Less Is More? Implications of Regulatory Capture for Natural Resource Depletion*

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Abstract

Well-designed regulation can check politically driven inefficiencies, but it can also exacerbate distortions if politicians capture the regulators. We examine the consequences of strengthening India's electricity transmission regulatory structure for groundwater extraction, where electricity is the key input, and we find evidence of regulatory capture by politicians. Guided by our model, in which politicians of national and regional parties compete for parliamentary seats, we show that empowering regulators amplified distortions in groundwater extraction in favor of national candidates, who have greater incentives and abilities to co-opt the regulators. Using nationally representative groundwater data from India for 1996-2006, we estimate that regulatory capture led to a 2.75 meter additional decline in water tables in closely-contested constituencies won by national parties' candidates. The short-term cost in closely-contested regional constituencies is around an 18 percent reduction in agricultural production.

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1 Introduction

Regulation is often considered a vehicle to curb the misallocation of resources resulting from market failure or political constraints. But regulation is susceptible to capture that can amplify distortions, and such capture is more likely in less developed economies with weak institutions. Seminal theories of regulatory capture based on the work of Stigler (1971), Peltzman (1976), and Becker (1983) describe how political incentives and interest group competition can influence regulation. Most subsequent studies of regulatory capture focus on capture by firms.[1] But regulatory capture by local politicians can also have large economic consequences. Politicians may indulge in inefficient redistribution or inefficient dynamic allocation of resources for political or private gains (e.g. Acemoglu and Robinson (2001), Besley and Coate (1998)). Regulatory capture can be used as a lever to operationalize such inefficient redistribution or allocation. Rigorous empirical examination of the nature and consequences of regulatory capture by politicians is sparse, despite its relevance to many settings. In this paper, we provide evidence of regulatory capture by politicians and estimate its economic consequences.

Specifically, we examine the consequences of increasing regulatory authority in the Indian electricity sector for groundwater extraction, where electricity is a key input. The Electricity Act of 2003 reformed the electricity sector, providing transmission grid regulators with unprecedented authority over electricity allocations. Using this setting, we make three contributions. First, we estimate the effect of empowering the transmission grid regulators on distortions in groundwater allocation. We focus on electoral constituencies led by a national party member of Parliament (MP) or a regional party MP, where national parties contest elections across the entire country and regional parties contest elections in four or fewer states (typically, just one state). We show that the regulatory reform favored extraction in constituencies with national MPs. Second, we develop a political economy model where national and regional party candidates have different incentives and abilities to capture the regulator. We show empirical evidence remarkably consistent with several implications and assumptions of the model. Third, we find novel evidence of spatially inefficient redistribution being facilitated by regulatory capture. We illustrate that the distortions in groundwater allocation that emerge between national and regional constituencies are inefficient and have significant short-run economic consequences.

[1] Regulatory capture by firms has been of interest to economists and political scientists alike, and examples have been well documented by Grossman and Helpman (1995), Goldberg and Maggi (1999), and Hansen and Park (1995). Dal Bó (2006) provides an excellent overview of this literature.

Despite no significant differences in the marginal benefit of groundwater across constituencies, national candidates are able to facilitate more groundwater extraction than regional candidates.

In weakly institutionalized settings such as India, this increased regulatory authority may be a politically stable outcome even though it favors inefficient allocations. Acemoglu et al. (2013) argue that voters may favor dismantling checks and balances and centralizing power because this centralization might make it easier for the executive authority to both extract private rents and serve its political agenda by redistributing to the majority. As an extension, voters who may benefit from resulting allocations may favor the empowerment of a regulator, and elect representatives who are able to co-opt the regulator and redistribute, regardless of concerns for efficiency. Consistent with this idea, we show that cultivators (including small tenant farmers) are more likely to vote for national candidates – the candidates most able to co-opt the regulator – in the most immediate post-reform elections.

Groundwater in India is an important setting for examining regulatory capture by politicians. Groundwater is vital to the livelihood of Indian farmers. Almost 60 percent of Indian agriculture, which employs more than half of India's work force, is sustained by groundwater irrigation. More than 90 percent of the groundwater extracted is used for irrigation, and aquifers are rapidly depleting (Jha and Sinha, 2009).[2] Current trends in groundwater depletion can cause a significant reduction in food grain production and agricultural growth. Seckler et al. (1998) estimate that food production may consequently fall by around 25 percent by 2025. Using historical data from the United States, Hornbeck and Keskin (2012) have demonstrated that groundwater availability affects long-term agricultural growth, and Sekhri (2013, b) shows that groundwater access leads to a significant reduction in poverty in the rural Indian setting as well. Hence, groundwater extraction and conservation is at the forefront of policy discussions.

Moreover, politics play an important role in the depletion of groundwater. In some contexts, politics affects the setting of electricity prices (e.g., Brown and Mobarak, 2009). However, in rural India, electricity prices are often low to begin with, and the more pressing concern is how scarce electric power is allocated across constituencies when irrigation is needed. The timing of power availability is especially crucial because the storage of water is prohibitively costly and rarely done.[3] A concrete example of the role of water in politics arose in 2004, in the state

[2] India is the largest extractor of groundwater in the world. With over 20 million wells, it extracts close to 250 billion cubic meters of water each year, almost twice as much as the United States and China (FAO AQUASTAT statistics).

[3] In the Ancillary Evidence and Robustness Tests Appendix Section C.4, we provide a detailed discussion of the reasons for lack of storage facilities.

of Andhra Pradesh. There, despite Chief Minister Chandra Babu Naidu's ability to generate striking urban reforms, such as IT-fueled urban growth, his government was ousted due in part to rural voters' dissatisfaction with water scarcity in rural areas (Tribune, 2004).[4]

Using nationally representative groundwater data from 1996 to 2006, we illustrate the motivation for our analysis in Figure 1. This figure plots year-by-year average depth to groundwater for constituencies won by candidates of national and regional parties. Prior to the 2003 electricity reform, we observe that depth to groundwater (a measure of the deterioration of water tables) is trending in a similar fashion in the national and regional constituencies. However, a striking wedge emerges between the two sets of constituencies in 2004. We argue that regulatory capture by national party legislators drives this wedge.

Our argument proceeds in several steps. We formalize the patterns we observe in Figure 1 using both a differences-in-differences (DID) strategy and a regression discontinuity (RD) analysis of close elections. In our DID framework, we compare groundwater depth in constituencies that stayed national with those that stayed regional before and after the reform, to avoid concerns about the endogeneity of switching representation. Constituencies could switch from national to regional or vice versa due to changes in the groundwater situation. By restricting our attention to constituencies that do not switch, we are able to isolate the effect of the reform, holding constant the incentives the candidates face. In a variety of DID specifications, including specifications in which we control for pre-reform trends in groundwater depth and generalized DID estimators with matching on pre-period characteristics, we find that groundwater depth falls less post-reform in constituencies with national candidates. Most strikingly, our RD approach demonstrates that in close elections, average groundwater depth is similar in constituencies won by regional and national candidates in every year before the reform, but a large and statistically significant wedge emerges after the reform.

We propose a theoretical model to explain this divergence and develop additional testable implications. The model captures the decision-making of voters, electricity distributors, and candidates for office. Candidates compete by making promises to secure electricity for water extraction. To secure electricity, they must influence electricity distributors, by way of political favors or cash bribes. The cost to candidates of procuring electricity from the distributors depends on how much monitoring and enforcement these distributors face. When the regulators are empowered in our model, candidates have the opportunity to co-opt them. If they co-opt

[4]See, for example, "Naidu loses Rural Andhra wins over Hyderabad " featured in Tribune, May 12, 2004.

the regulator, monitoring and enforcement of the local distributor falls, and the marginal cost of securing electricity falls correspondingly; however, if they do not co-opt the regulator, the monitoring and enforcement increases, and the marginal cost rises correspondingly. National party candidates have a larger net return to co-opting the regulator, because they have higher-stake career concerns and a wider network of influence. Bhavnani (2012) and Fisman et al.(2012) use private-asset growth data of Indian politicians in closely contested elections to show that asset growth is strikingly higher (by 13 to 16 percent higher) for politicians who are in the council of ministers. The politicians of national parties are much more likely to be elected to the national-level council of ministers.[5] Thus, the expected returns to office for national candidates are higher. Moreover, the national parties contest elections across the country, offering their candidates a wider net of political connections and more avenues to co-opting the regional and national regulatory bodies that oversee the state regulatory bodies. Our model explains the divergence in outcomes in Figure 1, and provides clear implications about the heterogeneity of effects.

The empirical evidence is remarkably consistent with additional implications of our theory. We show the emergent wedge between groundwater depth in national and regional constituencies is larger in areas where groundwater is valued more, and is smaller in areas where delivering a unit of water is more costly for the candidates. Furthermore, constituencies with closely contested elections have higher groundwater depth, because candidates see a higher probability of changing the election outcome through aggressive efforts to secure electricity and extract water. Finally, the model relies on the notion that politicians deliver groundwater by delivering electricity. We corroborate this mechanism using constituency-level data on average luminosity ("night lights"). Consistently, we find that in close elections, a statistically significant wedge emerges in average luminosity between national and regional constituencies post reform. To buttress our claim, we also provide suggestive evidence on differential electricity reliability from household-level survey data. We consider a variety of alternative explanations that would capture these results, and do not find support for them.

We contribute to two strands of literature. As mentioned, an important strand of literature has stressed the possibility of regulatory capture by firms, as through the use of campaign con-

[5]Almost 30 percent of the members from the winning party are represented in the council of ministers in some capacity. In general, a majority of the council of ministers (COM) is from national parties - in the current COM in India, only 3 out of 33 cabinet officials, 0 out of 12 Ministers of States with Independent Charge, and 3 out of 36 Ministers of State are from regional parties.

tributions to legislative candidates who will help set policies (Grossman and Helpman (1996)).[6] Our paper instead focuses on the ability of politicians to sway nominally independent regulators for electoral gain, and we empirically establish the presence of regulatory capture by an influential class of politicians. Evidence documents that politicians are responsive to political incentives and provide access to credit (Cole, 2009), electricity (Golden and Min, 2009), and environmental licenses (Ferraz, 2007) over election cycles. Recent studies have also shown that coalitions of lower- and higher-level politicians increase political influence and enable the manipulation of outcomes for private benefit (Ferraz, 2007; Asher and Novosad, 2012). By contrast, we examine electoral competition among politicians over a time period in which regulators gain unprecedented authority, and we estimate the short-run cost of the consequent regulatory capture by particularly influential types of politicians.

We also contribute to the literature examining the political economy of environmental goods and natural resource provision. Political incentives at the local level can lead to inefficient environmental choices and resource extraction under decentralization (Burgess et al., 2012; Lipscomb and Mobarak, 2011). Research has shown that career concerns among politicians are pivotal in influencing environmental policy (Jia, 2012), and political influence can affect electricity provision (Min, 2010). We study the economic and environmental consequences of regulatory capture, using uniquely rich measures on a valuable resource, and we estimate the extent of inefficiency that regulatory capture generates.

The rest of the paper is organized as follows. Section 2 provides background on elections in India, MPs' influence over groundwater extraction, electricity diversion, and the Electricity Act of 2003. In section 3, we discuss the data used in the analysis, and we present the empirical strategy and our basic results. Section 4 develops the theoretical model to explain these results and derives additional comparative statics. Section 5 also discusses the tests of the additional implications of the model and provides additional evidence on the underlying mechanisms. Section 6 covers alternative explanations for our results. Section 7 briefly discusses the implications of our results for efficiency. Section 8 concludes.

[6]For instance, Dal Bó and Rossi (2004) study inefficiencies in electric utilities in Latin America. Burgess et al. (2012) show compelling evidence that logging firms bribe local officials to allow illegal deforestation in Indonesia. Besley and Coate (2003) demonstrate the possibility of a novel form of regulatory capture by firms, where stake-holders in electric utilities sway politicians who appoint regulators.

2 Background

In this section, we first provide background on national parliamentary elections in India, with a special focus on the 1999 and 2004 elections that we will utilize in this paper. Next, we discuss the intersection of politics and groundwater, noting how politicians historically have influenced the usage (and over-usage) of groundwater. Finally, we describe the features of the Electricity Act of 2003 that strengthened centralized regulation and are used in our identification strategy.

2.1 National Parliamentary Elections

In this paper, we focus on national parliamentary elections and the party affiliation of Members of Parliament (MPs).[7] Typically, national parliamentary elections in India are held every five years. Many parties contest these elections, and candidates can be affiliated with regional or national parties, or can be independent. As noted above, the regional parties are state-centric and contest elections primarily in just one state. By contrast, national parties contest elections more broadly in various constituencies across the country.

In the period between 1998 and 2004, four general elections took place. No single party won a majority of seats in the 1996 elections. Two successive elections were held in India in 1998 and 1999 due to the withdrawal of coalition partners from the government over political issues.[8] The parliament elected in 1999 completed its five-year term and general elections were held in 2004.

In 1999, a national party (Bharatiya Janata Party (BJP)) and its coalition partners formed a government. The electoral turnout was 60 percent, which was comparable to previous elections. The alliance won 270 seats (constituencies) out of 543, with the BJP winning in 182 constituencies. In the 1999 elections, national parties won 369 seats, and regional parties won 162, which means that regional parties won about 30 percent of the seats.

In the 2004 elections, the winning coalition switched. The leading national party heading the central government, the INC, won 145 seats, and the leading national party in the opposition

[7]We focus on representation in the national parliament, rather than on state legislative assemblies, for several reasons. Electricity is a joint responsibility of the central and state governments, as it appears in the concurrent list of items in the Constitution. Moreover, the Electricity Act of 2003 was a national-level initiative. Because the grid is interconnected and states have an entitlement to central government-owned generation facilities, the reform involved the coordination of regulators at the state and central level.

[8] In 1996, the Indian National Congress (INC) withdrew its support from the United Front due to the implication of one of the member parties in the assassination of Rajiv Gandhi, a former leader of INC. The 1998 government was dissolved as a member party withdrew its support over a political row involving a state government and accusations of corruption implicating the leader of the withdrawing party.

won 138 seats. The voter turnout was around 60 percent in these elections as well. Regional parties won 31 percent of the seats, a percentage quite similar to the 1999 elections: national parties won 364 and regional parties, 169 seats. Therefore, no sweeping shift toward regional or national parties occurred from 1999 to 2004.

2.2 Influence of MPs on Groundwater Extraction

MPs do not have formal authority over groundwater provision to the farm sector, but they can facilitate access in a number of ways. The most important way is by influencing electricity provision to farmers.[9]Publicly owned and operated electricity boards have historically managed electricity supply. Local political regimes can influence both pricing and regularity of supply (duration and frequency of power cuts).

Tariffs are determined at the state level. In many regions of the country, electricity provision for the agricultural sector is supplied for free or is flatly tariffed based on the horse power of the pump used for water extraction (Shah et al., 2004). This subsidy reduces the marginal cost of extraction, and in many instances, farmers face a zero marginal cost. Annual losses to Indian State Electricity Boards (SEBs) because of power subsidies to agriculture are estimated to be around USD 5.65 billion (Shah et al., 2004).[10]

MPs easily influence electricity duration, frequency, and timeliness. Local distribution of electricity is frequently documented to be captured by politicians. Recent research has highlighted the link between politics and electricity provision in India. Golden and Min (2012) use data from the state of Uttar Pradesh to show that electricity losses (power that is supplied but not billed) increase over the election cycle, indicating politicians have some sway over bureaucrats that are responsible for the distribution of electricity. Min (2010) presents a case study of Uttar Pradesh to show that politicians influence electricity diversion. He documents various instances in which politicians ensure uninterrupted electricity to their constituencies. Politicians routinely request favors from engineers responsible for load shedding and distributing power locally (including unannounced cuts). A Supreme Court-appointed committee articulated the existence of a culture of political interference in the day-to-day operations of the state

[9]Politicians can also help farmers invest in wells by providing access to easy loans to cover the fixed cost of wells. Public banks offer loans for financing well construction ((Minor Irrigation Census,1993), and these banks may be influenced by local legislators (Cole, 2009). Local politicians may also influence other schemes that finance well construction and boring such as the *Free Boring Scheme* and the *Million Wells Scheme*.

[10]Numerous media outlets accuse politicians of bankrupting local state electricity boards. See, for example, “Powerless” in The Economist (July 31 , 2012).

electricity board.

2.3 Power Grid Operations

The within-state operation of the grid entails the collaboration of distribution agencies, transmission agencies, generators, and the SLDC. Generators can be centrally, state, or privately owned, and distribution and transmission agencies may be either state or privately owned. Determining the amount of power each distribution point receives is an involved process. We describe this general process below, using specific details from the state of Gujarat for concreteness (Gujarat Electricity Commission (2004)).

Distribution agencies share a large amount of information with transmission agencies and the SLDC. The distribution agencies predict demand on an annual basis. They produce 10 years of data to back their forecasts and submit all assumptions made about any growth. They have to provide details of the consumer profiles on their grid and the carrying capacities of each line and substation. Distributors also have to provide plans about load shedding on specific lines in the grid. The transmission agency provides details of its carrying capabilities, any maintenance that is scheduled for any lines or stations during the year, and any additions it plans to make to the infrastructure. This information is shared with the distributors and the SLDC.

Generators inform the SLDC about their generation schedule and any anticipated problems, although the amount injected into the grid can change depending on real- time conditions such as availability of inputs. The state is also entitled to the generation of national facilities in fixed amounts.[11]

The SLDC is responsible for overall grid integrity. It works as a clearing house of demand and supply, and controls the scheduling of announced downtime. It is expected to maintain the grid at a frequency of 50 Hz. Over-drawing power relative to supply lowers the frequency and can result in unscheduled power outages. Frequent outages result in severe damage to the grid equipment and are expensive. Finally, states are grouped into regions and each group of SLDCs is monitored by the relevant Regional Load Dispatch Center (RLDC). The RLDCs are, in turn, monitored by the National Load Dispatch Center (NLDC).

[11] A formal mechanism is also in place to buy the entitlement of other states from national generation facilities at the Unscheduled Inter-change (UI) rate under the Availability Based Tariff (Bhanu, 2005). The transactions are not very large and comprise only 3 to 5 percent of the energy consumption (Pandey, 2007).

2.4 The Electricity Act, 2003

Given financial problems in the electricity sector, partly due to politically driven mis-allocation and mis-pricing, reforms have attracted persistent interest. The Electricity Act of 2003 was passed and put into effect in June 2003. However, the implementing agencies made recommendations for amendments to the provisions of the Act. The amendments went into effect in January 2004, just four months before the national elections in April-May 2004.[12]

The act resulted in an immediate and significant increase in centralized regulation.[13] The State Electricity Regulatory Commissions (SERCs), bodies that now became mandatory rather than just encouraged, were given greater power. SERCs were to determine the state-wide tariff, as well as approve budgets and farm subsidies. In addition, according to Section 33(1), SLDCs became responsible for ensuring integrated grid operations and for achieving the maximum economy and efficiency in the operation of the power system. As per Section 33(2), every licensee, generating company, generating station, sub-station, and any other person connected with the operation of the power system had to comply with directions issued by the SLDC, under threat of fines. In turn, the SLDCs had to adhere to the instructions of their respective RLDCs, and all five RLDCs and all SLDCs were required to comply with the instructions of the NLDC. The Central Electricity Regulatory Commission (CERC) could impose individual fines if an SLDC were found in non-compliance. Hence, although an SLDC is run by state employees, it has to comply with the RLDC and NLDC instructions. The SLDCs had to cooperate with their neighbors to maintain the integrity of the regional grid. Each state was to have a grid code that described grid operation and the role each agency should play, but state operators had to also comply with regional grid codes and an overall national grid code. Prior to the reforms in 2003, SLDCs had limited monitoring and enforcement capabilities. They resorted to issuing warnings to distribution agents if there was excess load on a line due to overdrawal. After the reform, mandating use of software to maintain grid operations significantly enhanced

[12]The Electricity Act 2003, was proposed in 2001 and replaced the three existing pieces of electricity legislation: Indian Electricity Act, 1910, the Electricity (Supply) Act, 1948, and the Electricity Regulatory Commissions Act, 1998. The Act can be found at the Ministry of Power's website. The objective was to introduce and promote competition in generation, transmission, and distribution, and to make subsidy policies more transparent. The key features were delicensing of generation, provision for private licensees in transmission, and entry in distribution through an independent network. The act allowed private trading with fixed ceilings on margins, and it made metering of all electricity supply mandatory. Private entry has not taken-off under the ACT as envisioned.

[13]While other provisions of the Act relevant to open access and competition were not successfully implemented, state grid codes empowering the load dispatch centers were immediately issued. The grid codes available on the websites of the state electricity boards mention the dates they went into effect. These clearly delineated the increased powers of the SLDC.

the SLDCs' capabilities. The reforms also introduced punitive damages for not complying with SLDC instructions (The Electricity Act, 2003). [14]

Despite these changes, there are reasons to believe the regulators and local distributors are still co-opted by politicians. For instance, according to a survey of corruption in the electricity sector conducted by Transparency International, 24 percent of the respondents claimed to have bribed utility officials. In a more publicized example, in July 2012, India experienced the largest blackout in its history, affecting around 9 percent (620 million people) of the world's population. Spokespeople for the Power Grid Corporation of India Limited (PGCIL) and the Northern Regional Load Dispatch Centre (NRLDC) stated certain states (Uttar Pradesh, Punjab, and Haryana) were responsible for the overdraw that collapsed the grid. Surendra Rao, India's former head of CERC commented on NPR's "All things Considered" :

"Blackout was the result of powerful states guzzling more than their budgeted share of electricity while regulators looked the other way...The Load Despatch Centers must have known on their screens who was consuming too much. They could have disconnected the customer, they could have disconnected the whole state and protect the grid. They didn't do it. Why doesn't he do it? Because his bosses told him not to do it. Who is his boss? The politician and the bureaucrat. This is all politics. Everything here is political."

In the follow-up to the blackout, the CERC instructed the three SLDCs of Punjab, Haryana, and Uttar Pradesh to provide explanations for their actions and fined each one Rs 100,000 (Indian Express, August 15, 2012; The Hindu, August 24, 2012). In response, the spokesperson for the SLDC of Uttar Pradesh produced text messages from politicians, coaxing them to provide an uninterrupted supply of electricity (Indian Express, August 15, 2012). CERC has more recently charged a fine of Rs 100,000 to the SLDC of Uttarakhand for overdrawing electricity from the grid and not complying with the provisions of the Electricity Act, the Grid Code, and directions of the CERC and NLDC (Business Standard, July 2013). In the Ancillary Evidence and Robustness Tests Appendix Section C.1 and Appendix Figure A1, we show further evidence that SLDCs indeed have the power to monitor the grid and allow over-draw.

[14] The roles of the SLDC as highlighted by the Power System Operation Corporation Ltd. can be found at : http://srldc.org/Role%20Of%20SLDC.aspx.

3 Data

3.1 Data Sources

We use three main sources of data in our empirical analysis. The groundwater data are from the 16,000 monitoring wells monitored by the Central Groundwater Board of India, which maintains the data in a restricted access database. These wells are fairly evenly spread across India, except in the hilly regions in the North and Northeast of the country. The data provide the spatial co-ordinates of the monitoring wells and groundwater depths in four different months (pre and post-harvest) for the years 1996-2006.

We matched the groundwater data spatially to the election jurisdictions (constituencies) of India.[15]Four elections took place in this period in 1995, 1998, 1999, and 2004.[16] From the Election Commission of India, we obtain publicly available constituency-level data on the total votes cast and the winning political representative in each constituency, including his/her party affiliation, gender, caste, and winning margin. The elections data are available in the "*Statistical Report on the General Election to the Lok Sabha.*"

According to the Election Commission of India, a political party is a national party if the commission formally recognizes it in more than 4 states in the country. [17] If it is recognized in four or fewer states, it is considered a regional party. Appendix Table A1 provides a list of various parties that contested the 1998, 1999, and 2004 elections, along with their classification as national and regional parties.

Our analysis uses several supplementary data sources to test additional implications and mechanisms of the model, as well as deal with alternative explanations. We interpolate constituency-level average annual rainfall and temperature values using the University of Delaware 0.5 degree resolution data for India.[18] For household data on electricity usage, we use two waves of the India Human Development Survey conducted by the National Council for Applied Economic Research (NCAER). The first wave was conducted in 1993-1994 and was called the Human Development Profile of India (HDPI). The second wave was in 2005 (called the India Human Development Survey (IHDS)). A subset of the 1993-1994 districts were revisited in 2005. We use the *Global Agro-ecological Assessment for Agriculture in the 21st Century* spatial

[15]A kriging algorithm was used to obtain constituency-level data from the monitoring wells data.
[16]The constituency boundaries were redrawn in 2008. Hence, we restrict the analysis to elections before 2009.
[17] The criterion for recognition can be found at http://eci.gov.in/eci_main/faq/RegisterationPoliticalParties.asp
[18]Available at http://climate.geog.udel.edu/~climate/html_pages/archive.html

raster data to determine the suitability indices for water-intensive crops in India. Finally, we use the average luminosity data collected by U.S. Air Force weather satellites. Further details about the crop suitability and average luminosity data appear in the Data and Estimation Procedure Appendix Section A.1.

3.2 Summary Statistics

Table 1 shows the annual mean and standard deviation for depth to groundwater from 1996 to 2006, with each constituency taken as an observation. [19] We see an up-tick in depth over time, indicating aquifers are being depleted. Groundwater depth was 6.4 meters below ground level (mbgl) in 1996 and increased to 7.5 mbgl by 2006. Naturally, this trend masks considerable regional heterogeneity.

In our DID analysis, we restrict the data to parliamentary constituencies with national incumbents and national winners in the 2004 elections (N-N regime), and regional incumbents and regional winners in the 2004 elections (R-R regime). This design allows us to hold the candidates' party type constant and look at how their incentives interact with the regulatory regime before and after the reform.[20] By not using constituencies that switch from regional to national representation or vice versa, we focus the DID analysis on seats where the party type of the winner is less likely to be influenced by the electricity reform or by movements in groundwater over time. Hereafter, we call this sample the DID sample. Out of a total of 389 constituencies in the DID sample, 295 constituencies had national regimes before and after the 2004 elections and 94 had regional regimes. The remaining constituencies switched from N to R (71) or from R to N (64). Again, we exclude them from the DID sample but include these in our later analysis of close elections.

Table 2 provides summary statistics for the DID sample by constituency regime type. The geographical characteristics of rainfall and temperature were similar across regimes. The N-N constituencies were larger in area on average relative to R-R constituencies, but they had the same proportions of male winners. Total votes cast were marginally higher in R-R constituencies. The average groundwater depth in R-R constituencies was 5.31 mbgl in 2000 and 5.74 in 2006. On the other hand, in the N-N constituencies, the average groundwater depth went from

[19]The number of observations is less than the number of constituencies due to missing groundwater data for some constituencies in some years.

[20]Note that N-N regime allows for changes in party identity. For example, if a constituency switched from having a candidate from BJP to INC, it is counted in this group.

7.67 mbgl to 8.71 mbgl.

3.3 Empirical Strategy and Basic Results

Figure 1 strongly suggests the difference in average groundwater depth between constituencies with regional MPs and those with national MPs grew markedly after the electricity reforms. In this section, we formalize this result. In the following section, we will develop a theoretical model to explain this result and derive additional testable implications.

3.3.1 DID Approach

As described in the data section, we compare the constituencies won by national candidates in both 1999 and 2004 elections to those won by regional candidates in both elections before and after the 2003-04 reforms. To operationalize this comparison, we estimate a year-by-year DID model for a sample restricted to the years 2000 to 2006. This model is specified as:

$$Y_{it} = \alpha_0 + \alpha_1 \, RR_i + \kappa_t + \sum_{l=2001}^{2006} (RR_i . \, d_l) \, \delta_l + \alpha_2 \, X_{it} + \epsilon_{it} \tag{1}$$

where Y_{it} is the depth to groundwater in constituency i and year t, RR_i is an indicator that is equal to 1 if the constituency is a R-R regime, vector X_{it} includes time-varying constituency-level controls, and ϵ_{it} is an error term. Finally, d_l are the year indicators, κ_t are year fixed effects, and the coefficients δ_l give the differential year-by-year changes of the R-R regime relative to N-N regimes. We exclude year 2000 and its interactions as the reference year. We cluster the errors at the constituency level.

Many unobserved factors that affect groundwater depth may also affect the probability of an R-R regime emerging. Time invariant unobserved factors will be captured in the R-R main effect. Nevertheless, a remaining concern about the validity of this approach to assessing the impact of the Electricity Act could be that the depth to groundwater could be evolving differently in the constituencies under national versus regional regimes, and these trends across the reform period drive the results. We explore this possibility and show that trends in groundwater levels in the pre-periods do not differ across these regime types.

The results from estimation of (1) are reported in Figure 2 and Appendix Table A2. After the reform, the groundwater depth in regional regimes relative to national regimes is smaller. Time-varying characteristics of the constituencies could be potential confounders. Therefore, we control for geographical variables such as annual average rainfall and temperature, as well as other controls including area, total votes cast, and gender of the winning candidate interacted with year indicators. We report the estimates in column (ii) of Table A2. In column (iii), we also control for winning party fixed effects to confirm that the results are not driven by specific party identities.

As noted above, the identifying assumption in the DID estimation is that in the absence of the reform, the trends in water depths in constituencies with regional candidates would be similar to those constituencies with national candidates. To address formally whether this condition holds or not, we control for changes in groundwater levels in the pre-periods, and report the results in column (iv) of Table A2.

All these specifications indicate that prior to the reforms, the depth to groundwater was similar in both types of regimes. By 2005, depth to groundwater in the regional constituencies is lower than in national ones. This difference becomes more pronounced and statistically significant at the 1 percent significance level in 2006. The estimates indicate a 1 meter difference in decline which is about 1/7th of a standard deviation. We represent these coefficients and the confidence intervals graphically in Figure 2.

3.3.2 Generalized DID with Matching

Our DID approach might prompt two additional concerns. First, regional constituencies that are comparable to national constituencies in terms of pre-reform characteristics might not exist, and vice versa. Using a common support in the distribution of observable characteristics can address this concern. The second concern might be that the distributions of $\mathbf{X}$ are different across the two groups. Re-weighting the national regime observations within the common support can address this concern.

To allay these concerns, we follow Heckman et al. (1997), and implement a generalized DID matching estimator that combines matching methods and fixed effects approaches. Thus, we match constituencies on pre-reform characteristics and then carry out a DID estimation on this sample. This estimation conditions on the fixed effects, and hence identifies the parameter of interest without ruling out selection into treatment on the basis of time-invariant unobservables. We use data from one pre-reform year (2000) and one post-reform year (2006).

Specifically, first we estimate propensity scores using a probit model to predict the probability that a constituency is a regional regime (as opposed to a national regime) as a function of pre-election characteristics. Unfortunately, most of India's demographic and economic data are only available for districts, not constituencies.[21] Thus our approach uses the data we have for constituencies – namely, area, total voters in the constituency, average rainfall and temperature in 1999 and 2000, and change in groundwater level between 1999 and 2000. Then we restrict the sample to the common support of the propensity scores. We exclude all constituencies whose propensity scores are less than the maximum of the 5th percentile of the propensity-score distributions $PS(x)$ of regional and national constituencies, and also exclude all constituencies whose propensity score is greater than the minimum of the 95th percentile of these distributions. The Data and Estimation Procedure Appendix Section A.2 provides details on the weighting procedure.

The results of the generalized DID estimation with bootstrapped standard errors are reported in Table 3. Column (i) reports the results without the covariates, and we include covariates in column (ii). Across both specifications, we see a smaller decline across the reform period in the R-R regimes. The coefficient is negative and statistically significant at 5 percent in both specifications. These coefficients are around 1/7th of a standard deviation. The results are consistent with the basic DID approach.

These results establish compelling differences between N-N and R-R type regimes after the reforms. In order to further understand why the reforms result in a decline in water extraction in regional constituencies, we develop a political economy model. This model delivers additional implications, which we test in later sections.

4 Theoretical Model

The reforms increased the monitoring capabilities of the load dispatch centers (LDCs) and empowered them to impose their grid operation instructions on generators and distributors at the threat of financial punishment. In this section, we formalize the implications of the increase in regulation for groundwater depth and develop additional testable implications.

We set out a model to clearly delineate the potential mechanisms linking party type of legislators to groundwater depths in their constituencies. The goals of the model are to (1) examine how regional constituencies would respond differently from national constituencies to the reforms, and (2) create a framework to understand whether the new regulation led to an

[21] Constituencies are not fully contained in the districts and cannot be necessarily overlaid on district boundaries.

efficient allocation of water. In doing so, we also examine how groundwater extraction should differ between very competitive elections and elections with large winning margins.

The key tradeoff in the model is that a candidate can increase the probability of winning an upcoming election by promising to secure more electricity – and consequently groundwater – for her constituency, but this comes at a cost of effort or resources if the seat is won. We assume there is commitment to campaign promises, as in the standard probabilistic voting model. [22]Below, we provide the details of the model, including the agents and timing, as well as the objective functions and constraints of each actor. We describe the solution under a particular set of conditions and derive the consequent comparative statics.

4.1 Model Set-Up

4.1.1 Agents and Timing

The model consists of three sets of actors: one electricity distribution agent per constituency, which we hereafter refer to as a distributor; a continuum of citizens who vote; and two candidates- one from a national party and one from a regional party.

The model has four stages. In Stage 1, the candidates promise to secure a certain amount of electricity – and consequently groundwater – for the constituency if they are elected. In Stage 2, voters elect a candidate by plurality rule based on the policies to which each candidate has expressed committment. In Stage 3, a party candidate who becomes an elected MP follows through on chosen policy positions by exerting "influence" on the local distributor (see below for details on the definition of "influence"). In Stage 4, the distributors produce the electricity allocations to each constituency.[23]

We do not model the regulator's objective function directly. Instead, we think of the regulator (load dispatch centers at the state, regional and national levels) as an institution that can penalize a distributor for drawing more than the standard allocation. Prior to the reform, the regulator's monitoring and enforcement ability is low, so the expected cost it can

[22]A more complete model could endogenously produce commitment by incorporating the fact that the repetition of the election and policy game can allow voters (or the parties) to punish deviations from campaign promises; we do not pursue this complication here. We note, though, that MPs spend many continuous terms in a particular constituency.

[23]An important assumption that we make in this model is that the politicians are only committing to provide groundwater to the voters. We abstain from modeling politician's provision of other public services. The theoretical implications for other public services are ambiguous and will depend on the complementarity or substitutability with water and electricity provision. Decentralization in the provision hierarchy may also in part determine the effect on this other good. The vital point is that regardless of whether provision of this other public service goes up, down, or is unchanged, the increase in the water-allocation distortion continues to hold.

impose is low. Post-reform, the regulator has a greater ability to monitor allocations and greater discretion over enforcement. Monitoring and enforcement rises, unless the regulator is co-opted by a lump-sum “payment” (not necessarily money) from an MP, in which case monitoring and enforcement declines.[24]

4.1.2 Distributors

One distributor exists per constituency, and each one chooses how much electricity $\widehat{z_i}$ to supply to constituency i. The distributor takes as given the legal salary S and has access to a standard level of electricity a. Units of this electricity allotment can be transferred to other distributors at a unit value p, and additional units of electricity beyond a can be purchased from other distributors at the same unit value p. The incentive to obtain electricity for the local constituency comes from the fact that distributors receive a transfer of x_i from the local MP in exchange for a contracted amount of electricity z_i. This transfer is, broadly speaking, “influence”, where “influence” can involve monetary payments, in-kind goods, or favors that involve an expenditure of effort on the part of the MP. The distributor only receives x_i if he sets $\widehat{z_i} = z_i$.

However, by drawing more than the standard level of electricity, the distributor exposes himself to the threat of punishment from the regulator. The expected value of the punishment is $q(\widehat{z_i} - a)1(\widehat{z_i} > a)$. We index q by the party of the constituency's MP, q_k, where k can be ‘National’ or ‘Regional’ . Putting the above together, the distributor's optimization problem is therefore:

$$max_{\widehat{z_i}} \qquad S + x_i 1(\widehat{z_i} = z_i) - p(\widehat{z_i} - a) - q_k(\widehat{z_i} - a)1(\widehat{z_i} > a) \tag{2}$$

Here and below, we use 1(.) to represent the indicator function. Finally, we assume total electricity capacity available to the state is T. We assume T is a function of p, becuase electricity can be transferred into or out of the state.

[24]In our model, voters do not directly try to co-opt the regulator. This assumption is reasonable for two reasons. One, co-opting the regulator directly is costly for voters, whereas voting for a politician who co-opts the regulator is costless to the voters. Similarly, the transaction costs of transacting with several voters for the regulator would be high relative to dealing with just one representative politician. Two, not all voters can afford to co-opt the regulator. Only a few large firms, who are in high-tension heavy industries and use large amounts of electricity, may find co-opting the regulator worthwhile, but typically these types of firms invest in more reliable captive energy generation instead.

4.1.3 Voters

A continuum of voters exist who differ in their ideology/identity and their value for water. A candidate from party k in constituency i gives voter j the following utility:

$$v_{ijk} = \beta_{ij} w_{ik} + (1 - \beta_{ij})M + [\delta_{ij}]\, 1(k = R) \tag{3}$$

where the parameter β_{ij} indexes how important water is to voters, w_{ik} is the water implied by the campaign promise of the candidate from party k in constituency i (see below for details), M is income not reliant on water, and δ_{ij} is the ideology/identity of voter j. This ideology/identity indexes the voter's tendency to favor the regional party. As noted above, voters are heterogeneous: specifically, β_{ij} is distributed uniformly over the interval $[0, 2b]$, whereas δ_{ij} is distributed uniformly over the interval $[\Delta_i - \psi, \Delta_i + \psi]$, with β_{ij} and δ_{ij} independent of one another.

We assume Δ_i is stochastic and unknown to the parties in advance of each election. In particular, we assume $\Delta_i = \gamma_i + \nu$, where ν has a standard logistic distribution. Depending on the realization of this parameter, any party may win an election. The constituency-specific mean γ_i indexes the advantage of the regional party in the constituency on ideological/identity grounds, and can be either positive or negative.

4.1.4 Candidates

Two parties exist, one regional (R) and one national (N), and each party fields a candidate whose personal identity is irrelevant to the model. We assume the maximization problem of the candidate from party k in constituency i is:

$$max_{z_{ik}, H_{ik}} \quad M + P_j(z_{ik}, z_{ik'})\,[I - \theta_k C(z_{ik}) - \theta_k G H_{ik}] \tag{4}$$

with the constraint that $w_{ik} = A + \frac{z_{ik}}{L_i}$, where z_{ik} is the amount of electricity promised by candidate from party k in constituency i, A is rainfall, and L_i is the depth to groundwater. Here, I is the expected political rent for the candidate, the cost function $C(z_{ik})$ is the minimum influence cost needed to procure the contracted amount z_{ik} from the distributor, $H_{ik} = 1$ if the MP chooses to influence the regulator (only possible after the reform) and zero otherwise, G is the lump-sum payment to the regulator needed to ensure q goes down instead of up, and θ_k

gives party k's cost of exerting influence. Finally, $P_j(.)$ is j's probability of winning the election as a function of the electricity promises of party k and party k'. We assume a large number of constituencies exist, so that any given candidate does not perceive the impact of her electricity promise on p or T from above.

For convenience below, we define $I_k = \frac{I}{\theta_k}$. This expression is the political rent, normalized by the party's cost of exerting influence. Our use of this expression below makes clear that assuming the national and regional MPs have different political rents I (through differential expectations of securing a cabinet post, for example) is equivalent to assuming that they have different costs of influence θ (through using party connections to contact national load dispatch centers, for example).

We derive several implications from the model. Our assumptions on parameters, the solution to the model, and all proofs of the propositions are in the Theory Appendix.

4.2 Comparative Statics

Proposition 1: Assume (A1) and (A2) from the appendix. Then:
(a) $\frac{\partial w_R}{\partial \gamma} < 0$ and $\frac{\partial w_N}{\partial \gamma} > 0$.
(b) There exists γ^* such that constituencies with $\gamma_i > \gamma^*$ have $w_{iN} > w_{iR}$, and constituencies with $\gamma_i < \gamma^*$ have $w_{iR} > w_{iN}$.

Intuitively, this preposition establishes that in more competitive elections, candidates will tend to promise more water because ideology is less favorable. We examine the pre-reform situation for simplicity. Part (a) of the proposition implies that as the regional party's ideological advantage becomes larger, the regional party candidate will promise less water. This is because the candidate has a greater likelihood of winning on ideology alone, and does not need to exert influence to acquire water. Similarly, as the regional party's ideological advantage becomes smaller, the national party candidate will promise less water. Part (b) implies that if the regional party ideological advantage is large enough, then the national party candidate will always promise more water than his regional party opponent. If it is not large, then the national party candidate can win on ideology, and therefore promises less water than his regional party opponent.

We model the reform in a simple way: If a candidate is able to sway the regulator, $q_k = q - \epsilon$, whereas if she is not, $q_k = q + \epsilon$. Prior to the reform, $\epsilon = 0$, so that both national and regional candidates face the same threat of monitoring and enforcement. After the reform, ϵ increases. In the comparative statics, we examine the case where only the national candidate finds it optimal to co-opt the regulator.

Proposition 2: Assume (A1) and (A2) from the appendix, $|p'(\epsilon)| < \frac{I_k - G - pa}{I_k - G + qa}$ for $k = N, R$, and only the national candidate finds it optimal to co-opt the regulator. Then:
(a) $\frac{\partial w_{Ni} - w_{Ri}}{\partial \epsilon} > 0$.
(b) $\frac{\partial^2 w_R}{\partial \gamma \partial \epsilon} > 0$ and $\frac{\partial^2 w_N}{\partial \gamma \partial \epsilon} > 0$.
(c) There exists a threshold value γ_h such that $\gamma > \gamma_h$ implies $\frac{\partial w_R}{\partial \epsilon} > 0$, and there exists a threshold value γ_l such that $\gamma < \gamma_l$ implies $\frac{\partial w_N}{\partial \epsilon} < 0$.

Part (a) of Proposition 2 shows the reform will increase the gap in water promises between a national party candidate and a regional party candidates within a constituency, holding all else equal. To empirically test this prediction, we will examine close elections. We also examine how the "close elections" analysis compares with our "DID" analysis from the previous section. Recall that there we estimate the differing impact of the reform across national regimes and regional regimes. Intuitively, we can think of national regimes and regional regimes as places with a small regional party ideological advantage (low γ) and places with a large regional party ideological advantage (high γ), respectively. Part (b) of Proposition 2 suggests that regional regimes might draw more electricity after the reform, relative to the average regional MP. By contrast, national regimes might draw less electricity after the reform, relative to the average national MP constituency. Therefore, our DID estimates will underestimate the change in $w_{Ni} - w_{Ri}$ within a constituency before and after the reform. Part (c) of the proposition shows a counter-intuitive result. The reform might actually induce regional candidates to increase their water promises if their ideological advantage is high. Intuitively, this is because if a regional candidate has a large enough chance of winning the election on ideology, the desire to respond to the national candidate's increased promise dominates the direct price effect. According to part (c), a similarly counter-intuitive result holds for the national candidates when the regional party ideological advantage is extremely low.

Finally, we examine the heterogeneous effects of the reform, exploring two dimensions of heterogeneity: the value of water to voters b, and the initial depth of groundwater L. Specifically, we examine how the reform's impacts vary differentially by b and L in low γ and high γ

constituencies (national regimes and regional regimes, respectively).

Proposition 3: Assume (A1)-(A3) from the appendix, $|p'(\epsilon)| < \frac{I_k - G - pa}{I_k - G + qa}$ for $k = N, R$. Then:
(a) $\frac{\partial^2 w_N}{\partial b \partial \epsilon} > 0$ for $\gamma < \gamma^*$ and $\frac{\partial^2 w_R}{\partial b \partial \epsilon} < 0$ for $\gamma > \gamma^*$.
(b) If in addition $\gamma_l < \gamma < \gamma_h$, we have $\frac{\partial^2 w_N}{\partial L \partial \epsilon} < 0$ for $\gamma < \gamma^*$ and $\frac{\partial^2 w_R}{\partial L \partial \epsilon} > 0$ for $\gamma > \gamma^*$.

Part (a) tells us that in DID specifications with national regimes and regional regimes, the post-reform divergence in groundwater depth should be larger in magnitude in constituencies where water is highly desirable. Part (b) tells us that in DID specifications with national regimes and regional regimes, the post-reform divergence should be smaller in magnitude if the initial depth to groundwater is higher.[25]

5 Empirical Analysis to Test the Prediction of the Model

5.1 Close Elections

The model predicts that if all else is held equal, post-reform, we should observe a relatively smaller increase in groundwater depth in regional MP constituencies compared to national MP constituencies. The results from the basic DID and generalized DID approach are remarkably consistent with this prediction. To alleviate remaining concerns that time-varying differences across N-N and R-R constituencies (such as voters' water demand) might be driving our results, we examine changes in depth to groundwater in elections that are barely won and lost.

Following the literature, we examine close elections using a regression discontinuity design. We compare the constituencies where a regional candidate wins by a narrow margin to places where a national candidate wins by the same margin. Our identifying assumption is that in close elections, the switch in party is randomly determined. We carry out the RD analysis for every year between 1996 to 2006. Figures 3 and 4 show the results graphically. These figures plot the local means of depth to groundwater in narrow intervals of winning margins. Figure 3 shows the panels from 1996 to 2001, and Figure 4 shows local means from 2002 to 2006. The 95% confidence intervals appear in these figures as well. In these figures, we discern no difference in depth at the cutoff of 0 from 1996 to 2003 prior to the reform. But in 2004, we

[25]The additional restriction in part (b) means ideology is not so extreme in either direction that the counter-intuitive implications from part (c) of Proposition 2 arise.

observe a clear difference emerging in the depth to groundwater due to an upward shift in the constituencies with national winners.

We show the magnitudes and standard errors for this exercise from a non-parametric analysis in Table 4. We use a triangular kernel and an optimal bandwidth proposed by Imbens and Kalyanaraman (2009).[26] Column (i) reports the results without covariates, and we include the covariates in column (ii). We see the same pattern in both specifications. The RD estimate is close to 0 before 2004. A sharp change occurs in 2004. In column (i), we observe a shift of 2.6 m, statistically significantly different from zero at 10 percent. In column (ii), the magnitude is similar at 2.75 m but is more precisely estimated as we control for co-variates. The estimate is now significant at 5 percent. We observe similar but less precisely estimated magnitudes in 2005. When we control for covariates, the effect is significant at 10 percent. [27] As predicted by our model, our close election estimates are larger in magnitude than our DID estimates.

To better understand the size of this estimated effect, we can examine the range of annual groundwater declines in India. The Central Groundwater Board of India issues annual maps of changes in depth to groundwater. A fairly significant part of the country experienced declines of 2 m or more as per the 2011 report.[28] Hence, a decline in depth of 2.75 m in one year (2004) is plausible. This effect is equivalent to around 0.4 of one standard deviation and is economically significant.

In the 2002 regression, the optimal bandwidth is 6.7 and includes 234 constituencies, whereas in 2004 the optimal bandwidth is 6.4 and it includes 171 constituencies. In the Ancillary Evidence and Robustness Tests Appendix Section C.2 and Appendix Figure A2, we show that other controls (including total votes cast) do not exhibit any jump near the winning margin of 0. We also demonstrate in Appendix Section C.3 and Appendix Figures A3 and A4 that changes in the composition of the constituencies experiencing close elections over time do not drive our close election results.

[26]The triangular kernel has relatively good boundary properties. The IK bandwidth minimizes the root mean square.

[27]Our RD estimates are large and significant immediately after the reform is passed and then become imprecise for later years. By contrast, the DID estimates are negative immediately after the reform, but small and imprecisely estimated. The DID estimates become larger over time and become significantly different from zero in 2006. These estimation procedures are based on different samples. The DID estimates are from a sample that compares constituencies that are regional and stay regional to constituencies that are national and stay national in the post-reform era. The switching constituencies are not included. In addition, both closely contested and non-competitive constituencies are included. On the other hand, the RD sample is based on closely contested constituencies and does not condition on who is the incumbent. We include switching constituencies here.

[28]These maps are available at http://cgwb.gov.in/documents/Ground%20Water%20Year%20Book%20-%202011-12.pdf

5.2 Higher Groundwater Depth in More Competitive Elections

Proposition 1A predicts any candidate will promise more water when he holds a smaller ideological advantage. The intuition is that when the regional parties have a high chance of winning because of ideology, the national candidates must compensate for this by promising to extract a larger amount of water. Similarly, in constituencies where national candidates are more likely to win on ideology, regional candidates must compensate by promising to extract more water.

To examine this prediction, we regress groundwater depth on the absolute value of the winning margin of an MP over the nearest competitor. Higher groundwater depth corresponds to higher groundwater extraction. Therefore, we would expect that the coefficient is negative. The regression yields a highly statistically significant coefficient of -0.02 with a standard error of 0.001.

5.3 Heterogeneous Effects: Rice Suitability

Proposition 3A indicates that, post-reform, our DID estimates should be larger in magnitude in places where the voters' average dependence on water is higher. All else equal, the dependence of income on water will be higher in areas that are suitable for growing water-intensive crops. Thus after the reform, we should see a larger change in the gap in groundwater depth between national regimes and regional regimes where water-intensive crops are most likely to be grown. [29]

To conduct this test, we use the fact that rice is a water-intensive crop. We extract the rice suitability index for each point on the grid in India as described in the Data Section. Appendix Figure A5 shows the spatial variation in the distribution of this index over India. We find the mode of the indexes associated with the grid points within each constituency. The mode gives us a measure of the overall area that is suitable for cultivating rice within a constituency. The index value 1 indicates most suitable and 8 indicates least suitable. Because a one-unit change in this index does not have a clear meaning, we create a dummy variable breaking up constituencies into suitable versus unsuitable. Specifically, we categorize the constituencies for which the mode takes values 1, 2, 3, or 4 as suitable, and the ones for which the mode takes values 5, 6, 7, or 8 as unsuitable.

We report the results of the DID model for these categories in Table 5. Panel A reports

[29] Note that in such a test, controlling for precipitation is important. Places suitable for growing water-intensive crops because of high precipitation may be places that do not need much groundwater irrigation.

the results for constituencies with larger areas suitable for growing rice, and Panel B shows the results for constituencies with larger areas unsuitable for growing rice. Column (i) includes a basic set of controls, column (ii) adds winning-party dummies and winning margin to the column (i) controls, and column (iii) adds past water depth changes to the column (i) controls. We find that the results in Panel A are twice as large as those in Panel B. Hence, consistent with our hypothesis, areas that are more suitable for growing rice (water-intensive crop) experience larger effects post reforms. We formally test whether the coefficients in Panel A are statistically different than those in Panel B. The difference is statistically significant at 11 percent, 6.6 percent, and 11 percent across the three columns.

5.4 Heterogeneous Effects: Baseline Groundwater Depth

Proposition 3B states that our DID estimates should be smaller in magnitude in places where initial depth to groundwater is higher. In these areas, the marginal cost of water provision is high to begin with because a large amount of electricity is required to pump water from wells. To test this implication, we interact the main effect with the year 2000 groundwater depth. The results from a fully interacted model are reported in Table 6. In column (i), we report the results from a simple triple-interaction model. Column (ii) controls for geography and other controls, column (iii) controls for winning-party fixed effects and winning margin. Column (iv) shows a specification controlling for pre-baseline changes in depth to groundwater.

The main effect is negative and statistically insignificant until 2004. In 2004, it increases three-fold and becomes highly statistically significant at the 1 percent level. The effect remains negative and significant for 2005 and 2006. The interaction of this main effect with 2000 depth to groundwater is positive, small, and statistically insignificant until 2004. In 2004, this interaction doubles in magnitude to 0.3 and is highly statistically significant at 1 percent. This coefficient continues to be positive and highly statistically significant in 2005. We can statistically reject the null hypothesis that the triple-interaction coefficient in 2004 and 2005 are the same as for 2002 at 6 percent and 5 percent, respectively, for the specifications shown in columns (ii) through (iv). Therefore, the main negative effect is muted at higher depths, and only in the post-reform years. These findings are again consistent with our predictions.[30]

[30] These results are amplified for our small sample of close elections. The triple-interaction terms when the sample is restricted to a winning margin of 5 percent are 0.429, 0.675^{**}, 0.544^{*}, and 0.675^{**} for 2004 and 0.611^{**}, 0.902^{**}, 0.449, and 0.902^{**} for 2005 for the four specifications reported in Table 6. We do not conduct a similar exercise for the rice-suitability results because splitting the close election sample into suitable and unsuitable categories will result in extremely small samples.

5.5 Evidence on Mechanisms - Night Lights

In the model, one key factor that underlies the differences in the depth to groundwater that emerge in 2004 is differential electricity provision by national and regional candidates. If the politicians can indeed manipulate electricity provision to their constituencies, then we should expect to see similar patterns for electricity transmission. Unfortunately, we do not have data on the amount of electricity transmitted to each constituency. In the absence of such data, we use average luminosity (night lights) data as a crude proxy to examine electricity diversion.

We conduct the same non-parametric RD analysis as in Table 4, but now for average luminosity in the constituency. The results are reported in Table 7. Before 2004, the RD estimate is small and positive. It switches sign in 2004, and is negative and statistically significantly different from zero at the 5% level for 2004-2006. When we include controls, the coefficient flips sign and increases in magnitude by five times from 2003 to 2004. These patterns are remarkably consistent with the groundwater depth patterns in Table 4. Although we cannot rule out the possibility of an income effect (from increased groundwater availability) generating these patterns, the timing of the electricity response – emerging immediately after the reform – suggests that at least part of this variation reflects electricity diversion.

5.6 Evidence on Mechanisms- Household Survey Based Electricity Patterns and Voting Behavior

We can examine electricity reliability using two waves of household surveys from the India Human Development survey. The first wave of the survey occurs in 1993-1994, and the second wave occurs in 2005. This survey identifies the district in which households lives. Restricting our analysis to a subset of districts that can be matched to constituencies of each regime, we show the increase in household electrification from 1993/1994 to 2005 has been slower in the regional constituencies. Moreover, and more importantly, the regularity of electricity supply has grown by less in the regional constituencies. The details of this test and discussion of the results are presented in the Additional Evidence on Mechanisms Appendix Section D.1 and Appendix Tables A3 and A4.

Using recent nationally representative voter survey data, we also show that cultivators are more likely to vote for national candidates. The details appear in the Additional Evidence on Mechanisms Appendix Section D.2 and Appendix Tables A5 and A6. These systematic differences in the voting patterns of cultivators indicate that voters in agriculture who value groundwater vote more often for the candidates who, all else equal, have an advantage in providing groundwater.

6 Alternative Explanations

In this section, we explore several alternative explanations for our results. We provide evidence that they are not likely to drive our results.

6.1 Differential Demand

One alternate hypothesis might be that the N-N regimes have higher and more inelastic demand for groundwater, and the regulation makes electricity more expensive by properly pricing it. This differential-demand can produce the DID results we observe in section 4.

Nevertheless, this hypothesis cannot explain the patterns we observe in close elections. In constituencies with close elections, demand for water is likely to be similar, regardless of who wins the election. We detect an RD effect both in groundwater depth and in average luminosity emerging after 2003 (Figures 3 and 4 and Tables 4 and 7). In addition, the differential-demand hypothesis cannot by itself capture the increases in groundwater depth in more closely contested elections, whereas Proposition 1 of our model predicts this pattern.

6.2 Electoral Cycles

One major concern is that the reform occurred near an election year, suggesting the effects we see are due to the election rather than the reform. To ensure that the reform and not the electoral cycle are driving the results, we conduct a placebo test. We re-estimate (1), but now on a sample with years 1997 to 1999. Prior to 1999, two elections occurred, one in 1996 and the other in 1998. We compare the constituencies with regional regimes before and after the 1998 elections to those that had national regimes. Because the electricity sector reforms took place in 2003 and 2004, we should not expect to see a differential change over time for regional regimes.

The results are reported in Appendix Table A7. Column (i) reports the simple DID estimate. We control for co-variates in column (ii) and winning-party fixed effects in column (iii). The coefficients of interest are statistically insignificant across all these specifications. Moreover, in close elections in Figures 3 and 4, we observe no difference in depth to groundwater in the years near pre-reform elections. However, we observe large national-regional differences emerging after the reform. This evidence suggests electoral cycles do not drive our results.

6.3 Political Affiliation of State Governments

Another concern might be that the state government might facilitate MPs' efforts to acquire more electricity. The state government may be able to collude with an MP to influence bureaucrats by various means, such as threats of transfers or withholding promotions. If an MP is of the same party as the state government, this collusion may be more likely. In this case, the national party-regional party distinction might be picking up differences in party control of state governments.

We examine this issue with our data. We test if alignment with the party forming the state government drives our results by using state assembly election outcomes data from 2002 (prior to the reforms) and 2005 (after the reforms). Although national elections are held across the country at almost the same time, the timing of the state assembly elections vary. We constructed which party formed the government in each of the states in 2002 and 2005. Then we conducted two types of tests.

In our first test, we restricted the sample to constituencies where the party of the MP who won the 2004 national assembly election is in the state government either in both years or in neither year. We excluded the switches. We then checked if being an MP of the party that is in the state government provided an advantage. We report the results in columns (i) through (iii) of Appendix Table A8. Column (i) shows the DID coefficients. We sequentially add geographical and other controls in columns(ii) and column (iii). The interaction is statistically insignificantly different from zero in all the specifications. In our second test, we hold constant fixed constituency characteristics and examine within-constituency changes in whether the party of the MP forms the government. We do not impose any restrictions; we use a full sample. The switches may be endogenous with respect to water depths. But our concern is whether MPs whose party forms the state government after the reform benefit from own party government, holding constant the characteristics of the constituency. We report results using constituency fixed effects in Column (iv) of Appendix Table A8. We do not see any evidence that the MP's affiliation with the state government has an impact. The coefficient of interest is small and statistically indistinguishable from 0. [31]

6.4 Differences among National Parties

BJP formed the government at the national level until 2004, and the INC formed the government afterwards. One concern might be that the farmers extract more water under the INC relative to the BJP, and the change in the fraction of national party politicians who are from the INC accounts for the DID effects (rather than the reform).

We have already accounted for party identities in the analysis conducted so far by including party fixed effects. To address any persisting concern that switches from one national to another might make a difference, we re-estimate a DID model in which we interact every possible pre-2004/post-2004 party combination within the N-N constituencies with the post indicator. The excluded group is the R-R constituencies. We report the results in Appendix Table A9. All of these interactions are positive and significant regardless of the specification used. Moreover, no clear difference in the magnitude of estimates exists based on whether an MP is from INC or BJP. We cannot statistically reject that the coefficients INC-INC $*post$ and BJP-BJP $*post$ are equal at conventional levels of significance. The P-values for the tests of equality of these coefficients across the columns in Table A10 are 0.62, 0.61, 0.64, and 0.61.

6.5 Do National Party MPs Bring More Resources Due to Affiliation with the Central Government?

An additional concern might be that national party MPs bring more resources to their constituency due to their affiliation with the central government. These resources lead to greater development in their constituencies, and our groundwater and average luminosity results pick up that difference.

Two points cast doubt on the plausibility of this hypothesis. First, if it were true, why the national-regional difference would change after the electricity sector reforms is unclear. Second, if this hypothesis were true, the central government would have the strongest incentives to favor its MPs with resources just prior to elections. For three pre-election years (1997, 1998, 2003), we regress constituency-level groundwater depth on a national MP dummy, a dummy indicating

[31] Asher and Novosad (2012) examine the effects of party alignment of local and state politicians on a variety of outcomes and do not find evidence of an effect on provision of infrastructure or public services, including roads, electricity, schools, hospitals, and irrigation. We test whether alignment of MP and state government's party has any effect on groundwater extraction. Consistent with their findings, we do not find evidence that this type of alignment matters.

whether the MP is from the party forming the central government, and the interaction of the two dummies. The specifications also include geographic and other controls. We report the results in Appendix Table A10. The interaction of National MP with the party forming the central government is small and insignificant for all years.

In addition, in Appendix Table A9, we show that constituencies that INC won in 1999 and 2004 had the same decline in groundwater depth as constituencies that BJP won in both elections (relative to constituencies that were won by regional candidates in both elections). If this alternate hypothesis were true, we would expect INC-INC $*post$ coefficient to be different than BJP-BJP $*post$ coefficient, because the party forming the central government switched from BJP to INC in 2004. However, as shown before, we cannot reject the equality of these coefficients.

6.6 Higher Discounting by National Candidates due to Ease of Mobility

One possible alternative explanation of our results might be that regional party candidates are restricted to contesting elections from a state, whereas national party candidates are more mobile and can contest elections from different states and constituencies therein. Consequently, regional party candidates have stronger incentives to internalize inter-temporal externalities, and thus they tend to conserve groundwater.

Two facts contradict this hypothesis. First, in Figures 3 and 4, we see that before the reforms, the depth to groundwater in closely contested constituencies with regional and national winners was similar, but a wedge emerged after the reform. This alternate hypothesis cannot explain this finding. Second, a small fraction of national and regional candidates actually contests elections from different constituencies over time, and the proportion is no different for regional and national candidates. Using the history of the winners in elections since 1996, in Appendix Table A11, we examine how many national and regional candidates change constituencies. Only 4.52 percent of national winners and 5.45 percent of regional winners change constituencies over time (columns (iv) and (v)). Thus, if anything, regional candidates are more likely to change constituencies, though this difference is not statistically significant.

The number of times the candidates have contested elections does affect the likelihood of changing constituencies. Among those who have contested elections twice, national candidates are more likely to change constituencies, but this difference is small and not statistically significant. Among those who have contested elections four times, regional candidates are more likely to switch constituencies, and the difference is statistically significant at 10 percent. This pattern goes in the opposite direction of this alternate hypothesis. Finally, in columns (vii) and (viii), we show the likelihood of switching constituencies across states is near 0 for both types of candidates and does not change with the number of elections contested. Given this evidence, we find this alternate explanation unpersuasive.

7 Efficiency

We can use our results to speak to the issue of whether the regulator produced an efficient allocation of groundwater.[32]

We can determine whether the post-reform allocation is efficient by examining our close election results. We find that in close elections after the reform, less groundwater extraction occurs in jurisdictions that elect regional party MPs. Three explanations are possible for this national-regional gap: (i) National candidates can bring the constituency inputs that are complementary with water and electricity, and the regulator correspondingly directs greater electricity to national MPs; (ii) regional winners on one side of the cutoff have a large ideology advantage (high γ) that is balanced by a higher preference for water (high b) on the national winner's side of the cutoff; or (iii) national MPs enjoy higher expected political rents and/or a lower cost of influence than regional MPs (in terms of the model, $I_N > I_R$).

Distinguishing between these three possibilities is critical to the issue of efficiency. If (i) or (ii) hold, distorting the allocation of electricity so that national party MPs end up with more electricity and water may be efficiency enhancing. If instead (iii) holds, the regulatory reform did not lead to an efficient allocation.

Figure 3 suggests (i) does not hold. If (i) were true, national candidates would see a higher marginal return to electricity and groundwater than regional candidates. Even before the reform, they would therefore procure more electricity from their distributors than regional MPs. This gap would grow after the reform, when the possibility of co-opting the regulator arises. However, in Figure 3 we see that, prior to the reform, no discernible difference exists in water levels between narrow regional winners and narrow national winners.

Similarly, Figure 3 suggests (ii) does not hold. If (ii) were true, then voters in closely

[32] Without estimating a structural model (complete with welfare weights for various constituencies), determining whether one allocation yields greater social welfare than another is difficult. Although we cannot use our results to say whether the imposition of regulation through the Electricity Act of 2003 increased social welfare, we can address whether it was efficiency enhancing or detracting.

contested constituencies that yield a national party winner would have a stronger preference for water (have a higher b) than the voters in closely contested constituencies that yield a regional party winner. This implies that even prior to the reform, we should see greater groundwater extraction (and higher groundwater depths) on the national side of the cutoff. But, again, we do not see a large wedge between regional and national constituencies in Figure 3.

These facts imply the regulator is producing differential allocations across the national/regional dimension based on the differing personal incentives and constraints of national and regional politicians. Therefore, the evidence strongly suggests the Electricity Act of 2003 did not lead to an efficient allocation. In fact, the results indicate that regulatory capture ensuing after the reforms actually exacerbated the distortions involved in politically-driven allocations of electricity and water, at least along the national-regional party dimension. [33] Overall extraction rates continue to trend up indicating that social cost (scarcity rent of water) is not being factored in the extraction decisions post reforms either. Furthermore, despite no differences significant differences in marginal benefits, national candidates are able to facilitate more groundwater extraction than regional candidates.

We can calculate the immediate consequences of this inefficient allocation in terms of agricultural production using estimates derived by Sekhri (2013,a). As per these estimates, a one meter decrease in the groundwater depth in a district of India reduces total agricultural production by 7.18 percent on average, and food grain production by approximately 8 percent on average.[34] Using our estimates for the differential impact of the reform in closely contested elections, these numbers would imply an average reduction in total agricultural production and food grain production of 18 percent and 20 percent, respectively, in the constituencies won narrowly by regional candidates. This decline in agricultural production is a short-term cost to the regional constituencies; in the long-run, regional constituencies may be better off than their national counterparts because of the reduced groundwater extraction. Nevertheless, the size of these numbers indicate that regulatory capture in the aftermath of the Electricity Act of 2003 may have had significant economic consequences.

[33]The reforms might have mitigated distortions along other dimensions.

[34]Because districts and parliamentary constituencies do not overlap, we cannot precisely determine the average cost for a constituency.

8 Conclusion

In this paper, we examine a regulatory reform designed to improve an electricity sector that was commonly regarded as distorted by politically-motivated diversions of electricity. We propose a model of elections and groundwater extraction to understand the impact of this reform on groundwater extraction. Our empirical analysis of a rich data set on 16,000 monitoring wells in India confirms key predictions of this model. Most significantly, in response to a major reform, constituencies with elected representatives who have high-stakes career concerns and lower costs of influence appear to be less affected in terms of groundwater extraction than those without such concerns and costs. Our model indicates that the emergent wedge was the consequence of regulatory capture. In general, regulatory capture could either enhance or diminish the efficiency of an allocation. Our results indicate the regulatory reform did not lead to an efficient allocation and instead created a large and economically consequential distortion.

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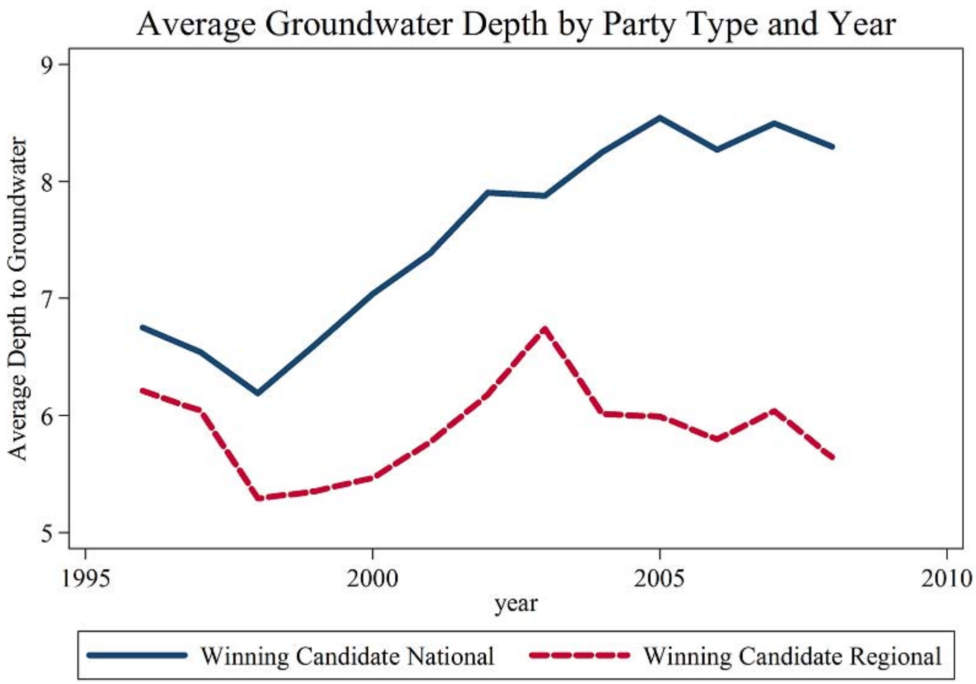


Figure 1: This figure plots the trends in Depth to Groundwater for National and Regional Constituencies

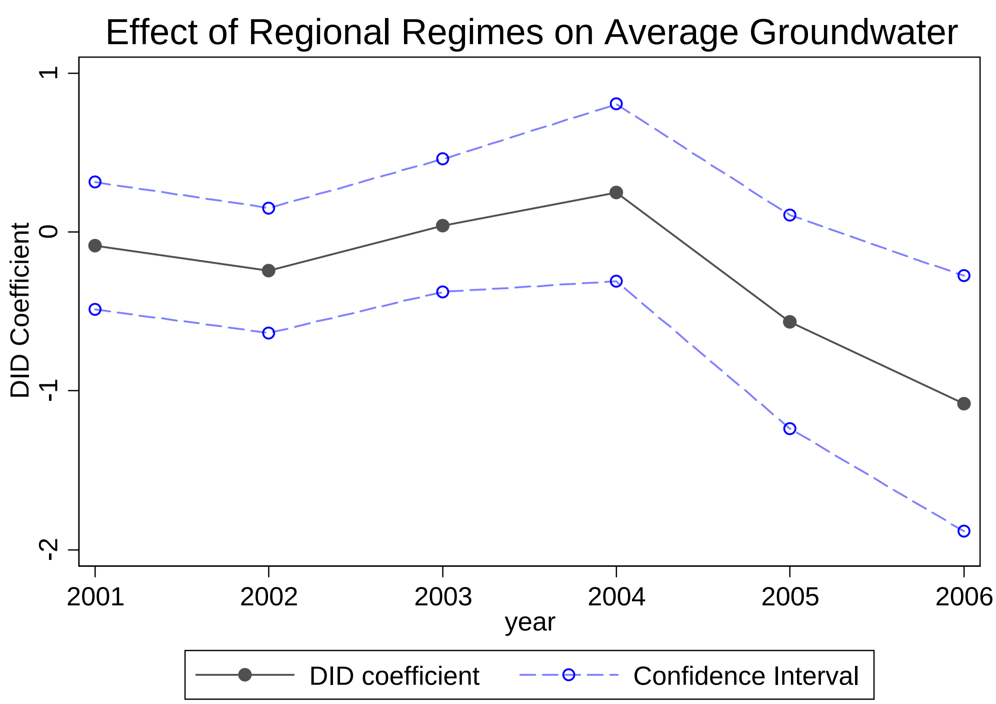
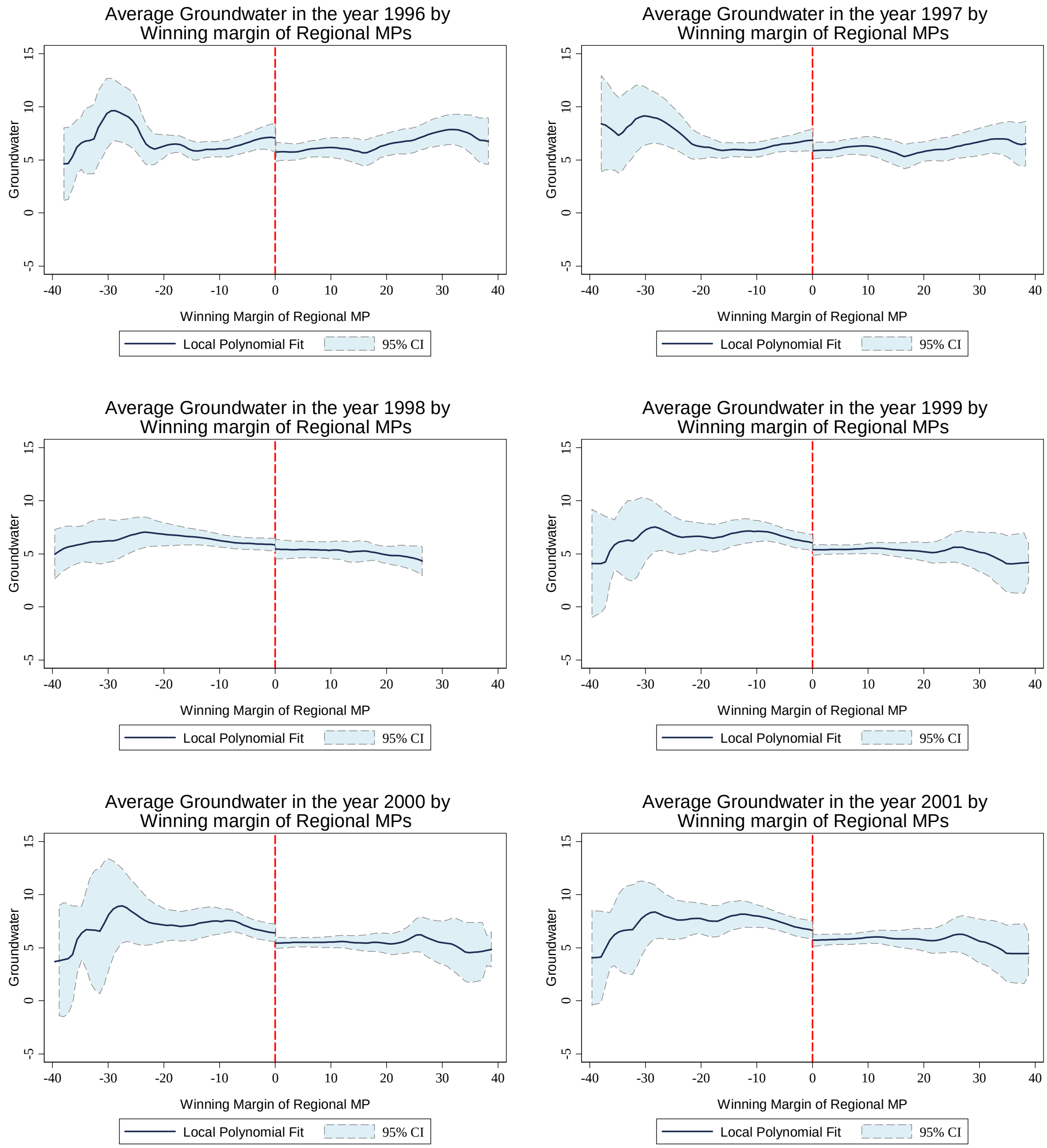


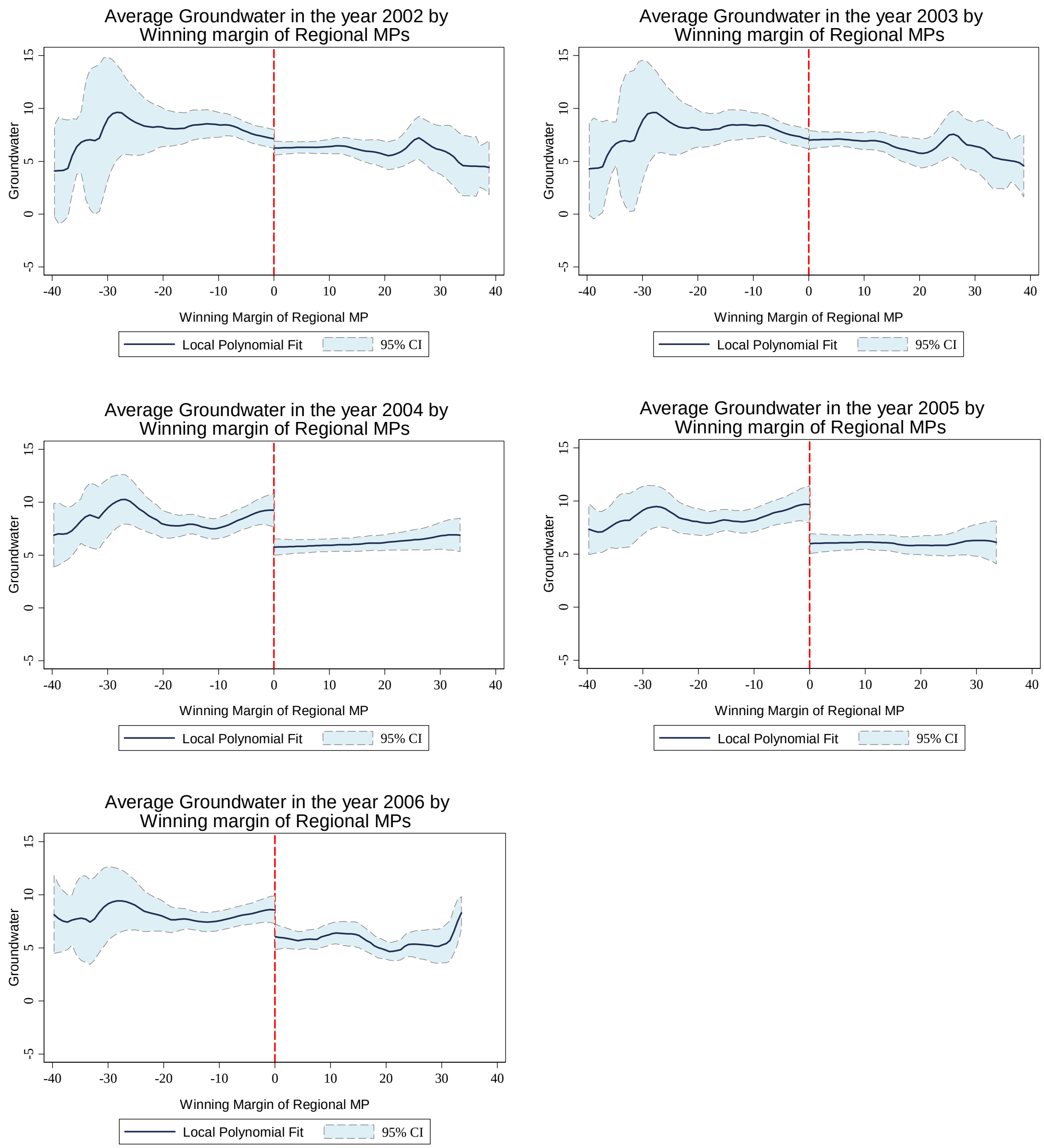
Figure 2: This figure plots the differences-in-differences Estimates of the effect of regional party legislator on groundwater depth relative to year 2000

Average Groundwater level by Winning Margin of Regional MP and year



Notes: The data is restricted to constituencies where the winning candidate was affiliated to a National or a Regional party. Winning Margin of a Regional MP is the product of winning margin and a variable equal to -1 if the winning candidate is affiliated to a National party equal to 1 if affiliated to a Regional party.

Figure 3: Regression Discontinuity Comparisons for Years 1996 to 2001



Notes: The data is restricted to constituencies where the winning candidate was affiliated to a National or a Regional party. Winning Margin of a Regional MP is the product of winning margin and a variable equal to -1 if the winning candidate is affiliated to a National party equal to 1 if affiliated to a Regional party.

Figure 4: Regression Discontinuity Comparisons for Years 2002 to 2006

Table 1: Summary Statistics for Average Depth to Groundwater (in meters)

	Mean	SD	Min	Max	Obs
1996	6.557	5.571	1.188	67.160	519
1997	6.367	4.858	1.584	47.695	519
1998	5.933	4.768	1.401	46.575	520
1999	6.204	4.873	1.322	47.284	518
2000	6.544	5.535	1.360	57.172	517
2001	6.881	5.538	1.474	51.926	519
2002	7.362	5.961	1.288	58.157	519
2003	7.509	6.061	1.430	56.178	518
2004	7.518	5.669	1.290	49.166	518
2005	7.682	6.076	1.400	52.155	477
2006	7.491	6.822	1.228	68.467	523

Table 2: Summary Statistics by Regime Type between 2000 and 2006

Sample	**All Constituencies**			**Constituencies with Regional incumbent and winner in 2004 Elections**			**Constituencies with National incumbent and winner in 2004 Elections**		
No. of Constituencies	**389**			**94**			**295**		
Variable	Mean	S.D.	# Obs	Mean	S.D.	# Obs	Mean	S.D.	# Obs
Depth to Groundwater in 2000	7.11	6.24	2618	5.31	2.16	623	7.67	6.95	1995
Depth to Groundwater in 2006	8.01	7.67	2639	5.74	3.16	623	8.71	8.47	2016
Average Rain	99.98	64.93	2688	101.45	60.08	658	99.50	66.43	2030
Average Temperature	25.67	3.02	2688	25.87	3.75	658	25.60	2.74	2030
Total Votes Cast	694923.20	179004.80	2723	698581.20	171447.50	658	693757.60	181371.70	2065
Area	6245.28	6675.96	2566	4276.98	2708.12	605	6852.53	7382.46	1961
Winning Candidate is Male	0.91	0.28	2723	0.93	0.26	658	0.91	0.29	2065

Note: Data used from 'Lok Sabha' (directly elected lower house of the parliament of India) elections for the years 1999 and 2004. A political party is called a `National' party if it is a recognized by the Election Commision of India in four or more states. If a party is recognized in less than four states it is called a `State' party (regional in our notation). The data is restricted to Parliamentary Constituencies with a National or Regional incumbent and winner in 2004 elections and the years 2000 to 2006.

Table 3: Generalized Differences-in-Differences With Matching

	Dependent variable: Depth to Groundwater from the Surface (in meters below ground level)	
RR X Post	**-0.786****	**-0.67****
	(0.32)	(0.31)
Controls	No	Yes

Notes: The sample is restricted to years 2000 and 2006. Each regression sample is restricted to the common support of the propensity scores for regional and national regime constituencies. The propensity score is modeled as a function of area, total voters, average rainfall and tempereature and change in groundwater levels in 2000. A kernel based matching algorithm is used to construct counterfactuals . The standard errors in the estimation of propensity scores are robust and clustered at constituency level. Bootstarp standard errors are reported. All regressions include RR and post indicator.

Table 4 : Non-Parametric Regression Discontinuity Estimates

	Depth to Groundwater from the Surface (in meters below ground level)			
	(i)	**(ii)**	**(iii)**	**(iv)**
R-R × Year 2001	-0.412	-0.024	224	6.2
	(0.864)	(0.841)		
R-R × Year 2002	-0.481	-0.051	234	6.7
	(0.9)	(0.824)		
R-R × Year 2003	0.184	0.373	233	6.6
	(1.034)	(0.937)		
R-R × Year 2004	**-2.599***	**-2.75****	171	6.4
	(1.51)	(1.36)		
R-R × Year 2005	**-2.567**	**-2.603***	167	7
	(1.65)	(1.6)		
R-R × Year 2006	-1.358	-1.682	173	6.4
	(1.5)	(1.6)		
Covariates	No	Yes		

Notes: Covariates include total votes, gender of the winning candidate, area of a constituency, and average annual rain and temperature. Triangular Kernel and optimal bandwidth proposed by Imbens and Kalyanaraman (2009) has been used. Column (iii) reports numbers of observations in each regression and column (iv) reports the bandwidth used. *** indicates significance at 1 percent, ** at 5 percent and * at 10 percent level.

Table 5: Impact by Suitability for Cultivating Water Intensive Crops

Dependent variable: Depth to Groundwater from the Surface (in meters below ground level)

	(i)	(ii)	(iii)
Panel A: Constituencies Suitable for Rice Cultivation			
R-R × Year 2001	**0.065**	**0.013**	**0.065**
	(0.44)	(0.46)	(0.44)
R-R × Year 2002	**-0.39**	**-0.47**	**-0.39**
	(0.49)	(0.49)	(0.49)
R-R × Year 2003	**-0.0073**	**-0.028**	**-0.0073**
	(0.44)	(0.45)	(0.44)
R-R × Year 2004	**0.56**	**0.43**	**0.56**
	(0.52)	(0.53)	(0.52)
R-R × Year 2005	**-0.38**	**-0.63**	**-0.38**
	(0.66)	(0.68)	(0.66)
R-R × Year 2006	**-1.89****	**-2.14****	**-1.89****
	(0.82)	(0.86)	(0.82)
Observations	662	662	662
R-Sqaured	0.18	0.25	0.53
Panel B: Constituencies Not Suitable for Rice Cultivation			
R-R × Year 2001	**-0.091**	**-0.071**	**-0.091**
	(0.17)	(0.19)	(0.17)
R-R × Year 2002	**-0.16**	**-0.15**	**-0.16**
	(0.18)	(0.18)	(0.18)
R-R × Year 2003	**0.16**	**0.15**	**0.16**
	(0.22)	(0.23)	(0.22)
R-R × Year 2004	**0.11**	**0.093**	**0.11**
	(0.31)	(0.32)	(0.31)
R-R × Year 2005	**-0.58**	**-0.57***	**-0.58**
	(0.37)	(0.34)	(0.37)
R-R × Year 2006	**-0.49**	**-0.49**	**-0.49**
	(0.40)	(0.35)	(0.40)
Observations	1852	1852	1852
R-Sqaured	0.27	0.30	0.75
Winning party Fixed Effects	No	Yes	No
Change in Water levels in Pre-years	No	No	Yes
Winning Margin	No	Yes	No

Notes: The sample is restricted to years 2000 to 2006. Each regression controls for geographic controls including annual average rain and temperature at the level of constituency; and other controls including total vote cast, gender of the winning candidate and area of the constituency interacted with year indicators. Errors are robust and clustered at the level of Parliamentary constituencies. *** indicates significance at 1 %, ** at 5% and * at 10 %. Panel A shows the results for constituencies where the mode value of the index for suitability for rice cultivation takes values 1-4. Panel B shows results for constituencies where the mode of the index takes value takes values 5-8. The index value 1 indicates most suitable and value 8 denotes least suitable.

Table 6: Impact by Baseline Depth to Groundwater

	(i)	(ii)	(iii)	(iv)
R-R × Year 2001	**-0.91****	-0.55	-0.5	-0.55
	(0.38)	(0.35)	(0.37)	(0.35)
R-R × Year 2002	**-0.94***	-0.62	-0.57	-0.62
	(0.48)	(0.47)	(0.45)	(0.47)
R-R × Year 2003	-0.66	-0.32	-0.26	-0.32
	(0.43)	(0.42)	(0.38)	(0.42)
R-R × Year 2004	**-1.55*****	**-1.45*****	**-1.45*****	**-1.45*****
	(0.57)	(0.56)	(0.53)	(0.56)
R-R × Year 2005	**-2.62*****	**-2.43*****	**-2.36*****	**-2.43*****
	(0.76)	(0.72)	(0.72)	(0.72)
R-R × Year 2006	**-1.14***	**-1.20***	**-1.13***	**-1.20***
	(0.65)	(0.66)	(0.68)	(0.66)
R-R × Year 2001 X Depth 2000	0.15**	0.092	0.081	0.092
	(0.7)	(0.7)	(0.7)	(0.7)
R-R × Year 2002 X Depth 2000	0.14	0.092	0.081	0.092
	(0.9)	(0.9)	(0.9)	(0.9)
R-R × Year 2003 X Depth 2000	0.19**	0.13	0.11	0.13
	(0.9)	(0.9)	(0.8)	(0.9)
R-R × Year 2004 X Depth 2000	**0.32*****	**0.30*****	**0.30*****	**0.30*****
	(0.11)	(0.10)	(0.10)	(0.10)
R-R × Year 2005 X Depth 2000	**0.41*****	**0.4*****	**0.4*****	**0.4*****
	(0.14)	(0.4)	(0.4)	(0.4)
R-R × Year 2006 X Depth 2000	0.17	0.15	0.15	0.15
	(0.14)	(0.14)	(0.14)	(0.14)
Geography & other controls	No	Yes	Yes	Yes
Winning party Fixed Effects	No	No	Yes	No
Change in Water levels in pre-years	No	No	No	Yes
Winning Margin	No	No	Yes	No
Observations	2587	2536	2536	2536

Notes: The sample is restricted to years 2000 to 2006. Geographic controls include annual average rain and temperature at the level of constituency. Other controls include total vote cast, gender of the winning candidate and area of the constituency interacted with year indicators. Errors are robust and clustered at the level of Parliamentary constituencies. *** indicates significance at 1 %, ** at 5% and * at 10 %.

Table 7 : Non-Parametric Regression Discontinuity Estimates

	Average Luminosity (Night Lights)	
	(i)	**(ii)**
R-R × Year 2001	1.402	0.261
	(1.3)	(1.18)
R-R × Year 2002	1.272	0.242
	(1.18)	(1.06)
R-R × Year 2003	1.794	0.595
	(1.31)	(1.15)
R-R × Year 2004	**-2.92****	**-3.07****
	(1.417)	(1.22)
R-R × Year 2005	**-3.944*****	**-3.695****
	(1.53)	(1.478)
R-R × Year 2006	**-2.551****	**-3.374****
	(1.326)	(1.436)
Covariates	No	Yes

Notes: Covariates include total votes, gender of the winning candidate, area of a constituency, and average annual rain and temperature. Triangular Kernel and optimal bandwidth proposed by Imbens and Kalyanaraman (2009) has been used. *** denotes significance at 1 percent, ** at 5 percent and * at 10 percent

Online Appendix: Supplemental Material

Appendices

A Data and Estimation Procedure Appendix

A.1 Details of Crop Suitability and Average Luminosity Data

Crop suitability : *Global Agro-ecological Assessment for Agriculture in the 21st Century* spatial raster data set is jointly produced by the Food and Agriculture Organization and the International Institute for Applied Systems Analysis.[1] The geo-spatial data provides suitability indices for cultivation in geographical locations for various crops based on climate, soil, and terrain conditions. These indices are available for 2.2 million grid cells spanning the entire globe, and we extracted the grids for India using spatial data for constituency boundaries. Each grid-cell is 0.5 degrees by 0.5 degrees (approximately 34.8 miles by 34.8 miles), and we assigned an index for several crops, which takes integral values between 1 and 9. An index of 1 implies the grid is most suitable, and an index of 8 implies it is least suitable for producing a specific crop, given the climatic and other conditions. Water bodies are assigned an index of 9. We extracted the suitability indices for rice, because these are the major water-intensive crops of India. Subsequently, we generate several measures of central tendencies (average and mode) for the indices of these two crops at the level of parliamentary constituencies using spatial tools.

Average Luminosity: The annual data for visible lights that emanate from Earth at night, often called "night lights," are available through the National Geophysical Data Centre (NGDC). U.S. Air Force weather satellites capture daily images of every location on Earth between 20:30 and 22:00 hours local time. An average yearly composite of these images per satellite, excluding those that might be compromised due to forest fires, gaslights, cloud coverage, and other disturbances, forms the satellite-year average stable lights data set. A data point measures the intensity of the night lights in a grid of length 30 arc seconds (approximately 0.86 square kilometres at the equator); this intensity is reported by a digital number between 0 and 63, with the former detecting no light and the latter capturing the greatest intensity. We use the average stable night lights from India between the years 1996 to 2006. During this period, three different satellites acquired the images of nighttime lights. Since variation in luminosity could arise when switching to a newer satellite due to aging, technological improvements, and so forth, the data are calibrated according to the specification in Elvidge et al. (2009). The

[1] The data can be found at http://www.iiasa.ac.at/Research/LUC/SAEZ/index.html

data were then re-projected to equal area to remove the distortion due to the curvature of the earth. The average luminosity was then aggregated over the parliamentary constituencies by year to get the annual mean luminosity per year per constituency.

A.2 Generalized Difference-in-Difference Weighing Procedure

A kernel density weighting procedure is used to estimate the generalized DID matching estimator.[2] Restricting to the common support, the counterfactual outcome for regional constituency i using the kernel matching estimator is given by a weighted average of the entire national regime sample with C observations. The weight for each national constituency is given by:

$$W(i, NN) = \frac{K(PS(x)_i - PS(x)_{NN})}{\sum_{NN=1}^{C} K(PS(x)_i - PS(x)_{NN})} \tag{1}$$

where $K(.)$ is the gaussian kernel function. Define:

$$\prod_i = [Y_{1,i,post} - \sum_{j=1}^{S} W(i,j)Y_{0,j,post}] - [Y_{1,i,pre} - \sum_{j=1}^{S} W(i,j)Y_{0,j,pre}] \tag{2}$$

where 1 indexes regional regimes and 0 indexes national regimes. The DID estimator with the national constituencies as the comparison group is then the sample average of $\prod_i$ over all regional constituencies i. We bootstrap the standard errors.

B Theory Appendix

In this section, we present the solution to the model described in the text and present proofs for each proposition. For convenience, we repeat the propositions here before each proof.

B.1 Solution

We solve the model moving from the last stage back to the first stage. We look for a Nash Equilibrium where both candidates strictly prefer to contest the election and choose positive amounts of electricity. In general, four types of equilibria of interest exist, depending on the parameter values: (i) both candidates have $z > a$; (ii) only the national candidate has $z > a$; (iii) only the regional candidate has $z > a$; and (iv) both candidates have $z \leq a$. Below, we focus on constituencies with equilibria of the first kind, a case in which both candidates are

[2] Heckman et al. (1997) provide the details.

drawing a relatively large amount of electricity. Note that constituencies must exist that draw relatively small amounts of electricity to supply those that draw heavily; we do not examine those constituencies here.

We make the following assumptions:

- **A1:** $\theta_N < \theta_R$**.** This condition ensures the national candidate finds it less costly to exert a given amount of influence. As seen below, this assumption is equivalent to an assumption that the national candidate has higher expected rents conditional on being elected.

- **A2:** $\frac{I}{\theta_k} - G > pa + \frac{L}{b}(p+q)\left[1 + e^{\gamma + \frac{b}{L}a}\right]$ **for** $k = N, R$**.** This condition ensures rents are sufficiently large relative to the cost of influence so that candidates have an incentive to procure more than a units of electricity, even after spending on a fixed cost to influence the regulator.

- **A3:** $\frac{I}{\theta_N} - G > \frac{I}{\theta_R}$**.** This condition ensures that the national candidate's rents, relative to costs, are higher than the regional candidate's even after the national candidate has influenced the regulator post-reform.

Again, note that Assumption (A2) cannot hold for all constituencies, since it must be the case that some constituencies procure less than their standard allocation in general equilibrium.

In Stage 4, observing the MP's proposed contract (x_i, z_i), the distributor chooses an allocation $\widehat{z}_i$. Note the distributor's economic cost of providing $\widehat{z}_i$ is $p\widehat{z}_i$ if $z_{Si} \leq a$ and $p\widehat{z}_i + q(\widehat{z}_i - a)$ if $\widehat{z}_i > a$. Consequently, the distributor is willing to agree to any contract such that $x_i \geq pz_i + q(z_i - a)1(z_i > a)$. If this condition holds, the distributor sets $\widehat{z}_i = z_i$; if it does not, the distributor sets $\widehat{z}_i = 0$. Note that we resolve indifference in favor of accepting the contract.

In Stage 3, the MP chooses x_i to obtain the promised level of electricity z_i at the lowest cost, which yields the cost function $C(z_i)$. The MP must be playing a best response and knows the distributor will follow the strategy above. If the inequality above holds strictly, the distributor strictly prefers the contract proposed by the MP. If it holds with equality, the distributor is just indifferent between the contract and selling off all the electricity elsewhere. Consequently, if the MP wants $z_i = 0$, the MP sets $x_i = 0$. For any electricity in the interval $(0, a]$, she sets $x_i = pz_i$. If the MP wants $z_i > a$, then from above, $x_i = pz_i + q(z_i - a)$. This relation gives us the following cost function:

$$\begin{aligned} C(z) &= pz \qquad ifz \in [0,a] \\ &= (p+q)z - qa \qquad ifz > a, \end{aligned}$$

Note that p will be determined endogenously by the choices z_i in each constituency. In equilibrium, $\sum_i z_i(p) = T(p)$ will determine p.

Next, we move to Stage 2, where voters in constituency i select a candidate taking the promises (z_{iN}, z_{iR}) as given. First, we find the share of voters who vote for the regional party for any given realization of Δ_i, S_R. Assuming ψ is sufficiently larger than b, a positive fraction of voters will vote for the regional party at any value of β. For a given value of β, a voter votes for the regional party if $\delta_{ij} > \beta_{ij}(w_{iN} - w_{iR})$. We have:

$$\begin{aligned} S_R &= \int_0^{2b} \int_{\beta(w_{iN}-w_{iR})}^{\psi+\Delta_i} \frac{1}{2\psi}\frac{1}{2b} d\delta d\beta \\ &= \frac{1}{2} + \frac{\Delta}{2\psi} - \frac{2b(w_N - w_R)}{4\psi} \end{aligned}$$

The regional party wins the election if the realization of Δ_i is large enough such that $S_R > \frac{1}{2}$. The probability of this event occurring is:

$$\begin{aligned} P_R(z_{iR}, z_{iN}) &= Pr(S_{iR} \geq \frac{1}{2}) \\ &= Pr(\nu \geq b(w_{iN} - w_{iR}) - \gamma_i) \\ &= \frac{e^{\gamma_i + bw_{iR}}}{e^{\gamma_i + bw_{iR}} + e^{bw_{iN}}} \\ &= \frac{e^{\gamma_i + (b/L)z_{iR}}}{e^{\gamma_i + (b/L)z_{iR}} + e^{(b/L)z_{iN}}} \end{aligned}$$

And $P_N(z_{iR}, z_{iN}) = 1 - P_R(z_{iR}, z_{iN})$. For convenience below, we use the notation P_k for the probability that party k wins.

Finally, we move to Stage 1, where the candidates promise electricity (z_{iR}, z_{iN}). We can divide the objective function of candidate k by θ_k and define $I_k = \frac{I}{\theta_k}$ and $M_k = \frac{M}{\theta_k}$ for notational convenience. The candidate from party k in constituency i will choose z_{ik} and H_{ik} to maximize $M_k + P_k [I_k - GH_{ik} - C(z_{ik})]$, taking the opponent's promise as given. $H_{ik} = 0$ necessarily before the reform, but after the reform, candidates can choose between $H_{ik} = 0$ and $H_{ik} = 1$. The first-order condition for an interior solution of electricity on the interval $z > a$ is:

$$\frac{\partial P_k}{\partial z_k}\left[I_k - GH_{ik} - C(z_{ik})\right] - P_k \frac{\partial C}{\partial z_{ik}} = 0$$

Note that GH_{ik} term is only relevant after the reform, because it must be zero prior to the reform.

For this solution to be a local maximum, we require the derivative of this condition to be negative where the first-order condition equals zero. To examine this, we first note the following relationships:

$$\begin{aligned} \frac{\partial P_k}{\partial z_k} &= \frac{b}{L} P_k (1 - P_k) \\ \frac{\partial^2 P_k}{\partial z_k^2} &= \frac{b^2}{L^2} P_k (1 - P_k)(1 - 2P_k) \end{aligned}$$

Using these relationships and the first-order condition, we can show the second-order condition for a maximum holds. Define the second derivative of a function f as $f_k^{''}$ and the first derivative as $f_k^{'}$. Then

$$\begin{aligned} P_k^{''}\left[I_k - GH_{ik} - C(z_{ik})\right] - 2P_k^{'}C_k^{'} - P_k C_k^{''} &= P_k^{''}\frac{P_k C_k^{'}}{P_k^{'}} - 2P_k^{'}C_k^{'} \\ &= \frac{b}{L} P_k (1 - 2P_k)(p + q_k) - 2\frac{b}{L} P_k (1 - P_k)(p + q_k) \\ &= -\frac{b}{L} P_k (p + q_k), \end{aligned}$$

which is less than zero.

Next, we establish that only one such maximum exists. Substituting from above, the first-order conditions can be rewritten as

$$I_k + aq_k - (p + q_k)z_k - GH_k = \frac{L}{b}\frac{p + q_k}{1 - P_k}$$

Note that the left-hand side is strictly decreasing in z_k and the right-hand side is strictly increasing in z_k. Therefore, the first-order condition can have at most one solution, given the opposing candidate's promise.

Next, we must examine when the solution to the first-order condition above is greater than

a. Note that using the steeper cost function segment, at most one positive solution to the first-order condition can exist, and this solution is a local maximizer. Assumption (A2) guarantees that the derivative of the objective function using $C_k' = p + q_k$ is positive at $z = a$, which means one of three things is true: (1) the maximizer is greater than a; (2) the maximizer is the solution to the first-order condition corresponding to the flatter cost function segment, $I_k - pz_k - GH_k = \frac{L}{b}\frac{p}{1-P_k}$; or (3) the maximizer is simply 0. But (2) cannot hold because if $z < a$ is not a maximizer with the steeper cost function, it cannot be a maximizer with the flatter cost function (which lies above the steeper cost function for $z < a$). And (3) cannot be the case, because the derivative of the objective function with the steeper cost function cannot be negative for $z < a$ if it is positive at $z \geq a$. Therefore, if the derivative of the objective function using $C_k' = p + q_k$ is positive at a, the global maximizer is greater than a.

Finally, we note when is it optimal post reform to choose $H_{ik} = 1$ and influence the regulator by expending G. Setting $H_{ik} = 1$ increases fixed costs and lowers marginal costs. To find whether this strategy is optimal, we can simply find a candidate's best response when choosing $H_{ik} = 1$ and the candidate's best-response when choosing $H_{ik} = 0$, and then compare the total expected income under both scenarios. Let the superscript $*$ indicate the situation in which $H_{ik} = 1$. The candidate's best-response is to choose $H_{ik} = 1$ as long as $M + P_k(z_{ik}^*, z_{ik'})\,[I_k - G - C_k(z_{ik}^*)] > M + P_k(z_{ik}, z_{ik'})\,[I_k - C_k(z_{ik})]$. In the case on which we focus, we assume the parameters are such that this holds for the national candidate but not the regional candidate.

This establishes the conditions under which the solution to the following first-order conditions yields the Nash Equilibrium. The system of equations can be expressed as $F(z_N, z_R) = [F_R(z_N, z_R), F_N(z_N, z_R)] = 0$, where

$$
\begin{aligned}
F_R &= P_N\,[I_R - GH_R - (p + q_R)z_R + q_R a] - \frac{L}{b}(p + q_R) \\
F_N &= P_R\,[I_N - GH_N - (p + q_N)z_N + q_N a] - \frac{L}{b}(p + q_N)
\end{aligned}
$$

Below, we will use this system of equations to perform comparative statics, exploring the simplest situation, in which only the national candidate finds it profitable enough to influence the regulator; namely, $H_R = 0$ and $H_N = 1$. In a footnote, we briefly discuss the case in which both candidates influence the regulator; namely, $H_R = 1$ and $H_N = 1$ – and show Proposition 2 carries through here as well.

B.2 Proofs of Propositions

Proposition 1: Assume (A1) and (A2). Then:
(a) $\frac{\partial w_R}{\partial \gamma} < 0$ and $\frac{\partial w_N}{\partial \gamma} > 0$.
(b) There exists γ^* such that constituencies with $\gamma_i > \gamma^*$ have $w_{iN} > w_{iR}$ and constituencies with $\gamma_i < \gamma^*$ have $w_{iR} > w_{iN}$.

Proof: To prove (a), we can apply the implicit function theorem to the system of equations given by $F(z_N, z_R) = 0$ above. By the implicit function theorem, the derivatives of the equilibrium electricity choices with respect to any parameter y are:

$$\begin{aligned} \frac{\partial z_R}{\partial y} &= \frac{1}{(p+q_N)(p+q_R)}\left[P_R(p+q_R)\frac{\partial F_N}{\partial y} + (p+q_N)\frac{\partial F_R}{\partial y}\right] \\ \frac{\partial z_N}{\partial y} &= \frac{1}{(p+q_N)(p+q_R)}\left[P_N(p+q_N)\frac{\partial F_R}{\partial y} + (p+q_R)\frac{\partial F_N}{\partial y}\right] \end{aligned}$$

where we have made substantial simplifications by substituting in the first-order conditions where useful. Prior to the reform, we have $q_R = q_N = q$. Therefore

$$\begin{aligned} \frac{\partial z_R}{\partial \gamma} &= \frac{1}{p+q}\left[P_R\frac{\partial F_N}{\partial \gamma} + \frac{\partial F_R}{\partial \gamma}\right] \\ \frac{\partial z_N}{\partial \gamma} &= \frac{1}{p+q}\left[P_N\frac{\partial F_R}{\partial \gamma} + \frac{\partial F_N}{\partial \gamma}\right] \end{aligned}$$

One can show that $\frac{\partial F_N}{\partial \gamma} = (I_N - C_N)P_N P_R$ and $\frac{\partial F_R}{\partial \gamma} = -(I_R - C_R)P_N P_R$. Substituting this expression in, we get

$$\begin{aligned} \frac{\partial z_R}{\partial \gamma} &= \frac{P_N P_R}{p+q}\left[P_R(I_N - C_N) - (I_R - C_R)\right] \\ \frac{\partial z_N}{\partial \gamma} &= \frac{P_N P_R}{p+q}\left[I_N - C_N - P_N(I_R - C_R)\right] \end{aligned}$$

Using the first-order conditions, we can substitute for the $I_k - C_k$ expressions above. For the regional candidate, we then have $\frac{\partial z_R}{\partial \gamma} < 0$ iff $[P_R(I_N - C_N) - (I_R - C_R)] < 0$, which is true iff $P_N < 1$. Similarly, we have $\frac{\partial z_N}{\partial \gamma} > 0$ iff $[I_N - C_N - P_N(I_R - C_R)] > 0$, which is true iff $P_R < 1$. Since $P_k < 1$ for $k = N, R$, and since $\frac{\partial w_k}{\partial \gamma} = \frac{1}{L}\frac{\partial z_k}{\partial \gamma}$, it follows that part (a) of the proposition holds.

Part (a) helps us establish part (b). Since z_{Ri} is strictly higher in constituencies where γ_i is lower, and z_{Ni} is strictly higher in constituencies where γ_i is higher, then part (b) will be true if there exists a $\gamma_i = \gamma^*$ where $z_{Ri} = z_{Ni}$ in equilibrium. To show that such a γ^* exists, we can examine the first-order conditions when $z_R = z_N = z$. Dividing one by the other yields $e^{\gamma}\frac{I_N - C_N}{I_R - C_R} = 1$. Solving for the common z gives $z = \frac{I_R + aq}{p+q} - \frac{e^{\gamma}(I_N - I_R)}{(p+q)(1-e^{\gamma})}$. We can then substitute this back into the first-order condition $F_R = 0$ and obtain $e^{-\gamma} - e^{\gamma} = \frac{b}{L}\frac{I_N - I_R}{p+q}$. The left-hand side is strictly decreasing, approaches positive infinity as γ approaches negative infinity, and approaches negative infinity as γ approaches positive infinity. This implies the existence of γ^*, where $z_R = z_N = z$. Part (b) follows. $\diamond$

Proposition 2: Assume (A1) and (A2), $|p'(\epsilon)| < \frac{I_k - G - pa}{I_k - G + qa}$ for $k = N, R$, and only the national candidate finds it optimal to co-opt the regulator. Then:
(a) $\frac{\partial(w_{Ni} - w_{Ri})}{\partial\epsilon} > 0$.
(b) $\frac{\partial^2 w_R}{\partial\gamma\partial\epsilon} > 0$ and $\frac{\partial^2 w_N}{\partial\gamma\partial\epsilon} > 0$.
(c) There exists a threshold value γ_h such that $\gamma > \gamma_h$ implies $\frac{\partial w_R}{\partial\epsilon} > 0$, and there exists a threshold value γ_l such that $\gamma < \gamma_l$ implies $\frac{\partial w_N}{\partial\epsilon} < 0$.

Proof: First, note that:

$$\begin{aligned}\frac{\partial F_R}{\partial\epsilon} &= -(z_R P_N + \frac{L}{b})(1 + p'(\epsilon)) + P_N a \\ \frac{\partial F_N}{\partial\epsilon} &= (z_N P_R + \frac{L}{b})(1 - p'(\epsilon)) - P_R a\end{aligned}$$

Using the first-order conditions and the implicit function theorem as above, we can obtain:

$$\begin{aligned}\frac{\partial z_R}{\partial\epsilon} &= P_R^2\left[\frac{I_N - G + q_N a}{(p+q_N)^2}(1 - p'(\epsilon)) - \frac{a}{p+q_N}\right] - P_N\left[\frac{I_R + q_R a}{(p+q_R)^2}(1 + p'(\epsilon)) - \frac{a}{p+q_R}\right] \\ \frac{\partial z_N}{\partial\epsilon} &= -P_N^2\left[\frac{I_R + q_R a}{(p+q_R)^2}(1 + p'(\epsilon)) - \frac{a}{p+q_R}\right] + P_R\left[\frac{I_N - G + q_N a}{(p+q_N)^2}(1 - p'(\epsilon)) - \frac{a}{p+q_N}\right]\end{aligned}$$

Differencing these two expressions, evaluating the difference at $\epsilon = 0$ and then simplifying yields:

$$\frac{\partial(z_N - z_R)}{\partial\epsilon} = P_R P_N\left[\frac{(I_N - G + qa)(1 - p'(\epsilon)) + (I_R + qa)(1 + p'(\epsilon))}{(p+q)^2} - \frac{2a}{p+q}\right]$$

This expression is positive. Since $\frac{\partial(w_N - w_R)}{\partial\epsilon} = \frac{1}{L}\frac{\partial(z_N - z_R)}{\partial\epsilon}$, (a) follows immediately.

To obtain (b), turn to the expressions above for the impact of the reform on the electricity promises. It is straightforward to show that $\frac{\partial^2 z_k}{\partial\gamma\partial\epsilon} > 0$ for $k = N, R$, since $\frac{\partial P_R}{\partial\gamma} > 0$ and $\frac{\partial P_N}{\partial\gamma} < 0$. Part (b) follows immediately.

As indicated in part (c), we can show that the reform may actually have counter-intuitive implications for very high values of γ and very low values of γ. Note that $\frac{\partial z_R}{\partial\epsilon} > 0$ if and only if

$$P_R^2 \frac{(I_N - G + qa)(1 - p'(\epsilon)) - a(p+q)}{(I_R + qa)(1 + p'(\epsilon)) - a(p+q)} + P_R - 1 > 0$$

The quadratic term only has one positive root, but this root is less than one. Since there is a P_R for which this is true, and since $\frac{\partial z_R^2}{\partial\gamma\partial\epsilon} > 0$, there must be a γ large enough that $\frac{\partial z_R}{\partial\epsilon} > 0$, and hence $\frac{\partial w_R}{\partial\epsilon} > 0$. Similarly, we can show that $\frac{\partial z_N}{\partial\epsilon} < 0$ if and only if

$$P_N^2 \frac{(I_R + qa)(1 + p'(\epsilon)) - a(p+q)}{(I_N - G + qa)(1 - p'(\epsilon)) - a(p+q)} + P_N - 1 > 0$$

The quadratic term only has one positive root, but this root is less than one. Since there is a P_N for which this is true, and since $\frac{\partial z_N^2}{\partial\gamma\partial\epsilon} > 0$, there must be a γ small enough that $\frac{\partial z_R}{\partial\epsilon} < 0$, and hence $\frac{\partial w_R}{\partial\epsilon} < 0$.[3] $\diamond$

Proposition 3: Assume (A1)-(A3) from the appendix, $|p'(\epsilon)| < \frac{I_k - G - pa}{I_k - G + qa}$ for $k = N, R$. Then: (a) $\frac{\partial^2 w_N}{\partial b\partial\epsilon} > 0$ for $\gamma < \gamma^*$ and $\frac{\partial^2 w_R}{\partial b\partial\epsilon} < 0$ for $\gamma > \gamma^*$.

[3] A modified version of the proposition carries through in the case where both candidates co-opt the regulator after the reform. In this case, $q_N = q_R = q - \epsilon$ after the reform. In contrast to above:

$$\begin{aligned}\frac{\partial F_R}{\partial\epsilon} &= (z_R P_N + \frac{L}{b})(1 - p'(\epsilon)) - P_N a \\ \frac{\partial F_N}{\partial\epsilon} &= (z_N P_R + \frac{L}{b})(1 - p'(\epsilon)) - P_R a\end{aligned}$$

The derivatives of the electricity promises then become:

$$\begin{aligned}\frac{\partial z_R}{\partial\epsilon} &= P_R^2\left[\frac{I_N - G + q_N a}{(p+q_N)^2}(1 - p'(\epsilon)) - \frac{a}{p+q_N}\right] + P_N\left[\frac{I_R - G + q_R a}{(p+q_R)^2}(1 - p'(\epsilon)) - \frac{a}{p+q_R}\right] \\ \frac{\partial z_N}{\partial\epsilon} &= P_N^2\left[\frac{I_R + q_R a}{(p+q_R)^2}(1 - p'(\epsilon)) - \frac{a}{p+q_R}\right] + P_R\left[\frac{I_N + q_N a}{(p+q_N)^2}(1 - p'(\epsilon)) - \frac{a}{p+q_N}\right]\end{aligned}$$

The difference between these two expressions, evaluated at $\epsilon = 0$ after simplifying, becomes:

$$\frac{\partial(z_N - z_R)}{\partial\epsilon} = P_R P_N (1 - p'(\epsilon))\left[\frac{I_N - I_R}{(p+q)^2}\right]$$

which is greater than zero. Consequently, part (a) holds for this case as well. To prove part (b) for this case, examine the expressions for the derivatives of the electricity promises above. One can show that $\frac{\partial^2 \partial z_R}{\partial\gamma\partial\epsilon} > 0$ if $P_R > \frac{1}{2}\frac{(I_R - G_R + qa)(1-p'(\epsilon)) - a(p+q)}{(I_N - G_N + qa)(1-p'(\epsilon)) - a(p+q)}$ in equilibrium. Meanwhile, $\frac{\partial^2 \partial z_R}{\partial\gamma\partial\epsilon} > 0$ if $P_N < \frac{1}{2}\frac{(I_N - G_N + qa)(1-p'(\epsilon)) - a(p+q)}{(I_R - G_R + qa)(1-p'(\epsilon)) - a(p+q)}$. Therefore, in some subset of elections, part (b) holds as well.

(b) If in addition $\gamma_l < \gamma < \gamma_h$, we have $\frac{\partial^2 w_N}{\partial L \partial \epsilon} < 0$ for $\gamma < \gamma^*$ and $\frac{\partial^2 w_R}{\partial L \partial \epsilon} > 0$ for $\gamma > \gamma^*$.

Proof: Define $K_N = \frac{I_N - G + q_N a}{(p+q_N)^2}(1 - p'(\epsilon)) - \frac{a}{p+q_N}$ and $K_R = \frac{I_R + q_R a}{(p+q_R)^2}(1 + p'(\epsilon)) - \frac{a}{p+q_R}$. For any parameter y, we can write the cross-partial for each electricity promise as:

$$\begin{aligned}\frac{\partial^2 z_R}{\partial y \partial \epsilon} &= \frac{\partial P_R}{\partial y}\left[\frac{2P_R}{p+q_N}K_N + \frac{1}{p+q_R}K_R\right] \\ \frac{\partial^2 z_N}{\partial y \partial \epsilon} &= \frac{\partial P_R}{\partial y}\left[\frac{2P_N}{p+q_R}K_R + \frac{1}{p+q_N}K_N\right]\end{aligned}$$

Note that the sign of both cross-partials will be determined by the sign of $\frac{\partial P_R}{\partial y}$.

Using these expressions, we begin by proving (a). Note that $\frac{\partial P_R}{\partial b} = \frac{1}{L}P_R P_N(z_R - z_N)$. The derivative of the water promise for the regional candidate is:

$$\frac{\partial^2 w_R}{\partial b \partial \epsilon} = \frac{1}{L}\frac{\partial^2 z_R}{\partial b \partial \epsilon}$$

which is negative for $\gamma > \gamma^*$. Similarly, for the national canddiate we have:

$$\frac{\partial^2 w_N}{\partial b \partial \epsilon} = \frac{1}{L}\frac{\partial^2 z_N}{\partial b \partial \epsilon}$$

which is positive for $\gamma < \gamma^*$. This proves (a).

We can approach part (b) similarly. First, we find that $\frac{\partial P_R}{\partial L} = \frac{b}{L^2}(z_N - z_R)P_R P_N$. Then, for the regional candidate we have:

$$\frac{\partial^2 w_R}{\partial L \partial \epsilon} = \frac{-1}{L^2}\frac{\partial z_R}{\partial \epsilon} + \frac{1}{L}\frac{\partial^2 z_R}{\partial L \partial \epsilon}$$

The first term is positive for $\gamma < \gamma_h$ and the second term is positive for $\gamma > \gamma^*$. Therefore, the overall expression is positive. For the national candidate we have:

$$\frac{\partial^2 w_N}{\partial L \partial \epsilon} = \frac{-1}{L^2}\frac{\partial z_N}{\partial \epsilon} + \frac{1}{L}\frac{\partial^2 z_N}{\partial L \partial \epsilon}$$

The first term is negative for $\gamma > \gamma_l$ and the second term is negative for $\gamma < \gamma^*$. This proves part (b).

C Ancillary Evidence and Robustness Tests

C.1 Do the Load Dispatch Centers Allow Overdraw?

With an objective to enhance transparency, one of the states in India provides data on daily planned allocation and actual withdrawal of electricity by distribution block. These data since 2010 are available on the SLDC's website. In Appendix Figure A1, we show the deviations from the planned allocations for the blocks on a few randomly chosen days. We choose two July days from different years and two January days from different years to deal with the potential for seasonality in a well-functioning electricity system. Although it is not surprising that, in a complex electrical grid, the deviations from the planned allocations are not zero, two facts stand out from these figures: (1) There is massive variation in the surplus withdrawal across time, even when holding the month fixed; (2) There is significant variation across blocks, and some blocks are able to withdraw much more than their planned allocation from the grid, compared with other blocks.

C.2 Close Elections - Smoothness of Other Variables

One concern with the close elections analysis is that some other covariate has a sharp change around the cutoff, which drives the results (Grimmer et al. 2011). Therefore, we test whether the covariates that we observe are smooth around the cutoff. Appendix Figure A2 plots the local polynomial regression of the gender of the candidate, area, total votes, rainfall and temperature on the winning margin. Panel A shows these for 2002 (pre-reform) and Panel B shows these 2006 (post-reform). The figure indicates these observables are well balanced. In results not shown here, the covariates change smoothly around the cutoff for all the years in the sample.

C.3 Close Elections - No Compositional Shifts over Time

An additional concern with this empirical strategy might be that a change occur in the type of constituencies that end up in close elections. For example, post-2003 changes in the depth could emerge for two reasons. First, groundwater depletes less in some constituencies because a regional party happened to win the election. This effect is the one we are most interested in isolating. Second, a change in closely contested constituencies with national winners could occur such that more constituencies with greater depths to groundwater become closely contested relative to pre-reform years. We refer to this latter effect as a "composition effect".

Accordingly, we examine whether compositional shifts occur by evaluating the difference in depth to groundwater for 2002 (pre-reform year) for constituencies that are closely contested in 2004. If a compositional shift drives our results such that larger depth constituencies become close elections in 2004, we should see a similarly large gap for these specific constituencies in 2002 groundwater depth as well. We examine this possibility in Appendix Figures A3 and A4. These figures show the 2002 differences in depth to groundwater for constituencies that are closely contested in 2004. Appendix Figure A3 shows a difference in means and Appendix Figure A4 uses a second-order polynomial fit. The confidence intervals are also mapped. These figures clearly show the depth in 2002 for these constituencies is similar and no large and negative pre-existing difference is present.

C.4 Groundwater Storage

In India, for several reasons, farmers do not typically store groundwater when electricity is available and cheap. First, groundwater storage would require massive storage facilities. The Columbia Water Center at Columbia University reports that flooding one acre of land (one episode of irrigation for rice cultivation) typically requires 200,000 liters of water. Larson et al. (2012) conducted a survey and showed that median farmers report irrigating 40 times per season. An average farmer could not afford the fixed cost of constructing the type of facility that can contain such massive volumes of water. Second, the average farm size in India is smaller than 1 acre, and consequently serious space constraints exist. Elevated storage facilities may not be viable because they require energy to lift water up. Third, joint well ownership in India is extremely low due to hold-up issues (Sekhri, 2011), and jointly owned tanks for irrigating fields are not prevalent for perhaps the same reason. [4]

D Additional Evidence on Mechanisms

D.1 Household Electricity Use

As mentioned in the text, night-lights are only a proxy for electricity. Luminosity may change due to income effects and lights emanating from urban or peri-urban areas are also a part of this measure in addition to rural areas. Given this challenge, we turn to household survey data

[4] In field visits to several villages in Uttar Pradesh and Punjab, we have not encountered a single farmer who stores water for irrigation over time.

on the provision and reliability of electricity from the India Human Development Survey. These household data do not identify the constituency of residence. Instead, they identify the district of residence. Parliamentary constituencies are not fully nested in districts, and constituency and district boundaries do not overlap in general. We restrict our sample to the districts such that either constituencies overlap with districts or two or more constituencies are completely nested in districts and all of them have the same type of party in power (either all are regional or all are national). We drop districts that split over time. We match the election outcomes from the 1991 and 2004 elections to these districts to create a panel. This matching leaves us with 109 districts out of 583 districts in India. Given this limitation, our household-level evidence should be construed as suggestive, but not conclusive.

Both waves of the household data asked households about whether they had electricity connections. We construct a binary indicator that takes the value 1 if the household has a connection and 0 otherwise. This variable captures the extensive margin of electricity. The intensive margin is more difficult to capture. Wave I asked the households a categorical question on regularity of supply with three categories – regular, power cuts two to three times a week, and power cuts more than three times a week. However, wave II asked about the number of hours the household received electricity. To homogenize these variables, we use the following procedure. We construct a binary variable that takes the value 1 if the supply is regular and 0 otherwise for wave I. We aggregate this variable to the district using district means. We then generate a binary variable – "regular" – which takes the value 1 if the district mean is higher than the median in the distribution. In wave II, our binary variable for regular electricity takes the value 1 if the average number of hours electricity is supplied in the district is higher than the median in the distribution.

We show evidence on both the extensive margin and the intensive margin in Appendix Tables A3 and A4, respectively. The specifications used in these tables include a dummy for having a regional MP, a dummy for the year 2005, and the interaction of the two. Appendix Table A3 reports the estimates in the case of having an electricity connection. In column (i), we report the DID estimate with no additional controls. In column (ii), we control for total number of households, the fraction of the scheduled caste population, and the fraction of the working population from the Population Census of India interacted with the year 2005 indicator. We control for whether the district has any constituencies reserved for scheduled castes in column (iii), and we also control for aggregation of constituencies in districts in column (iv). Results are robust across these specifications. The coefficient on the interaction term is -0.18 and is significant at the 5 percent level. This coefficient implies that the national-regional gap in the percentage of households that have electricity connections grows by 18 percentage points after the reform.

We also evaluate the effect on regularity of power supply in Appendix Table A4. We follow the same specifications as for the extensive margin. The results indicate that many fewer households (32 percentage points) have regular power supply post elections in constituencies won by regional candidates, relative to national candidates. This effect is marginally significant, at the 10 percent significance level.

D.2 Voting Behavior

The model suggests citizens who rely more on water will tend to vote more frequently for national candidates, because national candidates are more likely to be able to co-opt the regulator and – except for constituencies with small values of γ – will promise more water than regional candidates. Using the National Election Survey (NES), we can examine voting patterns to investigate whether people engaged in agriculture are voting for a particular type of candidate. The NES data provide the occupation of the respondent and the party for whom he or she voted. A total of 27,189 respondents are in the survey. Of these, 18,774 are employed. The occupation categorization has fine details.[5] Among those who work, we use the details in the occupation categories to construct an indicator that takes the value 1 if the individual is employed in agriculture and 0 otherwise. We also construct an indicator which takes value 1 if the individual is a cultivator (tenant or owner) and 0 otherwise. In all, 52.17 percent of the sample is employed in agriculture and 31.33 percent of those employed cultivate land.

We focus on the 2004 elections and report the voting patterns by occupation. Specifically, we examine whether an individual votes for the national candidate and whether the winner in the respondent's constituency is a national candidate in Appendix Tables A5 and A6, respectively. We control for the total electors in a constituency in every regression. In column (i) of Appendix Table A5, we show that in the full sample, voters who cultivate any land are more likely to vote for national candidates. The coefficient is significant at 5 percent. Next, we restrict the sample to closely contested elections and control for the margin of victory in column (ii). The cultivators in this sample are also more likely to have voted for the national candidates. The

[5] The data classify occupations into 96 categories.

coefficient for cultivators is now 2.75 times larger in magnitude and significant at 1 percent. We get the same patterns if we change the dependent variable to whether a national candidate won. We report the results in Appendix Table A6.

These results are consistent with our theory. Cultivators – those working in agriculture who have the primary interest in water provision – are more likely to vote for national candidates.[6].

References

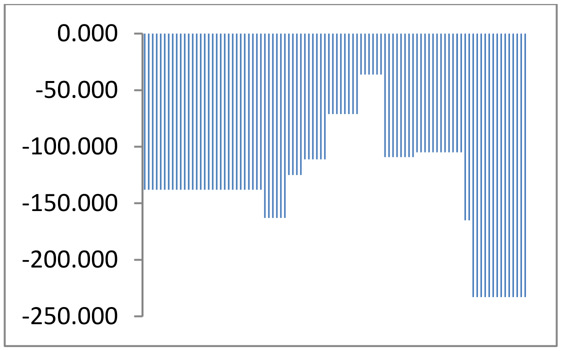
[1] Elvidge, C., Ziskin, D., Baugh, K. E., Tuttle, B. T., Ghosh, T., Pack, D. W., Erwin, E. H., Zhizhin, M (2009), "A Fifteen Year Record of Global Natural Gas Flaring Derived from Satellite Data," *Energies*, Vol. 2(3), pp. 595-622

[2] Food and Agriculture Organization and International Institute for Applied Systems Analysis (2002), *Global Agro-ecological Assessment for Agriculture in the 21st Century*

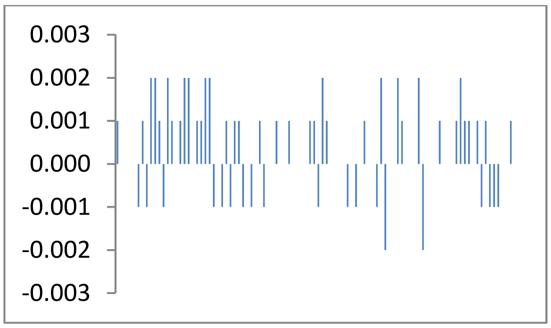
[3] Grimmer, J., Hersh, E., Feinstein, B. and D. Carpenter (2011), " Are Close Elections Random" Working Paper

[4] Larson, N., S. Sekhri, and R. Sidhu (2012), "Adoption of Water-Saving Infrastructure in Agriculture: The Case of Laser Levelers", Working paper

[6] Note that 92 percent of the groundwater extracted is used for irrigation (Jha and Sinha, 2009)



July 13, 2011



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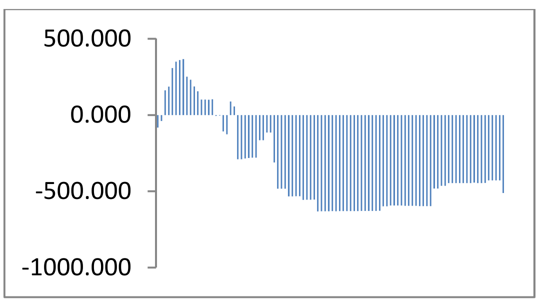
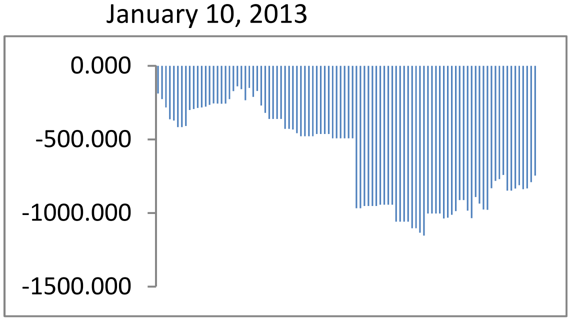


January 10, 2013



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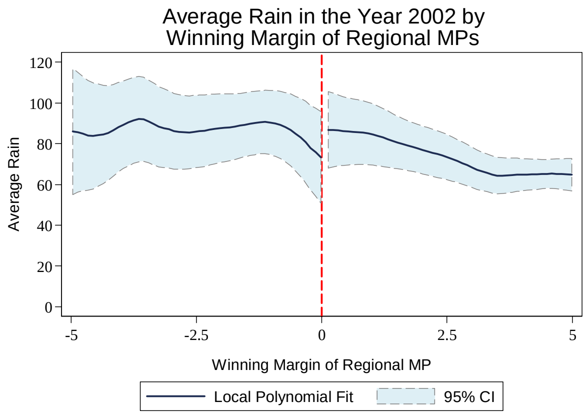
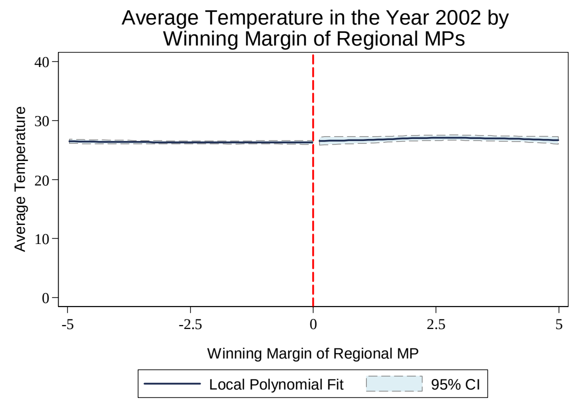
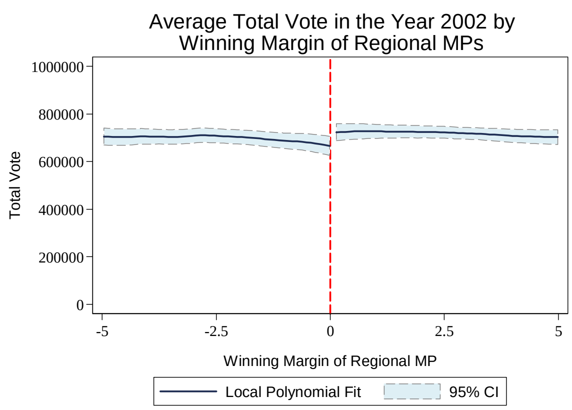
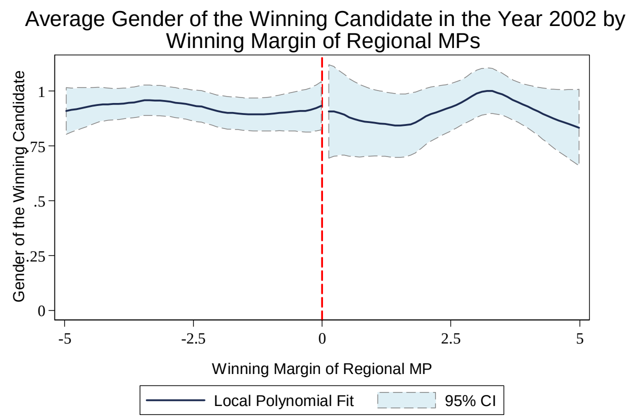
Appendix Figure A1: Examples of Block Wise Deviations in Withdrawal from the Planned Allocation

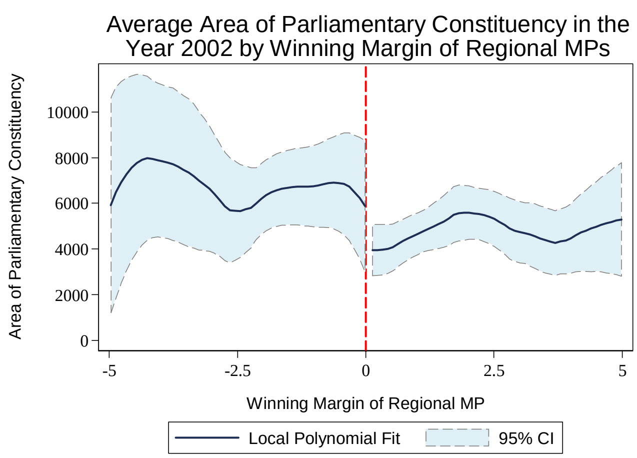
Appendix Figure A2: Balanced Covariates



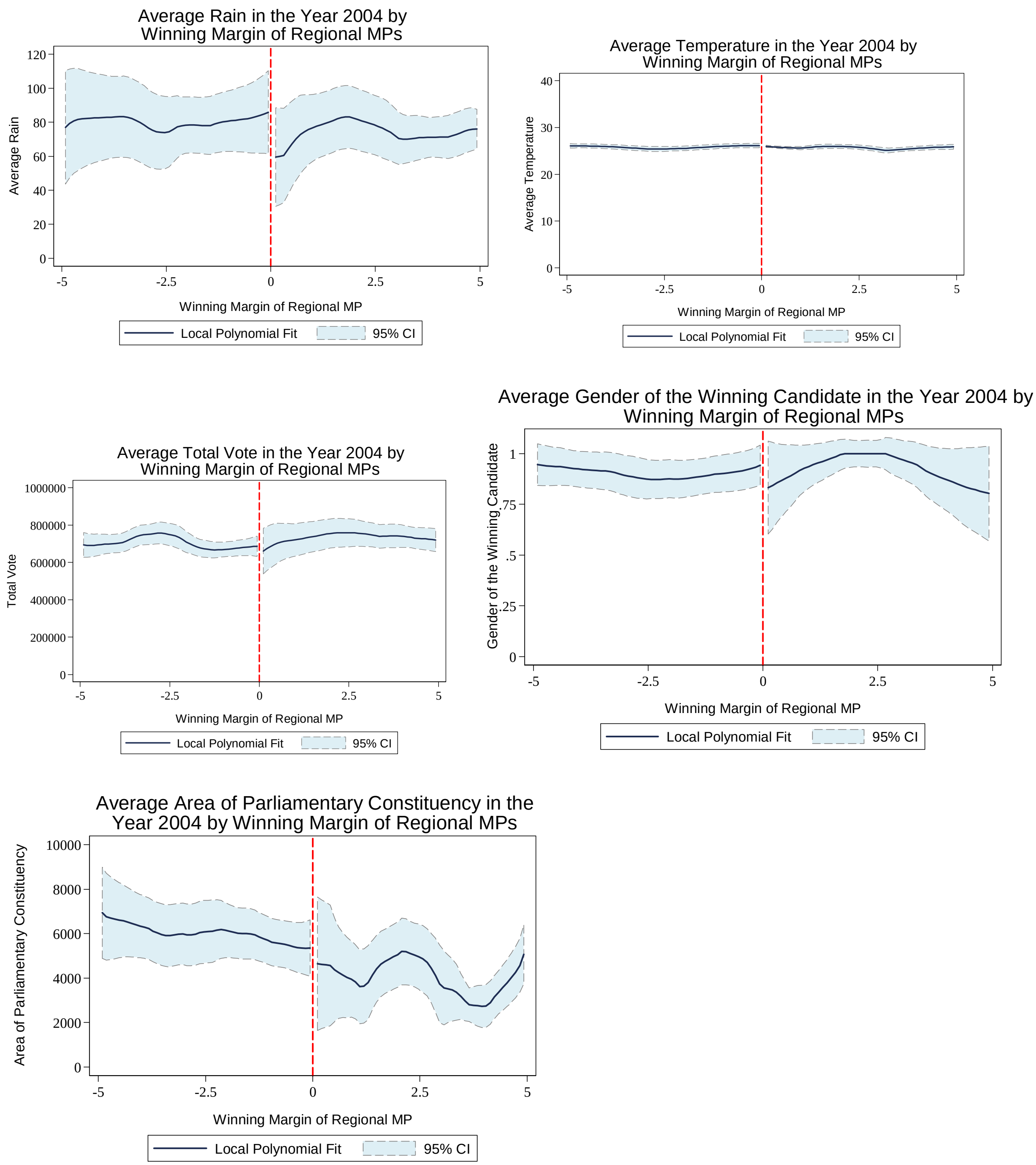




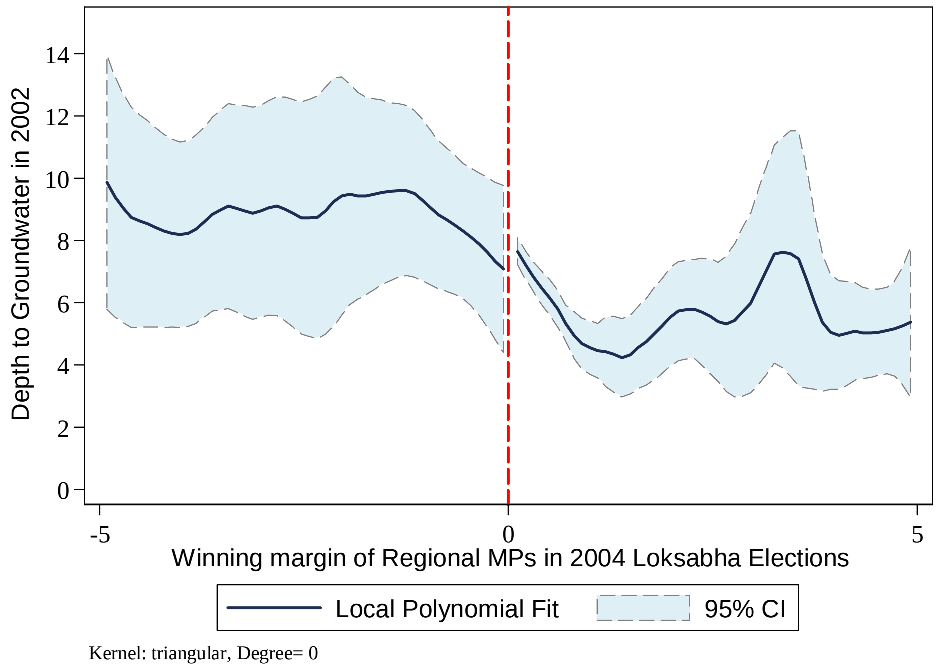




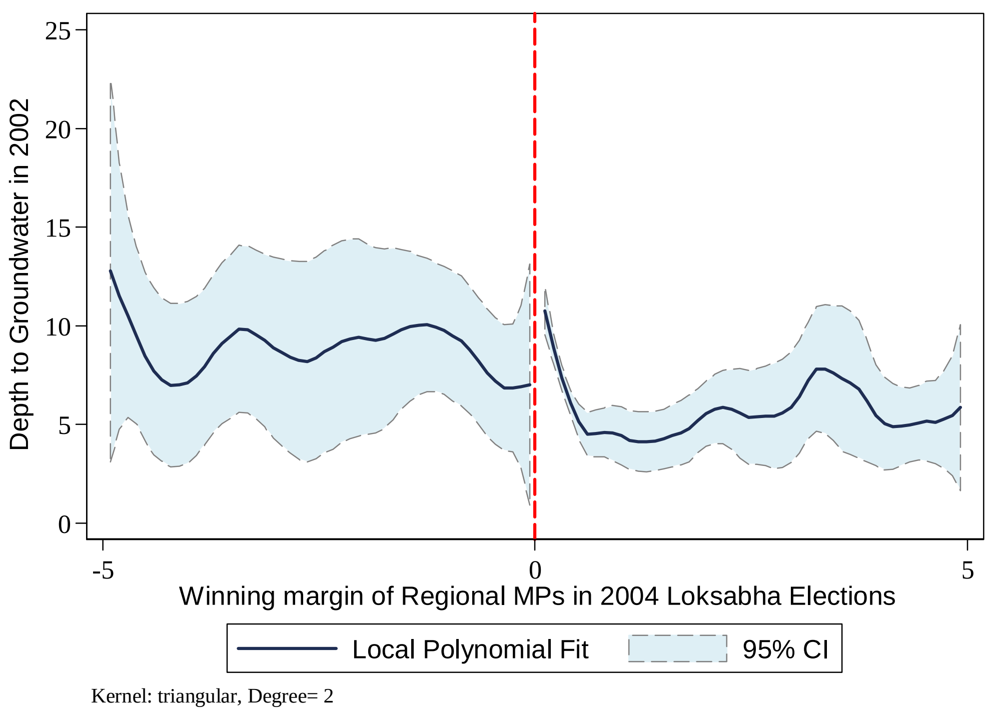
Panel A: Covariates in 2002



Panel B: Covariates in 2004



Appendix Figure A3: No Compositional shift in Type of Constituencies (Means Comparison)



Appendix Figure A4: No Compositional shift in Type of Constituencies (Polynomial of Degree 2)

Appendix Figure A5

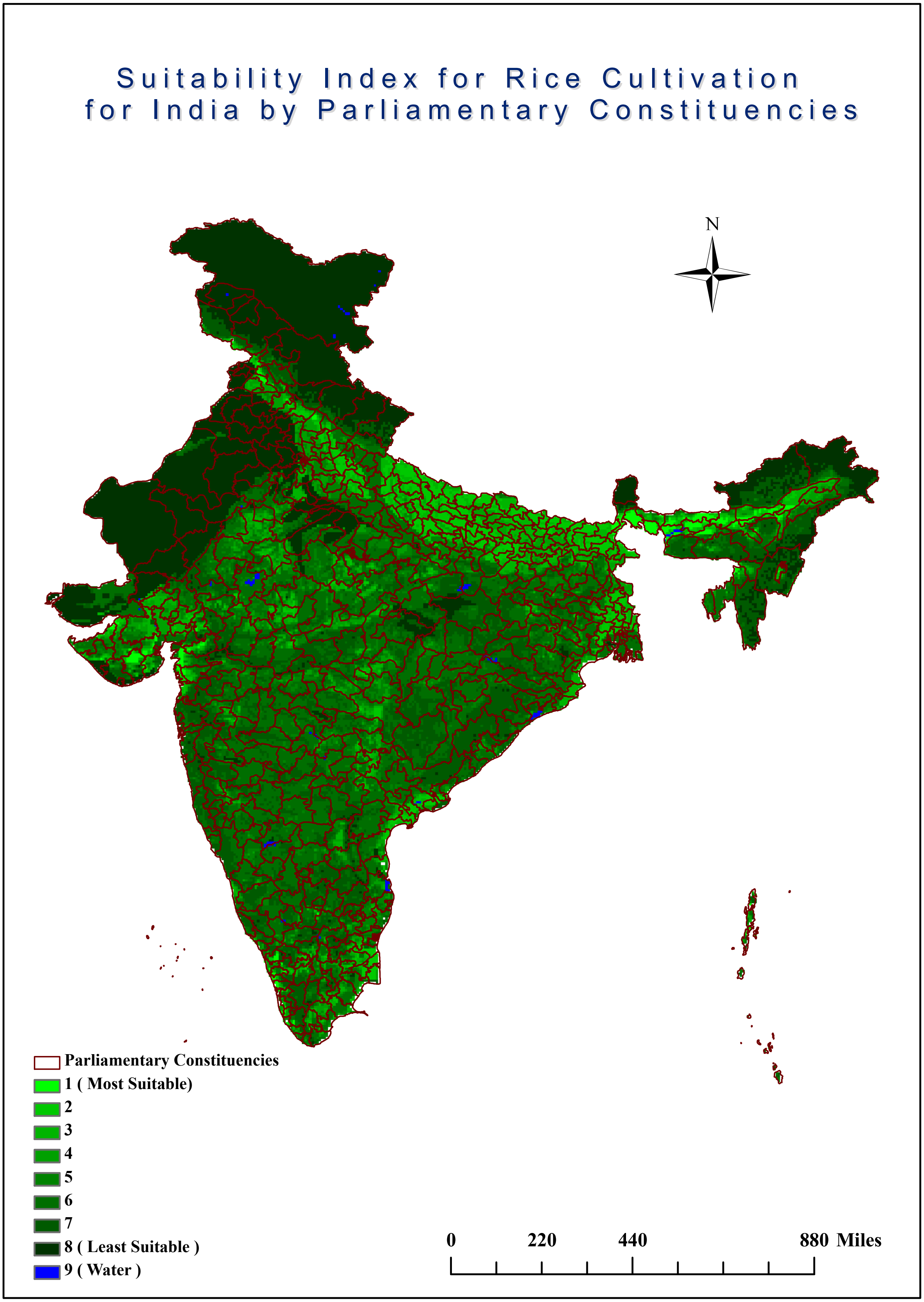


Table A1: Recognition of Political Parties in India by Election Years

Party	Abbreviation	1998	1999	2004
Indian National Congress	INC	National	National	National
Communist Party Of India	CPI	National	National	National
Bharatiya Janata Party	BJP	National	National	National
Communist Party Of India (Marxist)	CPM	National	National	National
Bahujan Samaj Party	BSP	National	National	National
Janata Dal	JD	National	×	×
Samata Party	SAP	National	×	×
Janata Dal (United)	JD(U)	×	National	State
Janata Dal (Secular)	JD(S)	×	National	State
Nationalist Congress Party	NCP	×	State	National
Shivsena	SHS	State	State	State
Revolutionary Socialist Party	RSP	State	State	State
Manipur People's Party	MPP	State	State	State
Samajwadi Party	SP	State	State	State
Dravida Munnetra Kazhagam	DMK	State	State	State
Pattali Makkal Katchi	PMK	State	State	State
Asom Gana Parishad	AGP	State	State	State
All India Anna Dravida Munnetra Kazhagam	ADMK	State	State	State
Sikkim Democratic Front	SDF	State	State	State
United Goans Democratic Party	UGDP	State	State	State
Kerala Congress (M)	KEC(M)	State	State	State
Muslim League Kerala State Committee	MUL	State	State	State
Shiromani Akali Dal	SAD	State	State	State
Telugu Desam Party	TDP	State	State	State
Jharkhand Mukti Morcha	JMM	State	State	State
Jammu & Kashmir National Conference	JKN	State	State	State
Arunachal Congress	AC	State	State	State
Kerala Congress	KEC	State	State	State
Janata Party	JP	State	State	×
Tamil Maanila Congress (Moopanar)	TMC(M)	State	State	×
Ntr Telugu Desam Party (Lakshmi Parvathi)	NTRTDP(LP)	State	State	×
Haryana Vikas Party	HVP	State	State	×
All India Forward Bloc	FBL	State	State	×
United Democratic Party	UDP	State	State	×
Hill State People's Democratic Party	HPDP	State	State	×
Republican Party Of India	RPI	State	State	×
Maharashtrawadi Gomantak	MAG	State	×	State
Mizo National Front	MNF	State	×	State
Autonomous State Demand Committee	ASDC	State	×	×
All India Indira Congress (Secular)	AIIC(S)	State	×	×
Federal Party Of Manipur	FPM	×	State	State

Table A1 Continued

Party	Abbreviation	1998	1999	2004
Marumalarchi Dravida Munnetra Kazhagam	MDMK	×	State	State
Rashtriya Janata Dal	RJD	×	State	State
All India Trinamool Congress	AITC	×	State	State
Indian National Lok Dal	INLD	×	State	State
Biju Janata Dal	BJD	×	State	State
Sikkim Sangram Parishad	SSP	×	State	×
Himachal Vikas Congress	HVC	×	State	×
Samajwadi Janata Party (Rashtriya)	SJP(R)	×	State	×
Lok Shakti	LS	×	State	×
United Minorities Front, Assam	UMFA	×	State	×
Manipur State Congress Party	MSCP	×	State	×
People's Democratic Movement	PDM	×	State	×
Uttarakhand Kranti Dal	UKKD	×	×	State
Jammu & Kashmir National Panthers Party	JKNPP	×	×	State
Rashtriya Lok Dal	RLD	×	×	State
Jammu & Kashmir Peoples Democratic Party	JKPDP	×	×	State
Shiromani Akali Dal (Simranjit Singh Mann)	SAD(M)	×	×	State
All India Forward Bloc	AIFB	×	×	State
Communist Party Of India (Marxist-Leninist) (Liberation)	CPI(ML)(L)	×	×	State
Nagaland Peoples Front	NPF	×	×	State

Note: Data used from Election Commission of India. × implies the party did not contest election. A political party is called a `National' party if it is a recognized by the Election party in four or more states. If a party is recognized in less than four states it is called a `Regional' party.

Table A2: Time Varying Differences-in-Differences Estimate of Regional Regime on Groundwater

	Dependent variable: Depth to Groundwater from the Surface (in meters below ground level)			
	(i)	**(ii)**	**(iii)**	**(iv)**
R-R × Year 2001	-0.091	-0.086	-0.073	0.046
	(0.16)	(0.20)	(0.21)	(0.198)
R-R × Year 2002	-0.29	-0.24	-0.24	-0.142
	(0.19)	(0.20)	(0.20)	(0.214)
R-R × Year 2003	0.22	0.042	0.030	0.105
	(0.21)	(0.21)	(0.22)	(0.233)
R-R × Year 2004	0.30	0.25	0.27	0.279
	(0.25)	(0.28)	(0.29)	(0.286)
R-R × Year 2005	-0.43	**-0.57***	-0.51	**-0.566***
	(0.31)	(0.34)	(0.32)	(0.341)
R-R × Year 2006	**-0.61***	**-1.08*****	**-1.03*****	**-1.08*****
	(0.32)	(0.41)	(0.39)	(0.409)
F -test (R-Rx2002= R-Rx2006)	1.29	5.62	5.63	5.62
	(0.25)	(0.0182)	(0.018)	(0.0182)
Geography & other controls	No	Yes	Yes	Yes
Winning party Fixed Effects	No	No	Yes	No
Change in Water levels in Pre-years	No	No	No	Yes
Winning Margin	No	No	Yes	No
Observations	2596	2542	2542	2529
R-Sqaured	0.028	0.21	0.24	0.67

Notes: The sample is restricted to years 2000 to 2006. Geographic controls include annual average rain and temperature at the level of constituency. Other controls include total vote cast, gender of the winning candidate and area of the constituency interacted with year indicators. Errors are robust and clustered at the level of Parliamentary constituencies. *** indicates significance at 1 %, ** at 5% and * at 10 %.

Table A3: Post- Reform Estimates of Regional MPs on Electrification in Districts

	Dependent Variable: Fraction of Households Electrified			
	(i)	**(ii)**	**(iii)**	**(iv)**
Regional X Post	-0.18**	-0.18**	-0.185**	-0.184**
	(0.09)	(0.09)	(0.09)	(0.09)
Controls	No	No	No	yes
Reserved Constituencies	No	Yes	Yes	Yes
Aggregation within Districts	No	No	Yes	Yes
Observations	218	218	218	218
Districts	109	109	109	109

Notes: Post is an indicator that takes value 1 for 2004 and 0 for 1991. Controls include total number of households, percentage of scheduled caste population, fraction of working population interacted with post indicator. Reserved Constituencies is an indicator that takes value 1 if any constituency included in the district is reserved for SCs. Aggregation within districts is an indicator that takes value 1 if district has multiple contituencies. Robust Standard errors are reported in parenthesis.

Table A4: Post- Reform Estimates of Regional MPs on Regularity of Electricity Supply

Dependent Variable: Regular Supply of Electricity

	(i)	(ii)	(iii)	(iv)
Regional X Post	-0.36*	-0.35*	-0.36**	-0.35*
	(0.19)	(0.19)	(0.18)	(0.19)
Controls	No	No	No	yes
Reserved Constituencies	No	Yes	Yes	Yes
Aggregation within Districts	No	No	Yes	Yes
Observations	218	218	218	218
Districts	109	109	109	109

Notes: Post is an indicator that takes value 1 for 2004 and 0 for 1991. Controls include total number of households, percentage of scheduled caste population, fraction of working population interacted with post indicator. Reserved Constituencies is an indicator that takes value 1 if any constituency included in the district is reserved for SCs. Aggregation within districts is an indicator that takes value 1 if district has multiple contituencies. Robust Standard errors are reported in parenthesis.

Table A5: Voting Patterns by Occupation Conditional on being Employed

	(i)	(ii)
Cultivating Land	**0.016****	**0.044*****
	(0.007)	(0.014)
Close elections (winning margin < 5 percent)	No	Yes
Observations	18,774	4,744

Note: Each regression controls for the total electors in the constituency.
Robust standand errors are reported in parentheses.
*** indicates significant at 1 percent, ** at 5 percent and * at 10 percent.

Table A6: Occupational Distribution in National Constitutencies

	(i)	(ii)
Cultivating Land	**0.016****	**0.06*****
	(0.007)	(0.013)
Close elections (winning margin < 5 percent)	No	Yes
Observations	18,774	4,744

Note: Each regression controls for the total electors in the constituency.
Robust standand errors are reported in parentheses.
*** indicates significant at 1 percent, ** at 5 percent and * at 10 percent.

Placebo Test

Table A7: Differences-in-Differences Estimates of Regional Regime on Groundwater

Sample 1997-1999

Dependent variable: Depth to Groundwater from the Surface (in meters below ground level)

	(i)	(ii)	(iii)	(iv)
R-R × Post	-0.17 (0.17)	-0.30 (0.23)	-0.23 (0.23)	0.22 (.44)
Geography & other controls	No	Yes	Yes	Yes
Winning party Fixed Effects	No	No	Yes	No
Change in Water levels in Pre-years	No	No	No	Yes
Winning Margin	No	No	Yes	No
Observations	1179	1164	1164	1164
R-Squared	0.0045	0.21	0.23	0.7

Notes: The sample is restricted to years 1997 to 1999. Geographic controls include annual average rain and temperature at the level of constituency. Other controls include total vote cast, gender of the winning candidate and area of the constituency interacted with year indicators. Errors are robust and clustered at the level of Parliamentary constituencies. *** indicates significance at 1 %, ** at 5% and * at 10 %.

Table A8: Effect of MP's Party Affiliation with the Party forming State Government

Dependent variable: Depth to Groundwater from the Surface (in meters below ground level)			
	(i)	**(ii)**	**(iii)**
MP From State Government Party X Post	-0.51	-0.72	-0.82*
	(0.44)	(0.44)	(0.45)
MP from State Government Party	1.54*	1.22*	0.57
	(0.83)	(0.74)	(0.7)
Geographical Controls	No	Yes	Yes
Other Controls	No	No	Yes
Constituency Fixed Effects	No	No	No
N	586	585	585
R-Sqaured	0.01	0.13	0.21

Notes: The sample is restricted to years 2002 to 2006. Geographic controls include annual average rain and temperature at the level of constituency. Other controls include total vote cast, gender of the winning candidate and area of the constituency interacted with year indicators. Errors are robust and clustered at the level of Parliamentary constituencies. *** indicates significance at 1 %, ** at 5% and * at 10 %. Column (i) through (iii) restrict the sample to constituencies where the party of the MP was in state government in both 2002 and 2005 and constituencies where it was in power in neither year.

Table A9: National to National Party Changes

	Dependent variable: Depth to Groundwater from the Surface (in meters below ground level)			
	(i)	**(ii)**	**(iii)**	**(iv)**
NN (INC to INC) X post	1.09***	1.03***	0.94***	1.03***
	(0.34)	(0.38)	(0.36)	(0.38)
NN (BJP to BJP) X post	0.88***	0.8**	0.72*	0.8**
	(0.33)	(0.4)	(0.38)	(0.4)
NN (INC to BJP) X post	0.82**	1.76***	1.75***	1.76***
	(0.38)	(0.6)	(0.6)	(0.6)
NN (BJP to INC) X post	0.92**	0.77***	0.71**	0.77***
	(0.28)	(0.3)	(0.28)	(0.3)
NN (Others to others) X post	0.53**	0.62**	(0.8)***	0.61**
	(0.23)	(0.24)	(0.28)	(0.25)
Geography & other controls	No	Yes	Yes	Yes
Winning party Fixed Effects	No	No	Yes	No
Change in Water levels in Pre-years	No	No	No	Yes
Winning Margin	No	No	Yes	No
Observations	1472	1430	1430	1430
R-Sqaured	0.028	0.21	0.24	0.67

Notes: The omitted group is RR. Geographic controls include annual average rain and temperature at the level of constituency. Other controls include total vote cast, gender of the winning candidate and area of the constituency interacted with year indicators. Errors are robust and clustered at the level of Parliamentary constituencies. *** indicates significance at 1 %, ** at 5% and * at 10 %.

Table A10: Effect of National MP from Party forming National Government in Pre-Election years

Dependent variable: Depth to Groundwater from the Surface (in meters below ground level)			
	(i) pre-reform	**(ii)** pre-reform	**(iii)** post reform
	1997	**1998**	**2003**
National MP * MP from the Party forming the National Government	0.48 (0.5)	0.7 (0.46)	0.077 (0.0607)
N	504	504	503
Observations	0.2	0.19	0.2

Notes: Geographic controls include annual average rain and temperature at the level of constituency. Other controls include total vote cast, gender of the winning candidate and area of the constituency interacted with year indicators. Robust Standard Errors are clustered at the level of Parliamentary constituencies. *** indicates significance at 1 %, ** at 5% and * at 10 %.

Table A11:Percentage of Winning Candidates Changing Constituency by Number of Elections Contested and Party Affiliation

No. of Elections Contested	Total Number of Winning Candidates		Percentage of Winning Candidates Changing Constituency			Percentage of Winning Candidates Changing State		
	National	Regional	National	Regional	Difference	National	Regional	Difference
All	354	110	4.52	5.45	0.93	0.01	0.01	0.00
2	210	66	5.24	3.03	-2.21	0.01	0.00	-0.01
3	92	28	5.43	7.14	1.71	0.01	0.03	0.02
4	52	15	0.00	6.67	6.67*	0.00	0.00	0.00

Notes: I restrict the sample to the candidates who contested two or more elections either under the banner of a national or regional party. The data is also restricted to 1996, 1998, 1999, and 2004 elections.