.03)	(0.04)
GovAlignment	−0.01	0.04	−0.01	0.05*
	(0.03)	(0.04)	(0.02)	(0.03)
PresGovAlignment	−0.09	−0.27***	0.07	0.05
	(0.07)	(0.10)	(0.05)	(0.08)
Wx				
Gini	1.38***	0.52	0.75**	0.76
	(0.34)	(0.76)	(0.29)	(0.54)
GiniIncome	−0.07***	−0.01	−0.03	−0.03
	(0.03)	(0.06)	(0.02)	(0.03)
Income	−0.03***	0.00	−0.01	−0.01
	(0.01)	(0.03)	(0.01)	(0.02)
EducationFrag	−0.97	5.78**	−2.85***	2.70
	(1.15)	(2.26)	(0.94)	(1.77)
Young	3.90	−3.78	6.70*	6.33
	(4.43)	(7.42)	(3.89)	(6.28)
Senior	4.70**	1.68	0.22	1.74

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Table 34 – *Continued from previous page*

	Mayors		Local Representatives	
	(22)	(23)	(24)	(25)
	Don/Vot	EV/Vot	Don/Vot	EV/Vot
	(2.13)	(3.98)	(1.95)	(3.25)
AgeFrag	−11.92*	33.00***	−7.72	14.44
	(6.58)	(11.62)	(5.54)	(9.05)
Urban	0.00**	0.00	0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	−0.03	−0.03	0.00	0.00***
	(0.03)	(0.04)	(0.00)	(0.00)
Candidates2	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	−0.01***	−0.01***	0.00	−0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Seats			−0.12***	−0.25***
			(0.04)	(0.06)
Seats2			0.00*	0.01***
			(0.00)	(0.00)
Runoff	−0.04	−0.01		
	(0.21)	(0.29)		
Incumbent	−0.03	0.01	0.07	−0.11
	(0.03)	(0.05)	(0.08)	(0.14)
PresAlignment	−0.03	0.15	−0.04	0.16
	(0.08)	(0.13)	(0.07)	(0.10)
GovAlignment	−0.01	0.08	0.11***	0.18***
	(0.05)	(0.08)	(0.04)	(0.07)
PresGovAlignment	0.07	−0.18	0.20**	−0.27**
	(0.13)	(0.18)	(0.09)	(0.14)
Spatial				
ρ	0.16***	0.19***	0.26***	0.34***

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Table 34 – *Continued from previous page*

	Mayors		Local Representatives	
	(22)	(23)	(24)	(25)
	Don/Vot	EV/Vot	Don/Vot	EV/Vot
	(0.01)	(0.01)	(0.01)	(0.02)
Variance				
σ_e^2	0.76***	1.23***	0.53***	0.76***
	(0.03)	(0.04)	(0.02)	(0.03)
Direct				
Gini	0.56***	0.42	0.31*	0.48**
	(0.16)	(0.28)	(0.17)	(0.24)
GiniIncome	−0.02**	0.00	0.00	−0.02
	(0.01)	(0.02)	(0.01)	(0.01)
Income	−0.01*	0.00	0.00	−0.01
	(0.01)	(0.01)	(0.01)	(0.01)
EducationFrag	2.44**	6.26***	3.29***	5.98***
	(0.78)	(1.38)	(0.66)	(1.11)
Young	7.1 ***	9.1 **	1.48	2.82
	(2.35)	(4.12)	(2.23)	(3.50)
Senior	2.23	5.64**	−2.03	2.97
	(1.45)	(2.65)	(1.32)	(2.03)
AgeFrag	−0.14	−3.67	3.28	0.4
	(4.24)	(7.45)	(3.59)	(5.77)
Urban	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.14	0.24***	0.00**	0.00***
	(0.02)	(0.03)	(0.00)	(0.00)
Candidates2	0.00	−0.01**	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	0.00	−0.01**	0.00**	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)

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Table 34 – *Continued from previous page*

	Mayors		Local Representatives	
	(22)	(23)	(24)	(25)
	Don/Vot	EV/Vot	Don/Vot	EV/Vot
Seats			−0.02	−0.10***
			(0.02)	(0.03)
Seats2			0.00	0.00
			(0.00)	(0.00)
Runoff	0.10	−0.13		
	(0.13)	(0.22)		
Incumbent	0.00	−0.11***	0.13***	−0.02
	(0.02)	(0.02)	(0.04)	(0.07)
PresAlignment	0.08**	0.17***	0.01	0.04
	(0.04)	(0.06)	(0.03)	(0.04)
GovAlignment	−0.01	0.04	0.00	0.07**
	(0.03)	(0.04)	(0.02)	(0.03)
PresGovAlignment	−0.09	−0.27***	0.09*	0.04
	(0.07)	(0.11)	(0.05)	(0.08)
Indirect				
Gini	1.73***	0.82	1.05***	1.27
	(0.41)	(0.93)	(0.39)	(0.80)
GiniIncome	−0.09***	−0.02	−0.04	−0.05
	(0.03)	(0.07)	(0.02)	(0.05)
Income	−0.04***	−0.01	−0.02	−0.02
	(0.02)	(0.03)	(0.01)	(0.03)
EducationFrag	−0.64	8.39***	−2.59**	6.54***
	(1.30)	(2.67)	(1.10)	(2.34)
Young	5.64	−2.72	9.04	10.19
	(4.89)	(8.47)	(4.55)	(8.05)
Senior	5.69***	3.1	−0.52	3.55
	(2.12)	(4.05)	(2.18)	(3.97)

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Table 34 – *Continued from previous page*

	Mayors		Local Representatives	
	(22)	(23)	(24)	(25)
	Don/Vot	EV/Vot	Don/Vot	EV/Vot
AgeFrag	−13.67*	38.81***	−8.74	20.57**
	(7.27)	(13.16)	(6.33)	(11.33)
Urban	0.00**	0.01	0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	−0.02	0.01	0.00	−0.01***
	(0.03)	(0.05)	(0.00)	(0.00)
Candidates2	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Voters	−0.01	−0.02***	0.00*	−0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Seats			−0.16***	−0.39***
			(0.05)	(0.09)
Seats2			0.00*	0.01***
			(0.00)	(0.00)
Runoff	−0.02	−0.04		
	(0.24)	(0.33)		
Incumbent	−0.03	−0.01	0.13	−0.17
	(0.04)	(0.07)	(0.10)	(0.20)
PresAlignment	0.00	0.24*	−0.05	0.23*
	(0.09)	(0.15)	(0.09)	(0.13)
GovAlignment	−0.01	0.10	0.15***	0.29***
	(0.05)	(0.10)	(0.05)	(0.10)
PresGovAlignment	0.06	−0.29	0.28**	−0.37**
	(0.14)	(0.2)	(0.11)	(0.19)
Total				
Gini	2.29***	1.24	1.37***	1.75**
	(0.46)	(1.02)	(0.44)	(0.88)

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Table 34 – *Continued from previous page*

	Mayors		Local Representatives	
	(22)	(23)	(24)	(25)
	Don/Vot	EV/Vot	Don/Vot	EV/Vot
GiniIncome	−0.11***	−0.02	−0.04	−0.07
	(0.03)	(0.07)	(0.03)	(0.06)
Income	−0.05***	−0.01	−0.02	−0.03
	(0.02)	(0.04)	(0.01)	(0.03)
EducationFrag	1.80	14.65***	0.70	12.52**
	(1.2)	(2.54)	(1.01)	(2.39)
Young	12.75***	6.38	10.52**	13.01
	(5.05)	(8.71)	(4.76)	(8.66)
Senior	7.93***	8.73**	−2.56	6.52
	(2.08)	(3.91)	(2.28)	(4.04)
AgeFrag	−13.81**	35.13***	−5.46	20.97*
	(6.53)	(12.05)	(6.2)	(11.37)
Urban	0.00**	0.01	0.00	0.00*
	(0.00)	(0.00)	(0.00)	(0.00)
Candidates	0.13***	0.26***	0.00	0.00*
	(0.04)	(0.07)	(0.00)	(0.00)
Candidates2	−0.01	−0.01	0.00	0.00
	(0.00)	(0.01)	(0.00)	(0.00)
Voters	−0.01***	−0.03***	0.00***	−0.02***
	(0.00)	(0.01)	(0.00)	(0.00)
Seats			−0.17***	−0.49***
			(0.06)	(0.11)
Seats2			0.00**	0.02***
			(0.00)	(0.00)
Runoff	0.08	−0.17		
	(0.29)	(0.4)		
Incumbent	−0.03	−0.12	0.26**	−0.19

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Table 34 – *Continued from previous page*

	Mayors		Local Representatives	
	(22)	(23)	(24)	(25)
	Don/Vot	EV/Vot	Don/Vot	EV/Vot
	(0.04)	(0.07)	(0.11)	(0.22)
PresAlignment	0.08	0.42	−0.04	0.27*
	(0.11)	(0.17)	(0.09)	(0.14)
GovAlignment	−0.02	0.14	0.14***	0.36***
	(0.06)	(0.11)	(0.05)	(0.11)
PresGovAlignment	−0.03	−0.57**	0.37***	−0.33
	(0.14)	(0.23)	(0.12)	(0.21)
Obs.	19968	16287	19968	16287
$R^2 within$	0.02	0.00	0.05	0.01
$R^2 overall$	0.00	0.00	0.00	0.00
$R^2 between$	0.02	0.01	0.01	0.00
$SAR\chi^2$	50.95	46.06	69.92	88.55
$SEM\chi^2$	52.36	60.83	81.51	108.96
$hau\chi^2$	702.06	668.11	1144.72	995.10
Time FE	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes

SDM models for Brazilian municipalities - Fixed Effects. The dependent variables are: Don/Vot - donations per voter and EV/Vot - estimated values per voter. Robust standard errors in parenthesis, *p < 0.1, **p < 0.05, ***p < 0.01. Source: author.

Table 35 – SDM Fixed Effects - Japanese Prefectures

	(26)	(27)	(28)
	Exp	ExpV	ExpVS
Main			
Gini	0.69**	0.60**	0.59**

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Table 35 – *Continued from previous page*

	(26)	(27)	(28)
	Exp	ExpV	ExpVS
	(0.29)	(0.27)	(0.27)
GDP	−0.22	−0.23	−0.24
	(0.16)	(0.16)	(0.15)
Inv	0.03	0.03	0.01
	(0.07)	(0.07)	(0.07)
Unemp	0.01	0.00	0.00
	(0.02)	(0.02)	(0.02)
Aid	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Pop	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
Farm	−0.01	0.00	−0.01
	(0.00)	(0.00)	(0.00)
Urban	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Voters	0.00**	0.00**	0.00*
	(0.00)	(0.00)	(0.00)
Cand	0.17***	0.17***	0.17***
	(0.02)	(0.02)	(0.02)
Cand2	0.00***	0.00***	−0.01***
	(0.00)	(0.00)	(0.00)
Seats	−0.15	−0.17	−1.09***
	(0.10)	(0.11)	(0.11)
Seats2	0.06***	0.07***	0.16***
	(0.02)	(0.02)	(0.02)
Wx			
Gini	−0.66*	−0.82**	−0.85**
	(0.36)	(0.35)	(0.35)
GDP	0.23	0.22	0.23

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Table 35 – *Continued from previous page*

	(26) Exp	(27) ExpV	(28) ExpVS
	(0.16)	(0.16)	(0.16)
Inv	0.20**	0.22**	0.23**
	(0.10)	(0.10)	(0.10)
Unemp	0.02	0.02	0.02
	(0.02)	(0.02)	(0.02)
Aid	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)
Pop	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Farm	0.00	0.01*	0.01*
	(0.00)	(0.00)	(0.00)
Urban	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Voters	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Cand	0.00	0.00	0.00
	(0.02)	(0.02)	(0.02)
Cand2	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Seats	0.16	0.20	0.19
	(0.20)	(0.20)	(0.20)
Seats2	−0.01	−0.01	−0.01
	(0.05)	(0.05)	(0.05)
Spatial			
ρ	0.05	0.03	0.02
	(0.05)	(0.05)	(0.05)
Variance			
σ_e^2	0.04***	0.04***	0.04***

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Table 35 – *Continued from previous page*

	(26)	(27)	(28)
	Exp	ExpV	ExpVS
	(0.00)	(0.00)	(0.00)
Direct			
Gini	0.69**	0.61**	0.60**
	(0.30)	(0.28)	(0.28)
GDP	−0.22	−0.24	−0.25*
	(0.15)	(0.15)	(0.15)
Inv	0.04	0.04	0.02
	(0.07)	(0.07)	(0.07)
Unemp	0.01	0.00	0.00
	(0.02)	(0.02)	(0.02)
Aid	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Pop	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
Farm	−0.01	0.00	−0.01
	(0.00)	(0.00)	(0.00)
Urban	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Voters	0.00**	0.00**	0.00*
	(0.00)	(0.00)	(0.00)
Cand	0.17***	0.17***	0.17***
	(0.02)	(0.02)	(0.02)
Cand2	0.00***	0.00***	−0.01***
	(0.00)	(0.00)	(0.00)
Seats	−0.14	−0.16	−1.09***
	(0.11)	(0.11)	(0.11)
Seats2	0.06***	0.07***	0.16***
	(0.02)	(0.02)	(0.02)

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Table 35 – *Continued from previous page*

	(26) Exp	(27) ExpV	(28) ExpVS
Indirect			
Gini	−0.64*	−0.81**	−0.83**
	(0.37)	(0.36)	(0.36)
GDP	0.23	0.21	0.23
	(0.16)	(0.16)	(0.16)
Inv	0.20**	0.22**	0.23**
	(0.10)	(0.09)	(0.09)
Unemp	0.02	0.03	0.02
	(0.02)	(0.02)	(0.02)
Aid	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)
Pop	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Farm	0.00	0.01*	0.01**
	(0.00)	(0.00)	(0.00)
Urban	0.00*	0.00	0.00
	(0.00)	(0.00)	(0.00)
Voters	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Cand	0.01	0.00	0.00
	(0.02)	(0.02)	(0.02)
Cand2	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Seats	0.14	0.19	0.15
	(0.21)	(0.20)	(0.20)
Seats2	0.00	−0.01	0.00
	(0.05)	(0.05)	(0.05)
Total			
Gini	0.05	−0.20	−0.24

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Table 35 – *Continued from previous page*

	(26)	(27)	(28)
	Exp	ExpV	ExpVS
	(0.53)	(0.49)	(0.49)
GDP	0.00	−0.02	−0.02
	(0.11)	(0.11)	(0.11)
Inv	0.24***	0.25***	0.25***
	(0.07)	(0.07)	(0.07)
Unemp	0.03***	0.03***	0.03***
	(0.01)	(0.01)	(0.01)
Aid	−0.01	−0.01	−0.01
	(0.01)	(0.01)	(0.01)
Pop	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
Farm	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Urban	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
Voters	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Cand	0.17***	0.17***	0.18***
	(0.03)	(0.03)	(0.03)
Cand2	0.00***	0.00***	−0.01***
	(0.00)	(0.00)	(0.00)
Seats	0.00	0.03	−0.94***
	(0.24)	(0.23)	(0.23)
Seats2	0.06	0.06	0.16***
	(0.05)	(0.05)	(0.05)
Obs.	602	602	602
$R^2 within$	0.53	0.58	0.59
$R^2 overall$	0.60		
$R^2 between$	0.73	0.72	0.93

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Table 35 – *Continued from previous page*

	(26)	(27)	(28)
	Exp	ExpV	ExpVS
$SAR\chi^2$	30.52	44.50	44.38
$SER\chi^2$	31.16	44.96	41.92
$hau\chi^2$	123.85	88.76	105.79
Time FE	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes

SDM models for Japanese prefectures - Fixed Effects. The dependent variables are: Exp - constant expenditure per citizen, ExpV - constant expenditure per voter, ExpVS - constant expenditure per voter per seat. Robust standard errors in parenthesis, *p $<$ 0.1, **p $<$ 0.05, ***p $<$ 0.01. Source: author.