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Free public transit and voter turnout

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A R T I C L E I N F O

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A B S T R A C T

Transportation costs are an under-studied barrier to political participation. In many elections worldwide, subsidies to voter transportation are already provided or are under discussion. However, these types of incentives have not been rigorously evaluated. Here we examine possibly the world's largest-ever intervention to lower these costs, the adoption of a fare-free public transit policy in Brazil during the 2022 national election, when about half of Brazilian voters were granted the right to use public transit for free on election days. However, while some cities adopted the benefit for both rounds of the election, others adopted it only for the second round. Using an event study design, we exploit this difference in adoption timing to examine the policy's causal impact on voter turnout rates and human mobility levels. We find that fare-free transit increased ridership between 7.2% and 17.5% on election days, however, we estimate a precise and robust null effect of the policy on voter turnout (Coef. −0.03p.p. with standard error of 0.22p.p.). Our results illustrate that monetary transport costs may not always be a critical factor behind non-participation. Although reducing transportation costs improves access to polling places, we show that even a full transit subsidy may not be sufficient to increase voter turnout.

1. Introduction

The cost of voting is a critical component in voters' decision to turn out on election day (Downs 1957; Verba et al. 1995; Blais et al., 2019). Given the expectation that the individual benefits from participation tend to be small, even moderately high costs may be enough to discourage political participation (Niemi, 1976; Dhillon and Peralta 2002). Existing works have studied the indirect (e.g., information, McMurray, 2015; Braconnier et al. 2017) and non-monetary, direct costs (e.g., distance, Brady and Mcnulty 2011; Fauvelle-Aymar and Abel, 2018; Cantoni 2020; Joslyn et al., 2020) of electoral participation on voter turnout. Transportation costs can act as an important barrier for individuals to access opportunities and participate in out-of-home activities (Cass et al., 2005; Preston and Rajé, 2007; Lucas, 2012). However, there is little evidence of the extent to which the reduction in transport monetary costs to access polling stations could influence electoral participation. Aware that transportation costs may have a negative impact on political participation, local governments in countries such as the United States, Israel and Hong Kong have previously adopted fare-free policies on election day, lowering the costs for voters who take public transit to go to polling places. According to the United States Federal Transit Administration [1], at least 10 major transit systems in the US did so in the 2020 general elections, but the impacts of this policy have not been evaluated.

In this paper, we provide the first evaluation of a large-scale intervention that lowered the monetary, direct cost of political participation through complete subsidization of transit fares during election days. Exploiting the heterogeneous adoption of a fare-free transit policy on election day across hundreds of major Brazilian municipalities between the 1st and 2nd rounds of the country's 2022 presidential elections, we evaluate the impact of zeroing out transit monetary costs on voter turnout rates, election outcomes, and human mobility levels on election days.

The Brazilian experience in the 2022 national election presents an

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[1] « https://www.transit.dot.gov/funding/grants/transit-programs-increase-access-voting ». Accessed in March 2023.

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interesting opportunity for evaluating the effects of zeroing out transit monetary costs during election days. First, a large portion of the Brazilian population uses public transit to travel within urban areas, especially in larger cities (Vasconcellos, 2018). Furthermore, transit ridership is usually higher on election days[2] if compared to regular Sundays,[3] indicating that public transit is a relevant mode for voters in Brazil. Second, the monetary cost of transit fares represents a non-negligible share of lower-income households (Pereira et al., 2021), precisely the group with lower turnout rates in the country (Power, 2009; Limongi et al., 2019). Consequently, zeroing out transit fares on election days could, in theory, incentivize this group to vote, promoting more significant voter participation and representation of lower-income populations in the political process. Finally, despite having a mandatory voting rule, election turnout rates in Brazil are within typical levels when compared to other democracies worldwide (Lührmann et al., 2018) largely in part because the penalties for non-participation and enforcement are relatively low.

In 2022, civil-society organizations in Brazil organized a social movement called "*passe-livre pela democracia*" (free fare for democracy) aimed at promoting fare-free transit on election days during the 2022 Brazilian national election.[4] Following pressure from this social movement, and a few weeks before the 1st round of the 2022 elections (October 2nd), 82 municipalities, encompassing 28.8 million (18.5%) voters, passed local legislation adopting fare-free public transit on election days. After this initial experience, 297 additional municipalities adopted fare-free transit for the 2nd round of the election (October 30th). Combined with the early policy adopters, a total of 75.8 million Brazilian voters (48.7%) had access to fare-free transit during the 2nd round of the election in 2022.

This time-heterogeneous adoption of the policy represents a quasi-experiment of lowering transportation costs during election days in a country where a large portion of the population relies on public transit. Moreover, the policy impacts can be estimated with high precision due to the large size of the impacted population and the high quality and granularity of Brazilian electoral data. We take advantage of this setting by employing a set of event study designs to estimate the causal impact of fare-free on voter turnout and on urban mobility.

However, contrary to the expectation of fare-free promoters, our results indicate that while the policy led to increased mobility on transit systems, it had a precisely estimated null effect on voter turnout.

2. Research design[5]

In our preferred specification, we take advantage of the time heterogeneity of fare-free policy adoption between major Brazilian municipalities to estimate policy impacts using a set of event study designs comparing outcomes in municipalities that adopted the policy in both rounds of the 2022 election (control group) with municipalities that only implemented the policy during the 2nd round (treatment group).

First, we analyze the effect of fare-free transit on voter turnout according to Equation (1):

$$y_{pmy} = \pi_p + \alpha_y + D_m * \beta_y + \epsilon_{pmy} \quad (1)$$

Where observations are at the level of polling stations, and y_{pmy} is voter turnout difference between 2nd and 1st round in polling station p from municipality m in year y. D_m is the treatment indicator for municipalities that only adopted fare-free transit during the 2nd round. Polling-station and year fixed-effects are represented by π_p and α_y. Finally, β_y are the coefficients of interest, indicating changes in turnout differences between the treatment and control group in each year y. If the fare-free policy were to positively impact turnout, we should expect a positive and significant estimate for β_{2022} as the turnout difference between rounds where fare-free was adopted only in the 2nd round should be higher than the turnout difference in cities where fare-free was provided on both rounds. The β coefficients for all other elections years should always be null as no fare-free policy was ever adopted in previous years. Hence, the estimates for β for all years other than 2022 serve as placebo tests for our design. Meanwhile, the election of 2018 was set as the reference period, and standard errors were clustered by municipality. We used the same identification strategy to examine the impact of fare-free transit on election outcomes.

In our preferred specification, we use "always-treated" municipalities as the control group. One advantage of this design is that, by restricting the sample to eventually treated municipalities, parallel trends assumption is more plausible as we only compare municipalities that for ideological or socio-economic reasons could adopt the fare subsidy and eventually adopted it. This alleviates many of the concerns over omitted variable bias in this type of research design.

However, because our sample does not include never-treated observations, besides the usual difference-in-differences assumption of parallel trends, an additional assumption for identifying the causal effect of fare-free transit on turnout is the stability of treatment effect over time, that is, the early treated group would not experience an additional effect in the second round of the election. If this additional assumption of stability were not valid, and the policy effect was larger in the second round for early treated municipalities, we would be underestimating the policy effects. This additional assumption of stability would not be necessary if we were able to include never-treated municipalities in the analysis, i.e., cities that did not adopt free-fare in either rounds of the election. However, never-treated municipalities are substantially different in observable characteristics (see Fig. S1 in the Online Appendix) when compared to both the early- and the late-treated groups. Moreover, we have found evidence that including these municipalities in the analysis would violate parallel trends in previous elections (see Fig. S2 in the Online Appendix). Therefore, for our preferred specification, we opted to exclude never-treated municipalities and to assume the stability of treatment in multiple rounds. Nevertheless, we also tested alternative specifications that allow us to relax the assumption of treatment effect stability, first by including never-treated municipalities (in which case parallel trends are less likely to hold) and second, by only looking at results in the first round of the election (thus reducing the precision of estimates). For both cases, our conclusions remained unchanged.

Our baseline model estimates the policy average treatment effect across all polling stations, however it is reasonable to imagine that the treatment effect may be heterogeneous, for example, being higher in lower-income areas where a larger portion of the population relies on public transit and for whom the monetary cost of the transit fare is more relevant. Moreover, the treatment effect may also be higher in lower density areas, where polling stations may be less easily reached by walking. Finally, one could also expect larger effects in polling places with historically lower turnout rates, as they include a larger share of individuals whose behavior could be more likely altered by the policy. We analyze the heterogeneity of policy impacts by restricting the sample used in the estimation to specific subgroups of polling stations. Specifically, we divided the polling stations in each municipality in deciles according to the educational attainment of the electorate, urban density around each polling station and historical turnout rates. Then, we estimate the policy treatment effect separately for each decile. We considered historical turnout rates in the 2018 elections, which was the

[2] This pattern is observed both on ridership data from multiple Brazilian transit agencies and on data from Google Mobility reports, which is described in further details in the data section and in the online appendix.

[3] Elections in Brazil are conducted on a Sunday, as in most democracies throughout the world.

[4] Additional information about this social movement can be found at: https://www.passelivrepelademocracia.org/.

[5] All code and data to replicate the paper have been deposited in GitHub at https://github.com/renatosv1988/eleicao/.

reference period considered in our event study analyses.

We also conducted several robustness checks for these analyses considering weighted observations using Inverse Probability Weighting (IPW) and using a two-period Differences-in-Differences. We also tried an alternative identification strategy looking only at the 1st round of each election. In this strategy, the treatment group were the polling stations in the municipalities that adopted the policy in the 1st round, and the control group was made of those municipalities that only adopted the policy in the 2nd (not yet treated).

We also investigated whether the adoption of the fare-free transit policy affected mobility levels using mobile cell-phone data. The estimation used to estimate the policy impacts on mobility is described by Equation (2):

$$y_{md} = \mu_m + \delta_d + D_m * \gamma_d + \varepsilon_{md} \quad (2)$$

Where observations are at the level of municipalities, y_{md} is the average daily mobility level of municipality m during Sunday d, D_m is a dummy for municipalities with fare-free in the first round (treatment group). The control group are the cities that only adopted the policy in the 2nd round. Municipality and date fixed effects are represented by μ_m and δ_d. Finally, γ_d are the main coefficients of interest, indicating relative average changes in mobility levels between treatment and control municipalities in each Sunday d. If the fare-free policy positively impacts mobility on election days, we should observe a positive and significant γ_d when d is an election Sunday. The Sunday immediately before the 1st round is set as the reference period, and standard errors are once again clustered by municipality.

3. Data

We used publicly available administrative records data from Brazilian Electoral Court (TSE), accessed on November 15, 2022, to calculate voter turnout rates. The data covers the universe of all (470,467) polling stations in the 1st and 2nd rounds of all Brazilian Presidential elections since 2010 (2010, 2014, 2018 and 2022). These data include aggregated information about the educational attainment of voters assigned to each polling station. We used the proportion of voters with only primary education or less (up to 9 years of schooling) as a proxy for the socio-economic level of the voters in each polling station. To understand the geographical context of each polling station, we geolocated the address of polling stations to get precinct-level spatial coordinates using a multiple step process (see Online Appendix).

Data on the implementation of fare-free public transit on election days were collected by the Brazilian Institute of Consumer Protection

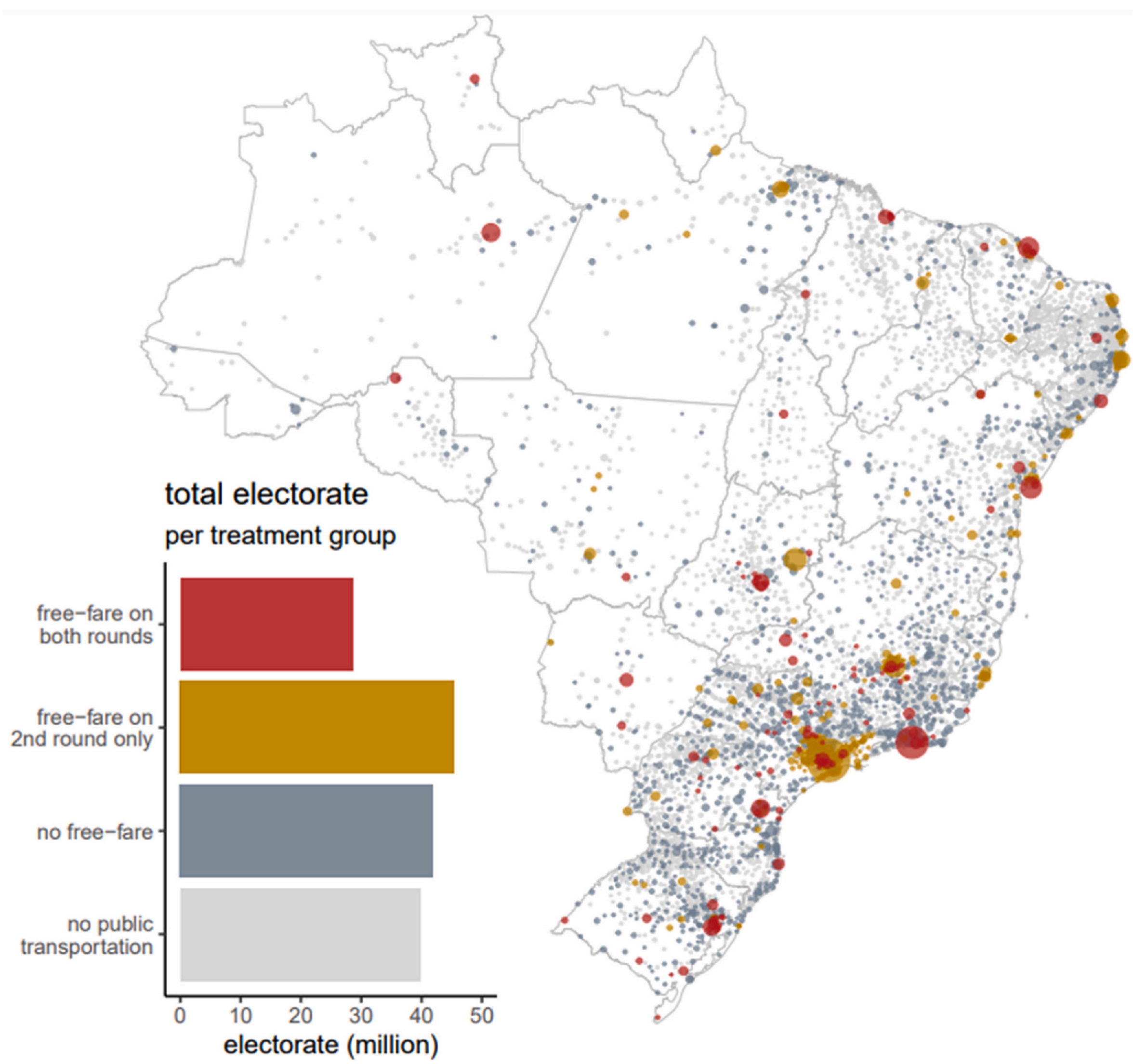

Fig. 1. Brazilian municipalities by adoption of fare-free public transit during the 2022 national election. The first round was conducted on October 2nd and the second round on October 30th, both of which were Sundays.

(IDEC) and grassroots organizations associated with the fare-free Movement (Movimento Passe Livre-MPL). The data was collected through a systematic search of news media outlets, government decrees, and official social media posts. Fig. 1 shows the spatial distribution of municipalities and electorate size by treatment group. Additional descriptive statistics of the municipalities within each treatment group are also presented in Fig. S1 in the Online Appendix.

The 1st and 2nd rounds of the 2022 election were conducted on Sundays (October 2nd and 30th). To measure human mobility levels on election days and other Sundays, we used publicly available mobile phone data from Google Community Mobility Reports, accessed on November 15, 2022. These data are only available until October 15th, and do not cover the 2nd round's election day. The data indicate the relative change in the daily number of visitors at different types of places (such as transit stops, grocery stores, and parks) compared to a baseline, which is the median number of visitors on Sundays between January 3rd and February 6th, 2020.

4. Results

We find that the fare-free transit policy had no discernible effect on voter turnout. The right-most coefficient in Fig. 2A shows the estimated policy impact in our preferred specification, with the coefficient indicating the difference in turnout variation between the 1st and 2nd rounds of Brazil's 2022 Presidential election against the same variation observed in the 2018 election for polling stations in treatment and control group municipalities. The Figure presents both the unweighted estimates and the estimates weighted with IPW. If the adoption of the fare-free policy meaningfully lowered the cost of participation, we would expect that the variation in turnout between the two rounds of the presidential election, compared with the variation observed in 2018, would be statistically different in the municipalities in which the monetary cost of public transit for voters changed between the 1st and 2nd rounds of the elections. Nonetheless, we find no significant difference (Coef. −0.0003% with 95% CI = −0.005, 0.004). Using the same identification strategy, we also find that the adoption of the fare-free transit policy had no significant effect on the share of votes for the left-wing candidate in the 2nd round of the presidential election, Lula da Silva from the Workers' Party, PT (Fig. 2B).

Fig. 2A and B also report coefficients for placebo tests in the 2010 and 2014 presidential elections when no fare-free policy was adopted. Results were equally indistinguishable from zero in the past, which gives us confidence that the treatment and control groups present parallel trends and that our identification strategy is valid. Detailed estimation results are presented in Tables S1 and S2 included in the Online Appendix.

Even though we found no significant average effect of the policy on turnout, it is possible that voters from some specific polling stations were more likely to be affected by the policy. So next, we examined whether the fare-free transit policy could have had a differential impact on the turnout rates of polling stations with different characteristics (Fig. 3). Using public official data on the educational attainment of voters assigned to polling stations, we estimated the effect of the fare-free policy on the turnout of polling stations with different shares of voters with low education attainment as a proxy for the socioeconomic level of the voters in each polling station (Fig. 3A). We found no significant effect across the socioeconomic spectrum. We also investigated whether the provision of fare-free transit could have heterogeneous effects on turnout rates at polling stations located in more remote or densely populated areas (Fig. 3B). Given that the Brazilian electoral system assigns a larger number of polling stations to areas with higher population densities, we calculated for each polling station the number of other polling stations within a 1 Km radius as a proxy for location remoteness. Again, we find that voter turnout was not influenced by fare-free transit policies, regardless of the location of polling stations.

We also estimated heterogeneous policy effects by the share of senior voters (60+) in each polling station (Fig. 3C). Seniors in Brazil have the right of riding public transit for free, so we could expect a higher policy impact on polling stations with fewer senior voters. However, no significant effect was found for any decile of our sample. Finally, we also estimated the policy effect on polling stations with different historical levels of turnout (Fig. 3D). However, even in polling stations with

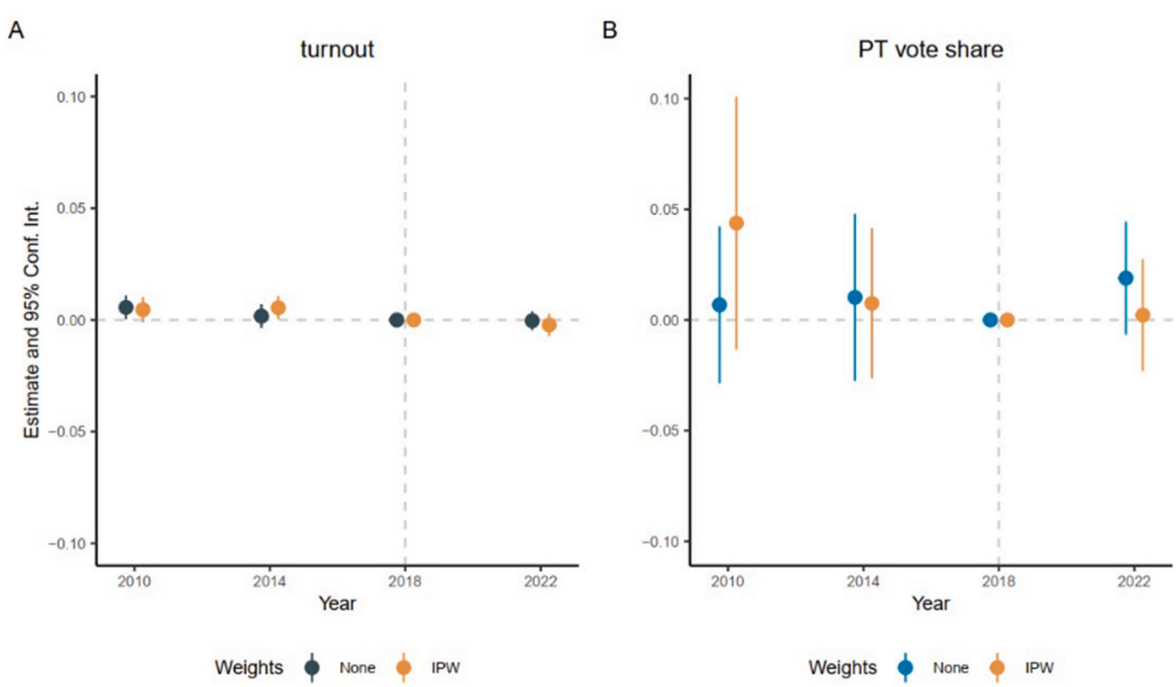

Fig. 2. Effects of the fare-free policy on the: (A) Voter turnout; (B) Share of votes for the Workers' Party (PT). Notes: All results were calculated based on our preferred baseline model that compares turnout and vote share differences between the 2nd and 1st round in polling stations in treated Vs control group municipalities relative to the difference observed in 2018. Both outcomes were estimated without weights and with IPW. Vertical lines indicate 95% Confidence Intervals with standard errors clustered by municipality. The complete set of results from each estimation is available in Table S2 in the online appendix.

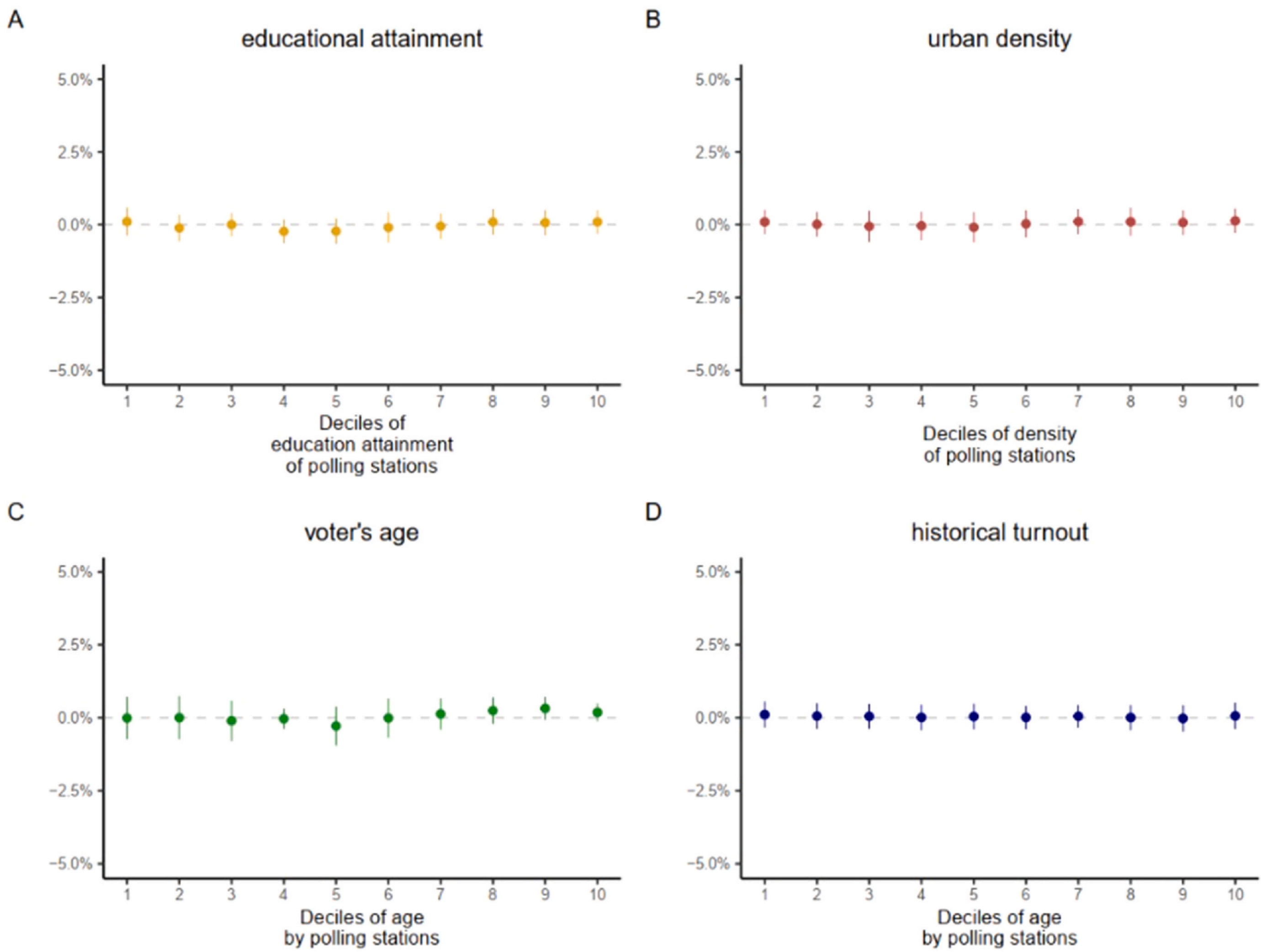

Fig. 3. Heterogeneous effects of fare-free transit policy on the turnout rates of polling stations by: (A) educational attainment of voters; (B) population density; (C) voter's age; and (D) historical turnout rates (lowest to highest historical abstention). Notes: All results were calculated based on our preferred baseline model that compares turnout differences between the 2nd and 1st round in polling stations in treated Vs control group municipalities relative to the difference observed in 2018. All estimations were calculated without weights. Vertical lines indicate 95% CIs with standard errors clustered by municipality. The complete set of results from each estimation is available in Table S3 in the online appendix.

historically lower turnout rates, where the fare-free policy could potentially have a higher impact, we found no significant effects.

4.1. *Mobility effects*

Using our preferred specification, we also investigated whether the adoption of the fare-free transit policy affected mobility levels more

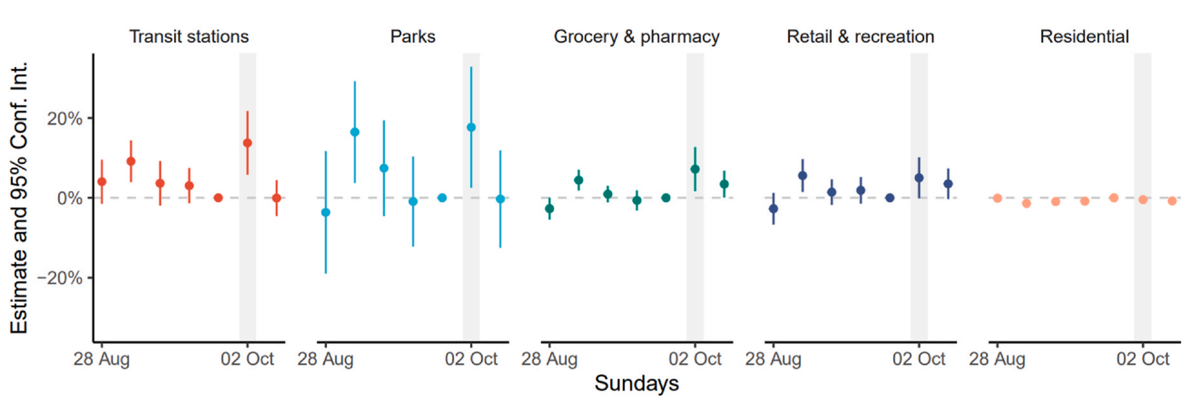

Fig. 4. Change in mobility levels in treated municipalities at different types of places on Sundays before, after, and on the day of the 1st round of the 2022 election relative to mobility levels at control group municipalities. Vertical lines indicate confidence intervals at 95%.

broadly on election day, captured through mobile phone data (see data session). Fig. 4 shows the results of an event study comparing human mobility for different activities in municipalities that provided free transit in the 1st round of election (treated group) relative to municipalities that only implemented the fare-free policy in the 2nd round (control group). The x-axis shows Sundays before and after the 1st election day, which is highlighted in gray. We found significant policy effects for all activities, except at residential areas. Compared to the control group, municipalities that provided free transit on the day of the 1st round saw an increase of 13.7% (95% CI = 5.8, 21.7) in the mobility levels at transit stops. The policy also increased mobility around parks by 17.7% (95% CI = 2.5, 32.9), at groceries & pharmacies by 7.2% (95% CI = 1.7, 12.7), and retail & recreational sites by 5.0% (95% CI = −0.1, 10.1). Combined, our results indicate that voters in treated municipalities have taken advantage of fare-free transit to participate in other activities beyond voting on election day. Detailed estimation results are presented in Table S3 in the Online Appendix.

5. Discussion

Here, we provide the first test of whether the substantial reduction in transit monetary costs during the Brazilian national election of 2022 increased voter turnout. We find that it did not. This is a rather solid null result given that we set out to test for non-negligible effects (Rainey, 2014), and we arrive at the same finding in all of the different model specifications, robustness checks and heterogeneity effect analyses conducted. In fact, in our main specification we can rule out effects on turnout lower than −0.005% and higher than 0.004%. It is expected that zeroing out transit monetary costs would not influence the voting decision of non-voters and of voters who live within walking distance to their polling place. Meanwhile, for voters who live far from their polling place, fare-free transit policies could also not affect the voting behavior of individuals residing in areas without transit services connecting to polling places or those for whom long travel times, rather than monetary expenses, significantly influence their decision to vote. Because Brazilian electoral data are aggregated at the polling station level, it is not possible to estimate how many people would fit in these situations, though.

We did find a positive and significant impact of the fare-free transit policy on transit ridership, nonetheless. These results indicate that the policy may have contributed to shifts in transportation mode on election day, for example with voters shifting from cars or walking to public transit, which could have environmental benefits such as lower carbon emissions or crashes. Additionally, our results suggest that while the fare-free policy has likely improved access to polling stations either by reducing monetary costs and/or the travel time necessary to reach polling places, it only did so for voters who had already decided to turn out and vote. The provision of fare-free transit did not have a meaningful role in reducing political absenteeism as it was not sufficient to convince non-voters to vote.

Why did the fare-free transit policy cause an increase in mobility levels but not an increase in voter turnout? We suggest three non-exclusive hypotheses related to specific characteristics of the Brazilian electoral process and particularly to the 2022 national election that may help reconcile these findings. First, the benefits voters accrue from political participation may be large enough to compensate even for reasonably high transportation costs. Fraga and Hersh (2011), for example, demonstrated that turnout in competitive elections is unaffected by exogenous increases in the cost of participation. As electoral competition increases, voters perceive a higher chance of them being pivotal for the election result, which generally leads to higher turnout rates and smaller participatory gaps between high- and low-propensity voters (Franklin et al., 2004; Andersen et al. 2014; Bhatti et al., 2019; Aarøe et al., 2021). The Brazilian 2022 presidential elections were highly polarized and competitive (the vote difference between the winner and the loser in the two-candidate, second round was 1.8p.p.). An eventual effect of lower transportation costs on willingness to participate could be attenuated under such circumstances. Fare-free transit policies could possibly increase turnout in less competitive elections, for example, where even small costs of participation may outweigh expressive or civic benefits that voters accrue from participating in non-competitive elections.

A second hypothesis is that the costs of not voting in contexts with compulsory voting could outweigh the costs of voting. Nonetheless, the influence of the compulsory voting policy adopted in Brazil is rather uncertain. Since 2002, the country has presented voter turnout rates relatively stable around 79%, slightly above the global average, which in the 2019–2021 period was 63% with a standard deviation of 16% (Lührmann et al., 2018; Speck and Peixoto, 2022). This is at least partly because, although the country imposes a monetary fine for those who abstain plus additional penalties for those who fail to pay the fine, enforcement of such penalties are low and the fine is quite inexpensive (in 2022 the fine was 3.51 Brazilian reais, less than 1 US dollar). Previous studies have found that compulsory voting in Brazil has smaller influence on low-educated voters (Cepaluni and Hidalgo. 2016; Katz and Levin, 2018), but we found that turnout rates were not affected by the fare-free transit policy across socioeconomic levels.

Third, it is possible that an important share of the population lives in close proximity to polling stations, which would make the direct, monetary costs associated with a trip to the polls irrelevant for the decision of voting. As a rule, voters in Brazil are assigned to polling stations close to their homes. Additionally, the Brazilian Electoral Court (TSE) distributes polling stations in a way that tries to increase the spatial proximity between residential areas and voting locations. As a consequence, distances and travel times to polling stations tend to be small for some share of the population. In our case, however, we found that turnout rates were unaffected by the fare-free transit policy even in low-density contexts with larger distances to polling stations (Fig. 3B). Fare-free policies may have a positive effect on turnout in other contexts in which voters must cover larger distances and have better access to transport resources. This is consistent with the conclusion of Benedictis-Kessner et al. (2021) who find that car-ownership increases turnout in the US particularly for voters who live far from their polling places.

Contrary to some studies (Niemi, 1976; Blais et al., 2019; Dhillon and Peralta 2002), though, our results show that monetary transport costs may not be a critical factor in electoral participation in all circumstances. These results go in line with previous research showing that policies that aim to address voter participation gaps could find more fertile ground by increasing the spatial proximity between voters and polling locations (Stein and Vonnahme 2008; Brady and Mcnulty 2011). In this sense, our work also adds to the contemporary literature on the importance of precinct location for political participation in democracy (Fauvelle-Aymar and Abel, 2018; Cantoni 2020).

Our findings suggest that reducing transportation monetary costs may improve people's access to polling places, but it is not sufficient on its own to increase voter turnout. Thus, governments may justify adopting fare-free policies on normative grounds, for example, arguing that government agencies and transit systems should not impose costs on voters who seek to participate in democratic elections, but knowing that such policies may not effectively bring more voters to the polls.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

All code and data to replicate the paper have been deposited in the GitHub <<https://github.com/renatosv1988/eleicao/>>

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.electstud.2023.102690.

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