Election Cycles and Electricity Provision: Evidence from a Quasi-experiment with Indian Special Elections

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Abstract

We present evidence from India showing that state governments induce electoral cycles in electricity service provision. Our empirical data and research strategy allow us to build on models of political business cycles and targeted distribution in two important ways. First, we demonstrate that by manipulating the flow of critical inputs into economic activity like electricity, elected leaders attempt to influence electoral outcomes even in contexts where they have constrained fiscal capacity. Second, we identify the effect of elections on electricity provision by focusing on special elections held for exogenous reasons. Our results show that state governments induce substantive increases in electricity service to constituencies that hold special elections. Manipulation of the power supply is stronger in contested constituencies and during special elections held in states where the government commands only a small majority. Overall, we find no evidence of positive welfare effects from electoral manipulation of electricity supply.

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1 Introduction

An influential literature asserts that democratic governments have strong incentives to use their leverage over economic policies to improve their electoral prospects, generating political business cycles in the process.[1] Most empirical research evaluating the existence of political business cycles draws largely on the industrialized world where government control over economic policies can have significant impact on the national economy.[2] In much of the developing world, however, governments face constraints on fiscal capacity and budget shortfalls which may limit their ability to influence economic conditions in ways that are meaningful to the majority of voters. By focusing on special elections held to fill unexpected vacancies in Indian state legislatures, this paper demonstrates a means by which elected leaders in developing countries can influence economic outcomes through an alternative channel: by manipulating the flow and quality of public services that are critical inputs into economic activity.

Our empirical data and research strategy allow us to build on models of the political business cycles in several ways. First, using a dataset on some 4,000 state-level assembly constituencies observed over the period 1992–2009, we examine whether state governments in India manipulate the provision of electricity before elections. Electricity is the lifeblood of the modern economy and a basic input into a wide variety of productive activities. Yet, persistent power shortages in many developing countries require governments to actively manage the supply and distribution of power through load shedding and power outages. In India, electricity service provision is highly valued by citizens and power shortages are known to significantly reduce firm output and revenues (Allcot et al., 2014). As a result, electricity often features as one of the top priorities of Indian voters in election

[1] See Nordhaus (1975); Lindbeck (1976); MacRae (1977); Cukierman and Meltzer (1986); Rogoff and Siber (1988); Rogoff (1990).

[2] Previous empirical contributions on political business cycles include Alesina (1989), Akhmedov and Zhuavskaya (2004), Brender and Drazen (2005), and Shi and Svensson (2006). See Drazen (2000) for a survey of the literature.

surveys (Chhibber et al., 2004; Banerjee and Somanathan, 2007). At the same time, the state government can apply significant pressure on public utilities regarding how, when, and where electricity is provided (Min and Golden, 2014). They can thereby influence economic activity and welfare even when they have limited capacity to influence broader levers of fiscal and monetary policy that are the focus of many studies of the political business cycle in the industrialized world.

Second, given that standard data on constituency-level electricity provision or consumption is unavailable, we use time series data on the emission of nighttime lights as an indicator of electricity service provision. Using satellite imagery of nighttime lights offers several advantages in our context. Given its high spatial resolution, estimates can be constructed for a variety of jurisdictional units. In addition, the data are automatically recorded, providing an objective measure resistant to human biases in reporting. Administrative data, in contrast, is often unreliable or poorly measured in developing countries.

Third, we employ a strategy that credibly identifies the effect of elections on government policy and economic outcomes, overcoming concerns in existing studies regarding the potential endogenous timing of elections. Our paper addresses potential identification problems by focusing on exogenously timed special (or bye-) elections in India's states — state assembly (*Vidhan Sabha*) elections that are held to fill seats that become vacant in between two regularly scheduled elections due to the death of a sitting incumbent. Special elections due to death (henceforth referred to simply as special elections) are credibly exogenous to economic developments and electricity supply since death is a natural phenomenon. The identification is also more credible in that special elections take place in different constituencies at different points of time. Previous studies of electoral business cycles at the local level, for example Baleiras and Costa (2004), Coelho et al. (2006), and Drazen and Eslava (2010), typically face the problem that local elections are held in all localities at the same date, making it difficult to separately identify electoral cycles

from other contemporaneous shocks.[3] We exploit this within-constituency variation in the timing of an election across constituencies for identification.

Fourth, we explore whether the extent of manipulation depends on constituency or state-level political variables. One strand of the theoretical literature on tactical redistribution predicts that politicians target particularly close races while another strand predicts that they aim to reward core supporters and engage in patronage (Cox and McCubbins, 1986; Lindbeck and Weibull, 1987; Dixit and Londregan, 1998; Golden and Min, 2013). Given our data and empirical framework, we test the main hypotheses developed by these two literatures.

Overall, our research identifies significant increases in the provision of electricity in years in which a constituency holds a special election, which we interpret as efforts by political leaders to boost service provision and improve the economic climate prior to elections. We also find that manipulation is more pronounced in constituencies that are contested (swing constituencies) and which were previously represented by a candidate aligned with the state government. We observe furthermore that manipulation is more pronounced in states where the government holds only a weak majority. These findings are meaningful because they demonstrate a pathway by which politicians can significantly engage in electoral manipulation even in a context of tight constraints on policy flexibility and budgets.

Finally, our results indicate that the increase in electricity supply to special election constituencies is due to diversion from non-election constituencies rather than due to the creation of additional electricity. This observation and other pieces of evidence that we present below arguably suggest that the welfare effects of manipulation around special elections are not positive or may even be negative.

[3]Dahlberg and Mörk (2011) attempt to address this problem by using a sample that includes both Swedish and Finnish municipalities. They exploit the fact that local elections in Sweden and Finland are held at different dates. While this approach is an improvement over previous identification strategies, the crucial but untestable assumption of common shocks in Sweden and Finland may not hold.

A previous contribution close to our paper is Khemani (2004), who studies electoral business cycles in India at the state level on the basis of within-state variation in fiscal policy. The author finds that Indian state governments do not manipulate aggregate fiscal variables such as total spending or deficits in the run-up to an election, but that they manipulate individual budget items and public investment projects. Similarly, Cole (2009) observes electoral cycles in agricultural credit provided by public sector banks in India. Our paper differs from Khemani (2004) and Cole (2009) in that they use state-level and district-level data, respectively, while we use constituency-level data, which allows us to study electoral manipulation at a more disaggregated level and for a politically relevant unit. Nevertheless, our findings are largely consistent with their results: while budget constrained state governments may not have the flexibility to boost overall levels of public resources, they are able to manipulate the composition and distribution of resources across political units. Min and Golden (2014) find electoral cycles in the incidence of electricity theft and line losses in the state of Uttar Pradesh. More specifically, the discrepancy between power supplied and billed increases in periods immediately prior to general elections. However, their study does not account for the potential endogeneity in the timing of elections.

The remainder of this paper is structured as follows. In the next section, we describe some institutional background regarding elections in India and electricity provision, and discuss our main theoretical hypotheses. Sections 3 and 4 describe the data and introduce our empirical model. Section 5 discusses the main results. We examine how the competitiveness of an election affects manipulation before special elections in Section 6 and discuss welfare implications in Section 7. We conclude in Section 8.

2 Background

2.1 Timing of Elections

India has a Westminster form of government both at the central and state levels. Elections to state assemblies are conducted based on a first-past-the-post system, under the administration of the Election Commission of India (ECI). Under the Indian constitution, the maximum term length of the state assemblies is five years. Although the Election Commission is responsible for scheduling the exact dates of an election, incumbent governments can exercise reasonable influence over the general timing of elections. An opportunistic government may resign early and necessitate dissolution of the elected body, resulting in early elections at a time when it thinks the winds are in its favor.[4] It is similarly plausible that a government may try to delay an imminent election as long as it is constitutionally possible. For instance, a government that is likely to lose a no-confidence motion may make an unexpected alliance with another party to sustain the government. So, the timing of elections is unlikely to be exogenous to economic conditions.

On the other hand, special elections are held to fill unplanned vacancies in the legislature. Vacancies may arise for several reasons, such as resignation, disqualification, or death of a current legislator. The Election Commission may also hold a special election if it voids an outcome due to electoral irregularities.

According to the Indian Constitution, special elections must be held within a period of six months from the date of occurrence of the vacancy unless the remaining term of the assembly is a year or less.[5] The actual length of the period between a vacancy and special

[4] A case in point is when incumbent National Democratic Alliance (NDA) government dissolved the national parliament in January of 2004, well ahead of the end of term in October. Many commentators noted that the political climate and strong economy favored the incumbent government. The eventual outcome however was not so favorable as the opposition alliance led by the Indian National Congress (INC) party won the majority of the seats and formed the government.

[5] The exact timing of special elections within that window of six months depends on various logistical issues such as delivery of ballot boxes, setting up of polling booths, and recruitment of officials to oversee

election varies from case to case within the six-month window. Lacking adequate data on the date of a vacancy, we cannot determine the exact length of the period. We can draw insights from a few cases, however. Mulayam Singh Yadav resigned from his constituency Gunnaur in Uttar Pradesh in May of 2007 after his party did not win a majority in the state legislature. A special election was held in August to fill the vacancy created by his resignation. In another case, Thiru Anbil Poyyamozhi, from Tiruchirapalli-II constituency, died in August 1999 and a special election was held in February 2000. Thus, there is usually a period of a few months between a vacancy and a special election.

Why should state governments have an incentive to manipulate the availability of electricity during the period leading up to a special election? One reason is that special elections are an important test for the popularity of the incumbent government, especially for a government that enjoys a weak majority in the legislature. Special election contests are often labeled as litmus tests for the chief minister's leadership in popular media. Further, losing badly in a special election might weaken the chief minister in his own party and, in turn, precipitate a decline in his or her authority and may even invite challenges from rival factions within the party.[6]

2.2 Politics of Electricity Provision in India

As in much of the developing world, India's power sector is mainly publicly-owned and managed. The public sector controls about 90% of generation and almost all transmission and distribution in India (Lal, 2005). Electricity provision is primarily a state-level respon-

the elections; and other factors such as weather, the agricultural cycle, school examination schedules, and religious festivals and public holidays. See `http://www.eci.nic.in/eci_main1/the_function.aspx#whendoelections` accessed on May 15, 2013.

[6]It is not unusual to find multiple changes in chief ministerships during the reign of the same party in a single term. See for example `http://articles.economictimes.indiatimes.com/2014-08-18/news/52941982_1_chief-minister-anandi-patel-prime-minister-narendra-modi-the-bjp`

sibility, overseen by public power corporations, many of which remain inefficient and loss making entities even after numerous reforms.

Demand for electricity far outpaces supply in much of India, resulting in regular and frequent power cuts, especially in rural areas. Many states post so-called rostering schedules listing the times during which the power is scheduled to be shut off, though power cuts often exceed even these hours. In the World Bank Enterprise Survey of Indian businesses in 2006, a large fraction of firms (35%) cited access to reliable electricity as the number one obstacle facing their business.[7] Indian firms estimated losing 6.6% of sales as a result of power outages. Given that electricity is so important to social and economic welfare, access to electrical power is also an important issue for voters. In a 2001–02 national survey of public attitudes, three-quarters of Indians ranked electricity as an important problem in their lives and 93% said governments were primarily responsible for electricity service provision (Chhibber et al., 2004).

Given the constraints on overall electricity supply and the political salience of electricity, state governments routinely intervene in the operations of state power utilities, from patronage transfers of employees, interventions in the selection of villages for electrification projects, and influence over the location and length power outages. Min (2014) documents how power officials in Uttar Pradesh are pressured to meet requests for uninterrupted electricity supply from different political interests. Badiani et al. (2012) argue that different political parties court politically organized rich farmers by promising them cheap, and in some cases free, electricity. Min and Golden (2014) further note that the agriculture sector in Uttar Pradesh received preferential supply of electricity, resulting in increased losses at the utility and degraded service for other sectors. Further, any reforms to alleviate bottlenecks in power sector have hit roadblocks as these politically organized farmers are reluctant to pay increased power tariffs (Lal, 2005).

[7] World Bank Enterprise Survey, `http://www.enterprisesurveys.org/` accessed in June 2014.

2.3 Theories of political business cycles and tactical redistribution

Two prominent sets of theories explain electoral manipulation by incumbent governments: models of political business cycles and models of targeted distribution. The political business cycle literature argues that politicians have an incentive to manipulate economic policy in election years. The early models in this literature, adaptive expectations models (Nordhaus, 1975; Lindbeck, 1976; MacRae, 1977), assume that voters expect economic variables to evolve in the election year as in the previous year. If economic outcomes surpass expectations, voters will credit the incumbent government for the economic upswing, leading them to re-elect the government. More recent contributions to this literature show that such manipulation is possible even in a rational expectation framework (Cukierman and Meltzer, 1986; Rogoff and Siber, 1988; Rogoff, 1990), arguing that if voters, who are unsure about a politician's competence, believe that competent politicians can affect economic outcomes more than incompetent ones, competent politicians would want to reveal their type through electoral manipulation.

According to this literature, we should expect manipulation of public services, such as electricity supply, before a special election. In our context, both the state government and individual candidates could in principle engage in manipulation of electricity supply. However, candidates may have limited influence over electricity provision given that the top bureaucrats of public utilities are appointed by the state governments. Hence, without the consent of the state government, candidates cannot effectively engage in manipulation. It is therefore likely that any manipulation is ultimately due to the state government.

A second major branch of the the political economy literature is concerned with the targeted distribution of resources by governments. One strand of this literature predicts that governments will allocate more resources to voters who strongly support the incumbent

government, i. e. to core supporters (Cox and McCubbins, 1986). One interpretation of these models is that governments engage in patronage because they want to induce core supporters to go to the polls in order to increase turnout (Nichter, 2008). While these models are concerned with individual voters, our unit of analysis is the constituency. However, it is plausible that constituencies where the incumbent government enjoys a large majority have a large number of core voters. If Indian state governments target core voters, therefore, electricity supply may increase particularly in those special election constituencies where the state government enjoys considerable support.

The second strand of the targeted redistribution literature argues that governments target resources to voters with weaker party preferences, or swing voters (Lindbeck and Weibull, 1987; Dixit and Londregan, 1998; Stokes, 2005). The main idea is that governments can buy votes from swing voters by providing them with material benefits. The swing voter model, too, has been developed at the level of individual voters, but most empirical studies explore its validity at the level of some aggregate geographical unit (Dahlberg and Johansson, 2002). In our context, we make the assumption that electoral victories will be systematically narrower in constituencies with many swing voters, i. e. that swing constituencies have many swing voters.

Since allocating resources to a given jurisdiction has opportunity costs, state governments should favor jurisdictions where the political rewards are highest and a small change in the vote share can make a large difference in political outcomes. In a first-past-the-post system as in India, decisive changes in political outcomes due to selective targeting of resources are most likely to happen in constituencies where the expected difference between the aligned candidate and its primary competitor is narrow.

Empirical evidence that public resources are subject to political targeting in India is offered by Cole (2009), who finds that agricultural credit is targeted toward districts with many swing constituencies and by Arulampalam et al. (2009), who show that swing states

that are politically aligned with the Indian federal government receive higher federal transfers.

3 Data

3.1 Night light output as proxy for electricity consumption

Building on a growing body of research, we estimate changes in access to electricity service by analyzing satellite imagery of the earth at night and recording the level of light output annually from 1992 to 2009.[8] Each pixel is encoded with a relative measure of its annual average brightness on a 6-bit scale from 0 to 63 (Elvidge et al., 1997, 2001). Studies have shown that DMSP-OLS can reliably detect electrified villages in the developing world and that nighttime light output is a useful proxy for electricity provision (Doll et al., 2006; Min et al., 2013; Min and Gaba, 2014).

The pixel-level light output data is aggregated at the state assembly constituency level to examine the effect of electoral cycles on electricity provision. We create three different constituency-level variables in each year. The first measure is *Light Output per Capita*, computed as the sum of light values from all pixels within the boundaries of each constituency divided by the number of registered voters as reported by the Election Commission. Since variations in light output are assumed to be correlated with electricity service provision, the measure thus tracks the availability and use of electricity within a constituency, a political unit for which few economic indicators are reported. To help account for the skewed distribution of light output towards lower values, we use the natural logarithm of the light

[8]The nighttime satellite imagery comes from the U.S. Air Force Defense Meteorological Satellite Program's Operational Linescan System (DMSP-OLS) and are processed by the National Oceanic and Atmospheric Agency's (NOAA) National Geophysical Data Center (NGDC). Due to space constraints, please refer to Section A in the online appendix for details of the light data.

output per capita.[9] Our second measure is *Growth of Light*, which is the growth rate of light output per capita in the constituency, comparing the current year to the prior year. The third measure is the *Proportion of Lit Villages* within a constituency, which is the proportion of villages with detectable levels of light output in each year. We consider this measure a useful alternative way of quantifying the breadth of access to electricity within a constituency compared to measures based on the level of light output alone.

3.2 Election Data Set

The election data come from various editions of statistical reports published by the Election Commission of India. For each state assembly election, the reports provide for each assembly constituency the name of the constituency, the size of the electorate, the number of votes cast, and the number of valid votes. In addition, it records the names, vote counts, gender and party affiliation of all contesting candidates.

Our data span all states in India, totaling close to 4000 constituencies with the exception of the northern state of Jammu and Kashmir and the smaller union territories. The geographic boundaries of state assembly constituencies remained unchanged for some decades following a constitutional amendment in 1976 that fixed the boundaries of constituencies until the 2001 Census. While India's delimitation commission began the process of redrawing boundaries following the 2001 Census, the first elections using the new boundaries were not held until 2008. As a result, the geographic boundaries of nearly all assembly constituencies in the dataset are fixed over the timespan of our study. For 2008 and 2009, our analysis includes only elections held before new boundaries took effect. In all, we have 68,529 constituency-year observations over the period 1992–2009.

[9]Since some constituencies emit no light above the threshold of detection, we add a constant of 1 before taking the natural logarithm. We tried other alternatives, such as adding a constant less than the minimum value of the light variable. The results are similar and available upon request.

The Election Commission also provides information on the year and reason for all special elections on its web site.[10] Between 1992–2009, there were 613 special elections. For 254 of these cases, the reason for vacancy is not reported. However, since special elections are notable events, we were able to find news coverage and fill in the reason for almost all cases. The most common reason for a special election is vacancy created due to resignation of the member of the legislative assembly (MLA), occuring in 337 of the 613 cases. The second most common reason is death of the MLA with 223 such cases.[11] In 22 cases, the special election was called due to disqualification of a candidate or the voiding of results due to irregularities in the original election. Finally, we could not find the reason for 27 special elections, which are treated as missing data. Given various sensitivity analyses we do below, we believe the small number of missing cases are unlikely to change our overall findings. Our analysis below focuses on special elections following death, which we consider are credibly exogenous to electricity supply and economic conditions.

3.3 Event study plots

For a first impression of how special elections affect light output, we construct event study plots for the three outcome variables. Figure 1 plots the raw average of *Log Light Output per Capita* (Panel a), *Growth of Light* (Panel b), and *Proportion of Lit Villages* (Panel c) in special-election constituencies and non-election constituencies in the three years before and after a special election. In Panels (d)-(f), we plot the difference between special election and non-election constituencies for averages of each outcome variable.[12]

[10] `http://eci.nic.in/eci_main1/bye_election.aspx` accessed on April 30, 2013.

[11] The Election Commission's files do not indicate cause of death. In order to affirm exogeneity of death from economic factors, we researched a large sample of cases and confirmed that almost all were due to natural causes. In our online searches, we did find that 6 legislators were murdered. However, these cases were rare and unrelated to our outcome variables nonetheless.

[12] The event study plots for special election constituencies trace the unweighted average of each light measure around the election year within the group of special election constituencies. For non-election constituencies, there are no obvious pre- and post-election periods. We therefore construct synthetic averages for non-election constituencies by matching to each special election constituency the average

The event plots show that light variables evolve similarly before special elections. In the special election year, there is a steep increase in light output in special election constituencies. In non-election constituencies, in contrast, there is a small dip in light output and its growth. The event plots also suggest that the light variables in both sets of constituencies revert largely back to pre-election trends in the post-election period.

Overall, the event study plots suggest that the state government manipulates light output in the special election year. The effects of electoral manipulation do not seem to persist. Panels (a) and (b) also suggest that the increase in light output in special election years may be due to diversion from non-election constituencies rather than due to the generation of additional electricity. Finally, the plots, especially in Panels (a) and (d) and Panels (c) and (f) also suggest that light variables have a trend prior to the election, which we should include in our more formal specifications below to partial out the effect of special elections.

4 Empirical Model

To quantitatively establish the effect of special elections on light output, we specify the following model:

$$Y_{ist} = \alpha_i + \gamma_t + \theta_s \times t + \beta \times \text{Special election}_{ist} + \delta \times X_{ist-1} + \mu_{ist}. \tag{1}$$

where Y_{ist} is one of the three light output measures (*Log Light Per Capita*, *Growth of Light Per Capita*, *Proportion of Lit Villages*) for constituency i in state s in year t.

Special election$_{ist}$ is an indicator variable capturing the incidence of a special election taking place after the death of an incumbent. The parameter α_i denotes the constituency fixed effects and account for time-invariant constituency-specific factors that affect night

of the relevant light measure in all non-election constituencies in a given year, and then collapsing this average across all special election constituencies. A more detailed description of our approach is available in Section B in the Online Appendix.

lights, such as geographical characteristics (e.g., distance to the electrical grid) and attitudes toward light consumption. γ_t denotes year fixed effects that account for secular trends in light output in the country that common to all constituencies, such as changes in electricity production technology, satellite technology and so on. We also include state-specific linear time trends $\theta_s \times t$ to account for secular trends in light output across different states and for other state-level changes. The presence of such trends is suggested in the event study plots, where we observe some small differences in light output trends in special election and non-election constituencies. We suspect that these differences are due to random variation in the incidence of special elections between states and confirm further below that special election and non-election constituencies do not differ in observable characteristics.

X_{ist-1} are lagged values of time-variant constituency-specific control variables. These variables include the following dummy variables: *State government constituency*, which is 1 if a constituency is represented by a party that rules or is part of the coalition that rules the state government and 0 otherwise; *Central government constituency*, which is 1 if a constituency is represented by a party that rules or is part of the coalition that rules the central government and 0 otherwise; and *Central and State government constituency*, which is 1 if a constituency is represented by a party that rules or is part of the coalition that rules both the central and state governments and 0 otherwise. We also control for natural log of the number of registered voters (*Electorate Size*), and natural log of percentage voter turnout (*Turnout*). We also use indicator variables for *Coalition government*, which is 1 if a state is ruled by a coalition government and 0 otherwise, and for *Female Legislator*, which is 1 if legislator is female and 0 otherwise. The reason for using lagged values is that most of the above variables are likely to be simultaneously determined with special elections. Lagging it by one year still allows us to control for constituency-specific variables that may drive the light variables.

In this setup, identification comes from within constituency variation in our outcome variables. We thus compare the change in the outcome variables in special election constituencies in the year of the special election with the change in the outcome variables in non-election constituencies after partialling out the effects of common time trends, state-specific linear time trends, and constituency-specific time-varying covariates. The implicit assumption here is that treatment (special election) is independent of unobserved variables, conditional on the observed covariates, fixed effects, and state-specific trends. This is the standard selection-on-observables assumption (Imbens and Wooldridge, 2009). Furthermore, Bertrand et al. (2004) and Angrist and Pischke (2009) show that in the presence of serial correlation, ordinary least squares (OLS) standard errors could be severely understated. This is highly likely in our case because the light output for a specific constituency could be correlated over time. Following their advice, we therefore cluster standard errors at the constituency level.

4.1 Quasi-randomness of special elections

As discussed above, our identification strategy depends on selection-on-observable assumptions. An indication that this assumption is invalid would come from evidence that constituencies holding a special election due to death are systematically different in predetermined observable characteristics from constituencies that do not hold special elections. If the timing of special elections is indeed random, we should expect to observe no differences in pre-determined characteristics of constituencies that held special elections and constituencies that did not.

We check the quasi-exogeneity assumption by relating special elections to pre-treatment characteristics of constituencies, such as lagged outcome or lagged values of covariates. Since these variables are supposed to have been determined before treatment assignment, any evidence of a relationship would cast doubt on the selection-on-observables assumption.

Columns (1)-(2) of Table 1 reports mean and standard deviation of the light variables and the predetermined covariates, mainly the lagged values of the independent variables, in special and non-special election constituencies. Column (3) tests whether the differences in means between the two groups are significant. Additionally, in column (4) we report the results from a regression of the pre-determined covariates on the special election dummy after partialling out constituency and year fixed effects, state-specific time trends and other covariates. The column is populated with the coefficient estimates for the special election dummy in each regression.

We find that neither the lagged values of covariates nor the within-variation in the lagged values differ significantly between constituencies in which special elections are held after the death of a legislator and the remaining constituencies except for the gender of the legislator who died. Constituencies that are held by a female legislator are less likely to have special elections due to the death of a legislator. This may, however, reflect the natural discrepancy that exists in mortality rates of older males and females.[13]

The above checks suggest that constituencies that hold special elections after death of a legislator are not systematically different from constituencies and imply that special elections due to death are indeed quasi-random. This quasi-random variation in occurrence of an election can then be used to identify the causal effect of an election on light output in a constituency.[14]

[13]The female infant mortality rate is higher than that of males in India. However, the mortality rate of older females, is much lower than that of older males (Mukhopadhyay and Majumdar, 2012; Ministry of Statistics & Programme Implementation, Government of India, 2011). As a result, females are less likely to die while in office. This natural discrepancy in male and female mortality rates is unlikely to be related to our outcome of interest. We however control for gender in our models.

[14]We have also tested for differences in constituencies that ever held a special election due to death and constituencies that never held a special election for a battery of characteristics that are available for each village in the 1991 census. Overall, the differences between special election after death and non-election constituencies are insignificant. We report these results in Table C-1 in the Online Appendix.

5 Results

5.1 Baseline Results

Table 2 reports the first set of results, which we treat as our baseline. In these regressions, we relate special elections held after death of a current legislator to the three outcome measures.[15] If the state government manipulates electricity, the special election dummy as specified in Equation 1 should display a significantly positive coefficient.

The results in column (1) suggest that per capita light output in constituencies that hold a special election is significantly higher than in other constituencies, on average 4 percent higher in special election years than otherwise. Column (2) adds the additional political control variables. While control variables are in principle not necessary to obtain consistent causal estimates if special elections are quasi-random, it is nonetheless useful to include them since they improve efficiency. The inclusion of pre-determined control variables may also serve as an informal test of our identification strategy. Following Altonji et al. (2005a,b), the argument is that if the inclusion of observable control variables does not significantly change the estimated coefficients for the variable of interest, it is unlikely that the estimates are biased due to omitted and possibly unobservable variables. We indeed find that the estimated coefficient is almost identical to the estimates in column (1).

Column (3) relates the special election dummy to the annual growth rate of per capita light output. The estimates suggest a significant and positive effect of special elections. The growth rate of light output is, on average, 5 percentage points higher for a constituency in the special election year. Column (4) adds the political controls. The estimate for the

[15] Table C-2 in the online appendix provides comparable results for all special elections including due to resignation and other causes.

special election dummy is again almost identical to the estimate in the model without control variables.

Columns (5) relates the third output measure, the proportion of lit villages, to special elections. The estimated coefficient is positive, even though it is not significant. However, once we add additional control variables in column (6), we observe a small but significant 1 percentage point increase in the proportion of lit villages during special elections.

Overall, these estimates confirm the findings in the event study plots. They suggest that state governments induce political business cycles in electricity provision during special elections. We conjecture that the bump in electricity supply is a way for the state government to signal its competence. The evidence suggests that the state government applies effort to reduce outages and to provide additional electricity to villages that were unlit in the pre-electoral period. Given the high priority voters in India attach to electricity supply, it is plausible that the state government expects them to form a positive impression of its competence if it manages to increase electricity provision in the run-up to unexpected special elections.

Although we should be cautious about causal interpretation, some control variables also have a significant effect on the outcome measures. Larger electorates seem to have lower levels of light output and fewer lit villages, but higher growth rates in light output. These findings may be related to our normalization of the level of light output by the size of the electorate. Turnout in regular elections is negatively related to light output and the proportion of lit villages. One explanation is that voters are more likely to participate in elections in constituencies that suffer economic difficulties. Constituencies with a legislator aligned with both the state *and* the central government display higher values for the output measures. On the other hand, constituencies aligned with only one of the two higher tiers of government have lower values for the outcome measures. Constituencies hence appear to receive more electricity if they are aligned with both tiers of government than if

governance is divided between state and central governments. Finally, constituencies with female legislators tend to have lower outcome measures.

5.2 Robustness

5.2.1 Redefined Bye-Election Dummies

A problematic aspect of the baseline specification is that the special election dummy are set to one in the year of the special election, irrespective of whether the election took place early or late in the year. If a special election is held early in the year, governments might start to manipulate the cycle already at the end of the year preceding the special election.

To check for sensitivity of our results, we estimate three sets of regressions in which we treat the timing of special elections differently than in the baseline models. Columns (1), (4), (7) of Table 3 present regressions for each of the three outcome variables where the special election dummy is set to one only for those elections that are held in the second half of the year. We know that special elections held in the second half were the result of a vacancy in the same year due to the constitutional requirement of filling up the vacancy within 6 months. Given this definition of special elections, the effect of special elections is consistent with what we find above. Light outcomes, on average, are larger in special election years than other years.

Columns (2), (5), and (8) of Table 3 present regressions where the special election dummy is set to 1 for those special elections held after January. For special elections held in January, the previous year is coded as the special election year.[16] While this is a more conservative recoding of the special election dummy than the previous one, the estimates are again in line with the baseline results. The special election dummy is consistently positive and significant.

[16]The results are insensitive to the choice of the month and available upon request.

Finally, columns (3), (6), and (9) of Table 3 present regressions where the special election variable is defined to be 0 if a special election was held in January, 1 if it was held in February, and so on until July, where it assumes a value of 6. From July onward, the variable remains at 6. The idea is that if the special election was held in January, none of the manipulation should have taken place in the special election year; if the special election was held in February, there was at least one month where manipulation could have taken place in the special election year. This redefined special election variable remains at 6 even after July because of the constitutional requirement that special elections must be held within six months.[17]

The results for this specification, too, are in line with both the baseline results and the results with the other redefinitions. While the magnitude of the estimates is naturally different as we now use a count variable to indicate special elections, they are significantly positive for all outcome variables. An additional month of campaign time within the special election year increases night light output in that year by about 1 percent. Similarly, an additional month of campaign time increases the growth of night light output by about 1 percentage point and the proportion of lit villages by about 0.4 percentage points.

5.2.2 Neighbor sample

A refutability test for the baseline estimates is to compare special election constituencies with geographically neighboring constituencies that did not have a special election. If the bump observed during special elections is due to some unobserved effect correlated with the timing of special elections, it is plausible that this unobserved effect will affect the neighbors of special election constituencies as well. Thus, if we observe a similar increase in light output in neighboring constituencies that do not hold a special election, we would question our claim that manipulation is electorally motivated.

[17]We are grateful to an anonymous referee for suggesting this check.

We examine this in columns (1)–(3) of Table 4, where our sample is restricted to special elections constituencies and their neighbors that share a border over our entire sample period. The results suggest that per capita light output is on average about 4 percent higher in constituencies that had a special election than in neighboring constituencies. Similarly, growth in per capita light output in special election constituencies compared to the neighboring constituencies is about 4 percentage points higher. Finally, the estimate for lit villages is also of the same magnitude as in the baseline estimates. These tests provide further evidence that constituencies that hold a special election experience increased electricity provision due to elections alone.

5.2.3 Special election constituencies sample

Yet another refutability test is to restrict the sample to only constituencies that ever had a special election. If special election constituencies are not significantly different from non-election constituencies, i. e. if special elections are indeed quasi-random, the estimated coefficients for the special election dummy should be similar to those in the baseline models, at least as long the effect of special elections on light output does not persist. We report such regressions results in columns (4)–(6) of Table 4. The estimated coefficients are indeed similar to those in the baseline regressions. Light output in special election years is about 4 percent higher, the growth rate is about 4 percentage points higher, and the proportion of lit villages increases by 1 percentage points.

6 Manipulation and targeted redistribution

The previous results suggest that, on average, state politicians induce electoral cycles during special elections. However, as indicated by the literature on targeted distribution, it is possible that the incentives of the state government for electoral manipulation depend

on the political characteristics of a constituency. In particular, state governments might focus on improving electricity supply to either swing or to core constituencies. We hence examine in Table 5 whether special election constituencies that were more closely contested or have shown greater support for the state government in the last general election witness a relatively larger increase in light output.

Pure swing voter models would predict that all swing constituencies will receive the same amount of electricity from state governments. However, this prediction may have to be qualified if opposition parties can claim some credit for an increase in electricity supply (Brollo and Nannicini, 2012). That is, if voters in constituencies where the previous MLA belonged to the opposition credit opposition parties for the increase in electricity during special elections, state governments may only target swing constituencies that are aligned, i. e. swing constituencies where the previous incumbent was affiliated with the ruling party or coalition. We therefore test whether special constituencies that are both swing and aligned receive more electricity than other special election constituencies.

We define dummy variables to identify both swing constituencies and constituencies that are represented by the ruling party or coalition. The variable *Special election <=5% and Ruling Party* is 1 for special elections that have a margin of victory of 5% or less in the previous election and are represented by the ruling party or coalition and 0 otherwise. This dummy identifies constituencies that were closely won by the incumbent party in the previous election. *Special elections >5% and Ruling Party* is 1 for special elections that have a margin of victory of greater than 5% in the previous election and represented by the ruling party or coalition and 0 otherwise. This dummy identifies constituencies that were won more comfortably by the incumbent party in the previous election. *Special election <=5% and Non-ruling Party* and *Special elections >5% and Non-ruling party* are constructed accordingly.

The results in columns (1)–(3) show that the effect on light variables is much larger in magnitude and statistically significant if special elections are held in constituencies that are both aligned and swing. While Wald-tests for the equality of the coefficients on close aligned and non-close aligned constituencies are insignificant for per capita light output and growth of light output, the Wald-test for proportion of lit villages is significant and the one for log light output displays a relatively low p-value. The results hence suggest that the state government only manipulates light output in constituencies that are both swing and aligned. These findings are consistent with Cole (2009), who also finds that manipulation of agricultural loans before elections is targeted toward districts that are more closely contested. Similarly, we find no evidence of a patronage effect where the state government rewards constituencies where it enjoys strong support.[18]

Another aspect of competitiveness that we explore is whether the state government enjoys a safe majority in the legislature. It is plausible that the majority party or coalition has stronger incentives to manipulate constituency outcomes if it enjoys only a fragile majority. Winning more seats would give the government a safer majority to work with. Conversely, states in which the government's majority is large may not have that extra motivation to increase its majority, keeping everything else the same. To explore this issue, we calculate *Government's Seat Margin* by $(Seats - 50)$, where $Seats$ is the percentage of seats in the legislature that the ruling party or coalition won in the last election. Given that a state government needs at least 50% of seats to rule, this measure reflects the strength of the government's majority. We interact this seat margin with special election dummies to examine how the effect of special elections is different between governments enjoying a larger seat margin and governments whose seats margin is closer to 50%.

The results are reported in columns (4)–(6) of Table 5. The light variables are significantly and inversely related to the size of a government's majority. While the Wald-tests

[18]We get similar results when we define a core constituency by the number of years a party has held a constituency. These results are reported in Table C-4 in the Online Appendix.

for the equality of the coefficients is only significant for one output measure, growth of light output, the results arguably suggest that the state government only engages in manipulation if it commands a narrow majority in the assembly.[19]

7 Welfare implications

The previous results suggest that the state government engages in manipulation of electricity supply to constituencies as a result of special elections. What remains unclear is whether this manipulation has any welfare implications. One critical question is whether the increase in night light output in special election constituencies is due to diversion of electricity from other regions or due to an overall increase in the availability of electricity within a state. If the increase in special election constituencies is due to diversion of power from other constituencies, it is likely that manipulation overall has no positive and plausibly negative welfare implications.

Several pieces of evidence suggest that the increase in special election constituencies is due to diversion rather than an increase in power supply. First, adding power generating capacity is a lengthy and costly endeavor, and many Indian states have struggled to increase their power supply. For example, in Uttar Pradesh, power generation totaled 21 terawatt-hours in 2010, a figure no higher than it was in 1995. In the meantime, numerous power plant proposals have stalled due to environmental protests and other political obstacles.

Second, we run regressions to explore manipulation of electricity output during general elections to evaluate the ability of the state government to generate additional electricity during elections. If electricity supply does not increase in general election years, it would suggest that state governments lack the resources to create additional electricity during

[19]We also find that special elections that are held earlier in a term have a larger effect on light output than special elections held later in the term (i. e. closer to a state-wide general election). We report these results in columns (1)–(3) of Table C-3 in the online appendix.

general elections and may be similarly constrained in special election years. The results are collected in columns (1)–(3) of Table 6. To identify the effect of general elections in these regressions, we use the identification strategy of Khemani (2004) and Cole (2009), i. e. we instrument the general election dummy with a dummy for scheduled general elections. The results suggest no significant increase of light output during general elections. It therefore seems more likely that the increase in electricity supply in special election constituencies is due to diversion rather than an overall increase in electricity supply.[20]

Third, the event study plots in Figure 1 show a small but noticeable dip in non-election constituencies for log light and growth of light in the special election year. These dips, too, suggest that the bump in special election constituencies is due to redistribution.

While there are arguably no positive welfare consequences for the state as a whole, we also find that the special election constituencies themselves, too, do not experience any long-run welfare improvements from the manipulation. First, as mentioned previously, the event study plots indicate that manipulation does not persist in the post-election period. Thus, any welfare improvements in special election constituencies are at best short-term.

Moreover, temporary increases in power supply are unlikely to have large impacts on economic behavior. Given that businesses and firms rely on stable and predictable electrical power for production, temporary improvements in the hours of service are unlikely to sway businesses to abandon generators, time-shifting of workers, and other strategies to accommodate the unevenness of electrical power supply. As a result, we do not expect significant increases in production by businesses without sustained long-term improvements in electricity supply. Instead, short term increases in electricity supply are most likely to result in increased consumption, primarily in the residential and agricultural sectors (Min and Golden, 2014).

[20]Given that there are no overall effect in general elections and that there are added constraints on manipulative redistribution in general elections, the effect of special elections is likely to be an upper bound to the effect of general elections.

Our data affirm this intuition. We run regressions where we relate GDP at the district level — which is the smallest administrative unit for which GDP data is available — to the incidence of special elections in constituencies located within a given district's boundaries. We analyze 587 districts for which we have GDP data from 2001–2007 out of a total of 640. Districts are administrative divisions within each state with multiple assembly constituencies. Despite the shorter time series, district level GDP is a good proxy for output in the local region in which a special election constituency is located. We consider three district-level output measures: total district GDP, per capita GDP, and per worker GDP.

Given that our neighbor sample regressions suggest that electricity to special election constituencies is not specifically diverted from neighbors, we would expect to observe an increase in district-level GDP if a constituency holds a special election and special elections have positive effects on output. The results from these regressions are collected in columns (4)–(6) of Table 6. We do not observe economically or statistically significant effects of special elections on any of the output measures. Overall, therefore, it seems that there are no positive effects on economic output due to electoral manipulation of the power supply resulting from special elections.

Our results are consistent with Cole (2009) who finds that increases in short-term agricultural loans prior to elections have no discernible effect on agricultural yield or output in Indian states. The implication is that such loans are inefficient and reflect political distortions designed to target votes rather than to actually improve agricultural output. Similarly, our findings suggest that the temporary diversion of electrical power into critical electoral constituencies prior to elections are linked to a targeting strategy to boost sentiment towards the government and may be similarly inefficient.

8 Conclusion

We examine in this paper whether Indian state politicians induce electoral cycles in electricity provision, a critical input for economic activity and crucial determinant of welfare. Our results provide strong evidence that electricity supply increases in constituencies during presumably exogenous special elections held due to the death of a legislator. In addition, we also uncover significant interactions between the prevailing political climate in a state and the state government's incentives to manipulate electricity supply during special elections. The state government increases electricity supply during special elections more strongly if a constituency is swing and aligned. We also find suggestive evidence that the bump in electricity before elections is due to diversion of electricity from non-election areas and hence find no evidence of any positive welfare effects.

Besides the opportunity to credibly identify political business cycles, the Indian experience offers an interesting contrast to the results in previous studies of the political business cycle. One theme that pervades the existing empirical literature is that electoral cycles emerge in developing countries mostly because voters have little experience with democratic politics and are more easily manipulated by politicians (Brender and Drazen, 2005; Akhmedov and Zhuavskaya, 2004). Many studies argue that as a democracy matures, electoral cycles become less pronounced. India has been a stable and vibrant democracy for over half a century, and yet we continue to observe evidence of strong cycles. This particular result suggests that electoral cycles are not necessarily dampened with increasing experience with democracy.

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Table 1: Descriptive Statistics: Special Elections vs Non-Special Election Years

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All Special Elections				**Special Elections after Death**			
	Mean		Difference	FE Coeff.	Mean		Difference	FE Coeff.
	Election=1	Election=0			Election=1	Election=0		
Panel A: Main Dependent Variables								
Log Per Capita Light $_t$	2.64	2.64	-0.0043		2.68	2.64	0.040	
	[1.11]	[1.09]	[0.047]		[1.08]	[1.09]	[0.077]	
Growth of Per Capita Light $_t$ (%)	6.79	2.68	4.10***		6.15	2.71	3.44	
	[36.9]	[35.3]	[1.51]		[38.6]	[35.3]	[2.49]	
Proportion of Lit Villages $_t$	0.65	0.65	0.0025		0.66	0.65	0.011	
	[0.36]	[0.36]	[0.016]		[0.36]	[0.36]	[0.026]	
Panel B: All Predetermined Variables								
Log Per Capita Light $_{t-1}$	2.57	2.61	-0.045	-0.003	2.62	2.61	0.0057	-0.008
	[1.11]	[1.10]	[0.047]	[0.011]	[1.09]	[1.10]	[0.077]	[0.019]
Log Electorate Size $_{t-1}$	11.8	11.7	0.088***	-0.004	11.8	11.7	0.030	0.000
	[0.74]	[0.80]	[0.034]	[0.003]	[0.77]	[0.80]	[0.056]	[0.005]
Log Turnout $_{t-1}$	4.18	4.19	-0.010	0.011*	4.19	4.19	0.0052	0.001
	[0.25]	[0.24]	[0.010]	[0.006]	[0.22]	[0.24]	[0.017]	[0.009]
Margin $_{t-1}$	13.5	13.0	0.52	0.270	12.4	13.0	-0.52	-1.079
	[12.1]	[11.8]	[0.50]	[0.423]	[11.7]	[11.8]	[0.83]	[0.678]
State Govt. Constituency $_{t-1}$	0.51	0.61	-0.096***	-0.036†	0.60	0.61	-0.0094	0.004
	[0.50]	[0.49]	[0.021]	[0.016]	[0.49]	[0.49]	[0.034]	[0.024]
Coalition Government $_{t-1}$	0.53	0.54	-0.013	0.004	0.59	0.54	0.047	0.023
	[0.50]	[0.50]	[0.021]	[0.012]	[0.49]	[0.50]	[0.035]	[0.017]
Central Govt. Constituency $_{t-1}$	0.36	0.36	0.0021	0.003	0.39	0.36	0.033	0.006
	[0.48]	[0.48]	[0.020]	[0.013]	[0.49]	[0.48]	[0.034]	[0.019]
Central and State Govt.	0.20	0.24	-0.042**	-0.008	0.26	0.24	0.016	-0.008
Constituency $_{t-1}$	[0.40]	[0.43]	[0.018]	[0.009]	[0.44]	[0.43]	[0.030]	[0.015]
Female Legislator $_{t-1}$	0.049	0.056	-0.0071	-0.008	0.025	0.056	-0.031*	-0.034‡
	[0.22]	[0.23]	[0.0098]	[0.007]	[0.16]	[0.23]	[0.016]	[0.009]
Observations	613	67916		68045	223	68306		68045

Columns (1) and (2) report means and standard deviations of all special elections (Election=1) and other years (Election=0). Column (3) reports the difference in the means of all special elections and other years. Columns (5) and (6) report means and standard deviations of special elections held after death of a legislator (Election=1) and other years (Election=0). Column (7) reports the difference in the means of special elections held after the death of a legislator and other years. Columns (4) and (8) report the coefficient on a dummy for special election from a fixed effect regression of each predetermined covariate on the special election dummy, other covariates, year fixed effects and state-specific time trends. The values with *,**, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Per Capita Light is light per 1000 registered voters. Electorate size is the number of registered voters. Turnout is percentage of people who voted. Margin is the difference in the voteshares (%) of winning and the runnerup candidates.

Table 2: Special Elections and Electricity Provision

	(1)	(2)	(3)	(4)	(5)	(6)
	Log Per Capita Light		Growth of Per Capita Light		Proportion of Lit Villages	
Special Election	0.040**	0.041**	4.973**	4.758**	0.011	0.011*
	[0.017]	[0.018]	[2.233]	[2.257]	[0.006]	[0.006]
Log Electorate Size $_{t-1}$		-0.505***		16.856***		-0.040***
		[0.061]		[2.502]		[0.011]
Log Turnout $_{t-1}$		-0.020		1.120		-0.014***
		[0.016]		[0.819]		[0.004]
State Govt. Constituency $_{t-1}$		-0.015***		-0.295		-0.002
		[0.005]		[0.262]		[0.002]
Central Govt. Constituency $_{t-1}$		-0.031***		-1.457***		-0.008***
		[0.005]		[0.324]		[0.002]
Central and State Govt. Constituency $_{t-1}$		0.043***		2.493***		0.010***
		[0.006]		[0.418]		[0.003]
Coalition Government $_{t-1}$		-0.012***		3.593***		-0.005***
		[0.004]		[0.353]		[0.002]
Female Legislator $_{t-1}$		-0.026***		-0.342		-0.013***
		[0.010]		[0.407]		[0.005]
R^2	0.37	0.39	0.36	0.37	0.34	0.35
N	68,529	67,962	64,358	64,055	65,123	64,579
Method	FE	FE	FE	FE	FE	FE

Log Per Capita Light is the natural log of total light output divided by the size of electorate. Growth of Per Capita Light is the annual growth rate of per capita light. Proportion of Lit Villages is the proportion of villages in a constituency that have positive light output. Special Election is 1 for years in which a special election is held to fill a vacancy after the death of a legislator and 0 otherwise. All control variables are lagged by one period. All regressions include year fixed effects and state-specific time trends. Standard errors are clustered at the constituency level and given in parentheses. The values with *,**, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 3: Special Elections and Electricity Provision: Alternative Definitions of Special Elections

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Log Per Capita Light			Growth of Per Capita Light			Proportion of Lit Villages		
Special Election Alternative I	0.061**			3.942			0.017*		
	[0.030]			[5.036]			[0.010]		
Special Election Alternative II		0.039**			4.627**			0.012*	
		[0.018]			[2.249]			[0.006]	
Special Election Alternative III			0.012***			0.981*			0.004**
			[0.004]			[0.594]			[0.001]
Log Electorate Size $_{t-1}$	-0.504***	-0.504***	-0.504***	16.854***	16.856***	16.856***	-0.040***	-0.040***	-0.040***
	[0.061]	[0.061]	[0.061]	[2.502]	[2.502]	[2.502]	[0.011]	[0.011]	[0.011]
Log Turnout $_{t-1}$	-0.020	-0.020	-0.020	1.122	1.120	1.122	-0.014***	-0.014***	-0.014***
	[0.016]	[0.016]	[0.016]	[0.819]	[0.819]	[0.819]	[0.004]	[0.004]	[0.004]
State Govt. Constituency $_{t-1}$	-0.015***	-0.015***	-0.015***	-0.298	-0.294	-0.297	-0.002	-0.002	-0.002
	[0.005]	[0.005]	[0.005]	[0.262]	[0.262]	[0.262]	[0.002]	[0.002]	[0.002]
Central Govt. Constituency $_{t-1}$	-0.031***	-0.031***	-0.031***	-1.455***	-1.455***	-1.456***	-0.008***	-0.008***	-0.008***
	[0.005]	[0.005]	[0.005]	[0.324]	[0.324]	[0.324]	[0.002]	[0.002]	[0.002]
Central and State Govt. Constituency $_{t-1}$	0.042***	0.042***	0.042***	2.490***	2.491***	2.494***	0.009***	0.009***	0.009***
	[0.006]	[0.006]	[0.006]	[0.418]	[0.418]	[0.417]	[0.003]	[0.003]	[0.003]
Coalition Government $_{t-1}$	-0.011**	-0.011**	-0.011**	3.596***	3.593***	3.592***	-0.005***	-0.005***	-0.005***
	[0.004]	[0.004]	[0.004]	[0.353]	[0.353]	[0.353]	[0.002]	[0.002]	[0.002]
Female Legislator $_{t-1}$	-0.026***	-0.026***	-0.026***	-0.357	-0.343	-0.348	-0.013***	-0.013***	-0.013***
	[0.010]	[0.010]	[0.010]	[0.407]	[0.407]	[0.407]	[0.005]	[0.005]	[0.005]
R^2	0.39	0.39	0.39	0.37	0.37	0.37	0.35	0.35	0.35
N	67,791	67,791	67,791	64,055	64,055	64,055	64,408	64,408	64,408
Method	FE	FE	FE	FE	FE	FE	FE	FE	FE

Log Per Capita Light is the natural log of total light output divided by the size of electorate. Growth of Per Capita Light is the annual growth rate of per capita light. Proportion of Lit Villages is the proportion of villages in a constituency that have positive light output. Special Election Alternative I is 1 for years in which a special election is held to fill a vacancy after the death of a legislator in July or later and 0 if earlier. Special Election Alternative II counts a special election in January as held in the previous year. Special Election Alternative III takes a value of 0 if the election is in January, 1 if in February, 2 if in March, 3 if in April, 4 if in May, 5 if in June and 6 if election is held in July or later. All control variables are lagged by one period. All regressions include year fixed effects and state-specific time trends. Standard errors are clustered at the constituency level and given in parentheses. The values with *,**, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Special Elections and Electricity Provision: Alternative Samples

	(1)	(2)	(3)	(4)	(5)	(6)
	Neighbor Sample			Special Election Constituencies Only		
	Log Per Capita Light	Growth of Per Capita Light	Proportion of Lit Villages	Log Per Capita Light	Growth of Per Capita Light	Proportion of Lit Villages
Special Election	0.042**	4.702**	0.011*	0.041**	4.764**	0.011*
	[0.018]	[2.254]	[0.006]	[0.017]	[2.293]	[0.006]
Controls	X	X	X	X	X	X
R^2	0.38	0.36	0.34	0.40	0.36	0.35
N	19,671	18,563	18,607	3,630	3,425	3,371
Method	FE	FE	FE	FE	FE	FE

In columns (1)-(3), the neighbor sample consists of constituencies with special elections and constituencies that border them. In columns (4)-(6), we consider only constituencies that ever had a special election. All control variables are included and lagged by one year. All regressions include year fixed effects and state-specific time trends. Standard errors are clustered at the constituency level and given in parentheses. The values with *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 5: Special Elections and Electricity Provision: Targeted Manipulation

	(1)	(2)	(3)	(4)	(5)	(6)
	Close Elections			Weak Majority		
	Log Per Capita Light	Growth of Per Capita Light	Proportion of Lit Villages	Log Per Capita Light	Growth of Per Capita Light	Proportion of Lit Villages
Election <= 5% Margin and Ruling Party	0.105**	6.366*	0.041***			
	[0.044]	[3.726]	[0.013]			
Election >5% Margin and Ruling Party	0.032	3.667	0.008			
	[0.027]	[4.113]	[0.010]			
Election <= 5% Margin and Non-Ruling Party	0.037	6.615	0.001			
	[0.053]	[5.398]	[0.019]			
Election > 5% Margin and Non-Ruling Party	0.017	4.581	0.007			
	[0.027]	[3.483]	[0.012]			
Election with Seat Margin<=5%				0.085***	11.866***	0.020**
				[0.029]	[3.381]	[0.010]
Election with 5%<Seat Margin<=10%				0.006	-2.268	-0.002
				[0.047]	[4.692]	[0.016]
Election with 10%<Seat Margin<=15%				0.014	4.390	-0.005
				[0.049]	[6.302]	[0.016]
Election with 15%<Seat Margin				0.017	0.542	0.016
				[0.028]	[4.137]	[0.011]
Margin of Victory	-0.000**	-0.002	0.000			
	[0.000]	[0.011]	[0.000]			
Government's Seat Margin				-0.002***	-0.090***	-0.001***
				[0.000]	[0.017]	[0.000]
Controls	X	X	X	X	X	X
Method	FE	FE	FE	FE	FE	FE
Wald p-value	0.16	0.63	0.04	0.28	0.05	0.46
R^2	0.39	0.37	0.35	0.39	0.37	0.35
N	67,791	64,055	64,408	67,444	63,768	64,083

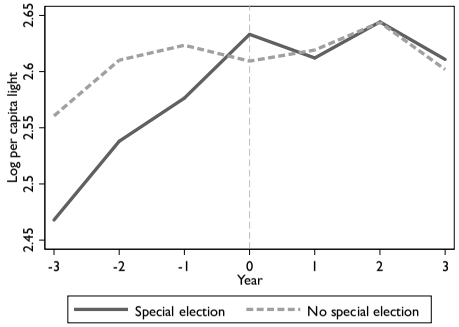
Election <=5% Margin and Ruling Party is 1 for a special election constituency if the margin of victory in the last election was within 5% and if it was represented by the ruling party or coalition and 0 otherwise. *Election >5% Margin and Ruling Party* is 1 for a special election constituency if the margin of victory in the last election was above 5% and if it was represented by the ruling party or coalition and 0 otherwise. *Election <=5% Margin and Non-Ruling Party* is 1 for a special election constituency if the margin of victory in the last election was within 5% and if it was not represented by the ruling party or coalition and 0 otherwise. *Election >5% Margin and Non-Ruling Party* is 1 for a special election constituency if the margin of victory in the last election was above 5% and if it was not represented by the ruling party or coalition and 0 otherwise. *Margin of victory* is difference between vote shares of the winner and runner-up party in the previous election. *Government's Seat Margin* is equal to (*Seats-50%)*, where Seats is the percentage of seats won by the ruling party or coalition. Election with Seat Margin<=5% is 1 for special elections in which Government's Seat Margin is less than 5% and 0 otherwise. Election with 5%<Seat Margin<=10% is 1 for special elections in which Government's Seat Margin is between 5% and 10% and 0 otherwise. Election with 10%<Seat Margin<=15% is 1 for special elections in which Government's Seat Margin is between 10% and 15% and 0 otherwise. Election with 15%<=Seat Margin is 1 for special elections in which Government's Seat Margin is greater than 15% and 0 otherwise. The Wald p-values are from H_0: Election <= 5% Margin and Ruling Party=Election >5% Margin and Ruling Party in columns (1)-(3) and from H_0: Election with Seat Margin<=5%= Election with 5%<Seat Margin<=10%= Election with 10%<Seat Margin<=15%= Election with 15%<Seat Margin in columns (4)-(6). All other control variables are included and are lagged by one year. Standard errors are clustered at the constituency level and given in parentheses. The values with *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Elections and Electricity Provision: Redistribution and Welfare Effects

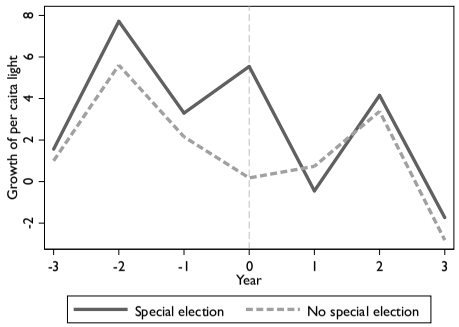
	(1)	(2)	(3)	(4)	(5)	(6)
	State-wide General Elections			District-level GDP Measures		
	Log Per Capita Light	Growth of Per Capita Light	Proportion of Lit Villages	Log GDP	Log GDP Per Capita	Log GDP Per Worker
Election Year	-0.021	-5.227*	0.014			
	[0.019]	[2.891]	[0.010]			
Special Election				0.010	0.012	0.008
				[0.007]	[0.008]	[0.008]
Log Electorate Size $_{t-1}$	-0.529***	9.838**	-0.021	0.026	0.012	0.026
	[0.101]	[4.950]	[0.028]	[0.018]	[0.016]	[0.017]
Log Turnout $_{t-1}$	-0.025	-0.199	-0.011	-0.173***	-0.180***	-0.055
	[0.029]	[3.547]	[0.010]	[0.032]	[0.032]	[0.035]
State Govt. Constituency $_{t-1}$	-0.015	-0.240	-0.002	0.006	0.004	0.024**
	[0.012]	[0.459]	[0.005]	[0.010]	[0.010]	[0.010]
Central Govt. Constituency $_{t-1}$	-0.031**	-1.653**	-0.007	-0.003	-0.004	-0.002
	[0.015]	[0.820]	[0.006]	[0.012]	[0.013]	[0.013]
Central and State Govt. Constituency $_{t-1}$	0.042	2.458*	0.009	0.001	0.002	-0.010
	[0.028]	[1.408]	[0.011]	[0.010]	[0.010]	[0.011]
Coalition Government $_{t-1}$	-0.012	3.179	-0.004	0.003	0.003	0.007
	[0.019]	[2.368]	[0.009]	[0.006]	[0.006]	[0.007]
Female Legislator $_{t-1}$	-0.027**	-0.454	-0.013**	0.018	0.013	0.013
	[0.012]	[0.343]	[0.006]	[0.028]	[0.029]	[0.030]
R^2	0.39	0.37	0.34	0.78	0.67	0.44
N	67,791	64,055	64,408	3,747	3,747	3,747
Method	FE	FE	FE	FE	FE	FE

Columns (1)-(3) examine the effect of state-wide general elections on constituency-level light variables. Election Year is 1 if a state held a general election in the year and 0 otherwise. Columns (4)-(6) examine the effect of a special election in a district on the district-level GDP measures. Special Election is 1 if a constituency in a district held a bye-election after death of a legislator in the year and 0 otherwise. All control variables are lagged by one year. All regressions include year fixed effects and state-specific time trends. Standard errors are clustered at the state level in columns (1)-(3) and at the district level in columns (4)-(6) and given in parentheses. The values with *,**, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

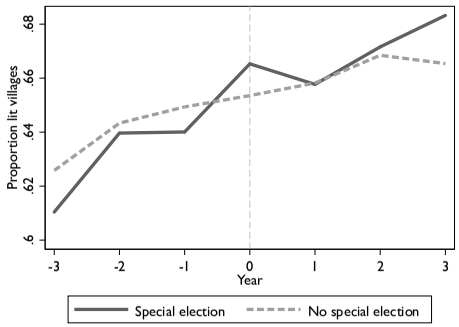
Figure 1: Event Study Plots



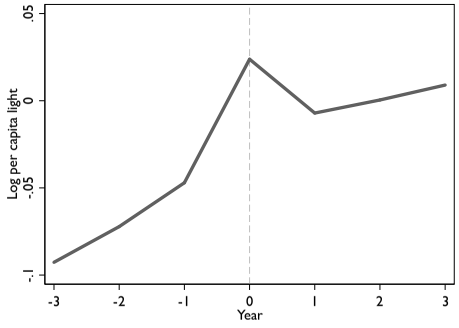
(a) Log Per Capita Light



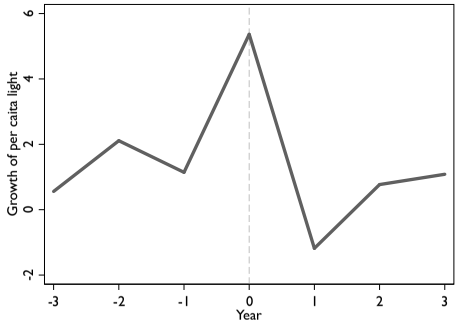
(b) Growth of Per Capita Light



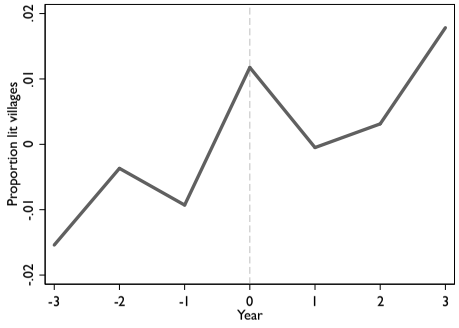
(c) Proportion Lit Villages



(d) Difference in Log Per Capita Light



(e) Difference in Growth of Per Capita Light



(f) Difference in Proportion Lit Villages