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Author(s): Sripad Motiram and Lars Osberg

Source: *Economic Development and Cultural Change*, Vol. 59, No. 1 (October 2010), pp. 63-94
Published by: The University of Chicago Press
Stable URL: http://www.jstor.org/stable/10.1086/649640

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

sripad motiram
Indira Gandhi Institute of Development Research

lars osberg
Dalhousie University

Human survival requires water for drinking and for sanitation and food preparation. The United Nations High Commissioner for Refugees (UNHCR 1992) has suggested that 15 liters per person per day is the minimum total necessary,[1] while the Human Development Report (HDR 2006) of United Nations Development Program (UNDP) sets a daily minimum of 20 liters per capita. Whatever the exact level of this basic need, the residents of developed countries (and the majority of Indian citizens) can simply turn on the tap and satisfy it immediately.[2] However, in 16% of rural and 9.6% of urban Indian households in 1999 (containing approximately 140 million people, using the 2001 census), somebody (usually female) had to spend, on average, approximately three-quarters of an hour each day fetching it.[3]

This article would not have been possible without the very generous help of Indira Hirway, director and professor of economics, Centre for Development Alternatives, Ahmedabad, India, who was instrumental in the design of the Indian Time Use Survey; her assistance in obtaining and interpreting the micro-data from this survey is deeply appreciated. We thank Will Gibbons for his work as research assistant and the Social Sciences and Humanities Research Council of Canada for its initial financial support under grant 410-2001-0747. We would also like to thank the editor, an associate editor, two anonymous referees, and participants at Dalhousie University seminars, INEQ2007 in Berlin and the 2006 Canadian Economics Association annual meeting in Montreal for their comments. Corresponding author: S. Motiram, sripad@igidr.ac.in.

[1] "Optimum standards in most refugee emergencies call for a minimum per capita allocation of 15 liters 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 liters per person per day should be regarded as the minimum 'survival' allocation. This quantity will be raised to 15 liters per day as soon as possible" (UNHCR 1992, 5).

[2] In this study, 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, table 1] for a breakdown of the sources of drinking water in India in 1998–99).

[3] In our sample, 18.6% (11.5%) of rural (urban) households.

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Why do they now not have the access that most people in India take for granted? This paper begins in Section I with an overview of water collection in India and a brief description of our data source: the Indian Time Use Survey of 1998–99. Section II 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 III then suggests that a natural metric for local social-capital-building activities might be the average amount of time that local residents spend in social interaction, group, or community activities and examines the correlations between the supply of water and community- and group-level social capital, inequality in land, and caste. Section IV presents our conclusions—recognizing that given concerns of endogeneity, the cross-sectional survey data available to us restrict this study to assertions about statistically significant correlations, not the stronger statements about causality that might be possible with, for example, randomized trial methodologies.

I. Overview

A. Basic Needs and the Time Burden of Carrying Water

Although the Human Poverty Index of the UNDP includes, as one of its components, the percentage of the population "without sustainable access to an improved water source," it goes on to define "reasonable access" as "the availability of at least 20 liters a person per day from a source within 1 kilometre of the user's dwelling."[4] As any reader can check, carrying this amount of water for a four-person family (i.e., 80 liters per day) is hard work[5]—and a return journey of up to 2 kilometers takes significant time. If there is no community provision, the affluent can often afford to dig their own private wells, so it is the poor—that is, poor women (this is a highly gendered task)—who may have to spend a significant part of every day carrying water. The

[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 HDR (2006, 307–8).

[5] A fit male weighing 80 kilograms (i.e., Osberg) can carry 25 liters of water one kilometer in 18 minutes on flat sidewalks. Adding 11 minutes to walk the empty journey, and 5 minutes to fill buckets, the total time required for one round trip is about 34 minutes. We conjecture that 25 liters (weighing 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—imply that multiple journeys with smaller loads would typically be required. A family of four using the UNDP minimum of 20 liters per person per day would need 80 liters—which weighs 80 kilograms (176.4 pounds in imperial units) and necessarily involves several trips.

construction and maintenance of public water distribution infrastructure require 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 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.

B. Data Description

Between June 1998 and July 1999, the Central Statistical Organization of India conducted a pilot Time Use Survey (the ITUS). As Pandey (1999) describes, a stratified random sampling design, as followed in the National Sample Surveys (NSS), was used to select 1,066 rural and 488 urban strata of small, medium, and large rural villages and urban towns within 52 (out of 147) separate districts in 6 states. In each First Stage Unit, 12 randomly selected households were interviewed, producing a sample of 18,591 households (12,750 rural and 5,841 urban) with 77,593 persons (53,981 rural and 23,612 urban). 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 9 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 aged six years or older.[6] Although the sample design was explicitly constructed to capture differences in time use between normal and weekly variant or abnormal 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 study therefore focuses on time use on "normal" days.

[6] The personal interview methodology was very labor intensive but was considered necessary to collect reliable diary data from respondents who are, in some cases, illiterate. Gershuny (1999) 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."

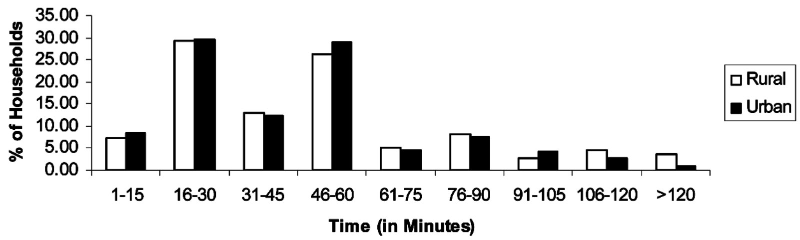

Figure 1. Distribution of time spent by households on fetching water

As Pandey (1999, 1) noted: "India has lot of socioeconomic, 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 northeastern regions respectively." Although one might wonder whether six states' data could fully capture the diversity of India, Hirway (2000, 11) has argued that "cross-checking of the results has confirmed that the sample is fairly representative of the country." In any event, these data would be interesting even if this were not the case, that is, even if the data were only seen as a random sample of the approximately 233 million people inhabiting these states (according to the 2001 census; the figure would be 254 million if we include the state of Chattisgarh, which was carved out of Madhya Pradesh in the year 2000).

Paid collection of water is a very minor phenomenon in both rural and urban areas. In rural areas only 1.2% of water collection time was paid, and in urban areas only about 1.4%. Just 0.13% (0.17%) of rural (urban) households that collect water do so only for payment.[7] In the analysis below, we therefore ignore the issue of paid water collection. Figure 1 plots the distribution of total water collection time in the households that have to collect water in rural and urban areas—throughout this study we examine rural and urban areas separately. We can see that both in rural and urban areas there is a wide variation in the times that households spend on collecting water.

Table 1 presents some basic descriptive statistics on who collects water in rural and urban areas. Columns R1–R3 and U1–U3 for rural and urban areas, respectively, focus on individuals living in households in which someone fetches water. Columns R1 and U1 show the total time spent on fetching water by individuals belonging to a particular category (e.g., boys) as a percentage of the total time spent on fetching water by all individuals. For example, in

[7] Even in these cases, it is difficult to rule out the possibility that some of this water is used for their own consumption.

rural areas 1.3% of all water-fetching work is done by boys and another 7.0% is done by adult men, while in urban areas boys do 0.4% of this work and men do about 10.9%. Columns R2 and U2 give the relative probability that if a household has to collect water, a particular type of person will do it. Given that an individual belongs to a certain category (e.g., a boy), we compute the probability that he or she collects water. We then normalize this by dividing it with the probability that any individual collects water—hence the interpretation of relative probability or a ratio of probabilities. Clearly, "carrying water" is a heavily gendered task—columns R1 and U1 indicate that in both the rural and urban areas of India, adult women do about 87% of this kind of work, while columns R2 and U2 show that, in households that have to fetch water, the frequency of water collection by adult women is twice as high as the average probability of collecting water.[8]

Columns R3 and U3 of table 1 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 significant task. As column R3 shows, gender inequity is greater among adults than among children—on average rural women who fetch water spend more time (47 minutes daily) than rural men (40 minutes), but boys (48 minutes) and girls (50 minutes) have a more similar average task. In our sample, 11.5% of urban households collect water, compared to 18.6% of rural households (somewhat more than the 9.6% [16%] of all urban [rural] Indian households), but for those households that do have to collect water, table 1 indicates that there are relatively small urban/rural differences in the distribution and difficulty of this task (except for girls).

Table 1 also indicates that intrahousehold gender differences in the burden of water collection are much larger than between-household differences associated with other characteristics—like caste status, land or homestead ownership, occupation, or gender of household head. With the exception of Scheduled Tribes status,[9] the relative probabilities of water collection (R2 and U2) and average daily time (R3 and U3) diverge somewhat, in the expected directions, but gender differences are clearly largest in magnitude.

II. A Simple Model of the Supply of Tap Water

Wherever they live, humans must have some source of water—what determines whether the infrastructure to deliver water is constructed or whether house-

[8] The gendered inequality of time spent in water collection is common to many countries—see HDR (2006, 87).

[9] In our data, a large percentage (>80%) of individuals who fetch water are in the states of Haryana and Tamil Nadu. These states combined have a small percentage of scheduled tribes; scheduled tribes are largely in Madhya Pradesh and Orissa.

TABLE 1

WATER COLLECTION TIME (MINUTES/NORMAL DAY) IN INDIA—ITUS 1999

	Rural			Urban			
	% of Total Water Collection Time (R1)	Relative Probability of Water Collection (R2)	Average Time If Collected (R3)	% of Total Water Collection Time (U1)	Relative Probability of Water Collection (U2)	Average Time If Collected (U3)	% of All Rural (Urban) Residents (POP)
Age and gender:							
Boys (6–14 years)	1.3	.123	48.46	.4	.048	42.19	10 (8.9)
Men (>14 years)	7.0	.199	39.96	10.9	.278	39.80	41.4 (43.2)
Girls (6–14 years)	4.8	.578	50.13	2.0	.278	36.03	8.6 (7.8)
Women (>14 years)	86.9	2.102	47.06	86.7	2.036	43.06	40 (40.2)
	100			100			100 (100.1)
Caste group:							
Scheduled tribe	9.1	.114	55.17	4.7	.823	58.33	17.7 (4.4)
Scheduled caste	27.4	1.020	47.99	8.4	1.104	38.77	18.1 (9.8)
Others	63.6	.978	45.08	86.9	.999	42.30	64.3 (85.9)
	100.1			100			100.1 (100.1)
Employment type of household:							
Professional	5.5	1.016	50.21	13	.903	35.47	5.8 (21.7)
Laborer	45.6	1.056	45.28	34.5	1.024	45.32	37.6 (19.8)
Others	48.8	.949	47.57	52.5	1.018	42.87	56.6 (58.5)
	99.9			100			100 (100)

Landownership of household:							
Landless	55.1	1.050	45.55				42.6
Landed	44.9	.942	48.02				57.4
	100						100
Homestead ownership of household:							
Owns	58.6	.926	48.42	13.2	.901	45.14	67.8 (46.2)
Does not own	41.4	1.115	44.32	86.8	1.016	42.14	32.2 (53.8)
	100			100			100 (100)
Gender of head of household:							
Female	11.7	1.363	42.75	9.2	1.201	39.98	7.2 (6.7)
Male	88.3	.963	47.20	90.8	.982	42.79	92.8 (93.3)
	100			100			100 (100)

Note. Columns R1–R3, U1–U3 refer to households in which someone fetches water on a normal day; R1 and U1 = total time spent on fetching water on a normal day by individuals belonging to a particular category (e.g., boys aged 6–14) as a percentage of the total time spent by all individuals on a normal day on fetching water; R2 and U2 = p_1/p_2, where p_1 is the percentage of individuals who belong to a particular category who fetch water on a normal day (e.g., boys who fetch water on a normal day as a percentage of the number of boys in households in which water is collected on a normal day) and p_2 is the percentage of individuals who fetch water on a normal day, expressed as a percentage of the total number of individuals who live in households in which water is collected on a normal day; R3 and U3 = average minutes per normal day spent in water collection, calculated over those individuals who spend some time on a normal day fetching water; POP = population percentages for all respondents aged six and above in both water-carrying and non-water-carrying households.

holds have to carry water from whatever source exists? Water is not a classic "public good" since it is both rival in consumption and excludable in access. But because wells, reservoirs, piping, and other water production facilities have significant indivisibilities and economies of scale[10] and since efficient distribution of water often requires piping or aqueducts that might cross many individuals' properties, in most countries the public sector is deeply involved in provision of water infrastructure.[11]

In affluent nations, tap water supply is nearly universal, but, as mentioned above, in developing countries like India a significant proportion of households do not have access to tap water supply. 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 that 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—for example, 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 wellhead. Since each individual household is located at a given distance from the well, line OC in figure 2 plots 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 ($w_i d_i$). 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 marginal cost per meter of connective piping and maintenance (annualized to b_1). Conditional on individuals closer to the well already being connected to the distribution system, line MC in figure 2 plots the marginal cost function (b_1).

The piped water system would pass an aggregate cost-benefit test if the

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

[11] Albeit sometimes, as in the United Kingdom, 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 HDR (2006, 77–107).

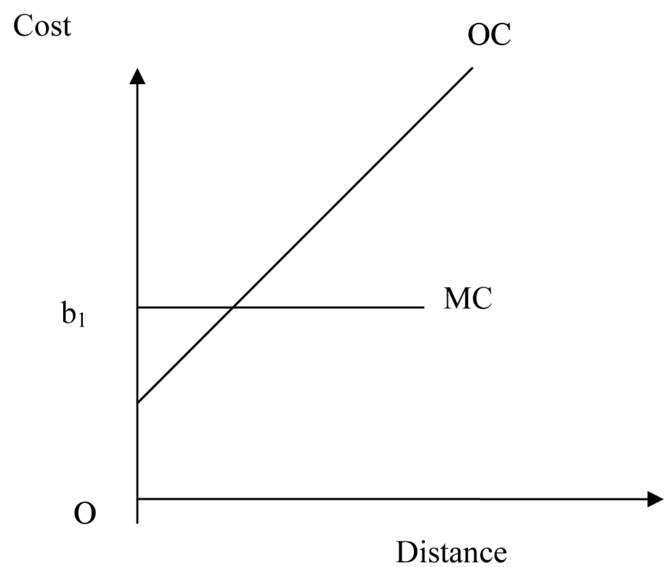

Figure 2. Relative costs of water delivery. b_1: annualized constant marginal cost per meter of connective piping and maintenance. OC: opportunity cost. MC: marginal cost.

aggregate gains from time savings cover the fixed and variable costs—that is, if net social benefits are positive (NSB > 0).

$$\text{NSB} = \sum_i (w_i c + w_i d_i) - (b_0 + b_1 D). \tag{1}$$

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

$$\text{ATTC} = (b_0 + b_1 D)/N. \tag{2}$$

The point of figure 2 is to illustrate a dilemma in piped water systems. The benefit to an individual household of the piped water system is the value of time saved ($w_i c + w_i d_i$), which varies 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 a piped water supply, because their current time costs of carrying water are smaller—indeed figure 2 is meant to illustrate the (extreme) case in which those closest to the water source are unwilling 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 neighbors who are nearer the source.

The household's opportunity cost of time (w_i) depends upon their human capital stock. There is also a pure wealth effect (e.g., from landownership) 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.[12] Since no agent would otherwise make irrevocable fixed cost investments in 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 neighbor and then try to exploit their market power over downstream neighbors. The nonexistence 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 landownership. As well, if water carrying is a gendered task and if the benefits of piped water in saved labor 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 that a net surplus is created by joint action, will households cooperate in the collective provision of water? Institutions (like water supply authorities) often require a process of negotiation, whose costs are greater if interests diverge and if mutual trust is absent. We presume that the total cost of negotiation depends multiplicatively on both the total absolute difference

[12] 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. If landownership is nonmonopolistic, landowners near the wellhead can attempt to exploit their market power but must make irrevocable investments to do so.

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—that is, fixed costs (b_0) and variable costs of connection ($b_1 D$) plus negotiation costs.

$$\mathrm{TC} = b_0 + b_1 D + b_2 \Sigma_i \Sigma_j |u_i - u_j|. \tag{3}$$

Average costs of piped water supply (ATC) are then given by equation (4).[13] 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.

$$\mathrm{ATC} = (b_0 + b_1 D)/N + b_2 \Sigma_i \Sigma_j |u_i - u_j|/N. \tag{4}$$

III. Why Do Some Households Have to Collect Water?

The question "Why do some households in India have to collect water?" 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?

In our data, we observe the likelihood that a particular household will have to spend time fetching water—a compound probability equal to 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. We want to examine the characteristics of communities that determine the local availability of drinking water and the characteristics of households that determine access to locally available supplies. We 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:

$$P_1 = f_1(b_0, b_1 D, b_2, \sigma). \tag{5}$$

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

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

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_1D) and the levels of mistrust (b_2) and inequality (σ) are characteristics of the community. Whether an individual household can connect to an available local network depends on their household disposable income (y_i) and on whether they are a member of a socially excluded group (S_i), which implies the conditional probability of tap water access as in (6) and the compound probability of fetching water as in (7).

$$P_2 = f_2(y_i, S_i), \tag{6}$$

$$[1 - P_1P_2] = f_3(b_0, b_1D, b_2, \sigma, y_i, S_i). \tag{7}$$

In recent years, a vast (and much contested) literature has stressed the importance of local "social capital" for the organization of cooperative action—either in direct voluntary supply of local infrastructure or in the mobilization of political pressure that produces government action.[14] The World Bank's Web site on social capital states: "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."[15] Putnam has variously defined "social capital" as "connections among individuals—social networks and the norms of reciprocity and trustworthiness that arise from them" (2000, 19) 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."

[14] 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"—by November 7, 2007, the number was 87,600. ECONLIT searches on these dates generated 3,750 hits on "social capital," increasing to 4,209. "Social capital" has been critiqued alternatively as a "confused and ill-specified" or as a "de-politicised, de-contextualising and neo-liberal" concept—Bebbington et al. (2004, 36, 40) provide a fascinating guide to the "battlefields of knowledge" within the World Bank over the meaning, measurement, and possible misuse of the concept of social capital. See also Arrow (1999), Solow (1999), and Sobel (2002).

[15] See World Bank, "Overview on Social Capital."

Phrased in this way, "social capital" sounds inherently positive, but many scholars have noted that norms and networks are specific to particular cultures and historical periods, implying that "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 that undermine development may be partly the product of strong within-group bonding as well as dysfunctionally high intergroup mistrust— 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 that sees local social capital as determining the cooperative behavior on which development depends, there is also a skeptical literature which notes that "not all local organizations are created equal. Depending on who is doing the organizing, and why, increased participation in local organizations can either be exclusionary and reinforce existing decision making powers and structures . . . or can widen the base of voice, information, and participation" (Alatas, Pritchett, and Wetterberg 2003, 38; see also Harriss 2002; Mansuri and Rao 2004; and Hammer and Pritchett 2006).

How should one measure social capital and test its implications for development? In particular, how might one distinguish between "bridging" and "bonding" social capital and test whether the positive impacts of "bridging" activities are outweighed by the negative influences of "bonding" into divisive subgroups?

One strand of the literature has relied on summary questions that ask respondents to indicate their level of trust in others. For example, Knack and Keefer's much-cited 1997 results reporting the positive impacts of social capital on economic growth relied 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 noted, 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.

A second tradition in the literature measures 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).[16] However, if "associational life" is measured by membership counts (by, e.g., asking respondents: "Are you, or is someone in your household, a member of any groups, organizations or associations?"),[17] it is not obvious how to aggregate memberships. The raw number of associational memberships is an index that weights equally intensive and marginal involvements of individuals and that does not differentiate the purposes and types of associations—but index numbers with arbitrary aggregation properties may produce econometrically fragile results.[18]

As well, both "trust" and associational membership may be important inputs into "norms and networks," but neither is a direct measurement of them.[19] "Trust" (like "politeness") is an aspect of interpersonal attitudes and relationships. Associational memberships are a proxy for a person's number of social contacts. Both may facilitate cooperation in networks, and may possibly help to sustain norms of behavior, but neither directly measures "norms and networks."

In this study, we suggest that time might be, in many ways, a natural metric for social-capital-building activities, because social interaction necessarily takes time—and should show up in time-use diaries. The minutes that people spend in group or community activities are a natural unit for aggregation, and the total time spent on an activity is an interpersonally comparable

[16] This finding 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."

[17] *Social Capital Assessment Tool* question 4A1; Grootaert and van Bastelaar (2001, 191). For a discussion of alternative measurement methodologies, see World Bank, "Measuring Social Capital."

[18] 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 might be somewhat sensitive to alternative scaling or weighting assumptions.

[19] Membership in the American Economics Association does not, for example, guarantee access to professional networks in the economics profession—but conference attendance can be a useful input. Social capital has much in common with its older cousin, "human capital." In both instances, something intangible (individual skills, social norms, and networks) is being thought of as a productive stock and labeled "capital." Both are in practice measured by accumulated inputs—e.g., years of education and work experience are used in many labor economics papers as measures of human capital, although these are clearly inputs into the productive skills of individuals. As Alatas et al. (2003) discuss, a strict interpretation of the aggregation conditions necessary to measure a "capital" stock is a demanding criterion. Labor economists finesse the problem of assigning relative values to different types of investments in skills by measuring them all in time inputs and adding up years of input to get human capital—perhaps because some may remember the "Cambridge Controversies" on deriving aggregate measures of the physical capital stock from market values (Cohen and Harcourt 2003). See also Hammer and Pritchett (2006).

indicator of intensity of involvement—unlike subjective grading by respondents of intensity of trust or of participation in associations. Additionally, 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, due to the time diary constraint that the aggregate length of all of a day's activities must sum to 24 hours. (In contrast, no aggregate consistency check on total memberships or "trust" is possible.) Time diaries therefore have the potential to provide a measure of "associational life" with important advantages—recognizing that social interaction time is, like associational membership or trust, an input into social capital (conceived of as "norms and networks") and not a direct measurement of it.

The designers of the ITUS were clearly aware of the literature on social capital: both formal political and "civil society" types of interaction and informal socialization were separately identified and coded, and the ITUS also distinguished between informal social interaction (such as Talking, Gossiping and Quarrelling [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[20] and group activities.[21] 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 subgroups, based partly on preexisting divisions (such as caste) or linking individuals across narrow interest groups.

As Putnam (2000) argues, 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

[20] Community services: 611: Community Organised Construction and Repairs: Buildings, Roads, Dams, Wells, Ponds, etc.; and 621: Community Organised Work: Cooking for Collective Celebrations, etc.

[21] Group activities: 631: Volunteering with or 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.

TABLE 2
TIME SPENT (MINUTES/NORMAL DAY) ON COMMUNITY, GROUP, AND 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%	.77%	.92%	.56%	.70%	.62%
Average time (over the total population)	.986	.656	.823	.512	.586	.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	.10%	.19%	.14%	.11%	.12%	.12%
Average time (over the total population)	.092	.131	.111	.036	.047	.041

Note. All average times calculated for adult men and women, i.e., ages 18 or above. Community activities: activity codes 611, 621. Group activities: activity codes 631, 641, 651, 661, 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 and nn. 20, 21, and 23.

and Talking, Gossiping, Quarrelling are common—in rural (urban) areas, 44.56% (28.72%) of adult men and 29.39% (28.59%) of adult women report doing some of this,[22] 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 are, for example, necessarily somewhat

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

episodic[23]—on any given randomly selected normal day one only observes about one male in 20 engaged in a recorded social event, with an average duration of about 1 hour and 20 minutes.[24]

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) and hence the same relationship with the provision of local public services—an assumption which Alatas et al. (2003) question, and one we can test explicitly.

Within each district, the average time spent in social activities by all men and by all women can be thought of as a local community characteristic. Since we want to examine its correlation with whether or not particular households within that community have to carry water, we have to worry about two possibilities—that such a correlation arises because of "reverse causality"—that is, that water carrying time might influence average social activity time, to some significant degree—and/or because both variables are causally determined by some unmeasured omitted variable(s) that we cannot control for explicitly.

In our data, a strong reason for doubting the empirical importance of reverse causality is the minority status of both water-carrying households and social activity among time uses. The average social activity time of all respondents within a district will necessarily be dominated by those who are in the 88.5% of urban (81.4% of rural) households who do not carry water—among this vast majority of households, individuals' social activity time cannot be influenced by something that they do not do. And although time spent one way must be taken from some other places in the day, this "arithmetic" interrelationship of time uses is likely to have a small impact on the average social activity time of all respondents. For the small (18.6%) minority of rural households (11.5% of urban) that do carry water, the time they have to spend carrying water will imply time adjustments to other activities, but these adjustments will be spread over all time uses. As table 2 shows, since only

[23] 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.

[24] Recall from n. 6 that an "abnormal" day is defined as "that day of the week when guest arrives, any festival occurs" and is separately coded.

about half an hour a day is typically spent in the social activities we track, time adjustments in the other 97% of the day are likely to absorb most of it.

A third reason to doubt the importance of reverse causality is gender role differentiation. As demonstrated in Section I, water carrying is largely women's work—and is a highly socially visible type of work. Arguably, such social visibility is a powerful social reinforcer of community norms in gender roles. If so, the time men spend in social interaction and the time women spend in carrying water cannot, in general, be directly substituted. Even within the same household, if gender roles are rigid, gender differentiation means that the time that men and women spend on gender-defined tasks is not simultaneously determined. In our regressions it is the average time spent by all the respondent men of a community on social interaction of different types that is being regressed on the (overwhelmingly female) water-carrying time of specific different individual households in that community.[25]

Having reasons for doubting reverse causality is, however, not a sufficient reason to assert that regression results establish causality—in the cross-sectional micro-data that are available to us we can at most say that such results are consistent with such a hypothesis. Our results may also be consistent with other hypotheses. Although we have experimented with numerous alternative specifications and additional explanatory variables, we can only assert from this that our results are robust to the specifications we have actually run with the ITUS data. As in any other empirical work, it is possible that variables omitted from our data set might be important enough empirically to affect our results.

In this study, we treat the district as the locus within which social capital will have its impact (or not).[26] We also focus on inequality at the district level

[25] Since we can measure separately the average social time of men and of women in each district, we can check whether there is any difference in empirical results when we examine the impacts of male social time, female social time, or both aggregated. Table 3 reports results using just average male social time, but estimation results using only female social time, or male and female time, are essentially similar. Because community work on water projects (activity code 611) is a particular type of communal time use plausibly linked to tap water availability, table 3 drops this very infrequent activity code from the measure of time use in community activities—but this also makes no appreciable difference to our results.

[26] According to the seventh schedule of the Indian constitution, water and sanitation are under the purview of the state governments (and not the federal/central government). The 73rd and 74th amendments (adopted in 1993) mandated state governments to devolve power to local rural (i.e., Panchayats) and urban bodies, respectively. However, since local government (including reform at the local level) comes under the State List, the onus of implementing these amendments fell on the state governments. As a result, implementation has been far from successful, and this would be particularly true in 1998–99, when the ITUS was conducted. According to Chaudhuri (2006),

(in land and expenditure), decomposing it into between-village and within-village components and separately assessing their impacts. Our results are essentially similar even if we use the village/urban block instead of the district.[27]

Table 3 reports probit regression results estimating equation (7) above for rural and urban households (i.e., we estimate the probability that one or more members of a given household will spend some time, in a normal day, collecting water). Table A1 in the appendix presents descriptive statistics for the variables used in these regressions. Because diary data generally do not observe "lumpy" types of events every day, episodic usages of time have to be thought of in terms of the conditional expectation of a particular time use, on a randomly selected normal day. This means that low-frequency events (like participation in community functions) may be susceptible to variability in small samples, which implies that the bootstrapping procedure described in Efron and Tibshirani (1993), Mooney and Duval (1993), and Davison and Hinkley (1997) is particularly appropriate for our purposes. To ensure that our results not be sensitive to sampling error, table 3 reports marginal effects and *p*-values based on estimated coefficients and standard errors from 1,000 replications for a base household (nonscheduled caste, nonscheduled tribe, male headed, with average monthly per capita expenditure and dependency ratio; this household lives in a district with average values for all the district-level variables—inequality, scheduled caste proportion, scheduled tribe proportion, etc.).[28] In rural areas,

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none of the states in the ITUS sample have undertaken significant devolution. State governments work through districts, which both function as administrative units and can make demands on the state. The district-level bureaucracy (especially the collector, who is the administrative head at the district level) plays an important role.

[27] In the ITUS data, 12 households were sampled in each village or urban block, implying that we indirectly have observations on approximately 1,554 local micro-communities (1,066 rural and 488 urban). With only 12 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.)

[28] Let b, $\hat{b}$, k, and N denote the true population value of a coefficient, estimate of the coefficient from a 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 the regression. We repeat this process k times. Let b_i^* denote the estimate of the coefficient in the ith iteration ($i = 1, \ldots, k$). The standard error of the point estimate of b can be estimated by $\sum_{i=1}^{k}(b_i^* - \overline{b}^*)^2/(k-1)$, where $\overline{b}^* = \sum_{i=1}^{k} b_i^*/k$. The bias in $\hat{b}$ can be estimated as $(\overline{b}^* - \hat{b})$. 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 $\overline{b}^*$, which is the bias subtracted from $\hat{b}$). There are three methods that can be used to compute $(1-\alpha)\%$ confidence intervals for b: (i) normal approximation, (ii) percentile, and (iii) bias corrected. In i, the assumption is that the sampling (and thereby the bootstrapping) distribution is normal. In ii, the confidence interval is constructed based

TABLE 3

PROBABILITY THAT HOUSEHOLD FETCHES WATER MARGINAL EFFECTS (*P*-VALUES IN PARENTHESES) USING BOOTSTRAPPED PROBIT ANALYSIS

	Rural			Urban		
Variable	Model A	Model B	Model C	Model A	Model B	Model C
Monthly per capita expenditure (100s of Rs)	.002	−.002	−.004	−.004	−.004	−.005
	(.05)	(.09)	(.00)	(.00)	(.00)	(.00)
Laborer household	.013	.010	.007	.046	.039	.036
	(.03)	(.13)	(.35)	(.00)	(.00)	(.00)
Professional household	−.010	−.008	−.013	−.014	−.018	−.019
	(.33)	(.48)	(.30)	(.21)	(.11)	(.06)
Owns homestead	−.041	−.012	−.007	−.137	−.117	−.096
	(.00)	(.06)	(.35)	(.00)	(.00)	(.00)
Landless household	−.010	−.003	−.001			
	(.05)	(.64)	(.93)			
Dependency ratio (unpaid members/household size)	.019	.034	.038	.048	.040	.037
	(.03)	(.00)	(.00)	(.01)	(.02)	(.03)
Female household head	.018	.014	.011	.009	.004	−.001
	(.01)	(.12)	(.25)	(.55)	(.76)	(.94)
Scheduled caste	.005	.007	.008	−.034	−.033	−.031
	(.40)	(.34)	(.34)	(.02)	(.01)	(.02)
Scheduled tribe	−.007	−.014	−.013	.012	.006	.003
	(.29)	(.10)	(.14)	(.49)	(.74)	(.87)
Percentage scheduled caste in district	.743	.550	.354	.417	.368	.311
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Percentage scheduled tribe in district	.269	.182	.111	.344	.274	.224
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Percentage of landless households in district	.163	.211	.235			
	(.00)	(.00)	(.00)			
Inequality in landholdings among landed in district	−.120	−.206	−.216			
	(.00)	(.00)	(.00)			
Within-district inequality in expenditure[a]	−.899	−.877	−.098	.123	.0003	−.338
	(.00)	(.00)	(.50)	(.44)	(.75)	(.05)
Between-district inequality in expenditure[b]	−.031	.485	.252	−1.399	−1.331	−1.019
	(.80)	(.00)	(.11)	(.00)	(.00)	(.00)

Talking, Gossiping, and Quarrelling[c]		−.002	−.004		−.002	−.002
		(.00)	(.00)		(.00)	(.00)
Social activities[d]		−.0001	−.002		.0004	.0001
		(.87)	(.01)		(.75)	(.93)
Community and group activities[e]		.034			.017	
		(.00)			(.00)	
Community activities[f]			−1.182			−.309
			(.00)			(.01)
Group activities[g]			.036			.044
			(.00)			(.00)
Net annual ground water per capita for district[h]	−2.923	−1.730	−1.627	−3.145	−2.686	−1.878
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Sample size	12,720	12,720	12,720	5,830	5,830	5,830

Note. Marginal effect calculated for a base household: nonscheduled caste, nonscheduled tribe, male headed, with average monthly per capita expenditure and 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. In rural areas, the base case is landless, laborer, and homestead owning, whereas in urban areas it is not homestead owning and neither laborer nor professional. Marginal effect of variable $i = \hat{\beta}_i f(X_b\hat{\beta})$, where $\hat{\beta}_i$ is the estimated coefficient for variable i, X_b is the vector of explanatory variables with values corresponding to the base household, $\hat{\beta}$ is the vector of estimated coefficients (including the intercept), and f is the density function for the standard normal. Interested readers can refer to the URL: http://economics.dal.ca/Research/Research_Papers_in_Economics/index.php for the estimated coefficients, standard errors, and computation of marginal effects. For the probit, the dependent variable = 1 if a household fetches water, 0 if not; number of households that fetch water in rural and urban areas is 2,363 (18.58%) and 671 (11.51%), respectively. The sample size for the rural (urban) regressions, namely, 12,720 (5,830) is less than the number of rural (urban) households in the survey, 12,750 (5,841), because we removed a few outliers and erroneous records. For the bootstrap, the number of replications: 1,000. We report the p-values in parentheses.

[a] The Theil index of inequality (R) can be written as ($W + B$) where the within component is: $W = \Sigma_g(n_gY_g/nY)R_g$. Y_g is the mean income in village/urban block g; n_g is the population of village/urban block g; R_g is the Theil for the village/urban block g; n is the population of the district; Y is the mean income of the district; (n_gY_g/nY) is the village/urban block g's share of the total income in the district.

[b] The between component is $B = (1/n)\Sigma_g n_g(Y_g/Y)\log(Y_g/Y)$.

[c] Activity code 951. Time spent outside the house. Average male time for the district (in minutes/normal day).

[d] Activity codes: 811, 812, 813, 814. Average male time for the district (in minutes/normal day).

[e] Activity codes: 621, 631, 641, 651, 661, 671, 681. Average male time for the district (in minutes/normal day).

[f] Activity code: 621. Average male time for the district (in minutes/normal day).

[g] Activity codes: 631, 641, 651, 661, 671, 681. Average male time for the district (in minutes/normal day).

[h] Calculated based upon data from the Central Ground Water Board (2006), which is for the year 2004. The data for district population are taken from the 2001 census. The districts in the ITUS are based upon the 1991 census. There was a reorganization of certain states and districts after 1991. Surguja, which was in the state of Madhya Pradesh in the 1991 census, is in the state of Chattisgarh in the 2001 census. The district of Chengai-Anna was split into Kancheepuram and Tiruvallur—hence, we computed the per capita value by using the combined values of ground water and population for these districts. A similar procedure was adopted for South Arcot (split into Cuddalore and Villupuram). Data for Chennai are not available in Central Ground Water Board (2006), so we used data for the neighboring districts (Kancheepuram and Tiruvallur) for the computation. Periyar, Kamarajar, and Chidambarnar were renamed Erode, Viruddhnagar, and Thoothkudi, respectively.

the base case is landless, laborer, and homestead owning, whereas in urban areas it is not homestead owning and neither laborer nor professional.[29]

Table 3 includes model A in the first column to show the results we would obtain if we did not consider any social capital variables. Model B adds time spent in social interactions but reports the results obtained when time spent by men in all types of community and group activities is added together and averaged.[30] However, our preferred specification is model C, in which male time spent in community and group activities is separately identified and averaged.

We present all these specifications because we want to examine the robustness of our results. Qualitatively, there are only a few differences in sign or statistical significance to note. 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 do 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 our preferred specification (model C) in both urban and rural areas, the household's monthly per capita expenditure is highly statistically significant[31] and negatively associated with having to fetch water, with a similar size marginal effect in urban and rural areas.[32] Moreover, one could arguably expect wealth and not income to be the more important individual household determinant of access to tap water. The negative, significant coefficient on "pro-

upon percentiles of the bootstrapping distribution. The computations for iii are more involved and, for details, see the references cited, which also present formulae for i and ii. In the bootstrapped regressions that we perform (reported in tables 3 and 4) the biases are small and the above three methods yield approximately the same results. Bias estimates and confidence intervals are available upon request.

[29] For the coefficients and standard errors of the probit models reported in table 3, see http://economics.dal.ca/Research/Research_Papers_in_Economics/index.php, where an Excel file also enables readers to calculate the marginal effects associated with alternative possible hypothetical base cases.

[30] Except activity code 611 (Community Organized Construction and Repairs), which includes work on "roads, dams, wells, ponds, etc."

[31] We use the terms "highly statistically significant," "strongly statistically significant," and "statistically significant" to refer to statistical significance at 1%, 5%, and 10%, respectively. Unless otherwise stated, we refer to model C.

[32] Other functional forms involving monthly per capita expenditure—logarithmic, quadratic (with both linear and squared terms), and quartic (involving a fourth degree term) are available upon request. Results remained essentially the same.

fessional" household status may reflect human capital wealth, and the highly significant (strongly significant in urban areas) positive association with greater number of dependents is also consistent with this interpretation. However, in rural areas, the statistical insignificance of landlessness, home ownership, and a dummy variable "laborer" (indicating that more than 50% of income is from agricultural or other labor 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 of positive correlation of laborer status and water carrying and the negative coefficient on home ownership status (both are highly statistically significant). These associations are consistent with a greater relative impact of "ability to pay" as a determinant of lack of access to tap water in urban, compared with rural, areas. Notably, our preferred specification (model C) is inconsistent with the hypothesis of discrimination in water access against female-headed households in both urban and rural areas.

Whether or not citizens can mobilize effectively for collective action, the cost of provision depends on how easily local wells can be dug to access water.[33] National water resources data provide estimates of ground water available per capita in different districts,[34] and in both urban and rural areas 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.[35]

Given the technical cost of water facilities, provision will be more likely where cooperative action can be more readily organized—this study attempts to assess the relative quantitative association of social interaction, and of the type of social interaction, compared to the structural barriers of caste and class. The novelty in time-use data is its direct observation of time spent in social interaction, which can be compared in magnitude of association with inequality in landownership, income, and caste status.

The social capital perspective on local public goods provision implies that a household's probability of having to fetch water will be higher where there is greater economic inequality (e.g., in landownership) and where the percentage of scheduled castes and tribes in the district's population is higher. As Habyarimana et al. (2006, 23) have 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 mo-

[33] In the simple model of Sec. II, we represented this fixed cost as b_0.

[34] From the Central Ground Water Board, Ministry of Water Resources, Government of India.

[35] We tried other controls at the state level, e.g., state per capita GDP, and the results were essentially the same.

bility. 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 and thereby facilitate cooperative 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 B. Contrary to the social capital model, time spent on community and group activities is highly statistically significant and positively associated with having to fetch water—that is, is negatively associated with local public goods provision. Only when the impacts of community work and group activities are examined separately does it become clear that associational life within groups has a very different correlation with development in India than wider community involvement. In model C in table 3, for both rural and urban areas, the average time spent by local men in community work (i.e., overwhelmingly by other local men, those residing outside the household that is either fetching water or not) is negatively associated with a household's having to fetch water, but the coefficient on time spent in group activities is highly statistically significant and positive—a result that we take as consistent with the possible importance of "bonding" within narrow in-groups defined by occupation, caste, and class. Apparently, not all forms of associational life are necessarily correlated with development.[36]

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). Since politics in India (especially rural India) is strongly influenced by caste affiliations, caste also plays a role in participation in political and civic activities (activity code 661). 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.[37]

Our results on the negative association of time spent in group activity in

[36] Alatas et al. (2003) came to a very similar conclusion—that different types of "social" activities can have differential effects. 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.

[37] On this, see Saberwal (1986), Gupta (2001), and Harriss (2002, 38). Some references on caste are Chatterjee (1993) and Gupta (1993).

India are therefore consistent with the many studies that have found that ethnolinguistic fragmentation leads to lower or inferior provision of public goods and to lower growth.[38] However, although our results using this Indian data can be seen as a cautionary counterexample 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. We note that the associational life that Narayan and Pritchett (1999a, 1999b) found to be so positive in Tanzania was the associational life of a society that 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.

As table 2 showed, average time spent in casual Talking, Gossiping, Quarrelling is by far the most prevalent type of social interaction; in all specifications, in both urban and rural areas, table 3 indicates that it is highly statistically significant and negatively correlated with having to fetch water. Average time spent in more episodic social engagements has a significant negative coefficient in rural, but not in urban, areas. The coefficients on casual social interaction and social activities are much smaller than those on community work, but all these variables are highly statistically significant and negatively associated with the 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.

Table 3 indicates that in both urban and rural areas, the percentage of the local population that is scheduled caste or tribe is highly significantly positively correlated with the probability that a household will have to fetch water.[39] Given that the locality has piped water, there is no evidence for individual-level discrimination against scheduled castes or tribes (indeed table 3 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

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

[39] We checked the robustness of our results by using the proportion of scheduled castes and scheduled tribes from the 2001 census. The results essentially remained the same.

TABLE 4
COMPARISON OF THE EFFECTS OF SOCIAL CAPITAL AND OTHER VARIABLES (USING PROBIT MODEL C)

	Rural	Urban
Probability that a household fetches water (in the sample)	.1858	.1151
Increase in probability of fetching water due to:		
i) A policy of eliminating landlessness	−.073 (39.5)	Not considered in the regression
ii) Change from nonprofessional to professional status	NS	−.018 (15.4)
iii) Increase in monthly per capita expenditure		
a) 10% increase	−.002 (.88)	−.004 (3.40)
b) 20% increase	−.003 (1.74)	−.008 (6.69)
iv) Ownership of homestead	NS	−.064 (55.45)
v) Change from nonprofessional to professional status and 20% increase in expenditure and (in urban areas) homestead ownership	−.021 (11.4)	−.073 (63.18)
vi) Decrease in percentage of scheduled caste individuals in the district from median to zero	−.046 (24.5)	−.027 (23.05)
vii) Decrease in percentage of scheduled tribe individuals from median to zero	−.005 (2.93)	−.006 (5.05)
viii) Doubling the average time spent on social activities	−.009 (4.76)	−.0005 (.46)
ix) Doubling the average time on community organized work	−.017 (9.13)	−.009 (7.87)
x) Doubling the average time spent on group activities	.035 (18.86)	.018 (15.34)

Note. Absolute change and percentage change (in parentheses) in the probability of fetching water, where the percentage change is calculated on the base case, i.e., = absolute change/.1858 for rural and absolute change/.1151 for urban. We compute the probability of fetching water for a base household (nonscheduled caste, nonscheduled tribe, male headed, with average monthly per capita expenditure and 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.). In rural areas, the base case is landless, laborer, and homestead owning, whereas in urban areas it is not homestead owning and neither laborer nor professional. To simulate the impact of eliminating landlessness in rural areas, we recalculate this probability by setting the landless proportion to zero and making the household landed (i.e., not a laborer). In simulation (v) we change several variables simultaneously—other simulations are ceteris paribus. NS = Not statistically significant.

village is more obvious, it is quite plausible that district governments may discriminate between localities, even if officials face more constraints in discriminating between individuals.

Because landownership is a meaningful indicator of wealth inequality in rural but not urban areas, this variable appears only in the first three columns of table 3. A robust result is that the percentage of landless households is highly statistically significant and positively associated with the chance that a given household (landless or not) will have to fetch water.[40] However, statistical significance does not necessarily imply quantitative importance. Furthermore, the marginal association of each independent variable, considered separately, may sometimes be a misleading guide to policy impacts. Table 4, therefore, presents the difference in probability of having to fetch water as-

[40] Using other indices of inequality, e.g., the coefficient of variation does not change the results (available upon request).

sociated with alternative ceteris-paribus-type thought experiments.[41] We compute the probability of fetching water for the same base household that we considered earlier in table 3, and, to simulate the impact of various policies, we recalculate this probability appropriately.

Table 3 reports regression results based on cross-sectional data, and the dangers involved in interpreting the reported coefficients as causal relationships, rather than as correlations, are well known—so we do not want table 4 to be interpreted as anything more than a thought experiment that is intended to complement the tests of statistical significance reported in table 3 by providing the relative magnitudes of empirical associations.

Table 4 indicates that 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 15% in urban areas. A thought experiment like "eliminating landlessness" would imply both that the percentage landless in all districts is zero and that no individual household is landless. If the correlations of table 4 are interpreted as causal influences, this might imply a decrease in the probability of having to fetch water of about two-fifths. If the district of residence were to have zero members of scheduled castes instead of the actual percentage in the median district, the proportion of households fetching water might fall by about a quarter in both rural and urban areas, which is much more than the corresponding figures for the proportion of scheduled tribes—about 3% (for rural) and about 5% (for urban). A 20% increase in the individual household's monthly expenditure levels would have a fairly small impact in rural areas, but a much larger impact (a decrease of about six and half percent) in urban areas. However, the difference in probability of fetching water associated with homeowner and renter (i.e., nonowner) status in urban areas is the single largest observed difference in the data.

Interest in social capital as a part of the economic development process is motivated by the perception that social capital matters empirically—so one would like to know if differences in local social capital are associated with "large" or "small" differences in water-carrying probability, relative to other influences. As a thought experiment, a district with twice the average amount of social interaction time (which would surely count as a "large" difference from the average),[42] in both rural and urban areas, would only be associated with about a four and half percent difference in chances of carrying water in

[41] Since each impact evaluated in table 4 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 homeowner.

[42] Activities 811–814; see n. 23 for definition.

rural areas, and about half a percent in urban areas. As noted earlier, districts with more community time have less water carrying, but districts with more group activity time have more water carrying. However, a doubling of community organized work is only associated with about 9% and 8% decrease in water-carrying chances in rural and urban areas, respectively. The same proportionate change in group activities has a much stronger opposite association—an increase of 19% (rural) or 15% (urban). In general, the large changes in social interaction patterns simulated in table 4 are associated with impacts substantially less than those of caste differentials and those associated with landlessness in rural areas and home ownership in urban areas—and even if these correlations are interpreted as indicating causality, feasible policies to change social interaction patterns are much less obvious than policies that might affect the percentage of a community that is landless.

Since some individual attributes can be thought of as a "package"—for example, acquiring professional status, having a higher income, and buying a home—it may also be more realistic to examine their joint association. In urban areas, these three individual household attributes are jointly associated with a decrease in the probability of fetching water of about 63%—but in rural areas the decrease is only 11%, implying that community characteristics retain a dominant role. Our results are therefore consistent with the hypothesis that some types of social interaction may help, while caste-based group activities may hurt, but it is economic inequalities and caste-based social divisions that are crucial to the social cooperation that is the basis for local public goods supply in India. In urban areas, individual economic advantage, as indicated by income, home ownership, and professional occupational status, is the key to whether or not a household has to collect water, while the inequality of landownership is crucial in rural areas.

IV. Conclusions

This study has used cross-sectional time diary data from six Indian states to measure social interactions and has compared the relative empirical association between social capital, inequality in landownership, caste, and the probability that an Indian household will have to fetch water. Although the possibility of omitted variables remains a concern in our data, we have (we believe) plausible reasons for doubting the empirical importance of reverse causality. We interpret our results as consistent with the hypothesis 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.

Our data on gendered inequality in carrying water and documentation of the importance of inequalities of caste and class in India may not be surprising. However, we also hope to have provided a cautionary counterexample to possibly 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 preexisting social groups—is an empirical issue, which depends on the specific historical context. In other contexts, time spent in group activities may build trust among individuals across society, enabling more effective collective action that improves basic public services, like the delivery of water. However, in the specific context of India, our results are more consistent with the hypothesis that many group activities reinforce the importance of preexisting social cleavages (like caste); exacerbate the negative impact of inequalities in landownership, professional status, and income; and undermine the likelihood of community-level collective action that might improve community well-being—particularly the well-being of poor women—by relieving people of the continuing daily drudgery of fetching water.

Appendix

TABLE A1
DESCRIPTIVE STATISTICS OF SOME IMPORTANT VARIABLES

	Rural		Urban	
Variable	Mean (SD)	Min (Max)	Mean (SD)	Min (Max)
Monthly per capita expenditure (in Rupees)	463.700	0	825.721	75
	(14,743.020)	(4,200)	(24,912.44)	(9,500)
Household size	4.206	1.000	4.041	1
	(105.953)	(23)	(88.72324)	(21)
Dependency ratio (unpaid members/ household size)	.547	0	.624	0
	(15.013)	(1)	(12.531)	(1)
Owns homestead	.639	0	.416	0
	(26.638)	(1)	(25.338)	(1)
Scheduled caste	.192	0	.101	0
	(21.843)	(1)	(15.475)	(1)
Scheduled tribe	.184	0	.049	0
	(21.513)	(1)	(11.103)	(1)
Laborer household	.406	0	.210	0
	(27.247)	(1)	(20.943)	(1)
Professional household	.056	0	.201	0
	(12.746)	(1)	(20.618)	(1)
Female household head	.099	0	.086	0
	(16.580)	(1)	(14.398)	(1)
Landless household	.468	0		
	(27.681)	(1)		

TABLE A1 (*Continued*)

	Rural		Urban	
Variable	Mean (SD)	Min (Max)	Mean (SD)	Min (Max)
Percentage of landless households in the district	.439 (.179)	0 (.781)		
Theil index of inequality in landholdings among the landed households in district	.516 (.193)	.170 (1.057)		
Within-district component of Theil index of inequality of monthly per capita expenditure	.055 (.027)	.021 (.174)	.084 (.077)	.001 (.321)
Between-district component of Theil index of inequality of monthly per capita expenditure	.034 (.021)	.005 (.096)	.040 (.034)	.001 (.132)
Percentage of scheduled caste individuals in the district	.179 (.125)	.000 (.603)	.111 (.096)	.000 (.392)
Percentage of scheduled tribe individuals in the district	.222 (.291)	.000 (.988)	.104 (.211)	.000 (.963)
Net annual ground water per capita for district	.061 (.094)	.008 (.698)	.059 (.092)	.008 (.698)

Note. No. of rural (urban) households: 12,750 (5,841). No. of rural (urban) districts: 51 (52).

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