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Communication

Electoral cycles in electricity losses in India

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HIGHLIGHTS

- A third of electricity in India is lost each year.
- Electricity losses increase by 3 percentage points in periods leading up to statewide elections in India's largest state.
- Candidates are more likely to win re-election in areas where line losses are allowed to increase.
- Political factors affect line losses in ways that technical and economic factors alone cannot explain.

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ABSTRACT

A third of electricity in India is lost each year, where losses refer to power that is supplied but not billed. Utilizing data from the power corporation of Uttar Pradesh, India's most populous state, we study the politics of electricity losses. Examining annual data over four decades, we document that UP's electricity losses tend to increase in periods immediately prior to state assembly elections. Drawing upon geographically disaggregated data for the period 2000–09, we observe higher line losses just prior to the 2002 and 2007 state elections. Our analysis shows that the incumbent party was more likely to retain the assembly seat as line losses in the locality increased. We interpret these results as corroboration that political parties deliberately redirect electricity to flat rate and unbilled users in a context of chronically inadequate supply. Political factors appear to affect line losses in ways that technical and economic factors alone cannot explain.

1. Introduction

In many developing countries, electricity theft and line losses are a costly burden on the power sector (Depuru et al., 2011). Transmission and distribution (T&D) losses are estimated to cost India's economy 1.5% of GDP each year, aggravating chronic power shortages and straining the precarious finances of its public electricity providers (Bhatia and Gulati, 2004). In India's largest state, Uttar Pradesh, 29% of all power sent out from 1970 to 2010 was never billed for, presumably lost to theft, billing irregularities, and technical losses. This cumulative loss amounts to some 300 million megawatt-hours (MWh), enough to power all of Italy or South Africa for a year. Moreover, rates of line loss in Uttar Pradesh are higher today than they were in the 1970s despite numerous policy interventions, regulatory reforms, and increased efforts to prosecute power theft.

We examine data from Uttar Pradesh to demonstrate that variations in electricity losses are related to the timing of statewide elections. The focus of our study is on line losses — electricity that is received by power substations for distribution to end consumers but for which bills are not issued. Some of these losses are technical in nature, including resistive losses from high voltage transmission and variations in the quality of electrical infrastructure.[2] The remaining (majority) line losses are widely assumed to reflect inefficiencies in billing, meter tampering, illegal connections, and use by flat rate consumers that exceeds their nominal allotments. Yet such explanations do not fully explain why rates of line loss vary over time within the same geographic unit. We present evidence that the cyclicality of losses are consistent with patterns of political manipulation of the power sector associated with election periods. Given the scarcity of electrical power, its value to consumers, and the central role of politicians and public officials in its provision, electricity is a potentially valuable weapon in electoral competition.

We report on statewide trends from 1970 to 2010 and then examine within-state disaggregated data on electrical power distribution, billing, and line losses from 2000 to 2009. The main results

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[2] Such technical losses range from 1–2 percent in efficient systems to as high as 9–12 percent in less efficient systems, according to Smith (2004, p. 2070). Line losses in India are much larger than this, on the order of 30 percent.

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of our analysis are as follows. First, the data show that line losses in Uttar Pradesh are substantively very large in magnitude. Second, line losses are substantially higher in periods immediately prior to state elections. Third, extending this line of argument, we document that the incumbent political party is more likely to retain the state assembly seat where line loss is more extensive. We interpret these results as corroboration of the theory that electricity distribution is manipulated for political gain. Our results suggest that a part of line losses can be explained by political motivations rather than only by technical and economic factors.

Our paper is related to studies of the political business cycle in subnational units (examples include Baleiras and Costa, 2004; Drazen and Eslava, 2005; Mouriuen, 2007), which grew out of studies of the political business cycle at the national level (Nordhaus, 1975; Tufte, 1980). Various papers show that municipal level elected officials manipulate aspects of the local political economy prior to elections in order to improve their chances of reelection. Of particular relevance is Khemani (2004), which documents state-level electorally sensitive targeting of advantage to special interests in India. Another paper especially related to this one Badiani and Jessoe (2011) shows that agricultural price subsidies for electricity increase significantly in the year prior to an election in India.

A large literature on political corruption is also relevant (Rose-Ackerman, 1999; Johnston, 2006; Treisman, 2007), particularly studies showing that corruption rates are correlated with the reelection incentives of politicians (Ferraz, 2006). The only studies of which we are aware that study energy theft as a problem of corruption are Smith (2004) and Joseph (2010). The first is a cross-national study of T&D losses in electricity transmission linking it to corruption as well as weaknesses in accountability and institutional performance. The second reports that T&D losses across Indian states are associated with decisions by firms to establish their own power-generating capacity, exiting the state provider.

Finally, our study draws on a large literature on the politics of public goods provision and a small literature specifically on the political economy of electricity provision. The former is exceedingly vast; for a review, see Golden and Min (2013). A main result of the distributive politics literature is to underscore that public officials use electoral criteria in the allocation of government goods and services rather than utilizing strictly welfare maximizing criteria. There is considerable national and local variation in how this occurs, however, in part because features of electoral competition differ. As regards electricity provision, Brown and Mobarak (2009) shows that in poorer countries, democratic political institutions shift electricity provision from the industrial sector to households, whereas authoritarian institutions favor industry. Min (2010) documents partisan effects in electricity provision in Uttar Pradesh. Other studies, including Bernard et al. (1997), show that electricity prices may be politically manipulated for electoral ends, in line with the general distributive politics theme.

2. Electricity in Uttar Pradesh

Uttar Pradesh is India's largest state, with a population of 190 million people in an area about half the size of California. According to World Bank estimates, it is home to 8 percent of the world's poor. Electricity transmission and distribution in Uttar Pradesh is the responsibility of the state-owned and -managed Uttar Pradesh Power Corporation Ltd (UPPCL), formed in 2000 as a result of power sector reforms to India's state electricity boards. Workers at UPPCL are state employees and its key leadership positions are filled by appointments made by the state government. Electricity provision is a state-level responsibility in India's federal structure and the central government plays little role in how electricity is distributed within the individual states.

Electricity provision in Uttar Pradesh is characterized by a severe shortage of supply relative to demand. Total generation capacity in the state barely changed from 4.4 GW in 2002 to 4.7 GW in 2012. Meanwhile, peak demand soared from 7.4 GW to 11.8 GW over the same period due to population growth and economic development (UPPCL, 2012). Some of the supply shortfall has been made up via power imports from out of state. The remaining gap results in continual load shedding – rolling outages lasting several hours a day across most of the state. Villages are supposed to receive 10 h of power per day, though actual provision varies widely.[3] The incidence and frequency of power cuts is widely assumed to be susceptible to political distortions.

Farmers, especially the wealthier owners of electric pumps used for irrigation, have long benefited from favorable power sector policies. Sumir Lal of the World Bank describes, "The tendency to tinker with power tariffs to buy popularity with the rich farming class began in the 1970s. Thereafter, such tinkering became a nation-wide contagion, and ruling parties have found that subsidizing agricultural inputs, and thus gaining big-farmer support, to be easier than developing long-term agrarian investment and growth strategies" (Lal, 2006, p. 9). Metering of rural households and agricultural users in Uttar Pradesh was eliminated in the mid-1970s and replaced by low flat rates, a policy that has been adopted by many states across India (Shah, 2000). In 2012, a farmer with a one horsepower electric tubewell was paying only 75 Rupees (about $US 1.50) per month for electricity.

Since rural users pay flat rates for power, rural electricity consumption is largely determined by how much supply is provided from substations in the form of hours of power per day. Meanwhile billing in rural areas is largely insensitive to variations in consumption since most users pay fixed fees. By contrast, in urban areas, where usage is metered, consumption and revenues should be positively correlated.

Our primary outcome variable is line losses, measured as the share of electrical power that is distributed from the power substation busbar but for which bills are not issued.[4] Line losses are thus a function of the total amount of power distributed to consumers and the total amount of billing sent out to consumers, activities that we postulate are subject to distortions during politically critical periods.

Line losses are not the only factor implicated in the financial distress of Uttar Pradesh's power corporation. Even when bills are sent to customers, many go unpaid, aggravating the power corporation's revenue shortfalls. In India, the combination of technical and financial losses are referred to as aggregate technical and commercial (AT&C) losses. While political factors may also be correlated with variations in the efficiency of bill collection, this study focuses only on technical line losses, which have not previously been linked to election cycles.

We examine annual data in statewide losses from 1970 to 2010 and compare these to the timing of state assembly elections, ten of which were held during this time period. For the recent period (2000 to 2009), we acquired more finely disaggregated data from the UPPCL at the level of the service division, the smallest geographic unit for which it reports line losses.[5] UPPCL divided the state of Uttar Pradesh into 193 divisions at the end of 2009. When the

[3] "UP Power Corporation Limited to give 10 h uninterrupted power supply to villages," *Times of India*, 18 November 2012.

[4] As defined by UPPCL, Line Loss = (Energy Received at the Substation in GWh -Energy Sold and Billed For in GWh)/Energy Received at the Substation in GWh $\times$ 100.

[5] UPPCL divisions are nested within larger circles, which are in turn nested within larger zones.

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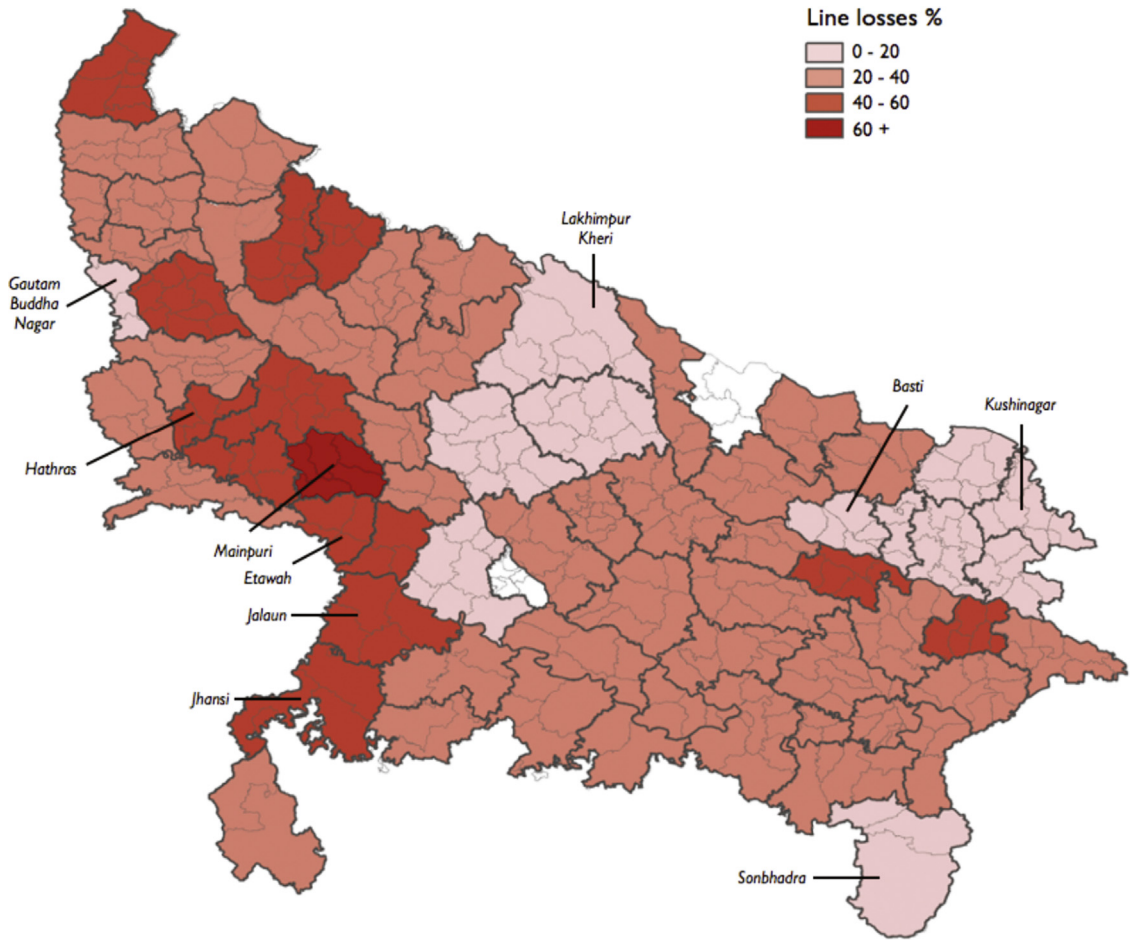

Fig. 1. District-level line losses across Uttar Pradesh, 2005. *Source*: UP Power Corporation. Dark lines represent district boundaries. Thin lines represent assembly constituency boundaries.

number of customers within a division gets sufficiently large, the division is split. As a result, the number of divisions at the beginning of our time frame is smaller than in 2009.

To investigate the electoral returns to line losses, we merged state assembly election results reported by the Election Commission of India with UPPCL data on electricity transmission and billing. Members of the legislative assembly (MLAs) are elected on party tickets in 403 single-member electoral constituencies. The state features a robust and competitive multiparty political environment and elections are held about every 5 years. However, there is no way to directly map assembly constituencies to UPPCL's geographic service divisions, since information on service division boundaries is not publicly available. Each assembly constituency and UPPCL service division can, however, be precisely located within a single administrative district, a unit roughly comparable to a U.S. county. We can thus aggregate data from both the constituency and the division to the higher administrative district level, of which there are 70 in Uttar Pradesh. We use this merged district-level dataset to evaluate whether greater line losses are associated with higher re-election rates.

3. Descriptive analysis

3.1. Geographic variations in line losses

Line loss, as observed in Fig. 1, varies widely across Uttar Pradesh. Losses are generally higher in the western areas of the state. The western part of UP is more developed economically and more intensively irrigated by electric tubewells, a significant driver of rural electricity use. Table 1 lists the districts with the highest average line losses between 2000 and 2009. On average, half of all power distributed from the busbar to consumers in the Hathras district (now known as Mahamaya Nagar) was not billed. Some of these districts are associated with politically powerful families. Etawah is the home of Mulayam Singh Yadav, leader of the Samajwadi Party and Chief Minister of the state from 2003 to 2007. Mainpuri, the district that ties for first place in line losses, is also known as a stronghold of the Samajwadi Party.[6]

The districts with the lowest average line losses during our study period are listed in Table 2. At the top of the list is Gautam Buddha Nagar, home to the bustling outsourcing hub of Noida, just east of New Delhi. The efficiency of collections in this district may reflect UPPCL's greater willingness to bill commercial customers, including many foreign-owned entities. Losses are also low in Sonbhadra district, which is sparsely populated and home to several of India's largest coal-based thermal power plants.

3.2. Variations in line loss over time

In Fig. 2a, we graph annual line losses in Uttar Pradesh as a percent of total electricity supplied in the state from 1970 through 2010. Overall, line losses are very high. By comparison, 2009 data from the International Energy Agency show that T&D losses were

[6] "Mainpuri refuses to pay power bills, cites SP's poll promise," *Indian Express*, 6 April 2012. "In power-starved UP, the SP's powerful have it easy," *Indian Express*, 21 June 2012.

Table 1
Highest line losses by district, 2000–2009 average.

District	Line losses (%)	Energy supplied (GWh)	Energy billed (GWh)
Hathras	49.9	472.5	192.7
Mainpuri	49.9	241.7	118.5
Jhansi	45.8	662.2	364.8
Jalaun	45.7	419.2	231.9
Etawah	45.4	321.8	173.5
Bulandshahr	43.8	933.0	526.5
Saharanpur	42.8	1233.9	709.4
Firozabad	42.5	675.5	395.7
Rampur	42.3	370.7	216.6
Moradabad	40.5	964.1	573.2

Table 2
Lowest line losses by district, 2000–2009 average.

District	Line losses (%)	Energy supplied (GWh)	Energy billed (GWh)
Gautam Buddha Nagar	13.6	1370.0	1197.0
Sonbhadra	16.4	259.7	218.1
Lakhimpur Kheri	19.5	218.2	174.8
Basti	19.8	196.7	157.4
Kushinagar	20.0	142.2	113.1
Maharajganj	20.3	120.7	95.8
Deoria	20.7	211.2	166.5
Hardoi	21.9	252.4	195.6
Sitapur	22.6	211.8	163.2
Hamirpur	22.8	275.9	213.3

5 percent in China, 15 percent in Argentina, and 16 percent in Kenya. Moreover, line losses in Uttar Pradesh are higher today than in the past, despite numerous regulatory reforms aimed at strengthening India's power sector.

The information depicted in the figure also indicates years in which elections to the state assembly were held. Visual inspection shows that election years are often marked by local peaks in T&D losses. The UPPCL fiscal year runs from April to March and state elections are typically held in the early months of the year.[7] The peak in T&D losses therefore typically reflects an increase in line losses in the period leading up to an election. For example, the 1974 peak reflects 28 percent line losses observed from April 1973 through March 1974 and an election held in February 1974.

The correspondence between election years and peaks in line losses are stronger in some periods than in others. During the 1970s and 1980s, politics in Uttar Pradesh was dominated by the Congress party, India's nationally dominant post-independence party. By contrast, the 1990s was a period of highly fractured state politics, characterized by short-lived coalition governments and periods of President's Rule for nearly all of 1993 and from October 1995–March 1997. Following the rise of the Bharatiya Janata Party (BJP) in the late 1990s, political power in the state consolidated around the lower-Caste Bahujan Samaj Party (BSP) and the Samajwadi Party (SP). Strikingly, electoral peaks in line losses were most notable during the era of Congress dominance and have re-emerged in the last decade of BSP and SP rule. We interpret this to suggest that parties are most capable of facilitating higher line losses when they enjoy firm control of the state governing apparatus. The unusual spike in line loss around 2000 coincides with a significant reorganization of the power corporation

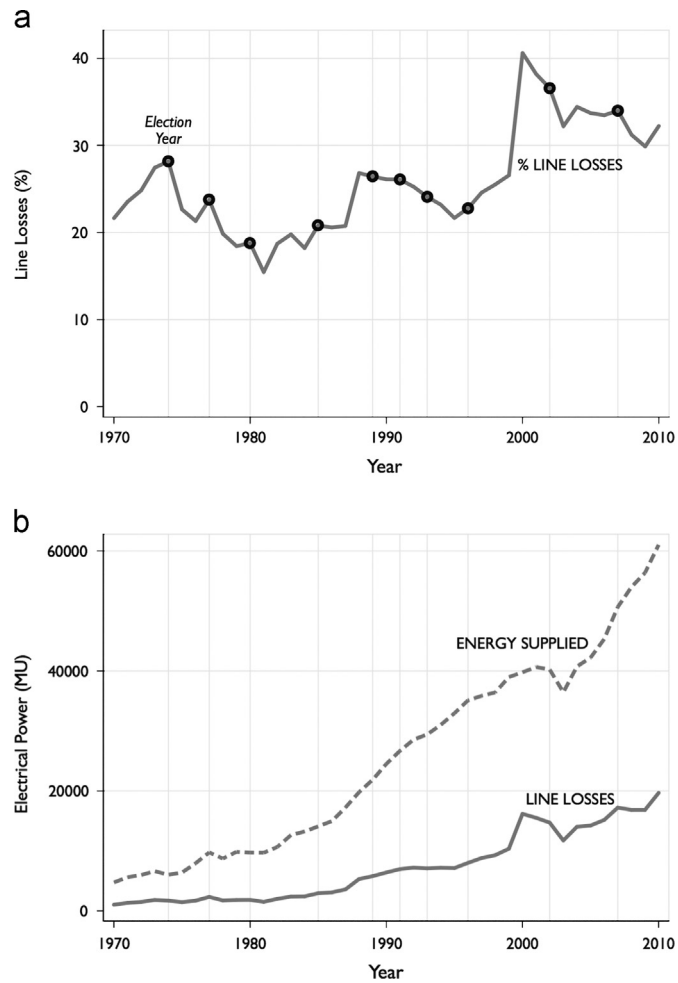

Fig. 2. Statewide line losses in Uttar Pradesh (1970–2010). (a) Line losses as percent of total electricity supplied. (b) Line losses and electricity supplied. *Note*: Electrical power in millions of units where a unit is one kilowatt-hour.
Source: Uttar Pradesh Power Corporation Ltd., *Statistics at a Glance*, various years.

and the creation of the new state of Uttaranchal out of the northern hill districts of UP, and may be an artifact of these disruptions.

Data also suggest that peaks in line losses are not simply a result of increased power supply availability. We can see this in the data depicted in Fig. 2a, which shows that overall electricity supply has increased relatively smoothly since 1970. We interpret these patterns to suggest that line loss peaks do not reflect more electricity being supplied around election periods but instead relatively lower levels of billing to consumers for the electricity they consume in those periods. Such a pattern seems consistent with the technical constraints facing the state in managing the power supply. While it may be difficult for the government to increase the overall volume of electricity available within the state, no purely technical obstacle limits the ability of elected leaders to influence the flow of power towards key constituencies during electorally critical periods. Given the flat rates paid by consumers in many rural areas of the state, the redirection of electricity to these areas can have important effects on the level of billing relative to power supply. We explore this connection between line losses and the electoral cycle in UP systematically below.

4. Statistical analyses of electoral cycles and line loss

Using statistical methods of analysis, we now investigate two questions: (1) whether line loss is temporally related to the

[7] State Assembly elections in Uttar Pradesh were held in Feb 1974, May–Jun 1977, Apr–May 1980, Feb–Mar 1985, Oct–Nov 1989, Apr–May 1991, Oct–Nov 1993, Jan–Feb 2002, and Apr–May 2007.

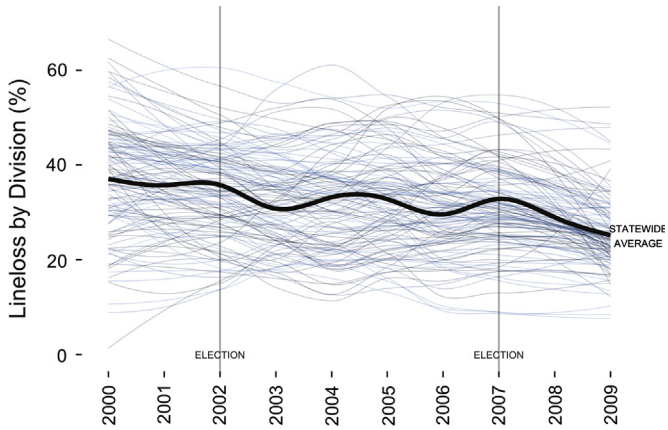

Fig. 3. Division level line losses, 2000–2009. *Note*: Lines are smoothed plots of line losses in individual UPPCL divisions using a generalized additive model. The solid dark line represents statewide average of division-level losses. The figure plots only divisions that could be consistently tracked across the period, excluding newly created divisions. Also excluded are divisions that were extracted into the new state of Uttaranchal in 2000. These help explain differences between this plot and Fig. 2a, especially around 2000.

Table 3
UP line losses in election and non-election years, 2000–2009.

	Division-year observations	Mean	Std. Dev.
Election year	325	34.1	10.3
Non-election year	1336	31.4	11.5
Difference		+2.7***	

Notes: State assembly elections held in 2002 and 2007.
*** $p \leq 0.001$.

occurrence of a state assembly election; and (2) whether line losses pay politically; that is, whether incumbents in the state legislative assembly benefit electorally when consumers are provided more electricity than they are billed. The first hypothesis examines whether the power corporation, presumably acting under unobserved pressure from elected politicians, permits users more unbilled electricity in the period prior to an election. The second examines whether the political party holding the state assembly seat is more likely to retain the seat in an election if more power is unbilled in the period prior to the election. The second hypothesis helps us understand the first: because there are electoral benefits to allowing users more unbilled electricity in the run-up to the election, state assembly members have strong incentives to pressure power corporation officials to provide more electricity while reducing the incentives for power officials to increase billing. We cannot observe directly the interactions of politicians and power corporation officials. However, we can examine whether the data are consistent with patterns showing successful political pressures on the power corporation.

4.1. Electoral cycles

Fig. 3 plots fiscal year line losses in Uttar Pradesh from 2000 to 2009. The individual lines depict smoothed trends for individual service divisions, with the thick line showing the average across all divisions. The overall pattern shows slight increases in line losses during the 2002 and 2007 fiscal years, which mostly capture the period preceding elections in February 2002 and May 2007. A *t*-test in Table 3 shows that line losses at the division level are nearly 3 percentage points higher in the two election years than in other years. The difference is highly statistically significant.

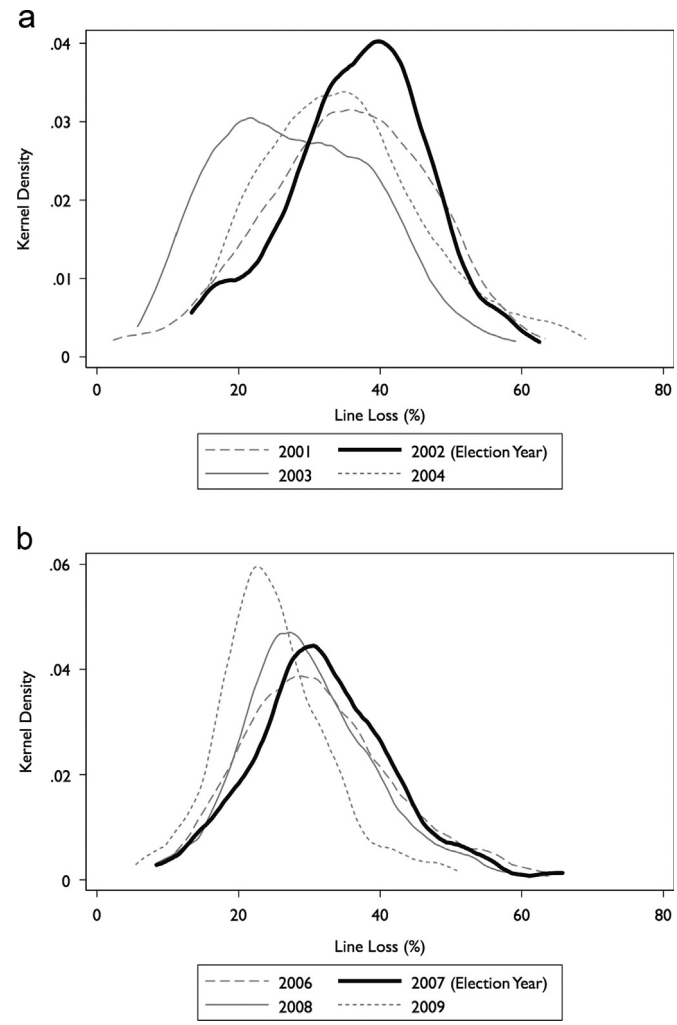

Fig. 4. Line losses around election years. (a) Kernel density plots of line losses around 2002 election. (b) Kernel density plots of line losses around 2007 election. *Source*: Uttar Pradesh Power Corporation Ltd.

Table 4
Fixed effects OLS results testing for electoral cycles in UP line loss, 2000–2009.

	(1)	(2)
Election year	2.847***	3.107***
	(0.336)	(0.336)
Power supplied to division		−0.018**
		(0.006)
Division fixed effects	Yes	Yes
Constant	30.972***	35.792***
	(0.067)	(1.501)
Division-level observations	1661	1661

Standard errors in parentheses.
** $p < 0.01$.
*** $p < 0.001$.

The higher average losses in election periods are not driven by outliers. Fig. 4a and b shows kernel density plots that reveal the distribution of line losses across all UPPCL divisions in the years surrounding the 2002 and 2007 elections. The overall distribution of losses in election years is shifted towards the right, indicating that most divisions experienced higher line losses in those year than in the years before and after.

Table 4 shows a fixed effects OLS regression that predicts division-level line losses using election years as regressors and indicator variables for each division to control for time-invariant division characteristics.[8] Model 2 adds a control for the total amount of electrical power supplied to the division, to account for the possibility that higher line losses are driven by an increase in electricity supply. In both models, line losses are about 3 points higher in election years than in other years, a result similar to the uncontrolled comparison-of-means above. These results provide additional circumstantial evidence that the provision of electricity is subject to political manipulation. Constituents appear to benefit from reduced efforts by the state to monitor electricity use in periods prior to elections.

4.2. The electoral returns to line loss

If politicians are involved in facilitating line losses prior to elections, such activities make sense only if they are electorally advantageous. We evaluate the electoral returns to line loss by closely examining the May 2007 election.[9] Previous research has documented a significant incumbency disadvantage for Indian state legislators (Uppal, 2009). The 2007 elections appear consistent with this expectation: across UP's 403 state assembly constituencies, only 146 of seats were retained by the same party that held the seat after the prior 2002 election.

Were rates of line loss higher in areas where parties retained their seats? The geographic mismatch between assembly constituencies and UPPCL's service divisions makes it difficult to answer this question cleanly. We can, however, compare incumbency reelection rates against line losses measured at the larger administrative district level.[10] In general, districts where parties retained more seats had higher rates of line loss than districts where most incumbents were replaced. In the five districts in which all incumbents retained their seats, line losses were 42.8 percent compared to 26.7 percent in the nine districts in which no incumbent was reelected.

Since incumbency reelection is a function of several factors, we run regressions at the administrative district-level to control for other potential variables. Our dependent variable is the proportion of constituency seats retained by the same party in the May 2007 election. The main theoretically relevant independent variable is district-level line loss in fiscal year 2007 (April 2006 – March 2007). This tests whether greater line loss is associated with a higher probability of seat retention by the party holding the seat in the assembly constituency.[11] Results appear in Table 5.

The results document a positive and significant effect of line loss on the probability that incumbent parties retain seats within a district. This is true in Model 1, which is simply a bivariate estimation of the impact of line loss on party seat retention, and also in Models 2 and 3, where we add in socio-economic and then partisan control variables. The results imply that an increase in line loss of 10 points (roughly one standard deviation) is associated with a 12 percent increase in the proportion of seats retained by the same party in a district. Overall, political parties retained only 38 percent of a district's seats on average, so the effect is substantively significant. Moreover, the association is notable given that so few policy-related factors have been identified that predict incumbency reelection in Indian state assembly elections. In our analysis, the only other variable that attains conventionally acceptable levels of statistical significance is urban population (in Model 2). Partisan effects are not statistically significant, nor are interaction effects between line losses and parties (not reported here). One possible interpretation of the results reported in Table 5 is that when incumbent MLA's allow high rates of line loss, their party is more likely to be rewarded by voters and to achieve reelection.

Table 5
OLS regressions predicting proportion of seats in each UP district retained by party, 2007 State Assembly Elections.

Variable	Model 1	Model 2	Model 3
Line losses, FY 2007 (%)	0.012**	0.012**	0.011*
	(0.003)	(0.003)	(0.003)
Power supplied (TWh)		0.133	0.102
		(0.098)	(0.095)
Level of development (HDI index)		0.632	−0.041
		(0.861)	(0.855)
Prop of pop urban		−0.926*	−0.041
		(0.458)	(0.447)
District pop (millions)		−0.030	−0.032
		(0.045)	(0.044)
District seats previously held by BSP			0.220
			(0.184)
District seats previously held by SP			−0.217
			(0.175)
District seats previously held by INC			−0.273
			(0.295)
District seats previously held by BJP			−0.131
			(0.206)
Intercept	−0.000	−0.213	0.245
	(0.108)	(0.495)	(0.557)
Observations	68	68	68

Standard errors in parentheses.
* $p < 0.05$.
** $p < 0.01$.

5. Conclusion and policy implications

Line losses are widespread in India, yet the variations in intensity across space and time can only partly be explained by technical and economic factors. Using disaggregated data from India's largest state, we provide evidence that line loss is politically correlated. It occurs more often around elections and proves advantageous to the political parties holding the legislative assembly seat. Our results underscore that line losses have become bound up with the intense electoral competition that now characterizes Uttar Pradesh. This suggests that what is often described as “power theft” is part of deliberate political strategy and not a by-product of weak institutions or the product of random fluctuations in the capacity of the public sector power corporation to enforce standard transmission or billing procedures. Although some line loss is unavoidable, the results of our data analysis suggest that much line loss is not a function of technical features of electricity provision but rather an outcome of processes that benefit politicians and some consumers in the short-run despite detrimental consequences to the state and its citizens in the long-run.

What policy implications emerge out of this study? We have shown above (see Fig. 2b) that the electricity supply does not increase in election years even while the unbilled electricity output as a proportion of the total increases. This suggests that

[8] The division fixed effects specification helps to account for differences in economic development, industrial/sectoral composition, rural/urban balance, population density, and other geographically specific characteristics that do not vary much over time but may affect rates of line loss.

[9] In that contest, the BSP won an outright majority of seats, the first time in nearly two decades that a power-sharing coalition was not required to govern the state.

[10] The typical district is composed of five or six assembly constituency seats.

[11] We include as control variables the total amount of power supplied; a development index averaging district income, education, and health; the proportion of the population residing in urban areas; the size of the population; and controls for which party controlled the seat in the prior period.

a reallocation of electricity occurs in election years, from sectors that are necessarily billed against output to sectors that are not. It is technically and administratively infeasible to supply more electricity to metered customers — urban households, commercial users, industrial concerns — than they are billed for on the periodic basis evident in the data. Because they are not on meters, rural households and agricultural tubewells are by contrast susceptible to periodic fluctuations in energy supply without commensurate increases in billing. Additional research is required to unpack the sectoral shifts that plausibly accompany the political business cycle to electricity provision that is highlighted in this article. In the meantime, our best interpretation of the data we have presented is that increases in line loss occur because rural electricity is almost entirely unmetered in UP. Preventing line loss in the future thus requires a thorough evaluation of the relative costs and benefits that would accrue to reintroducing meters into the agricultural sector in Uttar Pradesh. Meters have successfully been reinstalled in West Bengal and initial results for water users are highly promising (Mukherji et al., 2009). Similar reintroduction should be considered for Uttar Pradesh on the grounds that metering supply would reduce the political and partisan manipulation of the energy sector as well as improving the public sector's fiscal position.

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References

Badiani, R., Jessoe, K.K., Jan. 2011. Elections at What Cost? The Impact of Electricity Subsidies on Groundwater Extraction and Agricultural Production, unpublished paper.

Baleiras, R.N., Costa, J.D.S., 2004. To be or not to be in office again: An empirical test of a local political business cycle rationale. European Journal of Political Economy 20 (September (1)), 655–671.

Bernard, J.-T., Gordon, S., Tremblay, J., 1997. Electricity prices and elections in Quebec. Canadian Journal of Economics 30 (August (3)), 505–525.

Bhatia, B., Gulati, M., September 2004. Reforming the Power Sector: Controlling Electricity Theft and Improving Revenue. Public Policy for the Private Sector Note 272, World Bank, Washington, DC.

Brown, D.S., Mobarak, A.M., 2009. The transforming power of democracy: regime type and the distribution of electricity. American Political Science Review 103 (May (2)), 193–213.

Depuru, S.S.S.R., Wang, L., Devabhaktuni, V., 2011. Electricity theft: overview, issues, prevention and a smart meter based approach to control theft. Energy Policy 39 (2), 1007–1015.

Drazen, A., Eslava, M., January 2005. Electoral Manipulation Via Expenditure Composition: Theory and Evidence. Working Paper No. 11085, National Bureau of Economic Research.

Ferraz, C., May 2006. Political Influence and Environmental Regulation: Evidence from Municipal Electoral Cycles in Urban Brazil, unpublished paper.

Golden, M.A., Min, B., 2013. Distributive politics around the world. Annual Review of Political Science 16, 73–99.

Johnston, M., 2006. Syndromes of Corruption: Wealth, Power, and Democracy. Cambridge University Press, Cambridge.

Joseph, K.L., 2010. The politics of power: electricity reform in India. Energy Policy 38, 503–511.

Khemani, S., 2004. Political cycles in a developing economy: effect of elections in the Indian States. Journal of Development Economics 73 (1), 125–154.

Lal, S., 2006. Can Good Economics Ever Be Good Politics? Case Study of the Power Sector in India. Working Paper No. 83, World Bank, Washington, D.C.

Min, B., 2010. Democracy and Light: Public Service Provision in the Developing World. Ph.D. Thesis, University of California at Los Angeles.

Mouriuen, P.E., 2007. The local political business cycle. Scandinavian Political Studies 12 (March (1)), 37–55.

Mukherji, A., Das, B., Majumdar, N., Nayak, N., Sethi, R., Sharma, B., 2009. Metering of agricultural power supply in West Bengal, India: Who gains and who loses?. Energy Policy 37, 5530–5539.

Nordhaus, W.D., 1975. The political business cycle. Review of Economic Studies 42 (April (2)), 169–190.

Rose-Ackerman, S., 1999. Corruption and Government: Causes, Consequences, and Reform. Cambridge University Press, Cambridge.

Shah, T., August 2000. Wells and Welfare in the Ganga Basin: Essay on Public Policy and Private Initiative. Technical Report, International Water Management Institute. In: Paper Presented in the Workshop on Poverty, Gender and Water in South Asia Ahmedabad, India.

Smith, T.B., 2004. Electricity theft: a comparative analysis. Energy Policy 32 (December (18)), 2067–2076.

Treisman, D., 2007. What have we learned about the causes of corruption from ten years of cross-national empirical research? Annual Review of Political Science 10, 211–244.

Tufte, E.R., 1980. Political Control of the Economy. Princeton University Press, Princeton.

Uppal, Y., 2009. The disadvantaged incumbents: estimating incumbency effects in Indian state legislatures. Public Choice 138 (1), 9–27.

UPPCL, 2012. Statistics at a Glance 2011–12. Technical Report, Uttar Pradesh Power Corporation Ltd., Lucknow.