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ABSTRACT

Women Legislators and Economic Performance*

There has been a phenomenal global increase in the proportion of women in politics in the last two decades, but there is no evidence of how this influences economic performance. We investigate this using data on competitive elections to India's state assemblies, leveraging close elections to isolate causal effects. We find significantly higher growth in economic activity in constituencies that elect women and no evidence of negative spillovers to neighbouring male-led constituencies, consistent with net growth. Probing mechanisms, we find that women legislators are less likely to be criminal and corrupt, more efficacious, and less vulnerable to political opportunism.

JEL Classification: D72, D78, H44, H73

Keywords: political representation, identity, India, gender, women legislators, economic growth, luminosity, corruption, roads, close elections

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1 Introduction

More than a hundred countries have introduced quotas for women in parliament or in party lists in the last two decades (Besley et al., 2013; Dahlerup, 2006) and the percentage of women in parliament worldwide has more than doubled in the last twenty years, standing at 22.8 percent in June 2016.[1] The feminization of politics is one of the most exciting political phenomena of our time. Yet, we do not know what it portends for growth, the rising tide that is thought to lift all boats. In this paper we present the first systematic examination of whether women politicians are good for economic growth.

The association of women with redistributive politics and a tolerance of higher taxes (Edlund and Pande, 2002; Edlund et al., 2005; Campbell, 2004) makes it plausible that, at least in the short to medium term, women politicians are less effective than men at promoting growth. Women have been shown to favour public goods investments, such as in education and health (Bhalotra and Clots-Figueras, 2014; Clots-Figueras, 2012), which have only very long term returns. However, women legislators might promote growth if they are less corrupt (Beaman et al., 2006; Brollo and Troiano, 2014), with visible impacts even in the short term (Dollar et al., 2001; Swamy et al., 2001; Mauro, 1995; Prakash et al., 2014). Or, if women who select into public office have a stronger sense of public mission and are more motivated to perform (perhaps to meet higher expectations), they may be more effective at managing economic growth.[2]

We know of no causal estimates linking economic performance to the gender of politicians, but a few recent studies examine the impact of women on corporate boards on firm performance. The results of these studies are ambiguous, suggesting negative impacts or no impact (Ahern and Dittmar, 2012; Matsa and Miller, 2013; Gagliarducci and Paserman, 2014). However, this evidence base is too small to be conclusive, and the gender composition of decision makers may influence economic performance differently in the political and corporate sectors.

Two factors probably contribute to the scarcity of causal evidence on the relationship between legislator gender and economic performance. First, sub-regional and, in particular, constituency level data on economic activity are not available in most countries. We use satellite imagery of night luminosity as a measure of economic performance following Henderson et al. (2012) and Chen and Nordhaus (2011). The second constraint on research seeking to produce causal evidence is that constituencies in which women win elections will tend to be systematically different in ways that may be correlated with economic performance. To isolate the role of legislator gender from voter preferences and potentially omitted variables, we use a regression discontinuity design on close elections between men and women. In first-past-the-post elections in which 'the winner takes all', there is a sharp discontinuity at the

[1] In contrast, only 12 percent of corporate board members are women.

[2] See, for instance, http://www.forbes.com/sites/kerryhannon/2010/11/19/top-five-reasons-why-women-flock-to-nonprofit-jobs/).

zero vote margin between the top two candidates. In this setting, the identity (and hence gender) of the winner may be deemed quasi-random (Lee, 2008). Comparing constituencies in which a woman won against a man by a narrow margin ('treated') with those in which a man won against a woman by a narrow margin ('control') can then be argued to isolate the causal influence of leader gender.

We examine data for 4265 state assembly constituencies for the 1992–2012 period which, in most states, spans four elections. This was a period of strong economic growth. It is also a period in which the share of state legislative assembly seats won by women increased, from about 4.5 percent to close to 8 percent. Important for our purposes, there was vast regional variation in both the gender composition of state legislators and luminosity growth (see Figures 1 and 2).

We find that women legislators in India raise economic performance in their constituencies by about 1.8 percentage points per year more than male legislators.[3] Estimates on our sample that do not account for selection show no significant relationship between legislator gender and luminosity growth at the constituency level. Similarly, a scatter plot of GDP against the share of women in national parliaments (Figure A.3) indicates no relationship between the two variables. This underlines the importance of accounting for selection.

So as to assess impacts of raising the share of women legislators on overall economic growth, we tested for the possibility of negative spillovers that may arise, for instance, if constituencies compete for shares of the state budget. Using neighbours of every woman-led constituency, we can reject negative spillovers. This is consistent with yardstick competition between neighbours (Besley and Case, 1995) and with improvements in publicly provided infrastructure like roads having some positive effect on neighbours as infrastructure does not stop abruptly at constituency boundaries.

In probing mechanisms, we explore differences between male and female legislators in corruption (characteristics and behavior), efficiency (completion of federally funded road infrastructure projects), and motivation (behavior as a function of whether the legislator is elected in a swing constituency), each of which has been associated with economic growth in developing countries.

We identify a role for criminality and corruption in explaining better performance under women leaders. Male legislators (in the close election sample) are about three times as likely as female legislators to have criminal charges pending against them, and we estimate that this can explain about one fourth of the difference in growth between male and female-led constituencies. We buttress this result with RD estimates of actual corruption in office. Using a measure discussed and validated in Fisman et al. (2014), we find that the rate at which women accumulate assets while in office is 10 percentage points lower per annum than among

[3] Our estimates indicate that luminosity growth is about 15 percentage points higher in female-led than in male-led constituencies. We estimate the GDP-luminosity elasticity from Indian state level data as 0.12 and use this to translate the marginal effect into GDP growth.

men. These findings line up with experimental evidence that women are more fair, risk-averse and less likely to engage in criminal and other risky behavior than men (Andreoni and Vesterlund, 2001; Eckel and Grossman, 2008; Fletschner et al., 2010).[4]

Since economic infrastructure is an important input to economic growth, especially in developing countries (Jacoby, 2000a), we also analyze legislator performance in implementation of a massive federally-funded village road construction program. We find that, although male and female politicians are equally likely to negotiate federal projects for road building in their constituencies, women are more likely to oversee completion of these projects. We interpret this as a marker of efficacy. Since road construction has higher returns for men (Asher and Novosad, 2018), this finding also establishes that women politicians are not exclusively focused upon serving the interests of women voters, a commonly held claim.[5]

Finally, separating the sample into swing and other constituencies, we find that the relative economic performance of women legislators is higher only in non-swing constituencies. This is consistent with greater political opportunism among men or with women legislators having greater intrinsic motivation.

Overall, our analysis of mechanisms suggests that differences in preferences between men and women play a role in determining the better economic performance of women legislators. We provide important new evidence at a time when women are increasingly participating in government across the globe. In India, a historic constitutional amendment proposing to reserve one third of all federal and state assembly seats for women was passed by the upper house of the federal parliament in 2010. However, this bill still needs to pass the national parliament and state assemblies. Our findings are of interest beyond India, given the scarcity of evidence on the question of how legislator gender is associated with economic performance. We contribute new evidence to a literature on political identity and substantive representation (Osborne and Slivinski, 1996; Besley and Coate, 1997) that has tended to focus more narrowly upon differences in priorities and preferences of men and women in government.

The remainder of this paper is structured as follows. Section 2 offers contextual information on Indian elections and women's participation. Section 3 presents our empirical strategy. In Section 4, we discuss the electoral and luminosity data. Section 5 presents the main results. In Section 7, we discuss alternative interpretations of the results. Section 8 presents a number of extensions. Section 9 concludes.

[4]These studies do not investigate whether women influence economic growth.

[5]For instance, see Chattopadhyay and Duflo (2004); Iyer et al. (2012); Brollo and Troiano (2014); Bhalotra and Clots-Figueras (2014); Clots-Figueras (2012); Miller (2007); Edlund et al. (2005); Chaney et al. (1998); Thomas (1991); Svaleryd (2009). Amongst the findings of these studies are that women in politics have influenced the passage of abortion laws in the US, equal inheritance rights legislation, the reporting of crime against women, and the promotion of public health inputs to child survival in India; and government spending on child care, expenditures on education and elderly care in Sweden. A few studies find no significant influence of the gender of local politicians on policy choices ((Ferreira and Gyourko, 2014), (Rigon and Tanzi, 2012))

2 Context

India is a large federal country with highly competitive multi-party elections monitored by an independent electoral commission. Electoral fraud is uncommon, although some areas suffer from clientelism and elite capture (Anderson et al., 2014). The current 29 states of the Indian Union are parliamentary democracies where, typically, a new legislative assembly is elected every five years. There is a high degree of turnover at the state level with state governments often voted out of office. Assembly constituencies are also characterized by significant turnover. In fact, in contrast to the case of the USA but similar to the case of Brazil, incumbents in India are less likely to win than challengers (Uppal, 2009). Members of Legislative Assemblies (legislators) are chosen according to a first-past-the-post system in single member constituencies. Voters vote for individual candidates rather than party lists. Successful candidates are typically appointed and supported by an established party. In fact, parties are crucial arbiters of political careers given the high costs of running for office in India. In the 2009 federal elections, the average cost of winning a seat was around 2 million US dollars (Tiwari, 2014), a sum that most candidates would struggle to raise without the support of sophisticated party organizations. While there are political quotas for certain minority tribes and castes at the local, state and national level, gender quotas in India are only at the local level and only since 1993 (Chattopadhyay and Duflo, 2004).

State legislators shape policy. They influence the flow of federal funds and the financing of village councils and they are responsible, inter alia, for roads, electricity, law and order, health and education. Political manipulations by state governments can influence the allocation of federal transfers (Khemani, 2006) and of federally funded development programs (Gupta and Mukhopadhyay, 2014). Legislators can influence economic conditions in their constituencies by, for instance, improving the supply of public services like electricity (Baskaran et al., 2015; Min, 2015), attracting pork by lobbying the state government, exerting effort to pursue development opportunities, and implementing federal or state government programs more or less effectively.

Evidence emerging from political quotas in village and town councils and analysis of close elections to state assemblies suggest that women politicians have different priorities from men, tending to favor the concerns of women and children (see references in Section 1). Despite a secular increase in the share of women legislators, women remain vastly under-represented in Indian federal and state politics, their share oscillating around 10 percent in recent years (Beaman et al., 2012). This reflects not so much lower chances of winning conditional on standing, but that fewer women come forward as candidates (Bhalotra et al., 2017). This may be because women dislike competitive or corrupt environments or because party leaders discriminate against women in the nomination process (Spary, 2014). Figure 1 shows that constituencies in which women win are fairly evenly distributed across the country, so our analysis does not pertain to a specific region.

3 Empirical Strategy

We aim to estimate the causal effect of election of a woman legislator on economic activity in her constituency. As discussed in more detail in the following section, there are no constituency level economic data such as GDP and so we proxy economic activity with night light luminosity. If the election of women was randomly determined, constituencies that elected a man would serve as a valid counterfactual for constituencies that elected a woman. However, the election of women is unlikely to be random. For instance, one might expect that constituencies with more progressive voters are more likely to elect women, other things equal. This creates the identification challenge that unobserved differences between constituencies that elect women vs. men are correlated with the outcome (economic activity).

To address this challenge, we exploit the discontinuity in electoral outcomes that arises in first-past-the-post electoral systems by comparing female and male winners in close elections, defined as elections in which the margin of victory between the winner and the runner-up is arbitrarily small. Previous work shows that, in these circumstances, the identity of the winner is quasi-random (Lee, 2008).

The estimated model is :

$$y_{ist} = \alpha + \tau * woman_{ist} + f(margin_{ist}) + \varepsilon_{ist} \tag{1}$$

where y_{ist} is average growth of light in constituency i in state s over the election term t, and $margin_{ist}$ is the forcing variable. Since we restrict the sample to elections in which the top two vote getters are a man and a woman, $margin_{ist}$ is the margin of victory, defined as the difference between the vote shares of the female and the male candidate. So, by construction, it is positive when a woman wins against a male runner-up and negative when a male wins against a female runner-up. At a (notional) margin of zero, the gender of the constituency leader changes discontinuously from male to female. We can think of the treatment $woman_{ist}$, as an indicator for the winner being a woman, defined as follows:

$$\begin{aligned} woman_{ist} &= 1 \ if \ margin_{ist} > 0 \\ &= 0 \ if \ margin_{ist} \leq 0, \end{aligned} \tag{2}$$

The RD design considers a close neighborhood, λ, around the threshold margin of zero and premises that as λ goes to 0 the differences between constituencies that elected a female candidate and those that elected a male vanish, allowing us to identify the causal effect of electing a woman legislator:

$$\lim_{\lambda \to 0^+} E[y_{ist} \mid 0 < margin_{ist} \leq \lambda] - \lim_{\lambda \to 0^-} E[y_{ist} \mid -\lambda \leq margin_{ist} < 0] = \tau, \tag{3}$$

This is the difference in the average outcomes of constituencies that barely elected a female legislator against a male runner-up and constituencies that barely elected a male legislator against a female runner-up. Since there is no within election term variation in the treatment variable (female legislator), we average the growth of light over an election term. Standard errors are clustered at the constituency level to allow for within constituency correlation of the errors over time. The RDD assumption that the distribution of the error term, ε_{ist}, is continuous in the forcing variable is weaker than the identifying assumptions that other selection-on-observables methods rely upon.

We estimate the discontinuity using local linear regressions as suggested in Gelman and Imbens (2014). We also report results for several bandwidth choices including the optimal bandwidth procedure suggested in Imbens and Kalyanaraman (2012). In a further robustness check, we investigate sensitivity of our results to an alternative definition of the victory margin, using the larger sample of all races in which a female contested, irrespective of whether or not she was ranked among the top two in voteshare (Meyerson, 2014). As discussed in the Introduction, we shall study a number of potential mechanisms, investigate heterogeneity in impact, and conduct several robustness checks. The empirical specifications for these extensions of the main analysis are presented together with the findings below.

4 Data

Table A.2 summarizes the main outcome variables (Panel A) and the predetermined covariates (Panel B) in our data. It also provides summary statistics for variables available from the candidates' self-reported affidavits (Panel C). In this section, we discuss the luminosity data used to define the dependent variable, the electoral data, and the road construction data.

4.1 Night lights data

We use satellite imagery of the earth at night that is gathered by several satellites orbiting the earth under the U.S. Air Force Defense Meteorological Satellite Program's Operational Linescan System (DMSP-OLS).[6] The data are processed by the National Oceanic and Atmospheric Agency's (NOAA) National Geophysical Data Center (NGDC) to exclude late-evening sunlight due to longer days in the summer months, the effects of lunar illuminance, observations with clouds, effects of auroral lights, and active fires. The images are scaled onto a geo-referenced 30 arc-second grid (approximately 1 km^2). Each pixel is encoded with a measure of its annual average brightness on a 6-bit scale from 0 to 63. Night lights data were first digitized in 1992 and our electoral data run through 2012.

[6]The data sources, availability and summary statistics on all variables can be found in Tables A.1 and A.2, respectively.

Henderson et al. (2012) provide a detailed discussion of the satellite data, the filtering done to it and the caveats to interpreting light growth as economic activity. Importantly, they present various evidence that although GDP is widely gathered and hence used, it is often very unreliable in developing countries where the informal sector is large, making it harder to verify inputs, outputs, incomes and profits; also see Jerven (2013); Bhalotra and Umana-Aponte (2015). GDP and night lights are two error-prone measures of economic activity, it is unclear which is measured with more error, but the great advantage of night lights data, exploited here, is that it is available very local level annually and can be mapped into units of interest such as, in this case, Indian state assembly constituencies.

We overlay a map of 4265 Indian State Assembly constituencies to create constituency-level light output data as the sum of total light emitted by each pixel within constituency boundaries divided by the area of the constituency (light density). We calculated the growth of light as the difference in the logarithm of light density in years $t+1$ and t.[7] Since we are interested in the performance of a legislator over an entire election term (usually 5 years), we create our main outcome variable as average annual growth over an election term and then annualize it.

To validate our contention that night light growth measures economic growth in India, we use state-level GDP data, which is the smallest administrative unit for which consistent time series data on GDP are available through the study period. Figure 5 plots a scatter of the data which suggests a strong correlation. Panel data estimates that condition on state and year fixed effects indicate that a 1 percent increase in night lights is associated with a 0.12 percent increase in GDP (see Appendix Table A.3). Using Indian district level GDP data that is available for a few recent years, Bickenbach et al. (2013) estimate of elasticity of 0.107. Using global data, Henderson et al. (2012) estimate an elasticity of about 0.3.

4.2 Election data

The election data are drawn from successive editions of the Statistical Reports on General Elections to Legislative Assembly of States, published by the Election Commission of India. For each election, the reports contain candidate names, vote counts, gender and party affiliation; assembly constituency names and codes; year of the election, size of the electorate, total number of votes cast, and number of valid votes. India currently has 29 states. Our data, which cover about 99% of the population in India, include all states and the union territory of Delhi, and exclude the northern state of Jammu and Kashmir and other smaller union territories.[8] A constitutional amendment in 1976 fixed the boundaries of constituencies

[7] As some of the light values are zero, we add 1 to each value before taking logs.

[8] In 2000, three states, namely Bihar, Madhya Pradesh, and Uttar Pradesh, were partitioned to make three additional states. The newly formed states are Chhattisgarh (from Madhya Pradesh), Jharkhand (from Bihar), and Uttarakhand (from Uttar Pradesh). Chhattisgarh was allocated 90 constituencies from Madhya Pradesh and Jharkhand was allocated 81 constituencies from Bihar. The constituencies themselves remained

until 2001 to avoid adversely affecting representation of states that implemented population control measures. The fourth Delimitation Commission empowered by the Delimitation Act of 2002 set out to redraw constituency boundaries based on the 2001 census data. However, the Commission's order was only accepted in 2008 and the first election to use new boundaries was held in 2008 in the state of Karnataka. Due to non-comparability of the pre- and the post-delimitation constituencies, we only consider elections held before 2008. However, our data extend until 2012 for states which had not yet held new elections under newly drawn boundaries.[9]

In the analysis period, 1992-2012, there are 16,857 constituency-election years. Of these, 1,709 (10.3%) constituency-election years are in the mixed-gender sample, defined as a sample in which a woman and a man are the top two vote-winners.[10] Among mixed-gender elections, 471 (27.6%) are close elections, defined as elections with a victory margin of less than 5%. In fact a third of all Indian elections are won with a victory margin of less than 5%, a marker of how competitive Indian elections are in general.[11]

We also utilize data on candidate characteristics drawn from affidavits. The submission of an affidavit became mandatory for all political candidates following a Supreme Court of India order in 2003, the Right to Information Act. The Election Commission of India publishes the affidavits and they contain information on education, assets, liabilities, and criminal accusations. The Association of Democratic Reforms (ADR), an election watchdog, has compiled the information since 2004.[12] Our analysis using candidate characteristics is thus restricted to state elections held between 2004–2008, encompassing one election for each state.

4.3 Road construction data

We use completion of federally awarded village road building contracts as a proxy for public goods provision at the constituency level. We have administrative data on a centrally sponsored rural roads construction program, Pradhan Madri Gram Sadak Yojana (PMGSY), launched in 2000 that aims to provide all weather road connectivity in rural areas, and forms

unchanged. Uttarakhand was allocated 22 constituencies from Uttar Pradesh which were redrawn into 70 new constituencies.

[9]The data include: Assam till 2010, Bihar till 2009, Goa till 2011, Gujarat till 2011, Himachal Pradesh till 2011, Kerala till 2010, Manipur till 2011, Meghalya till 2012, Mizoram till 2012, Nagaland till 2012, Punjab till 2011, Sikkim till 2011, Tamilnadu till 2010, Tripura till 2012, Uttar Pradesh till 2011, Uttarakhand till 2011, West Bengal till 2010. The remaining states appear in our sample till 2008.

[10]It is notable that when a woman wins, in 91% of cases, the runner up is a man. However, when a man wins, it is only in 6% of cases that the runner-up is a woman. This is because it is only in 30% of constituency-years that at least one woman contests.

[11]The fraction of all mixed-gender elections that are close, at about a third, is similar to the share of all elections that are close (irrespective of the gender of the top two vote winners). The number of close elections is 4,727 which is 28.5% of all elections.

[12]`www.myneta.info` first accessed in March 2014.

an integral part of the Government of India's poverty reduction strategy. This program is unprecedented in its scale and scope (Aggarwal, 2017).

The National Rural Roads Development Agency (NRRDA), which manages the PMGSY program, places the administrative records of road projects under PMGSY in the Online Management and Monitoring System (OMMS). We accessed road sanctioning and completion dates. The data are available at the census block level, a sub-district census administrative unit. We matched the roads data to state assembly constituencies.[13]

5 Results

5.1 Validity of RD Design

Validity of the RD design requires continuity of predetermined characteristics of constituencies across the threshold of a zero victory margin. We use a rich set of variables determined before the election in t, either variables from the previous election in $(t-1)$, or outcome variables averaged over the previous electoral term. These include the growth of night lights, the share of incomplete road projects, electorate size (i.e. number of registered voters), number of candidates, turnout, female turnout, whether the legislator was a woman, whether the legislator (in $(t-1)$) was an incumbent, whether the head of the winning party was a woman, as well as whether the constituency was reserved for lower castes (Scheduled Castes or Scheduled Tribes), aligned with the state government, and aligned with the central government.

Figure 4 reports graphical evidence of the validity of the continuity assumption. For instance, consider Panel (a) which plots average growth of light output in the previous election term against the margin of victory in t. The scatter plot depicts the local averages of growth of light in each successive interval of 0.5% of a margin of victory. The local linear curve is estimated using a triangular kernel and a 5% bandwidth and the 95% confidence interval is shown. The average growth of light in the previous term is a continuous function of the margin of victory. Similarly, we find balance on other constituency characteristics. Overall, the evidence suggests that only the gender of the legislator changes abruptly at the zero margin of victory and that, therefore, we can take the RD design as identifying the causal effect of the election of a woman on economic growth. Table A.4 reports a comparison of means of constituency characteristics in female- vs male-led constituencies in the mixed-gender sample with and without restricting to close elections.

Another potential concern is that there is sorting around the cutoff, which would imply that the winning chances of men and women are not equal even in a close election. Such sorting has been documented in the case of close elections between Republicans and Democrats in

[13]The roads data are at `http://omms.nic.in/`, first accessed in May 2015. While there is significant geographical overlap between a census block and an assembly constituency (sharing on average 80% of villages), a census block could span more than one assembly constituency. We assign block-level road variables to an assembly constituency if the constituency contains at least 50% of villages in the block.

the United States, and associated with manipulation of the margin of victory that renders the close election experiment invalid (Snyder, 2005; Caughey and Sekhon, 2011; Grimmer et al., 2012). To investigate this, Figure 3 depicts the density of the margin of victory as suggested in McCrary (2008). There is no apparent discontinuity in the density around the cutoff. The point estimate of the discontinuity is 0.043 with a standard error of 0.075. This suggests there is no evidence of sorting in our sample of close mixed-gender races, and female and male candidates are equally likely to win. The figure (panel a) also shows that the distribution of the margin by which women win is broadly similar to the distribution of the margin by which men win in mixed-gender races.

5.2 Main Results: Legislator Gender and Economic Performance

In this section we present estimates of the causal effect of female relative to male legislators on economic activity over the electoral term in the constituency from which they were elected. The RD estimate of the impact of electing a woman rather than a man is the difference in luminosity at the zero margin of victory. In Figure 6, we plot average growth in luminosity against margin of victory. We average the underlying data across bins that each cover 0.5 percentage points in the margin of victory and provide local linear smooths of the underlying data using a bandwidth of 5 percent. We observe a discontinuous jump in light output at the threshold margin of victory of zero, suggesting that female legislators raise economic activity more than male legislators do.

The corresponding regression estimates are in Table 1. We estimate a local linear regression of growth of night lights on the margin of victory in the RD framework. The bandwidth is calculated using the optimal bandwidth procedure suggested by Imbens and Kalyanaraman (2012) (IK). The annual luminosity growth averaged over the electoral term is 15.25 percentage points higher in constituencies in which a woman was elected with a small margin than in constituencies in which a man won with a small margin, and this difference is significant at the 5% level (column 1). Using our estimate (from state-year data) of an elasticity of GDP to night lights of 0.12 (see Appendix Table A.3), a 15.25 percentage points difference in growth in light translates into a 1.85 percentage point difference in GDP growth. Given that average growth in India during the period of study was about seven percent per year, our estimates indicate that the growth premium for constituencies stemming from their having a female legislator is about 25 percent.

Senstivity to bandwidth. We investigated sensitivity of our result to bandwidth choice. Estimates using bandwidths that are half and twice the size of the optimal bandwidth are in columns (2)-(3). The estimated coefficient declines as the bandwidth increases, but the coefficients in these alternative specifications continue to be similar to the coefficient using the optimal bandwidth. We then revert to the IK optimal bandwidth but control for the predetermined covariates considered in Table 4 and constituency and year fixed effects (column (4)). The coefficient is again similar. Finally, in column (5), we report results with a second order local polynomial smoother. Gelman and Imbens (2014) argue against the use of polynomials in RD of higher order than the quadratic. The estimated treatment effect is only slightly larger than that estimated with a local linear control function.

Beyond bandwidth. Looking to the left of the zero victory margin threshold in Figure 6 we observe higher light growth in the region outside the IK bandwidth, left of about -6 on the horizontal axis. This indicates that men who win by a narrow margin against women achieve lower growth than men who win by a wide margin against women. It also suggests that for a large enough victory margin, men do as well as women although, notably, no better: the curve further left of -6 representing men who win with big margins is about level with the curve to the right of the threshold which represents women winning. This does not challenge our strategy or our findings because the rising part of the curve on the left is outside the optimal bandwidth, and the reason to use the RD design is of course that we expect there is selection in regions far from the zero margin threshold. In other words, a comparison of the growth performance of men and women far from the threshold is potentially confounded by differences in the constituencies in which they win. However, motivated by the dip, we removed from the sample constituency-election years which had either very high or low growth rates of luminosity. The RD plot with these outliers removed is in Appendix Figure A.1 and the corresponding RD regression in Column (1) of Table 2, which shows that the coefficient, while smaller, remains positive and significant.[14] [15]

All mixed gender elections. As a further sensitivity test, following (Meyerson, 2014), we estimated regressions with a larger sample that includes all mixed-gender races in which a woman contested, rather than just races in which a woman ranked among the top two. The margin of victory is again defined as the difference in the vote shares of the top-ranked female and the top-ranked male candidate, except that now the top-ranked female may not be one of the top two vote-winners.[16] The results are similar to those in Table 1; see Column (2) of Table 2. This is because the victory margin in the additional races that are incorporated is

[14]Outlying growth rates were identified as larger than 100 or -100 percent. The analysis sample of elections in which a man and a woman are among the top-two vote-winners contains 1,623 constituency-year observations. Of these, 20 observations are outliers according to our criteria. Of the 584 observations that are within the IK bandwidth in our estimation sample, 10 are outliers.

[15]As the slight curve to the left of the threshold is of descriptive interest, we examined pre-election characteristics of both candidates and constituencies using the sample of mixed gender races and comparing men who won by a narrow margin defined as 6.68% to correspond to the IK bandwidth with men who won by a wider margin. The characteristics we compare are those we discuss in the tests of balance (RD validity). The only significantly different candidate characteristic is that men who win in close elections carry more criminal charges than men who win with wide margins. The significant differences in the pre-election characteristics of the constituencies in which they win are that men who win by narrow margins are more likely to win in constituencies in which the incumbent is a woman legislator (consistent with these being close elections, and with the results in (Bhalotra et al., 2017)), the party leader is a woman, and the party is not aligned with the state.

[16]The margin is by construction positive for races in which women win. The runner up is typically the top-ranked man, there being very few races in which the top two vote winners are women (bout 0.5% of all the races in our time period) and negative for races in which men win.

likely to be away from the discontinuity and hence unlikely to influence estimates that exploit variation around the threshold of a zero victory margin.

Gender vs party. We may be concerned that we are capturing the effects of party of the winning legislator rather than of their gender. This seems unlikely since women are not significantly more likely to be from any one of the main parties. Nevertheless, to investigate this concern, we included indicators for whether the legislator is from the Congress or the BJP (with all other parties as the omitted category). The estimates are robust to this (Column (4) of Table 2).

6 Spillovers

We have shown that women are more effective than men at raising growth in their own constituencies. In this section we investigate if this comes at the cost of lower growth in other constituencies. Specifically, we examine spillovers to contiguous constituencies. All neighbours are in the same state as the index constituency and the vast majority are male-led. Spillovers can, in principle, go in either direction. They may be negative if legislators were playing a zero-sum game with fixed state resources. Alternatively positive spillovers may arise if, for example, legislators build roads which continue across constituency boundaries, or if road construction in one constituency increases access to markets in neighboring constituencies. The same applies to electricity networks. Alternatively, successful legislators (women) may encourage yardstick competition given previous work suggests that voters evaluate politicians in their jurisdiction by comparing outcomes with those in neighboring jurisdictions (Besley and Case, 1995).

We define the dependent variable as light growth averaged over neighbors of constituency j identified using a constituency map. The mean (s.d.) of number of neighbors of a constituency is 5.8 (1.6). The independent variable of interest is as before: the gender of the legislator in constituency j. The sample is still restricted to mixed gender races for j, and we use the RD approach described for the main analysis. This yields estimates of the difference in light growth in constituencies neighbouring female vs male led constituencies. The estimated coefficient is positive, but the difference is not significant, except in column 4 (Table 7).[17]

[17]We investigated spillovers using another strategy as follows. The idea is that if there are significant geographic spillovers, then the difference between the woman-led constituency and her largely male-led neighbours will be smaller than the difference we estimate using the full sample, which includes non-neighbouring male-led constituencies in the notional control group. We re-estimated the main equation limiting the estimation sample to constituencies with female legislators and their neighbors; see Column (3) of Table 2. The estimates are similar to those in Table 1, which suggests the absence of spillovers.

7 Mechanisms

In this section we attempt to identify differences in characteristics and behaviors of female vs male legislators that may explain the better performance of women legislators in achieving economic growth.

7.1 Candidate Characteristics

As discussed earlier, data on candidate characteristics are available for elections held during the 2004-2008 period. Using these data, we compared characteristics of male and female legislators in the analysis sample containing mixed-gender close elections. Graphs are in Appendix Figure A.2 and a comparison of means in Table A.5.

In the close election sample (and also in the sample of all mixed gender elections), women legislators are significantly less likely than men to be carrying criminal charges. They are also slightly younger on average. There is no significant difference in other characteristics including education and wealth.

If the difference in criminality between male and female legislators were to translate into a difference in their winning chances then this would be problematic for our identification strategy. We examined this; see Appendix Table A.7 which shows that criminality has no significant influence on winning chances in the sample of close mixed-gender races.

The difference in criminality between women and men is larger in the close election sample. Overall, male legislators are twice as likely to be carrying charges while, in the close election sample, about 10% of women legislators have pending charges in contrast to about 32% of men. Conditional on being criminally accused, women legislators have significantly fewer charges than men.[18]

Differences in criminality between men and women legislators are consistent with experimental evidence that women are more risk-averse than men (Eckel and Grossman, 2008; Fletschner et al., 2010) and more patient (Mastrobuoni and Rivers, 2016) since risk taking and high discount factors are positively associated with crime (Eckel and Grossman, 2008).

It seems plausible that legislators with a criminal record are more likely to practice corruption, to have priorities other than economic development and, possibly less likely to provide a stable business environment. A recent paper, using the same criminal charges variable for India, studies the impact of this characteristic on economic activity proxied by luminosity, but without paying any attention to gender (Prakash et al., 2014). These authors find that

[18] The criminal charges here refer to cases in which an indictment or a chargesheet has been filed. The judicial process in India is very slow and most are never convicted. Following (Prakash et al., 2014) we define financial crimes as charges pertaining to a loss to public exchequer. We follow the classification used by the ADR for serious crimes which include assaults, kidnapping and murders. Significant gender differences in criminality among legislators remain within crime categories. While 12.7% (21.8%) of male legislators in a close race carry a financial (serious) charge, only 3.8% (5.7%) of female legislators in a close race face any financial (serious) charges.

criminality is associated with a 22% point penalty in luminosity growth. We replicate their results in Panel A of Appendix Table A.6, using an expanded list of states, and obtain an estimate for the growth penalty of 16.8% points. Scaling this estimate with the difference in the propensity for criminality between men and women (a 21.8 percentage points difference in our close election sample – see Table A.5), back of the envelope calculations suggest that the difference in criminality explains about 24% of the growth premium of women.

7.2 Corruption in Office

Having observed that male legislators are much more likely than female legislators to be carrying pending criminal charges when they stand for election, we also investigate whether they are more corrupt while in office. Politicians in office face stricter scrutiny and are subject to a re-election constraint, which may encourage them to act in more accountable ways. Alternatively, they may develop a sense of duty once they attain office if "office ennobles" (Brennan and Pettit, 2002; Bénabou and Tirole, 2003).

Following Fisman et al. (2014), we use growth in net assets (total assets minus total liabilities) during office as a proxy for corruption. Since assets and liabilities are only recorded in the affidavit data that candidates submit when standing for election, Fisman et al. (2014) restrict the estimation sample to candidates who contest for two consecutive elections, whether or not they win. They then compare asset growth for winners with asset growth for runners-up in close races. They acknowledge the selection issues that arise with this sample restriction in some detail, and after a fairly comprehensive assessment, they conclude that analysis of this sample provides useful insight. They find that Indian state legislators who are elected into office with a narrow margin witness a larger growth in net assets through their five year tenure than candidates who came close but did not win, estimated as a difference of 3 to 5% p.a. They interpret this as evidence that politicians leverage public office for private benefits by engaging in rent-seeking activities.

Fisman et al. (2014) do not distinguish between male and female legislators. We adopt their strategy but rather than compare winners with runners up in close races, we compare women who won in a close race with men who won in a close race. In Figure 7 we plot growth of net assets between elections t+1 and t against the margin of victory between winners and losers (of opposite gender) in election t. By construction, the margin of victory is positive for female winners and negative for male winners. We find a discontinuity in growth in net assets at the zero margin of victory, indicating lower growth in net assets among female relative to male legislators. Regression estimates are in Table 3. Column (1), using the IK bandwidth, shows that net asset growth during an electoral term is about 50 percentage points lower among female legislators. This translates into a 10 percentage point per annum difference in the rate at which male vs female legislators accumulate rents in office. As a benchmark, note that the mean annual growth rate of net assets in the sample (averaging over all legislators) is 20 percentage points.[19]

If we half the bandwidth, this coefficient is similar but less precisely determined (column 2). If we double the bandwidth, the coefficient falls to 3 percentage points, suggesting that the difference weakens as we move away from the discontinuity (column 3). The next two columns show that the result is robust to conditioning on covariates and fixed effects and to replacing the linear with a quadratic polynomial.

Overall, the evidence suggests that women legislators are less likely than men to exploit their office for personal financial gain. It establishes corruption as a likely contributor to the economic advantage of women legislators given evidence that lower corruption is conducive to economic growth (Dollar et al., 2001; Swamy et al., 2001; Mauro, 1995; Prakash et al., 2014).[20]

7.3 Road Infrastructure

We next investigate a hard outcome that is growth producing. In general and especially in developing countries, road infrastructure is a key ingredient to growth. Rural roads are estimated to have significant positive effects on local economic outcomes including growth and structural transformation, involving the decline of agricultural work in favour of wage work (Jacoby, 2000b; Shrestha, 2015; Jacoby and Minten, 2009; Casaburi et al., 2013; Asher and Novosad, 2018).

We use administrative data from the Prime Minister's Gram Sadak Yojna (PMGSY) or Village Road Program which was launched in 2000 with the goal of providing all-weather access to unconnected habitations across India. The PMGSY is a useful case to analyze for the following reasons. First, it is a massive nationwide program of considerable political and economic significance. Between 2000 and 2015, it had funded the construction of over 400,000 km of roads (in over 100,000 new roads), benefiting almost 200,000 villages at a cost of almost 40 billion US dollars (Asher and Novosad, 2018). Second, efficacy of this program is likely to be a good marker for public goods delivery. Importantly, it involves state legislators bidding for federal funds and delivering goods at the local level.[21]

[19] According to Panel A of Table A.2, average asset growth over a five-year term is 100 percentage points in the full sample, so annual asset growth is 20 percentage points.

[20] We have analyzed two proxies for corruption- one pertains to the legislator carrying pending criminal charges against them at the time that they file their candidacy, and the other to the a measure of the rent they accumulate during office if elected. As a coherence check, we confirmed that these two measures are positively associated with one another. Although the coefficient is not statistically significant it is sizeable, i.e., legislators who entered office carrying criminal charges experience higher net asset growth if office (Panel C of Appendix Table A.6).

[21] PMGSY is federally funded but responsibility for road construction is delegated to state governments, and the program by definition involves village-level roads. Although eligibility is a function of village level population, Members of Parliament and State Legislative Assemblies are allowed to influence allocation through making suggestions; see Asher and Novosad (2018)).

Program eligibility involved the village having a population above 1000 till 2003 and above 500 after then. Therefore validity of the RD design we use requires that constituencies won by men vs women in close elections are not systematically different in population size, in particular around these thresholds. Using the 2001 census files, and using both threshold and average population figures at the village level, we test this premise just like we test for continuity across the zero vote margin threshold for other constituency characteristics. The results are in Appendix Table A.10 and show no significant differences in population size.

Using data for 2004–2012 and the same RD approach as used for the main analysis, we investigate whether the share of incomplete roads relative to awarded road projects is a function of legislator gender. While we find no significant difference in contracts allocated (Panel B of Table 4), the share of incomplete roads is 22 percentage points lower in constituencies with female legislators (Panel A of Table 4) than in constituencies with male legislators. This difference is significant across a range of bandwidth choices and robust to inclusion of covariates and to replacing the linear with a quadratic smoother.[22]

For our purposes, this result suggests that women are more effective at completing road projects and hence creating infrastructure for growth. It challenges any presumption that men are more effective at delivering growth-producing infrastructure. More clearly, since road construction in India has been shown to produce higher returns in terms of job mobility for men than for women (Asher and Novosad, 2018), our findings establish that women are not only good at serving the interests of women. The qualities that lead women to achieve higher completion rates may include efficiency, mission or lower corruption, all of which are related to effective delivery of public goods.[23]

7.4 Political Opportunism

A large literature on distributive politics highlights that a drawback of democratic politics is that politicians have an incentive to distort economic policies to pursue a narrow electoral agenda (e.g. Mani and Mukand (2007); Cole (2009); Golden and Min (2013)) and in models of political accountability, politicians are inherently opportunistic, being more likely to exert

[22] The mean number of road contracts won (by male and female legislators alike) in the close mixed-gender election sample is 3.5. If an additional fifth of these is left incomplete in male-led constituencies, that implies about 0.7 fewer roads on average. We examined costs associated with a project and found no significant differences in constituencies led by female and male legislators.

[23] Here we report results for roads because we have access to unusually good local-level data on a public infrastructure programme of large political and economic significance. We could not find similar data for other infrastructure. In India, electricity is, like roads, an important state provided infrastructural good (Lal, 2005). Several studies suggest that electricity is the lifeblood of the modern economy (Dinkelman, 2011; Rud, 2006; Lipscomb et al., 2013) and, in India, power shortages are common and have been shown to significantly reduce output and revenues (Allcott et al., 2014). Moreover, electricity often features as one of the top priorities of Indian voters in election surveys (Chhibber et al., 2004). We measure economic activity using night lights data and it is implicit that this is a proxy for electricity demand. However, to the extent that women legislators provide electricity better (for the same reasons that they provide roads better), some of the better performance of women leaders may reflect better electricity supply.

effort or avoid rent-seeking activities if they face sufficient electoral incentives (Ferejohn, 1986; Besley and Burgess, 2002).

On the other hand, some politicians may be intrinsically motivated (Brennan and Pettit, 2002; Bénabou and Tirole, 2003), exerting effort irrespective of the extent of electoral competition. As there are economic costs of opportunism, we investigated if the weaker growth performance of male legislators could be traced to greater political opportunism amongst men. We do this by comparing the male-female difference in performance in swing vs core constituencies. The premise is that there are stronger electoral incentives in swing constituencies.

To identify swing and core constituencies, we rely on information on the *previous* election. We define constituencies where the margin of victory in the previous election was below 5 percent as swing (i. e. relatively competitive) constituencies and all other constituencies as core constituencies. Around 32% of all constituencies in the close mixed-gender sample are defined as swing according to these criteria. The idea is that constituencies where the margin of victory was close in two consecutive elections (the election that we model as won by men vs women, and the one before) are ceteris paribus more competitive than constituencies where only the most recent election was close.

Results are in Table 5. We estimate the baseline specification (as in Table 1) on the two subsamples of swing and non-swing constituencies with close mixed-gender elections. In swing constituencies, growth does not depend upon legislator's gender. In contrast, female-led non-swing constituencies have significantly higher growth rates than male-led non-swing constituencies. One explanation of this is that women legislators are less opportunistic and exhibit higher intrinsic motivation.[24]

Notice that, insofar as the behavior of women in our sample appears not to be driven by the strength of electoral competition, the results in this section suggests external validity of our main findings (which are estimated on a sample of close and hence competitive elections).

8 Extensions

In this section we investigate differences in the relative performance of male and female legislators in sub-samples distinguished by party alignment and gender of the state minister, the education of the legislator and an indicator of human development (a correlate of corruption) at the state level.

[24] To the extent that women candidates face systematic prejudice in male-dominated environments such as politics, (Esteve-Volart and Bagues, 2012; Casas-Arce and Saiz, 2015; Bhalotra et al., 2017) women who contest and succeed may be positively selected on unobservables such as motivation or mission.

8.1 Party alignment and gender of state minister

The evidence suggests that state governments may have an incentive to favor aligned politicians when they allocate public resources (Brollo and Nannicini, 2012; Asher and Novosad, 2017). Thus, aligned legislators may have more resources to work with, and if women legislators make better use of these resources, this will reinforce their positive effect on growth.

We investigated heterogeneity by alignment i.e. whether women do better than men in constituencies that are vs are not aligned with the state.[25] See Table A.8. We find that the difference between female and male legislators is larger in the aligned sample, but not statistically significantly different from the unaligned sample.

If female chief ministers favor female legislators, this may contribute to their relative success. To investigate this, we estimate the baseline RD specification with subsamples of states ruled by female vs male chief ministers. The results are in Table A.8. In fact we find no significant difference in growth by legislator gender in the roughly 15% of constituencies with female chief ministers. The sample is small but the coefficient is not just imprecise, but small. We therefore see no evidence of favoritism along the lines of gender. The sample with male chief ministers (the overwhelming majority of states) exhibits a difference in favor of female legislators similar to the full sample results.

8.2 Education of legislator

We showed earlier that there is on average no significant difference in the level of education of female and male legislators in the close mixed-gender sample. So education is unlikely to be a mechanism. However, given an interest in the relationship between politician education and policy choices (Besley et al., 2011), we investigate whether the relative success of women emerges from samples of more or less educated legislators.

We separate the sample into constituencies led by legislators with and without a college education; see Table A.8. We find that growth in luminosity is only higher for women-led constituencies in the sample in which leaders have less than college education.

One explanation for this result that is consistent with our discussion of mechanisms is that male-female differences in criminality are greater in this sample. In both samples (with and without college) the share of women legislators carrying criminal charges is similar (13 vs 14 percent). However the share of men with criminal charges is larger among non-college educated legislators, at 32% vs 25%. [26]

[25]Note that the alignment status of a constituency may change within a term (e.g. if a coalition at the state-level breaks down). To account for this fact in our definition of the alignment dummy, we set the alignment dummy to one only for those constituencies that were aligned throughout the term.

[26]The effect size in the sample with less than college education is large and may be driven by influential outliers given that this subsample has only 80 observations.

8.3 Institutional environment

If clean governance is an important reason that women-led constituencies experience higher growth, we may expect that women make a larger difference in institutional environments where (male-dominated) corruption is pervasive. We investigate this using the Human Development Index as a proxy for the prevailing quality of government (Sen and Dreze, 2005). We split the sample into the relatively developed vs under-developed states based on their Human Development Index (HDI), using the median HDI value in 1999 as the threshold. We re-estimate the baseline model on the two sub-samples; see Table 6. The result that women are better than men at producing growth is only statistically significant in the less developed states.[27]

One reason for this difference is likely to be that male and female legislators have more similar criminal propensities in the more developed states (recall that we have already shown that they are balanced on other observables including education and wealth in the analysis sample). However, in the less developed states, male legislators are more likely than female legislators to have criminal histories. They exhibit a five percentage point higher likelihood of carrying financial crime charges (10.7% vs. 15.6%) and a seven percentage points difference in carrying serious criminal charges (23.3% vs. 30.6%). In line with this, we show that asset growth in office is higher for men than for women primarily in the less developed states sample (Table 6). This result is consistent with Fisman et al. (2014) finding that, in general (i.e. not distinguishing gender of legislator), rents from public office are higher in less developed states.

Overall, these findings are consistent with the results in the Mechanisms section which highlight the relevance of criminal histories and corruption in office in explaining our finding that constituencies led by women legislators exhibit stronger economic performance.

In summary, our findings that the better performance of women legislators stems from the less developed states and from the sample of less educated legislators can be (at least partially) traced to these sub-samples exhibiting larger differences by legislator gender in criminal charges and corruption. Comparison of coefficient magnitudes suggests that women are more effective than men when the constituency leader is aligned with the state level party, but the difference is not statistically significant. There is no evidence that women legislators are more effective when the state chief minister is a woman, so we can reject favouritism between women as a channel for the success of women leaders.

8.4 External validity

While RD is regarded as producing consistent or internally valid estimates of causal effects, a common concern is that the estimates may have limited external validity. We assess this in

[27] Although the difference in the two coefficients is not statistically significant, the coefficient is twice as large in the less developed states sample.

three different ways. First, we refer to previous work for India (Bhalotra et al., 2017), which examines voter preferences for women candidates measured as the vote share obtained by all women contesting in constituencies in which there are close mixed-gender elections. They show that this share ranges from less than 20% to 65%. This wide variation in preferences for female politicians suggests external validity of results from the close sample.

Second, the same authors show that among constituencies which have at least one mixed-gender election, nearly 60% have had only one or two mixed-gender elections over a period of three decades. This again points to external validity inasmuch as it establishes that our RD estimates do not capture features specific to mixed-gender constituencies.

Third, we compare characteristics of constituencies in the sample of mixed-gender elections divided up as close vs non-close elections; see Column (1)-(3) of Table A.9. We find very few differences. Constituencies with close mixed-gender elections are slightly more likely to have a female incumbent and a female party head and less likely to be aligned with the state government. Although the RD design does not require balance on candidate characteristics, for the descriptive purpose of understanding candidate selection into close elections we also compared candidate characteristics in close vs non-close mixed gender elections. The only significant difference we find is that, on average, candidates have a larger number of criminal cases in close mixed-gender elections (consistent with our discussion of the external validity of our baseline results in section 5.2).[28]

We estimated OLS regressions using the universe of elections in India, and panel data identification. We find no significant impact of legislator gender on growth.[29] As discussed in the Introduction, there is similarly no correlation between politician gender and growth (GDP) in cross-country data (see Appendix Figure A.3). This suggests negative OLS bias, or that women legislators are in general selectively elected in areas with lower growth potential. Since the causal effect of women on growth is not readily evident in observational data, it is important to investigate this relationship using techniques for causal identification in other settings.

9 Conclusion

We estimate that women legislators in India raise luminosity growth in their constituencies by about 15 percentage points per annum more than male legislators. This translates to a difference of about 1.8 percentage point in annual GDP growth. Given that average growth in India during the sample period was about 7%, our estimates indicate that the growth premium

[28]On the other hand, there are significant differences between candidates and constituencies in mixed gender vs non-mixed (mostly all-male) races (Column (4)-(6) of Table A.9). Candidates in mixed-gender constituencies have a lower propensity for criminality, are younger and slightly less educated. With respect to constituency characteristics, we observe e. g. that average light growth in the previous electoral term tends to be smaller in mixed-gender constituencies and that the likelihood of a female legislator being an incumbent is higher.

[29]These results are available upon request.

for constituencies stemming from their having a female legislator is about 25%. Evidence cited in the Introduction, showing that women politicians are more effective at delivering health and primary education (and hence, in creating human capital), suggests that the impact of women leaders on longer run growth may be even larger.

We find no evidence of negative spillovers from female-led constituencies. The evidence thus suggests considerable positive overall growth gains. The growth advantage conferred by women leaders is not apparent in observational data from India or from a cross-country database, but is evident once selection into office is accounted for.

We provide, as far as we know, the first causal estimates linking legislator gender to economic activity. A considerable body of evidence has demonstrated that women politicians more effectively represent the interests of women and children. As pro-female and pro-family policies are often associated with welfare payments, one may expect that widening the representation of women in government compromises growth, at least over a period as short as an electoral term. However, no previous work has attempted to investigate this. Our results reject such concerns, establishing that not only is growth unharmed but, indeed, it is enhanced under women's leadership.

Investigating mechanisms, we find that women are only about a third as likely as men to be carrying pending criminal charges when they enter office; their assets grow by about 10 percentage points per annum less while in office (a measure of rent-seeking); and for an equal number of funded village road contracts, the share of incomplete road projects is 22 percentage points lower. We find that women are good for growth only in non-swing constituencies, consistent with male legislators exerting additional effort or averting corruption in swing constituencies in which electoral incentives are sharper. All of these results are consistent with women being less corrupt, more effective and less opportunistic (in terms of being less responsive to electoral incentives).

Laboratory evidence, cited earlier, suggests that there are inherent differences in preferences between women and men (fairness, altruism, higher risk aversion, lower over-confidence) that are predictive of corrupt or criminal behaviour, and other studies, cited earlier, indicate that women may have stronger intrinsic motivation in occupations that generate public benefits. For these reasons, we may find that women legislators outperform men in many environments. We find some evidence that the gender gap in legislator performance is smaller in the more developed states of India, and in the the sample of constituencies in which the legislator has a college education. In both cases, this is consistent with lower criminality and corruption among men in these sub-samples, in particular, a smaller gender gap in criminality and corruption. Thus, to the extent that opportunities for corruption are more limited in more developed countries, women may be especially effective relative to men at producing growth in less developed countries.

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Table 1: Legislator Gender and Luminosity Growth

	(1)	(2)	(3)	(4)	(5)
	Growth of $Light_{t+1}$				
	Local Linear				Local Quadratic
	IK (h)	h/2	2h	IK (h) with Covariates	IK (h)
Female MLA_t	15.25**	16.97*	8.52**	10.53**	17.11*
	[6.12]	[8.96]	[3.79]	[4.40]	[9.42]
R^2	0.03	0.03	0.02	0.75	0.03
N	584	316	980	428	584
Bandwidth	6.68	3.34	13.36	6.68	6.68

The dependent variable is the growth of light, ,(Log($Light_{t+1}$+1)-Log($Light_t$+1))*100, per year (averaged over an election term). Female MLA_t is a dummy variable which is 1 for a female legislator and 0 for a male legislator in mixed gender races in which a female either won or was a runnerup against a male. Column (1) reports estimates from a local linear regression of Growth of Lightt+1 on Female MLAt, using a bandwidth determined by Imbens and Kalyanaraman (2012) optimal bandwidth calculator. The forcing variable is margin of victory ($margin_t$), which is the difference between voteshares of the female and male candidates. Columns (2) and (3) halve and double the optimal bandwidth. Column (4) additionally controls for the predetermined covariates, constituency and time fixed effects. The pre-determined covariates are: Log Electors t-1, Number Candidates t-1, Turnout t-1, Female Turnout t-1, Female MLA t-1, Incumbent t-1, Female Party Head t-1, SC-reserved Constituency t-1, ST-reserved Constituency t-1, Aligned with State Govt t-1, Aligned with Central Govt t-1. Column (5) uses a local quadratic smoothing function. The kernel used is triangular. The following it true for this and all subsequent tables unless noted otherwise. The standard errors are clustered at the constituency level. The number of observations with in the given bandwidth is denoted by N. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 2: Robustness tests

	(1)	(2)	(3)	(4)
	Growth of $Light_{t+1}$			
	Local Linear			
	Without outliers	With alternative margin	Neighbor sample	Party affilation
Female MLA_t	7.18**	14.78***	15.52**	13.52**
	[3.61]	[5.50]	[6.54]	[5.90]
INC				6.32**
				[2.69]
BJP				1.79
				[3.44]
R^2	0.02	0.02	0.03	0.04
N	568	685	553	584
Bandwidth	6.61	7.55	7.4	6.68

The dependent variable in Model (1), (2), and (4) is the growth of light, ,$(\text{Log}(\text{Light}_{t+1}+1)\text{-Log}(\text{Light}_t+1))*100$, per year, averaged over an election term. In Model (3) for each constituency, the dependent variable is defined as the average growth of light, $(\text{Log}(\text{Light}_{t+1}+1)\text{- Log}(\text{Light}_t+1))*100$ in neighboring constituencies, averaged over an election term. Model (1) drops constituency-election terms with growth of light above and below 100%. Model (2) uses a forcing variable that is defined as the difference between voteshares of the top-placed female and top-placed male candidates (irrespective if they are the top 2 candidates or not). Model (3) uses a sample that only consists the female-led constituencies and their neighbors. The neighbors are defined as the constituencies that share boundaries with any female-led constituencies. See the paper for details. Model (4) controls for the party of the MLA by means of two dumies that are 1 if the MLA belongs to the INC (Congress Party) or the BJP, respectively. See also Notes to Table 1.

Table 3: Legislator Gender and Asset Growth

	(1)	(2)	(3)	(4)	(5)
	Growth of Assets				
	Local Linear				Local Quadratic
	IK (h)	h/2	2h	IK (h) with Covariates	IK (h)
Female MLA_t	-0.50*	-0.61	-0.03	-0.48**	-0.76*
	[0.25]	[0.45]	[0.28]	[0.22]	[0.41]
R^2	0.01	0.01	0	0.12	0.01
N	383	176	734	340	383
Bandwidth	3.27	1.63	6.54	3.27	3.27

The dependent variable is the average growth rate of net assets over the election term, ($\text{Log}(\text{Assets}_{t+1}+1)$- $\text{Log}(\text{Assets}_t +1)$). The sample is restricted to candidates in mixed gender races who re-contest. Female MLA_t is a dummy variable which is 1 for a female legislator and 0 for a male legislator.
The standard errors are clustered at the state level. See also Notes to Table 1

Table 4: Legislator Gender and Road Completion

	(1)	(2)	(3)	(4)	(5)
	Road Projects				
	Local Linear				Local Quadratic
	IK (h)	h/2	2h	IK (h) with Covariates	IK (h)
	Panel A: Share of Incomplete Road Projects				
Female MLA	-0.22*	-0.26*	-0.17*	-0.22**	-0.35*
	[0.12]	[0.15]	[0.08]	[0.09]	[0.18]
R^2	0.04	0.11	0.03	0.83	0.05
N	122	63	226	67	122
Bandwidth	3.29	1.64	6.58	3.29	3.29
	Panel B: Number of Road Projects Awarded				
Female MLA	-1.13	-1.38	-0.88	0.05	-1.08
	[0.85]	[1.12]	[0.69]	[0.94]	[1.25]
R^2	0.01	0.03	0.01	0.43	0.02
N	255	134	435	110	255
Bandwidth	6.11	3.05	12.21	6.11	6.11

In Panel A, the dependent variable is the share of projects that remain incomplete in total projects awarded, averaged over an election term, and in Panel B, the dependent variable is the number of projects awarded. See also Notes to Table 1.

Table 5: Legislator Gender and Luminosity Growth: Swing vs Core constituencies

	(1)	(2)	(3)	(4)	(5)
	Local Linear				Local Quadratic
	IK (h)	h/2	2h	IK (h) with Covariates	IK (h)
	Panel A: Swing constituencies				
Female MLA_t	3.9	8.11	2.84	-1.97	7.12
	[7.23]	[16.12]	[4.14]	[2.99]	[16.44]
R^2	0.01	0.01	0.01	0.36	0.01
N	234	132	328	201	234
Bandwidth	10.59	5.3	21.18	21.18	10.59
	Panel B: Non-swing constituencies				
Female MLA_t	13.76**	16.13*	7.26	9.27*	16.36*
	[6.56]	[8.83]	[4.58]	[5.11]	[9.45]
R^2	0.03	0.03	0.01	0.38	0.03
N	387	217	648	329	387
Bandwidth	7.87	3.94	15.75	15.75	7.87

Swing constituencies are constituencies where the margin of victory was below 5% in the previous election. Covariates in Column (4) include predetermined variables, state and time fixed effects. We omit the constituency fixed effects in Column (4) due to insufficient within-constituency variation in the subsamples. See Notes to Table 1.

Table 6: Legislator Gender: Results by State-Level Development

	(1)	(2)	(3)
	Growth of Light	Share Roads Incomplete	Growth of Assets
	Panel A: Less Developed States		
Female MLAs	20.37*	-0.19	-0.73***
	[10.56]	[0.16]	[0.22]
R^2	0.03	0.02	0.02
N	258	72	251
Bandwidth	5.45	3.42	3.52
	Panel B: More Developed States		
Female MLAs	9.16	-0.25	0.19
	[5.75]	[0.19]	[0.25]
R^2	0.02	0.1	0.03
N	322	57	159
Bandwidth	8.3	3.62	3.44

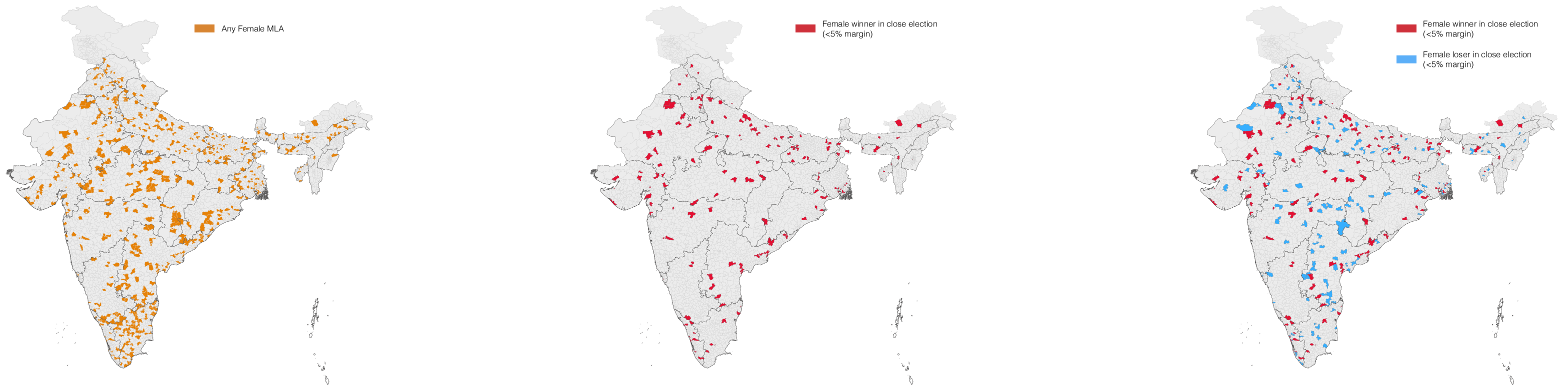
The Development Indicator (HDI) for all Indian states in available from a 1999 report. We define a state as less developed if the HDI is less than the median HDI. Based on this definition, the following states are classified as less developed: Andhra Pradesh, Assam, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh, and Uttarakhand. Source : "Indian Human Development Report, 2011 – Towards Social Inclusion" Institute of Applied Manpower Research, Planning Commission, Government of India. All models use the specification in model 1 of Table 1. See Notes to Table 1.

Table 7: Legislator Gender and Luminosity Growth: Spillovers to Neighboring Constituencies

	(1)	(2)	(3)	(4)	(5)
	Neighbor Average Growth of $Light_{t+1}$				
	Local Linear				Local Quadratic
	IK (h)	h/2	2h	IK (h) with Covariates	IK (h)
Female MLA_t	2.83	0.89	1.6	4.66*	1.46
	[1.76]	[2.39]	[1.26]	[2.66]	[2.54]
R^2	0.01	0.01	0	0.84	0.01
N	576	309	965	426	576
Bandwidth	6.63	3.31	13.25	6.63	6.63

For each constituency, the dependent variable is defined as the average growth of light, $(\text{Log}(Light_{t+1}+1)- \text{Log}(Light_t+1))*100$ in neighboring constituencies, averaged over an election term. See the paper for details. See Notes to Table 1.

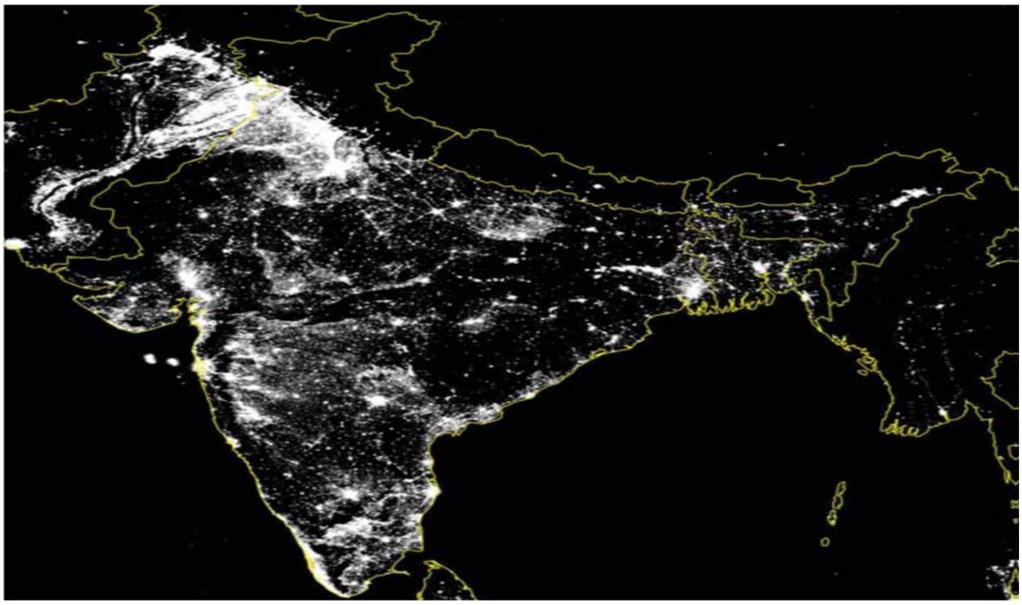
Figure 1: Female Legislators: 1992-2008.



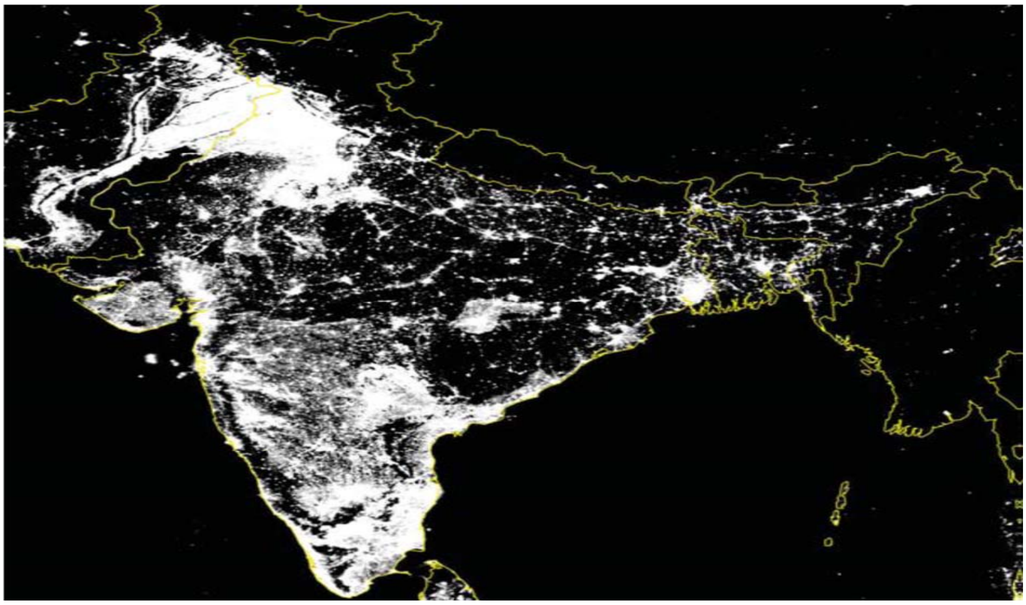
(a) Women MLAs / all races (b) Women MLAs / close races (c) Women and male MLAs / close races

Note: Subfigure (a) indicates constituencies in which a female candidate won an assembly constituency seat in state elections between 1992 and 2008. Subfigure (b) indicates constituencies in which the female candidate won in a close mixed-gender election. Subfigure (c) additionally shows constituencies where the female candidate lost in a close mixed-gender election.

Figure 2: Level of luminosity in India.



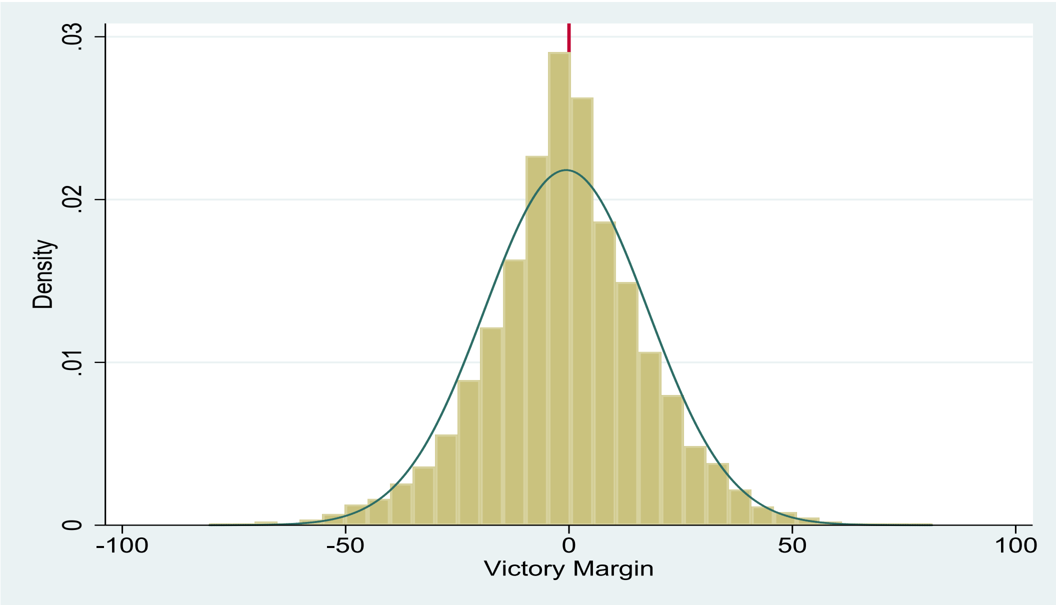
(a) Luminosity in 1992



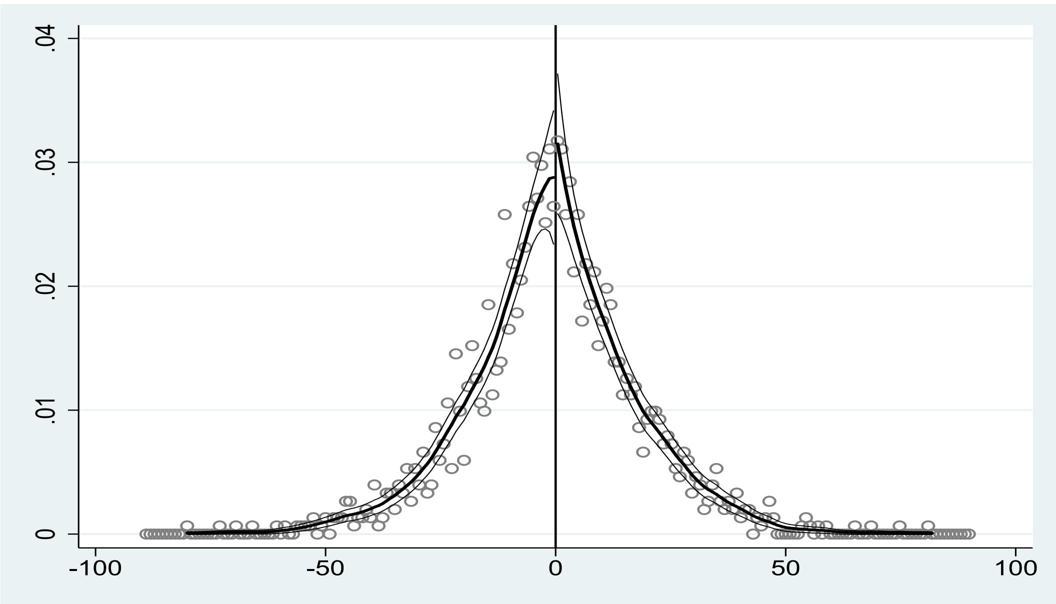
(b) Luminosity in 2009

Note: Subfigures (a) and (b) show the level of average luminosity in India in 1992 and 2009, respectively. The average growth rate of GDP in India during this period was about 120%. Source for all figures: DMSP-OLS v4 Time Stable Annual Composites from NOAA National Geophysical Data Center.

Figure 3: Density of the Forcing Variable



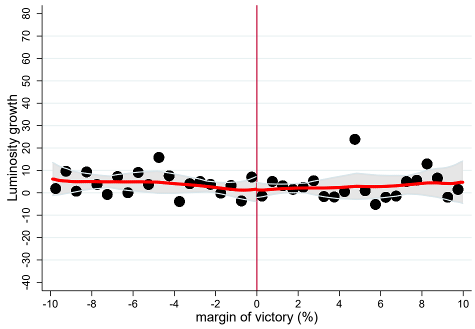
(a) Density of Victory Margin



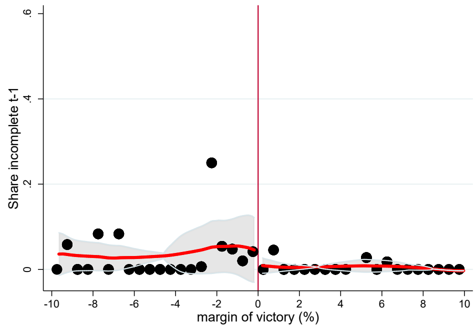
(b) McCrary's Density Test

The figures plot the density of the margin of victory, which is the difference between vote shares of the female and male candidates in mixed gender races. Mixed gender races are defined as those in which a man and a woman rank in the top two. By construction, margin of victory is positive for female legislators and negative for male legislators. The magnitude of the discontinuity (log difference in height) is 0.13 (with a standard error of 0.15).

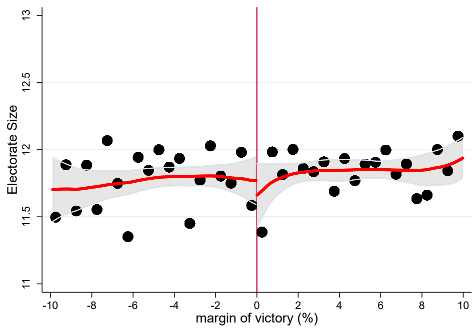
Figure 4: Continuity Checks



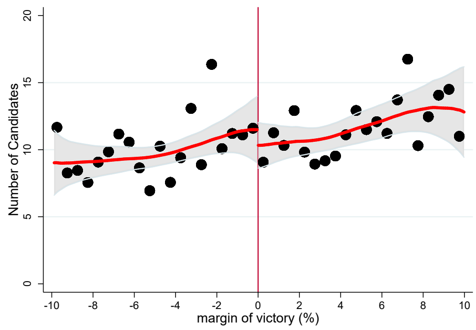
(a) Growth of Light in t-1



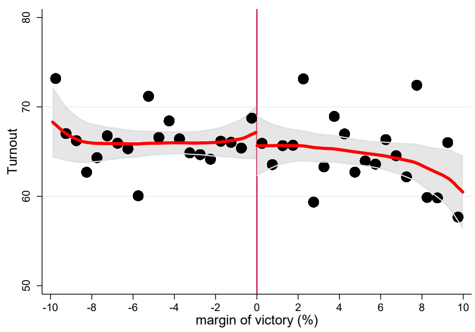
(b) Share Incomplete Roads in t-1



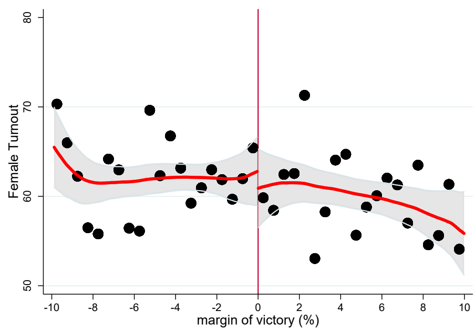
(c) Electorate Size in t-1



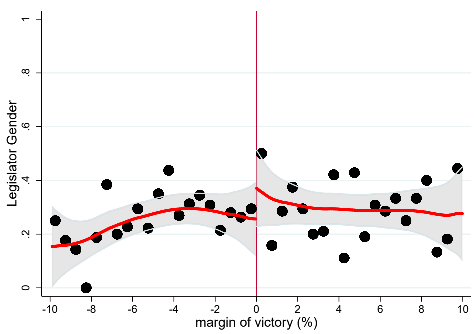
(d) Number of candidates in t-1



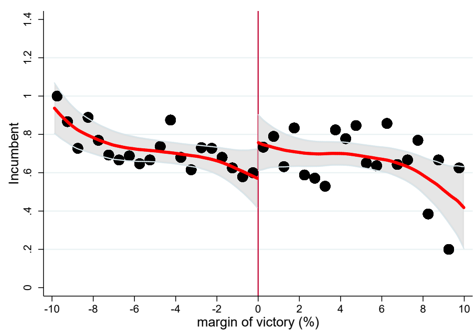
(e) Turnout in t-1



(f) Female Turnout in t-1

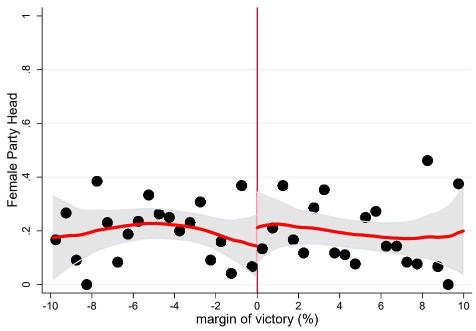


(g) Female legislator in t-1

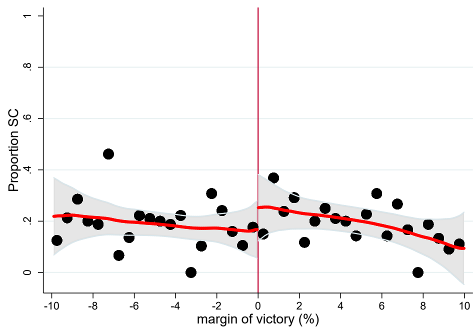


(h) Incumbent in t-1

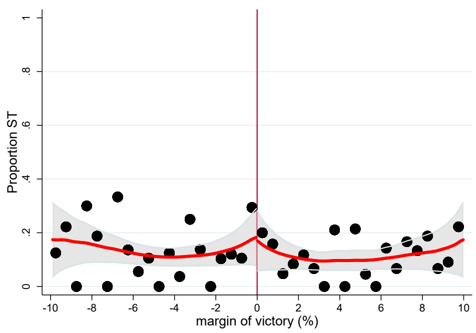
Figure 4: Continuity Checks



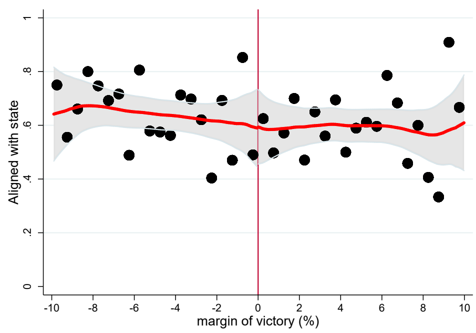
(i) Female party head in t-1



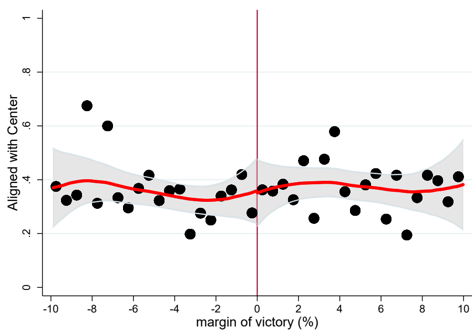
(j) SC-reserved constituency in t-1



(k) ST-reserved constituency in t-1



(l) Aligned with state government in t-1



(m) Aligned with central government in t-1

Each variable is plotted against female margin of victory in mixed gender races, which is the difference between vote shares of a female candidate and male candidate in mixed gender races. Mixed gender races are in which a woman either won or was a runnerup against a man. By construction, margin of victory is positive for female legislators and negative for male legislators. Each dot represents a local average in bins of 0.5 percent margin of victory. The solid lines are the smooth curves estimated using a local linear regression of each variable on margin of victory separately on either side of the cutoff of zero, triangular kernel and a 5 percent bandwidth. The figures also depict a 95 percent confidence interval for each variable around the solid curve.

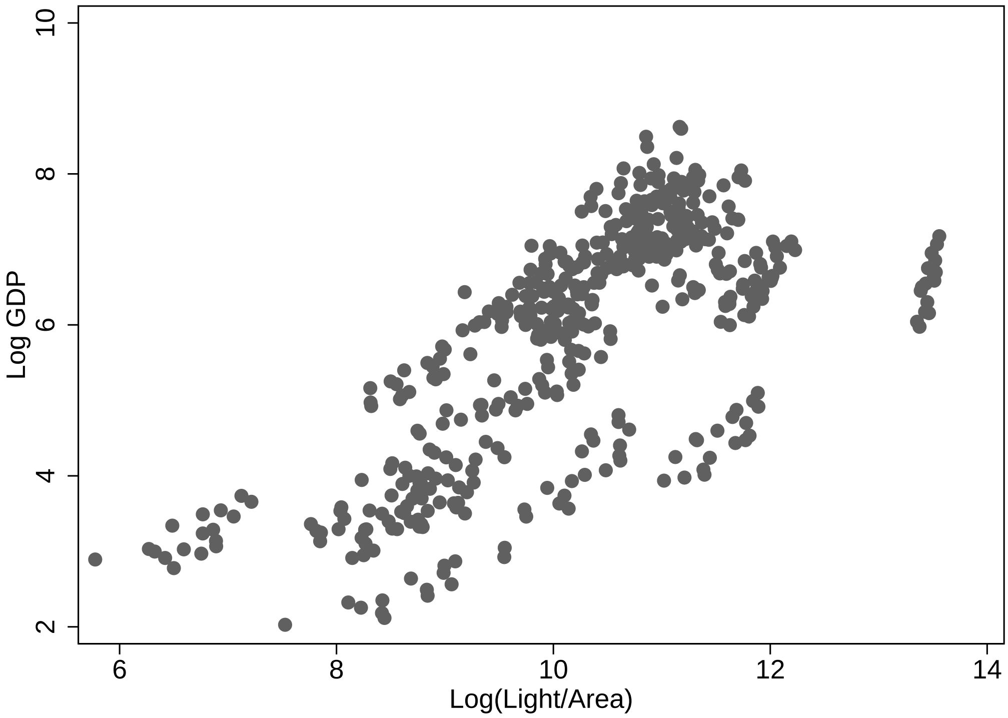
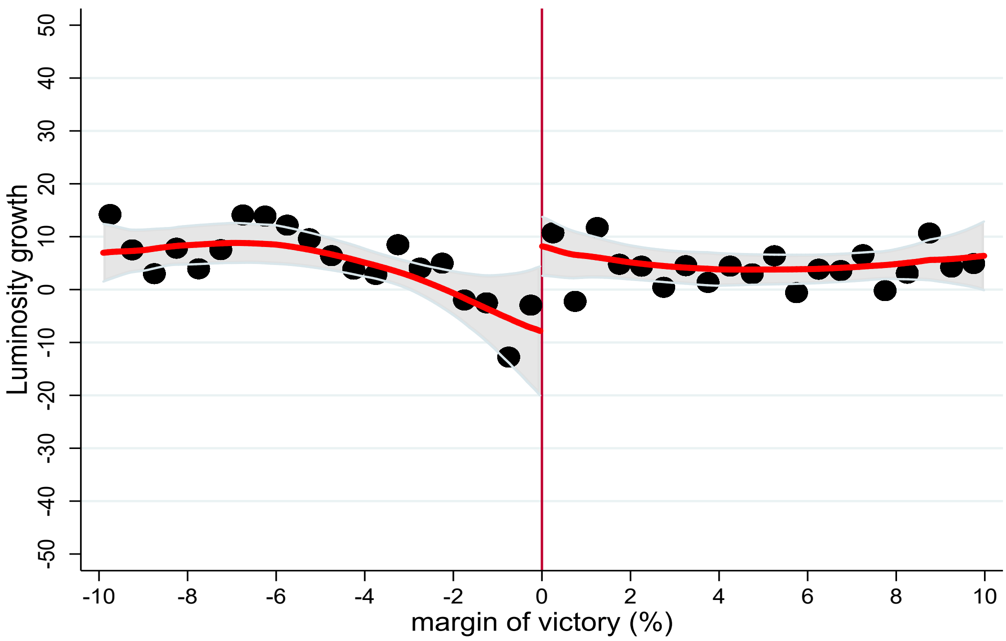


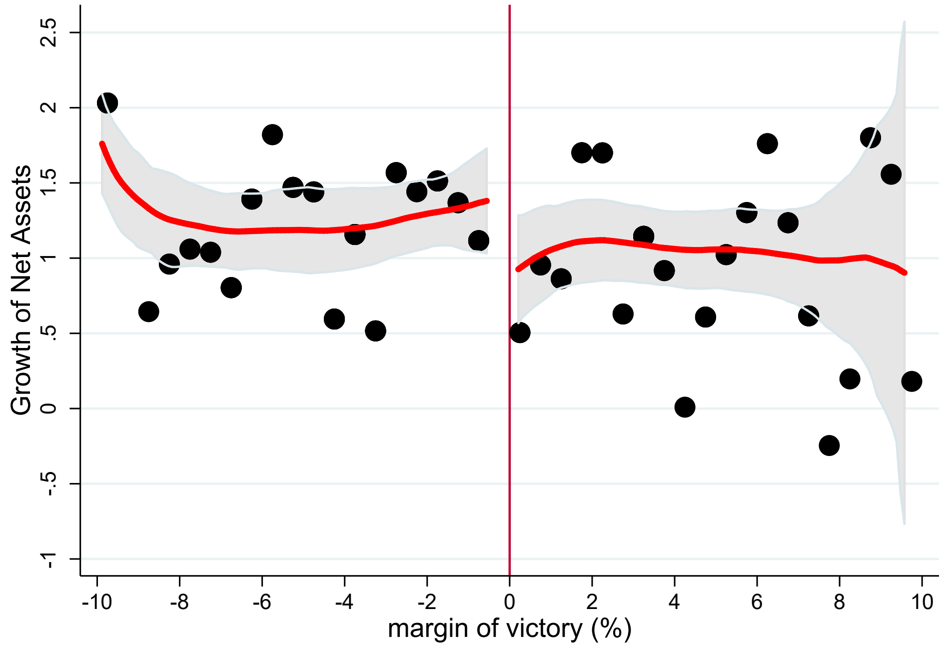
Figure 5: Scatter of GDP against Night Light Luminosity: State data Note: Log(Light/Area) is the natural log of total light output of a state in a given year divided by its geographical area. Log(GDP) is the natural log of real GDP for each state. The time period is 1992-2009.

Figure 6: Legislator Gender and Luminosity Growth



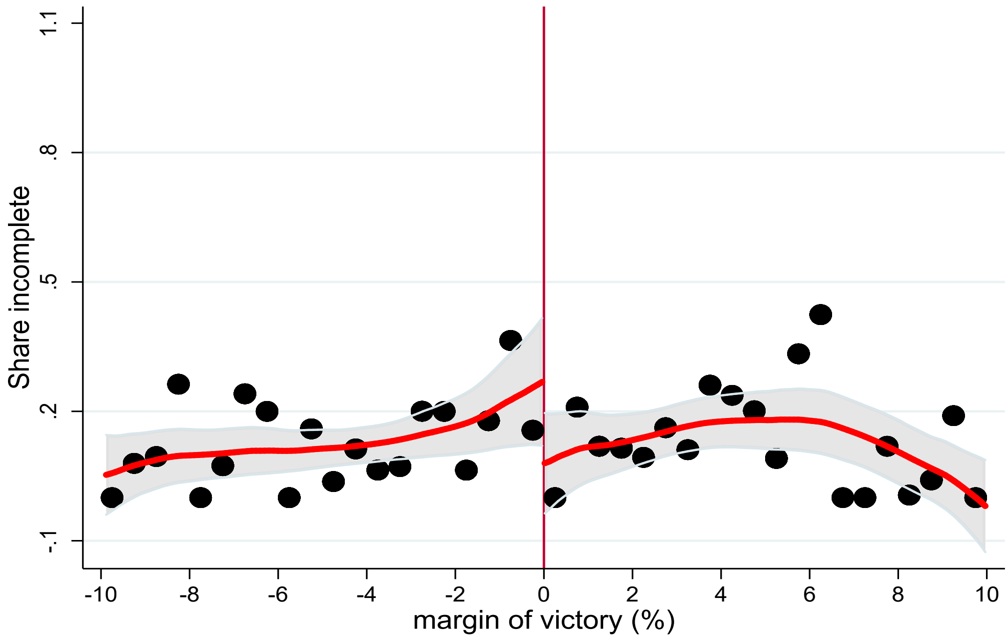
The dependent variable is the growth of light averaged over an election term against female margin of victory in mixed gender races. The victory margin is the difference between the vote shares of the female and male candidate in mixed gender races. These are races in which a man and a woman are the top two vote-winners. By construction, the margin of victory is positive when women win and negative when men win. Each dot represents a local average in bins of 0.5 percent margin of victory. The solid lines are the smooth curves estimated using a local linear regression of each variable on margin of victory separately on either side of the cutoff of zero, using a triangular kernel and a 5 percent bandwidth. The figures also depict a 95 percent confidence interval for each variable around the solid curve.

Figure 7: Legislator Gender and Asset Growth



The dependent variable is the growth of net assets plotted against margin of victory, which is the difference between the voteshares of the female and male candidates who rank in the top-2 vote winners in mixed-gender elections. The sample is restricted to candidates who re-contest. See the paper. Each dot represents a local average in bins of 0.5 percent margin of victory. The solid lines are the smooth curves estimated using a local linear regression of each variable on margin of victory separately on either side of the cutooff of zero, using a triangular kernel and a 5 percent bandwidth. The figure also depicts a 95 percent confidence interval for each variable around the solid curve.

Figure 8: Legislator Gender and Share of Incomplete Roads



The dependent variable is the share of incomplete roads averaged over an election term plotted against the female margin of victory in mixed gender races, which is the difference between the vote shares of the female and male candidate. Mixed gender races are races in which a woman and a man are among the top two vote winners. By construction, the margin of victory is positive when women win and negative when men win. Each dot represents a local average in bins of 0.5 percent margin of victory. The solid lines are the smooth curves estimated using a local linear regression of each variable on margin of victory separately on either side of the cutoff of zero, using a triangular kernel and a 5 percent bandwidth. The figures also depict a 95 percent confidence interval for each variable around the solid curve.

Table A.1: Variable definitions and data availability

Variable	Definition (Years of Data Availability)
Growth of Light Density	[Log((Light Output/Area)+1)i,t+1-Log((Light Output/Area)+1)i,t]×100 (1992-2012)
Share of Incomplete Projects	Number of incomplete projects / Number of projects awarded (2004-2012)
Log Electors	Natural log of number of registered voters (1992-2012)
Number Candidates	Number of candidates contesting (1992-2012)
Turnout (%)	Percentage of registered voter turned out to vote (1992-2012)
Female Turnout (%)	Percentage of registered women voter turned out to vote (1992-2012)
Female MLA	is 1 if a woman won and 0 otherwise. (1992-2012)
Incumbent	is 1 if a candidate is incumbent and 0 otherwise (1992-2012)
Female Party Head	is 1 if a party is headed by a woman and 0 otherwise (1992-2012)
SC-reserved Constituency	is 1 if the constituency is reserved for a Scheduled Caste (SC) candidate and 0 otherwise (1992-2012)
ST-reserved Constituency	is 1 if the constituency is reserved for a Scheduled Tribe (ST) candidate and 0 otherwise (1992-2012)
Aligned with State Govt	is 1 if the constituency was aligned with the state ruling party or coalition and 0 otherwise (1992-2012)
Aligned with Central Govt	is 1 if the constituency was aligned with the central ruling party or coalition and 0 otherwise (1992-2012)
Criminal	is 1 if a candidate has a criminal case pending against him or her and 0 otherwise (2004-2012)
Number of Criminal Cases	Total number of charges against the candidate (2004-2012)
Financial Crime Dummy	is 1 if a candidate has a criminal case that involves a loss to public exchequer pending against him or her and 0 otherwise (2004-2012)
Serious Crime Dummy	is 1 if a candidate has a criminal case that involves a serious charge (as defined by the ADR) against him or her and 0 otherwise (2004-2012)
College Educated	is 1 if a candidate has a college degree or higher and 0 otherwise (2004-2012)
MLA's Age	Age of an MLA in years (2004-2012)
Log Total Assets	Log(Total Assets+1) where Total Assets are the self-reported assets in the affidavits (2004-2012)
Log Total Liability	Log(Total Liabilities+1) where Total Liabilities are the self-reported liabilities in the affidavits (2004-2012)

Table A.2: Summary statistics

	Full Sample					Mixed Gender Sample				
	N	**Mean**	**SD**	**min**	**max**	**N**	**Mean**	**SD**	**min**	**max**
Panel A: Main Outcome Variables										
Growth of Light	15520	7.46	39.6	-829.8	916.3	1623	4.40	31.6	-829.8	318.2
Share of Incomplete Projects	4198	0.11	0.26	0	1	561	0.12	0.26	0	1
Growth of Net Assets	1766	1.00	0.90	-5.08	5.84	232	1.11	0.84	-1.06	4.04
Panel B: Predetermined Constituency Characteristics										
Log Electors t-1	12402	11.7	0.81	7.93	14.2	1377	11.8	0.61	8.76	13.1
Number Candidates t-1	10686	11.5	13.1	1	1033	1252	11.4	29.8	2	1033
Turnout t-1	12402	66.1	12.7	1.07	126.0	1377	65.3	11.7	4.48	96.1
Female Turnout t-1	10686	60.7	13.6	0.82	100.0	1252	61.0	13.2	4.32	95.7
Female MLA t-1	12402	0.050	0.22	0	1	1377	0.27	0.44	0	1
Incumbent t-1	10686	0.72	0.45	0	1	1252	0.69	0.46	0	1
Female Party Head t-1	10686	0.13	0.34	0	1	1252	0.16	0.37	0	1
SC-reserved Constituency t-1	12568	0.14	0.35	0	1	1393	0.20	0.40	0	1
ST-reserved Constituency t-1	12568	0.14	0.35	0	1	1393	0.13	0.33	0	1
Aligned with State Govt t-1	12568	0.61	0.48	0	1	1393	0.64	0.47	0	1
Aligned with Central Govt t-1	12402	0.33	0.41	0	1	1377	0.34	0.40	0	1
Panel C: Candidate Characteristics										
Criminal	3615	0.29	0.45	0	1	515	0.22	0.41	0	1
Number of Criminal Cases	2454	0.91	2.26	0	29	333	0.71	2.53	0	29
Financial Crime Dummy	2442	0.12	0.32	0	1	333	0.087	0.28	0	1
Serious Crime Dummy	2442	0.24	0.43	0	1	333	0.16	0.36	0	1
College Educated	2927	0.58	0.49	0	1	408	0.54	0.50	0	1
MLA's Age	3055	49.3	9.97	25	84	423	48.1	10.1	25	80
Total Assets ('000 Rs.)	3106	10771.2	31028.5	0	714083.8	430	9904.5	27855.4	0	330990.9
Total Liability ('000 Rs.)	2759	1102.6	6213.9	0	192653.3	375	686.8	3232.3	0	54852.6

Full Sample is the sample of the all races during the period 1992-2008. Mixed Gender sample is the sample of races where a female candidate placed either first or second against a male candidate. The unit of observation is an Assembly constituency. Each data point is a constituency-election year observation. For annual data, we compute election term averages. The source of the election data and candidate characterstics, such as criminal records, education, assets and liabilities, is the Election Commission of India. The source of night lights data is NOAA's National Geophysical Data Center.

Table A.3: Luminosity Elasticity of GDP Growth

	(1)	(2)	(3)
		Log(GDP)	
Log(Light/Area)	0.79***	0.72***	0.12**
	[0.15]	[0.05]	[0.05]
State Fixed Effects	No	Yes	Yes
Year Fixed Effects	No	No	Yes
R2	0.49	0.98	0.998
N	474	474	474

The above is a sample of 29 Indian states over the period 1992-2009. The standard errors are clustered at the state level and are in the parentheses. The symbols *, **, and *** indicate significane at the 10%, 5%, and 1% levels, respectively.

Table A.4: Balance in constituency characteristics, female vs. male legislators

	(1)	(2)	(3)	(4)	(5)	(6)
	All Mixed Gender races			**Mixed Gender Races within 5% margin**		
	Female Legislators	**Male Legislators**	**Difference**	**Female Legislators**	**Male Legislators**	**Difference**
Growth of Light Density t-1	3.505	6.761	-3.256	3.048	3.511	-0.464
	(29.052)	(42.261)	(2.042)	(30.402)	(30.140)	(3.200)
Share Incompete Projects t-1	0.032	0.032	-0.000	0.003	0.047	-0.044
	(0.150)	(0.127)	(0.016)	(0.021)	(0.175)	(0.027)
Log Electors t-1	11.825	11.777	0.047	11.815	11.818	-0.003
	(0.567)	(0.644)	(0.033)	(0.630)	(0.577)	(0.061)
Number Candidates t-1	10.761	11.903	-1.142	10.573	10.560	0.014
	(7.300)	(40.533)	(1.689)	(6.975)	(7.274)	(0.758)
Turnout t-1	64.993	65.580	-0.588	65.588	66.104	-0.516
	(12.104)	(11.326)	(0.632)	(11.542)	(10.427)	(1.119)
Female Turnout t-1	60.763	61.258	-0.494	61.192	62.262	-1.070
	(13.816)	(12.668)	(0.749)	(13.662)	(12.285)	(1.374)
Female MLA t-1	0.305	0.238	0.066***	0.311	0.301	0.009
	(0.461)	(0.426)	(0.024)	(0.464)	(0.460)	(0.047)
Incumbent t-1	0.666	0.707	-0.041	0.713	0.684	0.029
	(0.472)	(0.455)	(0.026)	(0.454)	(0.466)	(0.049)
Female Party Head t-1	0.152	0.176	-0.024	0.201	0.202	-0.001
	(0.359)	(0.381)	(0.021)	(0.402)	(0.403)	(0.043)
SC-reserved Constituency t-1	0.216	0.190	0.026	0.223	0.171	0.053
	(0.412)	(0.392)	(0.022)	(0.418)	(0.377)	(0.040)
ST-reserved Constituency t-1	0.113	0.137	-0.024	0.112	0.114	-0.002
	(0.317)	(0.344)	(0.018)	(0.316)	(0.318)	(0.032)
Aligned with State Govt t-1	0.627	0.656	-0.030	0.593	0.619	-0.026
	(0.476)	(0.468)	(0.025)	(0.482)	(0.474)	(0.049)
Aligned with Central Govt t-1	0.335	0.346	-0.012	0.390	0.322	0.068
	(0.395)	(0.411)	(0.022)	(0.408)	(0.410)	(0.042)

Columns (1)-(3) compare unconditional means of predetermined constituency variables between female-led constituencies with male-led constituencies in our mixed gender races sample. Columns (4)-(6) additionly condition the sample to close races that are decided by margin of 5% or less. Standard deviations in parentheses except in columns (3) and (6) which have standard errors in parentheses. The symbols *, **, and *** indicate significane at the 10%, 5%, and 1% levels from tests of no differences, respectively.

Table A.5: Balance in candidate characteristics, female vs. male legislators

	(1)	(2)	(3)	(4)	(5)	(6)
	All Mixed Gender races			**Mixed Gender Races within 5% margin**		
	Female Legislators	**Male Legislators**	**Difference**	**Female Legislators**	**Male Legislators**	**Difference**
Criminal	0.135	0.284	-0.149***	0.103	0.321	-0.218***
	(0.342)	(0.452)	(0.036)	(0.306)	(0.470)	(0.066)
Number of Criminal Cases	0.250	1.154	-0.904***	0.170	2.055	-1.885**
	(0.778)	(3.407)	(0.273)	(0.727)	(5.458)	(0.756)
Financial Crime Dummy	0.037	0.136	-0.100***	0.038	0.127	-0.090*
	(0.188)	(0.344)	(0.031)	(0.192)	(0.336)	(0.053)
Serious Crime Dummy	0.098	0.213	-0.115***	0.057	0.218	-0.162**
	(0.298)	(0.411)	(0.039)	(0.233)	(0.417)	(0.065)
College Educated	0.503	0.577	-0.075	0.460	0.565	-0.105
	(0.501)	(0.495)	(0.049)	(0.502)	(0.499)	(0.087)
MLA's Age	46.500	49.680	-3.180***	45.646	48.671	-3.025*
	(10.344)	(9.676)	(0.973)	(11.341)	(9.939)	(1.811)
Total Assets ('000 Rs.)	12588.207	7504.576	5083.631*	7859.415	6061.714	1797.701
	(37190.682)	(14978.659)	(2682.717)	(13907.696)	(9860.372)	(2026.900)
Total Liability ('000 Rs.)	777.249	605.144	172.105	741.619	724.553	17.066
	(4362.568)	(1653.743)	(334.589)	(2509.085)	(2337.882)	(443.373)

These candidate characteristics are available for elections held between 2004-2008 from the self-reported candidate affidavits. There is only election per state during the time period considered. Columns (1)-(3) compare unconditional means of candidate characteristics between female-led constituencies with male-led constituencies in our mixed gender races sample. Columns (4)-(6) additionly condition the sample to close races that are decided by margin of 5% or less. Standard deviations in parentheses except in columns (3) and (6) which have standard errors in parentheses. The symbols *, **, and *** indicate significane at the 10%, 5%, and 1% levels from tests of no differences, respectively.

Table A.6: Impact of Criminality of Legislator on Economic Growth

	(1)	(2)	(3)
	Full Sample	Only Males	Only Females
	Panel A: Growth of Light		
Criminal	-16.81**	-16.32**	-6.67
	[7.86]	[7.74]	[6.25]
R2	0.02	0.02	0.04
N	520	510	36
Bandwidth	6.44	7.02	8.39
	Panel B: Share Incomplete		
Criminal	0.15**	0.15**	0.06
	[0.07]	[0.07]	[0.15]
R2	0.03	0.03	0.26
N	162	150	17
Bandwidth	2.6	2.52	4.55
	Panel C: Growth of Assets		
Criminal	0.21	0.20	0.18
	[0.16]	[0.16]	[0.28]
R2	0.01	0.00	0.06
N	395	383	32
Bandwidth	3.43	3.52	4.76

See notes to Table 1. Criminal is a dummy variable which is 1 for a legislator with any criminal accusation and 0 for a legislator with no accusation. The forcing variable is margin of victory ($margin_t$), which is the difference between voteshares of the winning and runnerup candidates in races in which a candidate with criminal accusations either won or was the runnerup against a candidate with no accusations. Column (1) reports estimates from a local linear regression of Growth of Light (Panel A), Share of incomplete roads (Panel B), and Growth of Assets (Panel C) on the Criminal dummy for the full sample for which criminal accusation data is available from 2004 onwards. Columns (2) and (3) report the same results as in column (1) for males and females respectively.

Table A.7: Probability of Winning as a Function of Criminality

	(1)	(2)	(3)
	Probability of Winning		
	Panel A: Full Sample		
	OLS	IK(h)	IK(h) with covariates
Criminal	0.107***	-0.0424	-0.0855
	(0.0189)	(0.0596)	(0.0669)
N	2823	1227	977
	Panel B: Mixed Gender Sample		
Criminal	0.180***	0.0142	-0.0833
	(0.0534)	(0.175)	(0.204)
N	342	142	111

This table estimates the RD effect of criminally accused on probability of winning. In Panel A, the sample is races in which a candidate with criminal accusations either won or was the runnerup against a candidate with no accusations. In Panel B, the sample is mixed gender races in which a candidate with criminal accusations either won or was the runnerup against a candidate with no accusations. The dependent variables is a dummy variable which is 1 if a candidate wins and 0 otherwise. Criminal is a dummy variable which is 1 if a candidate has any criminal charges against him or her and 0 otherwise.

Table A.8: Legislator Gender and Luminosity Growth: Heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)
	Aligned	**Non-Aligned**	**Female Chief Minister**	**Male Chief Minister**	**Educated**	**Not Educated**
Female MLAs	15.67***	10.66	-5.33	17.56***	-2.29	65.95**
	[5.07]	[7.71]	[4.75]	[6.77]	[4.37]	[28.68]
R^2	0.04	0.02	0.04	0.03	0.02	0.21
N	337	332	101	511	121	80
Bandwidth	7.92	8.05	11.52	6.48	8.46	6.79

See notes to Table 1. Aligned constituencies are constituencies that were aligned with the state government in the election in year t. Female Chief Minister is 1 for the year in a state in which a female is the chief Minister (CM) for at least 6 months of the year and 0 otherwise. Educated is 1 for an MLA with a college degree and 0 otherwise. All models use the optimal IK bandwidth (the specification follows Column 1 in Table 1.)

Table A.9: Balance in constituency and candidate characteristics: close vs. non-close and mixed gender vs. non-mixed gender constituencies

	(1)	(2)	(3)	(4)	(5)	(6)
	Close vs Non Close			Mixed Gender vs Non Mixed Gender		
	Close	**Non-close**	**Difference**	**Mixed Gender**	**Non-Mixed Gender**	**Difference**
Panel A: Predetermined Constituency Characteristics						
Growth of Light Density t-1	3.293	5.974	-2.681	5.230	7.786	-2.556**
	(30.222)	(38.854)	(2.277)	(36.670)	(44.545)	(1.292)
Share Incompete Projects t-1	0.026	0.034	-0.008	0.032	0.047	-0.015
	(0.129)	(0.143)	(0.017)	(0.139)	(0.185)	(0.011)
Log Electors t-1	11.817	11.793	0.024	11.799	11.659	0.141***
	(0.601)	(0.613)	(0.037)	(0.610)	(0.829)	(0.023)
Number Candidates t-1	10.566	11.679	-1.114	11.362	11.566	-0.204
	(7.128)	(34.992)	(1.868)	(29.828)	(8.728)	(0.394)
Turnout t-1	65.868	65.087	0.781	65.306	66.241	-0.936**
	(10.941)	(11.975)	(0.702)	(11.695)	(12.833)	(0.363)
Female Turnout t-1	61.770	60.726	1.045	61.024	60.690	0.334
	(12.929)	(13.332)	(0.827)	(13.221)	(13.620)	(0.408)
Female MLA t-1	0.306	0.255	0.050*	0.269	0.023	0.246***
	(0.461)	(0.436)	(0.027)	(0.444)	(0.150)	(0.006)
Incumbent t-1	0.697	0.684	0.014	0.688	0.723	-0.036***
	(0.460)	(0.465)	(0.029)	(0.464)	(0.447)	(0.014)
Female Party Head t-1	0.202	0.150	0.052**	0.165	0.131	0.034***
	(0.402)	(0.357)	(0.023)	(0.371)	(0.337)	(0.010)
SC-reserved Constituency t-1	0.195	0.205	-0.010	0.202	0.131	0.071***
	(0.397)	(0.404)	(0.024)	(0.402)	(0.337)	(0.010)
ST-reserved Constituency t-1	0.113	0.131	-0.018	0.126	0.142	-0.016*
	(0.317)	(0.337)	(0.020)	(0.332)	(0.349)	(0.010)
Aligned with State Govt t-1	0.607	0.656	-0.049*	0.642	0.604	0.039***
	(0.477)	(0.469)	(0.028)	(0.472)	(0.480)	(0.014)
Aligned with Central Govt t-1	0.353	0.336	0.017	0.341	0.332	0.009
	(0.410)	(0.402)	(0.024)	(0.404)	(0.406)	(0.012)
Panel B: Candidate Characteristics						
Criminal	0.224	0.212	0.012	0.216	0.297	-0.082***
	(0.418)	(0.409)	(0.040)	(0.412)	(0.457)	(0.021)
Number of Criminal Cases	1.130	0.507	0.623**	0.709	0.936	-0.228*
	(4.024)	(1.261)	(0.294)	(2.525)	(2.219)	(0.133)
Financial Crime Dummy	0.083	0.089	-0.006	0.087	0.125	-0.038**
	(0.278)	(0.285)	(0.033)	(0.282)	(0.330)	(0.019)
Serious Crime Dummy	0.139	0.164	-0.026	0.156	0.250	-0.094***
	(0.347)	(0.372)	(0.043)	(0.364)	(0.433)	(0.025)
College Educated	0.515	0.554	-0.039	0.542	0.588	-0.046*
	(0.502)	(0.498)	(0.053)	(0.499)	(0.492)	(0.026)
MLA's Age	47.246	48.582	-1.336	48.147	49.473	-1.326**
	(10.691)	(9.818)	(1.048)	(10.118)	(9.919)	(0.521)
Total Assets ('000 Rs.)	6902.366	11338.543	-4436.177	9904.523	10910.411	-1005.888
	(11914.105)	(32770.404	(2867.379)	(27855.378)	(31511.198	(1612.232)
Total Liability ('000 Rs.)	732.233	665.473	66.760	686.836	1168.046	-481.209
	(2406.121)	(3559.485)	(358.284)	(3232.302)	(6558.791)	(345.142)

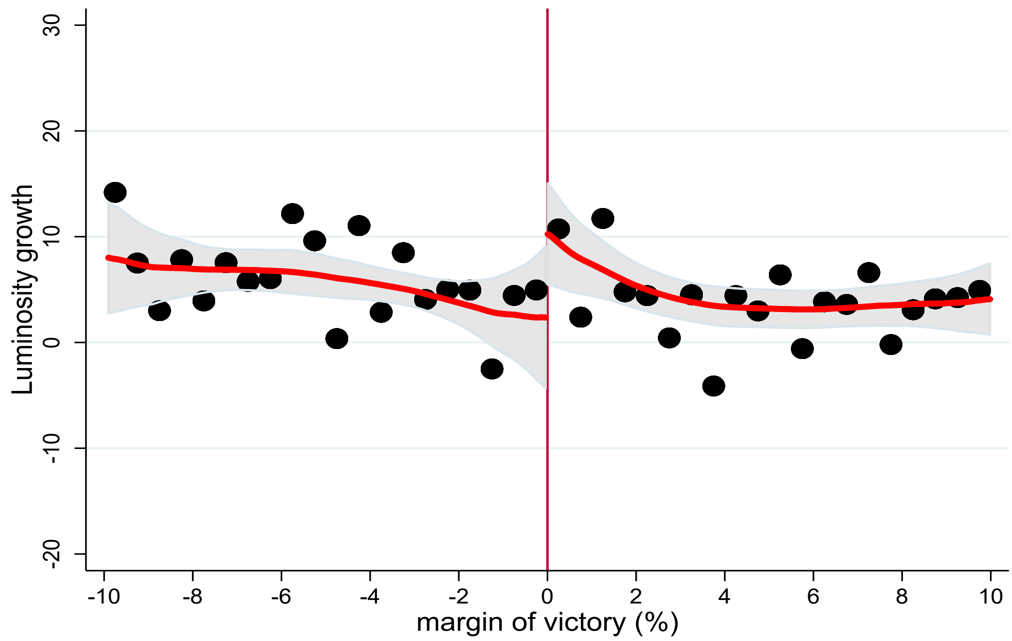
Columns (1)-(3) compare mixed gender races in which victory margin was within 5% with mixed gender races with a larger victory margin. Columns (4)-(6) compare mixed gender races with non-mixed gender races. Mixed Gender races are the sample of races where a female candidate placed either first or second against a male candidate. Standard deviations in parentheses except in columns (3) and (6) which have standard errors in parentheses. The symbols *, **, and *** indicate significane at the 10%, 5%, and 1% levels from tests of no differences , respectively.

Table A.10: RD Check for Road Completion- Constituency population thresholds

	(1)	(2)	(3)
	Average Village Population	Proportion of Villages with Population>=500	Proportion of Villages with Population>=1000
Female MLA_t	155.1	-0.0764	0.00707
	(500.10)	(0.10)	(0.12)
Bandwidth	10.7	2.27	3.23
N	281	72	104

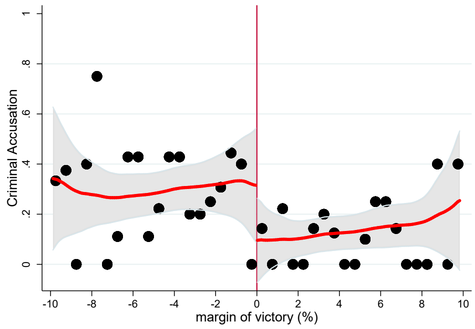
The village population data is from 2001 census. Female MLA_t is a dummy variable which is 1 for a female legislator and 0 for a male legislator in mixed gender races. The forcing variable is margin of victory ($margin_t$), which is the difference between voteshares of the winning and runnerup candidates in mixed gender races. Column (1) reports estimates from a local linear regression of average village population on Female MLA_t, using a bandwidth determined by Imbens and Kalyanaraman (2012) optimal bandwidth calculator. The dependent variables are proportion of villages with population of 500 or more in Column (2) and proportion of villages with population of 1000 or more in Column (3). The kernel used is trianglular and standard errors are in parentheses.

Figure A.1: Legislator Gender and Luminosity Growth: Without Outliers

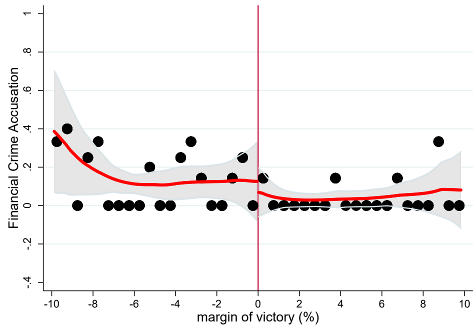


The dependent variable is the growth of light averaged over an election term against female margin of victory in mixed gender races. To account for outliers, we drop observations with an absolute value of light growth over 100. The victory margin is the difference between the vote shares of the female and male candidate in mixed gender races. These are races in which a man and a woman are the top two vote-winners. By construction, the margin of victory is positive when women win and negative when men win. Each dot represents a local average in bins of 0.5 percent margin of victory. The solid lines are the smooth curves estimated using a local linear regression of each variable on margin of victory separately on either side of the cutoff of zero, using a triangular kernel and a 5 percent bandwidth. The figures also depict a 95 percent confidence interval for each variable around the solid curve.

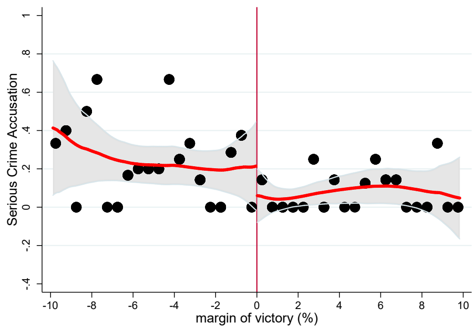
Figure A.2: Differences in legislator characteristics



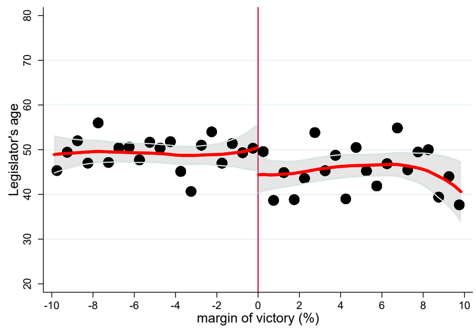
(a) Criminal



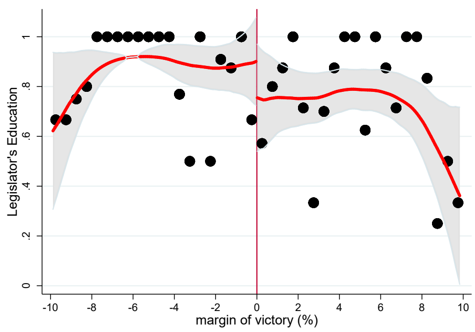
(b) Financial crime dummy



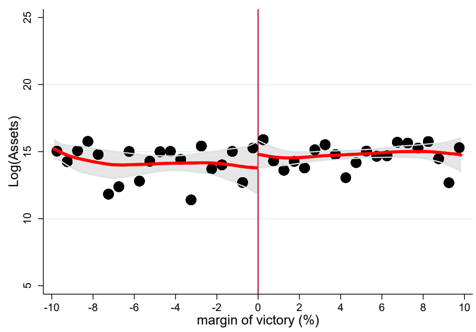
(c) Serious crime dummy



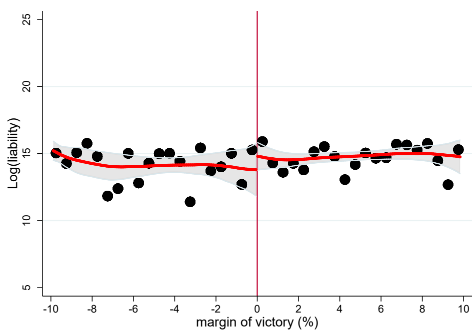
(d) Winner's age



(e) Education

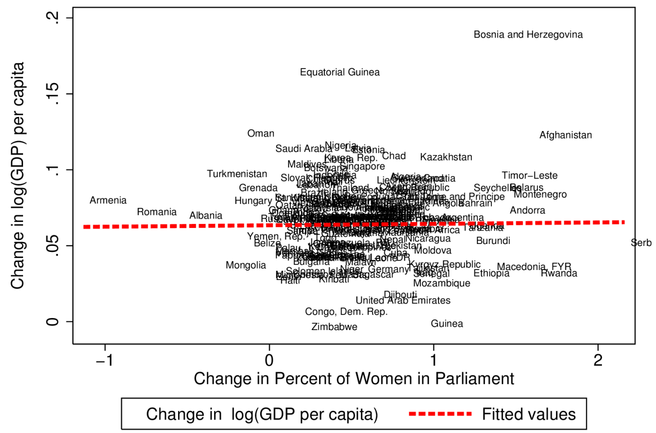


(f) Total Assets



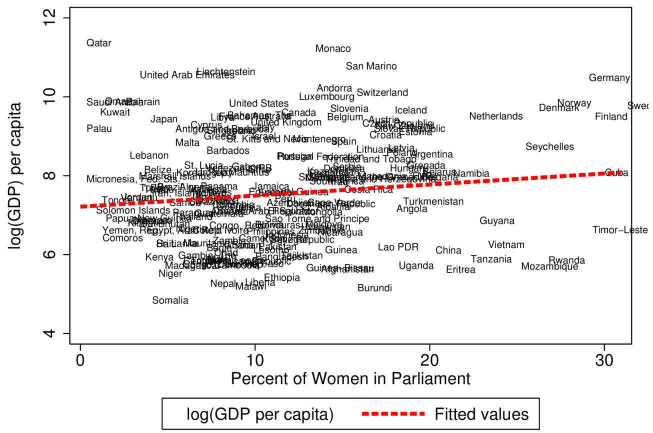
(g) Total Liabilities

Each variable is plotted against female margin of victory in mixed gender races, which is the difference between vote shares of a female candidate and male candidate in mixed gender races. Mixed gender races are in which a woman either won or was a runnerup against a man. By construction, margin of victory is positive for female legislators and negative for male legislators. Each dot represents a local average in bins of 0.5 percent margin of victory. The solid lines are the smooth curves estimated using a local linear regression of each variable on margin of victory separately on either side of the cutoff of zero, triangular kernel and a 5 percent bandwidth. The figures also depict a 95 percent confidence interval for each variable around the solid curve.



Averages for 1961–2012. Women in parliament is measured by WDI, ICPSR and the UN.

(h)



Averages for 1961–2012. Women in parliament is measured by WDI, ICPSR and the UN.

(i)

Figure A.3: Cross-country relationship between women in parliament and economic growth