

On the impacts of territorial fragmentation on voter engagement

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Abstract

In recent decades, territorial reforms have shown contrasting trends globally. Developed countries have focused on consolidating local governments into larger units for economies of scale and efficiency, while developing countries have opted for fragmentation to enhance political representation and resource allocation. This paper examines the impact of territorial divisions on local governments in Brazil, with a focus on their effects on political engagement. We analyze Brazilian electoral data from 1988 to 2020, covering 621 areas affected by municipal splits, provided by the Regional Electoral Courts (TREs) and the Superior Electoral Court (TSE). Our methodology employs a difference-in-differences estimator that is robust to group and time heterogeneity, using municipalities that attempted to split but were unsuccessful as a control group. Our study reveals an increase in political engagement after the implementation of administrative divisions in both municipal and general elections. This effect is further amplified in highly fragmented areas impacted by this territorial reform.

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1 Introduction

In recent decades, there have been contrasting trends in territorial reforms worldwide. Developed countries have primarily focused on consolidating local governments into larger administrative units to achieve economies of scale and increase efficiency. On the other hand, many developing countries have opted to fragment their territories, creating smaller administrative units to enhance political representation and allocate resources more effectively to address local needs. Although recent quasi-experimental studies have mainly examined the effects of government mergers in developed nations, there is a notable lack of research on the impacts of territorial splits in developing countries (Gendźwiłł, Kurniewicz, & Swianiewicz, 2021). A clearer understanding of fragmentation effects allows us to better comprehend the impact of decentralization on economic development and political dynamics.

This study examines how territorial divisions impact local governments in Brazil, focusing specifically on whether these divisions have increased voter political engagement. To achieve this, we analyze data from 1988 to 2020, focusing on 621 areas that experienced municipal splits across nineteen states. Brazil presents a unique context for examining territorial reforms. The 1988 Federal Constitution initiated a move towards decentralization by granting municipalities greater autonomy and encouraging the establishment of new ones through increased vertical transfers (Tomio, 2002). Between 1991 and 2013, municipalities grew from 4,491 to 5,569, mostly with less than 10,000 residents, providing a valuable context for assessing the impact of territorial splits.

A key challenge in this literature is the endogeneity, as decentralization is often linked to unobserved factors, such as subnational political power and resources, leading to reverse causality (Besley & Case, 1995; Rodden, 2019). Recent studies have explored territorial reforms as a source of exogenous variation in decentralization, using two-way fixed effects (TWFE) regression to assess their impact on local economies. However, recent developments in difference-in-differences methods show that TWFE can yield biased estimates due to group or time heterogeneity. To overcome this issue, we utilize the difference-in-differences estimator proposed by Callaway and Sant’Anna (2021) to evaluate the effects of municipal fragmentation. This method accommodates treatments across multiple periods while relying on conditional parallel trends assumption, and we apply it alongside the inverse probability weighting (IPW) matching approach (Abadie, 2005).

We collected data on requests for municipal splits from regional electoral courts (TREs) and legislative assemblies from 1988 to the early 2000s. This approach enabled us to assemble a control group of “almost treated” municipalities (those whose split attempts failed), providing a more suitable comparison for the newly formed municipalities. We also collected new local turnout data for the 1988 and 1992 elections, which we combined with existing electoral data from the Superior Electoral Court (TSE) for subsequent elections.

Our study highlights two important findings. First, political engagement rose after the administrative division. The voter turnout rate increased by 1.95 percentage points

for municipal elections and by 2.19 percentage points for general elections (federal and state positions). The effects on valid votes were similar, while there was no significant impact on blank and null votes. Since the pivotal probability for general elections remained unchanged after the territorial reform, the rise in voter participation is likely attributable to an increased sense of civic duty, greater social pressure to cast ballots, and an improved internal political efficacy that citizens experience following the municipal split process. The active participation of the local community in establishing the new municipality, which included a plebiscite on territorial independence and efforts to encourage politicians to pass legislation for territorial emancipation, likely influenced these intrinsic motivations to vote.

Secondly, we examine how the level of municipal fragmentation influences electoral engagement by using the Herfindahl-Hirschman Index (HHI) to measure the degree of fragmentation within each area. Highly fragmented areas experience significant increases in voter turnout, with an increase of 3.36 percentage points in municipal elections and 3.42 percentage points in general elections. More concentrated areas also experience improvements in voter participation, but these effects are smaller and, for municipal elections, statistically insignificant. These findings suggest that smaller municipalities have a greater impact on voter engagement in both local and national elections compared to low fragmented areas.

We contribute to two main areas of economic literature. First, the traditional literature on fiscal decentralization advocates for transferring responsibilities and resources from central to local governments. This approach would better accommodate local preferences, enhance accountability and increase responsiveness, and strengthen democratic practices (Brennan & Buchanan, 1980; Oates, 1972; Tiebout, 1956). To date, few studies have examined the effects of territorial reforms on electoral participation. Most existing research has focused on the amalgamation of subnational governments in developed countries, which has typically resulted in decreased turnout following a merger (Koch & Rochat, 2017; Lapointe, Saarimaa, & Tukiainen, 2018; Roesel, 2017).

Our study builds on previous research that examined the effects of Brazilian municipal splitting in the 1990s on financial aspects, public service delivery, and socioeconomic indicators (Dahis & Szerman, 2024; Lima & Silveira Neto, 2018; Mattos & Ponczek, 2013). This paper presents the first empirical estimates of how territorial fragmentation affects turnout in municipal and general elections. Compared to previous studies, we expanded the almost treated sample by including more states where municipalities attempted territorial splitting without success. Additionally, we employed a difference-in-differences estimator robust to heterogeneous effects, rather than relying on TWFE regression.

Our second area of contribution focuses on voting behavior within the context of political economy, specifically based on the rational voter model to analyze voter turnout (Downs, 1957; Riker & Ordeshook, 1968). According to this model, Voters evaluate the costs of casting a vote, the probability that their vote will be pivotal, the comparative advantages of their preferred candidate versus other candidates, and their intrinsic motivations. Territorial reforms can influence these mechanisms by affecting the size of the electorate and

potentially strengthening the connection between officials and their constituents. This, in turn, may enhance citizens' engagement in the voting process. Brazil is a notable case, where the territorial fragmentation resulted in the creation of several small municipalities. We contribute to the existing literature by presenting empirical estimates that suggest expressive motivations, such as civic duty, social norms, and political efficacy, were likely the primary drivers of increased electoral turnout in the newly established municipalities. Furthermore, we show that effects on voter engagement are greater in areas with higher degrees of fragmentation.

This study is organized as follows. Section 2 details the process of territorial emancipation, offering context for the Brazilian institutional environment in the 1990s. Section 3 presents the Downsian voting model and highlights the mechanisms through which territorial reforms can influence electoral participation. Section 4 discusses potential biases in the TWFE regression and introduces the estimator developed by Callaway and Sant'Anna (2021), which was applied in this study. Next, Section 5 details the sample construction, the variables used, and provides descriptive statistics. In Sections 6 and 7, we present our empirical findings and discuss them. Finally, we conclude our study in Section 8.

2 Institutional background

After Brazil's re-democratization, there was a significant movement toward political and administrative decentralization, transferring power from the federal government to the municipalities. As a result, the 1988 Federal Constitution (CF/88) elevated municipalities to the status of entities within the Federation, alongside the federal government and the states. This change ensured greater decision-making autonomy for municipalities, increased resources from intergovernmental transfers, and facilitated territorial reforms. Consequently, the number of municipalities grew from 4,490 in 1991 to 5,569 in 2013.

The Municipal Participation Fund (FPM) is one of the primary revenue sources for municipalities, distributed based solely on population size. It allocates larger per capita amounts to smaller jurisdictions and smaller amounts to larger ones.¹ Therefore, it is not surprising that the establishment of new municipalities significantly increased the share of FPM resources for areas affected by this reform (Dahis & Szerman, 2024; Lima & Silveira Neto, 2018; Mattos & Ponczek, 2013). This fact is often cited as a key reason for the substantial territorial fragmentation observed in the 1990s (Boueri, Monasterio, Mation, & Silva, 2013; Tomio, 2002).

This fiscal incentive for creating smaller jurisdictions was supported by the institutional and legal changes enacted in 1988. Prior to this year, the minimum criteria for municipal splits were largely uniform across all states. These requirements included geographic contiguity and minimum levels of population, urban development, and share of state government revenue. With the new Constitution, each state began to establish its own criteria through

¹For further information about the distribution criteria, see Tables A1 and A2, and Figure A1.

complementary laws. As a result, some states modified their requirements by either relaxing or tightening them, while also introducing new criteria, such as the age of the emancipatory district and its distance from the municipal seat².

According to Tomio (2002), the permissiveness level of state regulations does not fully explain the rise of new jurisdictions. Political factors, such as the governor's ideology and his/her relationship with the legislative assembly, also significantly influenced the establishment of new municipalities. Both Executive and Legislative branches had the authority to stop the emancipation process, which typically followed these steps:

1. local leaders requested an emancipation plebiscite from the state legislative assembly;
2. state deputies voted on a bill to authorize the plebiscite;
3. governor decided to veto the bill or to sign it into law;
4. plebiscite was conducted by the state electoral court with potentially affected voters;
5. state deputies voted on a bill to create the new municipality;
6. governor decided whether to veto or approve the emancipation; and
7. municipality would be established in the year following the municipal elections.

The governor had two opportunities to stop the process by vetoing the bills related to the plebiscite and the creation of the new entity. However, the legislative assembly could override these vetoes, allowing the bills to become law. Consequently, state deputies held most power in approving and vetoing legislation during the emancipation process. Lawmakers typically supported the preferences of local leaders and voters because opposing these measures could result in negative electoral consequences for them. Therefore, split request rejections occurred only when the Executive opposed creating a new municipality and was supported by a strong political coalition in the Legislative branch (Tomio, 2002).

In 1996, Constitutional Amendment 15 was enacted to reduce the rate of new municipality creation. This was achieved by requiring the establishment of a federal law to regulate the subnational processes of emancipation. As a result, only a limited number of municipalities were established after 2000. Some of these divisions were based on processes that had already been initiated earlier, while others are subjects of legal disputes and have even been deemed unconstitutional by the Brazilian Supreme Court (Acayaba, 2008; Rollsing, 2021).

3 Downsian voting model and jurisdiction size

Understanding voter behavior is a core component of political economy and political science, with its examination guided by two seminal theoretical frameworks. The rational voter model (Downs, 1957) posits that individuals make voting decisions based on rational calculations, evaluating the expected benefits against the costs of participating in the

²Refer to Table A3 for further details for municipal splitting.

voting process. Building on it, the expressive voting theory (Riker & Ordeshook, 1968) suggests that people vote for the intrinsic satisfaction the act of voting provides, which is rooted in personal identity and civic duty. Together, these frameworks highlight the various motivations that drive voter participation in elections.

Downs (1957) introduced the rational choice model, which states that, in its purest form, a voter decides to participate in an election if the expected benefits outweigh the costs (instrumental voting). This model can be expressed as:

$$R = PB - C, \tag{1}$$

where R represents the expected utility of the act of voting, P denotes the probability that one's vote will change the election outcome (pivotal), B is the utility difference between electing the preferred candidate over another, and C refers to the cost associated with voting.

This reasoning implies that a small number of people would vote in large electorates, since the impact of each individual vote decreases as the number of voters increases ($P \rightarrow 0$). This situation presents a dilemma known as the “paradox of voting.” Riker and Ordeshook (1968) introduced an expressive element, denoted as D , which captures the intrinsic rewards of voting and is not directly related to the election outcome. Therefore, the voter's turnout decision model can be expressed as:

$$R = PB - C + D. \tag{2}$$

Multiple factors influence this expressive element, which reflects the intrinsic benefits individuals obtain from voting, such as civic duty, partisan affirmation, and social pressure. These motivations are crucial for explaining why voter turnout can remain high, even when strategic incentives are minimal, particularly in large-scale elections where the impact of a single vote is relatively small.

In the following subsections, we will explore the theories and hypotheses³ related to each term in Equation (2) and how territorial reforms may influence them. These reforms can have a significant impact on the political landscape and dynamics of the affected areas, primarily by changing the population size.

3.1 Pivotal probability (P)

The probability of a vote being pivotal, P , is influenced by three key factors. First, the *expected closeness of the election* increases the likelihood that a single vote can change the outcome, which encourages a higher voter turnout (Downs, 1957; Riker & Ordeshook, 1968). Second, the *size of the electorate* plays an important role because as the number of

³Most recent empirical studies in this field have primarily focused on amalgamation. Consequently, we adapted the reasoning for the opposite territorial reform (fragmentation).

voters increases, the impact of each individual vote diminishes. Finally, voter turnout is also influenced by citizens' belief in how much political leaders and governments respond to their demands, which is referred to as *external political efficacy* (Balch, 1974; Norris, 2015).

The pivotal probability is clearly influenced by territorial fragmentation, which creates at least two smaller jurisdictions, each with a lower number of voters than the original area. This change directly increases the weight of each ballot in the election. Moreover, a higher ratio of representatives to residents in smaller areas likely contributes to stronger external political efficacy (Carr & Tavares, 2014; Dagger, 1981; Frandsen, 2002), as residents often advocate for more direct governance and visibility of government actions (Faguet, 2004; Van Houwelingen, 2017). Consequently, these mechanisms are likely to enhance local voter turnout, although they are expected to have no impact on regional or national elections.

On the other hand, fragmentation may reduce the competitiveness of local elections, as smaller jurisdictions tend to foster more homogeneous communities (Tiebout, 1956), which may decrease the necessity for political participation (Bönisch, Geys, & Michelsen, 2019; Oliver, 2000).

3.2 Differential benefit (B)

Larger jurisdictions can achieve economies of scale and increase resources, leading to more efficient delivery of public goods (Dollery, 2010; Larsen, 2002; Oates, 1972). In contrast, smaller administrative units may lead to politicians being more responsive to local preferences, making it easier to understand community needs and enhancing the utility of their policy proposals (Lapointe et al., 2018).

Brazil presents an intriguing case, as fragmentation reforms created smaller municipalities, while also increasing the influx of resources to local governments (Dahis & Szerman, 2024; Lima & Silveira Neto, 2018; Mattos & Ponczek, 2013), a benefit often attributed to territorial consolidations. This additional resource, which improved local policy capacity, could have made the candidates' platforms more appealing to citizens.

Nevertheless, B is the utility difference between electing one's preferred candidate over another contender. Therefore, it is unclear whether the territorial split has any impact on it. Even if it improves candidates' policy agendas, this does not necessarily mean that the benefit gap between candidates will widen.

3.3 Cost (C)

The cost of voting primarily involves the *time and effort* required to engage in the electoral process. This includes the mental effort needed to decide whom to vote for, particularly when voters lack sufficient information about the candidates and the preferences of other voters (Palfrey & Rosenthal, 1985). Additionally, there are logistical challenges to consider, such as traveling to the polling place, especially when there are long distances to

cover or inadequate public transportation options (Brady, Verba, & Schlozman, 1995).

Smaller municipalities could decrease the overall cost of voting, denoted as C , by reducing both the informational and logistical burdens on voters. They could simplify policy agendas, making them more immediate and less abstract. This would allow voters to spend less time and cognitive effort evaluating their choices (Lassen & Serritzlew, 2011; McDonnell, 2020). Moreover, smaller geographic areas can reduce the average distances voters need to travel to polling stations, reducing logistical challenges and time commitments, which can significantly improve voter turnout (Cantoni, 2020).

In some electoral systems, voting is mandatory, which significantly contributes to high voter turnout. In Brazil, citizens face fines and restrictions on accessing public services if they fail to comply with compulsory voting. Although the monetary cost of the fine is relatively low (just a few dollars), there is also a time cost associated with paying the fine, which can considerably increase the overall burden of not voting (and reduce the cost of participating in elections, C). In this context, when citizens vote without a preferred candidate ($B = 0$), casting an invalid vote (blank or null) can be seen as an equivalent option to abstaining. This behavior may reflect voters' dissatisfaction with the political or economic situation (Power & Roberts, 1995).

3.4 Expressive term (D)

Territorial reform can enhance the expressive reward of voting, D , by reshaping the social and psychological motivations that drive voter turnout. Dividing a municipality into smaller units can foster a stronger sense of community among residents (Alexander, 2013; Koch & Rochat, 2017). This may enhance the perception of voting as a civic duty, encouraging individuals to acknowledge their responsibilities to support the local community and uphold democratic values (Blais, Young, & Lapp, 2000; Funk, 2010; Knack, 1992).

Citizens often experience *social pressure* to vote, driven by the desire to conform to societal norms and maintain their standing within the community (Dellavigna, List, Malamendier, & Rao, 2017; Gerber, Green, & Larimer, 2008). In smaller jurisdictions, where neighbors and peers are more likely to observe each other's voting behavior, this pressure becomes even more intense. The increased visibility of voting decisions makes abstaining from voting more noticeable and socially risky, which encourages individuals to participate at higher rates in order to avoid community disapproval and meet shared expectations.

Moreover, individuals are more likely to vote when they believe in their ability to understand and engage in politics, a concept known as *internal political efficacy* (Niemi, Craig, & Mattei, 1991). When local jurisdictions are smaller, residents tend to develop closer relationships with their local officials and face more straightforward policy choices, making political engagement feel more accessible. As a result, these factors enhance citizens' confidence in their own abilities, which strengthens internal political efficacy and increases the personal satisfaction they derive from voting.

Voters may also find satisfaction in expressing their *partisan identity* (Riker & Ordeshook, 1968) by backing a candidate or political party, even one with little chance of winning. In Brazil, the debate about territorial fragmentation was not primarily shaped by ideological divides between left- and right-wing parties. Instead, local communities often sought to create new municipalities to gain administrative autonomy and secure access to fiscal transfers (Tomio, 2002). As a result, it is unlikely that fragmentation affected individuals' loyalty towards any political party.

However, it may have influenced voters' support for individual candidates, particularly in the short term. Local leaders in Brazil played a crucial role in initiating and advocating for the process of territorial emancipation from their original municipalities. These leaders often emerged as strong contenders for mayoral and council positions, which likely affected voters' decisions to support them.

Electoral participation can also be influenced by *voting habits*. For instance, external shocks like adverse weather can reduce turnout in one election and lower the chances of participation in future elections (Fujiwara, Meng, & Vogl, 2016). The municipal division likely acted as an electoral catalyst, as communities sought autonomy through a local plebiscite and expressed their desire to form a new municipality. Additionally, the elections for the new municipality were held for the first time, which may have increased initial voter participation and helped establish a consistent voting habit over time, along with other expressive factors⁴.

Overall, theories and hypotheses suggest that territorial fragmentation enhances voter turnout through both instrumental and expressive channels. However, there remains an empirical question regarding the impact of territorial reform on voter participation in the Brazilian context and how this effect evolves over time.

3.5 Empirical evidence

Some of the recent empirical studies use territorial reforms as an exogenous shock to identify the causal effect of population size on voter engagement. They mainly focus on the mergers of jurisdictions on developed countries (Cobban, 2019; Harjunen, Saarimaa, & Tukiainen, 2017; Lapointe et al., 2018; Roesel, 2017, and others) and primarily employ difference-in-differences and synthetic control methods. A key conclusion drawn from these studies is that merging municipalities results in a decrease in voter turnout. For example, Lyytikäinen and Tukiainen (2019) analyze municipal council size discontinuities in Finland, showing that increases in council seats led to a higher likelihood of a voter being pivotal, which in turn significantly boosted voter turnout.

Research has already explored some heterogeneities in the impact of mergers on voter turnout. Koch and Rochat (2017) focus on the long-term effects by examining multiple

⁴Gerber, Green, and Shachar (2003) and Meredith (2009) found that habit formation consistently increased voter turnout. However, these studies may have mixed effects of voting inertia and lasting changes in voters' perception on civic duties and exposure to media and education (Fujiwara et al., 2016).

“waves” of municipal mergers. They find significant reductions in turnout in the first election following the initial wave of mergers, but this effect diminishes in later waves. Similarly, Allers, De Natris, Rienks, and De Greef (2021) verifies the long-term effects, noting that the impact persists for at least five elections. In a contrasting finding, Bhatti and Hansen (2019) analyze the Danish context and show a positive effect of mergers on electoral participation in the short term.

Another heterogeneity relates to the size of the municipalities involved in the merger. Lapointe et al. (2018) report that the negative impact on turnout is only present in the smaller municipalities that are annexed to a larger administration. Finally, the effect of mergers on electoral participation reveals that the negative impact on turnout is three times greater for local elections than for general elections (Allers et al., 2021).

Most existing studies concentrate on amalgamations in developed democracies, while the opposite process (fragmentation) has been overlooked. Brazil presents an interesting case of fragmentation due to its mandatory voting system and the creation of new municipalities, with nearly 80% of them having populations under 10,000 residents. In this context, the principles of rational voting may be relevant, as citizens recognize their votes can directly affect local outcomes. Therefore, Brazil’s territorial fragmentation offers a valuable opportunity to examine how the interplay of instrumental and expressive factors influences voter turnout.

4 Empirical strategy

In this study, we examine the establishment of new municipalities in Brazil, which primarily took place in the 1990s as a means to promote political and fiscal decentralization to local governments. To assess the impact of territorial splitting on voter engagement, we employed a difference-in-differences approach. This method is commonly used in recent literature concerning territorial reform, particularly for mergers that have occurred in developed countries (Gendźwiłł et al., 2021).

Research in this field has applied two-way fixed effects (TWFE) regression to assess the impact of territorial reforms, including those in the Brazilian context (Dahis & Szerman, 2024; Lima & Silveira Neto, 2018; Mattos & Ponczek, 2013). However, recent literature on difference-in-differences (DiD) has shown that this regression approach raises concerns regarding the validity of the earlier findings. This bias arises because, in addition to comparing treated with untreated (or not yet treated) units to calculate the average treatment effect on the treated (ATT), the Two-Way Fixed Effects (TWFE) regression also compares one treated unit with another treated unit that received the treatment earlier (“forbidden comparisons”) (de Chaisemartin & D’Haultfœuille, 2023; Goodman-Bacon, 2021; Roth, Sant’Anna, Bilinski, & Poe, 2023).

In recent years, new DiD estimators have been proposed to address potential heterogene-

ity bias in staggered treatment designs (Borusyak, Jaravel, & Spiess, 2024; de Chaisemartin & d’Haultfoeuille, 2020; Sun & Abraham, 2021). In this type of design, a unit becomes treated once and remains treated for the duration of the analysis period. In this study, we employed the estimator developed by Callaway and Sant’Anna (2021). This approach addresses the potential bias caused by heterogeneity by estimating multiple disaggregated effects, denoted as $ATT(g, t)$. These represent the average treatment effects on the treated at time t for groups who were first treated at time g , where $g \leq t$. By doing this, we can carefully select appropriate comparisons and then aggregate them into a single average treatment effect on the treated (ATT). Moreover, we may also aggregate the $ATT(g, t)$ by group, time, or event study to enable further analysis.

This framework relies on parallel trends to identify the average treatment effect on the treated (ATT). However, this assumption may not be valid if the pre-treatment characteristics that influence outcome dynamics are not balanced between the treatment and control groups, leading to potential selection bias. Therefore, to strengthen the credibility of the parallel trends, one may apply a parametric or semi-parametric approach to adjust for potential differences between these groups using time-invariant covariates.

Callaway and Sant’Anna (2021) suggests three approaches. The first one is the outcome regression (OR) (Heckman, Ichimura, & Todd, 1997), which models the control group’s outcomes based on their covariates, allowing us to estimate an adjustment on the treated unit’s counterfactual based on their baseline characteristics. The second method is the inverse probability weights (IPW) (Abadie, 2005), a matching method that reweights the control units to make their characteristics similar to those of the treatment group. The doubly robust (DR) (Sant’Anna & Zhao, 2020) approach combines both previous methods, providing increased robustness since the estimate is unbiased if either the propensity score model or the outcome regression model is correctly specified.

To strengthen the parallel trends assumption and minimize potential selection bias, we also considered municipalities that requested a territorial split but were unsuccessful as control units. This could either be due to their requests being rejected during the emancipation process or being suspended after the implementation of the Constitutional Amendment 15/1996. We refer to these jurisdictions as “almost treated” (Dahis & Szerman, 2024; Lima & Silveira Neto, 2018). These units are arguably more suitable as control groups since they “selected themselves” for a territorial division. Additional information about these units is discussed further in the next section.

5 Data

5.1 Split requests

Data on the establishment year of new municipalities was obtained from the Brazilian Institute of Geography and Statistics (IBGE). Between 1990 and 2013, the number

of municipalities in Brazil increased by 1,078, representing a 24% growth. No additional municipalities were established afterward.

This increase was unevenly distributed among the states (Table 1). There are notable differences as some states experienced significant relative increases in the number of municipalities despite belonging to the same region and having similar socioeconomic conditions. In the Northeast, the number of municipalities in Bahia increased by 0.5%, while in Piauí, it surged by 90%. This substantial growth in Piauí led to a significant reallocation of the FPM transfers among municipalities due to the larger relative increase in new jurisdictions. As a result, this may violate the stable unit treatment value assumption (SUTVA), because the municipalities used as control groups might experience reduced transfers due to the establishment of new municipalities within the same state.

Table 1: Successful and failed split requests by state

State	Municipalities			Split requests		Failures collected		
	1990	2013	$\Delta\%$	succeeded	failed	NHS	DS	LSN
Brazil (all states)	4,491	5,569	24%	1,079	605	19	11	10
North								
Acre	12	22	83%	10	—			
Amapá	9	16	78%	7	6	✓	✓	
Amazonas	62	62	0%	0	—			
Pará	105	144	37%	39	9	✓	✓	
Rondonia	23	52	126%	29	10	✓	✓	
Roraima	8	15	88%	7	0	✓		
Tocantins	79	139	76%	60	15	✓		
Northeast								
Alagoas	97	102	5%	5	—			
Bahia	415	417	0.5%	2	113	✓		✓
Ceará	178	184	3%	6	—			
Maranhão	136	217	60%	81	17	✓		
Paraíba	171	223	30%	52	—			✓
Pernambuco	168	185	10%	17	54	✓		✓
Piauí	118	224	90%	106	4	✓		
Rio Grande do Norte	152	167	10%	15	—			
Sergipe	74	75	1%	1	—			
Southeast								
Espírito Santo	67	78	16%	11	6	✓	✓	✓
Minas Gerais	723	853	18%	130	65	✓	✓	✓
Rio de Janeiro	70	92	31%	22	10	✓		✓
São Paulo	572	645	13%	73	53	✓	✓	✓
South								
Paraná	323	399	24%	76	29	✓	✓	✓
Rio Grande do Sul	333	497	49%	164	101	✓	✓	✓
Santa Catarina	217	295	36%	78	22	✓	✓	✓
Central-West								
Goiás	211	246	17%	35	34	✓	✓	
Mato Grosso	95	141	48%	46	53	✓	✓	
Mato Grosso do Sul	72	79	10%	7	4	✓		

Sources: IBGE, TREs, State Legislative Assemblies, and Tomio (2002). Notes: There was no territorial division after 2013. The last three columns indicate whether we (NHS), Dahis and Szerman (2024) (DS), and Lima and Silveira Neto (2018) (LSN) collected the failed split requests in the corresponding state.

Since the emancipation process was carried out solely by subnational governments, there is no single source that compiles all territorial reform attempts. Consequently, the list of

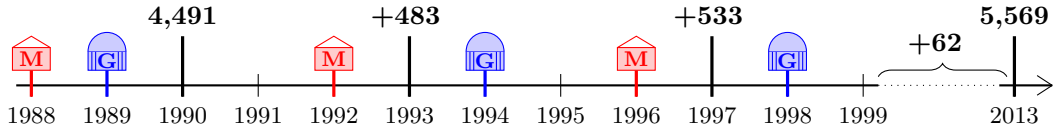
municipalities where an area attempted to achieve emancipation but was unsuccessful was gathered from the websites of state public entities or through direct requests. Unlike Dahis and Szerman (2024) and Lima and Silveira Neto (2018), we did not exclusively obtain this data from legislative assemblies. We also sourced it from regional electoral courts, as they play a role in the emancipation process by organizing plebiscites⁵. This essay examines nearly twice the number of states compared to similar studies (Table 1).

We identified 605 almost-split municipalities across 19 out of 26 states, which accounted for 86.8% of the Brazilian population in 2013. This data was collected from all the states in the South, Southeast, and Central West regions. However, there are gaps in the North and Northeast regions, where neither the legislative assemblies nor the regional electoral courts kept records of requests for territorial emancipation.

5.2 Elections and political parties

Elections in Brazil occur every two years, alternating between local and federal/state polls. Municipal elections are held every four years, beginning in 1988. General elections for federal and state governments take place every four years, starting in 1994, with the exception of the 1989 election (Figure 1). Until 1996, the country used paper ballots for voting, and local election information was not centralized in the Supreme Electoral Court (TSE). As a result, we collected new municipal data from 21 out of the 26 Regional Electoral Courts (TREs) for the 1988 and 1992 elections⁶. For the general elections and for municipal elections held after 1996, voting information was sourced from the TSE.

Figure 1: Elections and number of municipalities in Brazil (1990–2013)



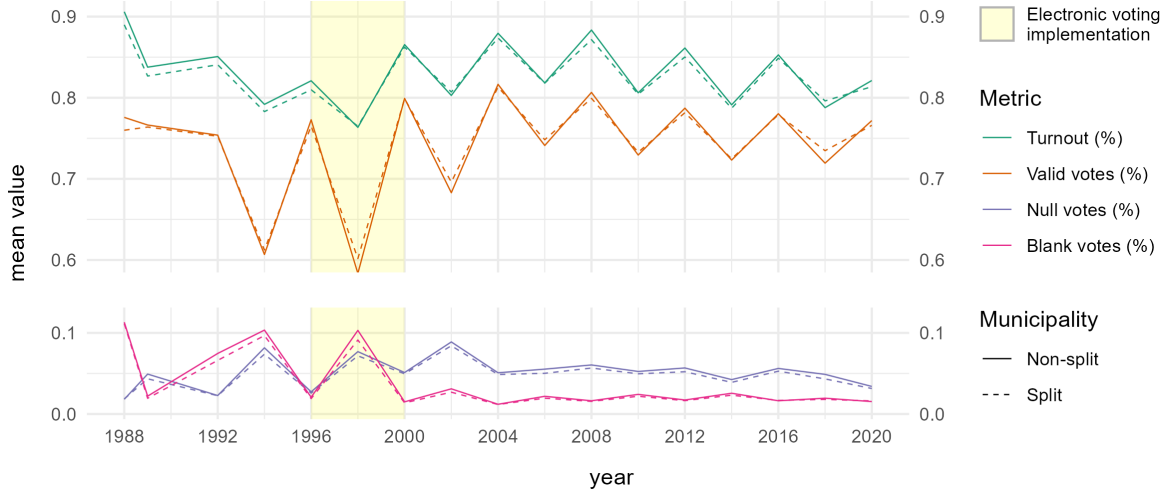
Notes: The colored markers denote election types: red for municipal elections (1992, 1996, 2000) and blue for general elections (1989, 1994, 1998), which occur every four years, except for 1989. Bolded numbers show the municipality count at milestones: 4,491 in 1990, with increases of +483, +533, and +62, reaching 5,569 by 2013.

Brazilian municipal elections have consistently shown higher voter turnout rates compared to federal and state elections (Figure 2), reflecting a greater interest in local politics among voters. Before 1996, the proportion of null (spoiled) and blank votes fluctuated considerably. The implementation of electronic voting machines from 1996 to 2000 resulted in lower and more stable invalid vote rates, likely due to enhanced ballot accuracy, which reduced the number of discarded votes (Fujiwara, 2015). Moreover, trends in areas affected by territorial changes were similar to those in municipalities that were not affected throughout the entire period.

⁵Refer to the Table A5 for details.

⁶Refer to Table A4 for further information on data collection.

Figure 2: Voting metrics in Brazil (1988–2020)



Notes: The y-axis is truncated to highlight differences between the split (dashed) and non-split (solid) lines. The x-axis labels show only municipal election years, omitting general election markers for clarity. Colors represent voting metrics: turnout, valid votes, null votes, and blank votes. The yellow shaded area indicates the rollout of electronic voting machines: 30% in 1996, 60% in 1998, and 100% in 2000.

To assess voter engagement in local politics, we used the *turnout rate* (calculated as the number of votes divided by the electorate), a commonly employed metric in this field. In Brazil, voting is mandatory for citizens over 17 years old, and failing to vote without justification can lead to a fine and certain restrictions. Therefore, we used the *valid vote rate*, which excludes null and blank votes⁷, often seen as protest votes, indecision, or input error. Additionally, the voter base may expand due to increased political engagement, which could negatively impact both turnout and valid vote rates. Therefore, we also examine the split effect on the *electorate*.

In our analysis, we considered the important roles of governors and state legislators in the process of territorial division by including two covariates: a dummy variable indicating whether the mayor is in the governor’s coalition and the coalition percentage in the legislative assembly. The power of the governor’s political coalition within the legislative assembly was relevant, as state deputies tended to support the creation of new municipalities and could override the governor’s veto against such divisions.

Alongside the political variables, we included a set of socioeconomic indicators widely used in the literature as controls: the log of total population size, population density (inhabitants per square kilometer), household income, the Gini coefficient (income inequality), the literacy rate among residents aged fifteen and over, the share of the working-age population (ages fifteen to sixty-four), and average age. These variables capture key dimensions of local development (economic welfare, inequality, and human capital) that may affect voter behavior. We obtained all socioeconomic data from the Brazilian Institute of Geography and Statistics (IBGE) and applied linear interpolation to the censuses data to estimate

⁷A blank vote occurs when a voter does not vote for any candidate. In the past, this was done by leaving the ballot unmarked. Voters now have the option to choose a ‘blank’ option in the electronic voting machine. On the other hand, a null vote happens when a voter enters a candidate number that does not exist.

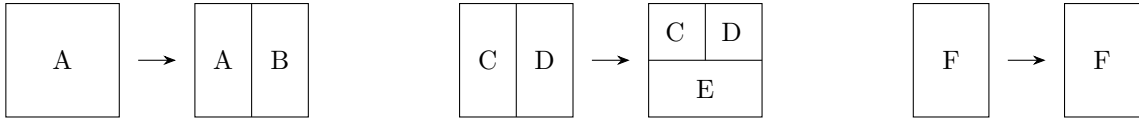
values for the intervening years.

Since municipal-level GDP data in Brazil was unavailable until 1997, we utilized satellite-captured nighttime lights as a proxy for economic activity levels (Henderson, Storeygard, & Weil, 2011)⁸. The 1992–2020 dataset from Li, Zhou, Zhao, and Zhao (2020) measures nighttime lights on a scale from 0 (no detectable light) to 100 (maximum intensity). It has a limitation due to the blooming effect, which causes spillovers from illuminated areas to adjacent non-illuminated ones (see Figure A2). Therefore, we considered only nighttime lights with values greater than 7 to reduce measurement errors (Coetzee & Kleynhans, 2021; Omar & Ismal, 2019).

5.3 Minimum comparable areas (MCA)

In our empirical analysis, we use the minimum comparable area (MCA) as the unit of observation to maintain spatial and temporal consistency despite changes in municipal boundaries. An MCA is the smallest contiguous territory whose border remains unchanged between years (see Figure 3). This approach aggregates all splits, mergers, and territorial transfers into stable analytical units. This ensures that any demographic and electoral changes accurately reflect real shifts in demographic indicators or voting behavior, rather than being the result of misleading data discontinuities caused by boundary changes (e.g., halving the population size after territorial division). To aggregate municipalities and their indicators, we utilized 1991-2010 MCA dataset from Ehrl (2017)⁹.

Figure 3: Examples of minimum comparable areas (MCAs)



Notes: When municipality A is divided to create municipality B, the MCA includes both A and B. Similarly, when municipalities C and D give up territory to form Municipality E, the MCA consists of C, D, and E. Finally, a municipality without any boundary changes, such as F, constitutes its own MCA.

Table 2 shows the composition of MCAs and their categorization based on treatment status. The "treated" group includes areas where pre-existing municipalities underwent a fragmentation process, resulting in the creation of new ones. The "almost treated" group consists of municipalities that formally requested a split but were ultimately denied. The "untreated" group refers to all jurisdictions that were not affected by the territorial reform.

In our sample of 3,557 MCAs, 2,523 (71%) did not attempt to split and remained as single-municipality units without any boundary change, while 413 (11.6%) requested a split but did not succeed (almost treated). The remaining 621 MCAs (17.4%) underwent fragmentation. Most commonly, 408 MCAs (65.7% of treated) produced one new municipality,

⁸The correlation between night light and GDP is stronger in urban areas (Chen & Nordhaus, 2019; Keola, Andersson, & Hall, 2015), it is weaker in rural areas (Gibson, Olivia, Boe-Gibson, & Li, 2019).

⁹The MCAs for municipalities established in 2013 were manually included by the authors.

while 151 (24.3% of treated) divided into three or four municipalities. Less frequently, 62 MCAs (10% of treated) experienced larger reorganizations involving five to twenty municipalities. Territorial reforms mostly established an additional municipality, yet one-third of them led to more complex fragmentations.

Table 2: MCAs by their territorial composition and treatment status

MCAs (obs.)	MCA composition			treatment status
	total munic.	new munic.	pre-existing	
2,523	1	0	1	untreated
413	1	0	1*	almost
408	2	1	1	treated
70	3	2	1	treated
28	3	1	2	treated
25	4	3	1	treated
23	4	2	2	treated
5	4	1	3	treated
62	5–20	1–13	1–8	treated

Notes: Column 1 reports the number of minimum comparable areas (MCAs) by composition type. Columns 2–4 indicate the total number of municipalities in each MCA, distinguishing between new and pre-existing ones. The final column categorizes MCAs by treatment status: untreated (no boundary change), almost treated (*attempted but failed division), and treated (affected by fragmentation). The last row combines MCAs with five to twenty municipalities, including varying quantities of new and pre-existing municipalities.

5.4 Descriptive Statistics

In Table 3, we present baseline descriptive statistics for electoral and socioeconomic variables across three groups of minimum comparable areas (MCAs). The differences between the treated groups and the other two groups are mostly statistically significant at conventional levels, particularly the socioeconomic variables. This was expected as the process of territorial reform was not implemented randomly but rather driven by the self-selection of emancipatory areas.

Before the split, the treated and almost treated groups exhibited similar statistics, although most of their differences remained statistically significant. The untreated municipalities showed more significant differences, with smaller electorate sizes and higher turnout rates in both local and general elections. Additionally, the proportion of the governor’s legislative coalition is lower in the treated group, which may suggest a less favorable political environment for vetoing territorial fragmentation laws in those states. Interestingly, stronger alignment of mayors with the governor’s political coalition does not seem to predict the success of the fragmentation request.

Treated areas had populations similar to almost treated areas. By the end of the fragmentation process, the average population and electorate sizes per municipality shrank to about one-third, resulting in smaller jurisdictions comparable to untreated municipalities. Fragmented areas had higher per capita incomes and inequality, improved literacy rates, and a slightly larger proportion of working-age residents. Night light intensity revealed no significant differences, indicating comparable economic activity among the groups.

Table 3: MCA baseline descriptive statistics

Variables	treated	almost	diff.	untreated	diff.
Municipal election (1988)					
Electorate size	25,539	38,657	13,118	13,733	-11,806***
Turnout (% electorate)	89.0	89.5	0.5	91.4	2.4***
Valid (% electorate)	76.3	75.9	-0.4	78.4	2.1***
Blank + Null (% electorate)	12.7	13.6	0.9***	13.0	0.3
General election (1989)					
Electorate size	27,759	41,703	13,944	14,879	-12,880***
Turnout (% electorate)	83.0	83.2	0.3	85.2	2.2***
Valid (% electorate)	77.0	75.4	-1.6**	78.4	1.4***
Blank + Null (% electorate)	6.0	7.8	1.8***	6.8	0.8***
Governor's legislative coalition (%)	45.2	49.8	4.6***	50.8	5.5***
Mayor in governor's coalition (%)	34.7	40.4	5.7*	39.5	4.8**
Socioeconomic variables (1991)					
Population	51,600	74,406	22,805	25,341	-26,259**
Rural households (%)	46.3	45.5	-0.9	43.6	-2.8***
Income [×]	738.2	684.3	-53.9***	724.7	-13.6
Gini Index (×100)	54.6	53.5	-1.1***	52.9	-1.7***
Literacy (%)	76.0	71.0	-5.0***	76.4	0.4
Working age population (%)	58.6	57.5	-1.0***	59.2	0.6***
Age	25.2	25.1	-0.1	26.0	0.8***
Nighttime luminosity [×] (×1000)	24.0	25.4	1.5	24.3	0.3
Municipalities per MCA	2.9	1		1	
Observations	621	413		2,523	

Notes: [×] per capita. The table presents average statistics for treated, almost treated, and untreated groups. In the “diff.” columns, we observe the differences between the treated group and the other groups, along with the significance levels of these differences: * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$. We used the 1988 electoral data because the 1992 elections elected officials for the newly formed municipalities.

These notable differences raise concerns about potential selection bias, as economic and demographic factors likely affected both the feasibility and desirability of fragmentation. To address this issue, our empirical strategy incorporates a comprehensive set of control variables to isolate the effects of fragmentation from any confounding socioeconomic factors. To strengthen the validity of the conditional parallel trends assumption, we also perform our analysis using the almost treated group as the control group. This is because their characteristics closely resemble those areas that successfully underwent territorial division, and also helps to account for unobservable factors that influenced the decision to pursue fragmentation.

6 Results

For our analysis, we applied Callaway and Sant’Anna’s (2021) difference-in-differences estimator with the IPW¹⁰ matching method (Abadie, 2005) to assess the impact of territorial splits on local voter engagement. We used two model specifications regarding the control groups. In Model I, we included all minimum comparable areas (MCAs) that did not undergo any administrative divisions between 1990 and 2020. Model II, our preferred

¹⁰Using the DR approach for estimation on our unbalanced panel resulted in numerical instability, leading to convergence failures. We implemented the IPW to account for the incomplete municipal election data, particularly from 1988 and 1992.

specification, focuses on MCAs that requested a territorial split but were unsuccessful. It includes only states from which we acquired this information, accounting for 82.8% of the total MCAs.¹¹

We estimated the effects on electoral outcomes separately for general and municipal elections, as these involve different political positions (governor/president and mayor, respectively) and have distinct historical levels of turnout, valid votes, blank votes, and null votes (see Figure 2). Elections for a new municipality are held three months before its official establishment. Therefore, for municipal elections, we set the voting baseline at four years before the first local election, while for general elections, it is set at two years before¹².

The results show an increase in voter turnout after the administrative division, suggesting that smaller municipalities with lower populations and electorates enhance electoral engagement. In both election types, the preferred specification (Model II) indicates statistically significant increases in voter turnout: 1.95 percentage points (pp) for municipal elections and 2.19 pp for general ones.

Table 4: Municipal split effects on electoral variables

Outcome variables	Municipal		General	
	(I)	(II)	(I)	(II)
Turnout (%)	1.14 (0.7)	1.95*** (0.6)	1.30 (0.8)	2.19** (0.7)
Valid votes (%)	1.41 (0.8)	1.86** (0.8)	1.33 (0.7)	2.62** (0.8)
Blank + Null votes (%)	-0.27 (0.5)	0.07 (0.5)	-0.03 (0.2)	-0.43 (0.3)
log(Electorate) ($\times 100$)	-3.11 (3.5)	1.06 (5.1)	-4.21 (3.6)	2.56 (5.0)
Specifications				
Only almost treated as controls	—	✓	—	✓
Observations	3,557	1,034	3,557	1,034

Notes: * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$. Bootstrapped standard errors in parentheses. Model I includes all minimum comparable areas (MCAs) that never underwent a split as controls; Model II (preferred) only uses MCAs that attempted but failed to split.

The impact on valid vote rates was similar, indicating that the rise in citizen engagement was primarily due to the votes cast for candidates, rather than blank or null votes, which had a non-significant effect.

The event study estimates for municipal and general turnouts indicate similar trends over time following the fragmentation (Figure A4). The impact peaks at 8-10 years post-division, then slightly decreases but remains significant at the 5% or 10% levels. Moreover, the estimates for all pre-split periods are consistently non-significant, which strengthens credibility on the conditional parallel trends assumption.

¹¹North region: Amapa, Para, Rondonia, Roraima, and Tocantins; Northeast region: Bahia, Maranhao, Pernambuco, and Piaui; Southeast region: Espirito Santo, Minas Gerais, Rio de Janeiro, and Sao Paulo; South region: Parana, Rio Grande do Sul, and Santa Catarina; Central-West region: Goias, Mato Grosso, and Mato Grosso do Sul. See Table A5 for further information.

¹²Except for 1989 general elections, which was held three years before the first municipal election.

For valid votes, we observe distinct patterns when compared to turnout. The effects on blank and null votes in general elections are negative, although significant only in the first general election, whereas they are non-significant and close to zero for all local elections. Increased voter turnout and fewer invalid votes clearly demonstrate the positive impact on valid votes, with significant effects maintained at least at the 10% level for up to 22 years after the fragmentation. Despite the positive effects on the valid votes in municipal elections (mostly non-significant), voter engagement in general elections showed even greater effects, as evidenced by a decrease in spoiled ballots.

Finally, there was no increase in the electorate. While voting is mandatory in Brazil, it is optional for individuals aged 16 and 17, as well as for those who are illiterate. The findings indicate that these groups did not become more engaged, as there was no significant positive impact on the number of eligible voters.

6.1 Heterogeneity by level of fragmentation

To assess the impact of fragmentation on electoral outcomes, we classified each MCA using the Herfindahl-Hirschman Index (HHI). This index effectively captures both the number of municipalities within an MCA and their relative “weight.” In our analysis, the HHI was calculated by summing the squares of the population shares, $\sum_i \text{pop}_i^2$, where pop_i represents the share of the population of municipality i relative to the MCA total population. This index is close to zero in areas with many municipalities and evenly distributed populations. Conversely, HHI is higher in areas with fewer municipalities, especially if one municipality holds a large portion of the population¹³.

The literature on territorial amalgamations classifies reforms into mergers and annexations based on population shares. While we could also assess fragmentation by looking at the population share, this approach may overlook the fundamental differences between MCAs. For example, two MCAs with 50% of their population from new municipalities can have different levels of fragmentation if one has a population concentrated in a single new municipality while the other is spread across ten smaller ones. The HHI addresses this issue by weighting each subunit based on its population share and penalizing uneven distributions.

In our sample, the fragmented MCAs show HHI values ranging from 0.086 (very highly fragmented) to 0.979 (near unity), with a median value of 0.568. We classify MCAs with an HHI of 0.568 or lower as “high fragmentation” and those with an HHI greater than 0.568 as “low fragmentation.” This cut-off divides the treated MCAs into two groups for comparison with the almost treated MCAs ($\text{HHI} = 1$).

Table 5 indicates that highly fragmented jurisdictions experience significant increases in voter turnout and valid vote rates – 3.36 pp and 3.11 pp in municipal elections, and

¹³For example, a MCA divided equally into two identical municipalities results in a Herfindahl-Hirschman Index (HHI) of $2 \times (0.5)^2 = 0.5$. In contrast, an MCA with one large municipality and one very small one could produce an HHI close to one.

Table 5: Municipal split effects on electoral variables by level of fragmentation

Outcome variables	Municipal		General	
	Low	High	Low	High
Turnout (%)	1.02 (0.6)	3.36*** (0.7)	1.56** (0.6)	3.42*** (0.8)
Valid votes (%)	1.11 (0.8)	3.11*** (1.0)	2.04*** (0.7)	3.98*** (0.9)
Blank + Null votes (%)	-0.01 (0.5)	0.22 (0.6)	-0.48 (0.3)	-0.57 (0.3)
log(Electorate) ($\times 100$)	1.87 (5.6)	4.94 (5.7)	2.80 (5.4)	4.88 (5.1)
Specifications				
AMCs with HHI > 0.568	✓	–	✓	–
AMCs with HHI \leq 0.568	–	✓	–	✓
Only almost treated as controls	✓	✓	✓	✓
Observations	724	723	724	723

Notes: * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$. Bootstrapped standard errors in parentheses. Both models use only MCAs that attempted but failed to split as controls.

3.42 pp and 3.98 pp in general elections, all of which are statistically significant at the 1% level. Low-fragmentation areas show a similar but reduced impact, approximately half that of highly fragmented areas during general elections. In municipal elections, their effect is about one-third as large and not statistically meaningful. Impact on shares of invalid votes and variation of the electorate are non-significant across low and high fragmented areas.

The event study estimates by fragmentation level (Figures A5 and A6) mirror the pattern of those obtained from Model II, but with stronger effects in areas of higher territorial fragmentation and weaker effects in areas of lower fragmentation.

These findings build on earlier results by showing that the creation of new municipalities extends its influence to national and state elections, with the strongest effects in highly fragmented AMCs.

6.2 Robustness check

For our robustness check, we assessed the stable unit treatment value assumption (SUTVA) and applied other recent difference-in-differences estimators for both binary and staggered treatment designs.

6.2.1 Stable Unit Treatment Value Assumption (SUTVA)

In our first robustness check, we limited our sample to states that had only a small increase in the number of new municipalities (up to 25%), since a fixed amount of FPM transfer is distributed within all municipalities of the same state. This approach was intended to consider only states whose controls were only marginally impacted by the decrease in FPM transfers.

The results from this analysis were presented as Model III, along with the findings from

our preferred Model II in Table 6. The effects observed in both models are similar. While we cannot completely rule out the possibility of violating the SUTVA, the impact on the control group seems to be minimal.

Table 6: Municipal split effects on electoral variables

Outcome variables	Municipal		General	
	(III)	(II)	(III)	(II)
Turnout (%)	2.68*** (0.5)	1.95*** (0.6)	1.62*** (0.6)	2.19** (0.7)
Valid votes (%)	2.68** (1.0)	1.86** (0.8)	2.38*** (0.7)	2.62** (0.8)
Blank + Null votes (%)	-0.01 (0.8)	0.07 (0.5)	-0.76** (0.3)	-0.43 (0.3)
log(Electorate) ($\times 100$)	1.83 (6.5)	1.06 (5.1)	1.12 (6.5)	2.56 (5.0)
Specifications				
Only almost treated as controls	✓	✓	✓	✓
Only low affected states	✓	—	✓	—
Observations	577	1,034	577	1,034

Notes: * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$. Bootstrapped standard errors in parentheses. Both models use only MCAs that attempted but failed to split as controls. Model III includes only those states that increased at most 25% of their municipalities to limit potential effects of FPM redistribution within the state.

6.2.2 Other staggered difference-in-differences estimators

The results using the estimators from Sun and Abraham (2021) and Borusyak et al. (2024) are presented along with the event study effects in Appendix A.3. For comparison, we also included the two-way fixed effect (TWFE) estimates, as these were used in previous studies. In general, the estimates from the methods are similar, demonstrating the robustness of the results. However, some confidence intervals differ significantly.

Both Borusyak et al. (2024) and Sun and Abraham (2021) rely on the parallel trends assumption and make linear adjustments for covariates. However, Borusyak et al. (2024) applies this assumption to all pre-treatment periods, which can enhance efficiency but may also lead to larger biases if the parallel trends assumption is only approximately valid (Roth et al., 2023).

In contrast, Callaway and Sant’Anna (2021) uses a weaker assumption of conditional parallel trends and considers more flexible adjustments for time-invariant covariates, including outcome regression, inverse probability weights, and doubly robust approaches. If the estimates from these three methods differ significantly, de Chaisemartin and D’Haultfœuille (2023) suggests that the parallel trends assumption used by Borusyak et al. (2024) and Sun and Abraham (2021) may be violated.

7 Discussion

The findings indicate that territorial fragmentation has a significant impact on voter turnout and the number of valid votes in both municipal and general elections, with a greater effect observed in more fragmented areas. We identify three potential mechanisms that may explain this effect, none of which are mutually exclusive.

First, since the weight of votes for federal and state positions in newly created municipalities remained unchanged, expressive motivations may be the primary drivers of increased electoral engagement. Higher fragmentation not only increases the probability of pivotal votes but can also enhance individuals' sense of civic duty, boost social pressure to participate in elections, and make citizens feel more empowered to cast their ballots (internal political efficacy). The creation of the new municipality likely influenced these expressive factors by engaging the local community. It encouraged citizens to participate in a plebiscite for territorial independence and urged politicians to enact the necessary legislation to establish the jurisdiction.

Second, since the territorial splitting always begins with the municipal election to elect the first mayor and councilors with a surge in the pivotal probability of votes. The initial mobilization may have positively influenced municipal participation. Consequently, the higher turnout in subsequent elections could be attributed to voting inertia resulting from this initial increase. Empirical studies showed that a 1 percentage point increase in turnout can lead to a 0.5 to 0.9 percentage point rise in the next election (Fujiwara et al., 2016; Gerber et al., 2003). However, the effects on electoral participation cannot be fully explained by the development of voting habits, as we would expect diminishing effects over time, given that turnout persistence is lower than one. However, event study estimates indicate that the effects actually grow over time (including in general elections), peaking 8 to 10 years after municipal division, followed by a slight decline.

Third, the fragmentation of territories may have alleviated the logistical and time burdens of voting by redrawing electoral districts and assigning voters to polling places closer to their homes. This reasoning is based on the assumption that a significant number of citizens voted in areas outside the boundaries of the newly formed jurisdictions and that polling stations were either opened or relocated. However, despite the potential for reduced voting burdens resulting from fragmentation, there is no evidence in the literature indicating that additional polling sites were established or that public transportation improved following territorial division in Brazil. Therefore, we cannot conclude that average travel distances or times actually decreased.

While all three mechanisms offer plausible pathways for explaining the rise in voter turnout following territorial fragmentation, the evidence most consistently supports expressive motivations as the primary driver. The creation of new municipalities appears to have fostered a renewed sense of civic engagement, elevating internal political efficacy and social pressure during a moment of institutional change. However, pivotal probability, habit for-

mation, and logistical improvements from electoral remapping cannot be overlooked. These factors may have played a complementary role, reinforcing the broader mobilization effect observed in newly formed jurisdictions.

8 Conclusion

This study offers an in-depth analysis of how territorial fragmentation affected voter engagement in Brazil. By examining data from 1988 to 2020, which includes 621 areas impacted by municipal splits across nineteen Brazilian states, we highlighted broader implications of decentralization on voter participation for constituents.

Using the difference-in-differences estimator from Callaway and Sant’Anna (2021) and considering areas that were unsuccessful in creating new municipalities as control units, we found a statistically significant impact on voter turnout: 1.95 percentage points (pp) for municipal elections and 2.19 pp for general elections, based on our preferred specification. Additionally, we found evidence suggesting that greater fragmentation further enhances the effect on electoral participation.

This study offers valuable insights into the impacts of territorial fragmentation; however, it has some limitations that policymakers should consider when interpreting the results. First, the number of registered voters may be overestimated because it includes individuals who have passed away or duplicates of individuals who have obtained a new electoral ID in another municipality. As a result, the actual voter base might be smaller, leading to an underestimation of the effect on turnout rate.

Second, the findings are specific to Brazil and may not be directly applicable to other countries with different electoral, economic, and social contexts. These limitations suggest that further research is also needed to address these gaps and explore the broader implications of decentralization in diverse settings.

Future research could explore how the creation of new municipalities has impacted Brazilian electoral mapping and voter access. Investigating whether the reallocation of polling stations or a better implementation of public transportation improved voting convenience could clarify the role of logistical mechanisms in fostering voter turnout.

Furthermore, analyzing electoral competitiveness using detailed municipal-level voting data can enhance our understanding of whether fragmentation led to increased electoral competition and, consequently, greater voter engagement. Unfortunately, accessing older local vote counts for candidates in Brazil can be challenging due to limited availability. Additionally, using voter-to-seat ratios to assess political efficacy may shed light on perceived responsiveness and its influence on political behavior.

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Appendices

Table A1: FPM Interior: Share of each state in the total distribution

State	Share of FPM Interior
North	
Acre	0.3%
Amapa	0.1%
Amazonas	1.3%
Para	3.3%
Rondonia	0.8%
Roraima	0.1%
Tocantins	1.3%
Northeast	
Alagoas	2.1%
Bahia	9.3%
Ceara	4.6%
Maranhao	4.0%
Paraiba	3.2%
Pernambuco	4.8%
Piaui	2.4%
Rio Grande do Norte	2.4%
Sergipe	1.3%
Southeast	
Espirito Santo	1.8%
Minas Gerais	14.2%
Rio de Janeiro	2.7%
Sao Paulo	14.3%
South	
Parana	7.3%
Rio Grande do Sul	7.3%
Santa Catarina	4.2%
Central-West	
Goiias	3.7%
Mato Grosso	1.9%
Mato Grosso do Sul	1.5%

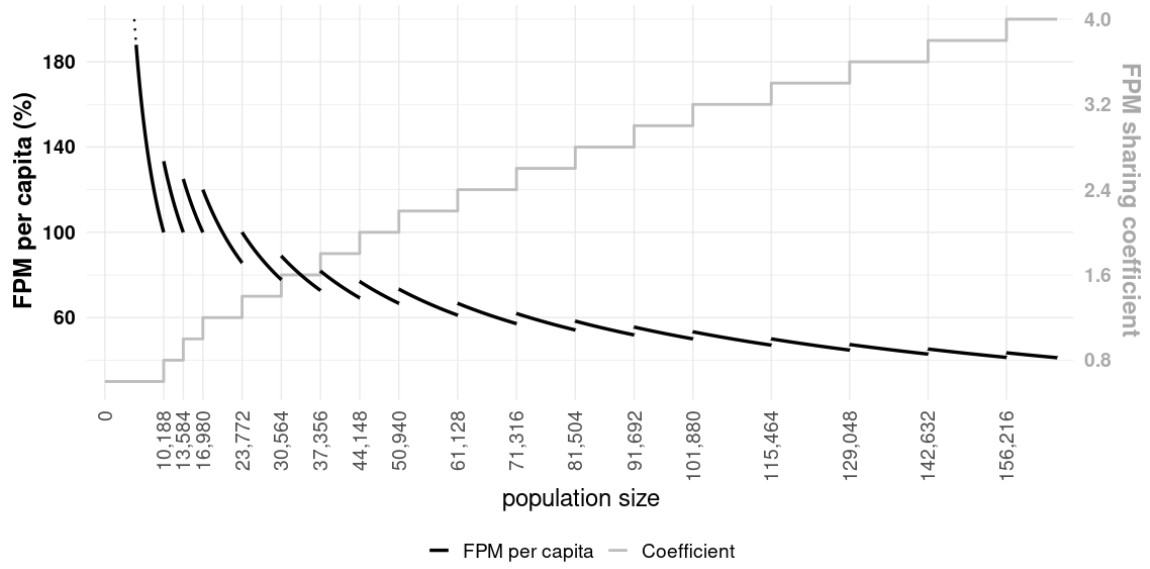
Source: Complementary Law 62/1989 and TCU Resolution 242/1990. Notes: These percentages represent fixed shares of the FPM Interior allocated to the states before distribution among municipalities within each state. These values have remained unchanged since their establishment.

Table A2: FPM Interior: Municipal coefficients by population size

Population size	Coefficient	Population size	Coefficient
up to 10,188	0.6	50,941 – 61,128	2.2
10,189 – 13,584	0.8	61,129 – 71,316	2.4
13,585 – 16,980	1.0	71,317 – 81,504	2.6
16,981 – 23,772	1.2	81,505 – 91,692	2.8
23,773 – 30,564	1.4	91,693 – 101,880	3.0
30,565 – 37,356	1.6	101,881 – 115,464	3.2
37,357 – 44,148	1.8	115,465 – 129,048	3.4
44,149 – 50,940	2.0	129,049 – 142,632	3.6

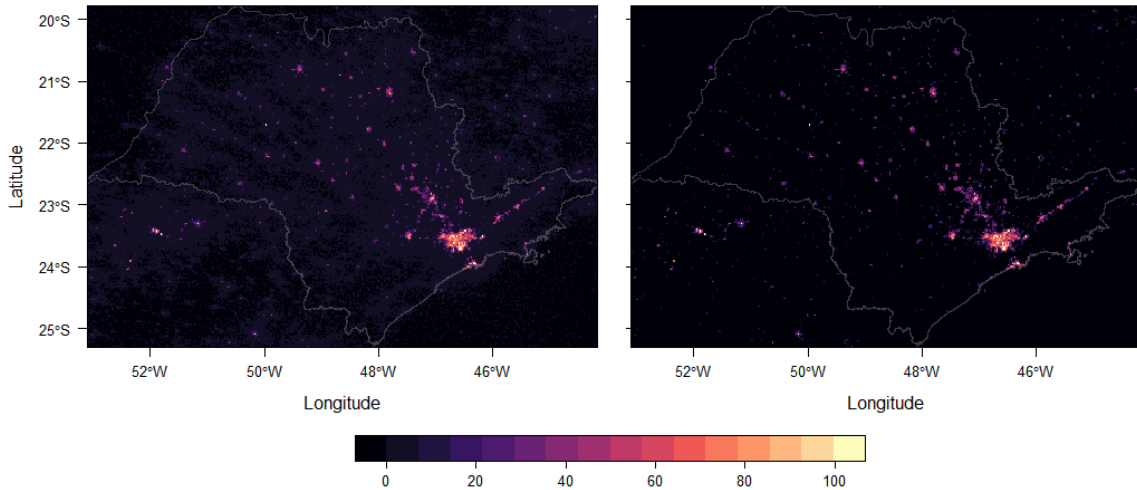
Source: Decree-Law 1881/1981.

Figure A1: FPM Interior per capita and sharing coefficients by population size



Sources: Boueri et al. (2013) and Decree-Law 1,881/1981. Notes: The black lines represent the per capita transfers from the FPM received by municipalities based on their population size. The per capita value for a municipality with 10,188 residents is established at 100%. The gray line indicates the sharing coefficient used for distributing FPM resources among the municipalities within a state. To illustrate the rapid increase in the number of municipalities, consider the following scenario: if a municipality of 10,000 residents with the lowest FPM coefficient of 0.6 splits into two jurisdictions of 5,000 residents each, the new combined coefficient for the area becomes 1.2. This change nearly doubles the amount of transfers received. While this adjustment enhances the per capita FPM transfers for the affected area, it slightly reduces the resources available to other municipalities within the same state (zero-sum game).

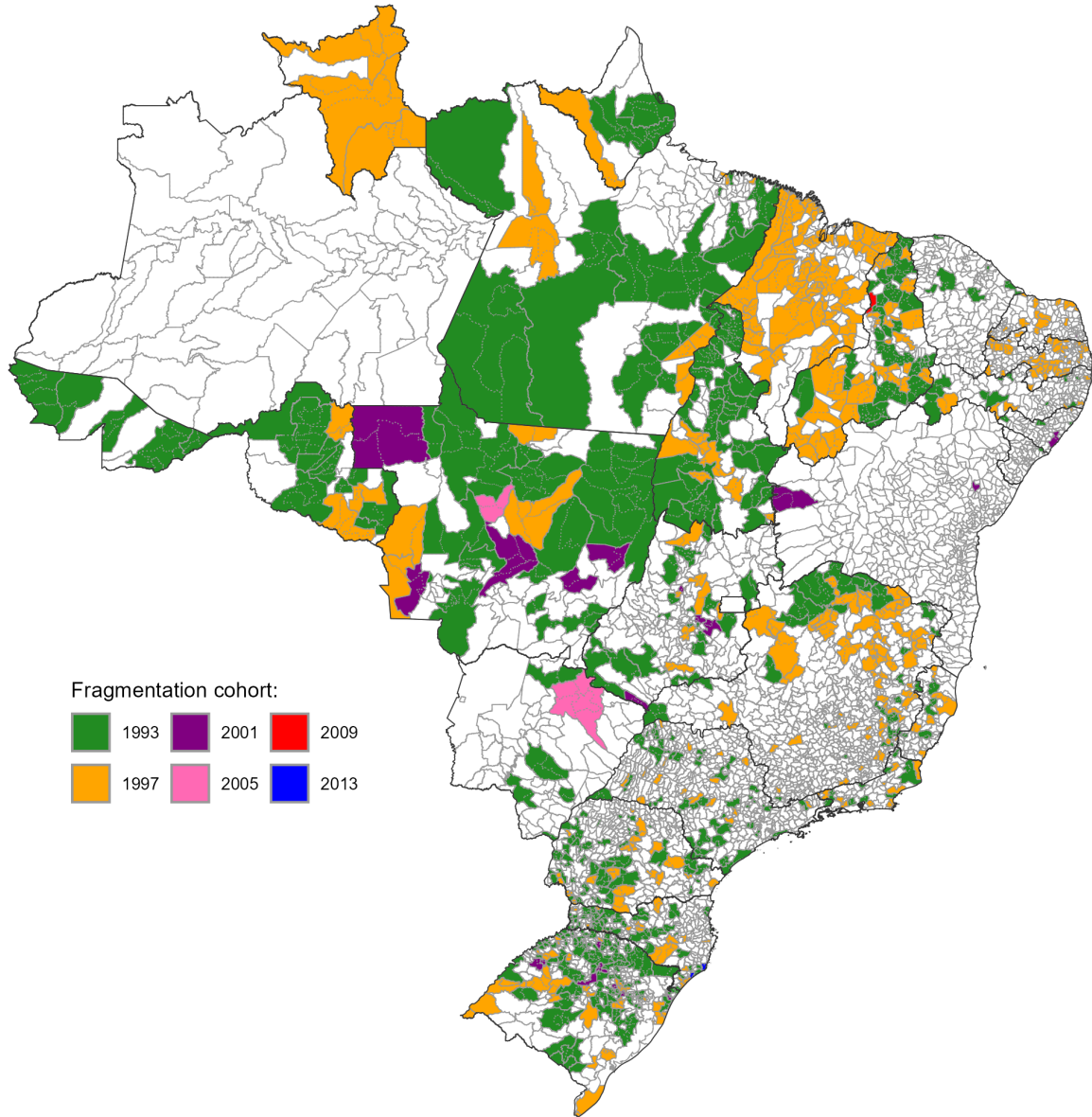
Figure A2: Comparison between the original nighttime lights and considering only DN > 7



Note: To the left, we have plotted the original night lights over Sao Paulo, which range from 0 (black) to 100 (light yellow). A blurring effect is noticeable in areas of high light intensity (purple), including beyond the southeastern boundary, which is adjacent to the Atlantic Ocean. On the right, we have plotted only the night lights with a digital number (DN) greater than 7.

A.1 Splitting in Brazil

Figure A3: MCAs affected by territorial fragmentation by year



Notes: MCA = Minimum Comparable Area: the smallest geographic unit maintaining consistent boundaries over two periods, encompassing all municipalities before and after any split. Only the first fragmentation event within each MCA is explicitly identified in the map.

Table A3: Minimum necessary criteria for territorial emancipation by state

State	Population/ Electorate*	District age	Share of revenue	Distance from seat	Urban buildings
Brazil (before 1988)	10,000 or 0.5% of state	–	5/1,000	–	200
North					
Acre	1,500	–	2/1,000	–	50
Amapa	948	–	–	–	–
Amazonas	965	–	–	–	–
Para	5,000	–	–	–	200
Rondonia	6,155	–	–	–	150
Roraima	2,471	–	–	–	100
Tocantins	1,200	–	0.3/1,000	–	50
Northeast					
Alagoas	5,500	–	1/1,000	–	–
Bahia	8,000	–	–	–	–
Ceara	10,213	5 years	10/1,000	–	400
Maranhao	1,000*	–	–	–	200
Paraiba	2,000	–	–	–	120
Pernambuco	10,000	–	–	–	300
Piaui	4,000	–	–	–	100
Rio Grande do Norte	2,558	–	–	–	–
Sergipe	6,000	–	3/1,000	–	300
Southeast					
Espirito Santo	8,600	–	2.5/1,000	–	200
Minas Gerais	2,000*	–	1.5/1,000	–	400
Rio de Janeiro	6,393	–	5/1,000	–	400
Sao Paulo	1,000*	2 years	–	3 km	–
South					
Parana	5,000	–	–	–	100
Rio Grande do Sul	1,800*	–	–	–	150
Santa Catarina	5,000	5 years	–	5 km	200
Central-West					
Goiias	2,000	–	0.7/1,000	6 km	133
Mato Grosso	4,000	–	–	–	200
Mato Grosso do Sul	5,781	–	3/1,000	–	–

Sources: Tomio (2002), Complementary Law 1/1967, and states' complementary laws. Notes: Until 1988, the minimum population size required for a new municipality was either 10,000 residents or 0.5% of its state population, whichever was lower. In some states, the number of eligible voters was used instead of the total population as the primary criterion for dividing municipalities. These cases are marked with an asterisk (*). The horizontal lines (–) indicate that the corresponding criterion was not applied in the state.

A.2 Detailed description of data sources

Table A4: Availability of the electorate and turnout data for 1988 and 1992 municipal elections

State	1988	1992	Sources
Brazil (all states)	19	21	
North			
Acre			
Amapa	×	×	Provided by TRE-AP upon request.
Amazonas	×	×	Provided by TRE-AM upon request.
Para	×	×	Provided by TRE-PA upon request.
Rondonia	•	•	Provided by TRE-RO upon request.
Roraima			
Tocantins			
Northeast			
Alagoas	•		Found at TRE-AL website (tre-al.jus.br).
Bahia		×	Provided by TRE-BA upon request.
Ceara	×	×	Provided by TRE-CE upon request.
Maranhao	×	×	Found at TRE-MA website (tre-ma.jus.br).
Paraiba	×	×	Found at TRE-PB website (tre-pb.jus.br).
Pernambuco	×	×	Provided by TRE-PE upon request.
Piaui	×	×	Provided by TRE-PI upon request.
Rio Grande do Norte	×	×	Provided by TRE-RN upon request.
Sergipe			
Southeast			
Espirito Santo	×	×	Found at 15th Electoral Museums Spring (tre-rn.jus.br).
Minas Gerais	×	×	Provided by TRE-MG upon request.
Rio de Janeiro		×	Found at TRE-RJ website (tre-rj.jus.br).
São Paulo	×	×	Found at SEADE website (produtos.seade.gov.br).
South			
Paraná	×	×	Provided by TRE-PR upon request.
Rio Grande do Sul	×	×	Provided by TRE-RS upon request.
Santa Catarina	×	×	Found at TRE-RS website (tre-sc.jus.br).
Central-West			
Goiás		×	Found at TRE-GO website (apps.tre-go.jus.br).
Mato Grosso	×	×	Found at 15th Electoral Museums Spring (tre-rn.jus.br).
Mato Grosso do Sul	×	×	Found at TRE-MS website (tre-ms.jus.br).

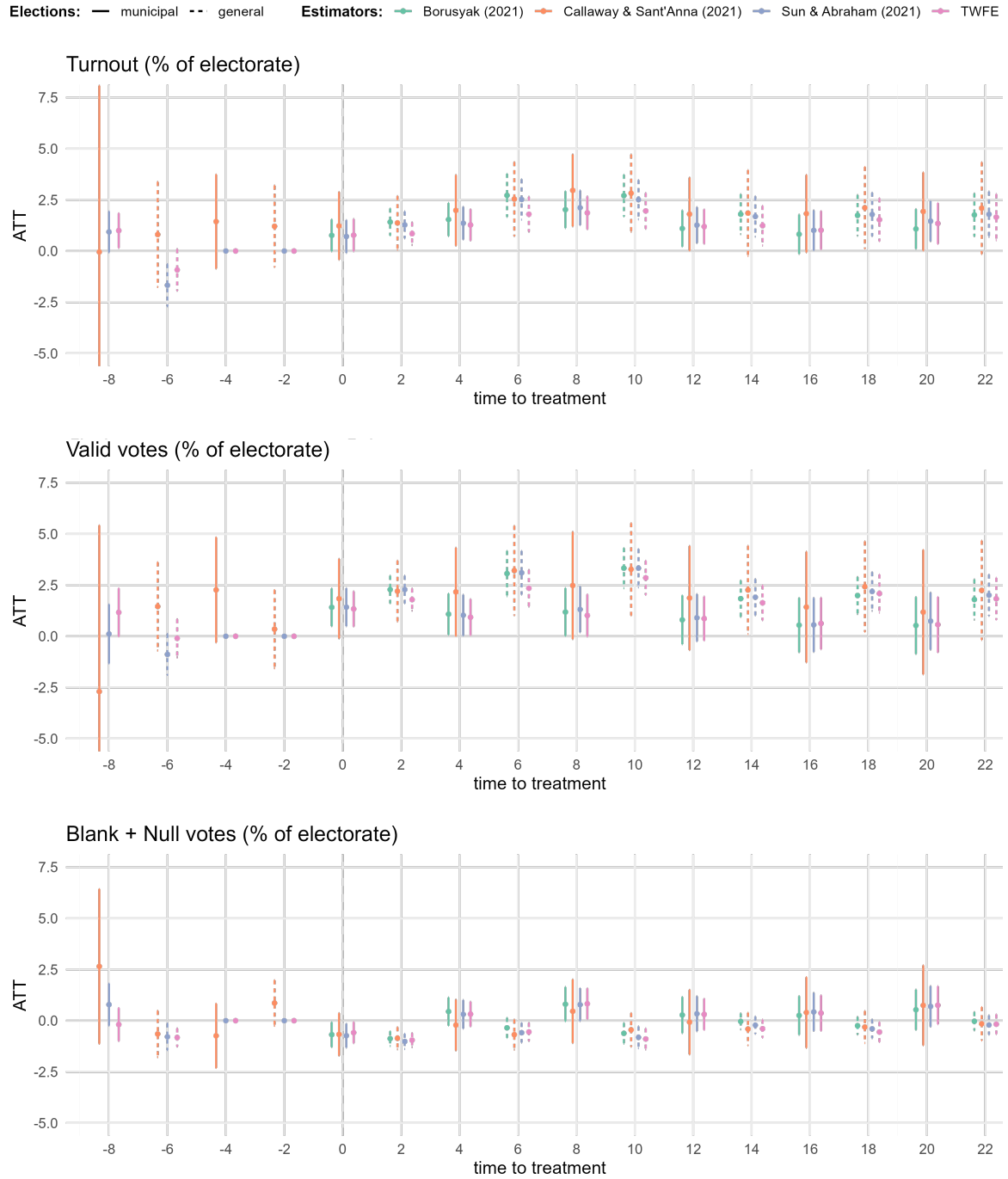
Notes: × both electorate and turnout data available. • missing only the electorate data. In this case, we assumed that the number of total voters in 1988 (1992) was 5% (2%) lower than in the 1989 (1994) general election, respectively. This assumption was based on the average increase in the electorate for municipalities with complete data between the years 1988/1989 and 1992/1994.

Table A5: Availability of failed split requests data

State	Sources
North	
Amapa	Decrees of the Legislative Assembly of Amapa (ALEAP) found at Leis Municipais website (leismunicipais.com.br).
Para	Plebiscite results found at Regional Electoral Court of Para's (TRE-PA) archives (atom.tre-pa.jus.br).
Rondonia	List of districts/areas that tried to emancipate received from the Regional Electoral Court of Rondonia (TRE-RO) upon request.
Roraima	List of districts/areas that tried to emancipate received from the Regional Electoral Court of Roraima (TRE-RR) upon request.
Tocantins	List of districts/areas that tried to emancipate received from the Legislative Assembly of Tocantins (ALETO) upon request.
Northeast	
Bahia	List of plebiscites suspended by the Regional Electoral Court of Bahia (TRE-BA), provided by Tomio (2002).
Maranhao	List of districts/areas that tried to emancipate received from the Regional Electoral Court of Maranhao (TRE-MA) upon request.
Pernambuco	List of emancipation requests in the Legislative Assembly of Pernambuco (ALEPE), provided by Tomio (2002).
Piaui	List of districts/areas that tried to emancipate received from the Regional Electoral Court of Piaui (TRE-PI) upon request.
Southeast	
Espírito Santo	Bills authorizing plebiscites found at Legislative Assembly of Espirito Santo (ALES) website (al.es.gov.br).
Minas Gerais	Requests for emancipation found at Legislative Assembly of Minas Gerais (ALMG) website (almg.gov.br).
Rio de Janeiro	List of plebiscites found at Regional Electoral Court of Rio de Janeiro (TRE-RJ) website (tre-rj.jus.br).
São Paulo	Resolutions authorizing plebiscites found at Legislative Assembly of São Paulo website (al.sp.gov.br).
South	
Paraná	Resolutions authorizing emancipation plebiscites at Legislative Assembly of Parana (ALEP) website (assembleia.pr.leg.br).
Rio Grande do Sul	List of rejected emancipation requests in the Legislative Assembly of Rio Grande do Sul (ALRS), provided by Tomio (2002).
Santa Catarina	List of rejected emancipation requests in the Legislative Assembly Santa Catarina (ALESC), provided by Tomio (2002).
Central-West	
Goiás	Plebiscite resolutions found at Regional Electoral Court of Goiás (TRE-GO) archives (acervo.tre-go.jus.br) and list of districts/areas that tried to emancipate received from the Legislative Assembly of Goiás (ALEGO) upon request.
Mato Grosso	List of districts/areas that tried to emancipate received from the Legislative Assembly of Mato Grosso (ALMT) upon request.
Mato Grosso do Sul	Plebiscite resolutions found at Regional Electoral Court of Mato Grosso do Sul's (TRE-MS) archives (atom.tre-ms.jus.br) and list of districts/areas that tried to emancipate received from the Legislative Assembly of Mato Grosso do Sul (ALEMS) upon request.

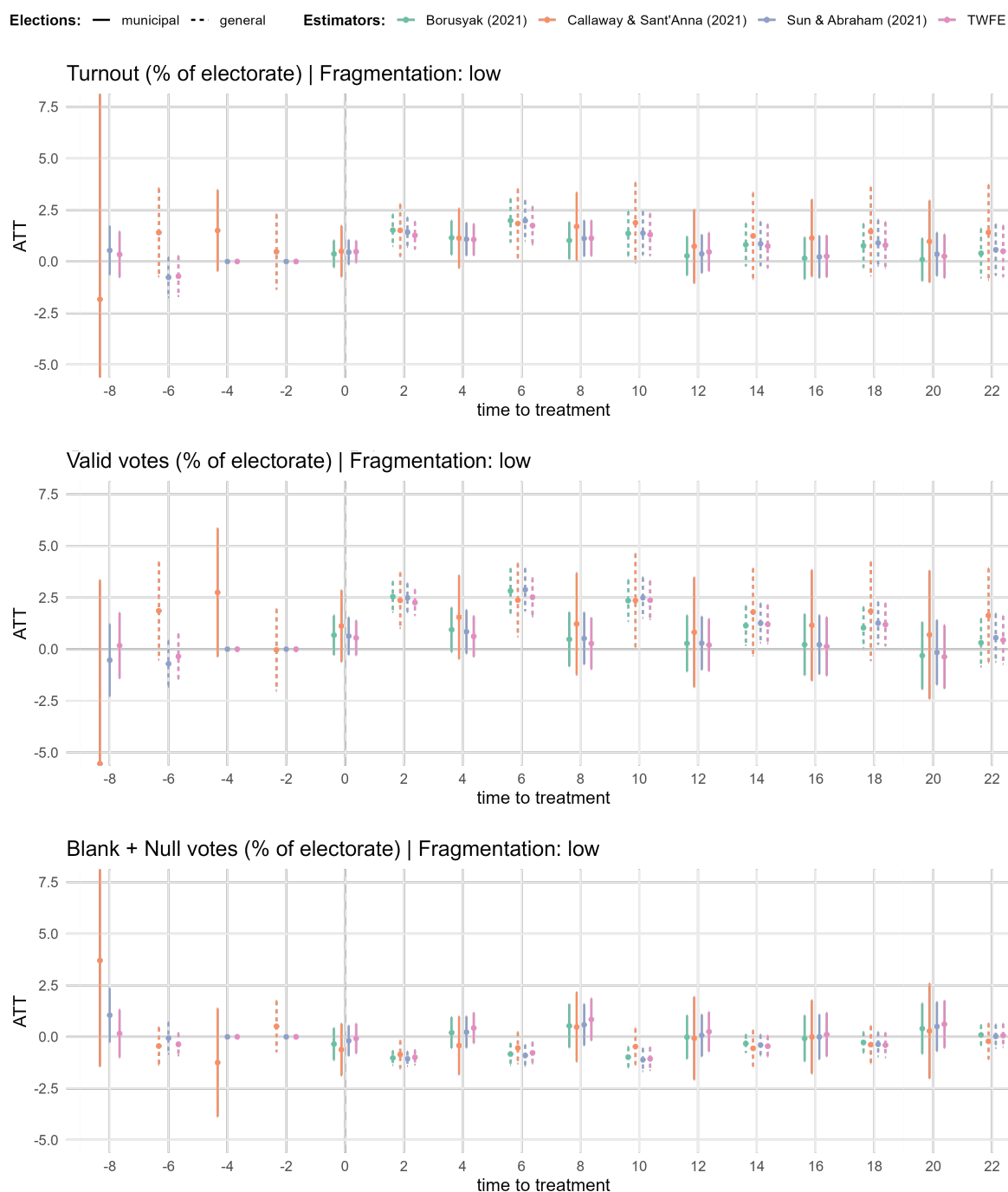
A.3 Event study estimates

Figure A4: Fragmentation effect on electoral outcomes (Model II)



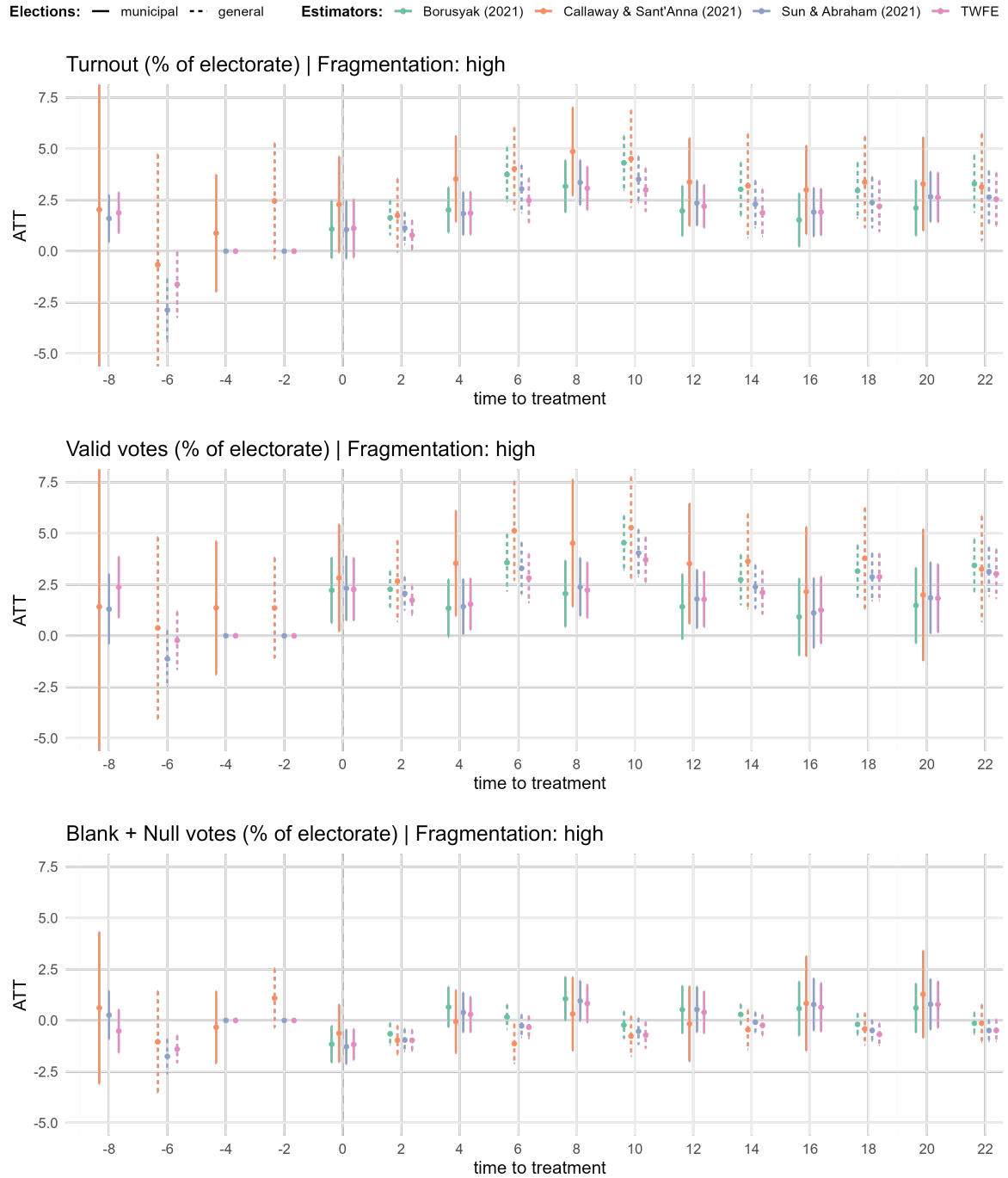
Notes: The figure presents event-study estimates of the impact of municipal splits on electoral outcomes, using the preferred difference-in-differences specification using only almost treated as controls (Model II). The estimates are plotted with 95% confidence intervals. Vertical dashed lines indicate the municipal elections, while solid lines represent the general elections. Estimations for municipal and general elections were conducted separately, and the results were plotted together.

Figure A5: Fragmentation effect on electoral outcomes (low fragmentation)



Notes: The figure presents event-study estimates of the impact of municipal splits on electoral outcomes, using the preferred difference-in-differences specification using only almost treated as controls (Model II) with low level of fragmentation ($HHI > 0.568$). The estimates are plotted with 95% confidence intervals. Vertical dashed lines indicate the municipal elections, while solid lines represent the general elections. Estimations for municipal and general elections were conducted separately, and the results were plotted together.

Figure A6: Fragmentation effect on electoral outcomes (high fragmentation)



Notes: The figure presents event-study estimates of the impact of municipal splits on electoral outcomes, using the preferred difference-in-differences specification using only almost treated as controls (Model II) with high level of fragmentation ($HHI \leq 0.568$). The estimates are plotted with 95% confidence intervals. Vertical dashed lines indicate the municipal elections, while solid lines represent the general elections.