THE GENDER OF CASTE: IDENTITY, POLITICAL RESERVATIONS AND ACCESS TO WATER RESOURCES IN RURAL INDIA

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Abstract. In this paper, I analyze the impacts of a centuries-old social institution, the caste system, (directly) on households' access to water resources and (indirectly) on female time allocation in India. The idea behind this study is quite intuitive, yet this remains an almost entirely unexplored topic: water is believed to be an agent that spreads pollution upon contact with a person who herself is in a state of pollution. Therefore, in many regions of India, the upper caste households insist on maintaining distinct water sources from the lower caste (i.e. untouchable) households in their villages. Data shows that over 69% of rural Indian households have to collect water for drinking purposes, and those fetching water are predominantly women. Thus, caste discrimination in the access to water resources creates an unequal burden for women and have important intra-household implications. My empirical findings support this hypothesis: the total time low caste women spend to collect water is significantly higher when they reside in a village dominated by lower castes (in terms of population shares), compared to a village dominated by upper castes. This is due to the congestion of the wells that low-caste members can access, and the results hold true even after controlling for village-level fixed effects. I also document the effect of the reservation of leadership positions in the village administrative bodies, i.e. Panchayati Raj, for low castes members: indeed, low caste members are more inclined to invest in water infrastructure in the low caste hamlets, which decreases the time spent at the water source by low caste women. This positive impact tends to be relatively higher in villages where low caste households represent a majority of the population. The analysis also shows that reservations for women in village leadership positions do not have a significant impact on low caste women's access to water resources.

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1. Motivation

> *"Water is fundamental for life and health. The human right to water is indispensable for leading a healthy life in human dignity. It is a pre-requisite to the realization of all other human rights."*
>
> *– United Nations Committee on Economic, Cultural and Social Rights, 2002*

The large discrepancy in the quality and quantity of public goods available to different socioeconomic and ethnic groups in both developed and developing countries is a widely discussed policy issue. Residential segregation and differences in other observable demographics have long been claimed as primary reasons for this disparity. While some public goods (such as the access road to a village) can only be built and made available to the entire community, some other public goods (such as a public water tap) can be delivered to each group separately. Residential segregation, and the resulting targeted supply of public goods of the second kind, may therefore have deep implications on the livelihoods of the more disadvantaged groups (Cutler et al. 1993; Cutler and Glaeser 1997; Kochar et al. 2009).

An important limitation of the research in economics on ethnicity-, race- or caste-based segregation and restricted access of disadvantaged groups to the public goods so far was the fact that it has mainly focused on the wellbeing of disadvantaged households viewed as a whole. However, the intra-household implications of segregation constitute a relatively under-researched area. For example, if restrictions in the access to public goods, such as water, impose a differential burden on men and women, this will alter the distribution of bargaining power within the household. Several earlier studies suggest that when women have control over resources, they are more likely to invest in children's health and education. Caste-based segregation may then have a direct effect on households' access to water resources, as well as indirect effects, on women's participation in the labor force and hence on the outcome of the intra-household bargaining process.

In this paper, I study an extreme case of segregation in the access to public goods in rural India. Almost all Indian villages are spatially partitioned into neighborhoods or hamlets which are characterized by the caste affiliation of the residents. The Indian caste system is a centuries-old social institution, and caste-based residential segregation naturally produces a group of excludable public goods. These include, among others, primary schools, health facilities, and especially water access. This is due to a combination of residential segregation and caste-based norms which determine the distribution of access rights to each water source. According to Hindu traditions, water use by an individual who belongs to a low caste group might cause pollution of the water source, which can be transmitted to the high caste individuals through future contact. Hence, it is a common practice in Indian villages to keep distinct water sources by caste. In addition, Indian culture has well-defined rules describing the gender roles within a household. Therefore, it is common for adult women in the family to collect water for drinking purposes. Thus, any restriction on the availability of water sources has direct consequences on women's day-to-day allocation of time between

water collection and labor force participation. As such restrictions to water access also have indirect implications on the bargaining position of women in the household.

The analysis of this paper departs from a descriptive question: does caste affiliation determine access to public water resources in rural India? If caste-specific rules are still effectively governing the water access, as many anthropologists have claimed, we should observe that low caste individuals spend more time in water collection in areas where low caste members represent the majority of the village population. Consistent with this initial hypothesis, the data reveal that a higher number of low caste members creates a "congestion effect" in the water sources low caste people can fetch water from. Clearly, this finding could also be rationalized on the basis of individuals' preferences: for example, under strong network externalities, individuals benefit by spending more time with their own peers; alternatively, members of a given cast may dislike the company of the other group, and thus prefer to use separated water sources. Under this alternative scenario, even though people do not have any intention to block the use of water by the other group, they can simply sort themselves into different water sources. Clearly, it is not possible to distinguish self-sorting due to network effects and the discrimination as a result of traditional Hindu customs, unless we introduce a certain amount of disutility from waiting in line. If so, some high caste individuals will choose to walk towards another water source, say in the low caste hamlets and vice versa.

Independently of the reasons for segregation in the access to water sources, it is an open question whether well-designed policy interventions can facilitate disadvantaged groups' access to public water resources. I address this question by documenting the effect of the identity of the village administrative leaders, i.e. Panchayati Raj, on the public good access of low caste households. I exploit a natural experiment in local governance in India, the random assignment of caste quotas across Indian village councils. I find that leaders who are members of a low caste invest more in water infrastructure in the low caste hamlets, which in turn decreases the time spent at the water source by low caste women. Interestingly, the data suggest that this positive impact tends to be relatively higher in the villages where low castes hold a larger share of the population. This finding demonstrates the link between the demographic characteristics of a village and the effectiveness of reservation policies, through the induced redistribution of public sources toward disadvantaged groups.

The remainder of the paper is organized as follows. Section 2 outlines the institutional background and its relevance for my purposes. Section 3 sketches a formal model (which is currently still work in progress) that will better explain the potential mechanisms in act. Section 4 describes the data used in the analysis and the empirical strategy to test my predictions. Section 5 presents the empirical results of the study, while Section 6 introduces a potential extension for the current study. Section 7 concludes and gives insights for the further work.

2. Institutional Background

2.1. **The Caste System.** The Hindu society has been divided for centuries into five hierarchical, hereditary and endogamous groups or castes: Brahmins (priests, teachers), Kshatriyas (warriors, royalty), Vaishyas (moneylenders, traders), Shudras (menial jobs) and Ati Shudras. The final group, Ati Shudras, is also known as untouchables and performed the lowest of the menial jobs such as garbage disposal or scavenging. According to the recent estimates from the Census of India 2001, untouchables (or Scheduled Castes as commonly referred) constitute approximately 16% of the Indian population. Although as a group untouchables add up to a nonnegligable share in the country, being considered unclean, they were historically denied political and civil rights and forbidden to use public goods such as school or temples. Moreover, untouchables are forced to live in segregated parts of the villages in order to maintain distinctness of these public facilities from the upper castes and to minimize the overall contact between the caste groups.

In 1947, the Constitution of India declared the discrimination against Scheduled Castes illegal and in the following years India placed reservations for the members of the Scheduled Castes in higher education institutions, public sector jobs, and in the elected offices to amend the historical disadvantages of this group. However, a large literature in the anthropology demonstrate that quite a few features of the caste principle is still a visible part of the rural life in India.[1]

The caste affiliation even today dictates the ways villager has interacted in their daily lives. However, the caste hierarchy has been ritualized in its extremes in case of sharing village water resources. In his seminal work Dumont (1980) states that water is considered in the ancient Sanskrit texts as a channel which can transmit pollution associated with its users. Dumont claims that, therefore, the upper caste households insist on preserving separate water sources from the lower caste households in their villages. Thus, the rights of water access enjoyed by the villagers is governed by the customs connected to the caste system in almost all parts of India.[2]

2.2. **The Panchayat System.** Decentralization has long been argued to be an important element in the democratization process of economies. The main argument in favor of decentralization is that it creates institutions that better identify the needs and preferences of

[1]Analogous considerations, including quotas provided by law, apply to the Scheduled Tribes, i.e.the indigenous tribal groups in the country.

[2]The problem faced by low caste households in the drinking water access is also emphasized by Joshi and Fawcett (2005) among many other anthropological studies. The study reports that, in the Indian villages, specific hamlets and families exercise control over the officially state-owned water sources (i.e. village communes). Joshi and Fawcett (2005) describes that local culture excludes the low caste individuals from using any water source in the village except the one that is assigned as theirs, quoting the low women in the central Himalayan state of Uttaranchal: *"Ask us what water scarcity is? It is not to bathe in the summer heat after toiling in the fields. It is to re-use water used in cooking for washing utensils, to use this water again for washing clothes and finally to feed the soapy water to buffaloes. It is to sit up the whole night filling glass by glass as water trickles from our naula".*

the local communities, by providing closer electoral monitoring. In the early 1990s, in an attempt to improve the performance and accountability of its local government institutions, India undertook an important policy experiment. This consisted of transferring administrative authority and responsibilities from central or state government agencies to lower level administrative units.

In 1992, the 73rd Amendment to the Indian Constitution introduced a three-tier structure of local governments below the level of state governments, known as the Panchayat. This consists of a system of district-level (Zilla Parishad), block-level (Panchayat Samiti), and village-level (Gram Panchayat) councils.[3] The Amendment gave considerable responsibility to the village councils for the provision of local public goods (such as construction of public water taps, maintenance of village roads, etc) as well as power to decide the beneficiaries of federal and state poverty alleviation programs.

While the 73rd Amendment required Panchayat elections to take place every five years, it also provided that no less than one third of the total available seats in the elected village governments should be reserved for women. The law also required the reservation of these positions for the two disadvantaged groups, Scheduled Castes (SC) and Scheduled Tribes (ST). This latter type of reservation was in the form of mandated representation, proportional to these groups' population shares in each district. The primary purpose of the law change was to guarantee that women and minorities would actively participate in the local governments. Increasing participation in the political decision making process was considered as the necessary first step for a more equal distribution of public resources among demographic groups.

A modification of West Bengal Panchayat Constitution Rule, passed in 1998, mandated that a third of the Pradhan (i.e. village council leader) positions, must be reserved for women and for the two disadvantaged minorities in India, SC and ST, in proportion to their population share in the district. During the implimentation of this rule, GPs are initially randomly assigned to three groups: reserved for SC, reserved for ST, and unreserved. Later, GPs in each of these three groups are then ordered by their serial numbers which were assigned by block, and every third GP in each group is reserved for a woman.[4]

Although law requires the Pradhan to consult with the villagers and the other council members while deciding the allocation of public goods, in many cases the final decision making power in the village councils belongs to the Pradhan in practice. Hence, one should expect differential impacts of reservations of Pradhan positions for SC/ST on policy decisions in a non-Downsian world.[5]

[3]Although the Panchayat system has existed in many states of India since the early 1950s, the Panchayats didn't have an active role in the local governance until the early 1990s. (Ghatak and Ghatak, 1999)

[4]Beaman et al. (2009) collected data on the GP serial numbers and reconstructed the reservation lists to verify that the Constitution Rule were followed in practice. They found that the rule held with no exception.

[5]In the Downsian model, political candidates commit to specific policy outcomes on a one-dimensional policy space and the only consideration of the candidates is the victory in the election. The theory shows that political candidate will converge to the policy preferred by the median voter in such a setting. Thus, political

3. Sketch of a Simple Model

I now develop a simple model to demostrate the relationship between the caste identity of a villager, the time spent by this villager in water collection and the caste distribution in her village. This framework is meant to formalize some of the preceding discussion, whereas the empirical results of this paper do not rely on the specific assumptions of this model.

3.1. **Setting.** Consider a village with a unit mass population. Assume there are two social groups in the village, indexed by i, representing low ($\theta_i = \theta_L$) and upper castes ($\theta_i = \theta_H$), with shares of the population σ_L and σ_H respectively.

The economy is characterized by residential segragation, with low castes living in one neighborhood and high castes living in another. The two neighborhoods are at a distance of d. The available water supply facilities, such as public water taps or public handpumps, are neighborhood-specific. Thus, two water sources in the village, ω_L and ω_H, are located in the high caste neighborhood and in the low caste neighborhood, respectively.

There are at least three factors to consider in explaining the particular relationship between the water collection time of a villager belonging to a certain caste and the demographic composition of the village: (1) mobility, i.e. the ability of the low caste people to move and access the water resources in the high caste neighborhood, (2) network effects, i.e. the preferences of an individual for spending time with people of her own caste, and finally (3) the time costs of water collection, i.e. both the time spent to walk to the water source and the time spent to wait at the source to fetch the water.

3.2. **Model.** Now define the utility function of an individual villager. Assume the value of fetching water is given by V and that the cost of waiting at the well is a quadratic function of the total number of people utilizing it. Furthermore, each villager derives (potentially negative) utility by interacting with the members of other caste at the well.

Denote by $A(\theta_i, \omega)$ the total number of people of caste θ_i using well ω. The utility of type θ_i when using well ω is then given by

$$U(\theta_i, \omega) = V - d(\theta_i, \omega) + \alpha A(\theta_i, \omega) + \beta A(\theta_{-i}, \omega) - \gamma \left(A(\theta_i, \omega) + A(\theta_{-i}, \omega)\right)^2,$$

where α is the taste for interacting with your own caste members, β is the (dis)taste for interacting with members of the other caste, and γ is the marginal cost of waiting. The marginal cost of walking is normalized to one, and $d(\theta_i, \omega_{-i})$ is the distance between the two neighborhoods. Furthermore, we have the following accounting equations:

$$\sum_{\omega} A(\theta_i, \omega) = \sigma_i, \tag{3.1}$$

decisions only reflect the voter preferences and consequently identity of the elected leader doesn't affect the policy outcomes.

and

$$\sum_{\omega} \left(A\left(\theta_L, \omega\right) + A\left(\theta_H, \omega\right) \right) = 1. \tag{3.2}$$

Now, let us evaluate four different environments and see how the assumptions of the model with respect to mobility and network effects influence the interaction between the time spent walking to the water source and at the water source as a function of one's caste identity and her village's caste composition.

3.2.1. *Pure Congestion with Free Mobility.* Let us first examine a case in which there is no caste-based discrimination (contrary to the environment described in the anthropological studies). Thus, both low and high caste members can fetch water from either well. For simplicity, I restrict attention to the case in which all high caste members visit well ω_H as well as some low caste members. Thus,

$$\begin{aligned} \alpha &= \beta = 0 \\ \gamma &> 0, \\ d &< \bar{d}, \end{aligned}$$

where $\bar{d}$ is the distance that would make it prohibitively costly in terms of time to walk from the low caste neighborhood to the high caste neighborhood to collect water. Suppose there are few high caste people (at least in user *per well*). If some low caste members choose to walk all the way to the high caste neighborhood, instead of waiting to collect water at the water source in the low caste neighborhood, then it must be the case that

$$U\left(\theta_L, \omega_L\right) = U\left(\theta_L, \omega_H\right).$$

Therefore, using the specification chosen for $U\left(\cdot\right)$, we obtain

$$\alpha A(\theta_L, \omega_L) - \gamma \left(A(\theta_L, \omega_L)^2 = -d + \alpha A(\theta_L, \omega_H) + \beta \sigma_H - \gamma \left(A(\theta_L, \omega_H) + \sigma_H\right)^2.\right.$$

Solving for the equilibrium value of $A\left(\theta_L, \omega_L\right)$, and using (3.1) and (3.2), we obtain

$$A^*(\theta_L, \omega_L) = \frac{1}{2} + \frac{d}{2\gamma}.$$

Therefore, pure congestion implies that as σ_L increases, the number of low caste villagers at their close-by well does not change. In other words, under pure congestion, where there are no restrictions on the available water sources for low caste individuals, we should expect to observe "more walking but not more waiting" by low caste women as the share of low caste individuals increases in the village.

3.2.2. *Weak Network Effects with Free Mobility.* I now focus on the case when the villagers value the time they spend at the water source but also like (dislike) interacting with members of their own (the other) caste during water collection.

Note that this is the case in which

$$\begin{aligned} \alpha &> 0 > \beta \\ \gamma &> \alpha, \\ d &< \bar{d}. \end{aligned}$$

Based on the indifference condition, I now have

$$A^*(\theta_L, \omega_L) = \frac{1}{2} + \frac{(\alpha - \beta)\,\sigma_H + d}{2\,(\gamma - \alpha)},$$

with the second term strictly positive and increasing in σ_H. Therefore, in villages with lower shares of high caste people and free mobility, we should expect *more* low-caste villagers walking to a far, less congested well. This is in stark contrast with the result under no network effects: indeed, as the number of high caste villagers decreases, more low caste villagers find it worthwhile to walk the distance. In turn, network effects induce more low caste villagers to join them. Therefore, low network externalities should yield decreasing waiting times and increasing walking times for low caste people living in the villages inhabited by relatively higher numbers of low-caste individuals.

As is to be expected, any interior partition of the population can only occur in equilibrium if network externalities are not too strong. This requires that

$$\alpha \leq 2\gamma - \beta - \frac{d + \gamma - \beta}{\sigma_L}.$$

3.2.3. *Strong Network Effects or Forced Segregation.* When α exceeds the threshold value, i.e. in the existense of strong network effects, the water source in the low caste neighborhood is exclusively used by the low caste individuals whereas the water source in the high caste neighborhood is only used by the high caste villagers. Thus,

$$A\,(\theta_i, \omega_i) = \sigma_i.$$

On the other hand, forced segregation due to rules and beliefs concerning sharing water suggested by anthropologists yield exactly the same outcome. Note that this allocation can be generated by either a very high d or a very high α, and it implies increasing waiting times and no effect on walking times as the shares of the population vary across villages.

4. Data and Empirical Strategy

4.1. **Data Description.** The data for this study comes from a survey conducted in the Birbhum district in West Bengal between June 2006 and November 2007.[6] The survey covered three randomly selected villages in each of 165 GPs in the district. In every sample village, data were collected on the basic characteristics of the village (number of households in each caste category, religion, quantity of public goods) as well as on the information related to the

[6]See Beaman et al (2009) for a more detailed description of the dataset.

spatial distribution of these goods within the village (i.e. the hamlet within the village). An independent audit study provided data on the objective quality of the existing public goods.

Finally, in each village 15 households have been chosen to administer household level surveys. An adult female and male in these households have also answered the individual level survey questions. This gives us a total of 13,210 individuals of which 6,568 were females.

4.2. **Empirical Strategy.** I am interested in the impact of the share of SC/ST households and the reservations of village council head positions for this disadvantage groups on their access to drinking water sources within a village. There are two key issues I will analyze through out the paper. I will first investigate implications of the demographic structure of the village and the reservations for the time spent by adult women in the water collection. Later, I will turn to the determinants of the village level public good allocation decision.

The first estimation equation for assessing this individual level effect of the population share of SC/ST households is the following:

$$y_{ivg} = \beta_1 C_{ivg} + \beta_2 \left(S_{vg} * C_{ivg}\right) + \beta_3 X_{ivg} + \beta_v + \epsilon_{ivg} \tag{4.1}$$

The dependent variable in this regression, y_{ivg}, is the time spent by a woman i located in village v in GP g in a given activity (in minutes). The regressor of interest is an interaction term $S_{vg} * C_{ivg}$ where S_{vg} is the share of SC/ST households in the village and C_{ivg} is a SC/ST dummy. The β_v are village level fixed effects and finally a vector of covariates, X_{ivg}, includes the individual level controls. The vector of covariates consists of female characteristics such as age, dummy variables which indicate the marital status and literacy of the woman, household characteristic such as household size, religion, demographic composition of the household as reflected in the proportion of women, children and elderly in the household, characteristics of the house they live in (e.g. electricity and water connection, types of the walls, type of the roof), an indicator variable for whether household owns any land, and the irrigated percentage of the owned land. Finally, adding village fixed effects, β_v, in equation (4.1) will let us identify the impact of population structure and reservations on water access from within village variation. I report robust standard errors, clustered by GP. Note that in equation (4.1) the coefficients of interest, β_2 captures the impact of share of SC/ST households in a village on the water collection time of SC/ST women. It is important to note that controlling for village fixed effects (i.e. total village population), this coefficient gives us the congestion effect I have discussed earlier.

I, then, expand the regressor set to analyze the impact of the political reservations on my outcome variable of interest and include the interactions terms for whether the elected representatives in GP g belong to SC/ST group:

$$y_{ivg} = \delta_1 C_{ivg} + \delta_2 \left(S_{vg} * C_{ivg}\right) + \delta_3 \left(R_g * C_{ivg}\right) + \delta_4 \left(S_{vg} * R_g * C_{ivg}\right) + \delta_5 X_{ivg} + \delta_v + \xi_{ivg} \tag{4.2}$$

where R_g is a dummy for the GP g being reserved for SC/ST candidates.

Finally, I address the village level public good allocation problem and run village level regression which has the form:

$$y_{vg} = \phi_1 R_g + \phi_2 S_{vg} + \phi_2 \left(S_{vg} * R_g\right) + \phi_3 V_{vg} + \phi_b + \varepsilon_{vg} \tag{4.3}$$

where ϕ_b are the block dummy variables and V_{vg} is a vector of village level covariates such as geographical area of the village and the population of the village.

4.2.1. *Exogeneity Issues.* The exogeneity of the village population shares of SC/STs in West Bengal constitutes the base for the empirical identification strategy used in this paper. Reservation of the head positions of the village councils for SC/ST through a random process is another key component of my empirical strategy.

Caste Distribution: A wide range of evidence suggests that current caste distribution in the West Bengali villages is largely the product of historical factors rather than contemporary migration. First of all, the inherited nature of caste rankings ensures that there is virtually no mobility of individuals across the different caste groups.

Second, there is almost no caste-based migration in India. Munshi and Rosenzweig (2005) attribute this phenomenon to the dependence on caste networks for insurance purposes, and claim that caste-based insurance networks lose their effectiveness once an individual leaves his own village. To explore this point further, I analyzed the people who have been interviewed for the Rural Economic and Development Survey in 1999 at a place different than their village of birth.[7] Results are presented in Table 1. In 1999, as much as 97.89% of all household heads have been enumerated in their place of birth. When I examine the location of the siblings of the household heads, I find that this number decreases as low as 47%. Yet, only less than 24% of adult brothers of the household head were not living in their natal village at the time of the survey.[8] Such small migration rates are unlikely to significantly modify the village level caste distribution.

[Table 1 Here]

Finally, although there are conflicting arguments and analyses on the issue of differential birth rates between castes in India; the most prevalent findings and information suggest that there is no effect of caste status on fertility rates. Panandiker and Umashankar (1994) note that studies have "shown that birth rates among the different religious groups do not vary greatly," and that "[t]he same would hold true for caste and community structures." Murthi, Guio, and Drèze (1995) also support this finding, using 1981 population data to demonstrate

[7]The 1999 Rural Economic and Development Survey, administered by the National Council of Applied Economic Research, covers 250 villages in 17 major states of India.

[8]Higher mobility of women can be explained mostly due to movement for marriage.

the statistical insignificance of scheduled caste status on fertility rates, although scheduled tribe status is found to have a small, significant negative impact. Using the same data, Malhotra, Vanneman, and Kishor (1995) run regressions that arrive at the same conclusions.

Allocations of Reserved Positions: Observing differential public goods investments or maintenance of a village council headed by a SC/ST pradhan in comparison to another council headed by a non-SC/ST leader does not tell us much about the impact of SC/ST leadership on the public good provision and distribution of these goods. One can simply argue that places in which SC/ST people are elected are inherently different from places that do not choose them as village leaders. However, an exogenous process that assigns reserved seats across village councils guarantees that the reserved and unreserved villages had similar pre-reservation characteristics, and allows us to interpret any difference between the provision and the distribution of public goods by village councils as a direct impact of the reservation policy.

In Table 2 I use 1991 Census data to compare the means of the pertinent village characteristics to test whether there are any systematic differences between the reserved and unreserved villages in my sample.[9] As the political reservation design suggested, Table 2 shows that reserved and unreserved villages were similar with respect to many of the village attributes before the reservations, except the overall literacy rate and the share of irrigated land.

[Table 2 Here]

Table 2 is also important to understand the fundamentals of the environment where my study takes place: most of the villages in the sample do not have access to a community (96% of the reserved, 97% of the unreserved villages). However, a large percentage of villages have tube wells and handpumps. A noteworthy share of the cultivated land in both types of villages is irrigated. There is on average more than one school in the sample villages. The bus or train stops are lacking in above 70% of all the sample villages.

5. Empirical Findings

5.1. **Congestion at the Water Sources and the Impacts of Political Reservations.** The first two columns in Panel A and Panel B in Table 3 present the impact of caste affiliation and the share of the SC/ST households in the village on the time spent walking to the water source, and on the time spent waiting at the source for the water collection, respectively. In the first columns of each panel I see that SC/ST women spend less time walking to the water source and at the source, although this difference is not statistically different from zero at the traditional confidence levels. Column (6) shows that, however, the higher share of SC/ST

[9]Column (3) in Table 2 report coefficients from a single regression that regress the indicated village characteristics in 1991 on a dummy variable indicating whether the village council's head position is reserved for a SC/ST candidate, conditional on block fixed effects.

households in a village appears to have caused a relative increase in the waiting time of the SC/ST women at the water source. In other words, controlling for the village population, column (6) confirms that if there are more people of my own identity in my village, as a SC/ST woman I spent more time waiting in the line to get water.

This result is in line with the implications of a congestion story due to residential segregation: if a woman has access to all the water resources in the village, the identity of the other water fetchers wouldn't have mattered for her waiting time for a given population level. As expected, given the strict rules of Hindu society related to the water sharing, she is competing for the water in limited locations and with the people of her own. It is important to note that the share of SC/ST households in a village has no significant impact on the walking time of the SC/ST women to the water source. Column (2) displays this fact.

[Table 3 Here]

Column (3) and column (7) in Table 3 indicates that the reservation of the head positions for SC/ST candidates reduces both the walking and the waiting time for SC/ST women. However, the coefficients are neither statistically nor economically significant. Indeed, living in a reserved village decreases the total time spent at the water source by only less than a minute for a SC/ST women relative to living in a village that is not reserved for SC/ST. Finally, in column (4) and column (8), I investigate the extent of the impact of reservations is improved by the share of SC/ST households in the village. These results suggest that the positive impact of reservations on the water access for SC/ST households only for the villages where the share of SC/ST households are higher.

Panel C of Table 3 replicates the results in Column (8) in case of reservations for women and reservations for SC/ST women. It appears that, unlike SC/ST, reservation for women council heads does not increase the access of SC/ST households to water sources. This finding is not inconsistent with the earlier studies documenting increased investment for water infrastructure in the villages in which pradhan positions are reserved for women candidates. Panel C only documents that reservation for women do not increase the water access of SC/ST households relative to non-SC/ST households. Whether reservations for women increase the overall quantity or quality of the water resources in the village is an independent question which I will discuss in the future drafts of this paper.

5.1.1. *Falsification Tests.* In column (1) of Table 4, I report a *placebo* regression for time spent in firewood collection by SC/ST women, relevant to my results reported in Table 3. No variable in this regression, except the interaction of SC/ST dummy and SC/ST share, is significant at the 10% level. Column (1) suggests that living in a village with a higher level of SC/ST population share increases the time spent in firewood collection for a SC/ST women on average. This result can be interpreted as the congestion effect as well, since earlier literature implies that the firewood collectors in rural India mostly belong to lower

caste households. However, this falsification test proves that the reservations do not have a significant impact on collection time of other natural resources, which are not supplied through public goods provision, such as firewood collection. Hence, the significant impact of reservations on the time spent on water collection is not spurious.

[Table 4 Here]

Another concern with regard to my findings in the Panel B of Table 3 is the potential change in the daily life of the SC/ST women in the reserved villages compared to similar women living in the unreserved villages. The effect of political reservations and the SC/ST share interaction on the time spent by women at the water source, identified through the increasing access to water resources in this paper could be misleading if the increasing reservations and population share makes women be more involved in other political activities. A plausible competing story is that women spend time at the water source not only to collect water but also to socialize with other villagers. If the SC/ST reservations causes SC/ST women to be more active in the political activities, these women can replace this chance as an alternative mean of social interaction and choose to spend less time at the public water source to socialize with other women of the SC/ST group. I test whether there is a significant difference in the time spent in political activities in two types of villages. Column (2) of Table 4 presents these results and shows that the increasing political participation of women cannot be the driving source behind the drop in the water collection times.

5.1.2. *Impacts on Overall Time Allocation Problem.* Columns (3) and (4) of Table 4 report an initial attempt to understand the implications of differential water collection time by women on the other daily activities. My preliminary and non-conclusive results show that an increase in the access to water resources have a potentially positive, but insignificant impact on the time spent in child and elderly care as well as leisure time of a SC/ST adult woman. Further analysis of the time allocation decision and the reflections of this decision on the intra-household bargaining problem are still work in progress.

5.2. **Investigating Potential Mechanisms.**

5.2.1. *Increased Access to Previously Forbidden Sources.* A mechanism which explains the positive impact of SC/ST reservations on the water collection times of SC/ST is the increased access of SC/ST women to water resources which were previously forbidden to them. Put differently, the existence of a village council leader who belong to the SC/ST himself can make high caste water resources an open territory for SC/ST women. An increase in the available water collection points, in turn, decreases the average waiting time at the source for SC/ST women. This hypothesis has a testable prediction. If SC/ST women start to fetch water from previously high-caste water collection points, this shift should have a negative impact on the high caste women, i.e. an increase in their waiting times.

[Table 5 Here]

The results from the OLS regressions, clustered at the GP level with robust standard errors in Table 5. Dependent variable is once more the minutes spent by a woman at the water source in each visit. Column (4) in Table 5 indicates that there is no significant impact of SC/ST reservations on the time spent at the source by high caste women. In other words, reservations do not increase the competition for water resources for these women by increasing congestion in the resources they use.

5.2.2. *Targeted Infrastructure Investments.* Another potential explanation for the decreasing water collection times of SC/ST women in the reserved villages is the increasing delivery of public water sources in the SC/ST hamlets by SC/ST Pradhans. This prediction stems from the previous findings in the literature such as Pande (2003), who finds that there are more transfers targeted to SCs in states where there are more reservations for SCs in parliament, Besley et al. (2004), who find that SC households are more likely to gain access to public resources if the Pradhan is SC or Duflo et al. (2005), who find SC head of the village council tends to invest more in hamlets populated by members of the SCs.

The survey data from West Bengal contains information related to all available infrastructure in the village including their location (i.e. whether it is placed in the SC/ST hamlet, general hamlet or minority hamlet), and also whether each of the goods had been built or repaired after the last Panchayat election. Moreover, the dataset includes objective measures of water and infrastructure quality. Using this detailed set of information, I test whether SC/ST Pradhans are more inclined to favor the SC/ST hamlets in terms of public goods delivery.

Quantity Improvements: Table 6 provides evidence for the differential provision of public water sources in reserved and non-reserved villages. Controlling for village area and village population and using block fixed effects, I find that the share of SC/ST households in a village is significantly and positively correlated with the number of public water sources in the village as well as the repair and construction of new ones since the last election. This correlation is even stronger if the head position in the village council is reserved for SC/STs. However, the joint effect of SC/ST share and the reservation is only significant for the repairs of the existing water infrastructure. Indeed, this finding is consistent with the fact that I only observe a drop in the SC/ST women's waiting time at the source, but not in the walking time to the source. One can argue that while repairs have made the existing sources more functional, since there was no addition to the water extraction points, the travel distance to the source has not been affected.

[Table 6 Here]

Quality Improvements: Table 7 presents the estimation results which includes the share of the SC/ST households in the villages, the reservation status of the village and the interaction of the key variable of the share of SC/ST households in the village and the reservation status of the village as the main explanatory variables while controlling for the village area and population. Interestingly, Column (1) shows that relative to the villages with lower share of SC/ST households, the villages with higher SC/ST occupancy start to receive water more frequently at the public water sources in the SC/ST hamlets. This increasing functionality of the water sources in the SC/ST hamlets is in line with the increasing repairs as I point out in the final column of Table 6.

Moreover, in column (2) of Table 7, I find a relative decrease in the likelihood of muddy color of the water from public hand pumps located in the SC/ST hamlets with the increasing share of SC/ST households in the reserved villages. This improved color change is an important sign that reservations combined with the increasing SC/ST population within a village had a positive impact on the healthiness of water in the SC/ST hamlets. One way of more explicitly testing this health-enhancing effect is to use the e-coli counts of the water tested by independent auditors during the survey as a dependent variable and run a similar regression. Column (3), however, shows no significant impact of the reservation status and the demographic structure of the village on the number of purple colonies, the presence of which indicates the presence of e-coli. However, this finding can also be explained by the lack of variation in the data. Surprisingly, the overall quality of water collected from these villages is quite high as measured by their bacterial content.[10]

Finally, column (4) shows that the reserved villages with high levels of SC/ST residency are more likely (although) to have the hand pumps in their SC/ST hamlets to be taken care regularly.

[Table 7 Here]

[10]Recent studies in Bangladesh indicate that the groundwater is severely contaminated with arsenic above the maximum permissible limit of drinking water. The data collected by the governmental bodies, NGOs and private organizations reveal that a large number of populations in Bangladesh are suffering from arsenic related diseases such as melanosis, leuco-melanosis, keratosis, hyperkeratosis, dorsum, non-petting oedema, gangrene and skin cancer as a result of the ingestion of arsenic compounds and their excretion from the body. Due to their similar geology and geographic location, eastern West Bengal and western Bangladesh are largely analogous herein, suffering many of the same effects. Sub-par natural filtration and separation of aquifers harms the quality of water drawn from tube wells. In addition, the floodplain morphology of these areas results in high levels of deposited organic material, which breaks down FeOOH, a naturally-occurring molecule that otherwise would significantly reduce the presence of free arsenic in the groundwater. A natural concern for this study is differential quality of drinking water accessed in the low caste and the high caste hamlets in terms of arsenic contamination. Das et al. (2009) has tested around 140,000 tube wells in West Bengal over a period of 20 years for arsenic. They show that nine districts, all in the state's east, experience severe arsenic problems with regards to their groundwater. Of these, three have even more extreme issues, with over 95% of their blocks experiencing arsenic concentrations over 50 micrograms per liter. However, the study shows that Birbhum, our district of interest, a state located in the Western border of the state doesn't suffer any problem related to arsenic contamination. See also Appendix Figure 1.

5.3. **Effectiveness of the Reservation Policy and the Village Demographics.** The results presented so far beg the question as to why the impact of SC/ST reservations on the policy outcomes, such as better targeting of infrastructure investments toward the SC/ST hamlets, become more pronounced in the villages where the share of SC/ST households increases. Hence, it is crucial to investigate the potential nonlinear impacts of population share as part of my econometric specification. In column (2) of Table 8, I add the square of the share of SC/ST households to check for nonlinear effects of population shares on public good investments in the SC/ST hamlets. I find a significant decline in the marginal effect of population shares on newly repaired wells, though this decline is significantly less pronounced in the reserved villages. Combining the coefficients on "Share" and "Share Square," I can therefore document a concave, non monotone relationship between population shares and newly repaired wells in non reserved villages. In contrast, in reserved villages, we find a monotone, increasing, and nearly linear relationship between these two variables. In column (3), I show that there are no significant differences in the effects of reservation if we use the (discontinuous) majority share variable instead of the (continuous) population share. In column (4), I control for the population share, in addition to the majority variable, and show that the results do not change.

[Table 8 Here]

There are two sources of nonlinearity I am concerned about. First, for the smaller shares of the SC/ST households in a village, the problem of public water access by the SC/ST households might be less prominent and this could make the local leaders more reluctant to invest in hamlet-specific water infrastructure. However, as the relative SC/ST population expands, the access problem becomes more pronounced and the elected leaders are forced to take action.

Alternatively, in an environment in which the villages are numerically dominated by upper caste households, upper caste groups might be capable to elect lower caste candidates which share their policy preferences more closely even in the reserved villages and this might have a diminishing impact on the expected re-distribution of public sources toward SC/ST hamlets under SC/ST reservation regimes (Dunning and Nilekani, 2009). On the other hand, the presence of a large number of SC/ST voters may be associated with the selection of SC/ST leaders which have preferences more similar to the average SC/ST household in the reserved villages.

6. A Potential Extension: Health Impacts

Glewwe and Miguel (2008) report that as of 2000 approximately 27% of children from developing counties were underweight. Although this figure varies across countries extensively (from 9% in Latin America to %48 in South Asian countries), the reasons of the poor growth rate of children are generally considered to be the same in these countries: malnutrition and

the frequent prevalence of diarrhea. Drinking unsafe water and inadequate availability of water for hygiene purposes are known to be two primary causes of diarrhea (Black et al., 2003). Can improved access to higher quality water sources decrease the prevalence of water related diseases among SC/ST children and have an positive impact of the long-run child growth? The data I have let us answer at least the first part of the question.

The results presented in Table 9 provide a coherent picture of the impact of SC/ST reservations on the child health outcomes. In Panel A, I report the estimates for the prevalence of water-borne diseases in a household. The dependent variable is a dummy variable which takes value 1 if at least one of the children under age 11 had the symptoms of these water-borne diseases, i.e. diarrhea, weakness or skin problems in the past 30 days prior to the survey. Conditional on observable characteristics, such as mother's education, household size, share of children in the households, I find that the prevalence of water-borne diseases in the SC/ST children is negatively correlated with the share of SC/ST households in the village for the reserved villages. However, this health improving impact of reservations is not significant.

[Table 9 Here]

An important point worth stressing about the potential health benefits for SC/ST children of the reservation policy is the type of households that this policy will actually affect. It might be the case that even though I do not observe a significant drop in the prevalence of the water-borne diseases such as diarrhea (i.e. the number of households which have any sick kids), the reservation policy might decrease the amount of children who are sick in each household which has the potential to produce sick kids. Panel B of Table 9 tests this alternative scenario. The dependent variable is the share of children in a household under age 11 who had the symptoms of diarrhea, weakness or skin problems in the past 30 days. Although I find a decrease in the share of the children in the SC/ST households with water-borne diseases with the increasing share of SC/ST in the reserved villages, this impact is again not significantly different from zero.

I also examine whether the health-enhancing impact of the reservation policy is more pronounced for certain groups of households. The results show that the health impacts of reservation policy (or related improved water infrastructure) tend to be greater, although not significant at traditional levels, for families in which mother is literate. Once I divide my sample according to the household land holdings, I find differential impact of reservation policies by income group. The overall health-enhancing impact of reservation policy has been driven neither by the richest or the poorest households, as defined by their landholdings. The positive health impact of the policy is almost entirely attributable to middle income families. The results are available upon request.

7. Concluding Remarks and a Look Ahead

The main empirical finding so far is that the total time spent at the water source by low caste women is systematically higher in villages with a higher share of low caste households. The political reservations provided for these disadvantaged groups have a positive impact on the time cost of water collection only if their population share is high enough. Surprisingly, there is no significant change in the child health outcomes, i.e. in the prevelance of water-related diseases as a result of political reservations.

The natural next step in this research agenda is to test whether these preliminary findings are robust to different specifications, in order to better understand the mechanisms underlying these results. At the later stage, I intend to focus on the optimal resource allocation problem. By setting-up a queue-theory problem, I will calculate the minimum cost of travel, when the public water sources are distributed optimally within a village. I will then compare the social cost with the estimated cost of travel resulting from the observed allocation of water sources. This difference provides deep insights into the extent of the misallocation problem under alternative regimes, i.e. leadership quotas for disadvantaged groups versus no political reservations.

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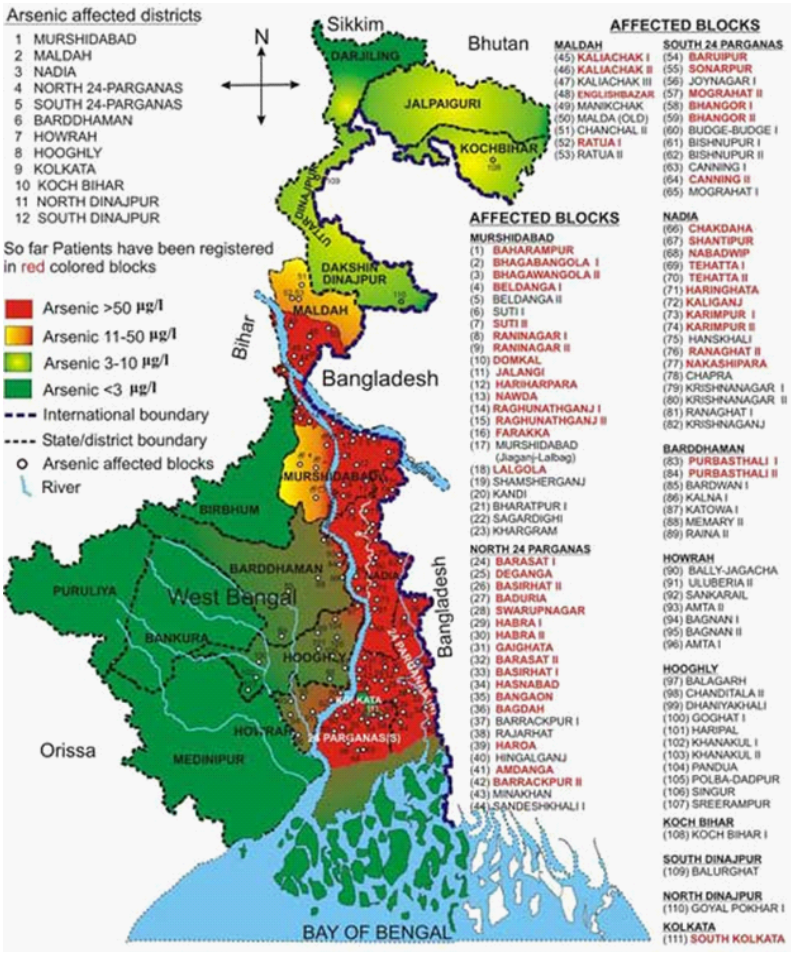
Appendix Figure 1:
Groundwater Arsenic Contamination Status in West-Bengal



Source: International Institute of Bengal Basin IIBB
(Ghosh Research Associates International)

TABLE 1: MIGRATION PATTERNS IN INDIA

	HH Heads	All Siblings*	All Brothers*
Born in the same village	97.89%		
Living in a place outside the survey village		46.65%	23.12%

Source: Rural Economic and Demographic Survey of India, 1999
* The sample includes the household head and all brothers (and sisters) of the household head who was born in the survey village.

Table 2: Randomization of Reservations at the Village-Level

	Reserved	Unreserved	Difference
Total population	1246.6	1304.4	56.30599
	(1405.4)	(1481.2)	(129.9627)
Share of SC/ST population	0.465	0.490	0.02020
	(0.266)	(0.258)	(0.02313)
Sex ratio	1.057	1.141	0.08283
	(0.0821)	(1.053)	(0.05712)
Sex ratio under 6	1.052	1.053	-0.00272
	(0.405)	(0.274)	(0.03124)
Village has a bus/trainstop	0.323	0.273	-0.05867
	(0.469)	(0.447)	(0.03889)
Literacy	0.359	0.396	0.03307*
	(0.128)	(0.130)	(0.01125)
Fraction of irrigated land	0.512	0.567	0.06985*
	(0.347)	(0.330)	(0.02670)
Village has community tap	0.0376	0.0242	-0.00321
	(0.191)	(0.154)	(0.11783)
Village has tube well	0.9355	0.9320	-0.00325
	(0.246)	(0.252)	(0.01506)
Number of schools	1.184	1.176	-0.05990
	(0.864)	(0.917)	(0.08176)
Number of health facilities	0.195	0.188	0.01401
	(0.695)	(0.536)	(0.05727)
Observations	189	306	495

Notes: The Census variables are from the 1991 Census of India. Reserved is an indicator variable for GPs reserved for a SC/ST candidate in 2003 elections. Column (1) and (2) report means. The standard deviations are in brackets. Column (3) report the tests of difference of means across groups. The coefficients reported in column (3) are from a single regression that regress the indicated village characteristics in 1991 on a dummy variable indicating whether the pradhan position is reserved for a SC/ST candidate, conditional on block fixed effects.

Table 3: Impacts of Political Reservations for SC/ST

	Panel A: Time to the source				Panel B: Time at the source				Panel C: Female Reservations	
									Female	Both
SC/ST	-0.274*	-0.821**	-0.234	-1.332**	-0.334	-2.231**	-0.213	-3.736***	-2.557**	-2.191*
	[0.163]	[0.398]	[0.189]	[0.541]	[0.449]	[1.068]	[0.523]	[1.320]	[1.261]	[1.152]
SC/ST*Share of SC/ST		0.985		2.031**		3.412**		6.508***	3.575*	3.531*
		[0.643]		[0.866]		[1.669]		[2.031]	[2.061]	[1.831]
SC/ST*Reserved			-0.099	1.043			-0.304	3.069	0.926	-0.382
			[0.279]	[0.725]			[0.762]	[1.875]	[1.999]	[2.549]
SC/ST*Share*Reserved				-2.193				-6.487**	-0.298	-0.790
				[1.256]				[3.204]	[3.436]	[4.345]
Additional Controls: Female Char, HH Demog House Char, Wealth	+	+	+	+	+	+	+	+	+	+
Observations	6722	6722	6722	6722	6722	6722	6722	6722	6722	6722

Notes: All regressions include village fixed effects. Robust standard errors, clustered by GP, are reported in brackets.
(* p<0.1, ** p<0.05, *** p<0.01)

TABLE 4: TIME SPENT IN THE OTHER ACTIVITIES

	Firewood Collection	Political Activities	Leisure: Radio/TV	Elderly/ Childcare
SC/ST	1.882	0.736	-1.547	17.791
	[2.636]	[1.800]	[5.804]	[11.456]
SC/ST*Share of SC/ST	7.986*	-2.300	-20.575**	-21.461
	[4.566]	[3.100]	[9.854]	[18.537]
SC/ST*Reserved	7.261	-1.102	-6.714	-15.224
	[4.706]	[1.639]	[7.538]	[13.182]
SC/ST*Share*Reserved	-11.615	3.952	13.565	32.007
	[8.755]	[3.050]	[13.380]	[23.087]
Additional Controls: Female Char, HH Demog House Char, Wealth	+	+	+	+
Observations	6721	6722	6721	6722

Notes: All regressions include village fixed effects. Robust standard errors, clustered by GP, are reported in brackets. (* p<0.1, ** p<0.05, *** p<0.01)

TABLE 5: ACCESS TO HIGH CASTE SOURCES

	Time spent at the source			
High Caste	0.317	0.186	-0.009	0.660
	[0.418]	[1.107]	[0.512]	[1.414]
High Caste*Share of SC/ST		0.241		-1.225
		[1.911]		[2.394]
High Caste*Reserved (SC/ST)			0.790	-0.875
			[0.745]	[2.077]
High Caste*Share*Reserved (SC/ST)				3.111
				[3.719]
Additional Controls: Female Char, HH Demog House Char, Wealth	+	+	+	+
Observations	6722	6722	6722	6722

Notes: All regressions include village fixed effects. Robust standard errors, clustered by GP, are reported in brackets. (* p<0.1, ** p<0.05, *** p<0.01)

TABLE 6: TARGETED INFRASTRUCTURE IMPROVEMENTS: QUANTITY

	Existing	Newly Built	Newly Repaired
Reserved (SC/ST)	-0.067	-0.022	-0.481
	[0.632]	[0.184]	[0.514]
Share of SC/ST	5.588***	0.765***	1.693**
	[0.830]	[0.214]	[0.666]
Share*Reserved (SC/ST)	0.152	0.207	1.640*
	[1.189]	[0.346]	[0.969]
Additional Controls:			
Village Area	+	+	+
Village Population	+	+	+
Observations	495	495	495

Notes: All regressions include block fixed effects. Robust standard errors, clustered by GP, are reported in brackets. (* p<0.1, ** p<0.05, *** p<0.01)

TABLE 7: TARGETED INFRASTRUCTURE IMPROVEMENTS: QUALITY

	Availability: Perennial	Color: Muddy	E-coli count: Purple colonies	Care: No one
Reserved (SC/ST)	-0.101	0.132*	-0.028	0.012
	[0.072]	[0.068]	[0.024]	[0.080]
Share of SC/ST	-0.051	0.026	-0.001	-0.025
	[0.092]	[0.050]	[0.036]	[0.079]
Share*Reserved	0.230*	-0.224**	0.004	-0.021
(SC/ST)	[0.123]	[0.101]	[0.034]	[0.127]
Additional Controls:				
Village Area	+	+	+	+
Village Population	+	+	+	+
Observations	400	400	400	400

Notes: All regressions include block fixed effects. Robust standard errors, clustered by GP, are reported in brackets. (* p<0.1, ** p<0.05, *** p<0.01)

TABLE 8: DEMOGRAPHICS AND THE EFFECTS OF RESERVATION

	# of Newly Repaired Sources in SC/ST Hamlet							
Reserved (SC/ST)	-0.481	[0.514]	0.752	[0.612]	-0.399	[0.372]	1.275**	[0.584]
Share of SC/ST	1.693**	[0.666]	9.241***	[2.096]			10.490***	[2.149]
Share Square			-7.453***	[1.991]			-7.448***	[1.995]
Share*Reserved	1.640*	[0.969]	-5.002	[3.363]			-8.127**	[3.288]
Share Square*Reserved			6.484*	[3.484]			6.423*	3.449]
Majority of SC/ST					0.417	[0.339]	-0.802	[0.545]
Majority*Reserved					1.500***	[0.562]	2.125**	[0.952]
Additional Controls:								
Village Area	+		+		+		+	
Village Population	+		+		+		+	
Observations	495		495		495		495	

Notes: All regressions include block fixed effects. Robust standard errors, cluster by GP, are reported in brackets. (* p<0.1, ** p<0.05, *** p<0.01)

TABLE 9: PREVALENCE OF WATER RELATED DISEASES

	Panel A:			Panel B:		
	Diarrhea	Weakness	Skin Problem	Diarrhea	Weakness	Skin Problem
SC/ST	0.003	0.015	0.045	0.000	0.026	0.040
	[0.046]	[0.058]	[0.053]	[0.039]	[0.047]	[0.044]
SC/ST*Share of SC/ST	0.052	-0.011	0.003	0.042	-0.036	-0.006
	[0.076]	[0.098]	[0.090]	[0.064]	[0.078]	[0.074]
SC/ST*Reserved	0.051	0.120	0.057	0.040	0.064	0.021
	[0.057]	[0.078]	[0.090]	[0.045]	[0.061]	[0.066]
SC/ST*Share*Reserved	-0.103	-0.161	-0.034	-0.082	-0.090	0.001
	[0.102]	[0.142]	[0.150]	[0.080]	[0.110]	[0.108]
Additional Controls: Female Char, HH Demog House Char, Wealth	+	+	+	+	+	+
Observations	4083	4083	4083	4083	4083	4083

Notes: All regressions include village fixed effects. Robust standard errors, clustered by GP, are reported in brackets. (* p<0.1, ** p<0.05, *** p<0.01)