Supplementary Materials for "Investment Capacity and the Electoral Marketplace: Evidence from Brazil"

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A A Simple Model of Elections, Government, and Investment Capacity

Let a strategic interaction between a politician, a firm, and a mass one of voters, that are responsive only to campaign expenditures.[1].

In line with Klašnja (2015) and inspired by the findings of Klašnja and Titiunik (2017), we consider that there are two types of politicians: *opportunistic politicians* and *career concerned*.[2] The difference between them is that a career concerned politician wants to invest more in public services, as she knows that her relationship with voters and firms will span for a longer time than an opportunistic politician. The opportunistic politician prefers not to invest for at least three reasons. First, she wants to pocket most of the money, and invest in public services is only attractive when she can add kickbacks to procurement. Second, if invest is costly, she may prefer to shirk and not spend any resources. Finally, her contact with voters and firms will shorter than the career politicians, and so, she prefers to makes the most out of her election regarding rent-seeking opportunities. These types are private information of the individual politicians.

Firms, on the other hand, look for an opportunity to provide services for the government as a for-profit enterprise. Firms then contribute to campaigns expecting to be compensated by the politicians by getting contracts and procurement. If they knew the politician's types, they would only contribute to long-term oriented politicians, as these politicians would keep investing in services, regardless of term limits. However, firms do not know whether the politician is an opportunistic or a career oriented one.

For the interaction between these two players, we consider a game with the following sequential time-line:

1. Nature draws the type of the elected incumbent politician from a common-knowledge distribution.
2. Politicians decide whether to invest or not in public services, hiring or not the firms. The term ends, and the re-election follows.
3. Upon being hired or not, firms then decide whether to donate or not for the incumbents' re-election contest.
4. If firms donate, then she wins the reelection, else, she retires.
5. Payoffs are realized, and the game ends.

Figure 1 depicts a simplified version of our argument as a simple signaling game.

[1] @baron1989service refers to these voters as uninformed, and @grossman1996electoral refer to them as impressionable. In any sense, they are responsive for campaigning and not strong ideologically attached.

[2] In @klavsnja2017incumbency, term-limits coupled with weak parties are the principal explanation for incumbency disadvantage, as they consider a moral hazard from the part of politicians. Here, we abstract from these concerns as the term-limits does not restrict politicians from run to other offices. In Brazil, an excellent mayoral administration is an important step to move forward in the political career. Some cities in Brazil, such as Sao Paulo, are critical to exposing a politician that wants to become a state governor, a senator, or even a president.

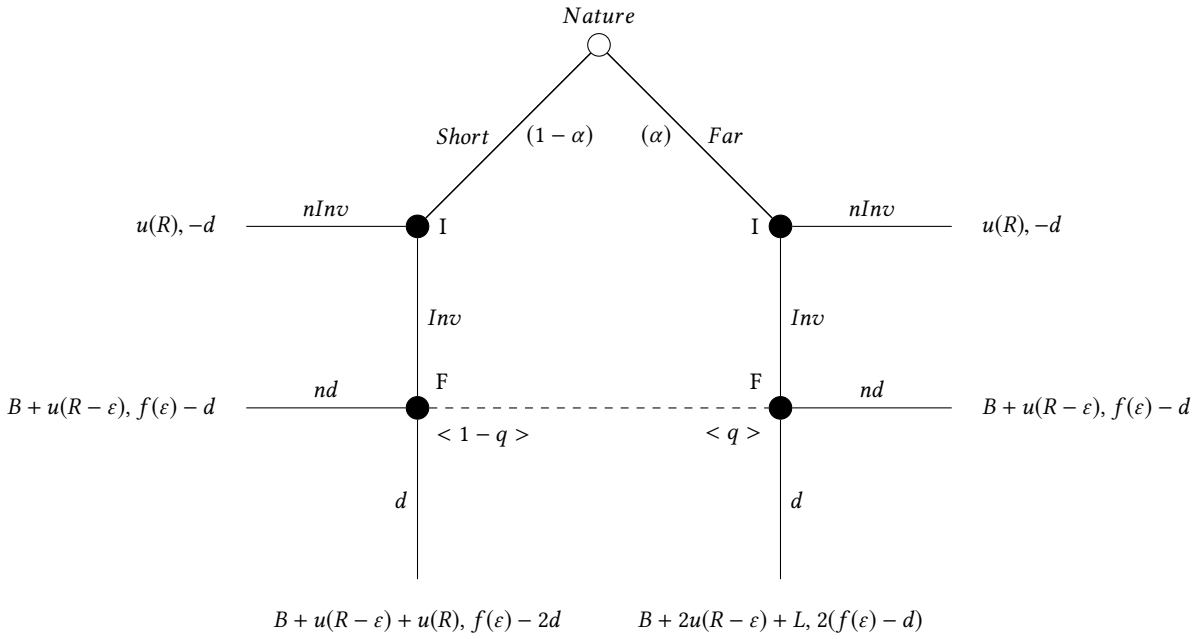

Figure 1: Extensive-Form Game for the politician-firm strategic interaction

We assume that mayors, upon taking office, have $R > 0$ resources to invest in public services. They then decide whether to pocket the investments, or they can proceed and hire the firms, paying R for its services.[3] As the Figure 1 suggest, if the politician does not invest any resources in public services, the Firm does not donate, and she is out of office, receiving B, which is the benefit from holding office once, and R, which represents the pocketed resources.

Upon observing an investment, firms provide the public services, and then, at the following electoral period, they decide again whether they want to donate an amount $d > 0$ for the incumbent, or not ($d = 0$). As we are assuming that voters are only responsive for campaign expenditures, receiving more resources than the challenger would increase the incumbent's chances of getting reelected.

The central tension in the model is that firms only want to donate for far-sighted politicians. Firms know that these politicians will hire them regardless of being lame-ducks, as they want to advance their political career. However, if they donate for short-sighted, they will not see the public investment in the second turn. This because the short-sighted politicians will pocket the money, and if they invest in the first term, it is just because they expect to pocket the resources in the second term.

Let q the belief that the Firms hold regarding the firm being far-sighted. The firm will donate for the incumbent if

$$E[d,\ q] \ = \ q[2(R-d)] + (1-q)[R-2d] \ \geq \ R-d \ = \ E(nd, q)$$

[3]The pocketing assumption may be inaccurate for some situations, as we may consider that it is not easy for mayors to pocket money as they wish. In any case, this is similar to consider that mayors pay a cost whenever they want to invest, and some mayors might decide to do nothing, avoiding the costs embedded in working toward improving services.

Solving this inequality leads us to the following threshold:

$$q \geq \frac{d}{R} = \tilde{q}$$

$\tilde{q}$ is the cutoff that limits the incentives for donation. If we study a pooling equilibrium, where both candidates invest in public services, it becomes easier to this equilibrium be theoretically sustainable, the smaller the $\tilde{q}$. Figure 2 summarizes the incentives.

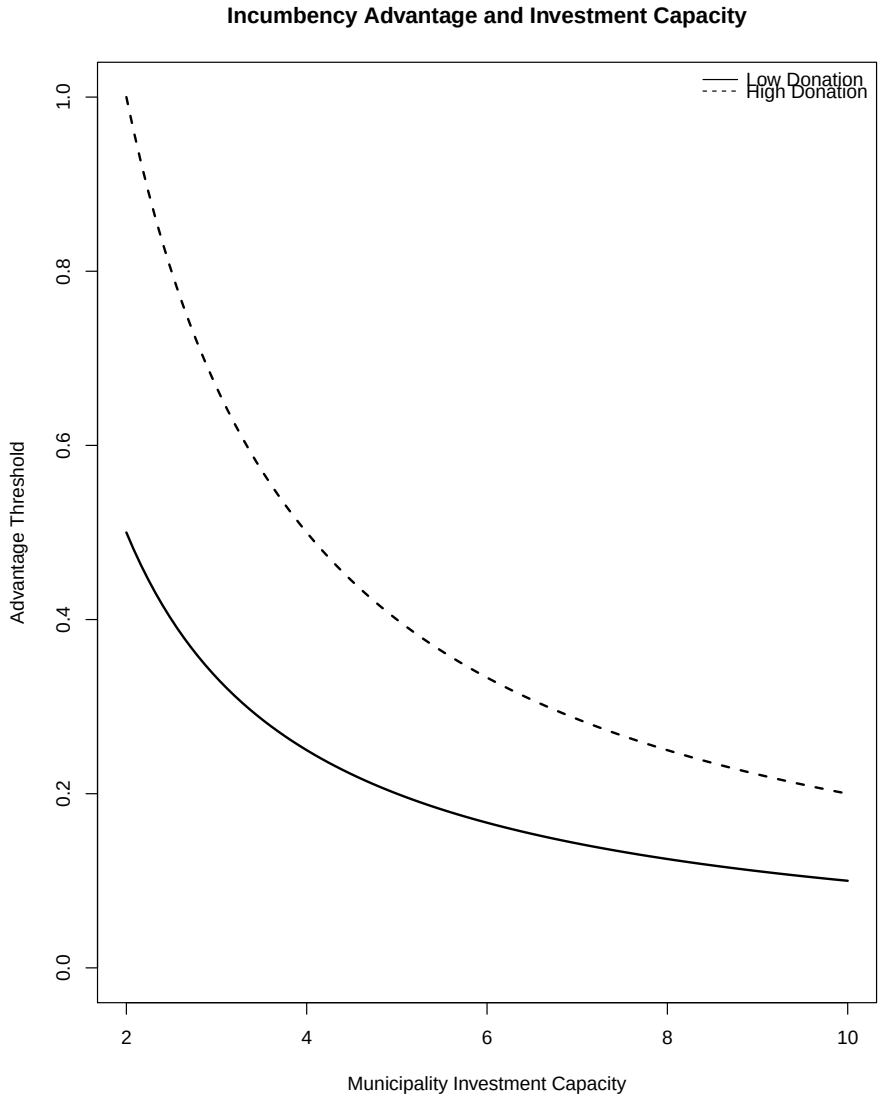

Figure 2: *Investment Capacity and Donation Thresholds*

The model has an equilibrium for pooling strategies, with incumbents always investing when $\alpha \geq \tilde{q}$ and never investing when $\alpha < \tilde{q}$. There is no equilibrium in separating strategies. To summarize our findings we have the following proposition.

Proposition 1 *If the municipal investment capacity increases, then the likelihood of receiving a donation from the firm also increases.*

The proof follows straightforwardly from the $\tilde{q}$ definition. When R increases, $\tilde{q}$ decreases. The range between $[\tilde{q}, 1]$, that depicts the incumbency advantage range, also increases.

Corollary 1 *If the municipal investment capacity increases, then the chance of getting reelected increases.*

The corollary follows from the fact that increasing the campaign resources also increases the chance that incumbents will spend more than challengers. This increases their reelection prospective when the electorate is impressionable.

Note that this simple model can be extended to add randomness in the investment capacity, or in the voter's utility. In the first case, we could make R a random draw from a continuous distribution, with finite support. The strategy from the politicians' perspective would be to invest R when the politician is career concerned. When the politician is opportunistic, she invests a fraction of R, enough to make the firm indifferent between donating or not. The optimal donation strategy would be to donate with an increasing probability, conditional on the amount of resources received.

From the voter's perspective, we could add public service provision concern or ideological voting. In the first case, the adverse electoral effects of investment capacity would come from two places: the campaign investments and the low service provision. Adding ideology would not change things substantially, as politicians would set their ideal policies at the median. Both extensions are available upon request.

B Budget Process in Brazilian Municipalities

The Brazilian federalism is commonly defined as a centripetal political union arrange (Arretche 2010; Beramendi 2012). First, municipalities are required by law to implement public policies in areas such as health and education according to the federal government specific guidelines. Second, most of the local level taxes are collected by the federal government and then redistributed among states and municipalities. Third, municipalities have low discretion to create taxes and contributions.

The decision on the allocation of the budget at the local level is composed of two steps. First, the executive branch defines the priorities based on the municipalities needs and the resources available. Second, politicians in the city council vote the executive budget spending proposal. Since the government coalitions with majorities is a hallmark of the Brazilian local politics (Santos 2013), it is implausible that the final budget proposal does not reflect the executive branch preferences. However, the investment capacity of municipalities is limited.

The Brazilian municipalities heavily depend on federal government transfers due to their low fiscal capacity. For instance, in 2015, 92% of municipalities have more than 70% of their budget composed by federal transfers[4]. To mitigate the problem of low investment capacity of municipalities, the Brazilian Congress created a rule to limit municipalities spending. The law of fiscal responsibility (Lei de Responsabilidade Fiscal), implemented in 2000, sets maximum limits (54%) on public budget levels for personnel payrolls, which creates incentives to mayors prioritize investments in infrastructure provision. Municipalities, however, continue to face challenges to fulfill this expectation. In 2015, on average, municipalities spent only 9% of their budget with infrastructure provision. By contrast, they spent 54% of their budget with personnel payrolls[5].

[4] Available at http://publicacoes.firjan.org.br/ifgf/2015/files/assets/common/downloads/publication.pdf [Accessed 05 May 2019].
[5] Available at http://publicacoes.firjan.org.br/ifgf/2015/files/assets/common/downloads/publication.pdf [Accessed 05 May 2019].

C Data Sources

We collect data on Brazilian elections and municipal investment capacity from 2000 to 2012. We report below the data sources with the link for helping with the replication of these results.

Table 1: Data Sources

Webpage	Sources	Acronyms
https://www.ibge.gov.br	Brazilian Institute of Geography and Statistics	IBGE
http://www.tse.jus.br	Superior Electoral Tribunal	TSE
https://cebrap.org.br	Brazilian Center of Analysis and Planning	CEBRAP
https://www.firjan.com.br/pagina-inicial.htm	Rio de Janeiro Industry Federation	FIRJAN
http://www.ipeadata.gov.br/Default.aspx	Brazilian Institute of Economics Research	IPEA

A short description of each variable follows in the Tables below.

Variable	Description	Original Source	Manipulation	Observations
electionMunic	Mayoral election year and TSE code for municipalities (for clustering purposes).	TSE	Merging the variable "election" with the variable "munCodeTSE".	
election	Mayoral election year.	TSE	None	Years 2000, 2004, and 2008. This means that the elections considered are the 2004, 2008, and 2012.
munCodeTSE	Superior Electoral Tribunal (TSE) municipal codes.	TSE	None	
munCodeIBGE	Brazilian Institute of Geography and Statistics (IBGE) 6-digit municipal codes.	IBGE	None	
candName	Candidate's name.	TSE	None	
state	State 2-character code.	TSE	None	
munName	Municipality name.	TSE	None	
candParty	Brazilian Acronym for the Candidate's political party.	TSE	None	
elecNext	Candidate's reelection in year t+4 (dummy).	TSE	None	
campaignResources	Candidate's total campaign resources in year t+4.	TSE	None	
propVot	Vote margin between the winner and the runner-up (running variable).	TSE	Computed from the TSE vote counting for Winner and Runner-up Candidates.	
elected	Election winner (dummy).	TSE	None	
elecBefore	Elected before in t-4 (dummy).	TSE	None	
donationRecipient	Candidate received funds (dummy).	TSE	None	
partyPT	Municipality with a candidate from PT (dummy).	TSE	Computed from TSE Candidate party Acronym.	
partyPSDB	Municipality with a candidate from PSDB (dummy).	TSE	Computed from TSE Candidate party Acronym.	
partyDEM	Municipality with a candidate from DEM (dummy).	TSE	Computed from TSE Candidate party Acronym.	
partyPP	Municipality with a candidate from PP (dummy).	TSE	Computed from TSE Candidate party Acronym.	
partyPTB	Municipality with a candidate from PTB (dummy).	TSE	Computed from TSE Candidate party Acronym.	
partyPDT	Municipality with a candidate from PDT (dummy).	TSE	Computed from TSE Candidate party Acronym.	
partyPSB	Municipality with a candidate from PSB (dummy).	TSE	Computed from TSE Candidate party Acronym.	
femaleCand	Female (dummy).	TSE	Computed from TSE Candidate information.	
candMD	Physician (dummy).	TSE	Computed from TSE Candidate information.	
candBusiness	Businessman(dummy).	TSE	Computed from TSE Candidate information.	
candLawyer	Lawyer (dummy).	TSE	Computed from TSE Candidate information.	
candCollegeDegree	College degree (dummy).	TSE	Computed from TSE Candidate information.	
aboveMedianAge	Candidate above the median age (dummy).	TSE	Computed from TSE Candidate information.	
incAndChalGov	Municipality with an incumbent and the challengers from parties in the Federal government coalition (dummy).	Cebrap and TSE	Computed considering the party that composed the Federal Coalition at the election year.	
incAndChalOposition	Municipality with an incumbent and the challengers from parties in the Federal government opposition coalition (dummy).	Cebrap and TSE	Computed considering the party that composed the Federal Coalition at the election year.	
incGovChalOpos	Municipality with an incumbent in the Federal government coalition party and challenger in the opposition party (dummy).	Cebrap and TSE	Computed considering the party that composed the Federal Coalition at the election year.	
incOposChalGov	Municipality with an incumbent in the opposition party and a challenger in a federal government coalition party (dummy).	Cebrap and TSE	Computed considering the party that composed the Federal Coalition at the election year.	
InvExpPerOverRev	One minus the proportion of the revenue spent with personnel: active and pensions.	IPEAData	Ratio between Municipal Personnel Expenditure and Municipal Revenue.	Data averaged for four year timespan. The year 2012 is absent from the dataset, so we consider the period 2008 to 2011 in the last election.
aboveMedInvExpPerOverRev	Above Median of the inverse proportion of the revenue spent with personnel (dummy).	IPEAData	Dummy equals 1 if above the median of "InvExpPerOverRev".	
InvQuartileExpPerOverRev	Quartile index of inverse proportion of revenue spend with personnel.	IPEAData	Position of the quartile, ranging from 1 (0 to 1st quartile), to 4 (third quartile) in the ratio between municipal personnel expenditure and municipal revenue.	
frlClassification	Classification of the Municipal Fiscal Healthy based on the Brazilian Fiscal Responsibility Law (Complementary Law 101 - 05/04/2000).	IPEAData	If the ratio between personnel expenditure and revenue is above 0.54 the state is considered "SEVERE", and the municipality may be punished; between 0.514 and 0.54, the municipality is in the "CRITICAL" zone; if the expenditure with personnel is between 0.4874 and 0.514, the municipal is in "ALERT"; below 0.4874 the fiscal health is "OK".	Data averaged for four year timespan. The year 2012 is absent from the dataset, so we consider the period 2008 to 2011 in the last election.
firjLiqIndex	Rio de Janeiro Industry Federation index of municipal liquidity.	FIRJAN	None	Data averaged from 2006, when the index started, to 2012. Missing data for the first election.
aboveMedianFirjLiqIndex	Above Median of Rio de Janeiro Industry Federation index of municipal liquidity (dummy)	FIRJAN	Dummy equals 1 if above the median for the variable "firjLiqIndex".	
quartileFirjLiqIndex	Quartile of the Rio de Janeiro Industry Federation index of municipal liquidity index.	FIRJAN	Position of the quartile, ranging from 1 (0 to 1st quartile), to 4 (third quartile) in the FIRJAN liquidity index.	

Table 2: Variable Descriptions and Codebook

D Summary Statistics

E Identification Strategy

Electoral results depend heavily on the efforts and resources employed by the candidates. However, candidates are unable to manipulate the vote share they will receive precisely. Elections decided by a small vote margin have a strongly random component, and in some of those elections, it was ex-ante unpredictable who would win the contest. Therefore, candidates that lose by a small vote margin serve as a suitable account for those candidates who were elected by a small margin of votes (Imbens and Lemieux 2008).

From 2000 to 2012, the RD running variable is the vote margin difference between the two most voted candidates. The differences between the electoral winners and immediate losers in consecutive terms, compared with the candidates that lost and then won or vice-versa, raises problems concerning the endogeneity of the reelection running decision (Song 2018). Magalhães (2015) addresses this selection problem proposing an outcome variable that takes value one (1) if the candidate reruns and wins in the next election, but takes value zero (0) if the candidate loses or drops the race. With this strategy, we can measure the outcome effects even when rerunning is not widespread and the RD estimates the incumbency effect on the probability of winning the next election, unconditional on rerunning. We estimate the incumbency effect on the probability of receiving campaign finance resources from firms unconditional to the fact that the candidate is rerunning in the next election.

The regression discontinuity design uses the arbitrary change vote share, with a sharp discontinuity when is positive versus negative, meaning that the candidate wins or lose, to estimate the causal effect. We use a local-linear polynomial estimate with a triangular kernel distance to the cutoff weighting (putting more weight to cases closer to the cutoff) and computing the optimal bandwidth using the Calonico et al. (2014) MSE-robust data-driven optimal bandwidth.[6]

The validity of our causal claim requires the empirical strategy to satisfy two assumptions: no endogenous manipulations, such as frauds, and the pre-treatment variables continuity. We show below that there are no sign of manipulations and all the pre-treatment variables such as the candidates' gender, age, profession, and party labels, were not statistically significant. These results reinforce that our empirical strategy is solid.

[6] As robustness checks we run the same regressions varying the polynomial degree from linear to a quartic, the optimal bandwidth using Calonico et al. (2014) and Imbens and Kalyanaraman (2011), and inserting versus taking off the pre-treatment covariates Calonico et al. (2016). We cluster all standard errors at the municipal level, as the elections occurs at the municipality. All the results are available in the Appendix.

F Covariate Smoothness and Threshold Manipulation Tests

G Main Paper Results

H Robustness

H.1 Main Results with Covariates as Controls

H.2 Placebo Cutoffs

H.3 Sensitivity to Bandwidth Selection

H.4 Sensitivity to Polynomial Degree

H.5 Party-centered Alternative Explanations

H.6 Federal Transfer's Thresholds: a Double RDD Approach

I Session Information

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sessionInfo()
```

```
## R version 4.0.3 (2020-10-10)
## Platform: x86_64-apple-darwin17.0 (64-bit)
## Running under: macOS Catalina 10.15.7
##
## Matrix products: default
## BLAS:   /Library/Frameworks/R.framework/Versions/4.0/Resources/lib/libRblas.dylib
## LAPACK: /Library/Frameworks/R.framework/Versions/4.0/Resources/lib/libRlapack.dylib
##
## locale:
## [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
##
## attached base packages:
## [1] grid      stats     graphics  grDevices utils     datasets  methods
## [8] base
##
## other attached packages:
##  [1] psych_2.0.12    gridExtra_2.3   rddensity_2.1   GGally_2.0.0
##  [5] broom_0.7.2     xtable_1.8-4    haven_2.3.1     rdd_0.57
##  [9] Formula_1.2-4   AER_1.2-9       survival_3.2-7  car_3.0-10
## [13] carData_3.0-4   lmtest_0.9-38   zoo_1.8-8       sandwich_3.0-0
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##
## loaded via a namespace (and not attached):
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## [13] mnormt_2.0.2       curl_4.3           compiler_4.0.3     cli_2.2.0
## [17] rvest_0.3.6        xml2_1.3.2         scales_1.1.1       digest_0.6.27
## [21] foreign_0.8-80     rmarkdown_2.6.6    rio_0.5.16         lpdensity_2.1
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