# Social Capital and Basic Goods: The Cautionary Tale of Drinking Water in India

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# Social Capital and Basic Goods:
# The Cautionary Tale of Drinking Water in India[*]

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**Abstract**

In 18.6% (11.5%) of rural (urban) Indian households in 1999, somebody (usually female) had to devote an average of 47 (42) minutes per day to fetching water – time which could have been put to other productive uses. This paper uses micro data from the 1998-99 Indian Time Use Survey (ITUS) conducted in Gujarat, Tamil Nadu, Madhya Pradesh, Meghalaya, Orissa and Haryana (covering 77,593 persons in 18,591 households) to examine the relative quantitative importance of social capital and of inequality in land ownership and caste status for the availability of tap water. Water supply illustrates two important problems of development – the organization of collective action which can potentially improve well-being and the distribution of the benefits of such co-operative behaviour. Time use data provides a natural metric for Social Capital, since the ITUS provides direct observation of time spent in individual social interaction outside the home, and in group or community activities. The paper provides strong evidence for the conflicting impacts of group-based and community-based activities on social capital, in the Indian context, and for the importance of inequalities in income, land ownership and caste status for public goods provision.

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"The human right to water", declares the United Nations Committee on Economic, Social and Cultural Rights, "entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic use."

- Human Development Report (UNDP 2006:77)

"a minimum water requirement for human survival under typical temperate climates with normal activity can be set at three liters per day. … in tropical and subtropical climates, it is necessary to increase this minimum slightly, to about five l/p/d, ... A further fundamental requirement .. is that this water should be of sufficient quality to prevent water related diseases."

- Gleick (1996:84)

Humans are all alike in facing the basic constraint of time and in needing water to drink every day. As well, water is needed for sanitation, bathing and food preparation. Adding all water needs together, the United Nations High Commissioner for Refugees (1992)[1] suggested that 15 litres per person per day is the minimum necessary while the Human Development Report (2006) of UNDP sets a standard of 20 litres per capita per day. Whatever the exact level of this basic need, the residents of developed countries (and the majority of Indian citizens) can simply turn the tap[2] and satisfy it immediately, but in approximately 18.6 % of rural Indian households (and 11.2% of urban households) somebody (usually female) has to spend an average of about ¾ of an hour per day fetching it. This paper is about the causes of inequality in access to this basic necessity of life.

Who has to fetch water and why do they not now have the access that most people take for granted? This paper begins in Section 1 with an overview of water collection in India and a brief description of the Indian Time Use Survey of 1998-99. Section 2 develops a simple model of water provision whose main feature is inequality in net individual benefits from collective water supply and the potential role played by social capital in helping to solve the problem of organizing collective action. Section 3 then suggests that a natural metric for local social capital is the average amount of time that local residents spend in social interaction and in group or community activities, and it examines the relative importance for the supply of water of community and group level social capital and of inequality in land and in caste. Section 4 concludes.

## 1. Overview

### 1.1 Basic Needs and the Time Burden of Carrying Water

Water is a physiological requirement for human survival, but the daily burden of carrying it does not fit neatly into current debates on basic necessities and poverty. The World Bank, for example, begins its training manual on the measurement of poverty with the general statement: "Poverty is "pronounced deprivation in well-being."," but emphasizes (2005:8) that the starting point for most analyses of poverty is to define "well-being" in terms of "command over commodities in general[3], so…. poverty is then measured by comparing an individual's income or consumption with some defined threshold below which they are considered to be poor. … (while) … a second approach to well-being (and hence poverty) is to ask whether people are able to obtain a *specific* type of consumption good." Although the Human Poverty Index of the UNDP includes, as one of its components, the percentage of the population[4] "without sustainable access to an improved water source", it goes on to define "reasonable access" as "the availability of at least 20 litres a person per day from a source within 1 kilometre of the user's dwelling". As any reader can easily check, carrying this amount of water for a four person family (i.e. 80 litres per day) is hard work[5] – and a return journey of up to two kilometres takes significant time. Hence, having "access" to water does not capture the burden of this daily task.

Sen's "capabilities" approach to thinking about deprivation is perhaps the closest in spirit to the current paper, but carrying water is a task, not a capability. For those individuals who physically cannot carry water, individual capability may be crucially important. However, for most people – i.e. most women (it is easy to observe that this task is very unequally shared within households) – the problem is not that they cannot do this job, but the fact that doing it subtracts from the time and energy available for other tasks.

Whether the task of carrying water is small or large depends on the local community's facilities for water provision – i.e. carrying water is an individual task but the availability of piped water is a community characteristic. Piping water to a dwelling, rather than having to carry it in a bucket, is about as clear an example of capital/labour substitution that improves well-being as one can find – but the affluent can afford to dig their own private wells, so it is the poor who have to spend a significant part of every day carrying water, and who consequently have a clear claim to be experiencing "pronounced deprivation in well-being." The construction and maintenance of public water distribution infrastructure requires community organization and the literature on social capital stresses the facilitating role of social interaction and group membership for that community organization – but the fact that the affluent do not now have to carry water is likely to be crucially important in determining their support. Analysis of the time people spend carrying water therefore raises, in a very concrete way, some central concerns about inequality, gender, public goods provision and social capital in the development process.

### 1.2 Data Description

Between June, 1998 and July, 1999, the Central Statistical Organization of India conducted a pilot Time Use Survey (the ITUS). A stratified random sampling design, as followed in the National Sample Surveys (NSS), was used to survey 18,591 households (12,750 rural and 5,841 urban) with 77,593 persons, of whom 53,981 were rural and 23,612 were urban residents. The survey was conducted in four rounds during the year to capture seasonal variations in the time use patterns of the population. Two person teams of male and female interviewers stayed in each village or urban block for nine days to compile time diaries for normal, abnormal and weekly variant days. Respondent households were first visited to assess their weekly pattern of time use and then revisited to complete a full diary of activities concerning the previous day for all household members over six years of age. Although the sample design was explicitly constructed to capture differences in time use between normal and weekly variant or abnormal[6] days, in practice Hirway (2000:24) noted that "On an average, of the total 7 days, 6.51 were normal, 0.44 weekly variant day and 0.05 was abnormal day… in rural areas people continue their normal activities on holidays also." This paper therefore focuses on time use on "normal" days.

As Pandey (1999:1) noted: "India has lot of socio-economic, demographic, geographic and cultural diversities. To ensure that all aspects of diversities are captured, Haryana, Madhya Pradesh, Gujarat, Orissa, Tamil Nadu and Meghalaya were chosen to represent northern, central, western, eastern, southern and north-eastern regions respectively." Although one might wonder whether six states' data could fully capture the diversity of India, Hirway (2000: 11) has argued "cross-checking of the results has confirmed that the sample is fairly representative of the country." In any event, this data would be interesting even were this not the case, i.e. even if the data were only seen as a sample of the 233 million people inhabiting these six states.

Figure 1 plots the distribution of total water collection time in the households who have to collect water while Table 1 presents some basic descriptive statistics on who collects water in rural and urban areas – throughout this paper we examine rural and urban areas separately. Within each panel of Table 1, the left column reports the percentage of all time spent, by all people, collecting water. Column R1 indicates, for example, that in rural areas approximately 1.3% of all water fetching work is done by boys and another 7.0% is done by adult men. Column U1 shows that in urban areas boys do 0.3% of this work and men do about 11%. The conditional probability that, if a household has to collect water, a particular type of person will have to do it is given in columns R2 and U2 of Table 1. Since bar graphs may help to confirm visually the relative size of demographic differences, Figures 2 and 2A show the relative probability, and percentage of total water collection time, of boys, men, girls and women. Clearly, "carrying water" is a heavily gendered task – in both the urban and rural areas of India, adult women do about 87% of this kind of work[7].

The third columns in each panel report the average time spent in a normal day by people who have to collect water. For those people who have to do it, carrying water is clearly a significantly important task. As column R3 shows, on the average rural women who fetch water spend more time (47 minutes daily) than rural men (40 minutes), but approximately the same time as boys (48 minutes). Moreover, in rural households where the girls are sent to do this task, it is little more onerous (50 minutes per day). Column U3 indicates that the time spent on water collection is actually not very different in urban areas, except for girls, who spent much less time.

In our sample, there is a wide range of variation across individual villages and districts in the percentage of people who are members of scheduled castes or scheduled tribes, but the percentage of scheduled caste members and of other castes who collect water is not very different (36.0% as compared to 34.7%) and neither is the length of time required (48 minutes daily as compared to 45 minutes). As the bottom row of Table 1 indicates, paid collection of water is very small relative to unpaid household collection – in rural areas only 1.2% of water collection time was paid, and in urban areas only about 1.4%. This paper will therefore focus on unpaid collection of water for household use.

**2. A Simple Model of the Supply of Tap Water**

Wherever they live, humans must have some source of water supply – what determines whether the infrastructure to deliver tap water is constructed or whether households have to carry water from whatever source exists? Water is not a classic "public good" since it is both rival in consumption and easily excludable in access. But because wells, reservoirs, piping and other water production facilities have significant indivisibilities and economies of scale[8] and because the efficient distribution of water often requires piping or aqueducts which may have to cross many individuals' properties, in most countries the public sector is deeply involved in provision of water infrastructure [9].

In affluent nations, tap water supply is nearly universal, but, as Table 1 indicates, in developing countries like India coverage is far from complete. Piped water delivery requires the construction of distribution facilities that in India are often far beyond the means of individual households. In addition to the fixed cost of pumping stations and the marginal costs of piping and maintenance, there is a cost to the negotiations required to arrange construction and the rights of way needed for water distribution – negotiations which are more difficult because the benefits of piped water are unequally distributed.

For a simple model to capture the inequality of net benefits in water distribution, we start by abstracting from the specificities of geography and assuming that a point source of water – a well with finite capacity – now serves a population that is uniformly distributed on a featureless plain. Suppose that this well can supply $N$ households spread uniformly over a radius $D$ from the well head. Since each individual household is located at a given distance from the well, we can summarize the cost in time and effort of collecting water from the well for household $i$ with opportunity cost of time $w_i$ as a fixed time cost of filling containers ($w_i\ c$) and a linear function of distance ($w_i\ d_i$), which can be represented as line OC in Figure 4.

We assume that the technology of tap water supply is characterized by the fixed cost of digging a well and maintaining a pumping station, whose annualized value is given by $b_0$, and a constant per meter marginal cost of connective piping and maintenance (annualized to be $b_1$). Conditional on individuals closer to the well already being connected to the distribution system, the marginal cost function ($b_1$) can be represented as the line MC in Figure 4.

The piped water system would pass an aggregate cost-benefit test if the aggregate gains from time savings cover the fixed and variable costs – i.e. if $NSB>0$.

$$NSB = \sum_i (w_i\ c + w_i\ d_i) - (b_0 + b_1 D) \qquad [1]$$

The average total technical cost ($ATTC$) of water supply per household is given by:

$$ATTC = (b_0 + b_1 D)/N \qquad [2]$$

The main point of Figure 4 is to illustrate a dilemma in piped water systems. The benefits to an individual household of the piped water system ($w_i\ c + w_i\ d_i$) vary with distance from the wellhead ($d_i$) and opportunity cost of time ($w_i$). Households located close to a point source of water have the least to gain from piped water supply, because their current time costs of carrying water are smaller – indeed Figure 4 is drawn to illustrate the (extreme) case where households closest to the well are not willing to pay even the marginal cost of connection. However, more distant households can only connect at the marginal cost of service ($b_1$) if the pipe system already serves those of their neighbours who are nearer the water source.

The household's opportunity cost of time ($w_i$) in other work depends on their human capital stock. There is also a pure wealth effect (e.g. from land ownership) on $w_i$, via the income elasticity of demand for leisure, conditional on human capital. For an individual household, the cost of digging a private well sufficient for the household's own use is plausibly less than the fixed cost of a well and pumping station big enough for the local district, but even if it is not, for sufficiently large values of $w_i$ one will observe ($w_i\ c + w_i\ d_i$) > $b_0$ . Although collective provision at an average total cost of $(b_0 + b_1 D)/N$ would usually be cheaper than self provision, if collective provision cannot be arranged, the affluent will find it worthwhile to dig their own private wells.

A pure market based system of water supply could involve a very complicated game of bluff, hold-up and reneging on contracts[10]. Since no agent would otherwise make irrevocable investments in fixed cost facilities and piping, some credible institutions for the enforcement of long term contracts would be needed. Substantial transactions costs in bilateral monopoly/monopsony bargaining would also be incurred if each household were to buy from their upstream neighbour and try to exploit their market power over downstream neighbours. The non-existence of long term contract enforcement institutions is arguably a crucial part of the development problem – but even in highly developed market systems, the provision of water to households is usually done by public utilities, or under strict public regulation.

Organizing collective action faces, however, the problem that inequality in the net benefits of a piped water system is inherent, since the opportunity cost of not having a water distribution system depends on the distance water must otherwise be carried and is accentuated by any inequality in the opportunity cost of time $w$ – which will vary with household wealth, in both human capital and land ownership. As well, if water carrying is a gendered task and if the benefits of piped water in saved labour are received by women while the cash costs of municipal water rates are paid partly by men, inequality in power within households will affect the perceived net benefits of the family patriarch, who may be the relevant "voter".

Even if all individuals realize that there are economies of scale in water supply that imply a net surplus is created by joint action, will households co-operate in the collective provision of water? Knowing that more distant neighbours would be willing to pay more to avoid carrying water, and that piping systems need transit rights to serve them, will households closer to the source attempt to exploit their location advantage – perhaps by arguing they should pay less than the average total cost of collective provision? If proxies for the opportunity cost of time ($w_i$) are observable, and if the less affluent know that the relatively rich would be willing to pay more, will they attempt to pass more of the costs onto their richer neighbours? Discriminatory pricing of water based on location and income may be technically feasible, but if such differential pricing is perceived to be unfair, these perceptions could undermine the social co-operation on which collective water systems depend. The model of this section therefore ignores the possibility of differential pricing and argues that the basic issue determining whether a collective community water system exists is whether the median voter[11] will support a community water supply authority which prices at average total cost.

Institutions (like water supply authorities) do not, however, drop without cost from the sky. A costly process of negotiation is needed to establish a public authority and determine its policies. If all individuals received the same benefit from the public authority, such negotiations could be short, as all could agree immediately on the optimal policy. Negotiation is necessary if interests diverge and tends to be more protracted if mutual trust is absent. We presume that the total cost of negotiation depends multiplicatively on both the total absolute difference between residents in the net benefits they will receive from the water system [ $\Sigma_i \Sigma_j |u_i - u_j|$ ] and the level of mutual mistrust.

If we summarize "mistrust" as a parameter $b_2$, Equation 3 expresses the total cost of water supply ($TC$) as the sum of the technical and negotiation costs – i.e. fixed costs ($b_0$) and variable costs of connection ($b_1 D$) plus negotiation costs.

$$TC = b_0 + b_1 D + b_2 \Sigma_i \Sigma_j |u_i - u_j| \qquad [3]$$

Average costs of piped water supply (*ATC*) are then given by Equation 4[12]. If the crucial issue for political support of a water authority is whether or not the critical voter is better off (i.e. whether $ATC < OC$), this implies that the important variables are the fixed cost of supply and the degree of inequality in the benefits of piped water and of mistrust.

$$ATC = \frac{b_0 + b_1 D}{N} + b_2 \frac{\Sigma_i \Sigma_j \left| u_i - u_j \right|}{N} \qquad [4]$$

**3. Why do some households have to collect water?**

The question "Why do some households in India have to collect water?" really has two components:

1] Why do some localities have tap water while others do not?

2] Why, when local facilities exist, do some households not benefit, because they are not connected to the local water distribution system?

The likelihood that a particular household will have to spend time fetching water is a compound probability – one minus the product of the probability [$P_1$] that tap water is available from a local well or pipe system and the conditional probability [$P_2$] that the household can connect to the local distribution system, if it exists. In our data, we observe this compound probability, and the issues we want to examine are the characteristics of communities that determine the local availability of drinking water and the characteristics of households that determine access to locally available supplies. The discussion above suggests that one should expect the probability of tap water availability to depend negatively on average total cost, so that (writing σ for a measure of inequality in the opportunity cost of time $w_i$) one would expect:

$$P_1 = f_1(b_0, b_1 D, b_2, \sigma) \qquad [5]$$

Isham and Kähkönen (2002) have also emphasized the benefits of village level social capital for the effective design, implementation and maintenance of rural water projects in rural India and Sri Lanka. The impacts of greater mistrust ($b_2$) on costs of water provision may therefore enter via multiple paths - in higher initial negotiation costs and in increasing the fixed and variable technical costs of water supply ($b_0$ and $b_1$) (also see Isham and Kähkönen (1999) on water in Java). In equation [5], the technical costs of water provision (summarized in $b_0$, $b_1 D$) and the levels of mistrust ($b_2$) and inequality ($\sigma$) are characteristics of the community. Whether an individual household can connect to an available local network plausibly depends on their household disposable income ($y_i$), and on whether they are a member of a socially excluded group ($S_i$). One could then write the conditional probability of tap water access as in [6] and the compound probability of fetching water (i.e. one minus the probability of having piped water) as in [7].

$$P_2 = f_2(y_i, S_i) \qquad [6]$$

$$[1 - P_1 P_2] = f_3(b_0, b_1 D, b_2, \sigma, y_i, S_i) \qquad [7]$$

### 3.1 Social Capital, Other Community Characteristics and Access to Water

Why might a *community* characteristic such as "mistrust" (which we have summarized as parameter $b_2$) vary across localities and thereby affect an *individual household's* access to tap water? The provision of tap water illustrates the linked problems of [1] organizing collective action, which can potentially improve the well-being of all residents of a locality and [2] distributing the benefits of such co-operative behaviour. If a local community can successfully organize the production of good quality schooling, water supply, roads or sanitation, the initial benefits will be greatest for the poor who now do without, and least for the affluent who can now purchase private substitutes - but all can benefit from longer term economic development. What determines whether this happens?

In recent years, a vast literature[13] has stressed the importance of local "social capital" for the organization of co-operative action – either in direct voluntary supply of local infrastructure or in the mobilization of political pressure which produces government action. The World Bank's website on Social Capital is particularly rosy:

> "Social Capital refers to the norms and networks that enable collective action. It encompasses institutions, relationships, and customs that shape the quality and quantity of a society's social interactions. Increasing evidence shows that social capital is critical for societies to prosper economically and for development to be sustainable. Social capital, when enhanced in a positive manner, can improve project effectiveness and sustainability by building the community's capacity to work together to address their common needs, fostering greater inclusion and cohesion, and increasing transparency and accountability[14]."

Putnam (2000:19) has variously defined "social capital" as "connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them" or as "features of social organization, such as networks, norms, and trust, that facilitate co-ordination and co-operation for mutual benefit" (Putnam, 1993). For Woolcock and Narayan

(2000: 227) “social capital refers to the norms and networks that enable people to act collectively”.

Phrased in this way, “social capital” sounds inherently positive, but norms and networks are specific to particular cultures and historical periods. As many authors have noted, “social capital” and associational life can be either positive or negative in its implications for development. Norms and networks can “bond” individuals into mutually exclusionary, divisive, small social groups or “bridge” social groups and thereby link individuals within the wider society. Ethnic and religious tensions (such as the long conflict in Northern Ireland, or the 1980s civil war in Lebanon) which undermine development may be partly the product of strong within group bonding, as well as abysmally high inter-group mistrust – and the “collective action” of social groups in that context can either accentuate or reduce communal mistrust. Although Mogues and Carter (2005) are representative of a large literature which sees local social capital as essentially positive and potentially determinative of the co-operative behaviour on which development depends, “collective action” in the pursuit of communal conflict can also be disastrous for development.

As Mogues and Carter note, individuals invest time in relationships with others to produce a valuable personal asset – their network of relationships. Aggregating these individual networks will produce a set of social networks. Since “knowing people who know people” generates indirect social contacts, network-building has economies of scale – but the extent of any pre-existing divisions within the wider community will limit the potential scope of indirect contacts. Individuals can try to optimize their personal investment in social capital but each individual will, in their network building, always have to work within the constraints on social interaction which their local society has inherited from the past. The amount of “bridging” social capital which might positively affect development, compared to the “bonding” of individuals into narrow sub-groups, depends on both the strength of inherited social divisions and the intensity and type of current social interaction among local residents.

If some aspects of social capital are positive for development, while other aspects might be negative, how might one test the social capital hypothesis? How might one empirically measure “social capital” – and distinguish between “bridging” and “bonding” social capital? Might it sometimes be the case that the positive impacts of “bridging” activities are outweighed by the negative influences of “bonding” into divisive sub-groups?

One strand of the social capital literature has relied on summary questions which ask respondents to indicate their level of trust in others. Knack and Keefer's much cited 1997 results reporting the positive impacts of social capital on economic growth relied, for example, on the World Values Survey question: "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?" As they note, responses to such general questions mingle how much trust one places in people who are not close friends or relatives, and the frequency of encounters with such persons, which makes it impossible to distinguish bridging and bonding effects.

Other researchers have attempted to measure the prevalence of local networks by querying individuals about their associational memberships and their participation in local community and political activities. Narayan and Pritchett (1999a, 1999b), for example, argued that Tanzanian villages in which individuals belonged to more groups were also richer (and that the relationship was causal) – a finding about the importance of associational life that conflicted with Knack and Keefer's (1997:1251) conclusion that: "Membership in formal groups—Putnam's measure of social capital—is not associated with trust or with improved economic performance".

An important issue in this debate is how one might want to measure "Associational life". If a person is asked: "Are you, or is someone in your household, a member of any groups, organizations or associations[15]?", the self-identification of memberships may be highly subjective, unless groups are very formalized[16] – which seems likely to be rare in most instances, particularly in less developed countries. The raw number of associational memberships is an index which weights equally the intensive and marginal involvements of individuals, and which does not differentiate the purposes and types of associations. On the other hand, index numbers with arbitrary aggregation properties[17] may produce econometrically fragile results.

This paper argues that the time spent in associational activities is, in many ways, a natural metric for associational life. If social interaction between persons happens, it takes time – and should show up in time use diaries. The minutes of time people spend in group or community activities provides a natural unit for aggregation – unlike aggregation across different types of associations and activities, which faces the problem that, because there is no natural way to add up associations, researchers must construct arbitrary indices. As well, the total time spent on an activity is a natural and comparable measure of each person's intensity of involvement – unlike subjective grading by respondents of intensity of participation in associations, which cannot be interpersonally comparable. Additionally, when respondents are asked for recall data on associational memberships, no aggregate consistency check on total memberships is possible - in contrast to the time diary constraint that the aggregate length of all of a day's activities must sum to 24 hours. Because the time diary method of data collection walks respondents through a specific day's activities from morning to evening, it provides both a narrative spur to more complete respondent recall of particular events and a consistency check on total reported activities.

In coding the time use of Indian respondents, it is clear that the ITUS designers were highly conscious of the social capital literature. Both formal political and "civil society" types of interaction and informal socialization were separately identified and coded. For the purposes of this paper, it is particularly important that the ITUS distinguished between informal social interaction (such as *Talking, Gossiping and Quarreling - 951*) and formalized associational interactions. Furthermore, under the general heading of activities identified as *Community Services and Help To Other Households:* the ITUS specifically distinguished between *community* based activities[18] and *group* activities[19]. The community based activities are specifically defined to correspond to the sort of "bridging" associations that bring benefits to the entire community, but it is an open question whether such usages of time as "participation in meetings of local and informal groups/caste, tribes, professional associations, union, fraternal and political organisations (651)" are bonding individuals into narrow sub-groups, based partly on pre-existing divisions (such as caste) or linking individuals across narrow interest groups.

As Putnam (2000) argues (and as any practicing politician can attest) personal connections and networks of trust are the basis of political organizing and civil society. The informal social interactions on which such networks depend occur both at social events and in casual encounters. The ITUS data reports the time individuals spend in "*SOCIAL AND CULTURAL ACTIVITIES, MASS MEDIA, ETC."* As Table 2 indicates, casual encounters and "*Talking gossiping quarrelling"* are common – in rural (urban) areas, 44.56% (28.72%) of adult[20] men and 29.39% (28.59%) of adult women report doing some of this, for an average of 33.75 (20.46) minutes for men and 19.85 (18.22) minutes for women. (Note that the impossibility of distinguishing between informal "talking", "gossiping" or "quarrelling" as different activities and the ambiguity associated with whether one would expect them to have a positive or negative impact for development illustrates somewhat concretely the broader ambiguity in the implications of social capital for development.)

However, many important time uses are not of daily frequency, for any specific individual. Social *events*[21] are, for example, somewhat episodic – on any given randomly selected normal day one only observes about one male in twenty engaged in a recorded social event, with an average duration of about one hour and twenty minutes[22]. Our hypothesis is that time use data can be used as an index of the social interaction that produces social capital and reduces mistrust ($b_2$). However, aggregating the average amount of time spent in each local area on all types of social interaction – community work, group activities, social activities and casual conversation – into a single total amount of local social interaction would presume that all types of social interaction have a common influence on mistrust ($b_2$). We prefer to test explicitly the assumption that they all have the same impact on social capital, and therefore the same impact on the provision of local public services.

An econometric issue which we must address is possible endogeneity between time spent collecting water and social time – at least for women. More time spent collecting water clearly means less time available for all other things, but because water carrying is such a highly gendered task, it is highly unlikely that male socialization time is directly affected by the availability of tap water. Since we can measure separately the average social time of men and the average social time of women – both of which arguably might be important for social networking – we can check whether there is any difference in results when we examine the impacts of male social time, female social time or both aggregated.  To sidestep the endogeneity issue, Table 3 in the main body of the text reports results using just male social time as well as male and female time – but Table A3 in the Appendix reports estimation results using only female social time, which are essentially similar.

A second possible source of endogeneity problems would be to include community work on water projects (activity code 611) as an explanatory variable predicting tap water availability. In this paper we therefore drop activity code 611 from the measure of time use in community activities.

In the Indian context, many of the administrative decisions which affect local villages or urban blocks are taken by the different administrative districts[23] within which they are located (within the six states examined[24]). As local political units, it is arguably the districts which are the locus within which social capital will have its impact (or not), so this paper focuses on differences across districts in outcomes, but uses as potential explanatory variables the inequality both among villages in the same districts and within villages.

Table 3 reports probit regression results estimating Equation [7] above for rural households (i.e. the probability that a members of a given rural household will spend some time, in a normal day, collecting water) while Table 4 presents urban results. Since we are concerned that our results not be sensitive to sampling error, both Tables report average estimated coefficients and standard errors from 1,000 bootstrapped replications.

In time diary data one cannot generally expect to observe "lumpy" types of events every day – although, for example, people who dine out with friends three times a week might be thought to be highly sociable, they still have four chances in seven of being at home on any random evening. Episodic usages of time have, therefore, to be analyzed in terms of the conditional expectation of a particular time use, on a randomly selected normal day – but this implies that estimation of the probability of low frequency events (like participation in community functions) may be susceptible to variability in small samples. The bootstrapping procedure described in Efron and Tibshirani (1993), Mooney and Duval (1993) and Davison and Hinkley (1997) is therefore particularly appropriate for our purposes. It can be summarized as follows.

Let $b$, $\hat{b}$, $k$ and $N$ denote the true population value of a coefficient, estimate of the coefficient from a probit regression, the number of bootstrapping iterations, and the number of observations in the original sample, respectively. We draw a random sample (with replacement) of $N$ observations from the original sample and estimate a probit regression. We repeat this process $k$ times. Let $b_i^*$ denote the estimate of the coefficient in the $i^{th}$ iteration ($i$=1,…,$k$). The standard error of the point estimate of $b$ can be estimated by $\sum_{i=1}^{k}(b_i^* - \bar{b}^*)^2/(k-1)$ where $\bar{b}^* = \sum_{i=1}^{k} b_i^*/k$ . The bias in $\hat{b}$ can be estimated as $(\bar{b}^* - \hat{b})$. Since this bias has an indeterminate amount of random error, it is best to use $\hat{b}$ as the point estimate of $b$ (rather than $\bar{b}^*$, which is the bias subtracted from $\hat{b}$ ).[25]

In both Tables 3 and 4 we include Model A in the first column as a cautionary example of the importance of disaggregating time use. In Model A, time spent by men and women in all types of community and group activities[26] are added together and averaged. However, in the remaining four columns of each table, community work and group activities are separately identified and average social time and inequality are differently measured. In Models B and C, average social interaction time is computed for all adults, while in Models D and E we use only male adults' social time. Columns B and D are estimated using the Theil index of inequality in land holding and monthly expenditure while columns C and E use the square of the coefficient of variation – since we want an index of inequality that is decomposable into within district and between district components of inequality (see Jenkins, 1991).

We present all these specifications because we want to examine the robustness of our results. Looking first at individual characteristics, the tendency of economists is to think of price and income effects as possible explanatory variables in predicting household demand for a service (such as tap water) – but the size of such effects, relative to the influence of other possible explanatory variables, is an empirical issue. The ITUS data does not contain any direct measurement of the money price of water but hook-up charges or local taxes to defray distribution costs may still imply that "ability to pay" could be a significant barrier to having tap water, even where it is locally available.

In both Tables 3 and 4, the household's monthly per capita expenditure is consistently and significantly negatively associated with having to fetch water, with a somewhat larger coefficient in urban than in rural areas. However, since the respondents to the ITUS were asked a single summary question about total average monthly expenditures by the household (rather than the series of questions on categories of consumption which a household expenditure survey would use to add up total consumption) we are cautious about possible measurement error in this variable[27] – particularly since it is unlikely to include self-production of food and fuel.

Moreover, since digging one's own well, or connecting to a local pipe system, represents an investment with a long term return in time and energy, one could arguably expect *wealth* and not *income* to be the more important individual household determinant of access to tap water. If one interprets occupation as indicator of human capital wealth, the negative coefficient on "professional" (e.g. engineer, doctor etc.) household status in Table 3, predicting the probability of fetching water, may reflect human capital wealth, and the significant positive association with greater number of dependents is also consistent with this interpretation. However, in Table 3 the statistical insignificance of landlessness, home ownership and a dummy variable “laborer” (indicating that more than 50% of income is from agricultural or other labour status) can be read as indicating that these variables have little additional explanatory power in rural areas that is not already captured in monthly expenditure. These results contrast with the urban evidence in Table 4 of positive correlation of labourer status and water carrying and the negative coefficient on home ownership status (both are strongly statistically significant). Hence, we have some evidence for a greater relative impact of “ability to pay” as a determinant of lack of access to tap water in urban, compared to rural areas. Notably, there is no evidence in either Table 3 or 4 for discrimination in water access against female headed households or scheduled castes or tribes.

Whether or not citizens can mobilize effectively for collective action, the cost of supply of tap water depends partially on cost of provision[28]. National water resources data[29] provide estimates of replenishable ground water reserves per capita in different states. Clearly, the less easily local wells can be dug to access water, the more likely it is that a particular household will have to fetch it. In both Tables 3 and 4 this proxy for technical cost of supply has the expected negative sign, is stable in empirical magnitude and is highly statistically significant in all specifications.

Given the technical cost of water facilities, provision will be more likely where co-operative action can be more readily organized – this paper attempts to assess the relative quantitative importance of social interaction, and of the type of social interaction, compared to the structural barriers of caste and class. This is possible because the novelty in time use data is its direct observation of time spent in social interaction, whose impacts can be compared in magnitude to the impact of inequality in land ownership, income and caste status. Indian villages are divided both by the social barriers of membership in Scheduled Castes and Scheduled Tribes and by economic inequality in household income and land ownership.

A clear implication of the social capital perspective on local public goods provision (see equation [7] above) is the expectation that a household’s probability of having to fetch water will be higher where there is greater economic inequality (e.g. in land ownership) and where the percentage of scheduled castes and tribes in the district’s population is higher. Of course, this expectation is not exactly new. A long tradition in thinking about development in India has emphasized the barriers of caste and class[30]. As Habyarimana et al (2006:23) have also noted:

"From Pakistan to Indonesia and from rural Kenya to the United States, a growing literature suggests that the relationship between diversity and the underprovision of public goods is not simply an artefact of differences in wealth or patterns of residential mobility. It appears that ethnic diversity has an independent (negative) impact on the likelihood that communities can organize collectively to improve their welfare."

The innovation in the social capital approach is its optimistic perspective that social interaction can create networks of mutual trust that facilitate co-operative action, *given* the structural divisions of ethnicity, class and caste. However, when we added together the time spent in both community and group activities, we got the results reported in Model A of Tables 3 and 4. Contrary to the social capital model, Model A indicates that time spent on community and group activities is strongly statistically significant and positively associated with having to fetch water – i.e. is *negatively* associated with local public goods provision. It was only when we examined separately the impacts of community work and group activities that it became clear that associational life within groups has a very different role to play in India than wider community involvement.

In Tables 3 and 4, the average time spent by local people in *community* work is *negatively* associated with having to fetch water but the coefficient on time spent in *group* activities is strongly statistically significant (at 1%) and *positive* in all specifications – a result which we take to indicate the possible importance of "bonding" within narrow in-groups defined by occupation, caste and class. Apparently, not all forms of associational life necessarily foster development.[31]

In the Indian context, caste activities are a form of associational life that is by its nature exclusionary.  The ITUS specifically asked respondents about their involvement in caste groups (activity code 651), and since politics in India (especially rural India) is strongly influenced by caste affiliations, caste may also play a role in participation in political and civic activities too (activity code 661). The above result would then highlight the disadvantages of caste based associational life.

The caste system is a controversial and contentious issue and even today considerable disagreement exists among scholars.[32] Some authors have argued that the defining characteristic of the caste system is hierarchy.[33] However, recent scholarship (e.g. see Chatterjee (1993) and Gupta (1993 b)) has argued that *difference* and not hierarchy is important. In either case, caste based associational life has been, and continues to be competitive and conflictual. Gupta (2001), for example, argues that: "The distinguishing characteristic of the caste order is the discrete character of its constituent units that resist being forced into a single hierarchical frame. As these castes are discrete and semaphore their separation on multiple fronts, caste competition is built in at various levels" and "Nor is it true that caste politics is a recent phenomenon. All through traditional and medieval India castes have fought and slaughtered each other to gain worldly pre-eminence."

While caste based associational life may build strong bonds within the caste-group, the counterpart of that within-group solidarity may be schisms and mistrust within the larger society.[34] Our results on the negative impacts of time spent in *group* activity in India are therefore consistent with the many studies[35] that have found that ethno-linguistic fragmentation leads to lower or inferior provision of public goods and to lower growth. However, although our results using this Indian data can be seen as a cautionary counter-example to the hypothesis that more associational life and a more active "civic society" are necessarily and unambiguously a "good thing", we do not mean to imply that "group" activities are inherently divisive. Our argument is that such activity is *historically and culturally specific* in its implications for social capital – and we note that the associational life in Tanzania which Narayan and Pritchett (1999a, 1999b) found to be so positive was the associational life of a society which developed a unique model of rural ujamaa socialism in the late 1960s, which was itself based on earlier traditions of mutual help and a *lack* of local class distinctions in rural areas (see Nyerere, 1968). Hence, we see no contradiction in finding that group activity in a different cultural context, at a different time, has a different impact on social capital and development.

Table 3 indicates that in rural areas both average time spent in social engagements and in casual "talking, gossiping, quarrelling" are highly statistically significant, and negatively related to having to fetch water – but Table 4 shows a different set of impacts in urban areas. The different specifications within each table address the substantive point of whether or not, in a patriarchal society, it is male social interaction or social interaction among all adults that matters for local public goods provision. Comparing columns B and D, and comparing columns C and E, leaves the same impression – adding female social interaction time to male social time changes the coefficient observed, but it generally does not make a statistically significant difference. However, the coefficient on average community work time in columns D and E is about four times larger than in columns B and C, which can be interpreted as an indication that in India involving men in community work is particularly important.

The coefficients on casual social interaction and social activities are much smaller than those on community work in Table 3, but all these variables are negatively and statistically significantly associated with a greater probability that rural Indian households will have to fetch water – which is consistent with Putnam's perspective on the positive social externalities of social interaction and with the World Bank's recent emphasis on "social capital" in development. In urban areas, Table 4 provides similar evidence for the importance of community work, but also indicates that "gender matters" for the somewhat different implications of social activity time and casual gossiping and talking when we look at all adults (Models B and C) or just males (Models D and E).

Tables 3 and 4 indicate that in both urban and rural areas the *percentage* of the local population that is scheduled caste or scheduled tribe is generally strongly positively correlated with the chance of having to fetch water. Given that the locality has piped water, there is no evidence for individual level discrimination (indeed Table 4 shows an anomalous *negative* association between scheduled caste and fetching water in urban areas). Since a decision to allocate priority in water supply infrastructure construction between villages can be buried within the bureaucracy while a decision to deny connection rights to an existing system within a village is obvious, it is quite plausible that district governments may discriminate between localities, even if village officials do not discriminate between individuals.

Because land ownership is a meaningful indicator of wealth inequality in rural areas, but not urban areas, this variable appears in Table 3, but not Table 4. A robust result is that the percentage of landless households is strongly positively associated with the chance of having to fetch water. However, we do not get robust results on the impact of inequality in land ownership among the landed, which appears to depend crucially on the index of inequality used.

Statistical significance does not necessarily imply quantitative importance. Furthermore, a policy such as land redistribution would, for example, affect both the percentage of households landless and the inequality of land ownership among the landed – i.e. the marginal impact of each independent variable, considered separately, may sometimes be misleading. Table 5 therefore presents the change in probability of having to fetch water corresponding to alternative "ceteris paribus" type thought experiments[36], using the regressions reported in Tables 3 and 4.

The underlying probability of having to fetch water, evaluated for a “typical respondent” – i.e. a non-female headed, non-scheduled caste or tribe, non-labourer, non-professional, non homestead-owning household with sample average income, average number of dependents and average district and village inequality in caste and class – is 0.185 in rural areas and 0.115 in urban areas.

Table 5 indicates that a thought experiment like “equalizing agricultural land ownership” (which would set to zero both inequality in rural land ownership among the landed and the percentage landless) is simulated to decrease the probability of having to fetch water by about a third. If all households were to have the same chance of connection to water supply as professional households, the decline in probability of fetching water would be about a sixth in rural areas, and about a third in urban areas. If the median district of residence were instead to have zero members of Scheduled Castes, the proportion of households fetching water might fall by about one fifth in rural areas, and one eighth in urban areas. A 10% or 20% increase in the individual household’s monthly expenditure levels would have a fairly small impact in rural areas, but a much larger impact (an elasticity of about 0.5) in urban areas. However, the difference in probability of fetching water associated with homeowner and renter status in urban areas is the single largest observed difference in the data.

By contrast, large changes in socialization patterns have relatively small, and offsetting, associations with the probability of fetching water. Simulation of a thought experiment of increasing time spent in social activities in rural areas from that typical of the median to that typical of the 90$^{th}$ decile of districts is associated with a decline of one sixth in chances of fetching water, while such a change in community time is associated with a decline of about one eleventh – but a similar change in group activities would have an impact of about a sixth in *increasing* the probability of fetching water.

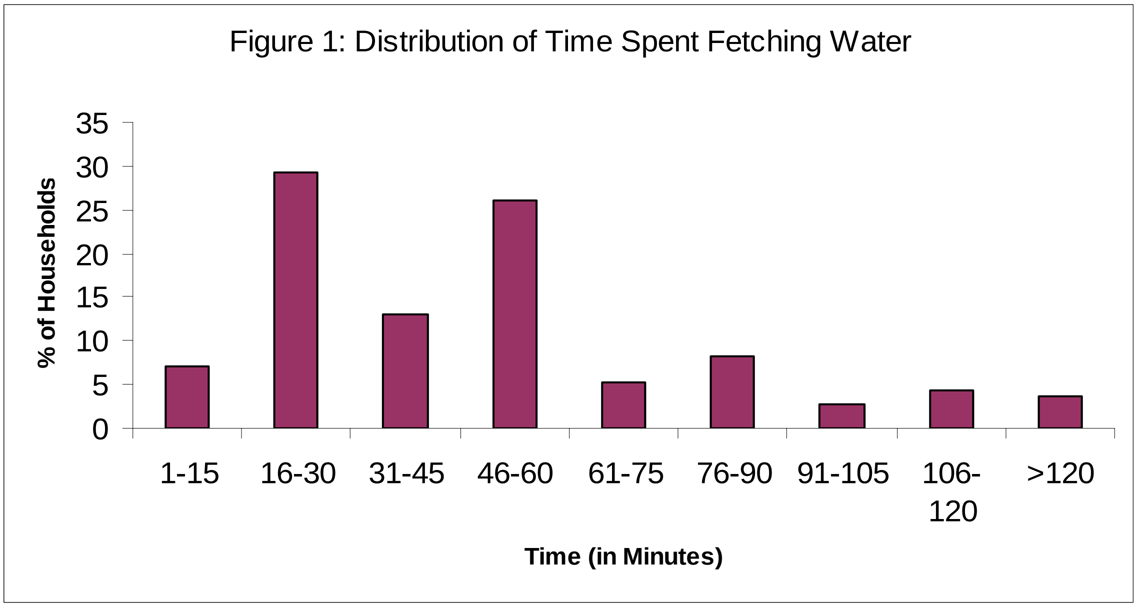
Our results are therefore consistent with the view that some types of social interaction help, but that land reform, and a reduction in caste barriers, are the crucial issues in the social co-operation which is the basis for local public goods supply in rural India. In urban areas, individual economic advantage, as indicated by professional occupational status or home ownership, is the key to whether or not a household has to collect water – and households in districts in which average group activity time is particularly high (i.e. 90$^{th}$ percentile compared to median) are more than twice as likely to have to collect water.

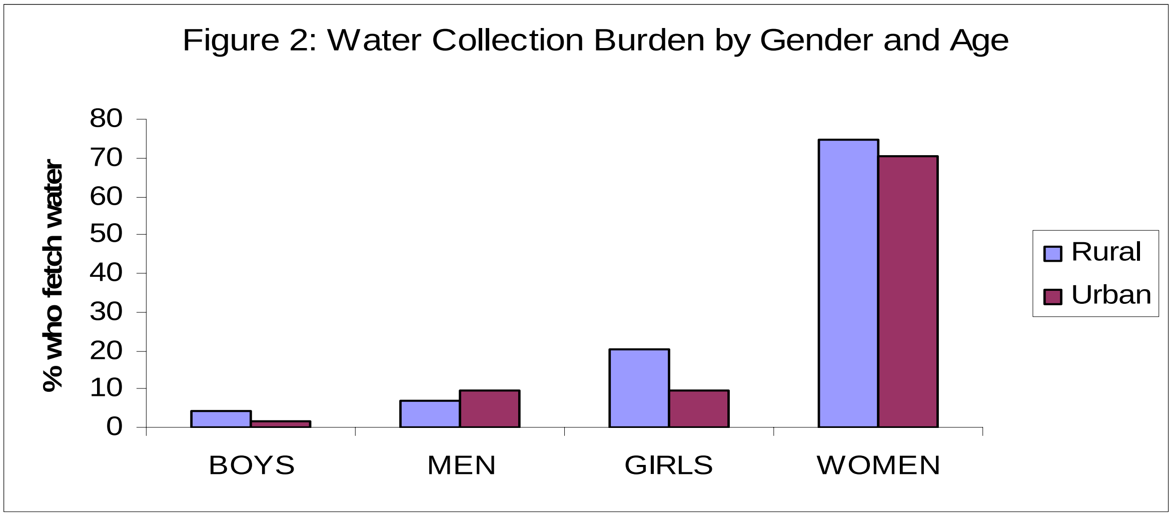
**4. Implications**

We hope that this paper has demonstrated the value of time use data in measuring social interactions and "social capital" and in showing the relative empirical importance of inequality in land ownership and caste, compared to the size of the impact of social interaction, in determining public services – like the probability that a household will have to fetch water. We interpret our results to indicate that although the recent literature on "social capital" has provided important insights into the development process, the cleavages of caste and class are fundamental, in the Indian context – as the early literature on Indian economic development emphasized.

Some readers might not be surprised by evidence on gendered inequality in carrying water. Some readers might also find our documentation of the importance of inequalities of caste and class in India unsurprising. Even if this is the case, given that drinking water is a basic good, there is some point in documenting these inequalities. Our main contribution is perhaps in providing a cautionary counter-example to excessive optimism that the growth of "civic society" is necessarily positive for development. Whether "social capital" is positive or negative for development – bridging social divides or bonding agents within pre-existing social groups – is an empirical issue, which depends on the specific historical context. We do not doubt that in many other contexts, time spent in group activities can build trust among individuals across society, enabling more effective collective action which improves basic public services, like the delivery of water. However, in the specific context of India, our results indicate that it is more likely that many group activities reinforce the importance of pre-existing social cleavages (like caste), exacerbate the negative impact of inequalities in land ownership, professional status and income and undermine the likelihood of community level collective action that might improve community well-being – particularly the well-being of the poor – by relieving people of the continuing drudgery of fetching water.

## Tables and Figures



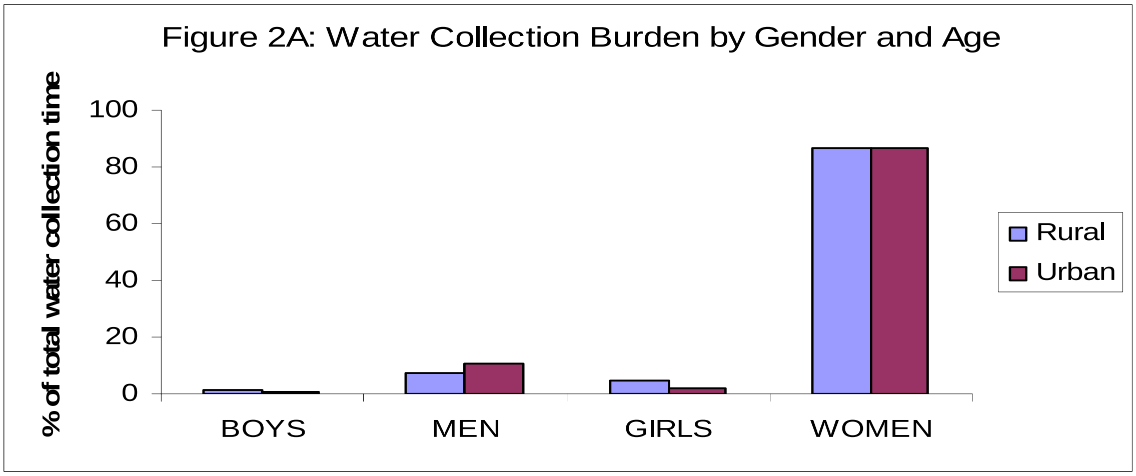



**Figure 4**

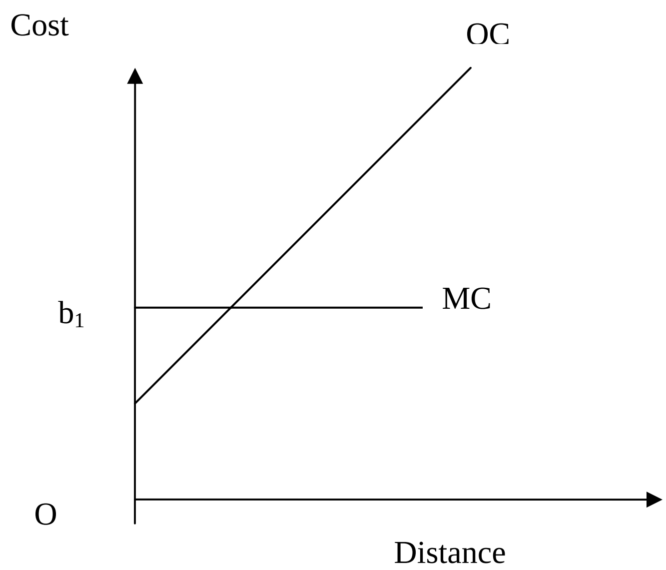


**Table 1:**

**Water Collection Time by Age, Gender, Social Group and Remuneration**

| | **Rural** | | | **Urban** | | |
|---|---|---|---|---|---|---|
| | **% of total water collection time R1** | **% of individuals of type in households gathering any water. R2** | **Average daily time spent (minutes) R3** | **% of total water collection time U1** | **% of individuals of type in households gathering any water. U2** | **Average daily time spent (minutes) U3** |
| | | | | | | |
| **Boys (6-14 yrs)** | 0.0128 | 0.0437 | 48.46 | 0.0037 | 0.0167 | 42.19 |
| **Men (>14 yrs)** | 0.0704 | 0.0705 | 39.96 | 0.1092 | 0.0964 | 39.80 |
| | | | | | | |
| **Girls (6-14 yrs)** | 0.0479 | 0.2052 | 50.13 | 0.0197 | 0.0964 | 36.03 |
| **Women (>14 Yrs)** | 0.8689 | 0.7461 | 47.06 | 0.8674 | 0.7047 | 43.06 |
| | | | | | | |
| **Scheduled Tribe** | 0.0907 | 0.0405 | 55.17 | 0.0465 | 0.2848 | 58.33 |
| **Scheduled Caste** | 0.2737 | 0.3620 | 47.99 | 0.0844 | 0.3821 | 38.77 |
| **Others** | 0.6355 | 0.3472 | 45.08 | 0.8691 | 0.3457 | 42.30 |
| | | | | | | |
| **For Payment** | 0.0123 | 0.0042 | 48.16 | 0.0136 | 0.0063 | 31.92 |

***Categories refer to:***

***R1 & U1:*** % of total water collection time of all people performed by persons in category Xi.

***R2 & U2:*** % of individuals in households that gather any water of type Xi who are involved in water collection

***R3 & U3*** Average daily time spent (in minutes) by all individuals in group Xi who are involved in water collection.

-

**Table 2:**

**Time Spent on Community, Group, Civic Activities and on Social Interaction**

| | | Rural | | | Urban | |
|---|---|---|---|---|---|---|
| | **Male** | **Female** | **All** | **Male** | **Female** | **All** |
| *Time* on "Talking, Gossiping, Quarrelling"* | | | | | | |
| Average Time (over individuals who spend positive time) | 76.08 | 67.53 | 72.71 | 71.23 | 63.74 | 67.62 |
| Percentage involved | 44.56% | 29.39% | 36.95% | 28.72% | 28.59% | 28.66% |
| Average Time (over the total population) | 33.75 | 19.85 | 26.87 | 20.46 | 18.22 | 19.38 |
| *Time on Social Activities* | | | | | | |
| Average Time (over individuals who spend positive time) | 77.91 | 73.47 | 76.04 | 77.041 | 79.879 | 78.606 |
| Percentage involved | 5.00% | 3.85% | 4.44% | 6.77% | 8.80% | 7.70% |
| Average Time (over the total population) | 3.89 | 2.83 | 3.37 | 5.138 | 7.033 | 6.052 |
| *Time on Group Activities* | | | | | | |
| Average Time (over individuals who spend positive time) | 91.718 | 85.752 | 89.264 | 91.535 | 84.352 | 87.679 |
| Percentage involved | 1.07% | 0.77% | 0.92% | 0.56% | 0.70% | 0.62% |
| Average Time (over the total population) | 0.986 | 0.656 | 0.823 | 0.512 | 0.586 | 0.548 |
| *Time on Community Activities* | | | | | | |
| Average Time (over individuals who spend positive time) | 90.503 | 70.296 | 77.486 | 33.469 | 37.433 | 35.535 |
| Percentage involved | 0.1% | 0.19% | 0.14% | 0.11% | 0.12% | 0.12% |
| Average Time (over the total population) | 0.092 | 0.131 | 0.111 | 0.036 | 0.047 | 0.041 |

* All times in minutes/normal day

Community Activities: Activity Codes 611, 621

Group Activities: Activity Codes 631, 641, 651, 671, 681

Social Interaction: Activity Codes 811, 812, 813, 814

Talking, Gossiping, Quarrelling: Activity Code 951 (Time spent outside the house)

For descriptions of these activities, see text, notes 18, 19, and 21.

All average times calculated for adult men and women, i.e. ages 18 or above.

**Table 3:**

**Bootstrapped Probit analysis of the probability that a rural household fetches water**

Dependent Variable: =1 if a rural household fetches water; = 0 if not

| Variable | Model A | Model B | Model C | Model D | Model E |
|---|---|---|---|---|---|
| Monthly per-capita expenditure (100's of Rs.) | -0.028*** (0.006) | -0.027*** (0.006) | -0.026*** (0.006) | -0.032*** (0.006) | -0.031*** (0.006) |
| Laborer Household | 0.004 (0.037) | 0.002 (0.037) | 0.001 (0.036) | 0.008 (0.036) | 0.012 (0.036) |
| Professional Household | -0.127** (0.065) | -0.126** (0.064) | -0.133** (0.065) | -0.146** (0.065) | -0.148** (0.066) |
| Owns Homestead | -0.034 (0.040) | -0.026 (0.041) | -0.014 (0.040) | -0.017** (0.039) | 0.024** (0.040) |
| Landless Household | 0.025 (0.037) | 0.027 (0.036) | 0.033 (0.040) | 0.042** (0.040) | 0.046** (0.039) |
| Dependency Ratio (Unpaid Members/Household Size) | 0.137** (0.058) | 0.135** (0.058) | 0.130** (0.061) | 0.181*** (0.060) | 0.172*** (0.057) |
| Female Household Head | 0.002 (0.048) | 0.010 (0.048) | 0.010 (0.048) | 0.006 (0.050) | -0.004 (0.048) |
| Scheduled Caste | 0.032 (0.040) | 0.035 (0.041) | 0.035 (0.041) | 0.035 (0.040) | 0.036 (0.038) |
| Scheduled Tribe | -0.099* (0.055) | -0.094* (0.054) | -0.092* (0.053) | -0.094 (0.057) | -0.093 (0.055) |
| Percentage of Scheduled Caste people in district | 1.324*** (0.185) | 1.043*** (0.201) | 1.099*** (0.200) | 0.692 (0.187) | 0.703 (0.180) |
| Percentage of Scheduled Tribe people in district | 0.464*** (0.095) | 0.357*** (0.090) | 0.348*** (0.093) | 0.088 (0.096) | -0.070 (0.096) |
| Percentage of landless households in district | 0.965*** (0.128) | 0.985*** (0.123) | 1.068*** (0.127) | 1.046*** (0.127) | 1.126*** (0.125) |
| Theil index of inequality in landholdings among the landed in district | -0.224*** (0.114) | -0.370*** (0.120) | | 0.236 (0.115) | |
| Coefficient of Variation in landholdings among the landed in district | | | -0.030 (0.076) | | 0.009*** (0.067) |
| Within district component of Theil index of inequality of monthly per-capita expenditure[a] | 3.895*** (1.051) | 3.532*** (1.021) | | 4.185*** (1.064) | |
| Between district component of Theil index of inequality of monthly per-capita expenditure[b] | -0.734 (0.761) | 0.219 (0.747) | | 2.727*** (0.767) | |
| Within district component of square of coefficient of variation of monthly per-capita expenditure[c] | | | 0.357 (0.260) | | 0.588*** (0.271) |
| Between district component of square of coefficient of variation of monthly per-capita expenditure[d] | | | 0.104 (0.396) | | -1.270*** (0.404) |
| Average time spent on talking, gossiping and quarrelling in district (minutes)[e] | -0.024*** (0.002) | -0.025*** (0.002) | -0.024*** (0.002) | | |
| Average time spent on social activities in district (minutes)[f] | -0.013*** (0.004) | -0.019*** (0.004) | -0.018*** (0.004) | | |
| Average time spent on community and group activities in district (minutes)[g] | 0.121*** (0.008) | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Average time spent on community organized work in district (minutes)[h] | | -0.864*** (0.252) | -0.606*** (0.255) | | |
| Average time spent on group activities in district (minutes)[i] | | 0.127*** (0.008) | 0.122*** (0.008) | | |
| Average time spent by men on talking, gossiping and quarrelling in district (minutes) | | | | -0.021*** (0.001) | -0.021*** (0.001) |
| Average time spent by men on social interaction in district (minutes) | | | | -0.023*** (0.003) | -0.023*** (0.003) |
| Average time spent by men on community organized work in district (minutes) | | | | -3.623*** (0.384) | -3.326*** (0.364) |
| Average time spent by men on group activities in district (minutes) | | | | 0.148*** (0.008) | 0.145*** (0.008) |
| Replenishable ground water per-capita for the state (Billions of cubic metres/year)[j] | -0.029*** (0.001) | -0.029*** (0.001) | -0.030*** (0.001) | -0.026*** (0.001) | -0.027*** (0.001) |
| Intercept | 0.284* (0.155) | 0.453** (0.155) | 0.392*** (0.160) | 0.409*** (0.150) | 0.392*** (0.151) |
| Sample Size | 12720 | 12720 | 12720 | 12720 | 12720 |

Number of Households that fetch water: 2363 (18.58%). The sample size for the regressions (12720) is less than the number of rural households in the survey (12750) because we removed a few outliers and erroneous records

Number of replications: 1000

*** 99% Confidence Level ** 95% Confidence Level * 90% Confidence Level

Standard Errors in Parentheses. Statistical significance calculated on the basis of normal approximation method. Other approximation methods (percentile, bias corrected) yield similar results.

Notes:

a) The Theil index of inequality (*R)* can be written as *(W+B)* where the within component is:
$W = \Sigma_g (n_g Y_g / n\overline{Y}) R_g$ $Y_g$ – Mean income in village *g*, $n_g$ – Population of village *g*,
$R_g$ – Theil for the village *g*, *n* – Population of the district, $\overline{Y}$ - Mean income of the district $(n_g Y_g / n\overline{Y})$ - Village g's share of the total income in district.
b) The between component is $B = (1/n)\Sigma_g n_g (\overline{Y_g} / \overline{Y}) \log(\overline{Y_g} / \overline{Y})$
c) As in the case of Theil, the square of the coefficient of variation ($C^2$ ) can be written as *(W+B)* where the within component is: $W = \Sigma_g (n_g / n)(Y_g / \overline{Y})^2 C_g^2$ The variables are as defined earlier, in the Theil. $C_g^2$ is the square of the coefficient of variation for the village.
d) The between component is $B = C^2 - W$
e) Activity Code 951. Time spent outside the house.
f) Activity Codes: 811, 812, 813, 814
g) Activity Codes: 621, 631, 641, 651, 661, 671, 681
h) Activity Code: 621
i) Activity Codes: 631, 641, 651, 661, 671, 681
j) Calculated based upon data from the Central Water Commission.

**Table 4:**

**Bootstrapped Probit analysis of the probability that an urban household fetches water**

Dependent Variable: =1 if an urban household fetches water; = 0 if not

| **Variable** | **Model A** | **Model B** | **Model C** | **Model D** | **Model E** |
|---|---|---|---|---|---|
| Monthly per-capita expenditure (100's of Rs.) | -0.031*** (0.006) | -0.032*** (0.006) | -0.033*** (0.006) | -0.033*** (0.006) | -0.033*** (0.006) |
| Laborer Household | 0.191*** (0.064) | 0.184*** (0.064) | 0.178*** (0.063) | 0.202*** (0.066) | 0.200*** (0.063) |
| Professional Household | -0.160** (0.066) | -0.172** (0.065) | -0.174** (0.068) | -0.123* (0.067) | -0.127* (0.069) |
| Owns Homestead | -0.622*** (0.063) | -0.575*** (0.061) | -0.560*** (0.063) | -0.614*** (0.065) | -0.618*** (0.064) |
| Dependency Ratio (Unpaid Members/Household Size) | 0.193* (0.108) | 0.188* (0.105) | 0.195* (0.105) | 0.244** (0.101) | 0.249** (0.109) |
| Female Household Head | -0.064 (0.080) | -0.071 (0.080) | -0.076 (0.080) | -0.031 (0.080) | -0.033 (0.081) |
| Scheduled Caste | -0.187** (0.089) | -0.175** (0.085) | -0.174** (0.085) | -0.205*** (0.086) | -0.203** (0.086) |
| Scheduled Tribe | -0.003 (0.118) | 0.005 (0.118) | -0.002 (0.122) | -0.001 (0.122) | 0.001 (0.128) |
| Percentage of Scheduled Caste people in district | 0.847** (0.345) | 0.617** (0.359) | 0.390 (0.361) | 1.579*** (0.320) | 1.588*** (0.313) |
| Percentage of Scheduled Tribe people in district | 1.659*** (0.201) | 1.664*** (0.209) | 1.659*** (0.201) | 1.170*** (0.203) | 1.152*** (0.214) |
| Within district component of Theil index of inequality of monthly per-capita expenditure | 1.652* (1.055) | 0.841 (1.080) | | -0.492 (1.105) | |
| Between district component of Theil index of inequality of monthly per-capita expenditure | 1.276 (1.332) | 1.941 (1.374) | | 0.276 (1.217) | |
| Within district component of square of coefficient of variation of monthly per-capita expenditure | | | 0.033 (0.261) | | -0.462 (0.330) |
| Between district component of square of coefficient of variation of monthly per-capita expenditure | | | 1.594** (0.650) | | 0.120 (0.563) |
| Average time spent on talking, gossiping and quarrelling in district (minutes) | 0.006** (0.003) | 0.006** (0.003) | 0.007** (0.003) | | |
| Average time spent on social activities in district (minutes) | 0.003 (0.005) | 0.000 (0.005) | -0.003 (0.005) | | |
| Average time spent on group and community activities in district (minutes) | 0.308*** (0.035) | | | | |
| Average time spent on community organized work in district (minutes) | | -1.386*** (0.504) | -1.981*** (0.549) | | |
| Average time spent on group activities in district (minutes) | | 0.367*** (0.041) | 0.416*** (0.039) | | |
| Average time spent by men on talking, gossiping and quarrelling in district (minutes) | | | | -0.002 (0.002) | -0.001 (0.002) |
| Average time spent by men on social interaction in district (minutes) | | | | -0.016* (0.009) | -0.017** (0.009) |

| | | | | | |
|---|---|---|---|---|---|
| Average time spent by men on community organized work in district (minutes) | | | | -1.438* (0.805) | -1.551** (0.732) |
| Average time spent by men on group activities in district (minutes) | | | | 0.159*** (0.051) | 0.178*** (0.052) |
| Replenishable ground water per-capita for the state (Billions of cubic metres/year) | -0.030*** (0.003) | -0.028*** (0.003) | -0.030*** (0.003) | -0.029*** (0.003) | -0.029*** (0.003) |
| Intercept | -0.155 (0.185) | -0.183 (0.176) | -0.118 (0.166) | 0.316* (0.190) | 0.331* (0.197) |
| Sample Size | 5830 | 5830 | 5830 | 5830 | 5830 |

i) Number of Households that do not fetch water: 671 (11.51%). The sample size for the regressions (5830) is less than the number of urban households in the survey (5841) because we removed a few outliers and erroneous records.

ii) *** 99% Confidence Level ** 95% Confidence Level *90% Confidence Level

iii) Standard Errors in Parentheses. Statistical significance calculated on the basis of normal approximation method. Other approximation methods (percentile, bias corrected) yield similar results.

iv) Number of replications: 1000

v) For the computation of within and between inequalities, see Table 3.

vi) For activity codes used in the computation of the averages, see Table 3.

**Table 5:**
**Comparison of the effects of social capital and other variables***

| | **Rural** | **Urban** |
|---|---|---|
| Base Case | 0.1858 | 0.1151 |
| Increase in probability of fetching water due to: | | |
| i) A policy of completely egalitarian land redistribution | -0.062 (33.17%) | Not considered in the regression |
| ii) Change from non-professional to professional status | -0.032 (16.97%) | -0.037 (31.83%) |
| iii) Increase in monthly per-capita expenditure | | |
| a) 10% increase | -0.003 (1.73%) | -0.006 (5.28%) |
| b) 20% increase | -0.006 (3.43%) | -0.012 (10.82%) |
| iv) Ownership of homestead | Not Statistically Significant | -0.097 (84.08%) |
| v) Decrease in percentage of Scheduled Caste individuals in the district from median to zero | -0.04 (21.34%) | -0.014 (12.07%) |
| vi) Decrease in percentage of Scheduled Tribe individuals from median to zero | -0.005 (2.64%) | -0.01 (8.84%) |
| vii) Increase in time spent on social activities | | |
| a) 10th percentile to median | -0.01 (5.47%) | Not Statistically Significant |
| b) median to 90th percentile | -0.030 (15.92%) | |
| viii) Increase in time spent on community organized work (median to 90th percentile) | -0.017 (9.04%) | -0.007 (6.26%) |
| ix) Increase in time spent on group activities | | |
| a) 10th percentile to median | 0.003 (1.44%) | - |
| b) median to 90th percentile | 0.032 (17.06%) | 0.177 (154.12%) |

*The number in parentheses and the other number represent the percentage and absolute change in the probability of fetching water, respectively. The percentages are calculated on the basis of the base case, i.e. percentage change = absolute change/0.1858 for rural and = absolute change/0.1151 for urban.

## Rural:

i) We compute the probability of fetching water for a base household (non-scheduled caste, non-scheduled tribe, male headed, landless, homestead owning, laborer household with average dependency ratio. The household lives in a district with average values for all the district-level variables - inequality, scheduled caste proportion, scheduled tribe proportion etc.). To simulate the impact of the policy, we recalculate this probability by setting the landless proportion and the Theil among the landed to zero and making the household landed (i.e. not a laborer).

ii) We consider cases similar to (i), but without and with professional status.

iii) We consider cases similar to (i), but with expenditures that are 10% and 20% above the average.

v) We consider cases similar to (i), but with different scheduled caste proportions in the district.

vi) We consider cases similar to (i), but with different scheduled tribe proportions in the district.

vii) We consider cases similar to (i) above, but with different values for the time spent on social activities. In (a), we look at the impact of moving from a district that is at the 10$^{th}$ percentile in terms of time spent on social interaction (i.e. 6$^{th}$ lowest among 51 districts) to a district that is the median. In (b), we consider the impact of moving from a median district to one that is at the 90$^{th}$ percentile (i.e. 46$^{th}$ lowest among 51 districts).

viii) This is similar to (vii). Both the 10$^{th}$ percentile and the median are zero, so we do not consider an increase from 10$^{th}$ percentile to the median.

ix) This is similar to (vii), but we consider different times on group activities.

## **Urban**:

ii) We compute the probability of fetching water for a base household (non-scheduled caste, non-scheduled tribe, male headed, non-homestead owning, non-laborer, with average dependency ratio. The household lives in a district with average values for all the district-level variables - inequality, scheduled caste proportion, scheduled tribe proportion etc.). We consider professional and non-professional cases.

iii) We consider cases similar to (ii), but with expenditures that are 10% and 20% above the average.

iv) We consider cases similar to (ii), but without and with homestead ownership.

v) We consider cases similar to (i), but with different scheduled caste proportions in the district.

vi) We consider cases similar to (i), but with different scheduled tribe proportions in the district.

viii) We consider cases similar to (ii), but with different values for the time spent on community organized work. As in the rural case, both the 10$^{th}$ percentile and the median are zero, so we do not consider an increase from 10$^{th}$ percentile to the median.

ix) This is similar to (vii), but with different times for group activities. The median group time is zero, so we only vary the group time from median to 90$^{th}$ percentile.

**Appendix**

**Table A1: Descriptive Statistics of Some Important Variables**

| Variable | Rural | | Urban | |
|---|---|---|---|---|
| | Mean (Std. Deviation) | Min (Max) | Mean (Std. Deviation) | Min (Max) |
| Monthly Per-capita Expenditure (in Rupees) | 463.700 (14743.020) | 0 (4200) | 825.721 (24912.44) | 75 (9500) |
| Household Size | 4.206 (105.953) | 1.000 (23) | 4.041 (88.72324) | 1 (21) |
| Dependency Ratio (Unpaid Members/Household Size) | 0.547 (15.013) | 0 (1) | 0.624 (12.531) | 0 (1) |
| Owns Homestead | 0.639 (26.638) | 0 (1) | 0.416 (25.338) | 0 (1) |
| Scheduled Caste | 0.192 (21.843) | 0 (1) | 0.101 (15.475) | 0 (1) |
| Scheduled Tribe | 0.184 (21.513) | 0 (1) | 0.049 (11.103) | 0 (1) |
| Laborer Household | 0.406 (27.247) | 0 (1) | 0.210 (20.943) | 0 (1) |
| Professional Household | 0.056 (12.746) | 0 (1) | 0.201 (20.618) | 0 (1) |
| Female Household Head | 0.099 (16.580) | 0 (1) | 0.086 (14.398) | 0 (1) |
| Landless Household | 0.468 (27.681) | 0 (1) | | |
| Percentage of Landless in the district | 0.439 (0.179) | 0 (0.781) | | |
| Theil index of inequality in landholdings among the landed in district | 0.516 (0.193) | 0.170 (1.057) | | |
| Coefficient of Variation in landholdings among the landed in district | 1.207 (0.383) | 0.586 (2.951) | | |
| Gini index of inequality in landholdings among the landed in district | 0.519 (0.087) | 0.325 (0.733) | | |
| Within district component of Theil index of inequality of monthly per-capita expenditure | 0.055 (0.027) | 0.021 (0.174) | 0.084 (0.077) | 0.001 (0.321) |
| Between district component of Theil index of inequality of monthly per-capita expenditure | 0.034 (0.021) | 0.005 (0.096) | 0.040 (0.034) | 0.001 (0.132) |
| Within district component of coefficient of variation of monthly per-capita expenditure | 0.151 (0.108) | 0.044 (0.668) | 0.191 (0.130) | 0.062 (0.905) |
| Between district component of coefficient of variation of monthly per-capita expenditure | 0.069 (0.043) | 0.010 (0.198) | 0.084 (0.077) | 0.001 (0.321) |
| Gini index of monthly per-capita expenditure in the district | 0.257 (0.054) | 0.144 (0.387) | 0.219 (0.045) | 0.131 (0.315) |
| Percentage of Scheduled Caste individuals in the district | 0.179 (0.125) | 0.000 (0.603) | 0.111 (0.096) | 0.000 (0.392) |
| Percentage of Scheduled tribe individuals in the district | 0.222 (0.291) | 0.000 (0.988) | 0.104 (0.211) | 0.000 (0.963) |
| Replenishable Ground Water per-capita | 47.535 (20.544) | 23.416(84.276) | 47.535 (20.544) | 23.416(84.276) |

No. of rural (urban) households: 12750(5841). No. of rural (urban) districts: 51 (52). No. of states: 6

**Table A2: Bootstrapped Probit analysis of the probability that a rural household fetches water**

Dependent Variable: =1 if an rural household fetches water; = 0 if not

| **Variable** | **Model A** | **Model B** | **Model C** | **Model D** | **Model E** |
|---|---|---|---|---|---|
| Monthly per-capita expenditure (100's of Rs.) | -0.027*** (0.006) | -0.024*** (0.006) | -0.023*** (0.006) | -0.029*** (0.006) | -0.026*** (0.006) |
| Laborer Household | 0.004 (0.037) | 0.019 (0.038) | 0.012 (0.037) | 0.009 (0.037) | 0.003 (0.036) |
| Professional Household | -0.119** (0.066) | -0.109* (0.062) | -0.120* (0.068) | -0.147** (0.065) | -0.128* (0.067) |
| Owns Homestead | 0.035 (0.040) | -0.076* (0.039) | -0.061* (0.039) | 0.0002 (0.039) | 0.051 (0.040) |
| Landless Household | 0.020 (0.038) | 0.004 (0.038) | 0.012 (0.037) | 0.031 (0.036) | 0.023 (0.038) |
| Dependency Ratio (Unpaid Members/Household Size) | 0.131** (0.059) | 0.117** (0.057) | 0.111** (0.055) | 0.164*** (0.055) | 0.128** (0.054) |
| Female Household Head | -0.014 (0.047) | 0.018 (0.045) | 0.018 (0.048) | -0.018 (0.047) | -0.013 (0.049) |
| Scheduled Caste | 0.036 (0.040) | 0.032 (0.039) | 0.033 (0.040) | 0.077** (0.039) | |
| Scheduled Tribe | -0.093 (0.055) | -0.090 (0.057) | -0.088 (0.054) | -0.067 (0.044) | |
| Percentage of Scheduled Caste people in district | 0.978*** (0.205) | 1.440*** (0.191) | 1.499*** (0.195) | | 1.232*** (0.200) |
| Percentage of Scheduled Tribe people in district | 0.296 (0.092) | 0.760*** (0.088) | 0.753*** (0.088) | | 0.304*** (0.076) |
| Percentage of landless households in district | 1.002*** (0.134) | 1.093*** (0.119) | 1.209*** (0.125) | 1.082*** (0.111) | 1.019*** (0.125) |
| Theil index of inequality in landholdings among the landed in district | | -0.332*** (0.120) | | -0.422 (0.118) | -0.368*** (0.114) |
| Gini index of inequality in landholdings among the landed in district | -1.405*** (0.222) | | | | |
| Coefficient of Variation in landholdings among the landed in district | | | -0.049 (0.075) | | |
| Within village component of Theil index of inequality of monthly per-capita expenditure | | 5.519*** (1.005) | | 3.665** (1.060) | 3.647** (0.996) |
| Between village component of Theil index of inequality of monthly per-capita expenditure | | 0.021 (0.754) | | 0.019 (0.753) | -0.317** (0.749) |
| Gini index of monthly per-capita expenditure | 1.038** (0.449) | | | | |
| Within village component of square of coefficient of variation of monthly per-capita expenditure | | | 0.883*** (0.238) | | |

| | | | | | |
|---|---|---|---|---|---|
| Between village component of square of coefficient of variation of monthly per-capita expenditure | | | 0.182***<br>(0.391) | | |
| Average time spent on talking, gossiping and quarrelling in district (minutes) | -0.025***<br>(0.002) | | | -0.027***<br>(0.001) | -0.025***<br>(0.002) |
| Average time spent on social activities in district (minutes) | -0.024***<br>(0.004) | | | -0.028***<br>(0.004) | -0.016***<br>(0.004) |
| Average time spent on community organized work in district (minutes) | -1.165***<br>(0.273) | | | -1.434***<br>(0.242) | -0.797***<br>(0.243) |
| Average time spent on group activities in district (minutes) | 0.131***<br>(0.008) | | | 0.117***<br>(0.007) | 0.112***<br>(0.008) |
| Average time spent by women on talking, gossiping and quarrelling in district (minutes) | | -0.030***<br>(0.002) | -0.029***<br>(0.002) | | |
| Average time spent by women on social interaction in district (minutes) | | -0.004<br>(0.004) | -0.003<br>(0.004) | | |
| Average time spent by women on community organized work in district (minutes) | | -0.061<br>(0.125) | 0.097<br>(0.126) | | |
| Average time spent by women on group activities in district (minutes) | | 0.103***<br>(0.007) | 0.097***<br>(0.008) | | |
| Replenishible ground water per-capita for the state (Billions of cubic metres/year) | -0.029***<br>(0.001) | -0.029***<br>(0.001) | -0.029***<br>(0.001) | 0.031***<br>(0.001) | -0.029***<br>(0.001) |
| Intercept | 1.000***<br>(0.189) | 0.042<br>(0.153) | 0.067<br>(0.159) | 0.878***<br>(0.142) | 0.462***<br>(0.151) |
| Sample Size | 12720 | 12720 | 12720 | 12720 | 12720 |

i) Number of Households that fetch water: 2363 (18.58%). The sample size for the regressions (12720) is less than the number of rural households in the survey (12750) because we removed a few outliers and erroneous records

ii) *** 99% Confidence Level. ** 95% Confidence Level. *90% Confidence Level

iii) Standard Errors in Parentheses. Statistical significance calculated on the basis of normal approximation method. Other approximation methods (percentile, bias corrected) yield similar results.

iv) Number of replications:1000

v) For the computation of within and between inequalities, see Table 3.

vi) For activity codes used in the computation of the averages, see Table 3.

**Table A3: Bootstrapped Probit analysis of the probability that an urban household fetches water**

Dependent Variable: =1 if an urban household fetches water; = 0 if not

| **Variable** | **Model A** | **Model B** | **Model C** | **Model D** | **Model E** |
|---|---|---|---|---|---|
| Monthly per-capita expenditure (100's of Rs.) | -0.032*** (0.006) | -0.029*** (0.006) | -0.029*** (0.006) | -0.027*** (0.006) | -0.031*** (0.006) |
| Laborer Household | 0.185*** (0.064) | 0.189*** (0.064) | 0.185*** (0.064) | 0.148** (0.063) | 0.165** (0.062) |
| Professional Household | -0.174** (0.065) | -0.176*** (0.066) | -0.181*** (0.065) | -0.196*** (0.065) | -0.168* (0.063) |
| Owns Homestead | -0.590*** (0.059) | -0.628*** (0.059) | -0.661*** (0.060) | -0.528*** (0.061) | -0.573*** (0.062) |
| Dependency Ratio (Unpaid Members/Household Size) | 0.184* (0.105) | 0.208** (0.101) | 0.223** (0.104) | 0.179* (0.102) | 0.189** (0.103) |
| Female Household Head | -0.068 (0.079) | -0.061 (0.077) | -0.056 (0.079) | -0.037 (0.076) | -0.076 (0.081) |
| Scheduled Caste | -0.174** (0.085) | -0.172* (0.091) | -0.173* (0.086) | -0.111 (0.086) | |
| Scheduled Tribe | -0.006 (0.118) | 0.018 (0.111) | 0.020 (0.111) | 0.566*** (0.095) | |
| Percentage of Scheduled Caste people in district | 0.764** (0.361) | 0.284 (0.395) | 0.286 (0.378) | | 0.478 (0.370) |
| Percentage of Scheduled Tribe people in district | 1.619*** (0.215) | 1.888*** (0.199) | 1.870*** (0.191) | | 1.664*** (0.175) |
| Within village component of Theil index of inequality of monthly per-capita expenditure | | 3.784*** (1.053) | | 0.031 (1.095) | 0.776 (1.039) |
| Between village component of Theil index of inequality of monthly per-capita expenditure | | 2.089** (1.293) | | 0.672 (1.360) | 1.937 (1.346) |
| Gini index of monthly per-capita expenditure | 0.403** (0.827) | | | | |
| Within village component of square of coefficient of variation of monthly per-capita expenditure | | | 0.687*** (0.233) | | |
| Between village component of square of coefficient of variation of monthly per-capita expenditure | | | 1.342** (0.636) | | |
| Average time spent on talking, gossiping and quarrelling in district (minutes) | 0.004 (0.003) | | | 0.002 (0.003) | 0.006** (0.003) |
| Average time spent on social activities in district (minutes) | 0.003 (0.005) | | | -0.004 (0.005) | -0.0002 (0.005) |
| Average time spent on community organized work in district (minutes) | -1.368** (0.574) | | | -1.448*** (0.488) | -1.408*** (0.539) |
| Average time spent on group | 0.348*** | | | 0.351*** | 0.370*** |

| | | | | | |
|---|---|---|---|---|---|
| activities in district (minutes) | (0.037) | | | (0.033) | (0.040) |
| Average time spent by women on talking, gossiping and quarrelling in district (minutes) | | 0.010***<br>(0.003) | 0.010***<br>(0.003) | | |
| Average time spent by women on social interaction in district (minutes) | | -0.002<br>(0.004) | -0.004<br>(0.004) | | |
| Average time spent by women on community organized work in district (minutes) | | 1.110*<br>(0.578) | 0.721<br>(0.574) | | |
| Average time spent by women on group activities in district (minutes) | | 0.214***<br>(0.023) | 0.223***<br>(0.022) | | |
| Replenishible ground water per-capita for the state (Billions of cubic metres/year) | -0.027***<br>(0.003) | -0.035***<br>(0.003) | -0.035***<br>(0.004) | -0.031***<br>(0.004) | -0.028***<br>(0.003) |
| Intercept | -0.189<br>(0.264) | -0.117<br>(0.181) | 0.039<br>(0.167) | -0.237<br>(0.201) | -0.191<br>(0.180) |
| Sample Size | 5830 | 5830 | 5830 | 5830 | 5830 |

i) Number of Households that fetch water: 2363 (18.58%). The sample size for the regressions (12720) is less than the number of rural households in the survey (12750) because we removed a few outliers and erroneous records.

ii) *** 99% Confidence Level. ** 95% Confidence Level. *90% Confidence Level

iii) Standard Errors in Parentheses. Statistical significance calculated on the basis of normal approximation method. Other approximation methods (percentile, bias corrected) yield similar results.

iv) Number of replications: 1000

v) For the computation of within and between inequalities, see Table 3.

vi) For activity codes used in the computation of the averages, see Table 3.

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## Notes

[1] "Optimum standards in most refugee emergencies call for a minimum per capita allocation of 15 litres per day plus communal needs and a spare capacity for new arrivals. When hydro-geological or logistic constraints are difficult to address, a per capita allocation of 7 litres per person per day should be regarded as the minimum "survival" allocation. This quantity will be raised to 15 litres per day as soon as possible." UNHCR (1992:5)

[2] In this paper we use the generic term of water "on tap" to mean water that can be immediately obtained – most often because it is piped into the residence, but also from private courtyard wells or hand pumps in the residence [see McKenzie and Ray (2004:Table1) for a breakdown of the sources of drinking water in India in 1998-99].

[3] One debate in this tradition is about whether command over commodities is best measured – conceptually and in actual survey data – by income (i.e. potential consumption) or by actual consumption (perhaps including the services of durable goods). A second debate questions whether the definition of the poverty threshold should be set as an absolute standard (e.g. the Purchasing Power Parity equivalent of US$1 or US$2 per day per capita) or relative to the income or consumption norms of the society (e.g. one half of median equivalent income). A third issue is the inability of household data to detect inequalities in "command over commodities" *within* families, which implies that gender based inequities are often ignored. In all this discussion the time cost of obtaining a specific commodity – such as water – is ignored.

[4] By the criterion of the percentage of the population with sustainable access to an improved water source, the UNDP ranks India (at 86%) as far superior to countries like Chad (42%) or Ethiopia (22%)– see Human Development Report (2006: pages 307 and 308).

[5] A fit male weighing 80 Kilograms (i.e. Osberg) can carry 25 litres of water one kilometre in 18 minutes on flat sidewalks – since it took 11 minutes to walk the empty journey, and 5 minutes to fill buckets, the total time required for one round trip was about 34 minutes. The authors conjecture that 25 litres (which weighs 55 pounds, in Imperial units) is not far from the maximum practicable weight for a single trip, given the awkwardness of the load. Smaller stature, uneven terrain or poorer nutrition – the reality of most people who do this daily – implies that multiple journeys with smaller loads would typically be required. A family of four using the UNDP minimum of 20 litres per person per day would need eighty litres – which weighs 80 Kilograms (approximately 176.4 pounds in Imperial units) and necessarily involves several trips.

[6] The personal interview methodology was very labour intensive, but was considered necessary to collect reliable diary data from respondents who are, in some cases, illiterate. Gersuny (1998) discusses the advantages of the diary methodology, which walks the respondent sequentially through the previous day's activities, in improving recall and imposing aggregate consistency of responses. An "abnormal" day is defined in the "Instruction Manual for Field Staff" (1998: 23) as "that day of the week when guest arrives, any member of the household suddenly falls sick, any festival occurs, etc.". The "weekly variant" is "determined according to the pattern of the major earners holiday. If the major earner does not holiday, then school children's holiday will be taken. If even this is not applicable, then day of weekly hat (bazaar) may be taken".

[7] The gendered inequality of time spent in water collection is common to many countries – see HDR (2006:87).

[8] Pipe capacity, for example, varies with the pipe's cross-sectional area (which, if $r$ is the pipe's radius, is given by $\pi r^2$) while pipe cost typically varies with a pipe's circumference (which is given by $2\pi r$).

[9] Albeit sometimes, as in the UK, the state may define its role as licensing and regulating privately owned local water utility monopolies. For a concise summary of the public/private sector debate in water provision see Human Development Report 2006 (especially pages 77-107).

[10] If all land were owned by a single landlord, the landlord could operate as a price discriminating water monopolist, who could extract from her tenants the entire consumer surplus in water distribution. But if land ownership is non-monopolistic, land owners near the well head can attempt to exploit their market power, but must make irrevocable investments to do so.

[11] More generally, given the imperfections of effective democracy in rural areas, supporters of community infrastructure may need to mobilize more than 50% + 1 – but the basic point remains, whatever the critical quantile of the distribution of voters.

[12] Recall that the Gini index is defined by $\Sigma\Sigma \left| u_i - u_j \right| / 2\mu N^2$, where $\mu$ is the average benefit, which we normalize to 1.

[13] On June 30, 2006 a Google Scholar web search restricted to Business, Administration, Finance, and Economics returned 56,500 hits on "Water and Social Capital". An ECONLIT search generated 3,750 hits on "Social Capital". We do not pretend to have read all this. The concept of "social capital" is not universally accepted - e.g. Arrow (1999) and Solow (1999) are sceptical of the metaphor of capital in "social capital" and of attempts to measure it. See also Sobel (2002).

[14] http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALDEVELOPMENT/EXTTSOCIALCAPITAL/0,,contentMDK:20642703~menuPK:401023~pagePK:148956~piPK:216618~theSitePK:401015,00.html

[15] *Social Capital Assessment Tool* question 4A1 – Gootaert and Van Bastelaar (2002:191)

[16] Even if an individual belongs to a formal group (e.g. the American Economics Association?), it may not be mentioned unless group membership is salient.

[17] Narayan and Pritchett (1999a) note that principal components analysis did not work well in their data, so they assume that associational memberships should be weighted by an index of heterogeneity of associational membership which is an equally weighted average of a common rescaling of five questions on kin, occupational and income heterogeneity, group functioning and membership fees. The implication is that their regression results are somewhat sensitive to alternative scaling or weighting assumptions.

[18] *Community services:*
611. community organised construction and repairs: buildings, roads, dams, wells, ponds etc. and
621. community organised work: cooking for collective celebrations, etc.

[19] *Group activities:*
631. volunteering with for an organisation (which does not involve working directly for individuals)
641. volunteer work through organisations extended directly to individuals and groups
651. participation in meetings of local and informal groups/caste, tribes, professional associations, union, fraternal and political organisations
661 involvement in civic and related responsibilities: voting, rallies, attending meetings, panchayat
671. informal help to other households
681 community services not elsewhere classified

[20] In the computation of average times, we look at adult men and women, of ages 18 and above.

[21] The social activities that we consider are:
811: Participating in social events: wedding, funerals, births, and other celebrations
812. Participating in religious activities: church services, religious ceremonies, practices, kirtans, singing, etc.
813. Participating in community functions in music, dance etc.
814. Socializing at home and outside the home.

[22] Recall from footnote 3 that an "abnormal" day is defined as "that day of the week when guest arrives, any festival occurs" and is separately coded.

[23] There are 51 rural and 52 urban districts.

[24] In the ITUS data, twelve households were sampled in each village or urban block, implying that we indirectly have observations on approximately 1554 local micro communities (1,066 rural and 488 urban). With only twelve household observations in each village, sampling variability can be expected to bedevil estimation of characteristics of these local communities which are aggregated from *household* observations at the village level. (Estimation of the characteristics of local village society derived from the approximately 50 adult *individuals* in each village can be expected to be more robust.)

[25] There are three methods that can be used to compute $(1-\alpha)\%$ confidence intervals for *b*: (i) Normal approximation method, (ii) percentile method, and (iii) Bias Corrected method. In (i) the assumption is that the sampling (and thereby the bootstrapping) distribution is normal. In (ii) the confidence interval is constructed based upon percentiles of the bootstrapping distribution. The computations for (iii) are more involved and for details, see the above references, which also present formulae for (i) and (ii). In the bootstrapped probit regressions that we perform (reported in Tables 3, 4, A2, and A3) the biases are small and the three methods of computing confidence intervals yield approximately the same results. Bias estimates and confidence intervals are available upon request.

[26] Except activity code 611 (community organized construction and repairs) which includes work on 'roads, dams, wells, ponds, etc.'

[27] Our caution is also partly due to the relatively small reported differentials in monthly expenditure for households with large differentials in land owned, in rural areas. The correlation between monthly per-capita expenditure and land ownership is also very low (0.16).

[28] In the simple model of Section 2, we represented this fixed cost as $b_0$.

[29] From the Indian Central Water Commission

[30] Within Western social science, this tradition goes back to Weber and Marx. Among modern development economists, Myrdal (1968) and Dreze and Sen (2002) are a few of the authors who have discussed how caste and class barriers hinder participatory growth in India. See Gupta (1993 a) for an overview of the literature on caste and Easterly, Ritzan and Woolcock (2006) for a general discussion of ethnic fractionalization and institutional quality.

[31] The more finely one disaggregates "Group activities" into specific types (e.g. 661 involvement in civic and related responsibilities: voting, rallies, attending meetings, panchayat), the smaller the sample of participants on the surveyed days. Regressions with further disaggregation (e.g. separately identifying 661 activities) – both using the original data and in 1,000 bootstrapped iterations – reinforce the conclusions above and are available from the authors, but are not reported explicitly here due to concern about small sample size.

[32] See e.g. the recent work by Dirks (2001), Gupta (1993 a) and the references therein.

[33] The classic reference is Dumont (1970)

[34] Sabarwal (1986) makes a similar argument. Also see Harriss (2002), p. 38.

[35] See Alesina and La Ferrara (2005) for a survey.

[36] Since each impact evaluated in Table 5 holds "all else constant", one cannot simply add up individual impacts to obtain the joint impact of, for example, becoming both a 'professional' and a home owner.