# The Relevant Third: Threat of Coalition and Economic Development*

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**Abstract**

We examine the impact of political competition on economic development in a multi-party setting by constructing a novel measure of competition: *threat of coalition*. We define a constituency as competitive when there is a 'relevant' third-position candidate, i.e., the ex-post vote share of the third-ranked candidate exceeds the winning margin. Using data from Indian Legislative Assembly elections and a regression discontinuity (RD) design we show that constituencies with a *barely* 'relevant' third witness a 1.2—3.5 percentage points increase in nightlights (our measure of economic development). The main mechanisms are higher availability of public goods and a reduction in reported crime in constituencies with a *relevant third*. We rule out other channels by showing that there is no effect when the threat of coalition is not credible.

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You win by working hard, making tough decisions and building coalitions.

*John Engler*
$46^{th}$ *Governor of Michigan*

# 1 Introduction

This paper examines the effect of political competition on economic development in a multi-party setting. We use a novel measure of political competition: the presence of a *relevant third* and the consequent threat of potential collusion that the incumbent faces: the possibility of coalition formation by the non-incumbents. Increased electoral/political competition results in favourable outcomes for the voters and citizens.[1] For example, Wittman (1989, page 1396) writes: *competition for political office reduces the potential for opportunism by politicians.* The underlying premise is that a substantial electoral advantage—or a lack of political competitors—diminishes the extent to which politicians are held accountable, allowing them to prioritize narrow self-interests without jeopardizing their re-election prospects. A growing body of literature supports the notion that increased electoral competition correlates with improved economic and political outcomes (Dash and Mukherjee, 2015, Solé-Ollé and Viladecans-Marsal, 2012, Ashworth et al., 2014, Padovano and Ricciuti, 2009). Politicians elected within a competitive setting are less likely to renege on their policy promises (Walkowitz and Weiss, 2017), engage in rent-seeking behaviour (Polo, 1998, Svaleryd and Vlachos, 2009), or prioritise special-interest policies during their term in office (Besley et al., 2010).

How to measure political competition, however, remains an open question. The empirical literature on political competition has employed various measures to define electoral competitiveness (see Dash et al., 2019). These include the effective number of candidates or parties (ENOC or ENOP), computed as the inverse of the Hirschman-Herfindahl concentration index (HHI) constructed using candidate or party vote or seat shares at a constituency (Arvate, 2013, Gottlieb and Kosec, 2019), vote share difference between the top-two candidates (Besley et al., 2010, Dash and Mukherjee, 2015, Solé-Ollé and Viladecans-Marsal,

[1] An election is defined as competitive or contestable if there exists an opposition party (or coalition formed prior to the election) that has chance of winning and credibly offers equivalent or superior performance to that offered by the incumbent (party).

2012), winning vote share (Sørensen, 2014), and seat share of opposing ideological blocs (Curto-Grau et al., 2018).

We use a new definition of political competition: the presence of a *Relevant Third* and the threat of collusion between non-incumbents. In our framework, the third placed candidate is relevant if the number of votes received by the third placed candidate exceeds the winning margin. In such a situation, if the second and third placed candidate could arrive at some form of an agreement, together they can beat the incumbent (in the next election). Using a regression discontinuity framework comparing situations where the third-ranked candidate is barely relevant to those where they are barely not, we exogenously identify a potential *threat of collusion* between the non-incumbents. We are thus able to causally isolate the impacts of competition on *ex-post* outcomes, through a potential shock to re-election probabilities. We rule out channels other than the threat of collusion as potential incentive compatible responses to political agency relationships: there are no effects when our analysis is restricted to cases where the threat of collusion is not credible.

Our definition of competition has several advantages in the context of India with its multi-party/multi-candidate nature of elections. *First*, while the commonly used difference in vote share margin between the first and the second placed candidate (winner vs runner up), might be satisfactory in a two-party system as in the US, it is less than satisfactory in a multi-party system as in India.[2] *Second*, interpreting the implications of an increase in the effective number of parties (ENOP) is problematic. An increase in the number of parties above 2, which is the long run equilibrium in a majoritarian system (the *Duverger Hypothesis*) is actually indicative of a decline in the competitiveness of the electoral system. *Third*, a different problem arises in the context of establishing a causal link between electoral competitiveness and economic development. The measures that have typically been used are potentially endogenous. For example, the existence of a close election (where the winning margin is small) is arguably non-random, and could potentially be correlated with unobserved constituency and candidate level characteristics that could directly affect development outcomes. A similar concern arises from other measures as well. The HHI index and ENOC are potentially outcomes of electoral competitiveness in the previous term and prior development trends. Even with the commonly-used instrumental variables strategy — employing IVs such as historical levels of competition, or legislative changes — it is difficult to rule out the effect of confounds such as collective preferences of the region or time-varying unobservables that could simultaneously affect both competition and devel-

[2]For example, Dash et al. (2019) argue that use of vote share difference between the top two candidates needs to be normalised by a measure of the volatility of the electorate.

opment outcomes. *Finally*, apart from identification problems, these metrics are usually weaker indicators of political competition. Measures such as the ENOC, the HHI, and seat-differences across ideological blocs might capture the level of political fragmentation, instead of being direct measures of competition faced by a candidate (Dash and Mukherjee, 2015). It is also unclear whether these measures are able to isolate any one aspect or channel of political competition through which the effects on development outcomes could manifest. Therefore, for our purpose, a majority of these metrics are inadequate in fully understanding political competition.

Our measure of political competition is particularly meaningful in settings with multiple parties or candidates, which differs significantly from the commonly studied two-party contests. Duverger (1954) argued that voters do not want to waste their vote and will thus, in most cases, exclusively vote for two front-runners. Several follow-up papers have shown that under plurality rule, when voters are instrumentally rational, an election with multiple candidates usually boils down to a two-candidate race, and of these two, the candidate who is preferred by the majority wins the election. The American election landscape with the two major parties (Republicans and Democrats) is a popular illustration of the Duverger Hypothesis. However, there are instances from many other countries that third- and lower-ranked candidates often receive a large share of the total votes and play an important role.[3] For example, Pons and Tricaud (2018), using data from French local and parliamentary elections show that the presence of a third candidate (decided by a specific electoral law) has important implications for electoral outcomes.

Multi-party/multi-candidate contests are prevalent worldwide, with an average of nine active political parties participating in elections across a sample of 235 countries (Seror and Verdier, 2018). In the context of Indian Legislative Assembly Elections, which is the focus of our paper, an electoral district (known as 'constituency' in India) had, on average, 11 candidates contesting an election during the period 2014–2018. Our approach, therefore, allows us to look beyond only the top-two candidates. Additionally, there are no term limits for contesting candidates and as a result, the potential incentives for re-election always exist. This makes the agency argument more nuanced and politicians are, therefore, always likely to respond to any incentives that may enhance or reduce the probability of their re-election.[4]

[3]Third ranked candidates can play an important role even if they receive a small fraction of votes. The Ralph Nader example from the 2000 US Presidential election is a case in point.

[4]One important characteristic of a "political market" is that there are no legal restrictions to competitors forging explicit and implicit alliances (engage in collusion) to consolidate of vote shares. This is quite common in Indian elections. For instance, leading up to the

The existence of a *Relevant Third* in a constituency might not be random. In particular, constituencies with a *Relevant Third* might differ systematically from constituencies without a *Relevant Third*. To overcome this empirical challenge, we exploit a regression discontinuity (RD) design that credibly identifies the effect of having a *Relevant Third*, by comparing development outcomes in constituencies with a *barely Relevant Third* with outcomes in constituencies *barely* without a *Relevant Third*. Our running variable here is the difference between the vote share of the third-placed candidate and the winning margin (i.e., difference in the vote share of the winner and the runner-up). A positive value of this variable indicates the presence of a *Relevant Third*, while a negative value indicates a non-relevant third.[5]

Our primary measure of the level of economic development or prosperity is nighttime lights or nightlights. Nighttime lights have been used extensively in the literature as proxies for levels of economic development at granular levels (see, for example Chanda and Kabiraj, 2020, Asher et al., 2021), particularly at levels of aggregation below the district level (in the Indian context). We find that having a *Relevant Third* results in a large an statistically significant growth in nighttime lights, which corresponds to a 1.8—5.5% growth premium during our sample period. The results are driven by the higher growth of nightlights in the second half of the electoral term. This is not surprising given that constituency development is likely to take some time and therefore effects on luminosity should ideally show up with a lag.

We show that our results are indeed driven by the threat of collusion. When the second and third placed candidates are from ideologically opposed major parties and it is unlikely that these two parties will ever collude (i.e., the threat of collusion is not credible) we find that the *Relevant Third* does not have a statistically significant effect on economic growth.

To understand the mechanisms We develop a stylized model that describes a potential channel through which the presence of a *Relevant Third* leads to higher investment in

2024 national elections, the major opposition parties have formed an explicit alliance and entered into a seat-sharing agreement. This is expected to result in consolidation of the vote shares of the parties in the alliance in every constituency where such an agreement has been reached, against the challenger in that constituency. See for example: `https://theprint.in/india/seat-sharing-agreement-among-india-bloc-partners-almost-finalised-sachin-pilot/2004008/`.

[5] Lee (2008) was possibly the first to exploit a regression discontinuity design using electoral data. Studies using a similar design in the context of India and elsewhere include Uppal (2009), Clots-Figueras (2011, 2012), Broockman (2014), Bhalotra and Clots-Figueras (2014), Fisman et al. (2014), Anagol and Fujiwara (2016), Asher and Novosad (2017), Bhalotra et al. (2017), Baskaran and Hessami (2018), Prakash et al. (2019), Lee (2020), Lahoti and Sahoo (2020), Prakash et al. (2022), Mahadevan and Shenoy (2023), Faravelli et al. (2023), Baskaran et al. (2023), Khalil et al. (2024).

public goods. We posit that the voters whose first preference is the party that has come third engage in strategic voting to support either the leading party or the runner-up in the next round of elections. The incumbent in the current round invests in public goods in order to attract the members of the *Relevant Third*. We show that the incumbent will invest in public goods only when she does not have majority i.e., when there is no *Relevant Third*. Investment in public goods is positive when there is a *Relevant Third*. Additionally the configuration of party positions explains differences in public goods investment by the incumbent. When the incumbent is moderate, all members of the third group prefer the incumbent and investment in public goods is low. When the runner-up is moderate, all members of the third group prefer the runner-up over the incumbent and correspondingly, the investment in public goods is the highest. Finally, when the third party is moderate, some prefer the incumbent and some prefer the challenger, and the investment in public goods also lies between the two extreme cases.

As potential mediating channels for increased luminosity, we estimate impacts of having a *Relevant Third* on a large set of public goods. We find that having a *Relevant Third* results in provision of better health care goods measured by the proportion of villages in the constituency having access to a particular health facility, better education infrastructure as measured by the proportion of villages in the constituency having different types of schools, improved drainage and market infrastructure and higher electricity supply to marginal, small and medium enterprises (MSMEs). We also find that a higher fraction of *Relevant Thirds* in a district results in reduction in district-level crimes. Finally, turning to the impacts on electoral outcomes, we find that the existence of a *Relevant Third* does not affect the likelihood of the incumbent re-contesting, but conditional on re-contesting it reduces the probability of re-election of the incumbent.

The paper makes several important contributions. *First*, it contributes to the literature on the effect of political competition on economic development. In contrast to most other studies, which, typically, estimate an association between the two, we provide credible causal estimates of the economic impact of electoral competition. *Second*, we propose a new measure of political competition for multi-candidate settings. *Third*, we contribute to the literature on the role of political competition in shaping politician performance (Kosec et al., 2018, Acemoglu et al., 2014, Besley et al., 2010). *Fourth*, we contribute to the link between re-election incentives and economic outcomes (Van Weelden, 2013, Pailler, 2018, Finan and Mazzocco, 2021). *Finally*, we show that in multiparty elections, it is important to look beyond the winner (and even the runner-up). Anagol and Fujiwara (2016) examine the political implications coming second: they compare the effects of barely coming second vs barely coming third and find the the runner-up effect is considerable. Pons and Tricaud

(2018), using data from French local and parliamentary elections show that the presence of a third candidate has important implications for electoral outcomes. Our focus is very different. In our case it is not about the presence of a third placed candidate; rather it is about the *relevance* of the third placed candidate.

The rest of the paper is organised as follows. Section 2 presents details on the setting and the datasets used in our analysis. The empirical strategy is discussed in Section 3. Section 4 discusses the validity of the RD design that we use in this paper. Section 5 presents the key results on growth of nightlights. Section 6 examines the credibility of the threat of coalition as a measure of political competition. In Section 7, we present the stylized model that describes a potential channel through which the presence of a *Relevant Third* leads to higher investment in public goods. Next, in Sections 8.1 and 8.2, we discuss two key channels that potentially explain how political competition can affect economic outcomes. Finally, (in Section 9), we analyse the impact of this coalitional threat on electoral outcomes in the subsequent election. Section 10 concludes.

# 2 Background and Data

## 2.1 Legislative Assembly Elections in India

India follows a parliamentary form of government, distributing power between the Centre and the States. State elections, known officially as *Vidhan Sabha* or Legislative Assembly elections, are conducted in single-member Assembly Constituencies (ACs) to elect Members of the Legislative Assembly (MLAs) that constitute a state-level Legislative Assembly. As per the latest delimitation exercise, which came into force in 2008, there are 4,123 Assembly Constituencies across 640 districts in the 28 states and three union territories of the country.

The Election Commission of India (ECI) is the apex body responsible for conducting elections for all echelons of the government. The ECI fixes electoral calendars that are not necessarily synchronised across states or within the same state for different tiers of the government. Elections are conducted under a first-past-the-post system, and an electoral term lasts for five years, unless the assembly is dissolved and the state goes to early elections.

## 2.2 Elections Data

The election data comes from the official statistical reports on Assembly elections provided by the Election Commission of India (ECI).[6] Since our preferred satellite data for night-time lights is from NASA's Visible Infrared Imaging Radiometer Suite Day/Night Band (explained in detail in Section 2.3), we are constrained in our choice of the sample period for elections. To accommodate the timeline of the VIIRS-DNB data which is available from 2012 to 2021, our sample period for elections is 2013–2017- i.e., we observe exactly one Assembly election per state in this period. We collect information on a number of electoral variables, including vote shares and party affiliation of the candidates, voter turnout rates, reservation status of the constituency, and the total number of contestants. We also collect information on candidate characteristics, including their assets, liabilities, education level, criminal record, age, and gender. Data for this comes from candidate affidavits submitted by contestants to the ECI.[7] This data then allows us to compute the key variables that we use in our analysis: the winning margin and the vote share of the third placed candidate.

Figure 1 presents the distribution and the means of some of the key variables that we use in our analysis. On average the winning margin is 12.5%, the vote share of the third placed candidate is 11.75% and there is significant overlap in the distribution of the winning margin and the vote share of the third placed candidate. The vote share of the top-3 candidates is on average 91.15%; the lower ranked candidates are, therefore, quantitatively considerably less important than the top-3 candidates.

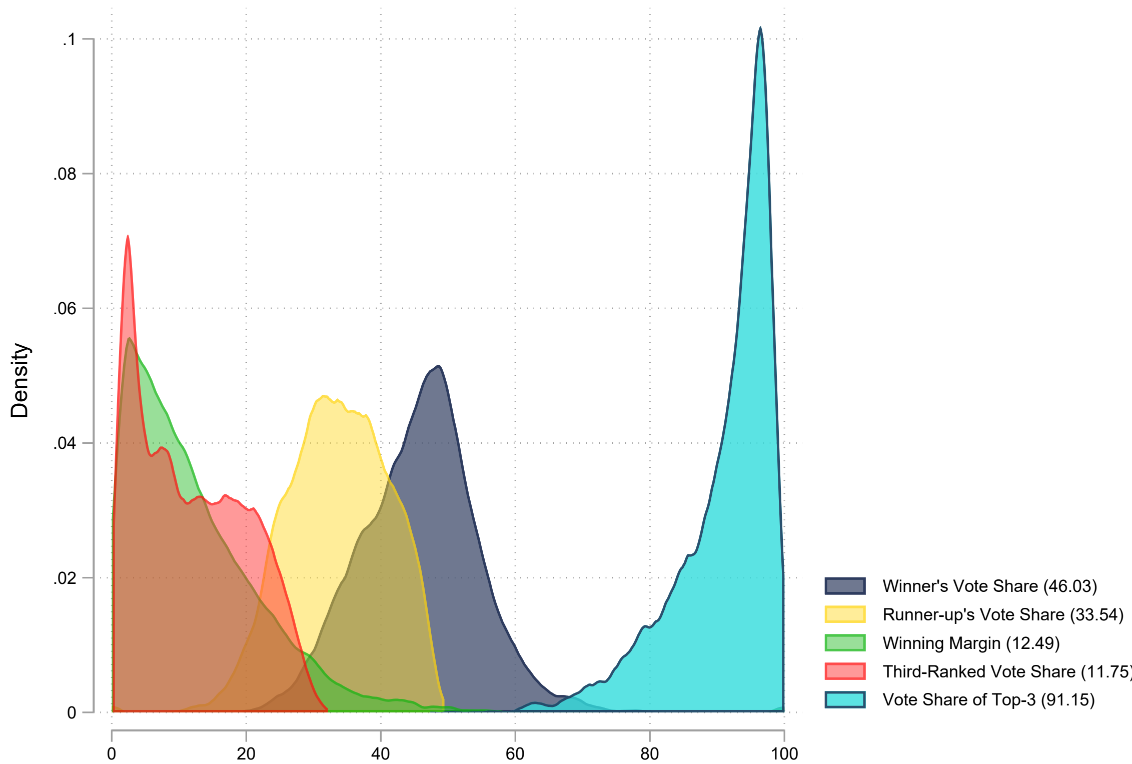
Panel A of Table C1 present summary statistics for the electoral data that we use in our analysis. The average constituency has around 206,000 voters and the average turn-out rate is 73% (voting in India is not compulsory). The average number of contestants in a constituency is 11 with 1 female candidate on average. The average vote share of the winners is 46% compared to the average vote share of 33.5% for the runner-up. There is considerable incumbency disadvantage with 36.7% of incumbents being re-elected in any particular election. On average winners have 2 terms of experience. 91% of winners are male; 56% of winners are from a national party and 38% are from state based parties.

It is also important to situate the distribution of the third-ranked candidates within the broader electoral setting considered in our analysis. In our sample, 2,028 (49.8%) con-

[6] We make use of the compiled elections dataset from Trivedi Centre for Political Data (TCPD), Ashoka University as well as the Socioeconomic High-Resolution Rural-Urban Geographic (SHRUG) data repository.

[7] The data on affidavits is compiled by the Association for Democratic Reforms (ADR) and the Socioeconomic High-Resolution Rural-Urban Geographic (SHRUG) data repository.

**Figure 1: Vote Share. Densities and Means**




**Notes:** Data from all assembly elections in the period 2013–2017 included. Vote share of the top-3 is given by $v_1 + v_2 + v_3$ where $v_i$ is the vote share of the candidate ranked $i : i = 1, 2, 3$. *Winning margin* is the vote share difference between the winner and the runner-up ($v_1 - v_2$). We present the sample mean for each variable in the parentheses.

stituencies had a *Relevant Third*, while 2,044 (50.1%) did not. Of the 2,028 constituencies that had a *Relevant Third*, 647 (31.9%) constituencies had a barely *Relevant Third* (i.e., $0 < v_3 - (v_1 - v_2) \leq 5$); while among the 2,044 constituencies without a *Relevant Third*, 668 (32.6%) were barely without a *Relevant Third* (i.e., $-5 < v_3 - (v_1 - v_2) \leq 0$).[8]

[8]Candidates can either stand as *independents* (those that contest the election without a political party affiliation) or be *party nominated*. In this case they can be nominated by a state based party (political party contesting elections in several states but being principally associated with one state), other state based party (a state based party that is contesting outside its principal state) a local party (a party that is limited to a particular state or a sub-region of a single state) or a national party (a party with a significant presence in different Legislative Assemblies (States) as well in the National Assembly). Finally voters have the option to vote for NOTA or none of the above. We use the party-type categorisation of the Trivedi Centre for Political Data (TCPD), Ashoka University. What *types* of candidates rank third in these elections and, in turn, become relevant (or non-relevant)? Figure C1 presents a descriptive picture of the third-ranked candidates (and their relevance) by their *type*. Candidates from national parties constitute

## 2.3 Nighttime Lights Data

Our measure of economic development at the assembly constituency level is growth in nighttime lights (nightlights). Nightlights are increasingly being used as a proxy for economic development when more standard data that capture economic conditions are unavailable. In our context, our unit of observation is the state assembly constituency and there is little data available at that level of disaggregation. We use data from NASA's Visible Infrared Imaging Radiometer Suite Day/Night Band (VIIRS-DNB), which has been reporting nighttime lights data from 2012 onwards.[9] We utilise the VIIRS-DNB data compiled under the SHRUG Data Project, which provides data disaggregated at the Assembly Constituency level for India for the period 2012–2021. Thus, for our sample period of elections, we observe nighttime lights for each constituency for the full electoral term of five years.[10]

Our primary variable of interest is *luminosity density*, defined as the sum of nighttime lights (pixel values) detected in a constituency in a year divided by the total area of the constituency. Panel B of Table C1 presents the descriptive statistics for the key outcome variable that we use. Excluding the election year, *luminosity density* grows by 4.4% in each year across the sample of constituencies. There is, however, considerable variation in the growth rate of luminosity density across constituencies.

## 2.4 Public Goods and Infrastructure Data

We also use the village-level data on a set of public goods and infrastructure from the Mission Antyodaya (henceforth MA) Facilities portal. MA is an initiative of the Government of India that surveyed nearly 650,000 villages across India to conduct gap analyses and provide inputs to participatory plans of village councils (Gram Panchayats or GPs),

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the largest proportion of third placed candidates/parties: 34% of the non-relevant thirds are from national parties while 35% are relevant. Candidates from state-based parties constitute 34.3% of the *Relevant Thirds* compared to 18% of the non-*Relevant Thirds*. On the other hand, the NOTA constitute 16.5% of the non-*Relevant Thirds* but only 2% of the *Relevant Thirds*.

[9] Much of the previous work in economics using nighttime lights has utilized data from an older U.S. Department of Defense's satellite, the Defense Meteorological Satellite Program (DMSP), that collected nighttime light emissions with the Operational Linescan System (OLS). The DMSP-OLS nighttime lights, while providing a much longer time-series for India (1992–2012), had several flaws which become important in its use as a viable proxy for economic activity. We utilize VIIRS-DNB (rather than DMSP-OLS) because of its ability to better detect low luminosity regions (better measurement of spatial variation) (Nordhaus and Chen, 2015), low sensitivity to blooming effects or spillovers (Gibson et al., 2021), and its ability to consistently produce NL data that maintains a positive NL-to-GDP elasticity (Baskaran et al., 2023).

[10] Table C2 provides a description of the state-wise timing of Assembly elections and the corresponding time period of nighttime lights considered in our main analysis.

the lowest level of government in the country.[11] All information as part of MA surveys is available at the village-level and we use the SHRUG repository to aggregate village-level data on facilities to the assembly constituency level. We use data on school availability, health facilities, market infrastructure, drainage/sanitation infrastructure, and electricity availability. We compute the proportion of villages in each assembly constituency that have the relevant public good. Panel C of Table C1 presents the average proportion of villages in each assembly constituency with each public good. While almost 45% of constituencies have a maternity centre, 91.3% have a primary school, 63% have a middle school and 39.8% have a high school, only 9.1% have closed drainage and 3.75% have a *mandi* (wholesale market).

## 2.5 Crimes Data

We are additionally interested in examining whether the presence of a *Relevant Third* generates a response from the winning candidate to uphold law and order in their constituency.

The Indian Constitution makes law and order, including crime prevention a state subject. This means that the state government is responsible for crimes within its jurisdiction. State governments are punished for poor performance in this sphere. While on the administrative side the responsibility for maintaining law and order is the responsibility of civil servants and bureaucrats, who are politically non-aligned, elected politicians can influence the administrative machinery.

We use data made available by National Crime Records Bureau (NCRB), as a part of their "Crime in India" reports. These reports provide data on the *First Information Reports* (or FIRs) filed with a particular police station in a given year under different Indian Penal Code (IPC) violations. For our analysis, we consider any recorded crime under IPC in a given year and aggregate the annual number of IPC offences to the district-level.[12] Thus, we have an annual district-level panel on total IPC crimes during the period 2014—2021, which is merged with our primary election data, which covers the period 2013—2017.

Panel D of Table C1 presents the summary statistics for district-level IPC crimes over the electoral term. On average, during the period 2014–2021, the average number of crimes

[11] See: https://missionantyodaya.nic.in/

[12] The NCRB publications are at the police jurisdiction level which, typically, subsume the whole district. We manually match each of these jurisdictions to their respective administrative districts as listed under the 2011 round of the Census. Additionally, from 2014 onwards, a number of Census-2011 districts have been broken down into several new districts. To maintain parity with other analysis, we match these new district names to their original counterparts that are listed in the Census.

reported is 5263 and the average number of crimes (per 1000 population) is 2.54. There are large variations across districts.

# 3 Empirical Strategy

We examine the impact of having a *Relevant Third* (candidate) on the level of economic development, proxied by growth in nighttime lights, in an electoral constituency. Essentially, we are interested in estimating the following equation:

$$GROWTH_{c,s,t+1} = \alpha + \beta Relevant\ Third_{c,s,t} + \varepsilon_{c,s,t+1} \tag{1}$$

where $GROWTH_{c,s,t+1} = \log(NL_{c,s,t+1}) - \log(NL_{c,s,t})$ is the annual growth rate in luminosity density measured as the difference in the natural log of nighttime luminosity density between the years $t$ and $t+1$, in constituency $c$ in state $s$. $Relevant\ Third_{c,s,t}$ is a binary variable indicating whether constituency $c$ in state $s$ in the election-year $t$ had a *Relevant Third* (candidate). Specifically:

$$Relevant\ Third_{c,s,t} = \begin{cases} 1 & \text{if } Third\ Margin > 0 \\ 0 & \text{if } Third\ Margin \leq 0 \end{cases} \tag{2}$$

*Third Margin* is defined as follows. Let $v_{icst}$ be the vote share of the candidate ranked $i; i = 1, 2, 3$ in constituency $c$ in state $s$ in year $t$. Then

$$Third\ Margin = (v_{3cst}) - (v_{1cst} - v_{2cst})$$

i.e., *Third Margin* is the difference between the vote share of the third placed candidate ($v_{3cst}$) and the winning margin ($v_{1cst} - v_{2cst}$). A positive value implies that the vote share of the winner is lower than the combined vote share of the second- and third-ranked candidates ($v_{2cst} + v_{3cst} \geq v_{1cst}$). A negative value, on the other hand, implies that the vote share of the winner is greater than the combined vote share of the second- and third-ranked candidates ($v_{2cst} + v_{3cst} < v_{1cst}$) and corresponds to the winner not facing a *threat of coalition from* the runner-up and the third-placed candidates.

Columns 1 and 2 of Table 1 present the OLS regression results corresponding to equation (1). Having a *Relevant Third* has significant implications for nightlight growth. The regression results in column 2 imply that having a *Relevant Third* is associated with a 0.27 percentage point higher growth in nightlights over the electoral term.

As a robustness exercise we also examine how our results compare to those that use other measures of political competition: *winning margin*, defined as the difference in vote shares between the winner and the runner up ($v_1 - v_2$) and the effective number of parties

**Table 1: Political Competition and Nightlights Growth. Using Alternative Measures of Political Competition**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Relevant Third* | 0.2944* | 0.268* | | | | |
| | (0.1537) | (0.1554) | | | | |
| *Winning Margin* | | | -0.0061 | 0.0025 | | |
| | | | (0.0057) | (0.0065) | | |
| *ENOP* | | | | | 0.0960 | 0.1478 |
| | | | | | (0.1076) | (0.1169) |
| State Fixed Effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Year Fixed Effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Controls | ✗ | ✓ | ✗ | ✓ | ✗ | ✓ |
| Observations | 14,564 | 14,184 | 14,564 | 14,184 | 14,436 | 14,068 |
| R-Squared | 0.42 | 0.43 | 0.42 | 0.43 | 0.42 | 0.43 |

**Notes:** Standard errors clustered at the Assembly constituency level presented in parentheses. All columns correspond to an OLS estimation with growth in luminosity density as the outcome (see Section 3). *Relevant Third* is a dummy variable = 1 if $v_3 - (v_1 - v_2) > 0$ and 0 otherwise, where $v_i, i = 1, 2, 3$ is the vote share of the $i^{th}$ ranked candidate in constituency $c$ in state $s$ in year $t$. *Winning Margin* is the difference in the vote share of the top-two candidates $(v_1 - v_2)$, and *ENOP* (effective number of parties) is calculated as $\frac{1}{\sum_j v_j^2}$ where $v_j$ is the vote share of the $j$-th candidate. The specifications in all columns control for state and year fixed effects. Columns 2, 4, and 6 additionally control for a set of candidate and constituency characteristics (the number of contestants, number of electors, reservation status of the constituency, gender of the winner, age of the winner, mean assets of the contestants, mean number of criminal cases against the contestants, and voter turnout). Significance: $^{***}p < 0.01$;$^{**}p < 0.05$;$^{*}p < 0.1$.

(*ENOP*, which is calculated as $\frac{1}{\sum_j v_j^2}$ where $v_j$ is the vote share of the $j$-th party). Both of these have been used extensively in any analysis of political competition. The higher is the *winning margin* and the lower is the *ENOP* the less competitive is the constituency.[13]

Irrespective of whether or not we control for other characteristics of the candidate and the constituency (number of contestants, number of electors, reservation status of the constituency, gender of the winner, mean asset of the contestants, mean number of criminal cases against the contestants and voter turnout), we see that neither of these more widely used measures of political competition is associated with an increase in the growth in luminosity density. See columns 3–6 of Table 1.

The basic story of increased political competition being associated with positive eco-

[13] *ENOP* gives the number of options or substitutes available to the voter. Political parties have to "work harder" to convince voters to vote for them. As a rule, competition is thus expected to increase in the number of parties.

nomic outcomes then holds for our new measure of political competition: the presence of a *Relevant Third*. The problem with estimating equation (1) arises from the fact that the presence of a *Relevant Third* in a constituency might not be random. Constituencies with a *Relevant Third* might differ systematically from constituencies without a *Relevant Third*. For instance, constituencies where the vote choice is ex-post concentrated toward a single candidate (i.e., when $Relevant\ Third = 0$) could reflect the collective preferences of the electorate, which could, in turn, be directly correlated with the level of local economic development. Similarly, constituencies where the winning candidate does not have a clear majority (i.e., when $Relevant\ Third = 1$) could possess anti-incumbency preferences, which could itself be an outcome of the level of economic development in the constituency.

To alleviate these concerns and estimate the causal impact of having a *Relevant Third* in the constituency on growth in nighttime lights, we employ a regression discontinuity (RD) design (Imbens and Lemieux, 2008). By definition, the probability that a constituency has a relevant third-placed candidate is a function of the difference between the third-placed candidate's vote share and the winning margin (i.e., the vote share difference between the winner and the runner-up). This probability has a discontinuous jump at the point where this difference is zero. That is, treatment assignment, whether a constituency has a relevant third-position candidate, (henceforth *Relevant Third*) is determined by the cut-off value, $d = 0$, of the forcing variable, *Third Margin*. Therefore, the rule for treatment assignment is completely described by equation (2). The crucial identifying assumption for this design is that no other variable faces a discontinuous jump at this cut-off. Thus, in a small neighbourhood of the cut-off, it is a reasonable assumption that the existence of a *Relevant Third* in a constituency is essentially random. In our setting, the RD design, therefore, compares constituencies that *barely* had a *Relevant Third* with constituencies that *barely* did not have a *Relevant Third*.

The regression specification (to estimate the causal impact of having a *Relevant Third* on prosperity) is given by:

$$GROWTH_{c,s,t+1} = \alpha + \beta Relevant\ Third_{c,s,t} + f(Third\ Margin_{c,s,t}) + \mu_{c,s,t+1} \tag{3}$$
$$\forall\, Third\ Margin_{c,s,t} \in (d-h, d+h)$$

where $GROWTH_{c,s,t+1}$ is the annual growth in luminosity density in the constituency, as defined earlier. $Relevant\ Third_{c,s,t}$ is the treatment variable, $Third\ Margin_{c,s,t}$ is the forcing variable, and $h$ is the bandwidth defined around the cut-off $d = 0$. The control function, $f(Third\ Margin_{c,s,t})$, is a polynomial of order $n$ in the forcing variable on each side of $d$. We estimate equation (3) employing a local linear regression method (Imbens and

Lemieux, 2008, Hahn et al., 2001). The optimal bandwidth ($h$) is computed using the Imbens and Kalyanaraman (2012) (IK) algorithm. We additionally report results using other bandwidths such as the CCT bandwidth (Calonico et al., 2014), half the IK-bandwidth ($h/2$), and double the IK-bandwidth ($2h$). We consider polynomials of degree 1 ($p = 1$) and degree 2 ($p = 2$).

# 4 Validity of the RD Design

In this section we conduct a series of tests to examine the validity of the RD design.

## 4.1 Continuity of the Forcing Variable

First, we conduct the McCrary (2008) density test for a discontinuity at the cut-off in the density of the forcing variable. In our context, this tests whether third-placed candidates whose vote shares are close to the winning margin become disproportionately 'relevant'- i.e., a disproportionate proportion of these candidates' vote share is barely above the cut-off. If this were the case, we would find a larger frequency of *Relevant Third* winners, compared to *Relevant Third* losers, in the neighbourhood of the cut-off. This would imply that the density of the margin of victory, the forcing variable, is discontinuous at the cut-off. Figure 2 shows that the density of the *Third Margin* (the forcing variable) below and above the cut-off is not statistically significantly different and the estimated size of the discontinuity in our running variable (log difference in height) is -0.004978 (SE = 0.11276), providing evidence against any manipulation at the threshold.

While immensely popular, the McCrary (2008) density test requires pre-binning of the data, which has been shown to be problematic in different circumstances (see for example Cattaneo and Titiunik, 2022). To address this potential issue, we conduct two alternative density (based) tests (Cattaneo et al., 2020, Bugni and Canay, 2021), which are presented in Panel A of Table 2.[14] Using both tests, we find that the discontinuity estimate of our running variable at the threshold is statistically not significant, providing stronger evidence against any manipulation at the cut-off.

[14]A graphical analogue of the Cattaneo et al. (2020) density test is presented in Figure C2 in the Appendix.

## Table 2: RD Validity Tests

**Panel A: Alternative Continuity Tests**

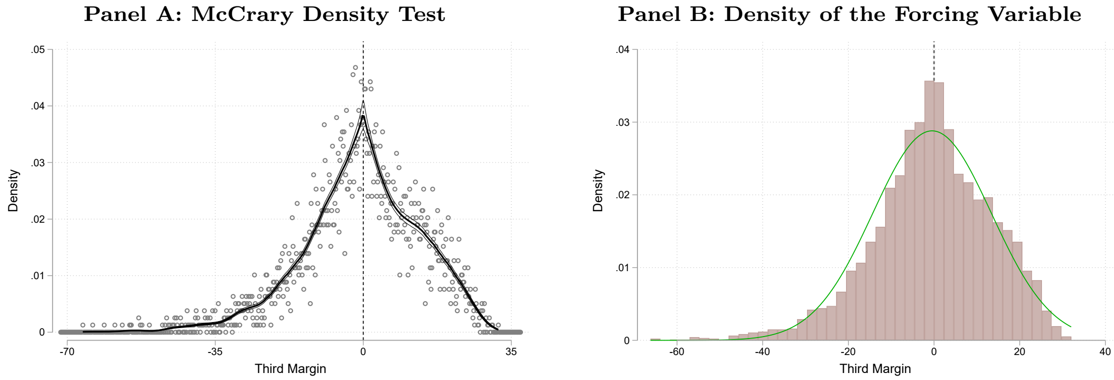
| **Method** | $N_h$ | $p$**-value** |
|---|---|---|
| Bugni and Canay (2021) | 138 | 0.799 |
| Cattaneo et al. (2020) | 1689 | 0.778 |

**Panel B: Approximate Permutation Test (Canay and Kamat, 2018)**

| **Measures in** $t-1$ | $N_q$ | $p$**-value** |
|---|---|---|
| Relevant Third $(t-1)$ | 89 | 0.556 |
| Third Margin $(t-1)$ | 85 | 0.446 |
| NL Growth (previous year) | 93 | 0.314 |
| Log(Electorate Size) $(t-1)$ | 91 | 0.907 |
| Voter Turnout $(t-1)$ | 91 | 0.246 |
| SC/ST Reserved | 93 | 0.343 |
| BJP Winner $(t-1)$ | 90 | 0.482 |
| INC Winner $(t-1)$ | 91 | 0.241 |
| BJP Runner-up $(t-1)$ | 91 | 1.000 |
| INC Runner-up $(t-1)$ | 91 | 0.275 |
| Male Winner $(t-1)$ | 91 | 1.000 |
| Criminally Accused Winner $(t-1)$ | 89 | 0.616 |
| Number of contestants $(t-1)$ | 93 | 0.883 |

**Notes:** Panel A presents the results from the density tests developed by Bugni and Canay (2021) and Cattaneo et al. (2020), where $N_h$ represents the effective number of observations within the optimally selected bandwidth. A graphicalanalog of the Cattaneo et al. (2020) density test is presented in Figure C2. In Panel B, we employ the approximate permutation test à la Canay and Kamat (2018), where $N_q$ is the effective number of observations in the optimally selected window, $q$, around the cut-off (zero).

**Figure 2: Continuity of the Forcing Variable**




**Notes:** The figure shows the continuity of the forcing variable, which is defined as the difference between the vote share of the third placed candidate and the winning margin. A positive value of *Third Margin* indicates that the vote share of the third-position candidate is higher than the winning margin (i.e., *Relevant Third* = 1). On the other hand, a negative value implies that the third-position candidate has a vote share lower than the winning margin. The estimated size of the discontinuity in our running variable, *Third Margin*, (log difference in height) is -0.004978 (SE = 0.11276).

## 4.2 Balance on Pre-Determined Characteristics

Next, we examine whether pre-determined constituency-level characteristics exhibit a discontinuity at the cut-off. A key identifying assumption of our RD design is that no other pre-determined variable, apart from the treatment, should exhibit a discontinuous jump at the cut-off of our running variable. To verify the validity of this assumption, we estimate equation (3) using a set of pre-determined constituency- and candidate-level characteristics from the previous election ($t-1$) as outcome variables. Of particular interest are the following variables: the previous election's third margin (running variable at $t-1$), whether the constituency had a *Relevant Third* in the previous election, and the growth in nighttime lights in the year leading up to the current election. The first two variables allow us to investigate potential contamination of our RD design from the fact that some constituencies may systematically have (close) *Relevant Thirds* in every election. We should ideally not observe any discontinuous jump in the previous year's nightlight growth at the current running variable's threshold. A discontinuity in prior growth would imply that any effects we observe on post-election nighttime lights growth are driven by a pre-treatment divergence in nighttime light trends between constituencies with and without a *Relevant Third*. We also consider the previous election's electorate size, turnout rate, reservation status, number of contestants, winner's party affiliation, winner's, winner's net assets, and winner's criminal record. The RD estimates are presented in Table 3.[15] We do not find a significant jump at the cut-off for the probability that a constituency had a *Relevant Third* in the previous election, as well as the *Third Margin* in the previous election. There is no evidence of a statistically significant difference in the growth in nighttime lights in the year leading up to the election-year around the cut-off. The RD estimate is never statistically significant, i.e., there is no discontinuous jump in any of the other pre-determined constituency and candidate level characteristics.

The recent literature (see Canay and Kamat, 2018) suggests employing a permutation-based test, which compares the empirical cumulative density function of pre-determined covariates on both sides of the cut-off. This method has the advantage of being asymptotically valid for small $n$ in the optimally selected neighbourhood, and is additionally able to detect a discontinuity in situations where features of a covariate's distribution other than the mean are discontinuous at the threshold. The results from this method, using the same set of covariates considered in Table 3, are presented in Panel B of Table 2. We continue to find no evidence of a discontinuity in any of the candidate and constituency-level baseline characteristics. This provides us with further confidence in the validity of our empirical strategy.

## 4.3 External Validity

We next address two related concerns with respect to the external validity of our empirical framework. In particular, we examine (1) whether the close third-ranked candidates are geographically concentrated; and (2) whether the observations lying in a small neighbourhood around the cut-off of our running variable are concentrated within a narrow range of political circumstances (vote share of the third ranked candidate and the winning margin).

Panels A and B of Figure 3 present the geographic spread of constituencies with a *Relevant Third* and the geographical spread of constituencies with and without a barely *Relevant Third*. There is no evidence of geographic clustering and constituencies with a *Relevant Third* and with and without a barely *Relevant Third*, are spread out across the country.

For our empirical strategy to be valid, the closely relevant (and non-relevant) third-

[15]Figure C3 in the Appendix presents a graphical analogue of this Table. In none of the panels, do we find a discontinuous jump in any of the pre-determined constituency- or candidate-level characteristics. A balance test for these characteristics based on a simple mean-comparison test is presented in Table C3 in the Appendix. While the mean differences are statistically significant in several cases in the full sample (see columns 1–3), none of the differences are statistically significant in the bandwidth of 5% (i.e., the vote share of the third placed candidate is within 5% of the winning margin).

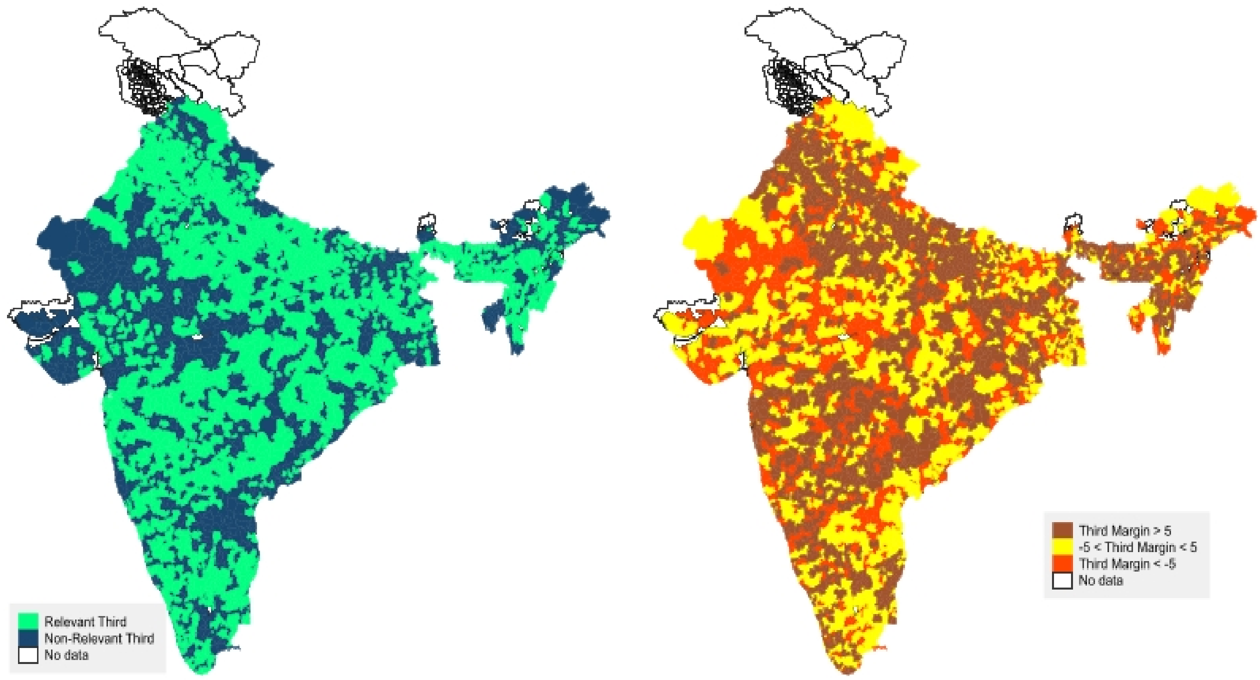
## Table 3: Balance Test: RD Estimates

| Variable | RD Estimate | IK($h$) | $N_h$ | $p$-value |
|---|---|---|---|---|
| Relevant Third ($t-1$) | -0.091<br>(0.073) | 2.83 | 783 | 0.225 |
| Third Margin ($t-1$) | -1.519<br>(1.319) | 5.59 | 1,395 | 0.250 |
| NL Growth ($t-1$) | 2.841<br>(1.879) | 5.11 | 1,340 | 0.131 |
| Log(Electorate Size) ($t-1$) | -0.034<br>(0.091) | 2.98 | 831 | 0.703 |
| Turnout ($t-1$) | 0.663<br>(1.271) | 5.78 | 1,437 | 0.602 |
| SC/ST Reserved | -0.069<br>(0.077) | 1.96 | 589 | 0.358 |
| BJP Winner ($t-1$) | -0.051<br>(0.064) | 2.75 | 764 | 0.417 |
| INC Winner ($t-1$) | 0.068<br>(0.065) | 2.70 | 750 | 0.300 |
| BJP Runner-up ($t-1$) | -0.001<br>(0.053) | 2.62 | 733 | 0.984 |
| INC Runner-up ($t-1$) | -0.104<br>(0.076) | 2.46 | 696 | 0.167 |
| Male Winner ($t-1$) | -0.015<br>(0.045) | 2.50 | 703 | 0.722 |
| Criminal Winner ($t-1$) | -0.065<br>(0.076) | 2.39 | 654 | 0.395 |
| Number of Contestants ($t-1$) | -0.360<br>(0.553) | 5.43 | 1,374 | 0.515 |

**Notes:** The table presents the RD estimates for pre-determined constituency-level characteristics estimated for the optimal bandwidth ($h$) employing the bandwidth selection procedure of Imbens and Kalyanaraman (2012), and a triangular kernel.

## Figure 3: External Validity

**Panel A: Geographic Concentration of Relevant Thirds** **Panel B: Geographic Concentration of Third Margin**



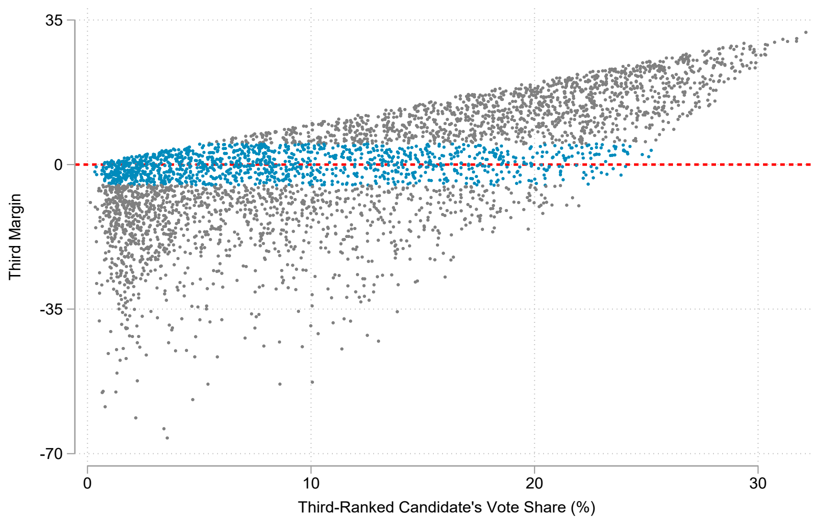

**Notes:** In Panel A, we present a map of constituencies colored-coded by a binary variable indicating whether there is a relevant third-ranked candidate. In particular, 49.8% of the constituencies have a relevant third-ranked candidate, while 50.2% are without one. In Panel B, we plot 3 intervals of the running variable, *Third Margin*, which is defined as the third-ranked candidate's vote share minus the winning margin. The red-colorued areas in Panel B represent constituencies where the third-ranked candidate was barely relevant or barely not relevant (i.e., within 5 percentage of the winning margin) — those that essentially comprise our RD sample.

ranked candidates should be representative of a broad range of political circumstances. Panel A of Figure 4 presents a scatter plot of the third-placed candidate's vote share against the Third margin. It shows that the barely relevant and the barely not relevant thirds are observed across a wide-range of vote shares of the third-ranked candidate. In particular, in the constituencies where the third-ranked candidate was within 5% of the winning margin (i.e., close), the vote share of the third-ranked candidate varies considerably, from 0.33% to 25.22%. Thus, the occurrence of a third-ranked candidate with vote share close to the winning margin is representative of a wide range of voter preferences towards the third-ranked candidates.

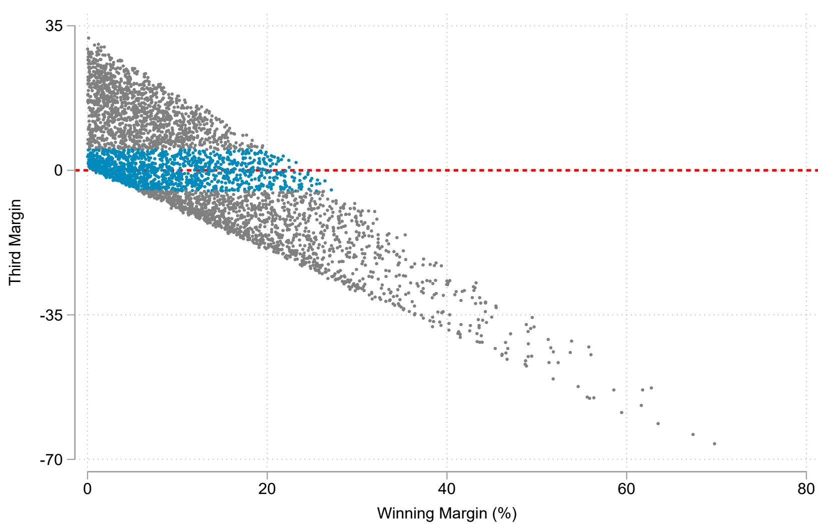
In Panel B of Figure 4, we present a scatter plot of the third margin on the winning margin. Again 'close' third-ranked candidates are observed across a range of winning margins, ranging from 0.009% to 27.14%.

# Figure 4: Third Margin and Vote Share of Third-Ranked Candidate

**Panel A: Third Margin and Vote Share of the Third-Ranked Candidate**




**Panel B: Third Margin and Winning Margin**




**Notes:** In Panel A, we present a scatter plot of the third-ranked candidate's vote share against *Third Margin*, which is defined as the third-ranked candidate's vote share minus the winning margin; Panel B presents a scatter plot of the winning margin against *Third Margin*. The highlighted regions in both panels represent constituencies where the third-ranked candidate's vote share was within 5 percentage points of the winning margin, in either direction. The unit of analysis is an Assembly constituency.

# 5 Effect of *Relevant Third* on Economic Growth

In this section, we present results from estimating equation (3) using a local linear regression technique with different bandwidths. Our primary outcome variable is *luminosity density* (defined as the total sum of nighttime lights detected within the boundaries of a constituency in a year, divided by the total area of the constituency). The growth rate of luminosity density is defined as the difference in the natural logarithm of luminosity density between the current and the previous year. For our main specification, we take the year-on-year (annual) growth rate over the election term, exclusing the election year. We exclude the election year as the effects in the year of the election could be potentially driven by the elected candidate from the previous term. We, thus, have four observations per constituency in the main specification. This also helps us examine within term heterogeneity of effects. In addition to the full electoral term, we break the electoral term into two sub-samples: (*i*) first half of the electoral term (years $t+1$ and $t+2$), and (*ii*) second half of the electoral term (years $t+3$ and $t+4$), where $t$ is the election year. Owing to the asynchronous electoral calendars across states, and by extension, varying time periods of nighttime lights by state, we control for year fixed effects in all specifications.

## 5.1 Main Results

Table 4 presents our main results. These are presented in Column 1. In columns 2–4, we examine the robustness of the results to alternative bandwidths and bandwidth selection procedures employing a local linear regression ($p = 1$). Finally, in column 5, we present estimates using a second order local polynomial smoothing function ($p = 2$) to examine the sensitivity of our main estimates to the choice of functional form. Panel A presents the results for the full election term (years $t+1 \longrightarrow t+4$); Panel B presents the corresponding results for the first half of the election term (years $t+1$ and $t+2$) while Panel C presents the results for the second half of the election term (years $t+3$ and $t+4$).

Across the full electoral term (Panel A), we find a weak positive effect of a *Relevant Third* on nighttime lights. A comparison of the results presented in Panels B and C imply that the (overall) positive effects are driven by the significantly higher growth in luminosity in the second half of the electoral term. In the second half of the term, constituencies with a barely*Relevant Third* experience 1.2–3.5 percentage points higher growth rate in nighttime lights compared to constituencies where the third placed candidate is *barely* not relevant.

Figure 5 presents a graphical analogue of the results reported in Table 4. Consistent with the regression results, the figures show a discontinuous jump in the growth of nighttime

**Table 4: Effect of a *Relevant Third* on Growth of Nightlights**

| | $p = 1$ | | | | $p = 2$ |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| **Panel A: Full Electoral Term** | | | | | |
| *Relevant Third* | 1.209* | 1.029 | 2.294** | 0.748 | 2.002** |
| | (0.719) | (0.639) | (0.945) | (0.551) | (1.013) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 4.97 | 6.59 | 2.49 | 9.94 | 4.97 |
| Observations | 4620 | 5840 | 2592 | 8004 | 4620 |
| **Panel B: First-Half of the Electoral Term** | | | | | |
| *Relevant Third* | 0.208 | 0.190 | 0.081 | -0.202 | 0.015 |
| | (1.000) | (0.892) | (1.354) | (0.758) | (1.416) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 6.41 | 8.56 | 3.21 | 12.82 | 6.41 |
| Observations | 2860 | 3564 | 1610 | 4778 | 2860 |
| **Panel C: Second-Half of the Electoral Term** | | | | | |
| *Relevant Third* | 2.081** | 1.718** | 3.257*** | 1.182* | 3.543*** |
| | (0.872) | (0.796) | (1.177) | (0.690) | (1.248) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.73 | 7.34 | 2.87 | 11.47 | 5.73 |
| Observations | 2604 | 3160 | 1468 | 4406 | 2604 |

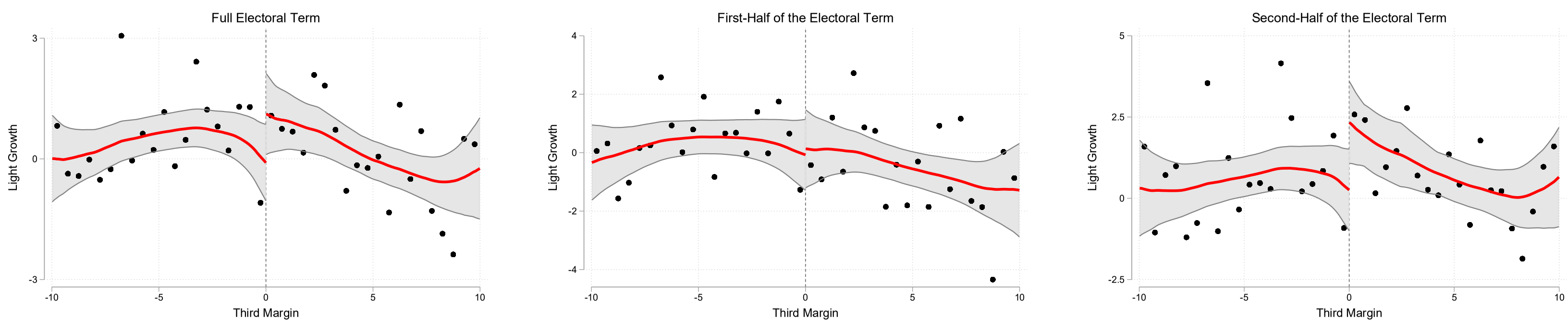
**Notes:** Local linear RD regression ($p = 1$) results presented in Columns 1–4. Column 5 presents results for a local quadratic RD regression ($p = 2$) using a triangular kernel using the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parentheses. In each column, the outcome variable is the annual growth in luminosity density (net of year fixed-effects) as defined in Section 3. Panel A: sample of annual growth rate in the full electoral term ($t+1$ to $t+4$); Panel B: annual growth rate in the first half of the term ($t+1$ and $t+2$); Panel C: annual growth rate in the second half of the term ($t+3$ and $t+4$). Significance: $^{***}p < 0.01$;$^{**}\, p < 0.05$;$^{*}\, p < 0.1$.

lights at the cut-off (i.e., $Third\ Margin = 0$) and the effects are particularly strong in the second half of the electoral term (Panel C).

There are no statistically significant effects of having a *Relevant Third* on nightlights in years $t + 1$ and $t + 2$, i.e., the first half of the electoral term. This is not surprising given that affecting economic outcomes (prosperity) takes time and hence any effects of actions undertaken to increase economic outcomes would possibly show up with a delay. Additionally, this shows that the improvements in nightlights are driven by the actions of

# Figure 5: Impact of a *Relevant Third* on Growth of Nightlights

**Panel A: Full Electoral Term** **Panel B: First-Half of the Electoral Term** **Panel C: Second-Half of the Electoral Term**




**Notes:** The figure plots the annual growth in luminosity density (net of year fixed effects) against the running variable, *Third Margin*. A positive value of the running variable implies that the vote share of the third-ranked candidate is higher than the winning margin; a negative value implies the winning margin is higher than the vote share of the third-position candidate. Each dot in the figure depicts the averages over successive bins of 0.5% of the running variable. The curves are local linear regression (with 95% confidence intervals) fit separately for the positive and negative parts of the cut-off.

the incumbent, and are not a product of the actions of the previously elected representative.

Using estimates of elasticity of GDP to nighttime lights we can compute the effect in terms of actual GDP growth (see Bickenbach et al., 2016, Baskaran et al., 2023). Based on a nighttime lights-to-GDP elasticity of 0.10, and using luminosity density as our primary outcome, we find that having a relevant third-placed candidate increases the regional GDP growth by 0.1 to 0.3 percentage points. The growth rate of India in the sample period, 2012–2021, averaged around 5.5% per year. The results presented in Table 4 indicate that the growth premium from having a *Relevant Third* was between 1.8 and 5.5%.[16]

## 5.2 Robustness Exercises

We examine the robustness of the results presented in the preceding section. We briefly summarize our results here and the details are presented in Appendix D. *First*, we examine the saliency of the cut-off of zero that we have used (i.e., $v_3 = v_1 - v_2$) by re-estimating our main specification (equation (3)) using placebo (alternative) thresholds. Specifically, we estimate the treatment effect at placebo cut-offs in increments of 5 percentage points either side of zero. With the exception of zero cut-off, the RD estimates are never statistically statistically significant (see Figure D1). *Second*, we examine how the estimates evolve with incremental changes in the optimal bandwidth. In Figure D2 in Appendix D, we present different point estimates (and the 90% confidence intervals) by varying the bandwidth between 0.1 and 2 of the optimal bandwidth in increments of 0.1. The patterns are fairly stable showing a steady decline in the estimated effect, as $h$ increases. *Third*, to address the concern that what we are estimating is the effect of a winner not being able to secure a majority vote share compared to a winner who wins by a majority instead of actually capturing the impact of having a *Relevant Third* vis-à-vis not having one in the constituency. We estimate a variant of our primary estimating equation (equation (3)) but with a new running variable $Majority\ Winner = 1$ if $v_1 > 50$, and 0 otherwise. The regression results are presented in Table D1 in Appendix D. We do not observe a significant difference in nighttime lights growth between constituencies where the winner *barely* secured a majority vote share relative to constituencies where the winner *barely* missed out on a majority. *Finally*, we examine whether candidates ranked lower than the third position matter? To examine this question, we estimate equation (3) using two alternative running variables: (*i*) $Fourth\ Margin = v_4 - (v_1 - v_2)$, and (*ii*) $Fifth\ Margin = v_5 - (v_1 - v_2)$; where $v_i$ is the

[16] This is calculated as follows. We calculate the proportion of average annual GDP growth rate explained by our estimates, i.e., estimated GDP growth as a result of a relevant third-ranked candidate (0.11–0.32%) divided by the average annual GDP growth rate in the country (5.5%).

vote share of the $i$-th ranked candidate. Table D2 in Appendix D presents the results from this estimation exercise. There is no statistically impact of a *relevant fourth* or a *relevant fifth* across the electoral term.

## 5.3 Heterogeneity Analysis

The impact of a *Relevant Third* on economic development may vary by the characteristics of the winner (party affiliation and alignment), the political/institutional environment of the state where the constituency is located the gender of the winner and the margins (of the winner and the runner-up). We conduct heterogeneity analyses along a number of different dimensions. We briefly summarize the results here and details are presented in Appendix E.

*First*, we examine whether the effects observed in Section 5.1 exhibit any heterogeneity based on political alignment of the winning candidate vis-à-vis the party in power at the state level i.e., aligned vs non-aligned winner. Table E1 presents the results from estimating equation (3) for the two sub-samples: ($a$) politically aligned winners and ($b$) politically non-aligned winners. We find that the effect is more pronounced and statistically significant for the set of constituencies that elect an aligned candidate, as compared to non-aligned winners.

*Second*, we consider heterogeneous treatment effects based on the local political and economic environment. We divide our sample into BIMAROU and non-BIMAROU states, and estimate equation (3) separately for the two sub-samples.[17] Table E2 in Appendix E reports the results separately for the BIMAROU and non-BIMAROU states (columns 6–10). We find that the effects are significantly larger in BIMAROU states compared to non-BIMAROU states and statistically significant only in the former.

*Third*, we examine whether the gender of the incumbent matter? Do male and female incumbents perform differently when they face a threat of collusion, i.e., when they are elected from a constituency with a *Relevant Third*. Table E3 in Appendix E resents the RD estimates of a *Relevant Third* on the growth of nightlights in male vs female incumbent constituencies. We find that the positive effects on prosperity that we observed in Table 4 are driven by constituencies with a male incumbent.

[17]BIMAROU is an acronym used to denote the group of states of Bihar, Madhya Pradesh, Rajasthan, Odisha and Uttar Pradesh. Bihar, Madhya Pradesh and Uttar Pradesh were sub-divided into Bihar and Jharkhand, Madhya Pradesh and Chhattisgarh and Uttar Pradesh and Uttarakhand. We include Jharkhand, Chhattisgarh and Uttarakhand as part of the BIMAROU states. These are considered to traditionally have weaker institutions. Heterogeneity of political economy outcomes by BIMAROU states have been commonly studied in the Indian context. See Prakash et al. (2019), Drèze and Sen (2013).

*Finally*, we examine what a *Relevant Third* mean in the context of overall electoral outcomes and how does that affect the decisions of the incumbent? Specifically we investigate how different margins affect post-electoral outcomes: we consider heterogeneity with respect to the winning margin $(v_1 - v_2)$, the runner-up margin $(v_2 - v_3)$ and the ratio of winning/runner-up margin $((v_1 - v_2)/(v_2 - v_3))$. The estimating regression is given by equation (3). The RD estimates are presented in Table E4 in Appendix E. For the full electoral term and in the second half of the electoral term the presence of a *Relevant Third* has a statistically significant effect on the growth of nightlights if winning margin is in the intermediate rate i.e., $v_1 - v_2 \in (0.025, 0.10)$. That the effects are not statistically significant when the winning margin is large is not surprising. Next, we find that the RD estimates are statistically significant when the runner-up margin is large enough $(v_2 - v_3 \geq 0.2)$. Finally, the RD estimates are statistically significant when the incumbent/runner-up margin ratio is small $((v_1 - v_2)/(v_2 - v_3) \leq 0.3)$.

# 6 Credibility of the Threat of Coalition

The premise of our paper relies on the hypothesis that the presence of a *Relevant Third* poses a coalitional threat to the winner. Since this threat negatively affects the probability of re-election, it forces the incumbent to deliver. However, this argument stands on the credibility of the threat of a potential coalition (between the runner-up and the third-ranked candidate). Given the complex political landscape of India, where political parties and actors have, in the past, formed electoral coalitions even with ideologically opposed blocks, it is difficult to directly estimate the probability of coalition formation. We, therefore, examine the credibility of potential coalitional threat using two alternative approaches.

## 6.1 Falsification Analysis: Third-placed candidate NOTA

*First*, we take advantage of the ballot option 'None of the Above' or NOTA, and we divide our sample into the following two sub-samples: $(i)$ when the ballot option 'None of the Above' (NOTA) receives the third-highest vote share, i.e., NOTA is ranked third in the constituency, and $(ii)$ when a contesting candidate – either party affiliated or independent – is ranked third in the election. Ever since its introduction in 2013, NOTA has been widely recognised as a pure protest vote option in the Indian electoral space, though without any (actual) impact on the final electoral outcomes (see Ujhelyi et al., 2021). In our setting, NOTA being ranked third in an election could not possibly correspond to a credible threat (of coalition formation) to the incumbent. Thus, a sub-sample analysis with NOTA as the third-placed candidate serves as a falsification exercise to ascertain whether the effects that we have observed are indeed driven by a *plausible* threat of collusion between the runner-up and third-placed candidate. Table 5 presents the results from this estimation exercise. The dependent variable is again the growth of luminosity density over the full electoral term (Panel A) or separately in the first and second halves of the electoral term (Panels B and C respectively). In Columns 1–5 we find that the results for the sub-sample of non-NOTA third-ranked candidates are almost identical to the full sample estimates presented in Table 4. On the other hand, for the sub-sample of constituencies where NOTA is ranked third in the election (columns 6–10), the results are statistically never statistically significant, i.e., there is no effect of having a *Relevant Third*. This lends confidence to our hypothesis that the observed effects are indeed a result of a (credible) possible coalitional threat.

## 6.2 Ideological Credibility of the Coalitional Threat

*Second*, we create two sub-samples from our sample constituencies based on the ideological compatibility of the second- and third-placed candidates. While historically, small parties have often formed electoral coalitions with large parties irrespective of their ideological position, these coalitions have almost exclusively centred around two major national parties, the Bharatiya Janata Party (BJP) and the Indian National Congress (INC). The BJP and the INC have been major political opponents for decades, and have, since the idependence of the country, formed central governments either as leaders of a major coalition bloc or on their own at different points of time. Our second approach to examining the credibility of coalitional threats relies on the hypothesis that it is unlikely that the BJP and the INC would ever form a coalition. We run our main specification for two sub-samples: (*i*) *Ideologically Non-Credible Coalitions*, which are defined as constituencies where the runner-up and the third-placed candidate are affiliated to the BJP and INC (irrespective of the order); and (*ii*) *Ideologically Credible Coalitions*, defined as constituencies where the runner-up and the third position is secured by any other combination of parties barring the BJP–INC pair. The regression results are presented in Table 6.[18] Columns 1–5 present the results for credible coalitions while columns 6–10 present the results for non-credible coalitions. For the sub-sample of constituencies with an ideologically credible coalitional threat, the effects are largely similar to the full sample results, though the estimates a more imprecise (see Panel A). The effects are largely positive and statistically significant

[18] Figure B8 present these results graphically and these figures corroborate the results presented in Table 6.

## Table 5: Impact of a *Relevant Third* on Growth of Nightlights: Falsification

| | Non-NOTA Third Candidate | | | | | NOTA Third Candidate | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $p=1$ | | | | $p=2$ | $p=1$ | | | | $p=2$ |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| **Panel A: Full Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 1.509** | 1.159* | 2.676*** | 0.890 | 2.544** | -3.578 | -4.691 | -2.727 | -2.848 | -4.454 |
| | (0.765) | (0.668) | (1.020) | (0.578) | (1.083) | (2.933) | (3.054) | (3.040) | (2.754) | (3.357) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 4.64 | 6.35 | 2.32 | 9.27 | 4.64 | 4.40 | 3.21 | 2.20 | 8.79 | 4.40 |
| Observations | 3916 | 5112 | 2156 | 6884 | 3916 | 404 | 336 | 248 | 668 | 404 |
| p–value (NOTA − Non-NOTA) | | | | | | *0.094* | *0.062* | *0.094* | *0.187* | *0.047* |
| **Panel B: First-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 0.138 | 0.087 | 0.273 | -0.281 | 0.204 | -1.131 | -4.431 | -4.515 | -1.409 | -4.251 |
| | (1.045) | (0.915) | (1.427) | (0.792) | (1.489) | (3.472) | (3.738) | (3.714) | (3.224) | (3.979) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 6.53 | 9.12 | 3.26 | 13.06 | 6.53 | 5.71 | 2.94 | 2.85 | 11.42 | 5.71 |
| Observations | 2622 | 3384 | 1458 | 4400 | 2622 | 258 | 152 | 150 | 404 | 258 |
| p–value (NOTA − Non-NOTA) | | | | | | *0.727* | *0.241* | *0.231* | *0.736* | *0.294* |
| **Panel C: Second-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 2.439*** | 2.070** | 3.872*** | 1.415** | 4.205*** | -5.310 | -5.518 | -1.202 | -4.248 | -2.705 |
| | (0.930) | (0.864) | (1.243) | (0.713) | (1.309) | (4.183) | (4.261) | (3.850) | (3.854) | (4.461) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.56 | 6.64 | 2.78 | 11.13 | 5.56 | 3.70 | 3.24 | 1.85 | 7.41 | 3.70 |
| Observations | 2306 | 2640 | 1280 | 3924 | 2306 | 184 | 170 | 108 | 302 | 184 |
| p–value (NOTA − Non-NOTA) | | | | | | *0.071* | *0.081* | *0.212* | *0.151* | *0.176* |

**Notes:** Local linear RD regression ($p = 1$) results presented in Columns 1–4 and 6–9. Columns 5 and 10 present results for a local quadratic RD regression ($p = 2$) using a triangular kernel using the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parentheses. Across all panels, columns 1–5 correspond to the sub-sample where NOTA does not rank third, while columns 6–10 report results for constituencies where NOTA was ranked third at the polls. In each column, the outcome variable is the annual growth in luminosity density (net of year fixed-effects) as defined in Section 3. Panel A: sample of annual growth rate in the full electoral term ($t + 1$ to $t + 4$); Panel B: annual growth rate in the first half of the term ($t + 1$ and $t + 2$); Panel B: annual growth rate in the second half of the term ($t + 3$ and $t + 4$). The p-values for equality of coefficients across the two sub-samples (NOTA vs Non-NOTA Thirds) using a Wald $\chi^2$ test presented in italics. Significance: $^{***}p < 0.01$;$^{**}p < 0.05$;$^{*}p < 0.1$.

for the second half of the electoral term (Panel C). On the other hand, for the sub-sample of constituencies where coalition threat is non-credible, we find that the effects are muted across the full electoral term, compared to the sub-sample of credible coalitions (Panel A). However, we find that, in the first-half of the electoral term, there is a weak negative effect on the growth of nighttime lights (Panel B).

# 7 Theoretical Model

In this section, we provide a stylized model that elucidates a likely channel through which the presence of a *Relevant Third* leads to higher investment in public goods. We posit that the voters whose first preference is the party that has come third engage in strategic voting to support either the leading party or the runner-up in the next round of elections. The leader who is the incumbent in the current round invests in public goods in order to attract the members of the *Relevant Third*. However, the incumbent also has to encounter the possibility that due to events beyond its control, the voters in the *Relevant Third* group may be all inclined to vote for the runner-up: we call this the threat of opposing coalition. The threat of coalition depends on relative preference between the incumbent and runner-up among the members of the *Relevant Third*.

Our model leads to three main results on the extent of investment in public good by the incumbent. *First*, there is a discontinuous increase in investment only if the third has enough support to affect the outcome. *Second*, in a weak sense this jump in investment is decreasing in the vote share of the incumbent. *Third*, this jump larger if the third is more closely aligned with the runner-up than with the incumbent.

Our model connects the intrinsic support of each party to the change in investment due to the pivotality of the third party. The model is presented with only three parties for parsimony of exposition. When there are three parties ranked by their support, the third can affect the outcome if and only if the leader falls short of simple majority (50% of the total support). The existence of a *Relevant Third* is determined simply by a vote share threshold of the incumbent. This allows us to express our intuition in terms of simple conditions.

## 7.1 Set-up

Assume that there are three parties $1, 2$ and $3$ competing in elections. Let the policy space be the unit interval $[0, 1]$ and the position of party $i$ be $x_i \in [0, 1]$. These positions are fixed: assume that these the inherited ideological positions of the parties. Without loss

## Table 6: Impact of a *Relevant Third* on Growth of Nightligts: Ideological Credibility of the Coalitional Threat

| | Credible Coalitions | | | | | Non-Credible Coalitions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $p=1$ | | | | $p=2$ | $p=1$ | | | | $p=2$ |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| **Panel A: Full Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 1.173 | 0.986 | 2.126** | 0.859 | 1.752* | -0.433 | 0.420 | 2.131 | -1.449 | 2.353 |
| | (0.738) | (0.611) | (0.967) | (0.573) | (1.037) | (1.740) | (1.996) | (2.418) | (1.303) | (2.601) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.20 | 8.64 | 2.60 | 10.40 | 5.20 | 7.57 | 5.95 | 3.79 | 15.15 | 7.57 |
| Observations | 4388 | 6496 | 2468 | 7448 | 4388 | 588 | 472 | 320 | 1036 | 588 |
| p–value (Credible − Non-Credible) | | | | | | *0.396* | *0.786* | *0.998* | *0.105* | *0.829* |
| **Panel B: First-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 0.463 | 0.451 | 0.133 | 0.137 | -0.088 | -4.245* | -4.300* | -1.129 | -3.357* | -0.804 |
| | (1.065) | (0.897) | (1.431) | (0.811) | (1.501) | (2.288) | (2.261) | (2.906) | (1.798) | (3.184) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 6.30 | 9.79 | 3.15 | 12.60 | 6.30 | 8.60 | 8.94 | 4.30 | 17.19 | 8.60 |
| Observations | 2574 | 3576 | 1462 | 4254 | 2574 | 330 | 340 | 176 | 574 | 330 |
| p–value (Credible − Non-Credible) | | | | | | *0.064* | *0.051* | *0.698* | *0.076* | *0.838* |
| **Panel C: Second-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 1.885** | 1.437* | 2.998** | 1.137 | 3.236** | 3.929 | 3.863 | 5.343 | 1.178 | 6.341* |
| | (0.901) | (0.784) | (1.217) | (0.720) | (1.292) | (2.702) | (2.681) | (3.627) | (2.083) | (3.762) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.92 | 8.93 | 2.96 | 11.84 | 5.92 | 5.88 | 5.97 | 2.94 | 11.75 | 5.88 |
| Observations | 2456 | 3310 | 1402 | 4076 | 2456 | 230 | 238 | 120 | 440 | 230 |
| p–value (Credible − Non-Credible) | | | | | | *0.473* | *0.386* | *0.541* | *0.985* | *0.436* |

**Notes:** Local linear RD regression ($p = 1$) results presented in Columns 1–4 and 6–9. Columns 5 and 10 present results for a local quadratic RD regression ($p = 2$) using a triangular kernel using the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parantheses. Across all panels, Columns 1–5 correspond to a sub-sample of constituencies where the BJP and the INC were *not* ranked second and third together, while columns 6–10 report results for constituencies where the BJP and the INC ranked second and third together (in whichever order). In each column, the outcome variable is the annual growth in luminosity density (net of year fixed-effects) as defined in Section 3. Panel A: sample of annual growth rate in the full electoral term ($t+1$ to $t+4$); Panel B: annual growth rate in the first half of the term ($t+1$ and $t+2$); Panel B: annual growth rate in the second half of the term ($t+3$ and $t+4$). The p-values for equality of coefficients across the two sub-samples (Credible vs Non-Credible Coalitions) using a Wald $\chi^2$ test presented in italics. Significance: $^{***}p < 0.01$;$^{**}p < 0.05$;$^{*}p < 0.1$.

of generality, we assume that $0 < x_1 < x_2 < x_3 < 1$, i.e., Party 1 is the left-party, Party 2 is the moderate party and Party 3 is the right party. In a particular constituency, the distribution of ideal voter points is $F$. Assume that it has full support. We denote

$$\begin{aligned} \frac{x_1 + x_2}{2} &= a \\ \frac{x_3 + x_2}{2} &= b \\ \frac{x_1 + x_3}{2} &= c \end{aligned}$$

Clearly $a < c < b$. The utility of an agent with location $x$ from party $i$ is assumed to be $-|x - x_i| + y_i$, where $y_i^t$ is the amount of public good provided by party $i$ in Round $t$ election.

The timeline of our game is as follows. First, we have Round 0 elections. In this election, each party promises an amount $y_i^0 = y^e$. We think of this amount $y^e$ as the "norm" which all parties are expected to provide. Voting is sincere in Round 0 elections. The outcome of Round 0 elections is the vote share $V_i$ for each party $i$, given by

$$\begin{aligned} V_1 &= F(a) \\ V_3 &= 1 - F(b) \\ V_2 &= F(b) - F(a) \end{aligned}$$

The winner in Round 0 is the party with the highest vote share, i.e., $w \in \arg\max_i \{V_i, i = 1, 2, 3\}$. We hold the party locations $\{x_1, x_2, x_3\}$ fixed and let $F$ vary so that we may vary the vote share profile and have different winners for Round 0 as different cases in our model. In any case, $w \in \{1, 2, 3\}$, the winner in Round 0 elections is the incumbent in Round 1. The incumbent makes an investment $y_w$ in public goods in period 1, which is observed by voters. Finally, we have Round 1 elections. In Round 1 elections, voters base their expectation of $y_i^1$ on the following rule: unless a party is observed to implement a different amount, they assume that it would stick to the norm $y^e$. Formally,

$$y_i^1 = \begin{cases} y_w & if \quad i = w \\ y^e & if \quad i \neq w. \end{cases}$$

Thus, the advantage of being the incumbent in period 1 is the ability to unilaterally influence voter expectations, in the next election. We write $y_w^1 = y^e + y$, where $y$ is interpreted as the change in the norm of public goods investment. We restrict ourselves to $y \geq 0$, i.e., the expectation is always updated upward.

For the sake of simplicity, we normalize $y^e$ to 0. Thus, we have

$$y_i^1 = \begin{cases} y & if \quad i = w \\ 0 & if \quad i \neq w. \end{cases}$$

We focus on the observed investment choice $y$ of the incumbent in period 1 as a function of the Round 0 vote shares $\{V_1, V_2, V_3\}$. This investment is chosen to maximize the probability of winning in Round 1 elections. We assume that the per unit cost of investment is $k$ and the gain from winning power in Round 1 election is $W$. We assume that $k < \frac{W}{C}$, i.e., $k$ is "small enough", where $\frac{1}{C}$ is a measure of the effectiveness of public goods investment in attracting votes. This assumption allows a "corner solution", i.e., if the incumbent decides to invest, it finds it optimal to raise the investment to guarantee a win in Round 1 elections.

We shall henceforth refer to voters with ideal points in $[0, a]$ as Type 1, those with ideal points in $(a, b)$ as Type 2 and agents with ideal points in $[b, 1]$ as Type 3.

At this point, it is important to define when the third party is relevant in the Round 1 elections.

**Definition 1 (Relevant Third)** *Let the vote shares of parties $\{i, j, k\}$ in the Round 0 election be $V_i, V_j$ and $V_k$. Assume that $V_i \geq V_j > V_k$. We say that party $k$ is the **Relevant Third** if $V_i < \frac{1}{2}$.*

To interpret Definition 1, notice that the third party in Round 0 is a threat to the frontrunner if all or some of its members by voting for the second party in the Round 1 election switches the outcome in favour of the second party. In other words, the the third party is relevant in political competition only if

$$V_k + V_j > V_i \Rightarrow V_k > V_i - V_j,$$

i.e., the vote share of the third party is larger than the margin between the frontrunner and runner-up. When there are only three parties, we have $V_i + V_j + V_k = 1$, the above condition reduces to $V_i < \frac{1}{2}$.

We shall consider different cases, with different locational orders of the incumbent, runner up and the third party. Investment in public goods by the incumbent is aimed at attracting the votes of the members of the group that came third. When the moderate party is the *Relevant Third*, the challenge for the incumbent is to secure the vote of the median voter who belongs to the third party. On the other hand, when one of the extreme parties is the relevant third, then all members of the third party have the same preference between the incumbent and runner-up. Then the objective of investment in public goods by the incumbent is to prevent all members of the third party from forming a coalition with the runner-up. Clearly, greater investment is needed when the runner-up is preferred over the incumbent (this is the case when moderate party is the runner up) than when the incumbent is preferred over the runner up (this is the case when the moderate party is the incumbent).

We shall discuss the nature of political competition in Round 1 elections once we have set up the first of these cases.

## 7.2 Moderate Third

Assume that $V_1 > V_3 > V_2$. In other words, Party 1 (the left party) is the incumbent and Party 3 (the right party) is the challenger in Round 1 elections, while Party 2 (the moderate party) is third. This might be the case in a very polarized electorate where the voters are concentrated at either end.

The incumbent now chooses $y \geq 0$ to maximize their probability of winning in Round 1 elections. We wish to capture the intuition that the incumbent uses public goods to attract votes from the third group provided it is pivotal. In order to model this in a simple way, we assume that voters in the incumbent group (group 1) and the challenger group (group 3) commit to vote for their respective parties. On the other hand, voters in the third group (group 2) engages in strategic voting: each voter in that group chooses to vote for one of the two leading parties so that their vote does not go waste.

Consider a voter $j$ with ideal point $x_j$ in Group 2. The utility of the voter from voting for Party 1 is $-|x_j - x_1| + y$, and the utility from voting for Party 3 is $-|x_j - x_3|$.

In addition, we assume that there is a common valence shock $\delta$. This is measured as relative utility of voting for the incumbent party (Party 1) against the runner up (Party 3) while engaging in strategic voting. We model this as a random variable uniformly distributed over $\left[-\frac{C}{2}, \frac{C}{2}\right]$ for some $C > 0$. This shock could be arising from any random event before the elections that could make all agents lean towards either the incumbents or the challenger, but one that cannot be accounted for by the incumbent at the investment stage.

$C$ is an important parameter of the model. A large $C$ means that the valence shock may have a large impact on voting decision. Notice that a large valence shock in favour of the runner-up makes *all* members of the third party more prone to voting for the runner-up. One can therefore consider $C$ as a measure of the threat of coalition formation between the challenger and the third group. Alternatively, $\frac{1}{C}$ is a measure of the effectiveness of investment in public goods in drawing voters from the relevant third group.

Thus, $x_j \in (a, b)$ prefers to vote for 1 if

$$x_1 - x_j + y + \delta > x_j - x_3 \Rightarrow c + \frac{y}{2} + \frac{\delta}{2} > x_j \tag{4}$$

Since everyone in group 1 votes for Party 1 and those in group 3 votes for Party 3, vote share for Party 1 in the Round 1 election is

$$V_1'(y) = \max\{V_1, F(c + \frac{y}{2} + \frac{\delta}{2})\}$$

Party 1 wins if $V_1'(y) > \frac{1}{2}$, since all votes are shared between Parties 1 and 2.

Probability of winning for Party 1 is $(P(y))$, which is given by

$$\Pr\left[\max\{V_1, F(c + \frac{y}{2} + \frac{\delta}{2})\} > \frac{1}{2}\right]$$

Party 1 chooses $y \geq 0$ to maximize $WP(y) - ky$. Recall that $k < \frac{W}{C}$, i.e., $k$ is ”small enough”, which allows a ”corner solution”.

Our first proposition (Proposition 1) states the optimal investment for the case with an extreme incumbent and an extreme challenger, with the third party is in the middle.

**Proposition 1** *Let $V_1 > V_3 > V_2$. If $V_1 > \frac{1}{2}$, then the optimal investment is $y^* = 0$. If $V_1 \leq \frac{1}{2}$, then the optimal investment is given by*

$$y^* = \max\left\{0, \frac{C}{2} - 2(c - x_m)\right\},$$

*where $x_m$ is the ideal point of the median voter.*

The Proof of the proposition is presented in the Appendix.

Proposition 1 states that there is additional investment by the incumbent only if the third party is relevant. When the third party is relevant, there is positive additional investment in public goods if either $(i)$ the median voter prefers the challenger to the incumbent ($x_m > c$), or $(ii)$ the threat of coalition formation is large enough.

To understand this result, notice that the Round 1 election is a binary contest between the incumbent (Party 1) and the challenger (Party 3). As in any model where voters are ranked on the basis of their ideal points, the challenge for the incumbent is to win the vote of the median voter (who we denote by $x_m$). When $V_1 > \frac{1}{2}$, i.e., the third party is not relevant, $x_m < a$, and the median voter has the incumbent as the most preferred party. Therefore, no additional investment is necessary to win her vote.

If, on the other hand, the third party is relevant, i.e., $V_1 \leq \frac{1}{2}$, we must have $a < x_m < b$. Since the median voter belongs to the relevant third, she votes for either Party 1 or Party

3 based on the location of her ideal point, the amount of additional public good provided by the incumbent and the valence shock. To ensure victory, the incumbent has to invest enough so that that the median voter votes in his favour irrespective of the valence shock. This amount is obtained by setting $\delta = -\frac{C}{2}$ and $x_j = x_m$ in condition (4), which gives us

$$y_m = \frac{C}{2} - 2(c - x_m)$$

Since both the marginal benefit and marginal cost of additional investment $y$ is constant, we have a corner solution. The assumption that the marginal cost is small enough allows us to have $y^* = y_m$. Therefore, the optimal investment ensures that the incumbent wins with probability 1.[19]

In our model, we take the location of each party as given. The vote share profile $(V_1, V_2, V_3)$ is a function of the distribution of voter preferences $F$ (and so is $x_m$). Proposition 1 indicates the extent of investment for a given $F$.

Now we turn to comparative statics: suppose that $F$ shifts right in a First Order Stochastic Dominance sense so that $x_m$ moves right, and therefore, $V_1$ goes down. The next result discusses how the investment in public goods depends on the vote share of the incumbent.

**Corollary 1** *Assume that $V_1$ goes down due to a rightward FOSD shift of $F$, while still retaining $V_1 > V_2 > V_3$. There is some threshold $V_0 \leq \frac{1}{2}$ such that $y^* = 0$ as long as $V_1 > V_0$; and $y^*$ is positive and decreasing in $V_1$ for $V_1 < V_0$. Moreover, $V_0 = \frac{1}{2}$ if $C \geq x_3 - x_2$ and $V_0 < \frac{1}{2}$ otherwise.*

The first part of Corollary 1 says that if the winner's vote share (and its lead over the runner-up) shrinks below a threshold, it must invest progressively higher amounts in public goods. In this sense, investment in public goods strictly increases with competition. Moreover, this threshold cannot be higher than the majority mark, implying that there is investment *only if* the third party is relevant. The second part tells us that if the threat of coalition is large enough, this threshold is precisely the majority mark. In other words, under a large enough coalitional threat there is investment *if and only if* the third party is relevant.

It is important to connect Corollary 1 to our empirical findings. We can think of different constituencies having different distributions of voter preference but the party positions are

[19]The result that the incumbent wins the Round 1 election surely is an artifact of the assumption of linear cost of investment. This is, of course, a simplification. However, our main focus is that there is a jump in investment at $V_1 = \frac{1}{2}$. This result will not change if we have an interior solution for $y^*$.

constant across constituencies. Our empirical finding is that the average constituency with a *Relevant Third* has higher public goods than the average constituency where the third party is not relevant. The first part of Corollary 1 corresponds to this result. Recall that $y^*$ in our model is the additional investment in public goods over the norm $y^e$. The first part of Corollary 1 says that some constituencies with a *Relevant Third* will have a positive $y^*$ while others may not. Provided there is sufficient variation in $F$, the *average* constituency with a relevant third is expected to have positive $y^*$. On the other hand constituencies where the third party is not relevant must have $y^* = 0$.

The second part provides a stronger result. If the threat of coalition is above a threshold, then *any* constituency with a *Relevant Third* will have $y^* > 0$ and any constituency where the third party is not relevant will have $y^* = 0$. Therefore, for any pair of constituencies with the feature that the third party is relevant in one and not the other, the former will have higher public goods than the latter.

When the *Relevant Third* is the moderate party, the incumbent uses investment to win over the median voter (who belongs to the third party). We have seen that the investment depends on the relative preference of the median voter between the incumbent and challenger. Now, we study the case where the third party is extreme. Here, all members of the third group have the same preference between the incumbent and runner-up, and the objective of the investment is to prevent a coalition between the third party and the runner up. Again, this is easier if the incumbent is the moderate party: then all members of the third party prefer the incumbent over the runner up in absence of the investment. On the other hand, if the moderate party is the runner-up and the incumbent is the other extreme from the third party, then preventing members of the third party from voting for the runner-up requires a large investment. We study these two cases separately.

## 7.3 Moderate Incumbent

Now, we consider a distribution of preferences $F$ such that the winner in the first round of elections is the moderate party. This might be the case if the distribution of ideal points is bell-shaped. In this case, we will consider the left party as the third and the right party as the runner-up in Round 0 elections. In other words, $F$ is such that

$$V_2 > V_3 > V_1$$

We again assume that group 2 and group 3 voters vote for their respective parties and only group 1 voters engage in strategic voting. By the same logic as before, if $V_2 > \frac{1}{2}$, then no investment is necessary. Therefore, we restrict ourselves to $V_2 \leq \frac{1}{2}$.

Thus, $x_j \in [0, a]$ prefers to vote for Party 2 instead of 3 if

$$x_j - x_2 + y + \delta > x_j - x_3 \Rightarrow \delta > -(x_3 - x_2) - y$$

Therefore, the only possibility why voters in group 1 might vote for Party 3 is a large negative common shock. In this case, all voters in group 3 vote for group 1, i.e., the only threat is that of coalition formation. Thus, for any given $y$, the probability $P(y)$ of party 1 winning in Round 1 election is

$$\begin{aligned} & \Pr[\delta > -(x_3 - x_2) - y] \\ = \ & \min\left\{\frac{1}{2} + \frac{1}{C}[(x_3 - x_2) + y], 1\right\} \end{aligned}$$

The next proposition (Proposition 2) then provides the optimal investment for the case with moderate incumbent. We skip the proof as it is straightforward.

**Proposition 2** *Let the distribution of voter ideal points $F$ be such that $V_2 > V_3 > V_1$. If $V_2 > \frac{1}{2}$, i.e., there is no Relevant Third, then $y = 0$. If $V_2 \leq \frac{1}{2}$, i.e., there is a Relevant Third, then the optimal investment $y^*$ is given by*

$$y^* = \begin{cases} 0 & if \quad C \leq 2(x_3 - x_2) \\ \frac{C}{2} - (x_3 - x_2) & if \quad C > 2(x_3 - x_2) \end{cases}$$

**Corollary 2** *If the incumbent is moderate and the third party is relevant, $y^* > 0$ if and only if the threat of coalition is large enough. As long as the third party is relevant, the investment is not sensitive to vote shares in Round 0 elections.*

Notice that in this case, investment happens only to counter the threat of formation of a coalition with the runner up. This is why $y^*$ is not sensitive to vote shares. Moreover, if the coalitional threat is small, there is no investment even if the third party is relevant. Thus, our empirical result relies on the coalitional threat being above a threshold. On the other hand, if the condition holds, we have larger investment in any constituency with a relevant third over any constituency where the third party is not relevant.

## 7.4 Moderate runner-up

If the party that came second in Round 0 elections is the moderate one and the first and third are at the two extremes, then all members of the third party prefer the runner up over the incumbent in absence of investment. The investment has to be large enough to overturn this ranking, and in addition, to counter the possibility of a valence shock in favour of the runner up.

We now assume that the incumbent is the left party and the relevant third is the right party. Thus, $F$ is such that Round 0 vote shares are $V_1 > V_2 > V_3$. This might be the case if the density of ideal points is single-peaked, with the peak sufficiently to the left.

We again assume that in Round 1 elections, group 1 and group 2 voters vote for their respective parties and only group 3 voters engage in strategic voting. By the same logic as before, if $V_1 > \frac{1}{2}$, then no investment is necessary. Then, we consider $V_1 \leq \frac{1}{2}$. Thus, $x_j \in [b, 1]$ prefers to vote for 1 instead of 2 if

$$x_1 - x_j + y + \delta > x_2 - x_j \Rightarrow \delta > (x_2 - x_1) - y$$

For any given $y$, the probability $P(y)$ of Party 1 winning in Round 1 election is

$$\begin{aligned} & \Pr\left[\delta > (x_2 - x_1) - y\right] \\ = \; & \frac{1}{2} + \frac{1}{C}y - \frac{1}{C}(x_2 - x_1) \end{aligned}$$

The next proposition provides the optimal investment in this regime.

**Proposition 3** *Let the distribution of voter ideal points $F$ be such that $V_1 > V_2 > V_3$. If $V_1 > \frac{1}{2}$, i.e., there is no Relevant Third, then $y^* = 0$. If $V_1 \leq \frac{1}{2}$, i.e., there is a Relevant Third, then the optimal investment $y^*$ is strictly positive for any $C$. It is given by $y^* = \frac{C}{2} + (x_2 - x_1)$*

Since the coalitional threat is already "large", we now do not need the additional condition on $C$ for investment to be positive. In this case, whenever we compare a pair of constituencies differing on relevance of the third party, we will find higher investment in the one with relevant third.

Before concluding this section, we provide a few insights about the role of coalitional threat that hold across the three above regimes.

## 7.5 Role of coalitional threat

In our model, there are two distinct reasons why the relevant third might vote for the runner-up. *First*, the runner-up may have a favourable valence shock, making all members of the *Relevant Third* more prone to voting against the incumbent. The size of $C$ is a measure of how large this shock may be, and therefore is a measure of coalitional threat. The following Remark (Remark 1) shows that, across the different regimes, the investment is an increasing function of $C$. The remark follows from comparing Propositions 1, 2 and 3.

**Remark 1** *For any $F$, there if some threshold $C_0$ such that the optimal investment $y^*$ is $0$ if $C \leq C_0$ and positive and strictly increasing in $C$ if $C > C_0$.*

The second source of coalitional threat lies in the distribution of voter preferences $F$ which determines the relative preference of the members of the third group between the incumbent and the runner-up (in absence of the investment). The share of third group members who prefer the runner-up to the incumbent is a measure of coalitional threat arising from $F$, and as the next remark illustrates, the optimal investment is monotonic in this share. This is manifested in the locational order of the incumbent, runner-up and the third party. When the incumbent is moderate, all members of the third group prefer the incumbent and optimal $y^*$ is low. When the runner-up is moderate, all members of the third group prefer the runner-up over the incumbent and correspondingly, the optimal $y^*$ is the highest. When the third party is moderate, some prefer the incumbent and some prefer the challenger, and the value of $y^*$ also lies between the two extreme cases.

**Remark 2** *Let $F_A$, $F_B$ and $F_C$ be three distributions of ideal points inducing moderate runner-up, moderate third and moderate incumbent respectively. Also assume that the incumbent vote share is less than half, i.e., the third party is relevant in each case. Fix $C$, and denote the corresponding optimal investments by $y^*_A, y^*_B$ and $y^*_C$. Then, $y^*_A > y^*_B \geq y^*_C$.*

# 8 Mechanisms

Before proceeding further, let us briefly summarise the key results thus far. Our RD estimates show that having a *Relevant Third* in a constituency, indicative of greater political competition because the incumbent faces a threat of collusion, results in higher growth in nighttime lights. Additionally, we find that investments in constituency development are significantly higher only when the coalitional threat posed by the *Relevant Third* is indeed a credible one (see Section 6). In this section we examine whether there is any truth to the argument that there is greater investment in constituencies with a *Relevant Third*. We consider investment along two dimensions: investment in public goods and (possible) investment in law and order and security that results in a reduction in crime. These two pathways also serve as mediating channels (mechanisms) to explain our key results.

## 8.1 Provision of Public Goods

Our primary data source for the estimation with respect to public goods is the Mission Antyodaya (MA) 2020 data on village-level facilities (see Section 2.4). For this analysis, we construct a cross-sectional data of constituencies where the outcome variables are measured in 2020. Thus we consider the electoral cycle 2015–2019, i.e., the elected representative holds office in 2019 for each constituency.[20] Each variable corresponding to a particular village-level public good is measured as the proportion of villages in a constituency having access to that good.[21] The set of public goods that we consider are (*a*) drainage infrastructure (closed drains, uncovered drains and open *kuchha* drains); (*b*) market infrastructure (*mandi* or wholesale market, regular market, weekly *haat* or local/informal market); (*c*) electricity supply (to micro, small and medium enterprises or MSMEs and solar/wind electricity for households); (*d*) public health infrastructure (Primary health centres, community health centres and maternity health centres); (*e*) school availability (primary school, middle school, high school and senior secondary school). We also construct an index using a principle component analysis for the set of variables corresponding to the different public goods. The regression results are presented in Table 7. We present the results corresponding to the optimal bandwidth using the Imbens and Kalyanaraman (2012) approach.[22]

The RD estimates show that having a *Relevant Third* in a constituency results in a significantly higher proportion of villages within the constituency having access to public goods. The proportion of villages with closed drainage is 12 percentage points higher, while the proportion of villages with uncovered drainage is 9.2 percentage points lower in constituencies with a *Relevant Third* (columns 1 and 2 respectively). The proportion of villages with a community health centre is higher by a statistically significant 5 percentage points (column 5). While the proportion of villages that have a primary health centre or a maternity health centre are higher by 1.45 percentage points and 5 percentage points respectively, these effects are not statistically significant (columns 4 and 6 respectively).

Constituencies with a *Relevant Third* have better market infrastructure: the proportion of villages with a wholesale market (or *mandi*) is higher by 2.2 percentage points (column 7) and the proportion of villages with a regular market is higher by 6.1 percentage points (column 8). While the proportion of villages with a local/informal market (weekly *haat*) this effect is not statistically significant (column 9). Constituencies with a *Relevant Third* have more schools. The proportion of villages with a primary school, a middle school, a

[20]Due to the asynchronous nature of the Legislative Assembly elections, in some states, the leaders would have had the full electoral term to affect the availability of facilities, while in some states, the leaders would have had just one year for the provision of these facilities. Therefore, we also control for election-year fixed effects in our regressions and find that our results vis-à-vis MA public facilities continue to hold.

[21]Each variable is multiplied by 100 for ease of interpretation.

[22]Results for alternative bandwidths and alternative ways of computing the bandwidth are available on request.

## Table 7: Effect of a *Relevant Third* on Provision of Public Goods in the Constituency

| | Drainage Infrastructure | | | Market Infrastructure | | | Electricity Supply | |
|---|---|---|---|---|---|---|---|---|
| | Closed Drains | Uncovered Drains | Open *Kuchha* Drains | Mandi | Regular Market | Weekly *Haat* | Supply to MSMEs | Solar/Wind Electricity for Households |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Relevant Third* | 12.289*** | -9.211*** | -0.655 | 2.227* | 6.118** | 1.470 | 10.206*** | 11.425*** |
| | (3.492) | (3.357) | (2.222) | (1.311) | (2.708) | (2.315) | (3.483) | (3.812) |
| Bandwidth Size ($h$) | 4.95 | 6.29 | 8.29 | 6.40 | 6.66 | 8.61 | 5.78 | 4.47 |
| Observations | 626 | 753 | 922 | 767 | 780 | 954 | 706 | 561 |

| | Public Health Infrastructure | | | Availability of Schools | | | | Index of |
|---|---|---|---|---|---|---|---|---|
| | Primary Health Centres | Community Health Centres | Maternity Centres | Primary School | Middle School | High School | Senior Secondary School | **Public Goods** |
| | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| *Relevant Third* | 1.446 | 4.947** | 5.075 | 2.535 | 5.685** | 4.022 | 3.096 | 0.785*** |
| | (1.256) | (2.233) | (3.355) | (1.724) | (2.685) | (2.803) | (2.531) | (0.283) |
| Bandwidth Size ($h$) | 6.77 | 5.65 | 7.79 | 7.26 | 6.90 | 7.28 | 8.39 | 2.52 |
| Observations | 789 | 695 | 888 | 837 | 801 | 837 | 933 | 351 |

**Notes:** Local linear RD regression ($p = 1$) results presented. Standard errors clustered at the Assembly constituency level presented in parenthesis. Significance: $^{***}p < 0.01$;$^{**}p < 0.05$;$^{*}p < 0.1$. Optimal bandwidth computed using the Imbens and Kalyanaraman (2012) technique. Results for alternative bandwidths and alternative ways of computing the bandwidth are available on request.
**Outcome variables:** proportion of villages in the constituency with closed drainage system (column 1); uncovered drainage system (column 2); open *kuchha* drainage system (column 3); at least one *mandi* or wholesale market (column 4); at least one regular market (column 5); at least one weekly *haat* (column 6); proportion of MSMEs in the villages within a constituency having access to electricity (column 7); proportion of villages in the constituency having access to solar/wind electricity (column 8); having at least one primary (column 9), community (column 10) and maternity (column 11) health centre; having at least one primary (column 12), middle (column 13), high (column 14) and senior secondary school (column 15). In column 16 the outcome variable is an index of public goods.

high school and a senior secondary school are all higher in constituencies with a *Relevant Third*; the effect is however only statistically significant for availability of middle schools (5.7 percentage points higher in constituencies with a *Relevant Third*).

Constituencies with a *Relevant Third* have more villages with electricity available for MSMEs and wind and solar electricity for households. Finally the presence of a *Relevant Third* candidate is associated with a 0.8 standard deviations higher overall availability of public goods. These results therefore support the argument that elected representatives from constituencies with a *Relevant Third* are able to improve the broad economic conditions in their constituencies.

## 8.2 Effects on Crime

Our second channel we consider is the effect of political competition on crime. The crime data made available by the NCRB is, however, only available at the district level, which is higher than the constituency level — constituencies are nested within districts. Therefore, we aggregate up our constituency level treatment variables to the district level to determine the causal impact of *Relevant Third*. So the main treatment variable becomes the district level fraction of constituencies with a *Relevant Third*.[23]

We use an IV approach to account for the potential endogeneity of the fraction of constituencies in a district that have a *Relevant Third*: we cannot rule out the possibility of time-varying district specific unobserved characteristics being correlated with both crime and competitiveness. For example, some unforeseen event might make the district more competitive and also reduce reported crime. If such district level factors change over time that can make the treatment variable endogenous. More details of the estimation methodology adopted in this case is presented in Appendix B.

Table 8 presents the OLS and the 2SLS regression results. Across the OLS and 2SLS estimations, we find a significant negative impact of *Relevant Thirds* in a district on the total number of crimes reported during the electoral term. The results remain robust to the addition of state-specific year fixed effects and state fixed effects, and to using different bandwidths to define a close relevant third-ranked candidate. In Panel B, we alternatively use the total number of crimes weighted by the population of the district as the outcome. We continue to find statistically significant negative results across different specifications.

[23]See Clots-Figueras (2012), Bhalotra and Clots-Figueras (2014), Bhalotra et al. (2014), Lahoti and Sahoo (2020), Prakash et al. (2022), Bhalotra et al. (2021), Anukriti et al. (2022), Jain et al. (2023), Baskaran et al. (2023) for more on this approach to examine the effect of different characteristics of politicians on a range of different outcomes in the context of India.

# Table 8: Impact of a *Relevant Third* on Crimes

| | OLS | | | | 2SLS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| **Panel A: Total IPC Crimes** | | | | | | | | | | | |
| Fraction of Constiuencies with a Relevant Third in the District | -32.437*** | -22.634*** | -34.335*** | -22.633*** | -97.499*** | -78.219*** | -99.035*** | -78.219*** | -71.785*** | -46.389*** | -34.318*** |
| | (8.983) | (6.530) | (9.021) | (6.539) | (17.055) | (14.633) | (16.896) | (14.633) | (18.165) | (10.686) | (9.895) |
| KP F-Stat (First-Stage) | . | . | . | . | 320.014 | 332.322 | 321.887 | 331.360 | 170.735 | 390.420 | 423.747 |
| Bandwidth | . | . | . | . | 5 | 5 | 5 | 5 | 2.5 | 7 | 10 |
| Mean of Dep. Variable | 5263.469 | 5263.469 | 5263.469 | 5263.469 | 5263.469 | 5263.469 | 5263.469 | 5263.469 | 5263.469 | 5263.469 | 5263.469 |
| Number of Observations | 2480 | 2480 | 2480 | 2480 | 2480 | 2480 | 2480 | 2480 | 2480 | 2480 | 2480 |
| **Panel B: Crimes per 10,000 Population** | | | | | | | | | | | |
| Fraction of Constiuencies with a Relevant Third in the District | -0.122*** | -0.057*** | -0.125*** | -0.057*** | -0.151** | -0.094** | -0.152*** | -0.094** | -0.158** | -0.083** | -0.085** |
| | (0.035) | (0.021) | (0.035) | (0.021) | (0.058) | (0.041) | (0.058) | (0.041) | (0.064) | (0.033) | (0.034) |
| KP F-Stat (First-Stage) | . | . | . | . | 320.01 | 332.32 | 321.89 | 331.36 | 170.735 | 390.420 | 423.747 |
| Bandwidth | . | . | . | . | 5 | 5 | 5 | 5 | 2.5 | 7 | 10 |
| Mean of Dep. Variable | 25.434 | 25.434 | 25.434 | 25.434 | 25.434 | 25.434 | 25.434 | 25.434 | | | |
| Number of Observations | 2468 | 2468 | 2468 | 2468 | 2468 | 2468 | 2468 | 2468 | 2468 | 2468 | 2468 |
| State Fixed Effects | ✗ | ✓ | ✗ | ✓ | ✗ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ |
| Year Fixed Effects | ✗ | ✗ | ✓ | ✓ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Notes:** OLS and 2SLS estimates presented. Standard errors clustered at the district level presented in parantheses. For the 2SLS estimation, we use a linear function of *Third Margin.*

In particular, we find that a 10 percentage points increase in the fraction of *Relevant Thirds* in the district leads to a 3.2–6.2% reduction in the average incidence of crimes (per 10,000 population) during the district's electoral term.

# 9 Electoral Outcomes

Improvement in economic outcomes, induced by the presence of a *Relevant Third*, is implicitly mediated by a shock to the re-election probability of the incumbent. In essence, our claim draws from the literature that suggests voters utilise elections as an accountability mechanism to re-elect (weed out) incumbents who deliver better (worse) development outcomes (Barro, 1973, Ferejohn, 1986, Arvate, 2013, Gottlieb and Kosec, 2019) i.e., voters engage in *retrospective voting*. Additionally, the implicit link between political competition and the salience of re-election incentives has been widely recognised in different contexts (Besley et al., 2010, Albornoz and Cabrales, 2013, Finan and Mazzocco, 2021). We examine the effect of a *Relevant Third* on two primary electoral outcomes for the incumbent in the next election: (*i*) the probability that the incumbent re-contests the next election; and (*ii*) conditional on re-contesting, the probability that the incumbent is re-elected.

The regression results are presented in Table 9. In columns 1–5, the dependent variable is the likelihood of the incumbent re-contesting in the next election while in columns 6–10 the dependent variable is the likelihood of winning in the next election (re-election), conditional on re-contesting. Having a *Relevant Third* does not have a statistically significant effect on the likelihood of the incumbent re-contesting. On the other hand, we find a weak negative impact of a *Relevant Third* on the probability that a re-contesting incumbent gets re-elected in the next election (see column 6 of Panel A). The small negative effect on the re-election probability of re-contesting winners is puzzling given that the incumbents who face a potential coalitional threat induce a higher growth in economic prosperity over the course of the electoral term. We conduct a heterogeneity analysis identical to the one presented in Section E.1 to further examine what *type* of incumbents witness a decline in their re-election probability. In particular, we present separate estimates for these outcomes for winners who are aligned with the state ruling party (Panel B) and those who are not (Panel C). As in the full sample, there is no significant impact of a *Relevant Third* on the probability of re-contesting in the subsequent election for the two sub-samples based on alignment of the incumbent (Panels B and C).

On the other hand, we find that the negative impact on the incumbent's re-election probability is driven by the 28–43 percentage points drop in the likelihood of the incumbent

## Table 9: Effect of a *Relevant Third* on Electoral Outcomes. Re-contesting and Re-election

| | Incumbent Re-contesting in Next Election | | | | | Incumbent Wins in Next Election (Conditional on Re-contesting) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $p = 1$ | | | | $p = 2$ | $p = 1$ | | | | $p = 2$ |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| **Panel A: Full Sample of Incumbents** | | | | | | | | | | |
| *Relevant Third* | 0.044 | 0.010 | -0.043 | 0.021 | -0.014 | -0.159* | -0.040 | 0.260* | -0.088 | -0.253* |
| | (0.069) | (0.045) | (0.095) | (0.050) | (0.099) | (0.096) | (0.062) | (0.136) | (0.072) | (0.142) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 2.75 | 7.12 | 1.37 | 5.49 | 2.75 | 2.34 | 6.24 | 1.17 | 4.68 | 2.34 |
| Observations | 764 | 1699 | 391 | 1398 | 764 | 460 | 1052 | 236 | 822 | 460 |
| **Panel B: Politically Aligned Incumbents** | | | | | | | | | | |
| *Relevant Third* | 0.058 | 0.021 | -0.048 | 0.034 | -0.003 | -0.040 | 0.065 | -0.050 | 0.053 | -0.060 |
| | (0.088) | (0.059) | (0.120) | (0.064) | (0.124) | (0.116) | (0.076) | (0.164) | (0.084) | (0.168) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 3.05 | 7.20 | 1.53 | 6.11 | 3.05 | 2.88 | 7.22 | 1.44 | 5.77 | 2.88 |
| Observations | 545 | 1111 | 270 | 977 | 545 | 334 | 710 | 163 | 596 | 334 |
| **Panel C: Politically Non-Aligned Incumbents** | | | | | | | | | | |
| *Relevant Third* | 0.012 | 0.005 | 0.062 | -0.003 | 0.089 | -0.284** | -0.159* | -0.433** | -0.171* | -0.378** |
| | (0.090) | (0.062) | (0.122) | (0.069) | (0.127) | (0.129) | (0.089) | (0.180) | (0.097) | (0.187) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 3.07 | 8.09 | 1.53 | 6.14 | 3.07 | 2.98 | 7.43 | 1.49 | 5.95 | 2.98 |
| Observations | 308 | 655 | 162 | 543 | 308 | 235 | 471 | 125 | 406 | 235 |
| p–value (Aligned − Non-Aligned) | *0.714* | *0.856* | *1.000* | *0.694* | *1.000* | *0.159* | *0.055* | *0.115* | *0.082* | *0.203* |

**Notes:** Local linear RD regression ($p = 1$) results presented in Columns 1–4 and 6–9. Columns 5 and 10 present results for a local quadratic RD regression ($p = 2$) using a triangular kernel sing the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parentheses. Across all panels, the outcome variable in Columns 1–5 is a binary variable indicating whether the incumbent re-contests in the next election, while in Columns 6–10, the outcome variable is a binary variable indicating whether the incumbent gets re-elected (conditional on re-contesting) Panel A: full sample of incumbent; Panel B: sub-sample of politically aligned incumbents; Panel C: sub-sample of politically non-aligned incumbents. The p-values for equality of coefficients across the two sub-samples (Aligned vs Non-Aligned Incumbents) using a Wald $\chi^2$ test presented in italics. Significance: $^{***}p < 0.01$;$^{**}p < 0.05$;$^{*}p < 0.1$.

winning the next election (conditional on re-contesting) if the incumbent is not politically aligned to the ruling party at the state legislature (Panel C). The effect is close to zero for politically aligned incumbents (Panel B).[24]

One potential explanation for these effects is as follows. It is now well documented that there is a considerable incumbency disadvantage in Indian elections (Linden, 2004, Uppal, 2009, Ravishankar, 2009, Lee, 2020, Karnik et al., 2023). Uppal (2009, page 11) argues that the *incumbency disadvantage is driven by variation in the state governments' inability to provide public goods, such as health facilities, and in other indices of governmental failure, such as high rates of unemployment and lower per capita income levels.* Our results are more nuanced. We too find evidence of an incumbency disadvantage, but only when the incumbent is not aligned to the state government. In the presence of a potential coalitional threat, incumbents aligned to the state governments benefit from the possible diversion of resources towards development of constituencies that are held by the governing party at the state level. This offsets the negative effect of competition on re-election probability. Non-aligned incumbents, who are unable to deliver improved economic outcomes, are voted out with a higher probability in the subsequent election.

Given our emphasis on the effect of non-incumbents, a natural question to ask is what happens to the electoral outcomes of the runner-up and the third-placed candidate. Table C4 in the Appendix presents results for the same outcomes for the runner-up and the third-ranked candidates. For these non-incumbents, there is no effect of the presence of a *Relevant Third* on their probability of ($i$) re-contesting and ($ii$) winning the subsequent election. The effects are generally not statistically significant, either for the runner-up or for the third placed candidate.[25]

[24]Figure B6 in the Appendix presents the graphical analogue of the results on re-contesting and re-election, for the full sample and separately for the sample of aligned and non-aligned incumbents. There is a slight drop in the likelihood of re-election (conditional on re-contesting), driven by the drop in the probability of re-election for incumbents not aligned with the state ruling party. Additionally, we do not observe any discontinuity in the likelihood of re-contesting, at the cut-off.

[25]We also examine the probability of the runner-up and the third placed candidate finishing in the top-3 in the next election and contesting from a different party (i.e., being a turncoat) in the next election. Having a *Relevant Third* does not generally have a statistically significant effect on either outcome The only exception is that third placed candidates are significantly more likely to contest from a different party in the next election (results available on request), but even in this case the effect is statistically significant only for $p = 1$. One way of interpreting this is that the winners can either work hard for constituency development or they can somehow break up the coalition, or engage in horse trading.

# 10 Conclusion

Unlike market competition (between firms), electoral competition (between political parties and/or candidates) usually culminates in a clear winner. Therefore, while rents from consolidating market shares can potentially be diffused among competitors, rents from consolidated vote shares usually accrues entirely to the winner. Consequently, the intensity of competition and efforts made towards winning have important implications for post-electoral outcomes and the actions of the incumbent. This paper, estimates the economic impact of political competition, using nighttime lights as a proxy for the level of economic activity at the constituency level. We use a novel measure of political competition, *threat from collusion*, which captures the effect of re-election uncertainty (induced by the *Relevant Third*) on the winning candidate. In politics there are no legal restrictions to competitors forging explicit and implicit alliances (engage in collusion) with an aim to consolidating vote shares. In fact such agreements are often welcomed because it is argued that then candidates need to make a case to elect them and cannot depend purely on what is termed as vote bank politics.

Using our new definition of electoral competition, we find that constituencies with a barely *Relevant Third*) witness a higher growth in nighttime lights, compared to constituencies barely without a *Relevant Third*). These effects are economically meaningful in that they translate to a 0.1–0.3 percentage points higher GDP growth in the constituency, or more broadly, a growth premium of 1.8–5.5%. Importantly we show that our results hold only when the threat of coalition (between the runner-up and the third placed candidate) is a credible one.

In terms of mechanisms we ind that having a *Relevant Third* results in provision of better health care goods, better education infrastructure improved drainage and market infrastructure and higher electricity supply to marginal, small and medium enterprises (MSMEs). We also find that a higher fraction of *Relevant Thirds* in a district can result in reduction in district-level crimes.

# References

Acemoglu, D., Reed, T., and Robinson, J. A. (2014). Chiefs: Economic Development and Elite Control of Civil Society in Sierra Leone. *Journal of Political Economy*, 122(2):319–368.

Albornoz, F. and Cabrales, A. (2013). Decentralization, Political Competition and Corruption. *Journal of Development Economics*, 105:103–111.

Anagol, S. and Fujiwara, T. (2016). The Runner-up Effect. *Journal of Political Economy*, 124(4):927–991.

Anukriti, S., Erten, B., and Mukherjee, P. (2022). Women's Political Representation and Intimate Partner Violence. Technical report, IZA Discussion PAper 15395.

Arvate, P. R. (2013). Electoral Competition and Local Government Responsiveness in Brazil. *World Development*, 43:67–83.

Asher, S., Lunt, T., Matsuura, R., and Novosad, P. (2021). Development Research at High Geographic Resolution: An Analysis of Night-lights, Firms, and Poverty in India using the SHRUG Open Data Platform. *The World Bank Economic Review*, 35(4):845–871.

Asher, S. and Novosad, P. (2017). Politics and Local Economic Growth: Evidence from India. *American Economic Journal: Applied Economics*, 9(1):229–273.

Ashworth, J., Geys, B., Heyndels, B., and Wille, F. (2014). Competition in the Political Arena and Local Government Performance. *Applied Economics*, 46(19):2264–2276.

Barro, R. J. (1973). The Control of Politicians: an Economic Model. *Public choice*, pages 19–42.

Baskaran, T., Bhalotra, S., Min, B., and Uppal, Y. (2023). Women Legislators and Economic Performance. *Journal of Economic Growth*, pages 1–64.

Baskaran, T. and Hessami, Z. (2018). Does the Election of a Female Leader Clear the way for more Women in Politics? *American Economic Journal: Economic Policy*, 10(3):95–121.

Besley, T., Persson, T., and Sturm, D. M. (2010). Political Competition, Policy and Growth: Theory and Evidence from the US. *The Review of Economic Studies*, 77(4):1329–1352.

Bhalotra, S. and Clots-Figueras, I. (2014). Health and the Political Agency of Women. *American Economic Journal: Economic Policy*, 6(2):164–197.

Bhalotra, S., Clots-Figueras, I., Cassan, G., and Iyer, L. (2014). Religion, Politician Identity and Development Outcomes: Evidence from India. *Journal of Economic Behavior & Organization*, 104:4–17.

Bhalotra, S., Clots-Figueras, I., and Iyer, L. (2017). Path-breakers: Women's Electoral Success and Future Political Participation. *Economic Journal*, 128(August):1844 – 1878.

Bhalotra, S. R., Baskaran, T., and Uppal, Y. (2021). *Women Legislators and Economic Performance*. Centre for Economic Policy Research.

Bickenbach, F., Bode, E., Nunnenkamp, P., and Söder, M. (2016). Night lights and regional GDP. *Review of World Economics*, 152:425–447.

Broockman, D. E. (2014). Do Female Politicians Empower Women to Vote or Run for Office? A Regression Discontinuity Approach. *Electoral Studies*, 34:190 – 204.

Bugni, F. A. and Canay, I. A. (2021). Testing Continuity of a Density via G-order Statistics in the Regression Discontinuity Design. *Journal of Econometrics*, 221(1):138–159.

Calonico, S., Cattaneo, M. D., and Titiunik, R. (2014). Robust Nonparametric Confidence Intervals for Regression-discontinuity Designs. *Econometrica*, 82(6):2295–2326.

Canay, I. A. and Kamat, V. (2018). Approximate Permutation Tests and Induced Order Statistics in the Regression Discontinuity Design. *The Review of Economic Studies*, 85(3):1577–1608.

Cattaneo, M. D., Jansson, M., and Ma, X. (2020). Simple Local Polynomial Density Estimators. *Journal of the American Statistical Association*, 115(531):1449–1455.

Cattaneo, M. D. and Titiunik, R. (2022). Regression Discontinuity Designs. *Annual Review of Economics*, 14(Volume 14, 2022):821–851.

Chanda, A. and Kabiraj, S. (2020). Shedding Light on Regional Growth and Convergence in India. *World Development*, 133:104961.

Clots-Figueras, I. (2011). Women in Politics: Evidence from the Indian States. *Journal of Public Economics*, 95(7 – 8):664 – 690.

Clots-Figueras, I. (2012). Are Female Leaders Good for Education? Evidence from India. *American economic journal: applied economics*, 4(1):212–244.

Curto-Grau, M., Solé-Ollé, A., and Sorribas-Navarro, P. (2018). Does Electoral Competition Curb Party Favoritism? *American Economic Journal: Applied Economics*, 10(4):378–407.

Dash, B. B., Ferris, J. S., and Winer, S. L. (2019). The Measurement of Electoral Competition, with Application to Indian States. *Electoral Studies*, 62:102070.

Dash, B. B. and Mukherjee, S. (2015). Political Competition and Human Development: Evidence from the Indian States. *The Journal of Development Studies*, 51(1):1–14.

Drèze, J. and Sen, A. (2013). *An Uncertain Glory: India and its Contradictions*. Princeton University Press.

Duverger, M. (1954). *Political Parties*. New York, Wiley.

Faravelli, M., Khalil, U., and Ponnusamy, S. (2023). Procedural Barriers to Political Candidacy: Gender, Discouragement, and Candidate Persistence. Technical report, University of Queensland, Deakin University and Monash University.

Ferejohn, J. (1986). Incumbent Performance and Electoral Control. *Public choice*, pages 5–25.

Ferris, J. S., Winer, S. L., and Grofman, B. (2016). *The Duverger-Demsetz perspective on electoral competitiveness and fragmentation: With application to the Canadian parliamentary system, 1867–2011*. Springer.

Finan, F. and Mazzocco, M. (2021). Electoral Incentives and the Allocation of Public Funds. *Journal of the European Economic Association*, 19(5):2467–2512.

Fisman, R., Schulz, F., and Vig, V. (2014). The Private Returns to Public Office. *Journal of Political Economy*, 122(4):806 – 862.

Gibson, J., Olivia, S., Boe-Gibson, G., and Li, C. (2021). Which Night Lights Data should we use in Economics, and Where? *Journal of Development Economics*, 149:102602.

Gottlieb, J. and Kosec, K. (2019). The Countervailing Effects of Competition on Public Goods Provision: When Bbargaining Inefficiencies Lead to Bad Outcomes. *American Political Science Review*, 113(1):88–107.

Hahn, J., Todd, P., and Van der Klaauw, W. (2001). Identification and Estimation of Treatment Effects with a Regression-discontinuity Design. *Econometrica*, 69(1):201–209.

Imbens, G. and Kalyanaraman, K. (2012). Optimal Bandwidth Choice for the Regression Discontinuity Estimator. *The Review of Economic Studies*, 79(3):933–959.

Imbens, G. W. and Lemieux, T. (2008). Regression Discontinuity Designs: A Guide to Practice. *Journal of econometrics*, 142(2):615–635.

Jain, C., Kashyap, S., Lahoti, R., and Sahoo, S. (2023). The Impact of Educated Leaders on Economic Development: Evidence from India. *Journal of Comparative Economics*.

Karnik, A., Lalvani, M., and Phatak, M. (2023). Political Incumbency Effects in India: a Regional Analysis. *Studies in Economics and Econometrics*, 47(1):43–60.

Khalil, U., Oak, M., and Ponnusamy, S. (2024). The Heterogeneous Role of Party Affiliation in the Runner-up Effect. *Journal of Applied Econometrics*.

Kosec, K., Haider, H., Spielman, D. J., and Zaidi, F. (2018). Political Competition and Rural Welfare: Evidence from Pakistan. *Oxford Economic Papers*, 70(4):1036–1061.

Lahoti, R. and Sahoo, S. (2020). Are Educated Leaders Good for Education? Evidence from India. *Journal of Economic Behavior & Organization*, 176:42–62.

Lee, A. (2020). Incumbency, Parties, and Legislatures: Theory and Evidence from India. *Comparative Politics*, 52(2):311–331.

Lee, D. (2008). Randomized Experiments from Non-random Selection in US House Elections. *Journal of Econometrics*, 142(2):675 – 697.

Linden, L. L. (2004). Are Incumbents Really Advantaged? The Preference for Non-incumbents in Indian National Elections. Technical report, Departments of Economics, University of Texas at Austin.

Mahadevan, M. and Shenoy, A. (2023). The Political Consequences of Resource Scarcity: Targeted Spending in a Water-Stressed Democracy. *Journal of Public Economics*, 220:104842.

McCrary, J. (2008). Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test. *Journal of econometrics*, 142(2):698–714.

Nordhaus, W. and Chen, X. (2015). A Sharper Image? Estimates of the Precision of Nighttime Lights as a Proxy for Economic Statistics. *Journal of Economic Geography*, 15(1):217–246.

Padovano, F. and Ricciuti, R. (2009). Political Competition and Economic Performance: Evidence from the Italian Regions. *Public Choice*, 138:263–277.

Pailler, S. (2018). Re-election Incentives and Deforestation Cycles in the Brazilian Amazon. *Journal of Environmental Economics and Management*, 88:345–365.

Polo, M. (1998). Electoral Competition and Political Rents. Technical report, IGIER working paper.

Pons, V. and Tricaud, C. (2018). Expressive Voting and its Cost: Evidence from Runoffs with Two or Three Candidates. *Econometrica*, 86(5):1621–1649.

Prakash, N., Rockmore, M., and Uppal, Y. (2019). Do Criminally Accused Politicians Affect Economic Outcomes? Evidence from India. *Journal of Development Economics*, 141:102370.

Prakash, N., Sahoo, S., Saraswat, D., and Sindhi, R. (2022). When Criminality Begets Crime: The Role of Elected Politicians in India. Technical report, IZA Discussion Paper 15259.

Ravishankar, N. (2009). The Cost of Ruling: Anti-incumbency in Elections. *Economic and Political Weekly*, pages 92–98.

Seror, A. and Verdier, T. (2018). Multi-candidate Political Competition and the Industrial Organization of Politics. *American Economic Association: Papers & Proceedings*.

Solé-Ollé, A. and Viladecans-Marsal, E. (2012). Lobbying, Political Competition, and Local Land Supply: Recent Evidence from Spain. *Journal of Public Economics*, 96(1-2):10–19.

Sørensen, R. J. (2014). Political Competition, Party Polarization, and Government Performance. *Public Choice*, 161:427–450.

Svaleryd, H. and Vlachos, J. (2009). Political Rents in a Non-corrupt Democracy. *Journal of Public Economics*, 93(3-4):355–372.

Ujhelyi, G., Chatterjee, S., and Szabó, A. (2021). None of the Above: Protest Voting in the World's Largest Democracy. *Journal of the European Economic Association*, 19(3):1936–1979.

Uppal, Y. (2009). The Disadvantaged Incumbents: Estimating Incumbency Effects in Indian State Legislatures. *Public choice*, 138:9–27.

Van Weelden, R. (2013). Candidates, Credibility, and Re-election Incentives. *Review of Economic Studies*, 80(4):1622–1651.

Walkowitz, G. and Weiss, A. R. (2017). "Read my lips! (but only if I was elected)!" Experimental Evidence on the Effects of Electoral Competition on Promises, Shirking and Trust. *Journal of Economic Behavior & Organization*, 142:348–367.

Wittman, D. (1989). Why Democracies Produce Efficient Results. *Journal of Political Economy*, 97(6):1395–1424.

# A Proofs

In this section, we provide the proofs of the propositions presented in the main text.

## Proof of Proposition 1

**Case 1.** Let $V_1 > \frac{1}{2}$. Then the optimal investment is $y = 0$. For any $y$ and any $\delta$, $\Pr\left[\max\{V_1, F(c + \frac{y}{2} + \frac{\delta}{2})\} > \frac{1}{2}\right] = 1$. Since $P(y) = 1$ for all $y$, $WP(y) - ky = W - ky$ is maximized at $y^* = 0$.

**Case 2.** Let $V_1 \leq \frac{1}{2}$. Now,

$$\begin{aligned}
& \Pr\left[\max\{V_1, F(c + \frac{y}{2} + \frac{\delta}{2})\} > \frac{1}{2}\right] \\
= \; & \Pr\left[F(c + \frac{y}{2} + \frac{\delta}{2}) > \frac{1}{2}\right] \\
= \; & \Pr\left[c + \frac{y}{2} + \frac{\delta}{2} > x_m\right], \text{ where } x_m = F^{-1}\left(\frac{1}{2}\right) \\
= \; & \Pr\left[\delta > 2(x_m - c) - y\right] \\
= \; & \min\left\{\max\left\{\frac{1}{2} + \frac{1}{C}\left[2(c - x_m) + y\right], 0\right\}, 1\right\} -
\end{aligned}$$

If $V_1 \leq \frac{1}{2}$, then $P(y) = \min\left\{\max\left\{\frac{1}{2} + \frac{1}{C}\left[2(c - x_m) + y\right], 0\right\}, 1\right\}$. First, assume that $\frac{1}{2} + \frac{1}{C}\left[2(c - x_m) + y\right] \leq 0$, implying that $P(y) = 0$, and hence $WP(y) - ky = -ky$. This can never be optimal, since $y = 0$ dominates this. So we now assume that $\frac{1}{2} + \frac{1}{C}\left[2(c - x_m) + y\right] > 0$, implying that $P(y) > 0$. If $0 < \frac{1}{2} + \frac{1}{C}\left[2(c - x_m) + y\right] < 1$ for some $y > 0$ then $0 < P(y) < 1$ and $WP'(y) = \frac{W}{C} > k$. Hence, payoff improves by raising $y$ to $y_m$ which satisfies $\frac{1}{2} + \frac{1}{C}\left[2(c - x_m) + y\right] = 1$. If $\frac{1}{2} + \frac{1}{C}\left[2(c - x_m) + y\right] > 1$, then $P(y) = 1$ and one can improve payoff by setting $y = y_m$ such that $\frac{1}{2} + \frac{1}{C}\left[2(c - x_m) + y\right] = 1$. However, if $y_m \leq 0$, i.e., $\frac{1}{2} + \frac{1}{C}\left[2(c - x_m) + y\right] \geq 1$, then $P(y) = 1$ for all $y > 0$ and it is optimal to set $y^* = 0$.

## Proof of Corollary 1

As $F$ shifts rightward in an FOSD manner, $x_m$ shifts right. If $x_m < a$, $V_1 = F(a) > \frac{1}{2}$ and $y^* = 0$. Hence $V_0 \not> \frac{1}{2}$. The condition for $y^* > 0$ from Proposition 2 is $x_m \geq a$ and $\frac{C}{2} > 2(c - x_m)$. A sufficient condition for $y^* > 0$ for all $x_m \geq a$ is $\frac{C}{2} \geq 2(c - a) = x_3 - x_2$. Then, $V_0 = \frac{1}{2}$. If on the other hand, this condition is not satisfied, then there is some $x_0 \in (a, c)$ such that $y^* = 0$ for $x_m \leq x_0$ and $y^* > 0$ for $x_m > x_0$. We then have $V_0 = F(a)$ when $x_m = x_0$. Since $x_m > a$, $V_0 < \frac{1}{2}$.

## Proof of Remark 2

First, note that $y_A^* > 0$ for all $C$ according to proposition 3. Now, from Proposition 1, if $y_B^* > 0$, then

$$y_B^* = \frac{C}{2} - 2(c - x_m) < \frac{C}{2} - 2(c - b) = \frac{1}{2C} + 2(b - c) = \frac{C}{2} + (x_2 - x_1) = y_A^*,$$

establishing that $y_A^* > y_B^*$.

Next, notice that $y_B^* = y_C^* = 0$ if $C < x_3 - x_2$. If $2(x_3 - x_2) > C > (x_3 - x_2)$, $y_B^* > y_C^* = 0$. If $C > 2(x_3 - x_2)$,

$$y_B^* = \frac{C}{2} - 2(c - x_m) > \frac{C}{2} - 2(c - a) = \frac{C}{2} - (x_3 - x_2) = y_C^*$$

# B Effect of *Relevant Third* on Crime

The crime data made available by the NCRB is, however, only available at the district level, which is higher than the constituency level — constituencies are nested within districts. Therefore, we aggregate up our constituency level treatment variables to the district level to determine the causal impact of *Relevant Third*. So the main treatment variable becomes the district level fraction of constituencies with a *Relevant Third*.[26]

We expect the characteristics of the elected politician (in this case if he/she is elected from a constituency that has a *Relevant Third*) in period $t$ would affect crime in the district in period $(t + 1)$. We specify the relationship between the characteristics of the elected politician and crime as follows:

$$C_{ds(t+1)} = \alpha_s + \eta_{st} + \beta A_{dst} + \varepsilon_{ds(t+1)} \tag{B1}$$

where $C_{ds(t+1)}$ refers to the total crime count in district $d$ in state $s$ in period $t + 1$; $A_{dst}$ denotes the fraction of seats in district $d$ in state $s$ in period $t$ with a *Relevant Third*. We include state fixed effects ($\alpha_s$), which capture time-invariant state-specific unobserved factors and state-specific year fixed effects $\eta_{st}$, which control for time-varying unobserved factors at the state level and also absorbs the overall year fixed effects capturing any year-specific macroeconomic shocks.[27] Standard errors are clustered at the district level to allow for any possible correlation between observations from the same district.

While we include fixed effects to control for unobservables, we still cannot rule out the possibility of time-varying district specific unobserved characteristics being correlated with

[26] See Clots-Figueras (2012), Bhalotra and Clots-Figueras (2014), Bhalotra et al. (2014), Lahoti and Sahoo (2020), Prakash et al. (2022), Bhalotra et al. (2021), Anukriti et al. (2022), Jain et al. (2023), Baskaran et al. (2023) for more on this approach to examine the effect of different characteristics of politicians on a range of different outcomes in the context of India.

[27] Since we observe only one time-period post the election, we have one data point for each district corresponding to the fraction of seats in district $d$ with a *Relevant Third*. Therefore, we are unable to include district-specific fixed effects. We, nonetheless, have four observations on each district corresponding to the total crimes recorded within the electoral term.

both $C_{ds(t+1)}$ and $A_{dst}$. For example, some unforeseen event might make the district more competitive and also reduce reported crime. If such district level factors change over time that can make the treatment variable ($A_{dst}$) endogenous.

We use an IV approach to address the problem of endogeneity. We use the fraction of seats in the district where the votes received by the third-placed candidate barely exceeds the winning margin as an instrument for the number of seats where with a *Relevant Third*. Since, the outcome of the close election is random for each constituency, and the average at the district level can be considered random too. Specifically the 2SLS regression specification is given by:

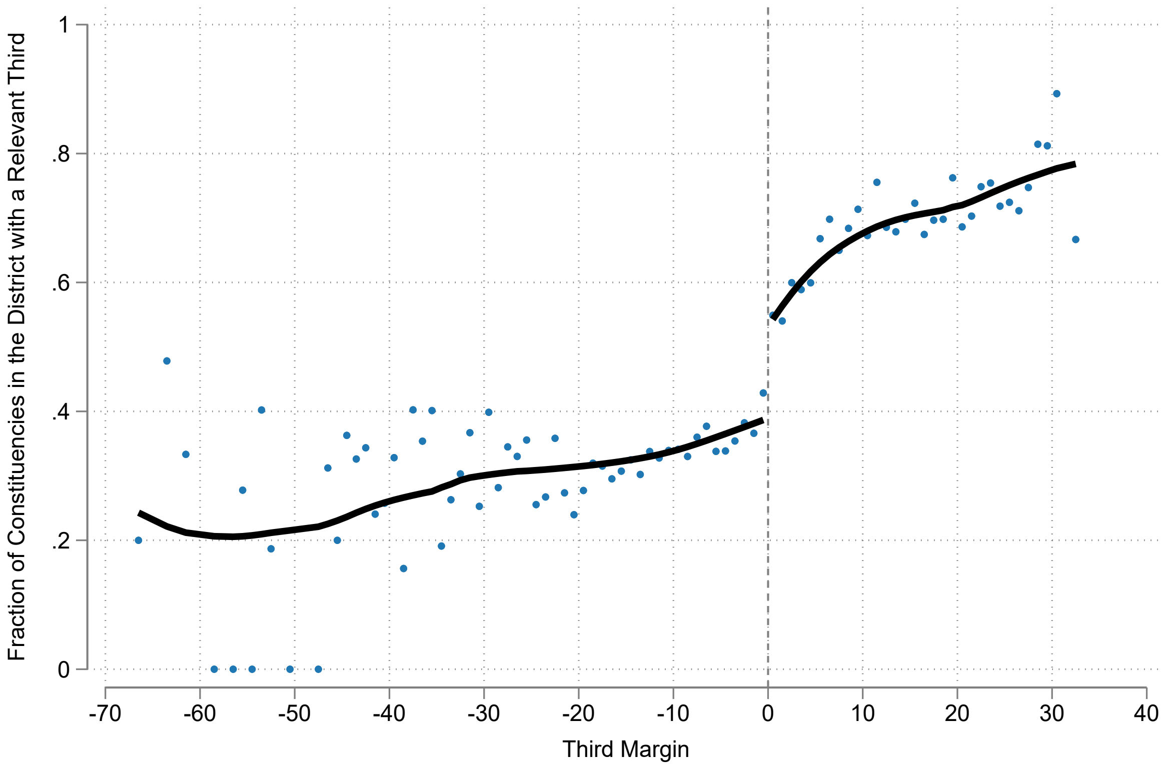
$$A_{dst} = \delta_s + \phi_{st} + \tau AC_{dst} + \sum_{j=1}^{J} \nu_j I_{jdst} + \sum_{j=1}^{J} \pi_j I_{jdst} \times F(M_{jdst}) + \epsilon_{ds(t+1)} \tag{B2}$$

$$C_{ds(t+1)} = \alpha_s + \eta_{st} + \beta A_{dst} + \xi TC_{dst} + \sum_{j=1}^{J} \mu_j I_{jdst} + \sum_{j=1}^{J} \psi_j I_{jdst} \times F(M_{jdst}) + \varepsilon_{ds(t+1)} \tag{B3}$$

Equations (B2) and (B3) are respectively the first and second stage of the 2SLS specification. $A_{dst}$ is the fraction of constituencies in the district with a *Relevant Third* and is potentially endogenous. In the first stage regression (equation (B2)) $A_{dst}$ is predicted by $AC_{dst}$, which denotes the fraction of constituencies where the third placed candidate is *barely* relevant. However, while the outcome of a close election is random, the possibility of the presence of a close election itself might not be random. To account for this possibility, we include as an additional control in the second stage (equation (B3)) the fraction of constituencies with a close third party ($TC_{dst}$). The inclusion of $TC_{dst}$ as an additional control also ensures that the exclusion criterion is met, as after controlling for a fraction of close elections in the district, the instrument ($AC_{dst}$) can affect the outcome only through the overall fraction of relevant thirds in the district ($A_{dst}$). Our regressions also control for $I_{jdst}$, which is a dummy variable indicating the existence of a third-ranked candidate in the $j^{th}$ constituency of district $d$ in state $s$. $F(M_{jdst})$ is a polynomial function of the difference between the margin of victory and the vote share of the third placed candidate (the *Third Margin*). We also include the interaction between $I_{jdst}$ and $F(M_{jdst})$.

Figure B1 plots the district level fraction of constituencies with a *Relevant Third* against the *Third Margin* in each constituency in the district. We create this figure as follows. The constituency-level data on *Third Margin* are aggregated into one percentage point bins, as suggested by Imbens and Lemieux (2008), and a lowess smoothing line is plotted on each side of the discontinuity. The figure then plots the fraction of constituencies in the district with a *Relevant Third* against the *Third Margin*. We see a significant and discontinuous jump in the fraction of constituencies when $Third\ Margin > 0$.

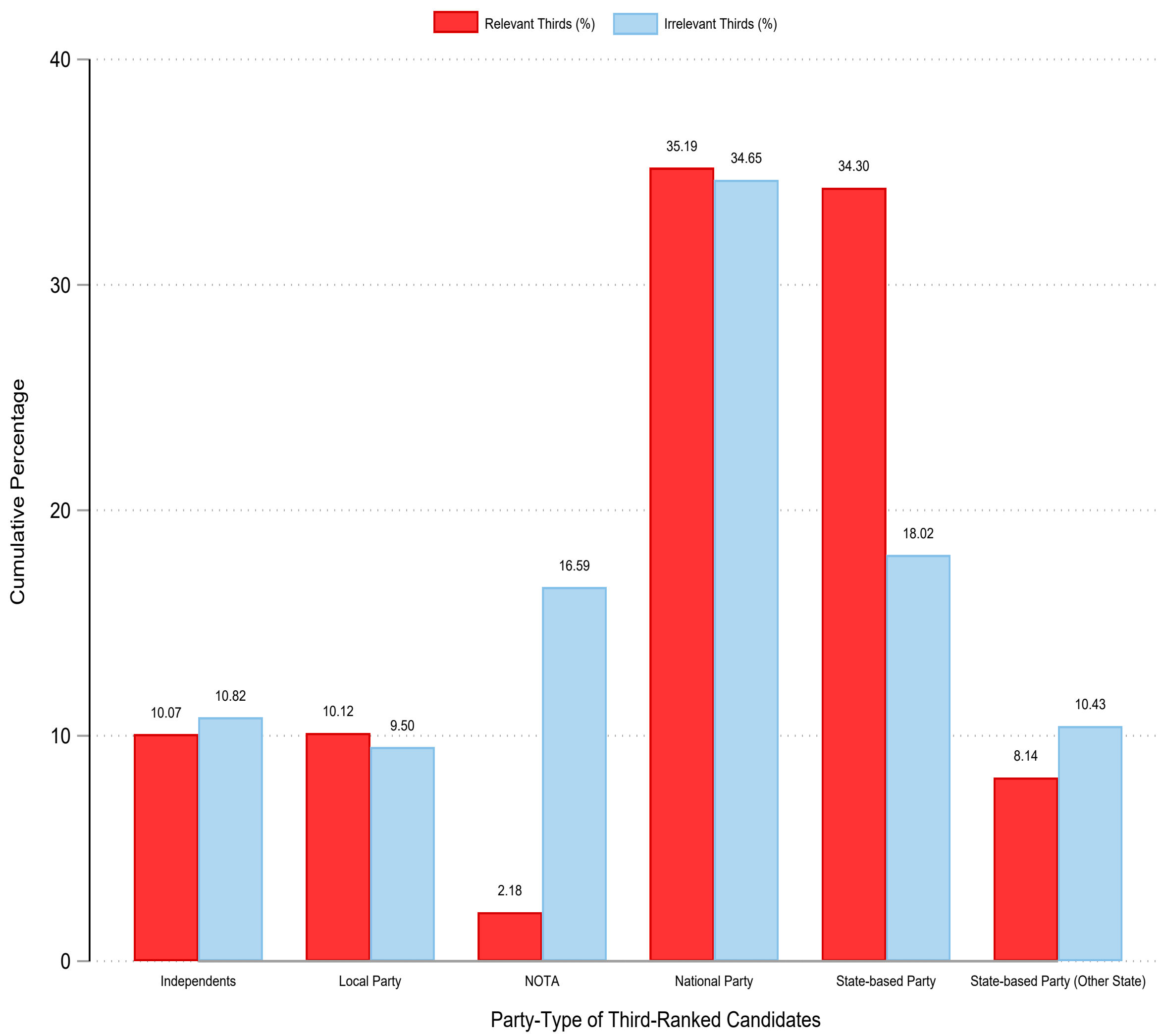
## Figure B1: First Stage for *Relevant Third*




**Notes:** District level fraction of constituencies with a *Relevant Third* plotted against the *Third Margin* in each constituency of the district. The curves are local polynomial regressions fitted separately for the positive and negative parts of the *Third Margin*.

# C Appendix. Additional Figures and Tables

## Figure C1: Distribution of *Relevant Thirds* by Candidate-Party Type



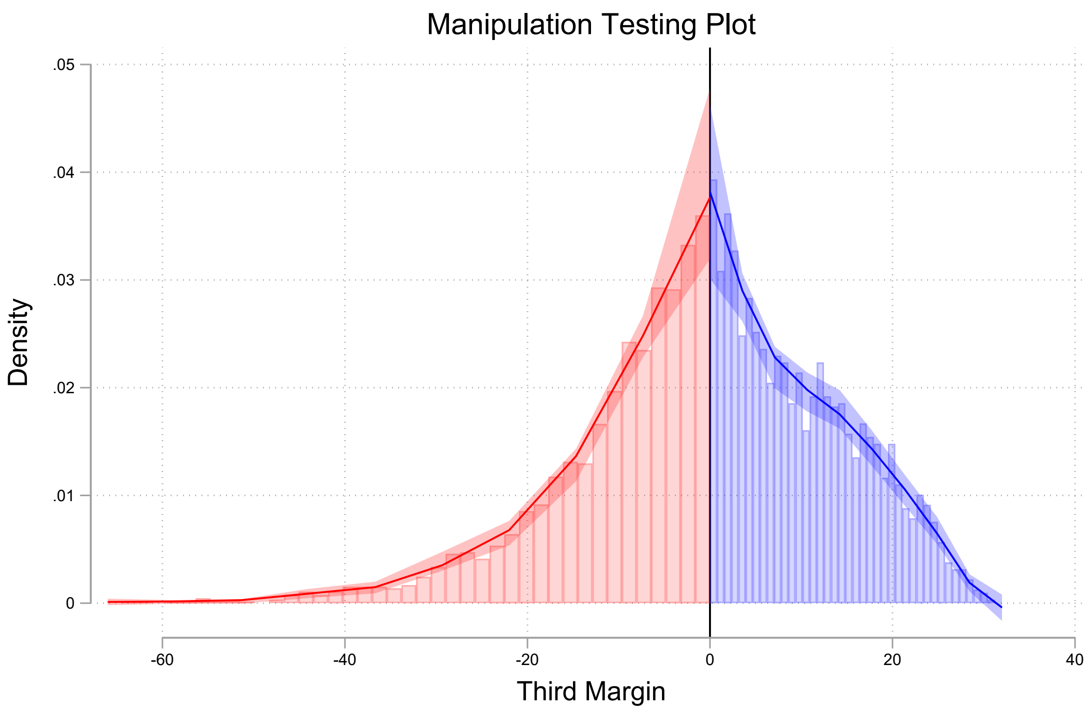

**Notes:** Data from all assembly elections in the period 2013–2017 included. The red bar corresponds to the number of *non-relevant* third-ranked candidates, i.e., when $v_3 < v_1 - v_2$, while the blue bar depicts the number of *relevant* third-ranked candidates, i.e., when $v_3 > v_1 - v_2$). The value at the top of each bar is the fraction of the group's (relevant v/s non-relevant third) candidates belonging to that particular party-type. We use the categorization of the Trivedi Centre for Political Data (TCPD) to divide our sample of third-ranked candidates into different candidate-party types. 'Independents' describes candidates that contest the election without a political party affiliation; 'NOTA' refers to the ballot option 'none of the above'; 'State-based Party' refers to a political party contesting elections in several states but being principally associated with one state; 'Other State-based Party' refers to a State-based party that is contesting outside its principal state; 'Local Party' refers to a party that is limited to a particular state or a sub-region of a single state; and a 'National Party' is defined as a party with a significant presence in different Legislative Assemblies (States) as well in the National Assembly.

# Table C1: Summary Statistics

| | $N$ | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| **Panel A: Electoral Characteristics** | | | | | |
| Electors ('000) | 4,107 | 206.589 | 93.166 | 2.904 | 865.650 |
| Voter Turnout (%) | 4,107 | 72.879 | 11.837 | 0.01 | 98.250 |
| Number of Contestants | 4,107 | 10.775 | 5.119 | 1 | 45 |
| Number of Female Contestants | 4,107 | 1.047 | 1.185 | 0 | 9 |
| Number of Re-Contesting Candidates | 4,107 | 1.946 | 1.204 | 0 | 8 |
| Number of Candidates losing Security Deposits | 4,107 | 10.876 | 5.666 | 0 | 43 |
| Number of Turncoat Candidates | 4,107 | 0.438 | 0.656 | 0 | 4 |
| Winner's Vote Share | 4,107 | 46.033 | 9.126 | 19.450 | 100 |
| Runner-up's Vote Share | 4,107 | 33.541 | 7.602 | 0 | 49.46 |
| Third-Ranked Candidate's Vote Share | 4,072 | 11.752 | 8.146 | 0.130 | 32.14 |
| Winning Margin ($v_1 - v_2$) | 4,107 | 12.492 | 11.152 | 0.010 | 100 |
| Re-Elected Winner (Incumbent) | 4,107 | 0.367 | 0.482 | 0 | 1 |
| Turncoat Winner | 4,107 | 0.101 | 0.301 | 0 | 1 |
| Winner's Experience (No. of Terms) | 4,107 | 2.042 | 1.453 | 1 | 13 |
| Re-Contesting Winner | 4,107 | 0.586 | 0.492 | 0 | 1 |
| Male Winner | 4,107 | 0.912 | 0.282 | 0 | 1 |
| National Party Winner | 4,102 | 0.562 | 0.496 | 0 | 1 |
| State-based Party Winner | 4,102 | 0.379 | 0.485 | 0 | 1 |
| **Panel B: Nighttime Lights (2013-21)** | | | | | |
| Total Nighttime Lights | 20,535 | 2715.403 | 2698.944 | 0 | 43626.43 |
| Luminosity Density | 18,205 | 21.292 | 71.063 | 0 | 981.8018 |
| Annual Growth in Luminosity Density (%) (excluding election year) | 14,564 | 4.361 | 14.429 | -76.925 | 257.742 |
| **Panel C: Proportion of Villages in the Constituency with Access to Public Facilities (2019)** | | | | | |
| Community Health Centre | 1,873 | 16.496 | 13.094 | 0 | 100 |
| Primary Health Centre | 1,873 | 6.618 | 7.127 | 0 | 77.181 |
| Maternity Health Centre | 1,873 | 44.872 | 22.443 | 0 | 100 |
| Closed Drainage | 1,873 | 9.109 | 16.573 | 0 | 100 |
| Uncovered Drainage | 1,873 | 36.980 | 24.237 | 0 | 100 |
| Solar Energy | 1,873 | 14.969 | 19.202 | 0 | 100 |
| MSMEs Having Electricity | 1,873 | 29.880 | 20.211 | 0 | 100 |
| *Kuchha* Drainage | 1,873 | 24.535 | 16.782 | 0 | 100 |
| Mandi | 1,873 | 3.757 | 8.315 | 0 | 100 |
| Regular Market | 1,873 | 13.058 | 16.104 | 0 | 100 |
| Weekly *Haat* | 1,873 | 21.165 | 18.256 | 0 | 97.138 |
| Primary School | 1,873 | 91.312 | 11.404 | 0 | 100 |
| Middle School | 1,873 | 63.048 | 19.001 | 0 | 100 |
| High School | 1,873 | 39.799 | 19.981 | 0 | 100 |
| Senior-Secondary School | 1,873 | 25.106 | 16.997 | 0 | 100 |
| **Panel D: District-level Crimes during the Electoral Term (2014-21)** | | | | | |
| Total IPC Crimes | 2,480 | 5263.469 | 7533.158 | 8 | 89611 |
| Crimes (per 1000 population) | 2,480 | 2.543 | 2.556 | 0.097 | 33.549 |

**Notes:** Data on public goods comes from the village-level survey of Mission Antyodaya. Each variable from this data measures the proportion of villages within the constituency having access to that particular public good. The number of observations (1,873) corresponds to the number of constituencies which consist of villages, and for which information on public facilities is available. Data on IPC crimes comes from the annual statistical reports of the National Crimes Record Bureau (NCRB). Crime count is measured at the district-level for the duration of the district's respective electoral term in our analysis. In the crime panel, the number of observations (2,480) represents the number of districts (620) times four (4 years of the electoral term, excluding the election-year) in our sample.

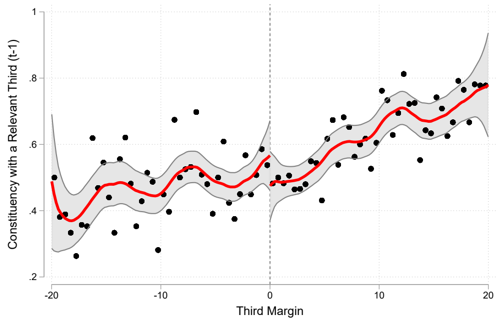
**Figure C2: Discontinuity Test**



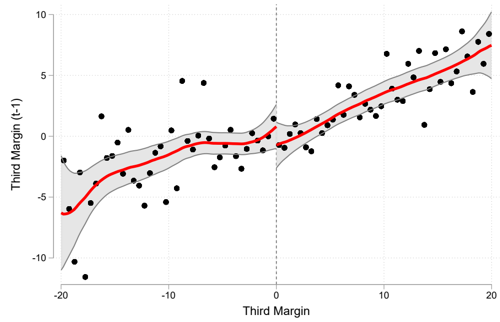

**Notes:** This presents the density plot using the method suggested by Cattaneo et al. (2020) to estimate the continuity of the forcing variable, *Third Margin*, at the threshold (zero).

## Figure C3: Balance Test for Pre-Determined Characteristics

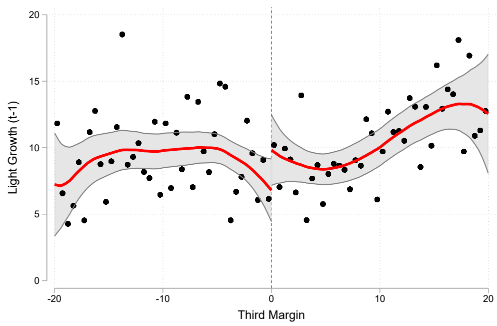
**Panel A: Relevant Third Constituency ($t-1$)**



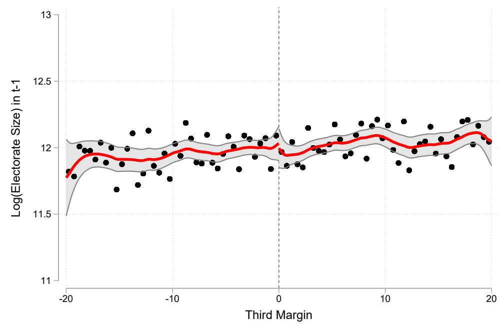

**Panel B: Third Margin ($t-1$)**



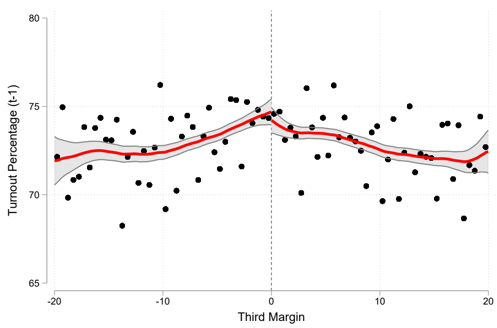

**Panel C: Nightlight Growth ($t-1$)**



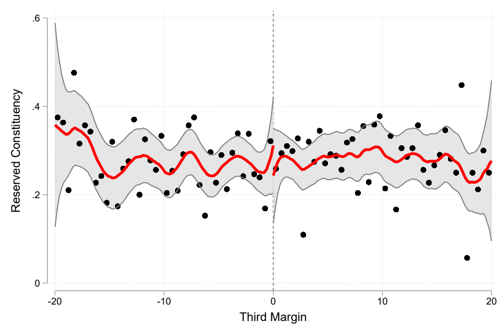

**Panel D: Log Electorate Size ($t-1$)**




**Panel E: Voter Turnout ($t-1$)**



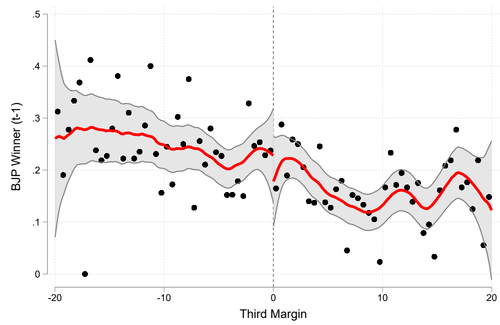

**Panel F: SC/ST Reserved Constituency**



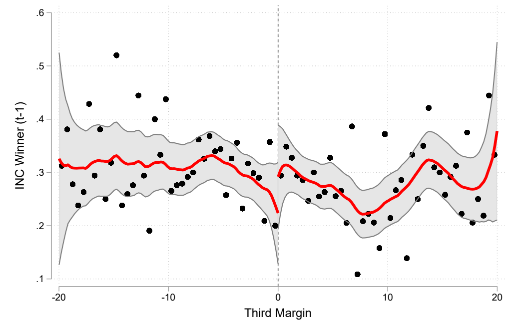

*Continued ...*

## Figure C3 (Continued): Balance Test for Pre-Determined Characteristics

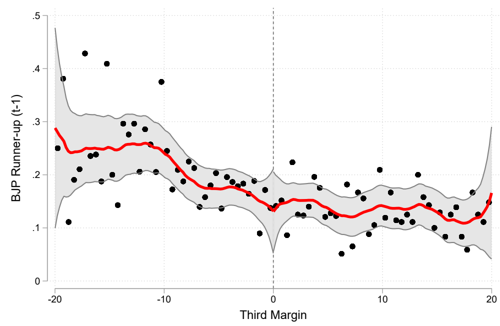
**Panel G: BJP Winner $(t-1)$**



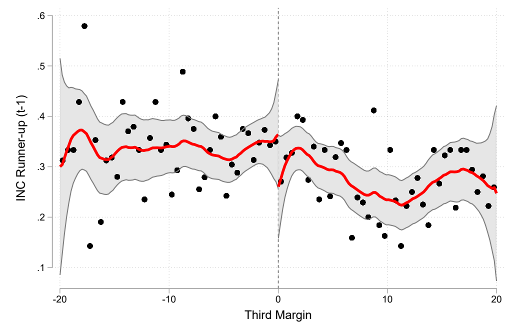

**Panel H: Congress(I) Winner $(t-1)$**



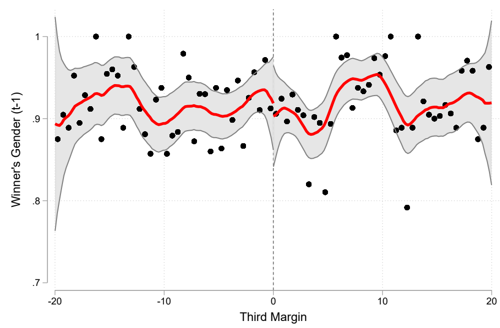

**Panel I: BJP Runner-up $(t-1)$**



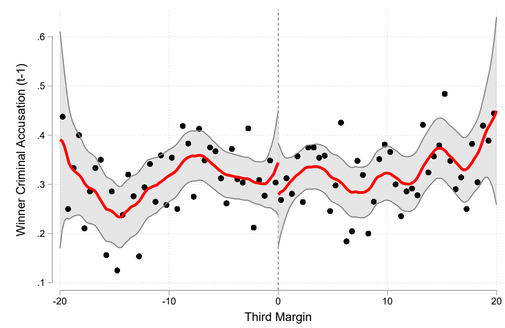

**Panel J: Congress(I) Runner-up $(t-1)$**




**Panel K: Male Winner $(t-1)$**



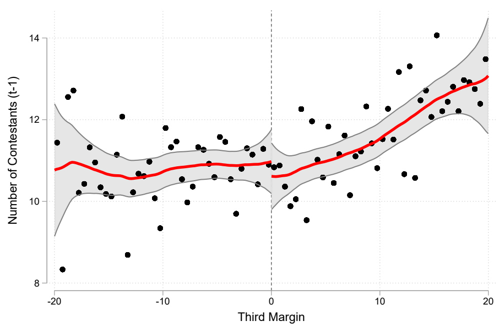

**Panel L: Criminal Winner $(t-1)$**



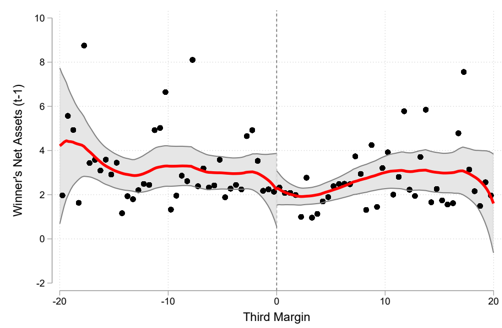

*Continued . . .*

## Figure C3 (Continued): Balance Test for Pre-Determined Characteristics

**Panel M: Number of Contestants $(t-1)$**




**Panel N: Winner's Net Assets $(t-1)$**




**Notes:** The running variable is $Third\_Margin$, defined as the difference between the third-position candidate's vote share and the winning margin. Each dot on the scatter plot is an average over successive bins of 0.5% of the running variable. The curves are local linear regressions fit separately for regions above and below the cut-off using a triangular kernel and an optimal bandwidth à la (Imbens and Kalyanaraman, 2012).

**Table C2: Timing of Elections and Sample Period of Nighttime Lights**

| States | Election-Year | Nighttime Lights Time-Period |
|---|---|---|
| Chhattisgarh, Karnataka, Madhya Pradesh, Meghalaya, Mizoram, Nagaland Rajasthan, Tripura | 2013 | 2013–2017 |
| Andhra Pradesh, Arunachal Pradesh, Haryana, Jammu & Kashmir, Jharkhand Maharashtra, Odisha, Sikkim, Telangana | 2014 | 2014–2018 |
| Bihar, Delhi | 2015 | 2015-2019 |
| Assam, Kerala, Puducherry, Tamil Nadu West Bengal | 2016 | 2016–2020 |
| Goa, Gujarat, Himachal Pradesh Manipur, Punjab, Uttar Pradesh Uttarakhand | 2017 | 2017–2021 |

**Notes:** The table presents the year of each state election in the sample and the corresponding time period of nighttime lights considered in the main analysis. For our balance test, we consider previous-year growth in nighttime lights, starting from 2012 for the 2013 electoral cycle, and so on.

## Table C3: Balance Test: Pre-Determined Characteristics

| | Full Sample | | | Within 5% of the Winning Margin | | |
|---|---|---|---|---|---|---|
| | Relevant Third | Irrelevant Third | Diff. | Relevant Third | Irrelevant Third | Diff. |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Relevant Third ($t-1$) | 0.630 | 0.470 | -0.160*** | 0.490 | 0.502 | 0.012 |
| | (0.483) | (0.499) | (0.016) | (0.500) | (0.500) | (0.028) |
| Third Margin ($t-1$) | 3.379 | -2.680 | -6.059*** | -0.006 | -0.481 | -0.475 |
| | (12.234) | (15.471) | (0.445) | (12.123) | (12.962) | (0.704) |
| NL Growth (previous year) | 10.597 | 8.839 | -1.758*** | 8.626 | 8.997 | 0.371 |
| | (19.211) | (16.633) | (0.563) | (17.857) | (16.691) | (0.953) |
| Log(Electorate Size) ($t-1$) | 12.009 | 11.943 | -0.066*** | 11.970 | 12.006 | 0.036 |
| | (0.683) | (0.723) | (0.022) | (0.687) | (0.634) | (0.037) |
| Voter Turnout ($t-1$) | 69.753 | 69.311 | -0.442 | 70.960 | 70.872 | -0.088 |
| | (11.553) | (12.684) | (0.385) | (11.474) | (12.287) | (0.665) |
| SC/ST Reserved | 0.286 | 0.270 | -0.016 | 0.277 | 0.271 | -0.006 |
| | (0.452) | (0.444) | (0.014) | (0.448) | (0.445) | (0.025) |
| BJP Winner ($t-1$) | 0.165 | 0.260 | 0.095*** | 0.205 | 0.220 | 0.015 |
| | (0.371) | (0.439) | (0.013) | (0.404) | (0.415) | (0.023) |
| INC Winner ($t-1$) | 0.285 | 0.308 | 0.023 | 0.294 | 0.281 | -0.013 |
| | (0.452) | (0.462) | (0.015) | (0.456) | (0.450) | (0.025) |
| BJP Runner-up ($t-1$) | 0.130 | 0.201 | 0.071*** | 0.150 | 0.161 | 0.011 |
| | (0.336) | (0.401) | (0.011) | (0.150) | (0.367) | (0.020) |
| INC Runner-up ($t-1$) | 0.276 | 0.353 | 0.076*** | 0.314 | 0.331 | 0.016 |
| | (0.447) | (0.478) | (0.015) | (0.464) | (0.471) | (0.026) |
| Male Winner ($t-1$) | 0.918 | 0.915 | -0.004 | 0.894 | 0.919 | 0.025 |
| | (0.274) | (0.279) | (0.009) | (0.309) | (0.273) | (0.016) |
| Criminally Accused Winner ($t-1$) | 0.317 | 0.307 | -0.010 | 0.319 | 0.308 | -0.011 |
| | (0.465) | (0.461) | (0.015) | (0.466) | (0.462) | (0.026) |
| Number of contestants ($t-1$) | 11.500 | 10.829 | -0.671*** | 10.746 | 10.922 | 0.175 |
| | (5.397) | (5.319) | (0.170) | (5.293) | (5.125) | (0.291) |

**Notes:** The 'Irrelevant Third' column reports statistics from constituencies where the vote share of the third-ranked candidate was lower than the winning margin; the 'Relevant Third' column corresponds to constituencies where the third-ranked candidate's vote share was higher than the winning margin. The first three columns contain all constituencies where there were more than 2 candidates, and the last three columns contain only those constituencies where the third-ranked candidate's vote share was at most 5 percentage points higher (or lower) than the winning margin. All variables recorded at $t-1$ correspond to the (previous) 2008–2012 election cycle. Significance: $^{***}p < 0.01$;$^{**}$ $p < 0.05$;$^{*}$ $p < 0.1$.

## Table C4: The Effect of a *Relevant Third* on Electoral Outcomes of the Runner-up and the Third Placed Candidate

| | Electoral Outcomes in the Next Election | | | |
|---|---|---|---|---|
| | Runner-up | | Third Placed | |
| | $p = 1$ | $p = 2$ | $p = 1$ | $p = 2$ |
| | (1) | (2) | (3) | (4) |
| **Panel A: Re-contesting in the Next Election** | | | | |
| *Relevant Third* | 0.041 | 0.0492 | -0.1073 | -0.2354** |
| | (0.7491) | (0.1097) | (0.0661) | (0.1040) |
| Bandwidth ($h$) | 2.878 | 2.878 | 2.209 | 2.209 |
| Effective Number of Observations | 821 | 821 | 579 | 579 |
| **Panel B: Winning in the Next Election** | | | | |
| *Relevant Third* | -0.0723 | 0.0258 | 0.0511 | 0.0299 |
| | (0.1174) | (0.1744) | (0.1497) | (0.2384) |
| Bandwidth ($h$) | 3.002 | 3.002 | 3.524 | 3.524 |
| Effective Number of Observations | 386 | 386 | 146 | 146 |

**Notes:** Local linear RD regression ($p = 1$) results presented in Columns 1 and 3. Columns 2 and 4 present results for a local quadratic RD regression ($p = 2$) using a triangular kernel using the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parentheses. Significance: $^{***}p < 0.01$;$^{**}$ $p < 0.05$;$^{*}$ $p < 0.1$.

# D Robustness Exercises

In this section, we conduct a set of robustness exercises to address important concerns related to the estimates presented in the preceding section.

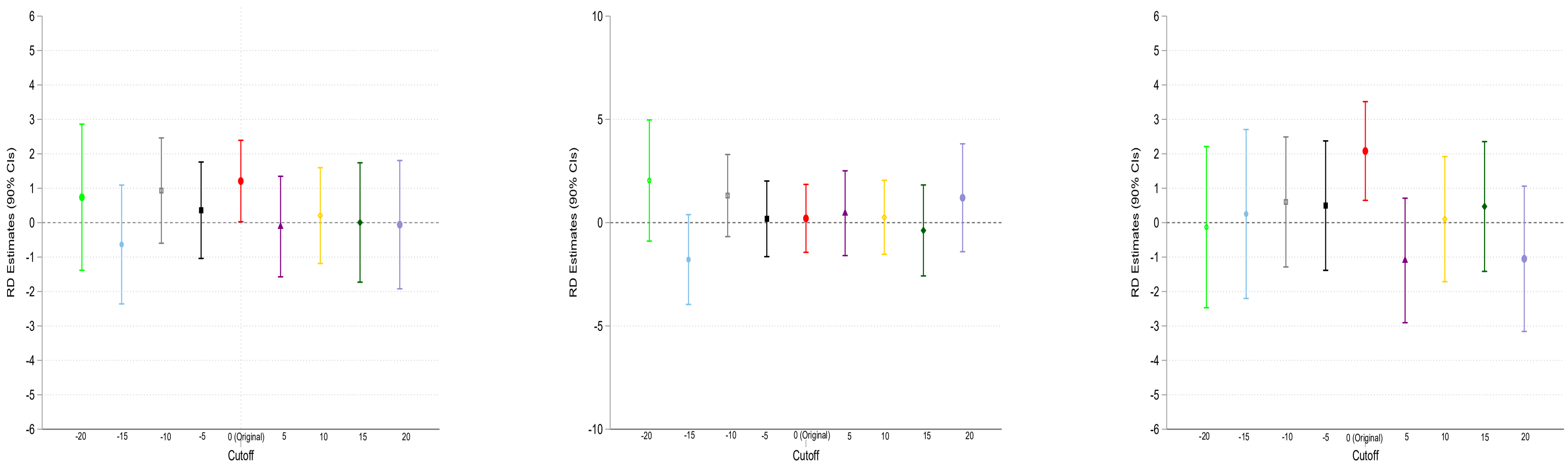
***Placebo Discontinuity*:** In our main analysis, the treatment assignment rule is described by *Third Margin*, i.e., the difference between the vote share of the third-ranked candidate, and the winning margin. While our RD specification is based on a cut-off of zero (i.e., $v_3 = v_1 - v_2$), the salience of this specific cut-off for an incumbent might not be as sharp. For instance, an incumbent, elected by a winning margin of, say, 10%, may regard a third-ranked candidate with a vote share of 9% to be as relevant as a third-ranked candidate with a vote share of 11%; i.e., the incumbent might view both cases as a credible threat of coalition. In our empirical framework, the former would be defined as a *non-Relevant Third*, while the latter would be considered *relevant*. We address this concern by re-estimating our main specification (equation (3)) using placebo (alternative) thresholds. In our case, a placebo threshold of, say, 5 would imply that third-ranked candidates are relevant only when their vote share exceeds the winning margin by more than 5 percentage points, and vote shares falling short of the winning margin by 5 percentage points or more correspond to 'non-relevant' thirds. We estimate the treatment effect at placebo cut-offs in increments of 5 percentage points either side of zero. The results for this exercise are presented graphically in Figure D1. We find that for all placebo thresholds, the results are not statistically significant, and it is only the cut-off of zero that matters for any effects on economic growth to materialise. Reassuringly, the placebo cut-offs do not yield a statistically significant results separately for the first- and the second-half of the electoral terms.

***Alternative Bandwidths*:** In Table 4, we presented RD estimates for the optimal bandwidth ($h$) computed using the Imbens and Kalyanaraman (2012) procedure, as well as results from using two variants of $h$: (*i*) half the optimal bandwidth ($h/2$), and (*ii*) double the optimal bandwidth ($2h$). While we do not expect coefficient stability as we move farther away from the cut-off, it is useful to examine how the estimates evolve with incremental changes in the optimal bandwidth. In Figure D2, we present different point estimates (and the 90% confidence intervals) by varying the bandwidth between 0.1 and 2 of the optimal bandwidth in increments of 0.1. The patterns are fairly stable showing a steady decline in the estimated effect, as $h$ increases, particularly in Panels A and C. Consistent with the results presented in Table 4, irrespective of $h$, the effects are never statistically significant for the first half of the electoral term (Panel B).

***Incumbent's Failure to Secure a Majority*:** In a first-past-the-post multi-party electoral system, it is entirely possible for a candidate to win the election without securing a majority vote share. For example, in our sample, only 31% of the winning candidates secured a vote share greater than 50%. One could argue that what we are estimating is the effect of a winner not being able to secure a majority vote share compared to a winner who wins by a majority, instead of actually capturing the impact of having a *Relevant*

## Figure D1: Placebo Discontinuities

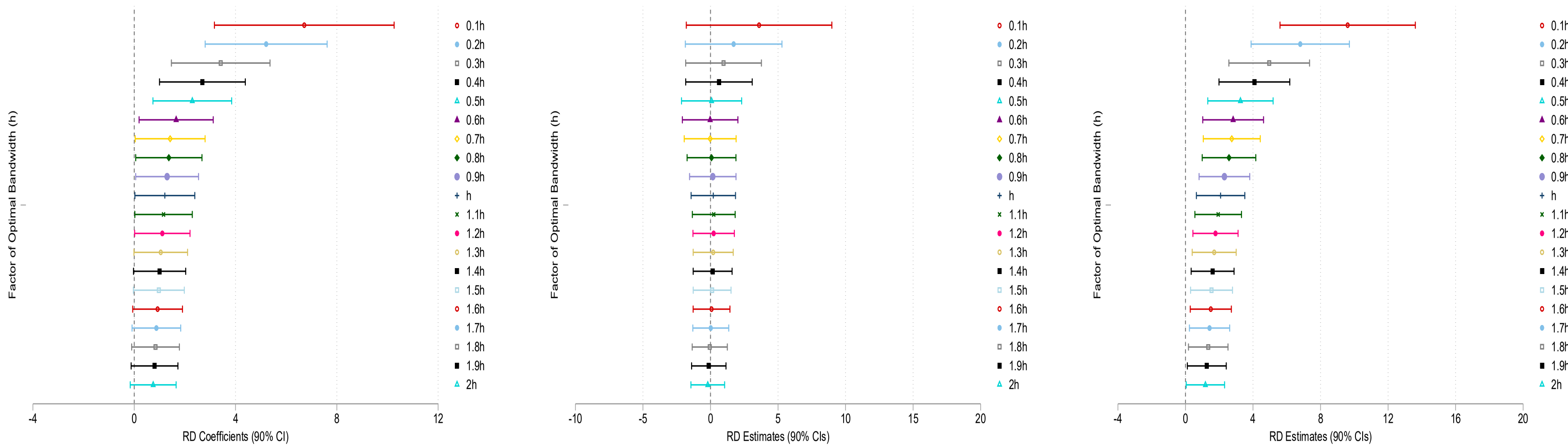
**Panel A: Full Electoral Term** | **Panel B: First-Half of the Electoral Term** | **Panel C: Second-Half of the Electoral Term**




**Notes:** This presents different point estimates (and the 90% confidence interval) at placebo cut-offs in increments of 5 percentage points on either side of zero (which is the original cut-off). For instance, a placebo cut-off of -5 implies that a third-ranked candidate is *not* relevant only when her vote share falls at least 5 percentage points short of the winning margin- i.e., she is relevant even if her vote share is, say, 4 percentage points short of the winning margin. We reproduce our main findings at zero (red), and show that the estimated ‘treatment effects’ for placebo cut-offs on either side of zero are statistically not significant.

# Figure D2: Robustness to Choice of Bandwidth

**Panel A: Full Electoral Term** | **Panel B: First-Half of the Electoral Term** | **Panel C: Second-Half of the Electoral Term**




**Notes:** This presents different point estimates (and the 90% confidence interval) by varying bandwidth ($h$) between a factor of 0.1 and 2 of the optimal bandwidth in increments of 0.1.

*Third* vis-à-vis not having one in the constituency. To address this concern, we estimate the following regression:

$$GROWTH_{c,s,t+1} = \alpha + \beta Majority\ Winner_{c,s,t} + f(Majority\ Margin_{c,s,t}) + \mu_{c,s,t+1} \tag{D1}$$
$$\forall\ Majority\ Margin_{c,s,t} \in (d-h, d+h)$$

where $Majority\ Margin_{c,s,t} = v_1 - 50$ (how far the winner is to securing majority) is our new running variable; $Majority\ Winner = 1$ if $v_1 > 50$, and 0 otherwise. Observing a jump in nightlights growth similar to the one presented in Table 4 at this placebo cutoff (i.e., at $Majority\ Margin_{c,s,t} = 0$ or $v_1 = 50$) would be problematic for two reasons. *First*, this would imply that the presence of a *Relevant Third* is potentially not a credible measure of electoral competition; instead, it is simply an indirect indicator of the electoral strength of the incumbent. *Second*, this would also imply that our estimates are not purely a product of an incumbent's response to a coalitional threat; instead, it could imply that the incumbent is simply responding to not acquiring a majority vote share.[28] The corresponding regression results are presented in Table D1 in the Appendix. Reassuringly, we do not observe a significant difference in nighttime lights growth between constituencies where the winner *barely* secured a majority vote share relative to constituencies where the winner *barely* missed out on a majority. In fact, the estimates are not statistically significant for any bandwidth choice, and for any phase of the electoral term.[29] This provides us with some confidence in our estimates in that we are not erroneously capturing the impact of a seemingly related feature of the election.

***Beyond the Third*:** Do candidates ranked lower than the third position matter? It is natural to ask whether the effects observed in the preceding section extend to, say, the fourth- or the fifth-ranked candidates who become 'relevant' according to our definition (i.e., when their vote share exceeds the winning margin). If this indeed were the case, then it would imply that the estimates presented in Table 4 are, in fact, capturing the impact of 'fragmentation' instead of a threat of coalition. Drawing on the Duverger-Demsetz hypothesis (see Ferris et al., 2016), our contention is that a 'relevant' candidate ranked lower than the third position cannot serve as (or represent a credible measure of) a viable threat of collusion. This is primarily because, theoretically, as fragmentation increases, the possibility of coalition formation among the non-incumbents decreases. To empirically validate our argument, we estimate equation (3) using two alternative running variables: (*i*) $Fourth\ Margin = v_4 - (v_1 - v_2)$, and (*ii*) $Fifth\ Margin = v_5 - (v_1 - v_2)$; where $v_i$ is

[28] This is essentially identical to estimating the effect of the combined vote share of candidates ranked third and lower exceeding the winning margin. Even if we take the running variable to be the difference in the combined vote share of all candidates finishing $3^{rd}$ and below, and the winning margin, we do not find statistically significant effects on growth in nightlights.

[29] Figure B1 in the Appendix presents a graphical analogue of the results presented in Table D1.

**Table D1: Effect of a *Majoritarian Winner* on Growth of Nightlights**

| | $p=1$ | | | | $p=2$ |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| **Panel A: Full Electoral Term** | | | | | |
| *Majority Winner* | 0.304 | 0.288 | 0.496 | -0.094 | 0.222 |
| | (0.564) | (0.575) | (0.754) | (0.428) | (0.793) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.10 | 4.88 | 2.55 | 10.20 | 5.10 |
| Observations | 6308 | 6088 | 3472 | 10244 | 6308 |
| **Panel B: First-Half of the Electoral Term** | | | | | |
| *Majority Winner* | 0.155 | 0.145 | 0.217 | 0.173 | -0.182 |
| | (0.756) | (0.761) | (1.031) | (0.581) | (1.084) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.85 | 5.76 | 2.92 | 11.69 | 5.85 |
| Observations | 3508 | 3474 | 1964 | 5496 | 3508 |
| **Panel C: Second-Half of the Electoral Term** | | | | | |
| *Majority Winner* | 0.507 | 0.506 | 0.780 | -0.142 | 0.753 |
| | (0.920) | (0.903) | (1.271) | (0.681) | (1.343) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 4.40 | 4.57 | 2.20 | 8.81 | 4.40 |
| Observations | 2764 | 2844 | 1532 | 4676 | 2764 |

**Notes:** Local linear RD regression ($p = 1$) results presented in Columns 1–4. Column 5 presents results for a local quadratic RD regression ($p = 2$) using a triangular kernel using the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parentheses. In each column, the outcome variable is the annual growth in luminosity density (net of year fixed-effects) as defined in Section 3. Panel A: sample of annual growth rate in the full electoral term ($t + 1$ to $t + 4$); Panel B: annual growth rate in the first half of the term ($t+1$ and $t+2$); Panel C: annual growth rate in the second half of the term ($t+3$ and $t+4$). *Majority Winner* is an indicator variable equal to 1 if $v_1 > 50$, and 0 otherwise (see equation (D1) for more details). Significance: $^{***}p < 0.01$;$^{**}$ $p < 0.05$;$^{*}$ $p < 0.1$.

the vote share of the $i$-th ranked candidate.[30] The same definition of a 'relevant' candidate using the margin variable, as described in equation (2), applies here. Table D2 presents the results from this estimation exercise. We find that there is no statistically impact of a

[30] We do not go beyond the fifth-ranked candidate since we do not have a sufficient number of observations where the vote shares of candidates ranked, say, sixth or seventh exceed the winning margin.

*relevant fourth* or a *relevant fifth* across the electoral term.[31] This provides further evidence that it is indeed the effect of a coalitional threat, induced by the presence of a *Relevant Third*, that drives our main results.[32] We discuss the coalition formation problem more in Section E.4 where we examine what kinds of non-incumbent vote share compositions constitute a credible coalitional threat.

[31] Figure B2 in the Appendix presents a graphical analogue of the results presented in Table D2.

[32] Even if we do not separately examine the 'individual' relevance of lower-ranked candidates, and instead pool the vote share of candidates ranked $4^{th}$ and below and use the difference between this combined vote share and the winning margin as the running variable, we find continue to find effects that are statistically indistinguishable from zero. This further strengthens our argument that a possible increase in fragmentation minimises the coalitional threat for the incumbent.

## Table D2: Impact of a *Relevant Fourth/Fifth* on Growth of Nightlights

| | Fourth-Ranked Candidate | | | | | Fifth-Ranked Candidate | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $p = 1$ | | | | $p = 2$ | $p = 1$ | | | | $p = 2$ |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| **Panel A: Full Electoral Term** | | | | | | | | | | |
| *Relevant Candidate* | -0.361 | -0.895 | -1.343 | -0.034 | -1.344 | 0.350 | 0.205 | 0.186 | 0.293 | 0.0468 |
| | (0.714) | (0.843) | (0.901) | (0.569) | (0.954) | (0.740) | (0.828) | (0.915) | (0.601) | (0.975) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.18 | 3.25 | 2.59 | 10.35 | 5.18 | 5.41 | 3.62 | 2.71 | 10.82 | 5.41 |
| Observations | 5348 | 3740 | 3120 | 5438 | 3916 | 5132 | 3956 | 3160 | 8376 | 5132 |
| **Panel B: First-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Candidate* | -0.304 | -0.697 | -1.102 | 0.162 | -1.089 | 0.585 | 0.321 | 0.231 | 0.683 | 0.227 |
| | (0.941) | (1.107) | (1.197) | (0.752) | (1.271) | (0.979) | (1.129) | (1.216) | (0.802) | (1.315) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.39 | 3.46 | 2.69 | 10.78 | 5.39 | 5.56 | 3.39 | 2.78 | 11.13 | 5.56 |
| Observations | 2760 | 1948 | 1604 | 4510 | 2760 | 2622 | 1898 | 1630 | 4274 | 2622 |
| **Panel C: Second-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Candidate* | -0.191 | -0.438 | -1.078 | -0.318 | -1.201 | 0.198 | 0.006 | 0.092 | -0.232 | -0.098 |
| | (0.901) | (0.972) | (1.118) | (0.719) | (1.172) | (0.969) | (1.041) | (1.141) | (0.804) | (1.198) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 6.22 | 4.89 | 3.11 | 12.43 | 6.22 | 6.29 | 4.69 | 3.14 | 12.57 | 6.29 |
| Observations | 3078 | 2544 | 1800 | 4874 | 3078 | 2868 | 2324 | 1790 | 4598 | 2868 |

**Notes:** Local linear RD regression ($p = 1$) results presented in Columns 1–4 and 6–9. Columns 5 and 10 present results for a local quadratic RD regression ($p = 2$) using a triangular kernel using the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parentheses. Across all panels, columns 1–5 correspond to regressions with *Fourth Margin* as the running variable, while columns 6–10 report RD estimates with *Fifth Margin* as the running variable (see Section 5.2). *Relevant Candidate* is an binary variable which- (a) for Columns 1–5, corresponds to whether the fourth-ranked candidate's vote share exceeds the winning margin, and (b) for Columns 6–10, indicates whether the fifth candidate's vote share exceeds the winning margin. In each column, the outcome variable is the annual growth in luminosity density (net of year fixed-effects) as defined in Section 3. Panel A: sample of annual growth rate in the full electoral term ($t + 1$ to $t + 4$); Panel B: annual growth rate in the first half of the term ($t + 1$ and $t + 2$); Panel B: annual growth rate in the second half of the term ($t + 3$ and $t + 4$). The p-values for equality of coefficients across the two sub-samples (NOTA vs Non-NOTA Thirds) using a Wald $\chi^2$ test presented in italics. Significance: $^{***}p < 0.01;^{**} p < 0.05;^{*} p < 0.1$.

# E Heterogeneity Analysis

The impact of a *Relevant Third* on economic development may vary by the characteristics of the winner (party affiliation and alignment), the political/institutional environment of the state where the constituency is located the gender of the winner and the margins (of the winner and the runner-up). In this Section, we conduct heterogeneity analyses along a number of different dimensions.

## E.1 Political Alignment of the Winner

We first examine whether the effects observed in Section 5.1 exhibit any heterogeneity based on political alignment of the winning candidate vis-à-vis the party in power at the state level i.e., aligned vs non-aligned winner. For coalition-based state governments that are constituted of multiple political parties, we consider winning candidates in constituencies to be aligned if they belong to any one of the parties that constitute the coalition. Table E1 presents the results from estimating equation (3) for two sub-samples: ($a$) politically aligned winner (columns 1–5) and ($b$) politically non-aligned winner (columns 6–10). Once again we present separate estimates for the full electoral term (years $t+1-t+4$) and for the first and second halves of the electoral term (years $t+1$ and $t+2$ and $t+3$ and $t+4$ respectively). We find that the effect is more pronounced and statistically significant for the set of constituencies that elect an aligned candidate, as compared to non-aligned winners.[33] This effect is strong both for the full electoral term (Panel A) and also separately for the second half of the electoral term (Panel C). There is no corresponding effect in the first half of the electoral term (Panel B). There is no effect of having a *Relevant Third* in constituencies where the winner is not politically aligned with the party in power in the state legislature.[34]

One possible explanation for these results is as follows: political parties as a unit also care about maximising their re-election probability in future electoral cycles. Candidates elected in competitive elections, from seats with a *barely* relevant third-placed candidate might be considered electorally 'weak' by the party. This is in addition to the incumbency disadvantage that is a common feature of Indian elections. The ruling party, might aggressively support such (weak) winners during their term, thereby, resulting in improved economic outcomes for such constituencies.

[33]Figure B3 presents a graphical analogue of the results reported in Table E1. Consistent with the results presented in Table E1, we see a discontinuous jump in the growth of nighttime lights at the cut-off ($Third\ Margin = 0$) in the second half of the electoral term when the winner is politically aligned (with the party in power at the state level).

[34]Using a Wald $\chi^2$ test we test for the equality of the coefficients across the two sub-samples. In Panels A and C, the differences are generally statistically significant, i.e., the effect of a *Relevant Third* is significantly higher in Aligned relative to Non-Aligned constituencies. That is not so for Panel B.

## Table E1: Effect of a *Relevant Third* Candidate on Growth of Nightlights: Effects of Political Alignment

| | Politically Aligned Winner | | | | | Politically non-Aligned Winner | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $p=1$ | | | | $p=2$ | $p=1$ | | | | $p=2$ |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| **Panel A: Full Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 2.298** | 2.166** | 3.708*** | 1.039 | 3.564*** | -0.089 | 0.688 | -0.818 | 0.621 | -0.778 |
| | (0.989) | (0.955) | (1.273) | (0.745) | (1.364) | (0.989) | (0.880) | (1.369) | (0.835) | (1.444) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 4.66 | 5.09 | 2.33 | 9.32 | 4.66 | 6.55 | 10.37 | 3.28 | 13.10 | 6.55 |
| Observations | 2744 | 2992 | 1496 | 4848 | 2744 | 1996 | 2752 | 1136 | 3196 | 1996 |
| p–value (Aligned − Non-Aligned) | | | | | | *0.088* | *0.255* | *0.015* | *0.708* | *0.027* |
| **Panel B: First-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 0.916 | 0.482 | 1.648 | 0.079 | 1.343 | -0.806 | -0.101 | -2.156 | -0.083 | -2.066 |
| | (1.441) | (1.193) | (1.916) | (1.072) | (2.011) | (1.570) | (1.358) | (2.240) | (1.231) | (2.313) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.61 | 8.78 | 2.80 | 11.22 | 5.61 | 6.07 | 9.14 | 3.04 | 12.14 | 6.07 |
| Observations | 1614 | 2286 | 894 | 2796 | 1614 | 946 | 1258 | 544 | 1526 | 946 |
| p–value (Aligned − Non-Aligned) | | | | | | *0.419* | *0.747* | *0.198* | *0.921* | *0.267* |
| **Panel C: Second-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 3.686*** | 3.535*** | 5.062*** | 1.642* | 5.022*** | 0.621 | 1.440 | 0.493 | 1.480 | 0.217 |
| | (1.301) | (1.270) | (1.721) | (0.963) | (1.809) | (1.216) | (1.120) | (1.656) | (1.106) | (1.767) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 4.77 | 5.04 | 2.38 | 9.54 | 4.77 | 6.67 | 12.36 | 3.34 | 13.34 | 6.67 |
| Observations | 1406 | 1480 | 766 | 2468 | 1406 | 1004 | 1540 | 582 | 1628 | 1004 |
| p–value (Aligned − Non-Aligned) | | | | | | *0.085* | *0.216* | *0.056* | *0.911* | *0.057* |

**Notes:** Local linear RD regression ($p = 1$) results presented in Columns 1–4 and 6–9. Columns 5 and 10 present results for a local quadratic RD regression ($p = 2$) using a triangular kernel using the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parentheses. Across all panels, Columns 1–5 correspond to the sub-sample of politically aligned incumbents, while Columns 6–10 report results for politically non-aligned incumbents as defined in Section 5.3. In each column, the outcome variable is the annual growth in luminosity density (net of year fixed-effects) as defined in Section 3. Panel A: sample of annual growth rate in the full electoral term ($t + 1$ to $t + 4$); Panel C: annual growth rate in the first half of the term ($t + 1$ and $t + 2$); Panel B: annual growth rate in the second half of the term ($t + 3$ and $t + 4$). The p-values for equality of coefficients across the two sub-samples (Aligned vs Non-Aligned) using a Wald $\chi^2$ test presented in italics. Significance: $^{***}p < 0.01$;$^{**}\, p < 0.05$;$^{*}\, p < 0.1$.

## E.2 Political and Economic Environment

Second, we consider heterogeneous treatment effects based on the local political and economic environment. For this, we divide our sample into BIMAROU and non-BIMAROU states, and estimate equation (3) separately for the two sub-samples.[35] While analysing this potential heterogeneity, we note that there are competing theoretical possibilities. On the one hand, voters in economically laggard (or institutionally weak) states may assign a higher weight to the level of economic development in deciding who to vote for. Therefore, the cost of reneging on, or under-providing on economic development might be higher in these states. On the other hand, voters in relatively more developed and prosperous states might be sensitive to any deviations from the pre-existing high-development trajectory, which could, in turn, push the competitively elected candidate to foster economic growth during their term. Which effect dominates is, therefore, an empirical question.

Table E2 reports the results separately for the BIMAROU (columns 1–5) and non-BIMAROU states (columns 6–10).[36] We find that the effects are significantly larger in BIMAROU states compared to non-BIMAROU states and statistically significant only in the former. This is true for the full electoral term (Panel A) and the second half of the electoral term (Panel C). The effect of a *Relevant Third* is never statistically significant in the non-BIMAROU states.[37]

## E.3 Gender of the Incumbent

Does the gender of the incumbent matter? It is argued that the increase in political participation of women has benefited the wider community. For example, Baskaran et al. (2023), using an RD approach, show that constituencies in India that elect women experience significantly higher growth in economic activity and they do not find any negative spillovers in neighbouring constituencies that elect men. In our context we ask whether male and female incumbents perform differently when they face a threat of collusion, i.e., when they are elected from a constituency with a *Relevant Third*. Table E3 presents the RD estimates of a *Relevant Third* on the growth of nightlights in male vs female incumbent constituencies. We find that the positive effects on prosperity that we observed in Table 4 are driven by constituencies with a male incumbent. A *Relevant Third*, or a threat of collusion does

[35]BIMAROU is an acronym used to denote the group of states of Bihar, Madhya Pradesh, Rajasthan, Odisha and Uttar Pradesh. Bihar, Madhya Pradesh and Uttar Pradesh were sub-divided into Bihar and Jharkhand, Madhya Pradesh and Chhattisgarh and Uttar Pradesh and Uttarakhand. We include Jharkhand, Chhattisgarh and Uttarakhand as part of the BIMAROU states. These are considered to traditionally have weaker institutions. Heterogeneity of political economy outcomes by BIMAROU states have been commonly studied in the Indian context. See Prakash et al. (2019), Drèze and Sen (2013).

[36]A graphical analogue of Table E2 is presented in Figure B4 in the Appendix.

[37]Again, using a Wald $\chi^2$ test we also test the equality of the coefficients across the two sub-samples. In Panels A and C, the differences are generally statistically significant, i.e., the effect is a *Relevant Third* is significantly higher in BIMAROU relative to Non-BIMAROU states. In Panel B, when we use a local quadratic RD regression ($p = 2$) — compare the results in columns 5 and 10 — we see that the effects are significantly higher in the BIMAROU states even in the first half of the electoral term.

## Table E2: Effect of a *Relevant Third* on Growth of Nightlights. Institutional Heterogeneity

| | BIMAROU States | | | | | Non-BIMAROU States | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $p=1$ | | | | $p=2$ | $p=1$ | | | | $p=2$ |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| **Panel A: Full Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 3.385** | 2.860* | 5.707*** | 1.598 | 5.634** | 0.114 | 0.139 | 0.084 | -0.132 | 0.017 |
| | (1.624) | (1.528) | (2.123) | (1.229) | (2.265) | (0.596) | (0.560) | (0.805) | (0.477) | (0.854) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.06 | 5.92 | 2.53 | 10.13 | 5.06 | 6.28 | 7.50 | 3.14 | 12.56 | 6.28 |
| Observations | 1692 | 1944 | 916 | 2952 | 1692 | 3568 | 4084 | 2044 | 5972 | 3568 |
| p–value (BIMAROU − Non-BIMAROU) | | | | | | *0.059* | *0.095* | *0.013* | *0.189* | *0.020* |
| **Panel B: First-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 2.147 | 1.811 | 3.825 | 0.967 | 4.168 | -0.797 | -0.751 | -1.543 | -1.013 | -1.781 |
| | (2.225) | (2.077) | (2.910) | (1.669) | (3.048) | (0.957) | (0.870) | (1.344) | (0.724) | (1.412) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 6.18 | 7.40 | 3.09 | 12.35 | 6.18 | 6.66 | 8.30 | 3.33 | 13.32 | 6.66 |
| Observations | 1010 | 1158 | 556 | 1698 | 1010 | 1862 | 2214 | 1074 | 3106 | 1862 |
| p–value (BIMAROU − Non-BIMAROU) | | | | | | *0.224* | *0.255* | *0.094* | *0.276* | *0.076* |
| **Panel C: Second-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 4.138*** | 2.784** | 6.344*** | 1.861 | 6.404*** | 1.043 | 0.970 | 1.576 | 0.624 | 1.661 |
| | (1.548) | (1.352) | (2.084) | (1.175) | (2.218) | (1.005) | (0.960) | (1.340) | (0.822) | (1.418) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.04 | 6.94 | 2.52 | 10.09 | 5.04 | 7.11 | 8.22 | 3.55 | 14.22 | 7.11 |
| Observations | 842 | 1102 | 456 | 1474 | 842 | 1958 | 2202 | 1132 | 3224 | 1958 |
| p–value (BIMAROU − Non-BIMAROU) | | | | | | *0.093* | *0.274* | *0.054* | *0.388* | *0.072* |

**Notes:** BIMAROU states include Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttar Pradesh and Uttarakhand. Local linear RD regression ($p = 1$) results presented in Columns 1–4 and 6–9. Columns 5 and 10 present results for a local quadratic RD regression ($p = 2$) using a triangular kernel using the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parentheses. Across all panels, Columns 1–5 correspond to the sub-sample of BIMAROU states, while Columns 6–10 report results for non-BIMAROU states. In each column, the outcome variable is the annual growth in luminosity density (net of year fixed-effects) as defined in Section 3. Panel A: sample of annual growth rate in the full electoral term ($t+1$ to $t+4$); Panel B: annual growth rate in the first half of the term ($t+1$ and $t+2$); Panel B: annual growth rate in the second half of the term ($t+3$ and $t+4$). The p-values for equality of coefficients across the two sub-samples (BIMAROU vs Non-BIMAROU) using a Wald $\chi^2$ test presented in italics. Significance: $^{***}p < 0.01$;$^{**}p < 0.05$;$^{*}p < 0.1$.

not have a statistically significant effect on growth in nightlights in constituencies with a female incumbent (irrespective of whether we consider the full electoral term or the second half of the electoral term).[38] It is possible that more resources are targeted towards constituencies where the male incumbent is facing a threat of coalition, but women are not provided that kind of support.

## E.4 Electoral Margins

What does a *Relevant Third* mean in the context of overall electoral outcomes and how does that affect the decisions of the incumbent? For example, consider the case where there are exactly three candidates with vote shares $v_1, v_2$ and $v_3$. Suppose the third placed candidate is relevant i.e., $v_2 + v_3 > v_1$. But the combination of vote shares is potentially important. Consider three alternative possibilities: $(a)$ $v_1 = 0.49, v_2 = 0.48, v_3 = 0.03$; $(b)$ $v_1 = 0.49, v_2 = 0.27, v_3 = 0.24$; and $(c)$ $v_1 = 0.35, v_2 = 0.31, v_2 = 0.29$. In case $(a)$, while there is a potential threat of collusion, it is clear that the third placed candidate is not substantive. That is not so in cases $(b)$ and $(c)$ where the third placed candidate receives a high vote share. However, in case $(b)$, the winner is without doubt the preferred candidate. It is possible that the incumbent will act differently in the three cases.

To investigate how the different margins affect post-electoral outcomes we consider heterogeneity with respect to the winning margin $(v_1 - v_2)$, the runner-up margin $(v_2 - v_3)$ and the ratio of winning/runner-up margin $((v_1 - v_2)/(v_2 - v_3))$. The estimating regression is given by equation (3). Once again we present separate regressions for the full electoral term, the first half of the electoral term and the second half of the electoral term. The RD estimates are presented in Table E4. In Panel A, we present the RD estimates for three different categories of the winning margin: $v_1 - v_2 \leq 0.025; v_1 - v_2 \in (0.025, 0.10); v_1 - v_2 \geq 0.10$. The first interval, $v_1 - v_2 \in (0, 0.025]$, corresponds to the conventionally close election case.[39] The other two sub-samples, $(0.025, 0.10)$ and $(0.10, 1)$, are constructed to ensure a sufficient sample size and a similar distribution of relevant vis-à-vis non-relevant Thirds within each interval.

For the full electoral term and in the second half of the electoral term (but not for the first half of the electoral term) the presence of a *Relevant Third* has a statistically significant effect on the growth of nightlights if winning margin is in the intermediate rate i.e., $v_1 - v_2 \in (0.025, 0.10)$. That the effects are not statistically significant when the winning margin is large is not surprising. In this case even though the election is competitive as defined (consider case $(b)$, above), there is no doubt as to who the preferred candidate is and possibly the threat of coalition is not particularly credible in practical terms.

In Panel B we present the heterogeneous effects by the runner-up margin $(v_2 - v_3)$. In this case we consider two categories of the runner-up margin: $v_2 - v_3 \leq 0.2$ and $v_2 - v_3 > 0.2$.

[38] Figure B5 in the Appendix presents a graphical analogue of these results and corroborate them.

[39] In our sample, 588 (14.3%) constituencies have a winning margin of less than 2.5%. On average, 145,819 valid votes are cast in these constituencies, which implies that a winning margin of 2.5% corresponds to the average difference in the votes polled by the winner and the runner-up being approximately 3,645 votes.

## Table E3: Effect of a *Relevant Third* on Growth of Nightlights: Gender of the Incumbent

| | Male Incumbent | | | | | Female Incumbent | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $p = 1$ | | | | $p = 2$ | $p = 1$ | | | | $p = 2$ |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| **Panel A: Full Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 1.507* | 1.462** | 2.730*** | 0.992* | 2.359** | -1.019 | -0.964 | 0.403 | -0.028 | 0.179 |
| | (0.790) | (0.736) | (1.041) | (0.595) | (1.118) | (1.870) | (1.895) | (2.325) | (1.545) | (2.464) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 4.72 | 5.48 | 2.36 | 9.44 | 4.72 | 6.96 | 6.35 | 3.48 | 13.92 | 6.96 |
| Observations | 3944 | 4568 | 2248 | 6936 | 3944 | 572 | 540 | 312 | 956 | 572 |
| p–value (Male – Female) | | | | | | *0.214* | *0.234* | *0.361* | *0.538* | *0.421* |
| **Panel B: First-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 0.561 | 0.560 | 0.470 | 0.492 | -0.130 | -2.512 | -2.777 | -2.871 | -1.137 | -3.327 |
| | (1.067) | (1.064) | (1.462) | (0.801) | (1.530) | (2.526) | (2.629) | (2.939) | (2.109) | (3.027) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 6.49 | 6.54 | 3.25 | 12.98 | 6.49 | 7.90 | 5.78 | 3.95 | 15.80 | 7.90 |
| Observations | 2616 | 2634 | 1476 | 4366 | 2616 | 310 | 262 | 178 | 510 | 310 |
| p–value (Male – Female) | | | | | | 0.263 | 0.241 | 0.310 | 0.656 | 0.260 |
| **Panel C: Second-Half of the Electoral Term** | | | | | | | | | | |
| *Relevant Third* | 2.278** | 2.238** | 3.267*** | 1.235* | 3.458*** | 0.313 | 0.457 | 2.748 | 1.125 | 1.999 |
| | (0.894) | (0.882) | (1.215) | (0.710) | (1.292) | (2.743) | (2.870) | (3.386) | (2.142) | (3.563) |
| Bandwidth Type | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) | IK($h$) | CCT | IK($h/2$) | IK($2h$) | IK($h$) |
| Bandwidth size | 5.92 | 6.10 | 2.96 | 11.84 | 5.92 | 8.86 | 7.71 | 4.43 | 17.72 | 8.86 |
| Observations | 2428 | 2482 | 1390 | 4096 | 2428 | 346 | 306 | 202 | 532 | 346 |
| p–value (Male – Female) | | | | | | *0.496* | *0.554* | *0.885* | *0.961* | *0.701* |

**Notes:** Local linear RD regression ($p = 1$) results presented in Columns 1–4 and 6–9. Columns 5 and 10 present results for a local quadratic RD regression ($p = 2$) using a triangular kernel using the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parentheses. Across all panels, Columns 1–5 correspond to the sub-sample of male incumbents, while Columns 6–10 report results for constituencies with a female incumbent. In each column, the outcome variable is the annual growth in luminosity density (net of year fixed-effects) as defined in Section 3. Panel A: sample of annual growth rate in the full electoral term ($t + 1$ to $t + 4$); Panel B: annual growth rate in the first half of the term ($t+1$ and $t+2$); Panel B: annual growth rate in the second half of the term ($t+3$ and $t+4$). The p-values for equality of coefficients across the two sub-samples (Male vs Female incumbent) using a Wald $\chi^2$ test presented in italics. Significance: $^{***}p < 0.01$;$^{**}\ p < 0.05$;$^{*}\ p < 0.1$.

The effects are statistically significant in the second half of the electoral term: we find that the RD estimates are statistically significant when the runner-up margin is large enough ($v_2 - v_3 \geq 0.2$).

Finally, in Panel C we present the heterogeneous effects by the ratio of the winning/runner-up margin. In this case for the full term and also for the second half of the electoral term the RD estimates are statistically significant when the ratio of the margins is small ($(v_1 - v_2)/(v_2 - v_3) \leq 0.3$).

**Table E4: Effect of a *Relevant Third* on Growth of Nightlights: Electoral Margins**

| | $p=1$ | $p=2$ | $p=1$ | $p=2$ | $p=1$ | $p=2$ |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **I. Winning Margin** | $\leq 0.025$ | | $\in (0.025, 0.1]$ | | $\geq 0.1$ | |
| *Full Electoral Term* | | | | | | |
| Relevant Third | -0.461 | 2.206 | 2.110* | 3.332** | 0.991 | 1.478 |
| | (1.698) | (2.596) | (1.250) | (1.779) | (1.113) | (1.548) |
| Bandwidth ($h$) | 2.56 | 2.56 | 4.63 | 4.63 | 6.04 | 6.04 |
| Effective Number of Observations | 512 | 512 | 2032 | 2032 | 2112 | 2112 |
| *First Half of Electoral Term* | | | | | | |
| Relevant Third | -4.495 | -3.577 | 0.935 | 2.356 | 1.234 | 0.305 |
| | (2.818) | (4.937) | (1.737) | (2.419) | (1.554) | (2.372) |
| Bandwidth ($h$) | 3.004 | 3.004 | 6.23 | 6.23 | 7.46 | 7.46 |
| Effective Number of Observations | 290 | 290 | 1312 | 1312 | 1290 | 1290 |
| *Second Half of Electoral Term* | | | | | | |
| *Relevant Third* | 3.899 | 8.674* | 2.965** | 4.182** | 0.700 | 2.326 |
| | (3.068) | (4.826) | (1.460) | (2.055) | (1.464) | (2.234) |
| Bandwidth ($h$) | 2.11 | 2.11 | 4.44 | 4.44 | 7.19 | 7.19 |
| Effective Number of Observations | 222 | 222 | 962 | 962 | 1240 | 1240 |
| **II. Runner-up Margin** | $\leq 0.2$ | | $> 0.2$ | | | |
| *Full Electoral Term* | | | | | | |
| *Relevant Third* | 0.354 | 0.422 | 1.367 | 2.038* | | |
| | (1.051) | (1.449) | (0.858) | (1.225) | | |
| Bandwidth ($h$) | 6.25 | 6.25 | 5.21 | 5.21 | | |
| Effective Number of Observations | 1652 | 1652 | 3444 | 3444 | | |
| *First Half of Electoral Term* | | | | | | |
| *Relevant Third* | 0.728 | 0.362 | -0.043 | 0.0142 | | |
| | (1.572) | (2.402) | (1.191) | (1.665) | | |
| Bandwidth ($h$) | 7.57 | 7.57 | 5.74 | 5.74 | | |
| Effective Number of Observations | 1002 | 1002 | 1858 | 1858 | | |
| *Second Half of Electoral Term* | | | | | | |
| Relevant Third | 0.014 | 0.229 | 2.642*** | 3.785*** | | |

*Continued ...*

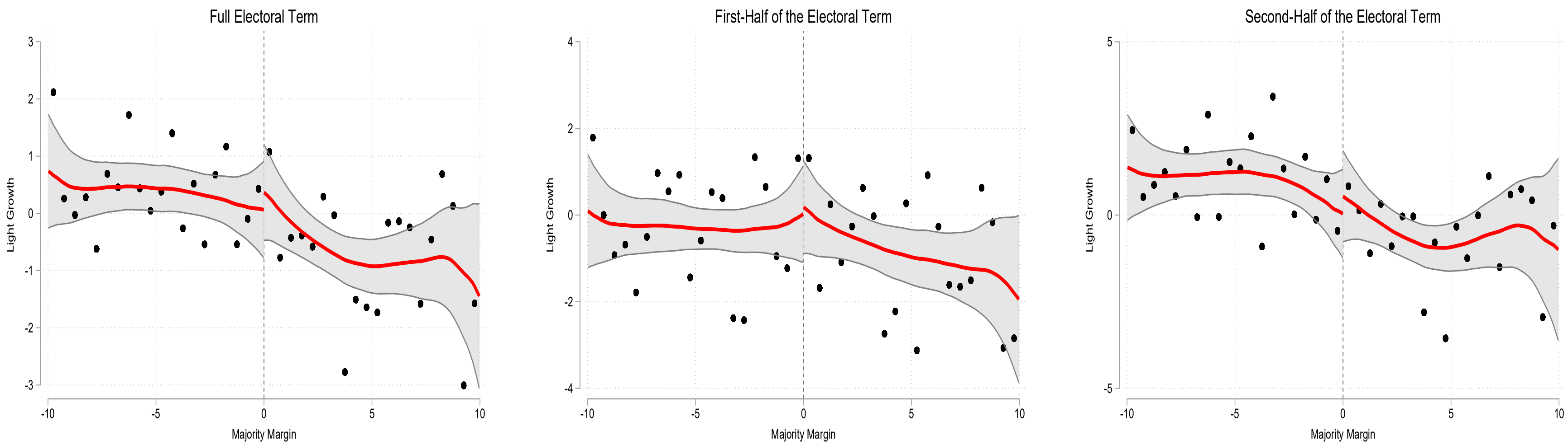
## Effect of a *Relevant Third* on Growth of Nightlights: Electoral Margins (Continued)

| | $p = 1$ (1) | $p = 2$ (2) | $p = 1$ (3) | $p = 2$ (4) | $p = 1$ (5) | $p = 2$ (6) |
|---|---|---|---|---|---|---|
| | (1.452) | (2.316) | (1.008) | (1.431) | | |
| Bandwidth ($h$) | 7.57 | 7.57 | 5.74 | 5.74 | | |
| Effective Number of Observations | 1002 | 1002 | 1858 | 1858 | | |
| **III. Ratio of Margins** | $\leq 0.3$ | | $(0.3, 1]$ | | $\geq 1$ | |
| *Full Electoral Term* | | | | | | |
| Relevant Third | 1.481* | 1.716 | 0.201 | 2.144 | 0.374 | 0.457 |
| | (0.838) | (1.205) | (1.732) | (2.632) | (1.252) | (1.732) |
| Bandwidth ($h$) | 5.64 | 5.64 | 6.63 | 6.63 | 5.9 | 5.9 |
| Effective Number of Observations | 2856 | 2856 | 1396 | 1396 | 1172 | 1172 |
| *First Half of Electoral Term* | | | | | | |
| Relevant Third | 0.214 | 0.507 | -0.21 | -0.858 | 0.698 | 0.305 |
| | (1.252) | (1.670) | (2.170) | (3.409) | (1.873) | (2.927) |
| Bandwidth ($h$) | 6.67 | 6.67 | 7.83 | 7.83 | 7.66 | 7.66 |
| Effective Number of Observations | 1580 | 1580 | 852 | 852 | 738 | 738 |
| *Second Half of Electoral Term* | | | | | | |
| Relevant Third | 2.684** | 2.862* | 0.055 | 3.089 | 0.132 | 0.497 |
| | (1.076) | (1.557) | (1.708) | (2.475) | (1.818) | (2.883) |
| Bandwidth ($h$) | 5.73 | 5.73 | 8.47 | 8.47 | 7.29 | 7.29 |
| Effective Number of Observations | 1440 | 1440 | 952 | 952 | 702 | 702 |

**Notes:** Local linear RD regression ($p = 1$) results presented in Columns 1, 3 and 5. Columns 2, 4 and 6 present results for a local quadratic RD regression ($p = 2$) using a triangular kernel using the IK($h$) bandwidth. Standard errors clustered at the Assembly constituency level presented in parentheses. In each column, the outcome variable is the annual growth in luminosity density (net of year fixed-effects) as defined in Section 3. Panel A: sample of annual growth rate in the full electoral term ($t + 1$ to $t + 4$); Panel B: annual growth rate in the first half of the term ($t + 1$ and $t + 2$); Panel B: annual growth rate in the second half of the term ($t + 3$ and $t + 4$). Results for optimal bandwidth ($h$) using the Imbens and Kalyanaraman (2012) approach presented.

# Figure B1: Robustness: Effect of a *Majoritarian* Winner

**Panel A: Full Electoral Term** | **Panel B: First-Half of the Electoral Term** | **Panel C: Second-Half of the Electoral Term**

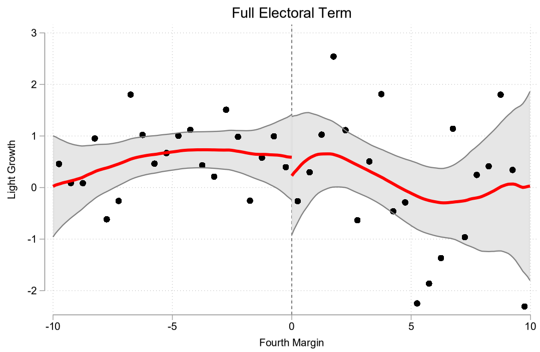



**Notes:** The figure plots the annual growth in luminosity density (net of year fixed effects) against the running variable, *Majority Margin* (see equation (D1). A positive value of the running variable implies that the vote share of the winner exceeds 50% of the total valid votes ($v_1 > 50$); a negative value implies the winner does not secure a majority vote share ($v_1 \leq 50$). Each dot in the figure depicts the averages over successive bins of 0.5% of the running variable. The curves are local linear regression (with 95% confidence intervals) fit separately for the positive and negative parts of the cut-off.

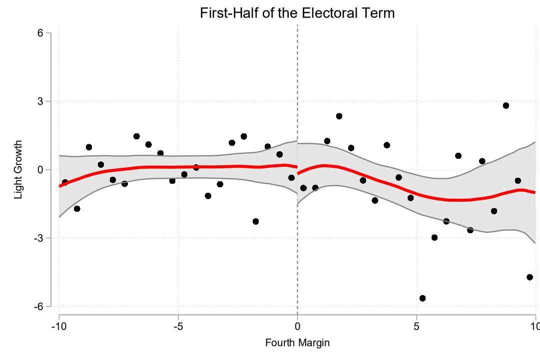
# Figure B2: Robustness: Effect of a *Relevant Fourth/Fifth*

## Panel A: Fourth-Ranked Candidates

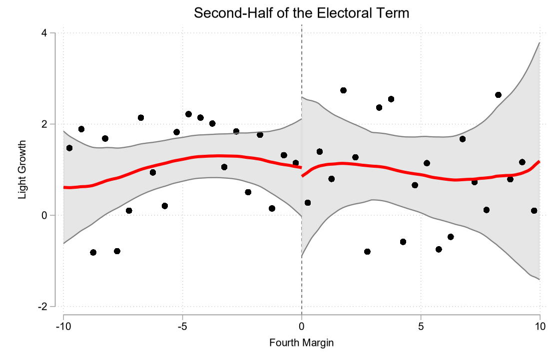
### (a): Full Electoral Term




### (b): First-Half of the Electoral Term

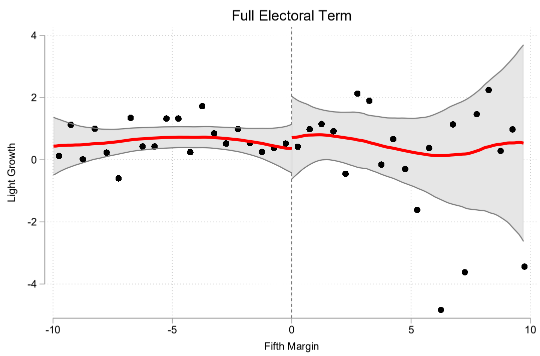



### (c): Second-Half of the Electoral Term

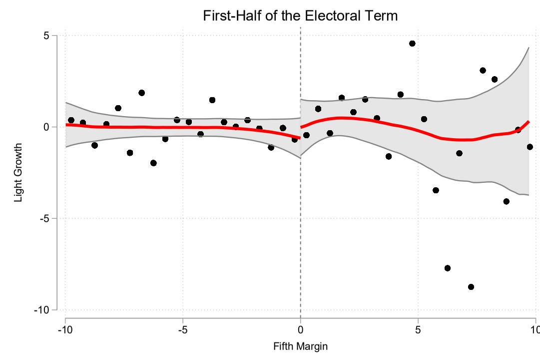



## Panel B: Fifth-Ranked Candidates

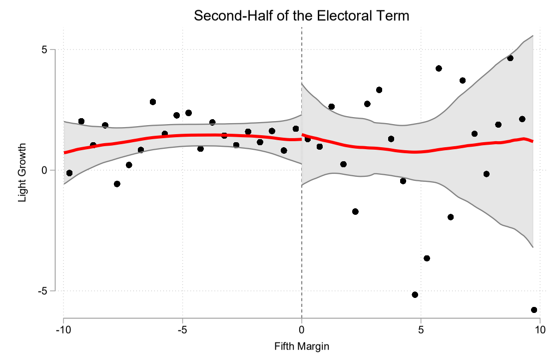
### (a): Full Electoral Term




### (b): First-Half of the Electoral Term




### (c): Second-Half of the Electoral Term

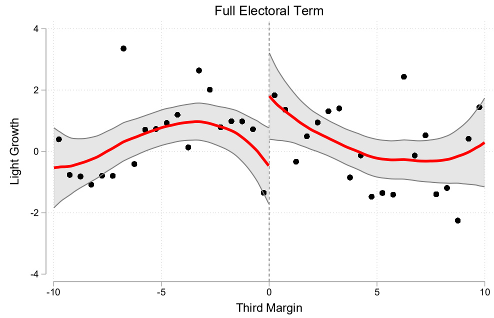



**Notes:** The figure plots the annual growth in luminosity density (net of year fixed effects) against the running variable, *Fourth Margin* in Panel (A), and *Fifth Margin* in Panel (B) (see Section 5.2 for details). A positive value of the running variable implies that the vote share of the fourth-ranked (or fifth-ranked) candidate exceeds the winning margin; a negative value implies the fourth-ranked (or fifth-ranked) candidate's vote share is lower than the winning margin. Each dot in the figure depicts the averages over successive bins of 0.5% of the running variable. The curves are local linear regression (with 95% confidence intervals) fit separately for the positive and negative parts of the cut-off.

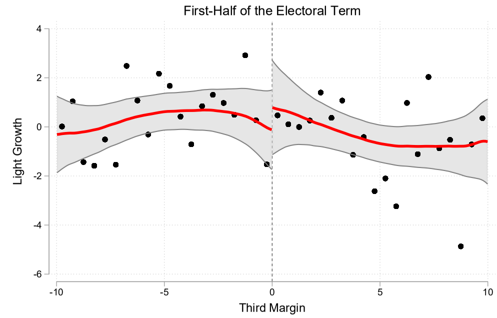
# Figure B3: Impact of a *Relevant Third* on Growth of Nightlights: Effects of Political Alignment

## Panel A: Politically Aligned Winner

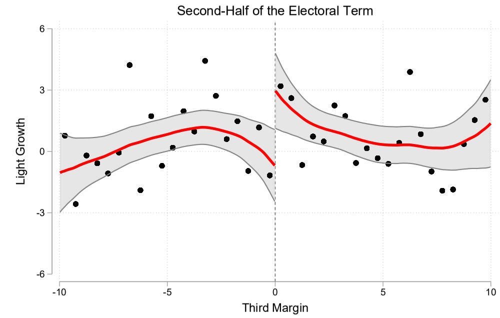
### (a): Full Electoral Term




### (b): First-Half of the Electoral Term

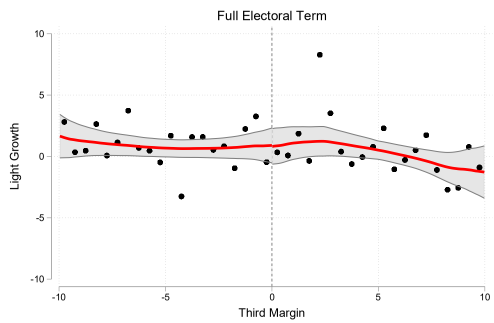



### (c): Second-Half of the Electoral Term

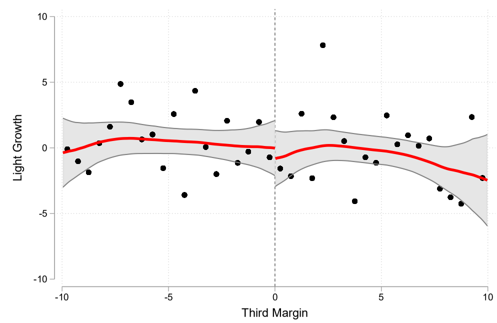



## Panel B: Politically non-Aligned Winner

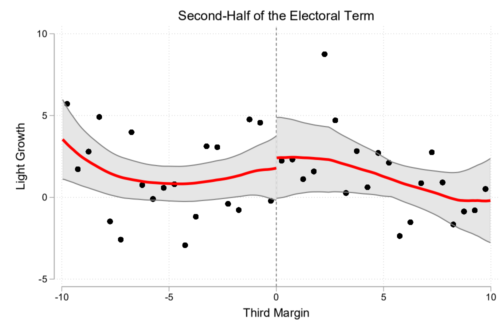
### (a): Full Electoral Term




### (b): First-Half of the Electoral Term




### (c): Second-Half of the Electoral Term

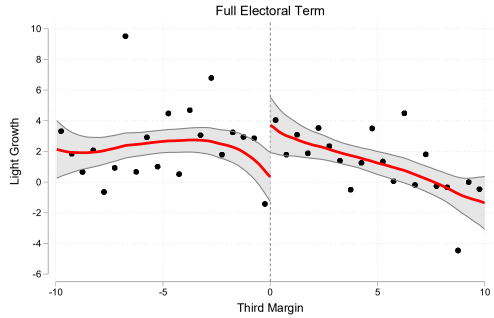



**Notes:** The figure plots the annual growth in luminosity density (net of year fixed effects) against the running variable, *Third Margin*, separately for the sub-sample of politically aligned (Panel A) and politically non-aligned (Panel-B) winners (Section 5.3). A positive value of the running variable implies that the vote share of the third-ranked candidate is higher than the winning margin; a negative value implies the winning margin is higher than the vote share of the third-position candidate. Each dot in the figure depicts the averages over successive bins of 0.5% of the running variable. The curves are local linear regression (with 95% confidence intervals) fit separately for the positive and negative parts of the cut-off.

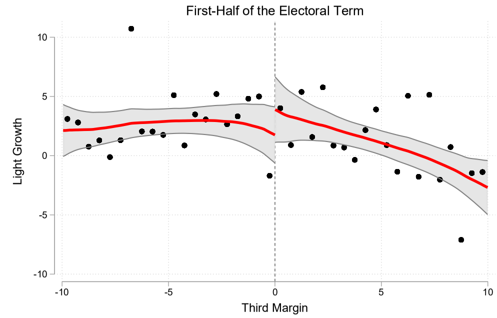
# Figure B4: Impact of a *Relevant Third* on Growth of Nightlights. Institutional Heterogeneity

## Panel A: BIMAROU States

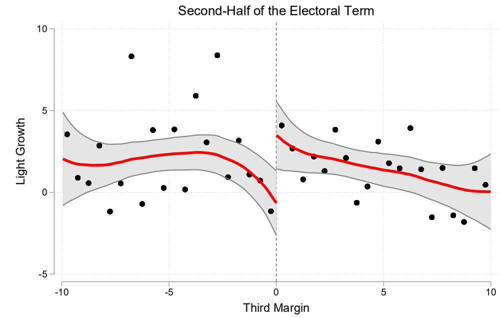
### (a) Full Electoral Term




### (b) First-Half of the Electoral Term

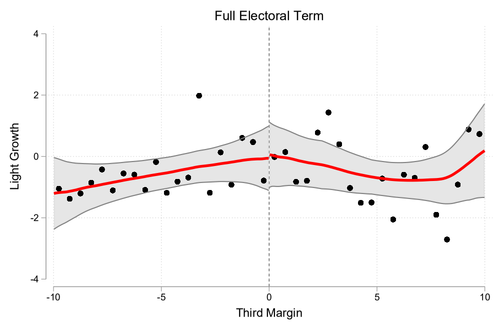



### (c) Second-Half of the Electoral Term

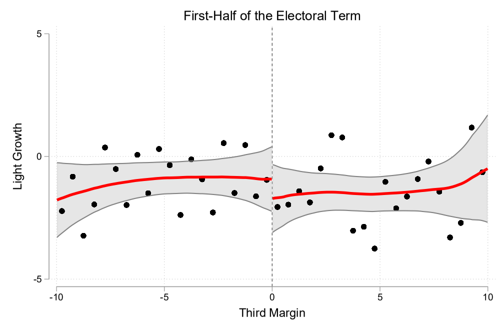



## Panel B: Non-BIMAROU States

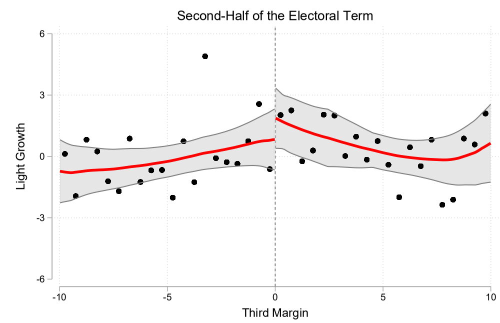
### (a) Full Electoral Term




### (b) First-Half of the Electoral Term




### (c) Second-Half of the Electoral Term

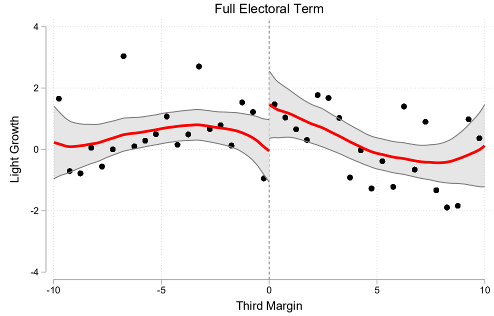



**Notes:** The figure plots the annual growth in luminosity density (net of year fixed effects) against the running variable, $Third\_Margin$, separately for the sub-sample of BIMAROU (Panel A) and non-BIMAROU (Panel-B) states (Section 5.3). A positive value of the running variable implies that the vote share of the third-ranked candidate is higher than the winning margin; a negative value implies the winning margin is higher than the vote share of the third-position candidate. Each dot in the figure depicts the averages over successive bins of 0.5% of the running variable. The curves are local linear regression (with 95% confidence intervals) fit separately for the positive and negative parts of the cut-off.

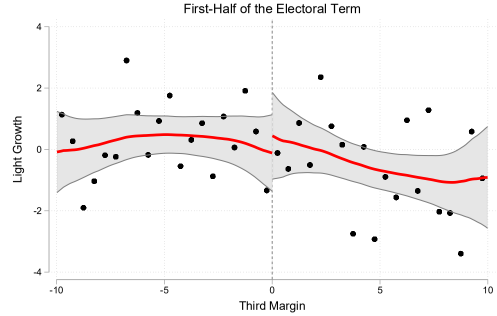
# Figure B5: Impact of a *Relevant Third* on Growth of Nightlights. Incumbent Gender

## Panel A: Male Incumbents

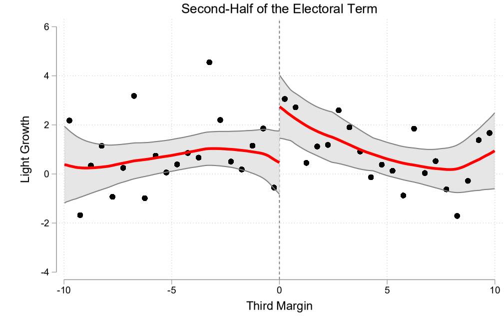
### (a) Full Electoral Term




### (b) First-Half of the Electoral Term

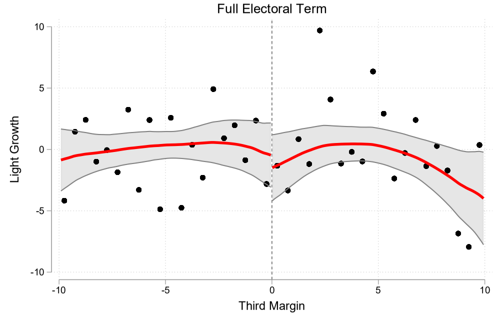



### (c) Second-Half of the Electoral Term

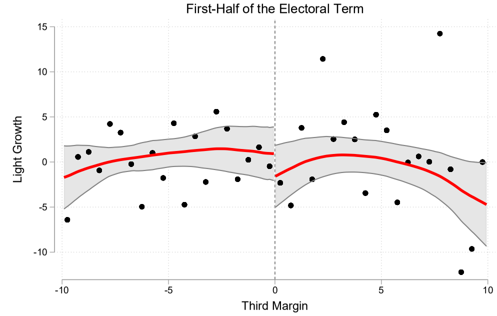



## Panel B: Female Incumbents

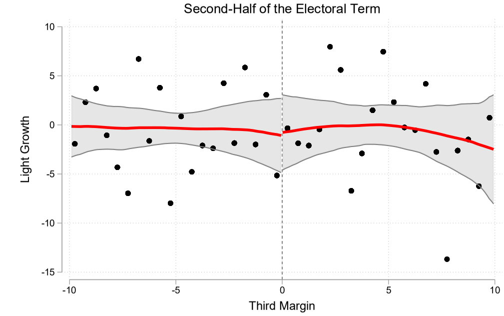
### (a) Full Electoral Term




### (b) First-Half of the Electoral Term




### (c) Second-Half of the Electoral Term

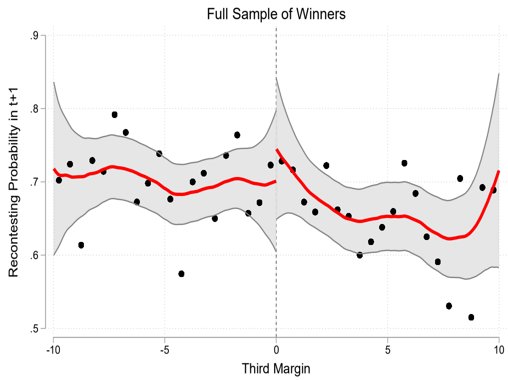



**Notes:** The figure plots the annual growth in luminosity density (net of year fixed effects) against the running variable, $Third\_Margin$, separately for the sub-sample of constituencies with a male incumbent (Panel A) and contituencies with a female incumbent (Panel-B). A positive value of the running variable implies that the vote share of the third-ranked candidate is higher than the winning margin; a negative value implies the winning margin is higher than the vote share of the third-position candidate. Each dot in the figure depicts the averages over successive bins of 0.5% of the running variable. The curves are local linear regression (with 95% confidence intervals) fit separately for the positive and negative parts of the cut-off.

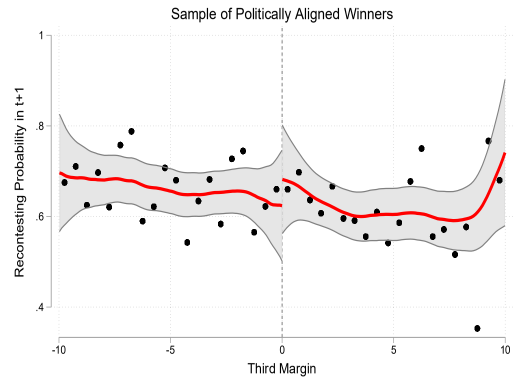
# Figure B6: Impact of a *Relevant Third* on Electoral Outcomes. Re-contesting and Re-election

## Panel A: Probability of Re-contesting in $t + 1$

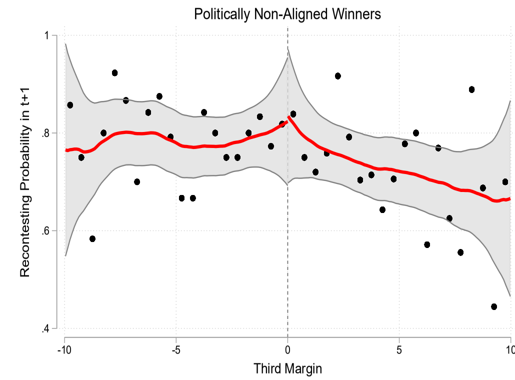
**(a) Full Sample of Incumbents**




**(b) Subsample of Politcally Aligned Incumbents**

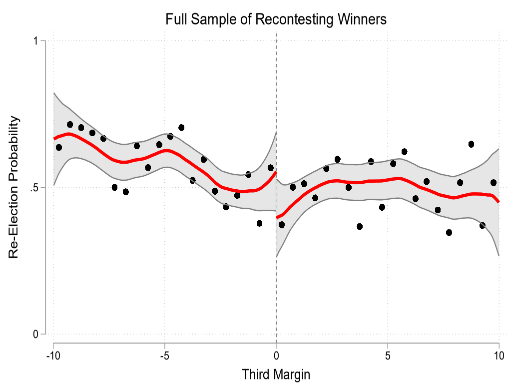



**(c) Subsample of Politcally Non-Aligned Incumbents**

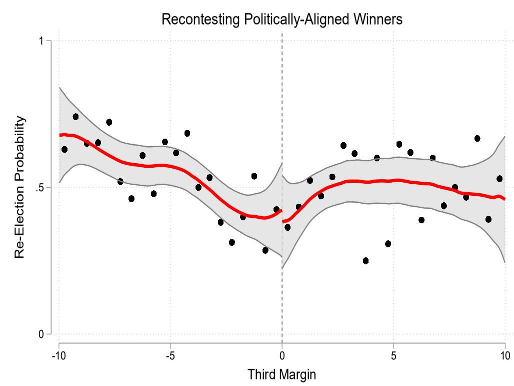



## Panel B: Re-Election Probability Conditional on Re-contesting in $t + 1$

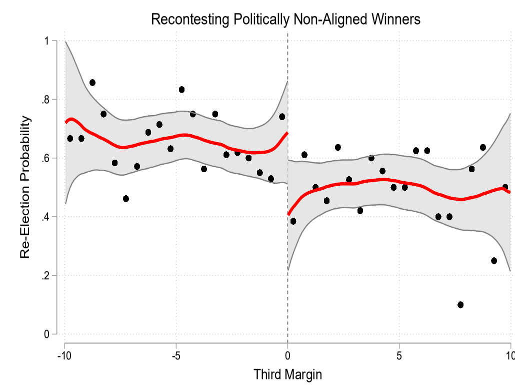
**(a) Full Sample of Re-contesting Incumbents**




**(b) Subsample of Re-contesting Politcally Aligned Incumbents**




**(c) Subsample of Re-contesting Politcally Non-Aligned Incumbents**

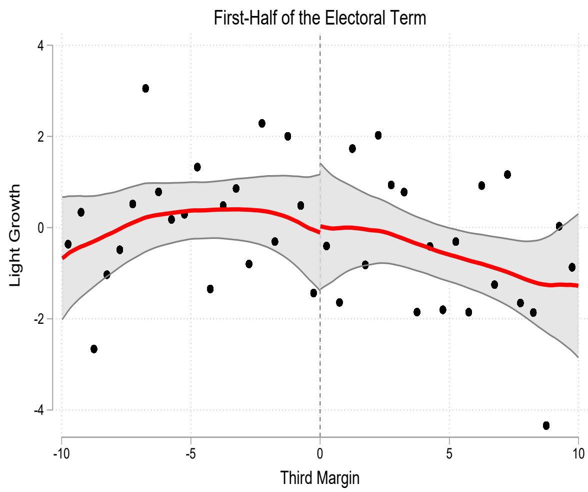



**Notes:** The figure plots the probability that the incumbent re-contests (Panel A), and gets re-elected in the next election (conditional on re-contesting) (Panel B), against the running variable, *Third Margin*. A positive value of the running variable implies that the vote share of the third-places candidate is higher than the winning margin; a negative value implies the winning margin is higher than the vote share of the third-places candidate. Each dot in the figure depicts the averages over successive bins of 0.5% of the running variable. The curves are local linear regression (with 95% confidence intervals) fit separately for the positive and negative parts of the cut-off.

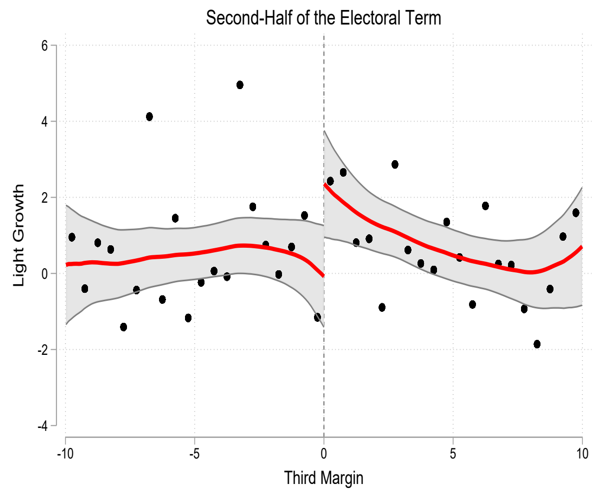
## Figure B7: Impact of a *Relevant Third* on Growth of Nightlight: Falsification Tests

### Panel A: Non-NOTA Third-Ranked Candidte

**(a): First-Half of the Electoral Term**

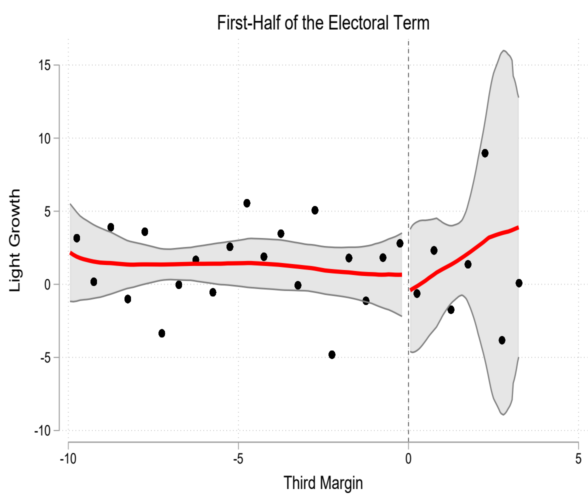



**(b): Second-Half of the Electoral Term**

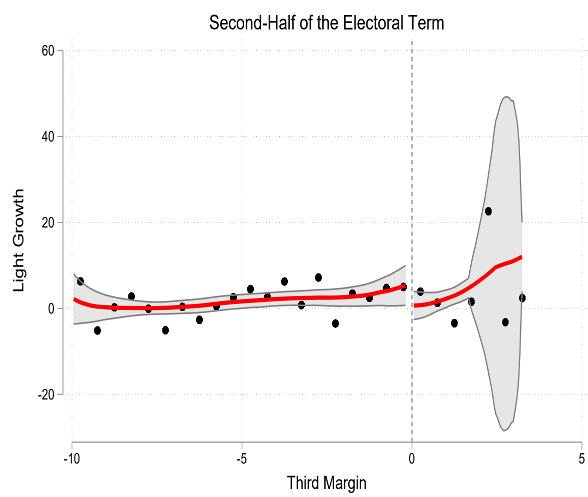



### Panel B: NOTA at the Third Rank

**(a) First-Half of the Electoral Term**




**(b) Second-Half of the Electoral Term**

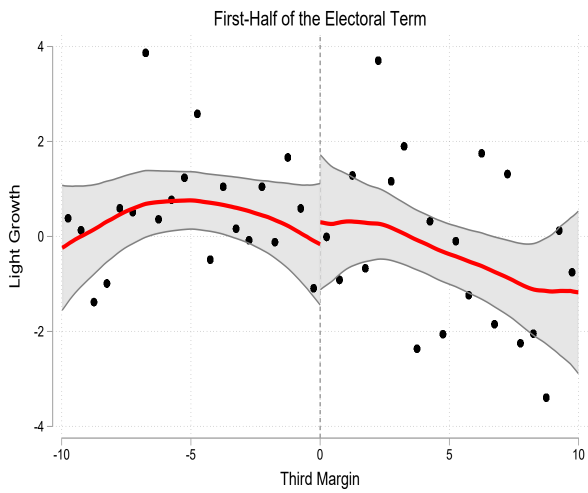



**Notes:** The figure plots the annual growth in luminosity density (net of year fixed effects) against the running variable, *Third Margin*, separately for the sub-sample of constituencies where the third-ranked candidate is not NOTA (Panel A) and constituencies where NOTA ranked third in the polls (Panel-B). A positive value of the running variable implies that the vote share of the third-ranked candidate is higher than the winning margin; a negative value implies the winning margin is higher than the vote share of the third-position candidate. Each dot in the figure depicts the averages over successive bins of 0.5% of the running variable. The curves are local linear regression (with 95% confidence intervals) fit separately for the positive and negative parts of the cut-off.

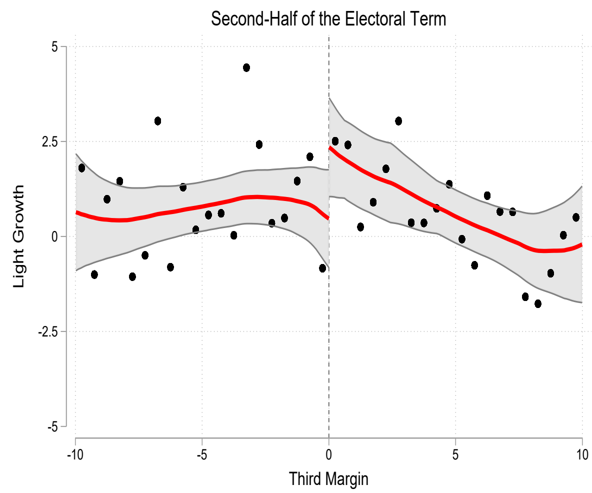
## Figure B8: Relevant Third and Growth of Nightlight: Ideological Credibility of Coalitions

### Panel A: Ideologically Credible Coalition

**(a): First-Half of the Electoral Term**

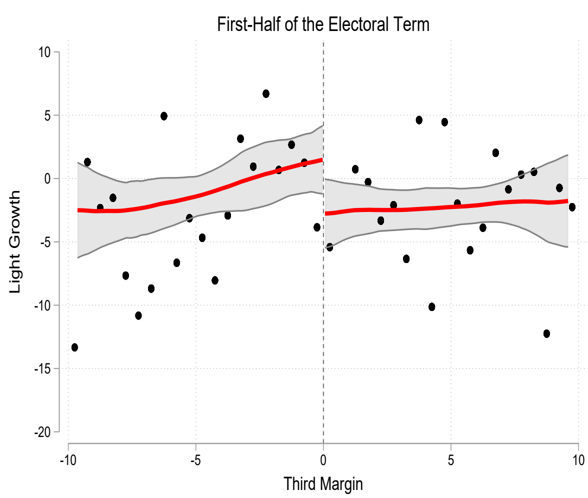



**(b): Second-Half of the Electoral Term**

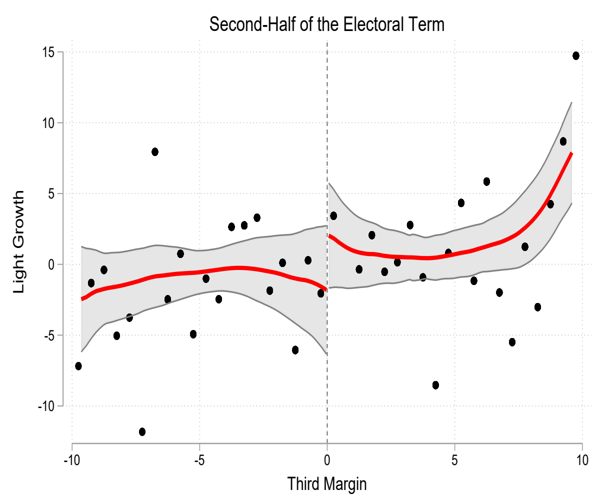



### Panel B: Ideologically Non-Credible Coalition

**(a) First-Half of the Electoral Term**




**(b) Second-Half of the Electoral Term**

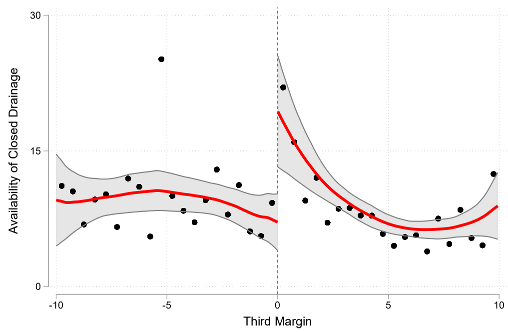



**Notes:** The figure plots the annual growth in luminosity density (net of year fixed effects) against the running variable, *Third Margin*, separately for the following sub-samples- Panel A: constituencies where the runner-up and the third-ranked candidate are not affiliated to the BJP and the INC (in whichever order), and Panel B: constituencies where the runner-up and the third-ranked candidate are affiliated to the BJP and the INC (in whichever order). A positive value of the running variable implies that the vote share of the third-ranked candidate is higher than the winning margin; a negative value implies the winning margin is higher than the vote share of the third-position candidate. Each dot in the figure depicts the averages over successive bins of 0.5% of the running variable. The curves are local linear regression (with 95% confidence intervals) fit separately for the positive and negative parts of the cut-off.

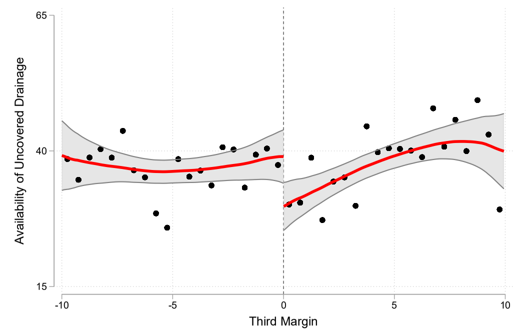
# Figure B9: Impact of a *Relevant Third* on Public Goods Provision

## Panel A: Drainage Infrastructure

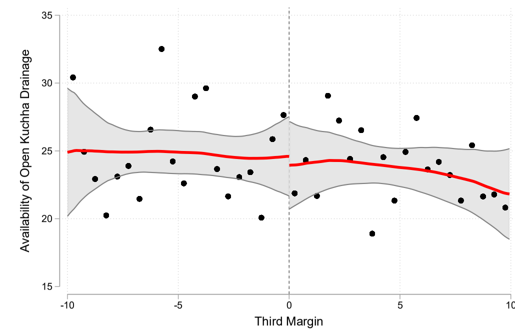
### (a): Closed Drainage System




### (b): Uncovered Drainage System

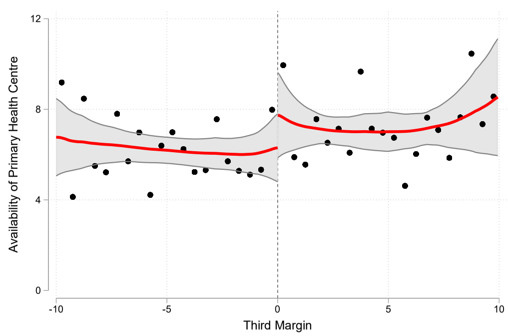



### (c): Open Kuchha Drainage System

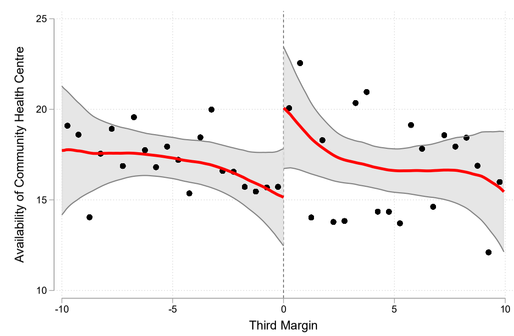



## Panel B: Health Infrastructure

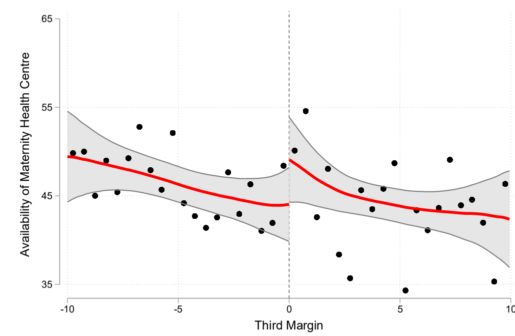
### (a): Primary Health Centres




### (b): Community Health Centres

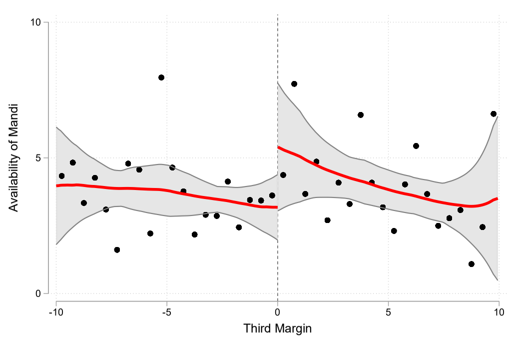



### (c): Maternity Health Centres

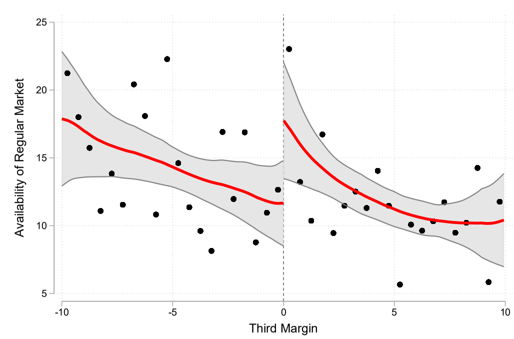



## Panel C: Market Infrastructure

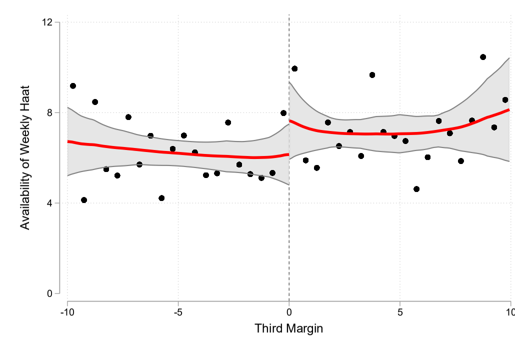
### (a): Mandi




### (b): Regular Market




### (c): Weekly Haat

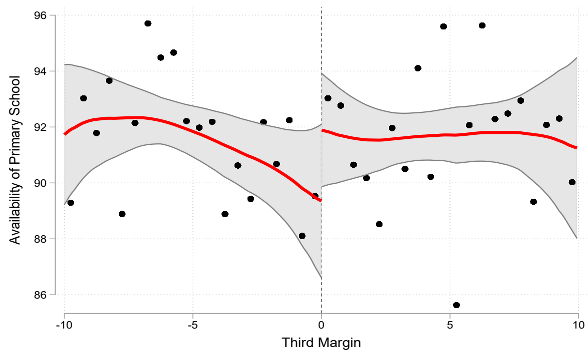



*Continued . . .*

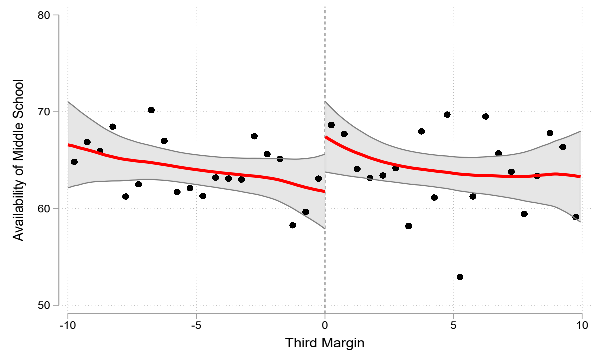
## Figure B9 (Continued): Impact of a *Relevant Third* on Public Goods Provision

### Panel D: Availability of Schools

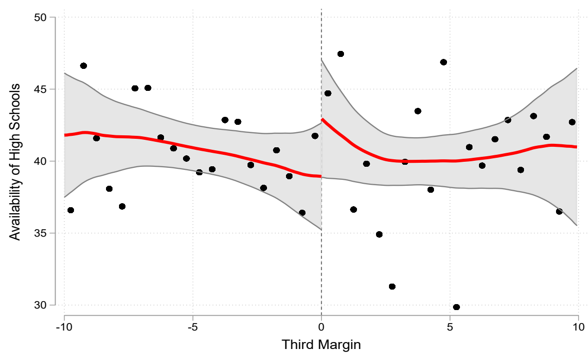
**(a) Primary Schools**



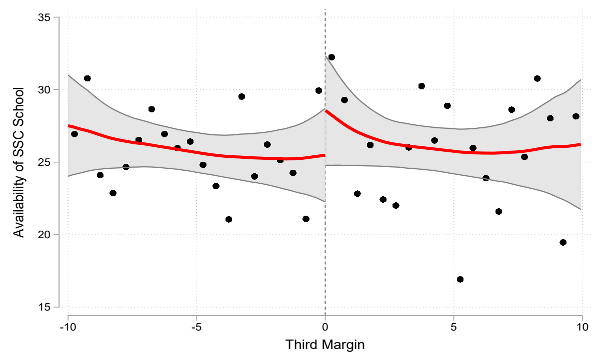

**(b) Middle Schools**




**(c) High Schools**

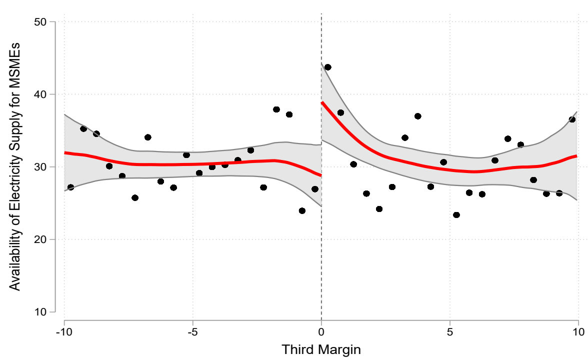



**(d) Senior Secondary Schools**

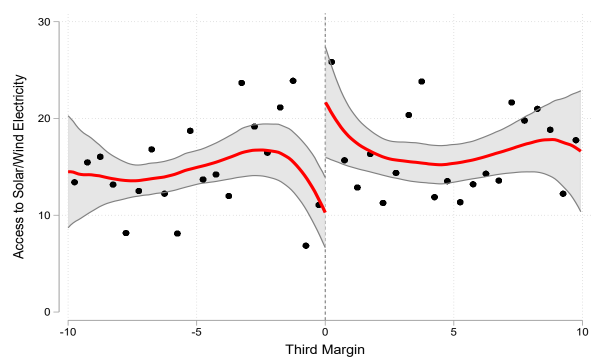



### Panel E: Availability of Electricity

**(a) Electricity Supply for MSMEs**




**(b) Solar/Wind Electricity Availability**




**Notes:** The running variable is *Third Margin*, defined as the difference between the third-position candidate's vote share and the winning margin. Each dot on the scatter plot is an average over successive bins of 0.5% of the running variable. The curves are local linear regressions fit separately for regions above and below the cut-off using a triangular kernel and an optimal bandwidth à la Imbens and Kalyanaraman (2012).