

# Gender, Electoral Competition, and Sanitation in India

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## **Abstract**

Although electoral competition is important for government responsiveness, the women and politics literature pays little attention to this factor when considering whether female politicians make different policy choices from their male counterparts. This study does so by examining policy outcomes regarding sanitation, a basic service that disproportionately affects women. Drawing from district-level data across fifteen major states in India from 2006 to 2011, this paper exploits the quasi-randomness of the gender of the winner in very close elections to estimate the influence of female legislators on providing better quality latrines. The results show that, even after considering the role of electoral competition, female politicians are more likely to deliver high-quality latrines, which suggest they make decisions in ways that are better for women's well-being.

## **Gender, Electoral Competition, and Sanitation in India**

*YuJung Julia Lee*

A central question in the literature on women in politics is whether female representatives make different policy choices than their male counterparts. So far, empirical research has shown that female politicians are more likely to favor policies that benefit women, children, and family.<sup>1</sup> However, these gender-based preferences have not been considered together with electoral competition that, in theory, plays a central role in motivating the degree to which all politicians respond to their constituents. Because female politicians, just like their male counterparts, act within electoral constraints in order to be in office, it is important to consider their influence on policy making. How does electoral competition shape women's representation of women-friendly issues? I address this question by investigating how access to sanitation facilities in rural India is affected by female representation and electoral concerns.

As of 2015, 2.4 billion people worldwide are still without access to improved sanitation.<sup>2</sup> Poor sanitation causes waterborne diseases, most notably diarrhea. Studies show that the quality of household latrine facilities is an important determinant of malnutrition and child mortality.<sup>3</sup> Furthermore, the United Nations and other development organizations note that women disproportionately bear the cost of poor quality latrines compared to men.<sup>4</sup> However, despite these negative effects, sanitation and latrine quality have received less attention in the public goods literature compared to other basic services such as electricity or clean water.

Given that female politicians are more likely to have a stronger desire to improve sanitation because they are more aware of its benefits for women and children, I explore the link between politicians' gender, electoral competition, and access to latrines. In order to test for causal effects, I exploit the quasi-randomness of the gender of the winner by using only women who won in highly competitive elections against a male candidate in fifteen major Indian states from 2006 to 2011. This acts as a proxy to measure the influence of female state legislators without potential bias since the gender of the winner is effectively random in very close races.<sup>5</sup> To provide support for this estimation strategy, I show that districts with and without female winners from close elections between a male and female candidate have similar observable characteristics, including voter turnout, literacy rates, and other political and demographic factors.

The results show that in areas with very close races between a male and female candidate, female state legislators increase access to high-quality latrines. In contrast, competitive elections in general are associated with increased access to latrines, but they tend to be low-quality latrines. Taken together, the findings show that while competitive elections motivate politicians to increase the level of basic services for their constituents, they do not ensure the quality of the services. Female politicians, once elected, make different decisions regarding women-friendly issues compared to their male counterparts by prioritizing the delivery of high-quality services, like latrine access, because of the greater impact they have on women's well-being. .

This study makes several contributions to the literature on women and policymaking in democracies. First, it examines public goods provision with an emphasis on the delivery of better quality services. To the best of my knowledge, it is the first study to analyze variation in sanitation services by differentiating between low and high quality latrines. This is important because the higher the quality of the latrine facility, the more likely it is to produce the intended health benefits.

Therefore, access to high quality latrines will make a significant difference to the quality of life for women. Second, this study evaluates women's representation in a setting without quota seats. A number of studies in developing country contexts have shown the impact of women representatives in settings where legislators have reserved seats for women.<sup>6</sup> Chattopadhyay and Duflo (2004) find that female entry into local governments in India results in favorable policy outputs for women.<sup>7</sup> From these studies, however, it is unclear whether female politicians can still promote women-friendly policies when quotas are not in place and are subject to the same electoral constraints as their male counterparts. Analyzing public goods allocation in a context without quotas for women helps refine arguments about female representation.

## **Theoretical Framework**

**Politicians' Gender and Electoral Competition in Policymaking** A large literature on women and politics investigates policy differences between men and women in office regarding public goods provision. Numerous studies argue that women legislators are more likely than men to promote "women-friendly" policies that increase the welfare of women, children, and family.<sup>8</sup> A wide range of empirical evidence supports this such as the tendency of women to take leadership roles, actively introduce and pass bills, and predominantly be in committees related to child care, family health, education, and welfare.<sup>9</sup> Additionally, studies suggest that female leaders are more likely than their male counterparts to contribute to the funding of public goods,<sup>10</sup> interact with a wider group of people in the investment decision-making process,<sup>11</sup> be more socially-minded in their spending,<sup>12</sup> and engage less in corrupt activities while in office.<sup>13</sup>

These empirical studies, however, are largely based on developed country cases, where

women's effectiveness partly comes from having a critical mass in the legislature. It is hard to generalize from these cases to the situation in developing countries where breaking the glass ceiling may be more difficult and women are represented in relatively smaller numbers. Existing studies also focus on a variety of policies from daycare policies to fairness in the workplace, which may not be a priority for women in developing countries.<sup>14</sup> Research in developing countries shows that gender issues are far more pronounced in development policies related to health, poverty, and education. This suggests that the specific issues and legislation constituting "women-friendly" policy may be different.<sup>15</sup>

The women and politics literature has also investigated whether female politicians are more likely to advance women's issues, but without considering a central factor in achieving government responsiveness in democracies: electoral competition. Because many female politicians act within a competitive electoral environment just like their male counterparts, their decisions can change when faced with intense competition. Theoretically, electoral competition improves public goods provision because it ensures that office-seeking politicians respond to citizens' demands.<sup>16</sup> For politicians, increasing access to basic services when faced with tougher competition may be a winning strategy to gain votes. This means that politicians must make decisions on how to improve basic services in ways that maximize their electoral returns. However, in the research so far the intersection between electoral competition and gender remains obscure, and there is a need to examine to what extent gender-based preferences are advanced or hindered by electoral competition. Thus, this article attempts to measure the influence of female politicians' presence on policy outcomes regarding a basic service that affects women's well-being, within the context of elections.

**Sanitation as a Women-Friendly Issue** Sanitation is one of the least accessible basic services in the developing world, and one that most affects women and children. In India, over 60 percent of the population lacked access to improved sanitation facilities in 2012, which is substantially worse than the average for middle- and low-income countries (44 percent).<sup>17</sup>

The positive impact of increasing access to improved sanitation is more pronounced for women's well-being than men's for several reasons. The World Bank argues that the primary benefit of having improved sanitation for women is related to productive time gained from preventing water-borne diseases. It estimates that the economic loss from inadequate sanitation in India in 2006 was 48 USD per capita, which amounts to 6.4 percent of the country's GDP in the same year.<sup>18</sup> The main contributors to these costs (71.6 percent of total economic loss) are productive time losses of caregivers looking after illnesses in the family and costs associated with child deaths due to diarrhea and malnutrition caused by poor hygiene. A lack of school sanitation facilities has also been linked to frequent school absences and lower educational attainment for girls.<sup>19</sup> Most of the cost from time losses are borne by women because they are the primary caregivers to children who are sick or absent from school.

Furthermore, the benefits of having access to latrines for women are related to the increased risks associated with the practice of open defecation such as exposure to physical and sexual violence.<sup>20</sup> Studies that trace the experience of women in select rural areas of states such as Odisha and Maharashtra find evidence of emotional stress associated with the practice of open defecation that comes from feelings of shame and vulnerability as well as social restrictions on how women should behave in public spaces.<sup>21</sup> Because of these risks, women search longer for safer places to practice open defecation, and this is additional productive time lost for women.<sup>22</sup> Collectively, these factors show that having access to improved latrines is likely to have a larger impact on the

well-being of women than men.

The role of gender in the effective implementation of sanitation policies has also been noted by practitioners. Agencies under the United Nations view inaccessibility to quality latrine facilities as a violation of human dignity, and women's organizations in India have organized movements demanding latrines.<sup>23</sup> Policy analysts have noted that the success of sanitation programs depends on increased women's involvement, and that the projects are more likely to be sustained when women are actively engaged in the management of these resources.<sup>24</sup>

Because the health benefits of sanitation for women depend on the extent to which a latrine facility prevents water-borne diseases, it is necessary to distinguish between high-quality and low-quality latrines. According to the World Health Organization (WHO) and the United Nations Children's Fund's Joint Monitoring Programme (JMP) for Water Supply and Sanitation, latrines can be categorized as "improved" or "unimproved" facilities, depending on whether they are designed to hygienically remove human waste without human contact to avoid the spread of bacteria.

Following JMP's definition, improved latrines, also referred to as high-quality latrines in this study, are flush latrines connected to septic tanks or piped sewers, pit latrines with slabs, and ventilated improved pits.<sup>25</sup> For example, these include pit latrines with cement slabs as covers or ventilation pipes that prevent flies that are attracted by the odors and transport and spread communicable diseases. On the other hand, unimproved or low-quality latrines are pit latrines without covers or ventilation. Among unimproved latrines, the most problematic in terms of health hazards are service latrines, which are dry pits from which human excreta is removed by human (usually from lower caste) or animal (usually pigs) scavengers.<sup>26</sup> Shared latrines are also included in the low-quality latrine category due to their tendency to be poorly maintained and unsanitary.<sup>27</sup>

Several studies emphasize the health benefits of high-quality latrines compared to other types. WHO, for instance, claims that upgrading from an unimproved to an improved latrine facility reduces overall child mortality by about one third.<sup>28</sup> Similarly, a metastudy based on Demographic and Health Surveys in seventy developing countries from 1986 to 2007 finds that flush toilets reduce the likelihood of child mortality by about 23 percent compared to low quality pit latrines, and it finds similar results for child stunting and diarrhea.<sup>29</sup> Another study shows that having sanitation facilities has a more significant impact on children's health, especially for reducing diarrhea-related mortality, than access to clean water.<sup>30</sup> In India, it is estimated that improved sanitation alone can reduce deaths from diarrhea by 32 percent.<sup>31</sup>

Having high-quality latrines also increases the chances that toilets will actually be used. A major obstacle in overcoming preferences for open defecation is cultural, including beliefs about purity rooted in the caste system. These notions of purity discourage the use of unimproved pit latrines due to the human contact required for cleaning them.<sup>32</sup> This suggests that having improved latrines, such as flush toilets, that do not require human contact for emptying, would encourage usage, which is necessary if it is going to bring about the intended health benefits.

**Hypotheses** In this section, I develop testable hypotheses that aim to explain how preferences regarding sanitation provision may differ between male and female politicians. The existing women and politics literature referenced above suggests that if politicians' genders affect their policy preferences, female politicians are more likely than men to promote women-friendly policies, such as improved sanitation. In particular, female politicians will invest in sanitation in ways that maximize the benefits of sanitation access for women by providing more improved or high-quality latrines, and high-quality latrines are more likely to improve women's well-being in

terms of physical and emotional health and their ability to engage in productive activities in their daily life. Therefore, female politicians should have a stronger preference than men to invest in improved latrines as opposed to unimproved ones, even after controlling for electoral competition. Thus, I hypothesize:

*H1. All else equal, areas with a greater presence of female politicians are more likely to have high-quality latrine facilities than areas with a lower presence of female politicians. (Gender hypothesis.)*

However, if politicians are chiefly motivated by office-seeking goals, then there is an electoral risk in making policy choices solely based on personal preferences. With a desire to stay in office, politicians must make decisions on how to improve basic services in ways that maximize their electoral returns. One strategy politicians may choose when facing competitive elections is to devote resources to sanitation access in ways that increase the visibility of their actions, so that it is easier for voters to observe and evaluate their actions. For sanitation, it is easier for voters to observe the overall quantity of latrines constructed in their community; however, it is harder for voters to obtain the information required to evaluate latrine quality. In other words, the quality of a new latrine (whether it is an improved latrine or not) is less obvious. If increasing the quantity of latrines is the goal, resources will be focused on building low-quality latrines, which are relatively cheaper and faster to construct.<sup>33</sup> Therefore, politicians facing highly competitive elections will have incentives to increase the quantity of latrines, even if they are lower quality facilities with minimal health benefits, in order to raise constituents' awareness of their efforts. This suggests:

*H2. Areas with smaller margins of victory are more likely to have low-quality latrines than areas with larger margins of victory. (Competitive election hypothesis.)*

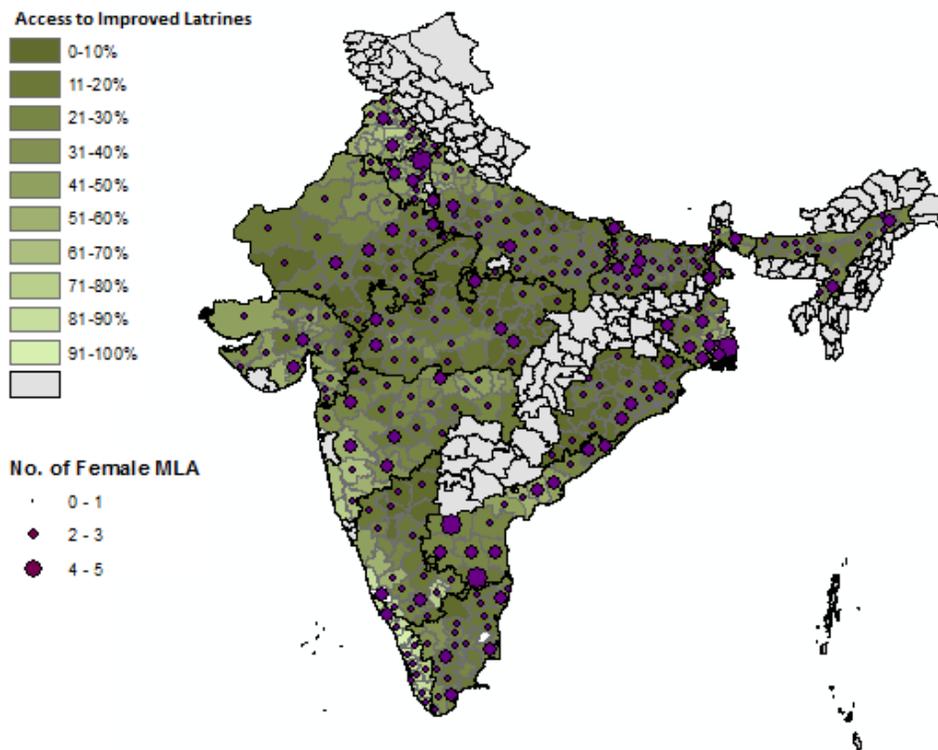
## **Context and Data**

**Policy and Institutional Context** The Indian government has adopted a decentralized approach towards improving sanitation. Under the Constitution of India, sanitation and water supply are state responsibilities, meaning sub-national state governments are in charge of planning, designing, implementing, and monitoring sanitation policies.<sup>34</sup> At the national level, the Ministry of Drinking Water and Sanitation, formerly a department under the Ministry of Rural Development, sets the framework for sanitation strategies in rural areas. For example, under the Total Sanitation Campaign (TSC) launched in 1999 by the central government to provide subsidies to rural households for latrine building, policies are implemented at the state and local level. Part of the national framework is for states to have a central agency such as the State Water and Sanitation Mission to coordinate among the different departments involved including rural development, women and child development, and public health engineering and to execute their policies more efficiently. Within a state, decision-making and the implementation of sanitation projects are usually conducted in coordination with the corresponding District Water and Sanitation Mission (DWSM). State legislators, as well as members of the national parliament, of the relevant constituencies are formal members of the DWSM. Many local projects on sanitation carried out by DWSMs rely heavily on state government funds and are also partially funded by the central government.

Perhaps the most important role of the state government is to educate and communicate to the public about hygiene and the benefits of sanitation. One of the main obstacles to improving sanitation is the social acceptance of open defecation. In rural India, open defecation is widely practiced without much community disapproval, even in places where there is access to sanitation, in part because there is little awareness about the health risks and environmental impact associated with the practice. Similar to other social practices, eliminating open defecation is a slow process because it requires a collective change in norms from community members. Recognizing this problem, communication and education about hygiene is a major component of sanitation campaigns today, and among the primary responsibilities of state governments. Under the TSC, funds are allocated to state governments to raise public awareness through mass media about the dangers of water-borne diseases caused by a lack of latrines and other unhygienic practices. States also train personnel who are able to provide technical assistance on latrine building to communities.

While the state government's responsibilities regarding sanitation include a range of activities such as budgeting, monitoring, communication, and education, the extent to which improvement is made in a given locality depends on the level of commitment and participation by state legislators. For example, a study of the activities of female legislators from thirteen assembly elections in Uttar Pradesh from 1952 to 1996 shows that they are primarily engaged in programs regarding water and sanitation problems, building schools, and promoting welfare policies for women, girls, and widows.<sup>35</sup>

**Figure 1:** Improved Latrines and Female Politicians in Districts of Fifteen States in India, 2011



Data: Census of India 2011. In accordance with the definition of improved latrines by WHO and UNICEF's Joint Monitoring Programme for Water Supply and Sanitation, improved latrines include flush latrines that are connected to septic tanks or piped sewers, pit latrines with slabs, and ventilated improved pits.

Although the number of women in state assemblies has steadily increased during the past decade, there is wide variation by state, and the overall figure still remains low. Among over 4,000 seats in state assemblies nationwide, from 2001 to 2011, an average of about 6.1 percent of the seats were held by women. In this article, the scope of the empirical analysis includes all districts in fifteen major states.<sup>36</sup> Figure 1 shows the district-level variation of improved latrines and female state legislators in these states, which covers about 90 percent of the total population in India. These states were chosen because they are considered by the Planning Commission as key drivers of the Indian economy, due to their large population sizes. This makes it more likely that the delivery of infrastructure and basic services such as sanitation will be prioritized.

**Data** From the 2011 India Census, I categorize high-quality latrines according to the aforementioned definition. From this source, I also take demographic variables, including the fraction of the population in a district living in rural areas, the fraction of the scheduled caste and scheduled tribe population, and female literacy rates. District-level poverty estimates are from Chaudhuri and Gupta, which are based on calculations using the 2004–2005 National Sample Survey Consumer Expenditure Survey data.<sup>37</sup>

Sanitation data are combined with state assembly election data from the Election Commission of India by aggregating the political data to the district level.<sup>38</sup> I use electoral results of state assemblies up to five years prior to the outcome variable (from 2006 to 2010). Because different states hold assembly elections in different years, choosing only the most recent election would result in different state governments to be in power for a varying number of years. This possibility is considered in the robustness section using the two most recent elections. Instead, the five year period allows for about two elections in each state to be analyzed and for a sufficient number of highly contested elections between male and female candidates to be included.

The proportion of female politicians is averaged across the five year period, meaning it is calculated by weighing the number of years from 2006 to 2010 in which the seat was held by a woman. All proportions are based on the total number of constituencies in each district except for the instrumental variable, which is based on the proportion of constituencies with very close elections between one female and one male candidate (see next section). In the subsample, about 41 percent of districts have at least one constituency seat with close elections between a male and female candidate. The average share of female politicians in a district is 11 percent. The average proportion of female winners from close races between a male and a female candidate in a district

is 18 percent. Descriptive statistics of all variables are in Table 1.

**Table 1: Descriptive Statistics**

unit of observation: district; scope: 15 major states, 2006-2011; n=295				
	mean	std.dev.	min.	max.
<u>A. Sanitation variables (2011)</u>				
Proportion of rural households with high-quality latrines	0.26	0.204	0.03	0.93
Proportion of rural households with low-quality latrines	0.07	0.098	0.01	0.55
<u>B. Electoral variables (2006-2010)</u>				
Average proportion of female politicians	0.11	0.104	0.00	0.50
Average proportion of female winners from close races between one male and one female candidate	0.18	0.343	0.00	1.00
Dummy for close election between one male and one female candidate	0.41	0.493	0.00	1.00
Average of winner's vote margin	0.11	0.078	0.00	0.46
Average proportion of politicians from ruling party	0.11	0.123	0.00	0.67
<u>C. District Characteristics</u>				
Rural population (% , 2011)	0.74	0.176	0.16	0.97
Female literacy rate (2011)	0.63	0.119	0.34	0.96
SC/ST population (% , 2011)	0.26	0.149	0.00	0.94
Poverty rate (2005)	0.26	0.187	0.00	0.87
Population growth rate (2001-2011)	0.18	0.074	-0.02	0.47
Open defecation rate (2001)	0.78	0.192	0.10	0.98

**Empirical Methods** The challenge of empirically testing the impact of female politicians on policy making is that districts where female politicians have won may be systematically different from districts in which they have not won. Therefore, latrine construction in these areas may be caused by factors other than being governed by a female politician. If so, regressing the fraction of women representatives on the share of available latrines in a linear model could produce biased estimates. In order to correct for this bias, the fraction of female politicians who won in closely contested elections against male candidates is used to instrument for the fraction of female representatives in each district.

The underlying idea of this instrumental variable is that in constituencies with highly contested

elections, the winner is effectively random in a sense that the top two candidates have an equal chance of winning. In these cases, where the top two runners happen to be of opposite gender, the outcome of the election is therefore determined not by the gender of the candidates, but instead by random chance. This means that other socioeconomic factors that may affect the attitude of voters towards women should be highly similar between races where a man wins with a very narrow margin and where a women wins with a very narrow margin, so that the winner's gender is as good as random.

Bhalotra and Clots-Figueras and Clots-Figueras also use this method to examine the impact of female politicians in India on aggregate health and development outcomes during periods prior to this study.<sup>39</sup> Following Clots-Figueras' work on India, I define close elections with the top two candidates being one man and one woman and with a vote margin of 3.5 percent or less.<sup>40</sup> This is a reasonable threshold to define highly competitive elections that allows a large enough sample size for analysis.

**Table 2.** Comparison of District Characteristics

unit: electoral year and district, 2002-2009			
		Districts without female winners from close elections compared to districts with female winners from close elections (close election sample)	Districts without close elections compared to districts with close elections (full sample)
Fraction of female candidates	diff.	-0.004	0.001
	std.err.	(0.014)	(0.009)
	n	168	447
Female turnout (%)	diff.	0.010	0.056
	std.err.	(0.027)	(0.040)
	n	168	447
Male turnout (%)	diff.	-0.029	-0.003
	std.err.	(0.089)	(0.053)
	n	168	447
Fraction of ruling party members	diff.	0.007	0.003
	std.err.	(0.020)	(0.012)
	n	168	447
Male literacy rates	diff.	-0.020	0.003
	std.err.	(0.015)	(0.010)
	n	155	413
Female literacy rates	diff.	-0.022	0.007
	std.err.	(0.021)	(0.014)
	n	155	413
Rural population (%)	diff.	-0.005	-0.006
	std.err.	(0.026)	(0.016)
	n	155	413
SC/ST population (%)	diff.	-0.026	0.019
	std.err.	(0.022)	(0.015)
	n	166	406

Notes: Mean differences reported with standard errors in parentheses. Samples include districts in 15 major states with at least one election where the top two candidates are one male and one female candidate. Close elections are defined as a winner with a margin of victory of 3.5% or less. Data sources: Election Commission of India, various years by state. India Census 2001, 2011.

To provide support for the “effectively random” assumption, I test for differences in various observable characteristics between districts with and without female winners among those that held close elections between a man and a woman. These district characteristics include the fraction of female candidates, voter turnout by gender, seats held by the ruling party, literacy rates by gender, rural population, and scheduled caste and scheduled tribe population. I also compare the same characteristics between districts that have held close elections between a man and a woman and districts that have not held close elections. These results are reported in Table 2, and additional

balance tests are in the online appendix (see robustness section).<sup>41</sup> The unit of analysis here is electoral year and district and includes electoral results from the years that are relevant for this study. The results of the balance test are reassuring in that they show that there are no significant differences in observable characteristics across different groups of districts.

With the instrumental variable, the following two-stage least squares regression analysis is used. The first stage is the bottom equation and the second stage is the top equation:

$$latrine_d = \beta_{20} + \beta_{21} * \widehat{fwin}_d + \beta_{22} * I_d + \beta_{23} * M_d + \beta_{24} * X_d + \gamma_s + \zeta_s \quad (1)$$

$$fwin_d = \beta_{10} + \beta_{11} * fwinclose_d + \beta_{12} * I_d + \beta_{13} * M_d + \beta_{14} * X_d + \gamma_s + \varepsilon_s \quad (2)$$

where the dependent variable is  $latrine_d$  for district  $d$  in 2011, which is measured by the proportion of rural households with high or low-quality latrines.

The main coefficient of interest is  $\beta_{21}$ , where  $fwin_d$  is the fraction of female state legislators out of the total number of constituency seats in a district. In the first stage (bottom equation),  $fwin_d$  is instrumented by  $fwinclose_d$ , which is the fraction of constituencies with female politicians who won in a close election against a male politician out of the total number of constituencies that held a close election between a male and female candidate (regardless of the gender of the winner) in district  $d$  averaged across all years from 2006 to 2010. Although the outcome of close elections is effectively random, whether or not a close election between a male and female candidate takes place is not. Therefore, I include an indicator variable  $I_d$  that is one if at least one of the constituencies held a close election between a male and female candidate. If there are no close elections between a male and female candidate in a district, the value is set to zero.

The vector  $M_d$  contains two political variables: one for the level of electoral competition and

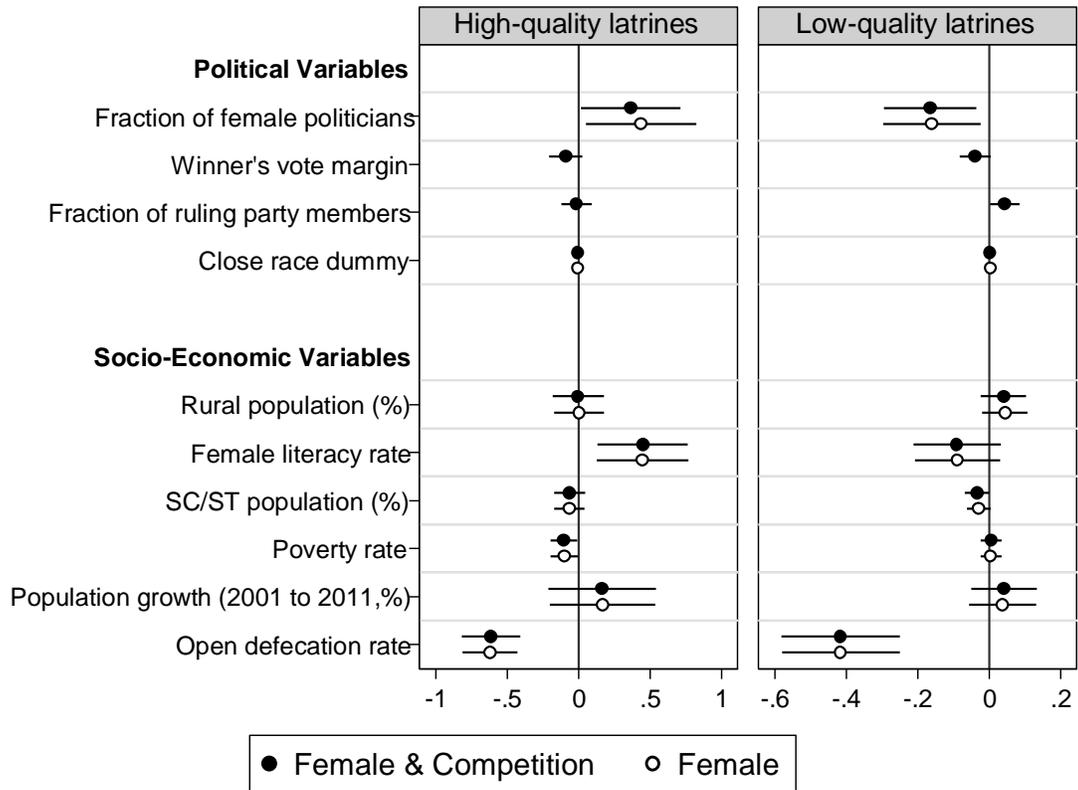
one for ruling party membership. The degree of electoral competitiveness is measured by the difference between the vote share of the winner minus the vote share of the runner-up averaged across all seats in a district. We should expect areas with smaller margins of victory and hence greater electoral competition to have more latrine coverage. Ruling party membership is measured by the proportion of seats in a district that are won by candidates in the same party as the state's Chief Minister. The ruling party has an incentive to display its competency for re-election, and thus it is easier for ruling party members to divert funds to their constituencies. Being a member of the party in government is also believed to be an advantage because ruling party members are likely to have greater access to resources that can widen latrine coverage.<sup>42</sup>

$X_d$  is a vector of socioeconomic variables. Female literacy rate is included because educated women are more likely to be aware of the negative health effects of not having access to sanitation or more open to hygienic practices and thus be more inclined to demand high-quality latrines from their representatives. The proportion of scheduled caste and scheduled tribe (SC/ST) populations in a district represents the size of historically disadvantaged members of the population, so these areas are less likely to have high-quality latrines. District-level poverty rates are included, and the expectation is to see districts with greater poverty having slower progress in the construction high-quality latrines. I include population growth in the past decade because those areas that experience rapid population growth are more likely to experience greater demand for more sanitation facilities than those that do not have population increases. The proportion of rural population in a district is included in consideration of the size of the target population of sanitation efforts, which are the rural population. I also include the open defecation rate in 2001 to control for initial levels of sanitation and the level of social acceptance of this practice. Because social norms take a long time to change, districts where open defecation was more prevalent ten

years ago are likely to have communities where this practice is considered less shameful and harder to correct, so the demand for latrines would be low. All models include state dummies  $\gamma_s$  to account for unobserved state-specific effects.

**Results** The results using the instrumental variable approach to correct for potential endogeneity in ordinary least squares estimates are presented in a coefficient plot in Figure 2. The white circles are the coefficients estimating the impact on improved latrines without controlling for electoral competitiveness (“female” model), and the black circles represent the full model that includes political controls (“female & competition” model). The graph includes confidence intervals at the 95 percent level in horizontal lines going through the coefficient points. The full results from ordinary least squares and instrumental variable estimates are in Appendix Tables A1 and A2.

**Figure 2: The Effect of Female Politicians and Electoral Competition on Sanitation in Rural India, 2006-2011**



Note: Plot shows coefficients estimated from 2SLS with 95 percent confidence intervals. Estimates from the full model are in black circles and the partial model that doesn't include political covariates on electoral competition are in white circles. State fixed effects are included in all models.

After using the fraction of female winners in very close races against males to proxy for the influence of female politicians in the state legislature, the results on the left panel show that the presence of female state legislators has a positive and statistically significant impact on increasing high-quality latrines in households at the 95 percent confidence level in both types of specifications. In fact, their impact on high-quality latrines is quite substantial even after controlling for the winner's vote margin and ruling party membership: An increase in female state legislators by 1 percentage point results in a 0.37 percentage point increase in the share of rural

households with improved latrines in districts with close elections. Moreover, the right panel shows that districts with more female politicians are less likely to have unimproved latrines, and the results are statistically significant as well. It should be noted that the results should be interpreted with caution because the instrumental variable approach limits the generalizability of the point estimates to districts with very close elections between male and female candidates. There are, however, other studies in India that have found differences in public goods provision between male and female leaders, which is broadly consistent with these findings.<sup>43</sup> Overall, the results show strong support for the gender hypothesis and suggests that, all else equal, female politicians have stronger preferences than their male counterparts for improving sanitation in ways that matter for women, which is by providing high-quality latrines.

In contrast, the results on the right panel show that the variation in low-quality latrines is associated with the degree of electoral competitiveness and ruling party membership. Districts with politicians elected from more competitive elections on average (measured by the winner having smaller margins of victory) are more likely to increase low-quality latrines. The coefficient on winner's vote margin is statistically significant at the 0.10 level. Consistent with the electoral competition hypothesis, with more competitive elections in general, politicians increase the visibility of their performance by providing low-quality latrines because it is an easier way to signal their performance to voters and gain positive recognition. The results also show a positive relationship between ruling party affiliation and low-quality latrines. This highlights the importance of the visibility effect, since ruling party members also have an incentive to focus on activities that are more easily observed by voters to continue their power. In contrast, when considering associations with high-quality latrines, the coefficients for "winner's vote margin" and "fraction of ruling party members" are in their expected direction, but are both statistically

insignificant. Together, these results point to the tradeoff that exists between investing in low-quality versus high-quality latrines.

Turning to the socioeconomic variables, the results show that higher female literacy rates have a positive and statistically significant association with high-quality latrines, but not low-quality ones. This finding is consistent with the competitive election results. If having more competitive elections produces a visibility effect, that is, if the observability of politicians' actions motivates their decisions, then barriers to information required to evaluate latrine quality are likely to make a difference. If there are high barriers to information, making it difficult for voters to discern between high and low-quality latrines, it is more likely that politicians will channel resources towards providing low-quality latrines that are easier to build in larger quantities and thus more visible. On the other hand, if it is less costly for voters to obtain information on latrine quality, it will be more desirable for politicians to increase high-quality latrines. One possible factor that helps lower barriers to information is female education. Following studies that show maternal literacy improves health outcomes for both mothers and their children, women with more education are more likely to be receptive to information on latrine quality and health.<sup>44</sup> This suggests that districts with higher female literacy rates will have more high-quality latrines.

The coefficient on open defecation rates shows a large negative and statistically significant relationship to access to latrines; districts with higher proportions of people practicing open defecation a decade ago are less likely to have latrines. This reflects the difficulty in overcoming the open defecation as a social norm. Districts with higher poverty rates are less likely to have high-quality latrines. Other covariates such as the size of SC/ST population do not have an effect.

## **Robustness**

The robustness of the results is tested through alternative specifications and validity checks of the model. Detailed results are in the online appendix starting from Table A3. Here, I only summarize the findings.

**Testing the Effectively Random Assumption** I conducted empirical tests for the validity of the instrumental variable (e.g., the weak instrument test). Following Olea and Pflueger, who extend Staiger and Stock's widely used test of weak instruments for clustered panel data, the result of the effective F-test rejects the null hypothesis that the instrument is weak.<sup>45</sup> The results were also robust against tests that took into consideration problems that could potentially arise from a small number of clusters.<sup>46</sup>

The point estimates on the fraction of female politicians using OLS estimates (Tables A1 and A2) are generally insignificant and smaller than when using the 2SLS estimation (Figure 2) across different specifications. The OLS coefficient is likely to have endogeneity issues due to voter characteristics that could affect women's victory in elections and sanitation preferences. The downward bias in OLS coefficients could be explained if, perhaps, the proportion of female winners were inversely related to a correlate of the level of sanitation (such as poor baseline health as discussed in Bhalotra and Clots-Figueras<sup>47</sup>).

As previously mentioned, I conducted additional balance tests that compared characteristics in districts where there is at least one female winner from a very close election to all other districts. The results in appendix Tables A5 and A6 show that districts with very close elections do not have systematically different characteristics related to the electorate and other socioeconomic factors from other districts and provide some support for the validity of the quasi-random assumption.

**Model Specifications** The robustness of the results, shown in appendix Tables A3 and A4, is tested through different specifications of the instrumental variable, with additional controls in the model, and through excluding an outlier case. I use a different denominator to calculate the instrumental variable. Clots-Figueras specifies the instrument by using female winners from close elections between men and women out of the total number of constituencies in a district, instead of out of the total number of constituencies with close elections in a district as used in this article.<sup>48</sup> Using this measure, the results in Table A4 show that the size of the coefficient and statistical significance are slightly reduced (significant at the 90 percent confidence level), but overall the model remains robust in terms of the direction for the main variable of interest, which is the influence of female politicians, and other covariates.

Next, I consider the long-run effect of legislator's gender, which allows the analysis to go beyond the five-year period. It may be easier for female legislators to implement their preferred policies in areas where there were previous female leaders who had already lowered some of the gender barriers that hinder women from pursuing policies in office. Thus, instead of examining electoral results that pertain to the past five years as in the current analysis, I rerun the model using the percent of female politicians during the entire duration of the past two governments prior to 2011, allowing for differences in the number of relevant years by state. State assembly members generally serve for five years so this measures a six to ten year effect depending on the state, which is a longer duration than in the original analysis.

The results in Table A3 show that having a history of female legislators has a positive influence on latrine provision, and the results are significant at the 90 percent level for high-quality latrines. The results also show a positive relationship between electoral competitiveness and low-quality latrines. The coefficient estimating the impact of female legislators in the past two governments

on high-quality latrines is 0.27, which is attenuated compared to baseline results that measures their influence in the past five years. This is reasonable since this analysis spans a longer number of years. The results suggest that having a longer history of female legislators may make it easier to implement women-friendly policies, perhaps by lowering traditional gender norms that may play out in the legislature that prevent female politicians from asserting their agenda.

In addition, I include in the model the fraction of children aged zero to six years to account for the fact that households with young children may have a greater desire for latrines (Table A4). Because young children are at the greatest risk of death from diarrhea caused by a lack of sanitation, households with children may prioritize having improved latrines. However, the results show that this is not a significant influence. Lastly, Assam is the only state where there are significantly lower portions of households with improved latrines compared to other states. To ensure that the results are not being driven by an outlier, I run the analysis without including Assam. In all the different specifications, the results remain robust and comparable to the original results.

## **Conclusion**

Taking the case of sanitation provision in India, this study evaluates whether female politicians make policy choices that are different from their male counterparts and not confounded by the role of electoral competition. The results show that among districts with very close races between a male and female candidate, the presence of female politicians has a positive impact on increasing household access to high-quality latrines, which have larger benefits for women's well-being than low-quality latrines. These results are robust even after considering the role of electoral competition. In contrast, access to low-quality latrines in a district is explained by the degree of

electoral competitiveness and ruling party membership. Other factors that increase the likelihood of having high-quality latrines in a district are higher female literacy rates, which help lower barriers to information required to recognize high-quality latrines, and low rates of open defecation, which reflect the difficulty of overcoming social norms and behavior.

These results are explained by a tradeoff between low-quality and high-quality latrines that influences how politicians make decisions on sanitation provision while responding to electoral pressure. Politicians' actions are more likely to be visible when the overall quantity of latrines in a community increases because voters need more information to evaluate differences between high- and low-quality latrines. Thus, more competitive elections motivate politicians to maximize electoral returns by providing low-quality latrines that are cheaper to build. However, the benefits to health and women's well-being from low-quality latrines are limited. Therefore, female legislators, who are more likely to implement women-friendly policies, have a greater tendency to provide high-quality latrines.

While the findings from close races limit the generalizability of the results, this study demonstrates gender differences in politicians' behavior even in highly competitive electoral environments, where the stakes could be higher. It also provides evidence of the impact of women in office in a context where there are few in number. For policymakers, it suggests a greater need for innovative ideas for shaping and making more visible the dialogue around hygiene, sanitation, and the importance of high-quality latrines

## NOTES

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<sup>1</sup> Sue Thomas, "The Impact of Women on State Legislative Policies," *The Journal of Politics*, 53 (November 1991), 958–76; Raghavendra Chattopadhyay and Esther Duflo, "Women as Policy Makers: Evidence from a Randomized Policy Experiment in India," *Econometrica*, 72 (September 2004), 1409–43.

<sup>2</sup> UNICEF and World Health Organization, *Progress on Sanitation and Drinking Water: 2015 Update and MDG Assessment* (Geneva: WHO Press, 2015).

<sup>3</sup> Günther Fink Isabel Günther Kenneth Hill, "The Effect of Water and Sanitation on Child Health: Evidence from the Demographic and Health Surveys 1986–2007," *International Journal of Epidemiology*, 40 (October 2011), 1196–1204; Santosh Kumar and Sebastian Vollmer, "Does Access to Improved Sanitation Reduce Childhood Diarrhea in Rural India?" *Health Economics*, 22 (April 2013), 410-427.

<sup>4</sup> World Bank, Water and Sanitation Program, "Gender in Water and Sanitation" (November 2010), available at: <https://www.wsp.org/sites/wsp.org/files/publications/WSP-gender-water-sanitation.pdf>; Joanna Pearson and Kate McPhdran. "A Literature Review of the Non-Health

Impacts of Sanitation,” *Waterlines*, 27 (January 2008), 48–61.

<sup>5</sup> David S. Lee, “Randomized Experiments from Non-Random Selection in US House Elections,” *Journal of Econometrics*, 142 (February 2008), 675–97.

<sup>6</sup> Susan Franceschet and Jennifer M. Piscopo, “Gender Quotas and Women’s Substantive Representation: Lessons from Argentina,” *Politics & Gender*, 4 (February 2008), 393–425.

<sup>7</sup> Chattopadhyay and Duflo 2004.

<sup>8</sup> Sue Thomas, *How Women Legislate* (New York: Oxford University Press, 1994); Sue Thomas and Susan Welch, “The Impact of Gender on Activities and Priorities of State Legislators,” *The Western Political Quarterly*, 44 (June 1991), 445–56.

<sup>9</sup> Michele Swers, “Research on Women in Legislatures: What Have We Learned, Where Are We Going?” in Karen O’Connor, ed., *Women and Congress: Running, Winning, and Ruling* (West Hazelton: Haworth Press, 2001), 167–85; Susan Carroll, *Representing Women: Women State Legislators as Agents of Policy-Related Change* (Bloomington: Indiana University Press, 2001), ch. 1; Thomas, 1994; Thomas and Welch, 1991, 445–56.

<sup>10</sup> Steffen Andersen, Erwin Bulte, Uri Gneezy, and John A. List, “Do Women Supply More Public Goods than Men? Preliminary Experimental Evidence from Matrilineal and Patriarchal Societies,” *American Economic Review*, 98 (May 2008), 376–81.

<sup>11</sup> Lyn Kathlene, “Words that Matter: Women’s Voice and Institutional Bias in Public Policy Formation.” in Susan J. Carroll, ed., *The Impact of Women in Public Office* (Bloomington: Indiana University Press, 2001), ch. 2.

<sup>12</sup> Catherine C. Eckel and Philip J. Grossman, “Differences in the Economic Decisions of Men and

Women: Experimental Evidence,” in Charles R. Plott and Vernon L. Smith, eds., *Handbook of Experimental Economics Results 1* (Oxford: North-Holland, 2008), ch. 57.

<sup>13</sup> Fernanda Brolo and Ugo Troiano, "What Happens When a Woman Wins an Election? Evidence from Close Races in Brazil," *Journal of Development Economics*, 122 (September 2016), 28–45.

<sup>14</sup> Kathleen A., Bratton and Leonard P. Ray, “Descriptive Representation, Policy Outcomes, and Municipal Day-care Coverage in Norway,” *American Journal of Political Science*, 46 (April 2002), 428–37.

<sup>15</sup> This is not to say, however, that women always have homogeneous preferences, and in fact the evidence is not always uniform across female politicians in the same country. For instance, Clots-Figueras (2012) finds that the degree to which female politicians in India promote primary school completion depends on their geographic location. The impact of female politicians on education is positive in urban areas but not in rural areas. See Irma Clots-Figueras, “Are Female Leaders Good for Education? Evidence from India” *American Economic Journal: Applied Economics*, 4 (January 2012), 212–44.

<sup>16</sup> Robert J. Barro, “The Control of Politicians: An Economic Model,” *Public Choice*, 14 (March 1973), 19–42; John Ferejohn, “Incumbent Performance and Electoral Control,” *Public Choice*, 50 (January 1986), 5–25.

<sup>17</sup> World Bank, *World Development Indicators 2012* (Washington D.C.: World Bank, 2012). Based on World Bank’s country income classification, where India is considered a lower-middle-income country.

- <sup>18</sup> World Bank, *Economic Impacts of Inadequate Sanitation in India*, Water and Sanitation Program (Washington, DC: World Bank, 2011).
- <sup>19</sup> Anjali Adukia, "Sanitation and Education," *American Economic Journal: Applied Economics*, 9 (April 2017), 23–59.
- <sup>20</sup> Kathleen O'Reilly, "From Toilet Insecurity to Toilet Security: Creating Safe Sanitation for Women and Girls," *WIREs Water*, 3 (January/February 2016), 19–24.
- <sup>21</sup> Krushna Chandra Sahoo, Kristyna R.S. Hulland, Bethany A. Caruso, Rojalin Swain, Matthew C. Freeman, Pinaki Panigrahi, and Robert Dreibelbis, "Sanitation-Related Psychosocial Stress: A Grounded Theory Study of Women across the Life-Course in Odisha, India," *Social Science & Medicine*, 139 (August 2015), 80–89; Siddhivinayak Hirve, Pallavi Lele, Neisha Sundaram, Uddhavi Chavan, Mitchell Weiss, Peter Steinmann, and Sanjay Juvekar. "Psychosocial Stress Associated with Sanitation Practices: Experiences of Women in a Rural Community in India," *Journal of Water Sanitation and Hygiene for Development*, 5 (March 2015), 115–26.
- <sup>22</sup> World Bank, 2011.
- <sup>23</sup> UNICEF and World Health Organization, 2015; A notable movement is the “No Toilet No Bride” campaign in Haryana, which has been studied by Yaniv Stopnitzky, “No Toilet No Bride? Intrahousehold Bargaining in Male-skewed Marriage Markets in India,” *Journal of Development Economics*, 127 (July 2017), 269–82.
- <sup>24</sup> Christine van Wijk-Sijbesma, *Gender in Water Resources Management, Water Supply and Sanitation: Roles and Realities Revisited*, IRC International Research Centre for Water and Sanitation (The Hague, The Netherlands: IRC, 1998).

- <sup>25</sup> Definition of improved latrines by JMP available at: <http://www.wssinfo.org/definitions-methods/watsan-categories/>.
- <sup>26</sup> In 2013, India passed a law banning manual scavenging by humans in pits but the practice is still common.
- <sup>27</sup> Shared latrines are also classified as unimproved latrines by JMP.
- <sup>28</sup> United Nations, “International Decade for Action ‘Water for Life’ 2005–2015,” available at: <http://www.un.org/waterforlifedecade/sanitation.shtml> <accessed on Oct 5, 2016>.
- <sup>29</sup> Fink et al., 2011.
- <sup>30</sup> Steven A. Esrey, James B. Potash, Leslie Roberts, and Clive Shiff, “Effects of Improved Water Supply and Sanitation on Ascariasis, Diarrhoea, Dracunculiasis, Hookworm Infection, Schistosomiasis, and Trachoma,” *Bulletin of the World Health Organization*, 69 (1991), 609–21.
- <sup>31</sup> World Bank, 2011.
- <sup>32</sup> Aashish Gupta, Diane Coffey, and Dean Spears, “Purity, Pollution, and Untouchability: Challenges Affecting the Adoption, Use, and Sustainability of Sanitation Programmes in Rural India,” in Petra Bongartz, Naomi Vernon, and John Fox, eds., *Sustainable Sanitation for All: Experiences, Challenges, and Innovations* (Warwickshire: Practical Action Publishing, 2016), ch. 17.
- <sup>33</sup> In India, the World Bank (2011) estimates that a latrine with a septic tank (a high-quality latrine) is most expensive in terms of new installations, upgrades from an unimproved type of latrine, and maintenance compared to other types of latrines.
- <sup>34</sup> India is a parliamentary democracy with three tiers of government: central, state, and local.

According to the 73rd and 74th Constitutional Amendments, states may give the responsibility to provide public goods to local governments (called Panchayati Raj). Therefore, the degree of decentralization of sanitation-related responsibilities from state to local governments differ by state. However, state governments remain to be an important actor in sanitation provision in all cases. Each state has its own legislative assembly and the size of the legislative assembly depends on the population of the state. State legislative assemblies, with lower houses called Vidhan Sabha, are made up of members who generally serve for five years, unless dissolved earlier. And after that elections are held for all seats in the assembly. Assembly elections are held in different years for different states. Since India's independence in 1947, women have had the right to run for political office. Although there have been attempts to pass bills to reserve seats for women in state and national level governments, unlike local governments that reserve one-third of their seats for women, gender quotas at higher levels of government have not yet been established.

<sup>35</sup> Pitnam Singh and J.K. Pundir, "Women Legislators in UP: Background, Emergence and Role," *Economic and Political Weekly*, 37 (March 2002), 923–28. There is also anecdotal evidence of assembly members conducting inspections on the progress of sanitation by visiting their constituencies or working with local NGOs in promoting awareness on sanitation.

<sup>36</sup> Out of the 29 states in India, the 15 states included in this article are Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal.

<sup>37</sup> Siladitya Chaudhuri and Nivedita Gupta, "Levels of Living and Poverty Patterns: a District-wise Analysis for India," *Economic and Political Weekly*, 44 (February/March 2009), 94–110.

<sup>38</sup> Francesca Jensenius' Indian Election data available at [www.francesca.no](http://www.francesca.no), developed for, "Power, Performance and Bias: Evaluating the Electoral Quotas for Scheduled Castes in India," Ph.D. dissertation (University of California Berkeley, 2013). The state's electoral constituencies were mapped to districts, which is not a straightforward task in India's case. State assembly constituencies are generally smaller units than administrative districts and fit into district boundaries. India implemented a new 2003 Delimitation Act in 2008, in which the political map was reconfigured on the basis of the 2001 Census. Although the total number of seats in State Assemblies did not change, the relevant constituencies that constitute a district as well as their reservation status changed for some political constituencies. For elections prior to 2008, I use data from Francesca R. Jensenius (2013) that matches constituencies to districts. In cases where constituencies lay across more than one district, it was included in the district that had the most geographic overlap. For elections after 2008, the matching was done by the author according to the Delimitation Order in 2003.

<sup>39</sup> These studies note that the method is derived from a regression discontinuity analysis by Lee (2008), who examines the incumbency advantage effect of parties in the U.S. by exploiting the nearly random assignment in treatment between Democrats who "just barely won an election" to those who just barely lost. Because constituency level sanitation measures are not available for India, I aggregate to the district level so that it is closer to a fuzzy regression discontinuity design. Other papers that use a similar estimation strategy in a different context include a study based on the U.S. case by Marit Rehavi, "Sex and Politics: Do Female Legislators affect State Spending?" unpublished manuscript (University of Michigan, 2007); a study on the impact of candidates' religion and not gender by Sonia Bhalotra, Irma Clots-Figueras, Guilhem Cassan,

and Lakshmi Iyer, "Religion, Politician Identity and Development Outcomes: Evidence from India," *Journal of Economic Behavior & Organization*, 104 (August 2014), 4–17; and Brollo and Troiano that use a sharp regression discontinuity instead of a fuzzy one. Other studies that use this method in the women and politics context in India include: Sonia Bhalotra and Irma Clots-Figueras, "Health and the Political Agency of Women," *American Economic Journal: Economic Policy*, 6 (May 2014), 164–97; Irma Clots-Figueras, "Women in Politics: Evidence from the Indian States," *Journal of Public Economics*, 95 (August 2011), 664–90; and Clots-Figueras, 2012.

<sup>40</sup> Clots-Figueras, 2011.

<sup>41</sup> The online appendix is available at: <https://yujunglee.com/>

<sup>42</sup> In India, parties show little difference in ideological commitment regarding basic service delivery, especially for sanitation. Thus, instead of including all party seat shares, I include ruling party membership which is more likely be influential in this case due to party competition for resources.

<sup>43</sup> Chattopadhyay and Duflo, 2004; Clots-Figueras, 2011; Bhalotra and Clots-Figueras, 2014.

<sup>44</sup> Robert LeVine, Sarah LeVine, and Beatrice Schnell, "Improve the Women: Mass Schooling, Female Literacy, and Worldwide Social Change," *Harvard Educational Review*, 71 (April 2001), 1–51.

<sup>45</sup> Using the baseline provided Olea and Pflueger, the test was conducted at the 5% level with the null that the Nagar bias is greater than 10% of a "worst-case" bias. The effective F-statistic is 46.77, exceeding the critical value of 23.11, suggesting a strong instrument. See José Luis Montiel Olea and Carolin Pflueger, "A Robust Test for Weak Instruments," *Journal of Business*

& *Economic Statistics*, 31 (2013), 358–69; Douglas O. Staiger, and James H. Stock, “Instrumental Variables Regression with Weak Instruments,” *Econometrica*, 65 (May 1997), 557–86.

<sup>46</sup> The results remain robust when testing with critical values from the t-distribution as Cameron and Miller recommend due to potential downward-bias in the clustered standard errors when having a few number of clusters. See A. Colin Cameron and Douglas L. Miller, "A Practitioner's Guide to Cluster-Robust Inference," *Journal of Human Resources*, 50 (March 2015), 317–72.

<sup>47</sup> Bhalotra and Clots-Figueras, 2014.

<sup>48</sup> Clots-Figueras, 2012.

**Table A1:** Effect of Female State Legislators on High-Quality Latrines

DV: Improved Latrines per rural household, 2011				
	OLS	2SLS	OLS	2SLS
	(1)	(3)	(2)	(4)
Fraction of female legislators	0.02 (0.034)	0.44** (0.197)	0.02 (0.0326)	0.37** (0.177)
Has at least 1 women in close race		-0.00 (0.008)		-0.01 (0.006)
Winner's vote margin			-0.08 (0.063)	-0.091* (0.060)
Fraction of ruling party members			0.04 (0.035)	-0.02** (0.054)
Rural population (%)	-0.01 (0.091)	0.00 (0.090)	-0.01 (0.092)	-0.00 (0.091)
Female literacy (%)	0.43** (0.173)	0.45*** (0.163)	0.43** (0.169)	0.45*** (0.161)
SC/ST population (%)	-0.06 (0.058)	-0.06 (0.054)	-0.06 (0.057)	-0.06 (0.054)
Poverty (%)	-0.10** (0.046)	-0.10** (0.050)	-0.10** (0.045)	-0.10** (0.047)
Population growth (% 2001-2011)	0.12 (0.20)	0.17 (0.189)	0.12 (0.198)	0.16 (0.192)
Open defecation rate (% , 2001)	-0.58*** (0.121)	-0.62*** (0.0985)	-0.58*** (0.120)	-0.62*** (0.104)
Constant	0.53*** (0.162)	0.51*** (0.150)	0.54*** (0.162)	0.53*** (0.148)
First Stage IV				
Fraction of female legislators who won in close election against a man		0.09*** (0.057)		0.11*** (0.017)
State FE	Y	Y	Y	Y
Observations	295	295	295	295
R-squared	0.876	0.836	0.877	0.850

Notes: Full results for Figure 3. District level observations in 15 states. State fixed effects included in all models. Robust standard errors clustered at the state level in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table A2:** Effect of Female State Legislators on Low-Quality Latrines

DV: Unimproved latrines per rural household, 2011				
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
Fraction of female legislators	-0.04** (0.019)	-0.16** (0.0696)	-0.05** (0.020)	-0.17** (0.066)
Has at least 1 women in close race		0.00 (0.004)		0.00 (0.005)
Winner's vote margin			-0.04* (0.022)	-0.04* (0.022)
Fraction of ruling party members			0.02 (0.018)	0.04** (0.021)
Rural population (%)	0.05 (0.034)	0.04 (0.032)	0.04 (0.035)	0.04 (0.032)
Female literacy (%)	-0.09 (0.070)	-0.09 (0.061)	-0.09 (0.071)	-0.09 (0.062)
SC/ST population (%)	-0.03* (0.017)	-0.03* (0.017)	-0.03* (0.018)	-0.03** (0.018)
Poverty (%)	0.00 (0.016)	0.00 (0.015)	0.01 (0.016)	0.01 (0.015)
Population growth (% 2001-2011)	0.052 (0.047)	0.0364 (0.048)	0.0544 (0.046)	0.0411 (0.047)
Open defecation rate (% , 2001)	-0.43*** (0.094)	-0.42*** (0.084)	-0.43*** (0.095)	-0.42*** (0.085)
Constant	0.42*** (0.092)	0.42*** (0.081)	0.42*** (0.094)	0.42*** (0.083)
First Stage IV				
Fraction of female legislators who won in close election against a man		0.09*** (0.017)		0.11*** (0.017)
Observations	295	295	295	295
R-squared	0.842	0.829	0.844	0.830

**Table A3: Robustness Check Tables I**

DV: Latrines per rural household, 2011		
Estimation for: Latrine type:	Long-run female effect	
	High-quality Latrines	Low-quality Latrines
	(1)	(2)
Avg. fraction of female legislators in past two govt.	0.27* (0.148)	-0.13** (0.042)
Winner's vote margin	-0.07 (0.061)	-0.06** (0.025)
Fraction of ruling party members	-0.00 (0.054)	0.05* (0.03)
Rural population (%)	0.02 (0.090)	0.03 (0.031)
Female literacy (%)	0.47*** (0.185)	-0.12* (0.065)
SC/ST population (%)	-0.07 (0.050)	-0.04** (0.019)
Poverty (%)	-0.09** (0.049)	-0.00 (0.015)
Population growth (% , 2001-2011)	0.17 (0.203)	0.05 (0.046)
Open defecation rate (% , 2001)	-0.65*** (0.125)	-0.40*** (0.078)
	First Stage IV	
Fraction of female legislators who won in close election against a man	0.12*** (0.019)	0.12*** (0.019)
N	265	265

Notes: District level observations in 15 states.

State fixed effects included in all models. Robust standard errors clustered at the state level in parentheses.

\* p<0.10; \*\* p<0.05; \*\*\* p<0.01

**Table A4: Robustness Check Tables II**

DV: Latrines per rural household, 2011						
Estimation for:	Clots-Figueras 2011 IV		% Children effect		Dropping "Assam" effect	
Latrine type:	High-quality Latrines	Low-quality Latrines	High-quality Latrines	Low-quality Latrines	High-quality Latrines	Low-quality Latrines
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction of female legislators	0.17* (0.102)	-0.14** (0.046)	0.31* (0.171)	-0.13** (0.066)	0.33* (0.172)	-0.17** (0.070)
Winner's vote margin	-0.08 (0.060)	-0.04* (0.022)	-0.12* (0.063)	-0.06** (0.025)	-0.08 (0.065)	-0.05** (0.022)
Fraction of ruling party members	0.02 (0.045)	-0.04* (0.021)	-0.02 (0.07)	0.05** (0.198)	0.03 (0.035)	0.02* (0.013)
Rural population (%)	-0.01 (0.087)	0.04 (0.032)	0.02 (0.111)	0.03 (0.038)	0.02 (0.092)	0.03 (0.033)
Female literacy (%)	0.44*** (0.158)	-0.09 (0.063)	0.39** (0.158)	-0.14** (0.147)	0.45** (0.159)	-0.09 (0.057)
SC/ST population (%)	-0.06 (0.053)	-0.03** (0.017)	-0.06 (0.058)	-0.04** (0.020)	-0.08 (0.052)	-0.03** (0.015)
Poverty (%)	-0.10** (0.046)	0.01** (0.014)	-0.10** (0.047)	-0.01 (0.049)	-0.10** (0.049)	0.00 (0.016)
Population growth (% , 2001-2011)	0.14 (0.184)	0.04 (0.045)	0.28 (0.251)	0.05 (0.269)	0.25 (0.184)	-0.00 (0.029)
Open defecation rate (% , 2001)	-0.59*** (0.108)	-0.47*** (0.087)	-0.56*** (0.105)	-0.46*** (0.083)	-0.67*** (0.113)	-0.40*** (0.095)
Young Children population (% , 2011)			-0.91 (-0.900)	0.10 (0.389)		
N	295	295	251	251	281	281

Notes: District level observations in 15 states.State fixed effects included in all models.

Robust standard errors clustered at the state level in parentheses. \* p<0.10; \*\* p<0.05; \*\*\* p<0.01

**Table A5:** Balance test: Characteristics of Districts by Gender of Winner

unit: electoral year and district, 2002-2009

		Districts with female winners from close elections	Districts without female winners from close elections	P-value of difference	Districts with male winners from close elections	Districts without male winners from close elections	P-value of difference
Fraction of female candidates	mean	0.183	0.184	0.8986	0.179	0.185	0.5451
	obs.	125	322		95	352	
Male turnout	mean	0.727	0.717	0.8734	0.703	0.725	0.6456
	obs.	125	322		95	352	
Female turnout	mean	0.643	0.663	0.658	0.658	0.9966	
	obs.	125	322		95	352	
Fraction of ruling party members	mean	0.108	0.110	0.9129	0.115	0.108	0.6665
	obs.	125	322		95	352	
Male literacy	mean	0.776	0.774	0.8062	0.761	0.778	0.1344
	obs.	117	296		90	323	
Female literacy	mean	0.571	0.567	0.7570	0.555	0.571	0.3211
	obs.	117	296		90	323	
Rural population	mean	0.735	0.752	0.3110	0.725	0.753	0.1880
	obs.	117	296		90	323	
SC/ST population	mean	0.251	0.263	0.4583	0.230	0.268	0.0288
	obs.	111	295		86	320	
Initial level of latrines per hh (2001)	mean	0.207	0.209	0.9298	0.184	0.212	0.2999
	obs.	68	294		51	311	

Samples are from districts in the 15 major states with at least one election with the top two candidates being one male and one female candidate. Close elections are those where the winner's margin of victory is 3.5% or less. P-value is the statistical significance of the difference between means.

Data sources: Election Commission of India, various years. India Census 2011, 2001.

A concern with the quasi-random assumption used in the identification strategy is that districts with large portions of very close elections may have systematically different characteristics from other districts. In order to check the external validity of the effectively random assumption, in Table A5 I compare the characteristics of districts by gender of the winner from close elections. I compare various characteristics of districts where there was at least one female winner from a very close elections to all other districts which had the two top candidates that were one male and one female, including those that didn't have close elections (where the winner could be male or female). And I examine the characteristics of districts with male winners from very close elections to all other districts in the sample as well. Overall, the results in Table A5 show that characteristics related to the electorate and other socioeconomic factors are not significantly different between the two groups being tested. The only characteristic that shows a statistically significant difference is the SC/ST population in districts with male winners in close races and

**Table A6: Balance test: Characteristics of Districts with Close Elections Only by Gender of Winner**

unit: electoral year and district, 2002-2009

		Districts with female winners from close elections	Districts without female winners from close elections	P-value of difference	Districts with male winners from close elections	Districts without male winners from close elections	P-value of difference
Fraction of female candidates	mean	0.180	0.176	0.8330	0.174	0.183	0.4995
	obs.	94	57		81	70	
Male turnout	mean	0.752	0.719	0.7124	0.712	0.771	0.5453
	obs.	94	57	81	70		
Female turnout	mean	0.657	0.640	0.6615	0.669	0.629	0.3021
	obs.	94	57	81	70		
Fraction of ruling party members	mean	0.102	0.113	0.6038	0.117	0.092	0.2671
	obs.	94	57	81	70		
Male literacy	mean	0.776	0.774	0.8062	0.763	0.775	0.4375
	obs.	117	296	77	65		
Female literacy	mean	0.571	0.567	0.7570	0.557	0.565	0.7171
	obs.	117	296	77	65		
Rural population	mean	0.735	0.752	0.3110	0.731	0.755	0.3757
	obs.	117	296	77	65		
SC/ST population	mean	0.251	0.263	0.4583	0.231	0.258	0.2835
	obs.	111	295	73	63		
Initial level of latrines per hh (2001)	mean	0.207	0.209	0.9298	0.184	0.212	0.2999
	obs.	68	294	51	311		

Samples are restricted to districts in the 15 major states with at least one close election with the top two candidates being one male and one female candidate. Close elections are those where the winner's margin of victory is 3.5% or less. P-value is the statistical significance of the difference between means.  
Data sources: Election Commission of India, various years. India Census 2011, 2001.