Happiness on Tap:

The Demand for and Impact of Piped Water in Urban Morocco[1]

Florencia Devoto, PSE
Esther Duflo, MIT
Pascaline Dupas, UCLA
William Parienté, UCLouvain
Vincent Pons, MIT

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Abstract

This paper presents the results from a randomized experiment designed to study the demand for and the effect of home water connections on health, time use, social integration and well-being among households in urban Morocco. Unconnected households were randomly offered a simplified procedure to access a credit facility to pay for a water connection at home. Since the participating households already had access to the same water grid through the free public tap, we find no improvement in the quality of water household consume; and despite significant improvement in quantity, we find no change in the incidence of waterborne illnesses. Nevertheless, we find that households are willing to pay a substantial amount of money to have a private tap at home. Getting connected generates important time gains, but does not lead to increases in labor market participation, income, or schooling attainment. The spared time seems to be used for leisure and social activities. Because water is often a source of tension between households, home connections improve social integration. Overall, despite the financial cost, households' self-reported happiness improves substantially when they get connected to the water system.

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1. Introduction

Households in developing countries spend considerable amount of time fetching water. For example, Kremer et al. (2009) estimate that a rural household in Western Kenya does around seven water-fetching trips per day, with each trip requiring a 20-minute walk on average. In urban Morocco, the setting of this study, households that rely on public taps spend more than seven hours a week collecting water, despite the higher density of water taps. The time-burden of water collection does not typically spare anyone in the household, but in many countries it is borne primarily by women and girls. This burden generates considerable stress and tension. For example, in Morocco, 65% of households without a water connection report that water is a major source of concern, 15% have had a water-related conflict within the family and 12% with their neighbors; thus, both within the family and between families, water seems to be the primary source of stress and tension.

Most interventions to connect poor households to the drinking water network are primarily concerned with physical health. Yet, over and beyond its direct effect on physical health, improved water access could have important effects on the household well-being. A water connection could be welfare-improving: By reducing the time burden of water collection, it, not only frees up time that could be spent on additional leisure or production (paid labor or schooling), but also removes an important source of stress and tension. Or it could be welfare-reducing: If women face restricted mobility outside of excursion to collection water, an in-home water connection could cut off an important source of opportunities to socialize, and possibly reduce their well-being.

The first order effects of access to clean water on health, even in cities, have been amply demonstrated (Merrick (1985), Galiani, Gertler and Schardrogsky (2005) and Gamper-Rabindran, Khan and Timmins (*forthcoming*)). Given these first-order effects, it is difficult, in most settings, to separate the effects of clean water directly due to health from the effect due to the reduced burden of water collection. This paper uses a randomized design to study the effects of in-home water connections on poor urban households in Morocco. Because the households already had access to clean water from a public tap, the connection did not result in access to water of better quality or to better access to sanitation, allowing us to separate out the reduced water-collection burden on time use, social integration, and mental well-being. We find considerable improvement in all these dimensions, without any change in the

incidence of water-borne diseases. This suggests that the time and resources spent on water collection substantially reduce welfare of poor households, a finding consistent with their high willingness to pay for a home connection.

We worked in collaboration with Amendis, the local affiliate of an international private utility company, which operates the electrical and wastewater collection networks as well as the drinking water distribution in Tangiers, Morocco. In 2007, Amendis launched a social program to increase access to piped water and sanitation. As of the end of 2007, approximately 845 low-income households living in "on-the-grid neighborhoods" of Tangiers (i.e. in principle easily connectable) did not have a household water connection because they could not afford the connection fee. These households got free access to public taps installed in their neighborhood, and they also all had sanitation facilities at home. The program provided a subsidized interest-free loan to be applied to installing a water connection. The loan was to be repaid in regular installments with the water bill over three to seven years. The subsidy did not cover the cost of installing the connection or the cost of water consumed. To pilot-test the program, a door-to-door awareness campaign was conducted in early 2008 among 434 households, randomly chosen from the 845 that needed a connection. Those households received information about the credit offer as well as help with the administrative procedures needed to apply for the credit. The remaining households (the comparison group) were eligible to apply for a connection on credit if they wanted to, but they received neither individualized information nor procedural assistance until 2009.

We find that households are willing to pay a substantial amount of money to gain access to a private tap at home: by August 2008, 69% of households in the treatment group had purchased a connection (against 10% in the control group), and as a result their average monthly water bill more than doubled, from 73 to 192 Moroccan dirhams (MAD), or US$ 9 to $24 a month (the previous cost came from households who took water from their neighbors). The quality of water was unchanged, since public taps are also maintained by Amendis and the water comes from the same source. There was, however, a large increase in water consumption, which may be as important for health as quality (Esrey et al. (1991), though see Fewtrel and Colford (2004) for a recent meta-analysis suggesting the contrary). We find no change in the incidence of water-borne diseases, such as child diarrhea.

In contrast, the connection generated important time gains. This time gain did not lead to increases in labor market participation, income, or schooling attainment. The spared time seems to have been used for leisure and socializing time. The private connection program reduced the risk of conflict or ill-feelings between neighbors. Overall, despite the financial cost, we observe that households' mental well-being improves substantially when they get connected to the water system. These results echo those of Cattaneo et al. (2009), showing that a program in Mexico replacing dirt floors by cement floors significantly improved adult welfare, as measured by increased satisfaction with their housing and quality of life. However, Cattaneo et al. (2009) find that cement floor also improve child health, and they hypothesize that it may be a source of the increase in happiness.

To our knowledge, this paper provide the first experimental estimates of the effect of connecting households to the piped water system, in contrast with only providing public taps, arguably a cheaper way to ensure everyone has access to safe drinking water. Improving access to safe drinking water and basic sanitation is one of the Millennium Development Goals, and accordingly, many initiatives in the developing world, such as the "National Initiative for Human Development" in Morocco, are planning or in the process of increasing access to safe drinking water by helping poor households get connected to piped water. Our results suggest that such initiatives, while they may not improve child health, can have substantial welfare effects at relatively low public cost, since households are willing to pay for them. These results also suggest that access to credit, rather than costs, may be a significant barrier to improvement in household infrastructure. Banerjee, Duflo and Kinnan (2009) find that many households use microcredit loan to purchase assets for their homes more often than to start a new business. Our results suggest that access to credit can enable households to invest in substantial quality-of-life improvements that can significantly improve welfare, even if they do not result in income gain.

2. Research Design

2.1. Amendis's BSI program

Amendis is a public-private partnership responsible for the management and operation of public services such as potable water, sanitation and electricity distribution networks in the city of Tangier.

One of Amendis's mandates is to increase access of low income households to basic infrastructure. As such, Amendis' created a program called "Social Home Connections" (in French, "Branchements Sociaux Individuels" or BSI), which allows low income households to buy a connection to the water and sanitation network *on credit*. The price of a connection is a function of the works required to install a pipe from the network to the home entrance, and it is typically at least 3,500 MAD (around US$500), a relatively important lump sum that households without access formal credit cannot pay upfront. The BSI program offered interest-free credit to households in Tangiers' inner city interested in getting a connection. Households have to repay the credit over a period of 3, 5 or 7 years (depending on the cost of their connection) at a monthly rate of 105 MAD or $15.

2.2.Sampling Frame

Using detailed maps of the city of Tangiers, and merging them with information on existing water connections registered in the Amendis database, we first identified 4,600 "plots" that did not seem connected to the city water system but that fell within the three zones that Amendis had delineated for the BSI program. A team of surveyors inspected these plots and carried out a quick survey to estimate their eligibility. Eligibility required that (1) the plot was indeed not already connected to a water network (12% of plots did not meet this criteria); (2) the plot was used for residential purposes (25% plots were excluded because they were empty, and 14% were excluded because they were used for commercial purposes); (3) the plot hosted the main residence of at least one owner or non-paying family occupant (20% of plots were excluded because they were occupied by tenants)**.**

Our final sample includes 845 households residing on 732 plots. These plots host relatively small houses, with a surface below 100 square meters for 96% of the houses. Most plots were inhabited by only one household (79% of plots), but 15% included two households, and 6% of plots included three or more households. Close to 60% of households relied on the public

tap as their main source of water. The rest were getting their water from a neighbour (either directly through a hose, or by filling in containers), in which case they shared the water bill with them.[2]

2.3. Experimental Design

Households in the sample were randomly assigned to a "treatment" and a "control" group. The "treatment" consisted of an information and marketing campaign about the BSI program, along with assistance in preparing the application. The three main hurdles in the application process were the following: obtaining an authorization from the local authorities, providing photocopies of important identification documents, and making a down payment at the branch office. We simplified these procedures radically for households in the treatment group, by obtaining pre-approval from the authorities, making digital copies of their identification document (with cameras), and bringing a branch officer to their home to collect the payment. Thus, control households could have obtained a connection (some did), but they would have to be aware of the new program, and manage all the paperwork.

Since part of the strategy relied on differential access to information, in order to avoid assigning immediate neighbours to different treatment, the assignment of households to the treatment and control groups was done after clustering by location. Specifically, the 732 plots in the sample were grouped in "clusters" as follows: two adjacent plots, or two plots facing each other on the street or up to 1 house apart, were considered part of the same cluster. In total, this method generated 626 clusters. These clusters then randomly assigned to one of the two following groups: the treatment group (315 clusters, including 372 plots and 434 households) and the control group (311 clusters, including 360 plots and 410 households). These clusters are sufficiently close to each other that the information can probably flow from one cluster to the next. In forthcoming work, we will study the diffusion of the information on the water connection to geographic neighbours who were not directly targeted by the intervention.

The random allocation of clusters between treatment and control groups was stratified by location, water source, the number of under- children, and number of households within the cluster.

[2] More summary statistics are presented in Table 1.

As shown in Figure 1, this randomized encouragement design led to a very strong first stage. By August 2008, 7 months after the initiation of the encouragement for the treatment group, 298 (68.7%) of the 434 households in the treatment group had gotten connected to the water system. In contrast, only 40 out of 411 households in the control group (9.7%) were connected. On average, households received the water connection 25 days after completing their application and submitting their file.

3. Data

3.1. Data Collection

Baseline Household Survey

A baseline survey was administered in August 2007. It included modules on socioeconomic characteristics, work and work-related conditions, health, hygiene practices, water collection, storage and treatment practices, social networks, as well as a time use survey for the female head and the main child in charge of fetching water. In addition, for a random subsample of households, the drinking water was tested for levels of chlorine and the presence of the fecal coliform bacteria *E coli*.

Incidence of illnesses: daily follow-up via « illness calendars »

We carried out an initial month-long survey in December 2007 to estimate the occurrence of illnesses among children (diarrhea, fever and vomiting) and to collect data on their schooling (registration in school, presence at school and time allocation to homework). Data collection of this type requires multiple successive visits to the households in order to record an evolution in the occurrence of illnesses.

As these questions only concern children under the age of 15 years, the daily health-schooling follow-up took place only with 437 households who had declared having children in this age bracket at the time of the initial survey.

In each household, a first visit was made to distribute the “illness calendars” (the calendar is presented in Appendix). The adult identified as the primary caretaker of the children (the mother in most of the cases) would then fill out the calendar each day, and mark with crosses the occurrence of fever, vomiting or diarrhea attacks. The calendar had been designed in such a way that even an illiterate person would be able to fill it out.

At the end of each of the 4 weeks of the survey, a surveyor visited the households to collect the week's information and, if necessary, complete and correct the calendar tables for that week. Information on schooling was only collected in the final week of the survey.

Treatment and control households with children under the age of 15 years participated in a follow-up survey in the months of May, August and November 2008. During each of these three months, the households filled an "illness calendar" with the regular help of a surveyor. The calendar was identical to the one used in the initial survey of December 2007 and recorded the occurrence of fever, vomiting and diarrhea attacks for children. Each week, the surveyors collected the calendars for the week gone by, which they verified and corrected in case of a mistake.

During the surveys of May and November 2008, the surveyors also asked questions related to children's schooling on each of their weekly visits. For children enrolled in school, they noted the number of days of school attendance during the week and the time spent on homework in the last two days.

Endline Household Survey

A final survey, similar to the initial survey, was carried out in August 2008, 4 months after the end of the information and marketing campaign, and on average, 5 months after the installation of household connections for the treatment group.

Height, weight and arm circumference measurements of children under 7 years were taken as part of the endline survey. In addition, new drinking water samples were collected to measure the level of chlorine and detect the presence of *E coli*.

Among the 845 households who participated in the baseline survey, only 794 households (94%) could be resurveyed. Attrition was due to the following: around 2% of the baseline household had moved house, without leaving behind their new address. 2% refused to answer, despite repeated efforts made by the surveyors. The remaining 2% consisted of households who were absent (on vacation, Hajj pilgrimage etc), or households who no longer existed due to the death of their sole member.

3.2.Data Quality Assurance

To obtain truthful information from households and to avoid creating any desirability bias in the "treatment" group, the data collection efforts were completely separated from the BSI program implementation itself. Namely, the staff that conducted the information campaign and assisted households in the treatment group with their connection application was completely different from the team of enumerators that administered surveys. We obtained a waiver of informed consent from the IRB in order to not be obligated to disclose the full design of the study to the participants until the very end.[3] This also enabled us to ensure that the survey team *did not know* about the research team's relationship with the BSI program.

4. Results

4.1. Verifying Randomization

Table 1 presents summary statistics for households in the sample, separately for the control and treatment groups. We also show the difference between the means of the two groups and report the p-value of a test of the null hypothesis that they cannot be distinguished from each other.

Overall, households in the two groups are extremely similar. Out of 57 differences shown in Table 1, only 4 at significantly different from zero at the 10% level and only 2 are significant at the 5% level, as should be expected.

As mentioned above, at baseline 58% of households used the public tap as their main source of water. Of those, 22% (13% of the total) lived sufficiently close to the public tap to use a hose to fill their water containers at home. The remainder (45% of our sample) had to take their containers to the public tap. On average, those households who carried containers to and back from the public cap lived 240 meters away from the closest public tap. At baseline, they reported filling 55 containers per week. The average time spent fetching water was around 7.5 hours for these households. Water collection trips are common among both men and women, but done mostly by adults: while households do more than 7 trips per week to the public tap, less than one trip per week is done by a child under 15.

[3] At the end of the study, we fully informed all participants about the study, and asked them for informed consent to let us use the data collected from them over the previous two years.

4.2. The Demand for Private Taps: Take-up of the BSI credit offer

By August 2008 (four months after the end of the marketing campaign), 298 (68.7%) of the 434 households in the treatment group had gotten connected to the water system. In contrast, only 40 out of 411 households in the control group (9.7%) were connected.

Among households in the treatment group who did not get connected to the water system, the most commonly cited reasons for refusing the BSI offer were the following: *inability to pay*, especially for households with just one member, who was typically an elderly person; *inheritance problems* (namely refusal by other heirs to the house applying for the water connection; plans to move out); *plans to move out*; and, finally, *access to running water* obtained from a neighbor with a water connection.[4]

Households that got connected had to install taps inside their house. 27% installed only one tap (typically in the bathroom or in the kitchen), 32% installed two taps, and 24% installed three taps. Only 17% installed more than three taps. In August 2008, only 2% of treatment households that got a connection reported selling water from their tap to neighbours, and 7% reported having given water to neighbours in the previous 7 days.

When asked if their water consumption is larger or lower than a year before, 37% of connected households answered "larger", 50% said it was the same, and only 10% said it was lower.

4.3. Effects of the water connection

The effect of access to water is estimated through two parameters of interest. First the effect of being assigned to the treatment group, examined for each outcome using the following specification:

$$Y_i = \alpha_1 + \beta_1 Treated_i + X_i \varphi_1 + \varepsilon_{i1}$$

where $Treated_i$ is equal to 1 if the household has received the encouragement and is equal to 0 otherwise and X_i is a vector of households and respondents characteristics. By construction, random assignment ensures us that $E(\varepsilon_{i1} | X_i, Treated_i) = 0$.

[4] The installation of a new water meter would have allowed a more just distribution of costs between neighbors. It would also help households sharing a water connection save money (due to the system of subsidized consumption brackets) but these advantages would have mainly benefited households that were already connected, and not those that needed to pay for a new water meter.

Secondly, we are interested in evaluating the average effect of actually having a connection on each outcome. This is estimated with the following specification:

$$Y_i = \alpha_2 + \beta_2 Connected_i + X_i \varphi_2 + \varepsilon_{i2} \ ,$$

where $Connected_i$ (equal to 1 if the household is connected to the water system and equal to 0 otherwise) is instrumented with $Treated_i$, being assigned to the treatment group, such as $Connected_i = \pi + \vartheta Treated_i + X_i \sigma + \eta_i$. For all specifications, standard errors are clustered as the plots were grouped in clusters when they were located close to each other.

All results presented from Table 2 to Table 9 in appendix display the two parameters of interest.

4.3.1. Quality and Quantity of water used

The impact of the BSI offer on the quality and quantity of water used is analyzed in Table 2. We find no effect of getting connected to the water system on the main indicator of the quality of drinking water, the level of fecal bacteria *E coli* detected (column 1,2) even though there is a positive effect on the chlorine level with a 14 points increase for the treatment households (column 3,4). These results suggest not only that the quality of water coming from public taps is high but also that there is no contamination during the transport of water carried home and from the way the water is stored.

While there is no effect on the quality of drinking water, getting connected seems to lead to a substantial increase in the quantity of water used. Households in the treatment group report increasing their frequency of baths and showers: the number of times respondents in the treatment group washed themselves (baths, showers, simple wash) during the last 7 days is 25% (1.44/5.84, column 2 Panel B) higher than in the control group (the observed effect for the youngest child in the household is also positive but not significant). However, hygiene practices that require less water, such as hand washing, were not affected.

4.3.2. Costs

Table 3 estimates the impact of the BSI offer on the time and financial costs experienced by households. Overall, we find that household connections generate a substantial time gain for their beneficiaries, but at the same time generate a substantial financial cost since households now have to pay for their water as well as repay the BSI credit.

Columns 1 to 8 of Table 3 show that the connection considerably reduced the number of water fetching trips in the treatment group. The time spent fetching water reduced from 1073 minutes to 182 minutes on average. The effect on the treated is larger, with a reduction to essentially zero. This result is more interesting than it seems. While water at public taps is free, households have to pay for the water that is piped directly to their home. Therefore one of the concerns at the time the BSI program was designed was that people would keep using the public tap and limit their private tap usage, in order to limit the size of their water bill. We find little supporting evidence for this.

The increase in available time comes at a cost. First, households had to pay a relatively large fixed cost to get connected (column 11 and 12). Second, households who get connected now have to pay both their monthly water bill and their monthly instalment. Overall, the IV estimate suggest that the average monthly water costs more than doubled, from 73 to 192 Moroccan dirhams (MAD), a jump from US$ 9 to 24 (Table 3, columns 9-10).

Furthermore, preliminary analysis of the payment information shared by the water company suggests that, even though the BSI credit is interest free, by August 2009, 34% of treatment households were late in paying at least one credit instalment, suggesting that the financial cost associated with the connection is not a trivial issue for this population.

4.3.3 Health

The major result arising from the analysis of our health data is the absence of any systematic positive effect of the program on health of either children or adults. The data on the incidence of water-related illnesses (diarrhea, vomiting, or fever) collected through detailed health diaries show no significant pattern (columns 1 to 18, Table 4). The addition of various control variables does not change the results. We collected data on two other water-related illnesses (skin and eye infections among adults and children, and digestive problems for adults), but also find no effect of the treatment on any of these, for any age groups (data not shown but available on request). We also do not find any effect when we look at the number of medical visits reported at endline (data not shown).

The lack of effects on health is probably due to the fact that the households already had access to good quality water as well as good access to sanitation. Most households reported using the Amendis sanitation system to discharge used water and 95% reported having a toilet at home.

Nevertheless, positive effects could have been expected from the improvement in quantity and the corresponding increase in the washing frequency of households' members. The fact that we find no health effects despite the effect on quantity suggest that water quantity, alone, plays at best a small role in health. This is consistent with findings of Kremer et al (2009), who find that improved water sources improve child health through improvements in water quality without increased water quantity.

4.3.4 Time Use

As shown earlier, the connection generated large time gains for households who no longer needed to spend time fetching water. Four months or more after they got connected, these time gains were still very salient for households. Table 5 presents estimates of respondents' self perception of time availability. When asked to compare their current situation with that a year before, respondents in the treatment group reported significantly more gains in time for daily activities such as shopping, housework, going to the market or watching television than the control group (column 1 to 6). Respondents in the treatment group also reported having gained comparatively more time to engage in social activities, such as visiting or receiving the visit of family or friends, or simply spending time with other members of their households (columns 7 to 18).

Interestingly, while respondents in the treatment group have more time for these activities, they do not necessarily spend more time on them. Table 6 presents estimates of the respondents' actual use of time. The treatment respondents, who declared having more time for housework, shopping or visiting family, are not reporting doing those activities more often. They do, however, spend more time watching television (though the effect is marginally significant) and are 25 percent more likely to receive the visit of family or friends. Overall, most of the time gains do not seem accounted for in the time categories presented in Table 6, however.

Table 7 presents results on two other time categories: labor market participation and schooling participation. Data on labor market participation comes from the question: "did this person engage in an income generating activity in the past 30 days", which was asked at endline to the main respondent (typically the female head of the household) about each household member. If the answer was yes, we then asked the income gained over the past 30 days. The data on schooling participation presented in columns 11-16 also comes from the

endline: school completion is a dummy equal to 1 if a boy or a girl completed the school year in June 2008 (the endline was administered in between two academic years). We also collected detailed school absenteeism data through the use of diaries (similar to the health diaries).

Overall, the results are very clear: the time gained thanks to the water connection had absolutely no impact on productive activities, as measured in Table 7. Table 7 shows no increase in the probability that either male or female heads in treatment households participate in the labor market. As a result, the program had no effect on income (although our income data is extremely noisy and the standard errors are extremely large, even with trimming). While it is possible that the impact of time gains on productive activities might take more than 6 months to be effective and thus was not captured in our endline survey, we also cannot rule out the possibility that our labor market participation and income data suffer from under-reporting biases. While there is no reason to believe that the under-reporting bias would be correlated with the water connection itself, it has been shown that under-reporting of income increases as income goes up.

4.3.5 Social Integration

While getting a home connection might have reduced the opportunities to socialize while fetching water, the overall impact of the treatment on social integration seems to have been positive. Table 8 presents results on various measures of the strength of social ties. The first two columns suggest that the treatment increased the likelihood that households belong to a social group. While overall participation in social of groups is very rare (only 2% of the control group report participating), it is twice as high in the treatment group. This effect is entirely driven by an increase in the likelihood that households belong to a rotating savings and credit association (ROSCA). This suggests that some households in the treatment group decided to join such a group after taking on the BSI credit, which requires saving rigor in order to repay the monthly instalments.

In addition, gaining access to a private water connection seems to ease the tensions that surround access to water when people share a public tap, or share a private tap and need to divide water bills among relatives or neighbors. Water is indeed a common source of conflict: at endline, 12% of control households stated that they were in conflict or disagreement with neighbors on water-related problems, and 16% were in disagreement with family members on such issues. Even within the household, both the allocation of the task of fetching water and

the allocation of the water at hand among possible uses can be a source of tension. These sources of tensions were almost completely eliminated as a result of the program, as shown in columns 3-4 and 9-10 of Table 8. The ITT estimates show a 66% reduction in the proportion of households in conflict or disagreement with neighbors or relatives on water-related problems, and the IV estimates of a complete elimination of such conflicts for those who got a connection. Note that treatment households are not less likely to report conflicts with respect to matters unrelated to the treatment (property or heritage issues, in columns 5-9 and 11-12), which suggests that the observed decrease in reported conflicts linked to water is more than just a reporting artefact.

In addition or perhaps as a result of reducing the occurrence of conflicts between family members or neighbors, access to a private water connection seems to also enhance the social status of beneficiary households. Indications of such an effect are presented in columns 13 to 16 of Table 8. They show that the proportion of households entrusted with valuable goods in the last 30 days was almost twice as high in the treatment group than in the control group (13% compared to 7%). The connection also increased the likelihood that a household member was consulted on family issues by more 24 percentage points, compared to an average of 38 percent in the control group.

4.3.6 Mental Well-Being

Overall, the endline satisfaction of households on water-related issues had dramatically improved in the treatment group relative to the control group. Table 9 presents estimates of the effects on several measures of satisfaction. While 65% of control households mentioned water when prompted to list their 5 major sources of concerns, only 22% of treatment households did so. This went down to zero among households that did get connected, as shown by the IV estimate in Panel B. Similarly, treatment households are significantly more likely to report that they have enough water for bathing and for cleaning. The proportion of households that mention their house is cleaner than it was at the time a year earlier is nearly three times greater (from an average of 13% of households in the control group to 34% in the treatment group, column 7 and 8). Again, these reported levels are not driven by social-desirability bias: when asked whether the water they have access to now tastes good, treatment households are not more likely to say yes than treatment in the control group. This should be expected since all households have access to same water – the only difference between them is how far that water is from them.

In addition to this higher level of satisfaction with water-related issues, Table 9 also shows that the BSI program, more generally, improved households' perceived quality of life. While only 24% of households in the treatment group report that their life has improved compared to a year ago, this rises to 50% in the treatment (columns 11 and 12). The IV estimates in Panel B suggest an effect on the treated of +44 percentage points, corresponding to almost an 80% increase compared to the control group. Measures of mental health shown in columns 13 to 18 do not show any effect of the program. The likelihood that respondents in the treatment group have felt angry, exhilarated, or tired is not different across groups.

Finally, respondents were asked to rank their satisfaction with life on a scale from 1 to 10. The mean of the ranking for the treatment group (5.61) is slightly above the one of the control group (5.45). Moreover, the cumulative distribution function of these rankings is presented, by groups, in Panel A of Figure 2. The distribution for the treatment group appears to dominate the distribution for the control group although a Kolmogorov-Smirnov test does not reject the hypothesis of equality of the two distributions. In contrast, in Panel B, the distributions of rankings for households' satisfaction with their health, an outcome for which we objectively observe no program effect, are virtually indistinguishable from each other, not only statistically, but also by the eye. Once more, this coherence between the self-reported measures and the more objectives measures lend credibility to our estimates of the program effect on social integration, well-being and satisfaction levels, for which we need to rely on self-reports since objective measurements are harder to come by.

5 Conclusion

This paper studied the impact of a program giving households in urban Morocco the option to purchase a private connection to the water system on credit. We find that the demand for individual house connections is high, with 68% of households taking on a 10-year credit to get connected. After six months, this investment turned out to have important private returns. While it freed up a lot of time for household members, he did not generate increases in labor market participation and income, but it led to important improvements in quality of life and welfare. While the private returns are high, the public health returns seem low, if not nonexistent. In the study context, home connections do not reduce the incidence of

waterborne diseases compared to the existing system of public taps. This lack of health effect suggests that investing public funding in expanding access to home connections might not be justified from a public finance standpoint. However, the high private returns and high observed willingness to pay suggests that relaxing credit constraints for poor households might be sufficient to generate important private investments in water connections.

6 References

Banerjee, Abhijit, Esther Duflo and Cynthia Kinnan (2009). "The Miracle of Microfinance ? Evidence from a Randomized Evaluation", unpublished manuscript.

Cattaneo, Matias D., Sebastian Galiani, Paul J. Gertler, Sebastian Martinez, and Rocio Titiunik (2009) "Housing, Health, and Happiness." *American Economic Journal: Economic Policy*, 1(1): 75–105.

Esrey, S.A., J.B. Potash, L. Roberts, and C. Shiff, "Effects of improved water supply and sanitation on ascariasis, diarrhea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma", *Bulletin of the World Health Organization*, 69(5), 1991, pp. 609-621.

Fewtrell, Lorna, and John M. Colford, "Water, Sanitation and Hygiene: Interventions and Diarrhea. A Systematic Review and Meta-analysis", HNP Discussion Paper, World Bank, July 2004.

Galiani, Sebastien, Paul Gertler and Ernesto Schargrodsky (2005). "Water for life: The impact of the privatization of water supply on child mortality". *Journal of Political Economy*, Volume 113, pp. 83-120.

Gamper-Rabindran, Shanti, Shakeeb Khan and Christopher Timmins (forthcoming). "The Impact of Piped Water Provision on Infant Mortality in Brazil: A Quantile Panel Data Approach," *Journal of Development Economics.*

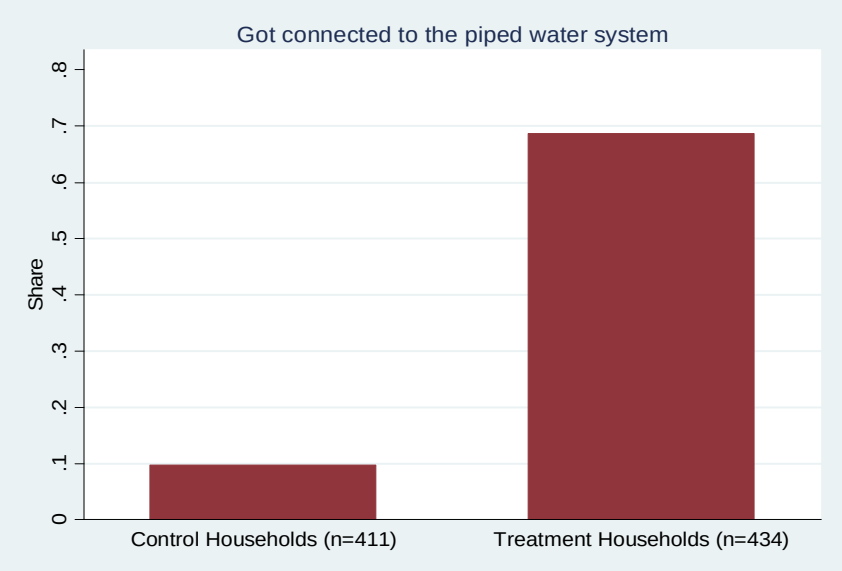
Karlan, Dean, and Jonathan Zinman (2009). "Expanding Microentreprise Credict Access : Using Randomized Supply Decisions to Estimate the Impacts in Manila", unpublished manuscript.

Kremer, Michael, Jessica Leino, Edward Miguel and Alix Zwane (2009). "Spring Cleaning: Rural Water Impacts, Valuation and Institutions", unpublished manuscript.

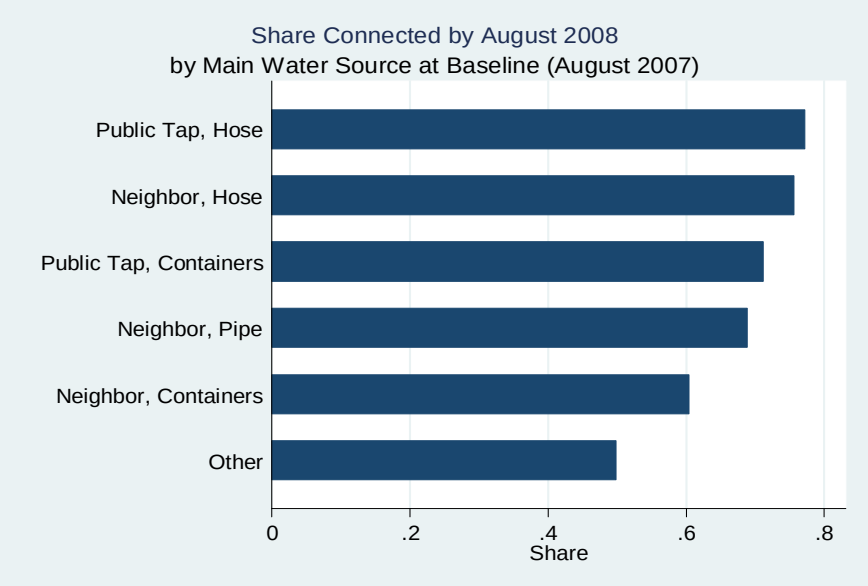
Merrick, Thomas W. "The Effect of Piped Water on Early Childhood Mortality in Urban Brazil, 1970 to 1976", *Demography*, 22(1), February 1985, pp. 1-24.

Figure 1. First Stage: Impact of the Encouragement Design

Panel A. Fraction of Households that Bought a Connection



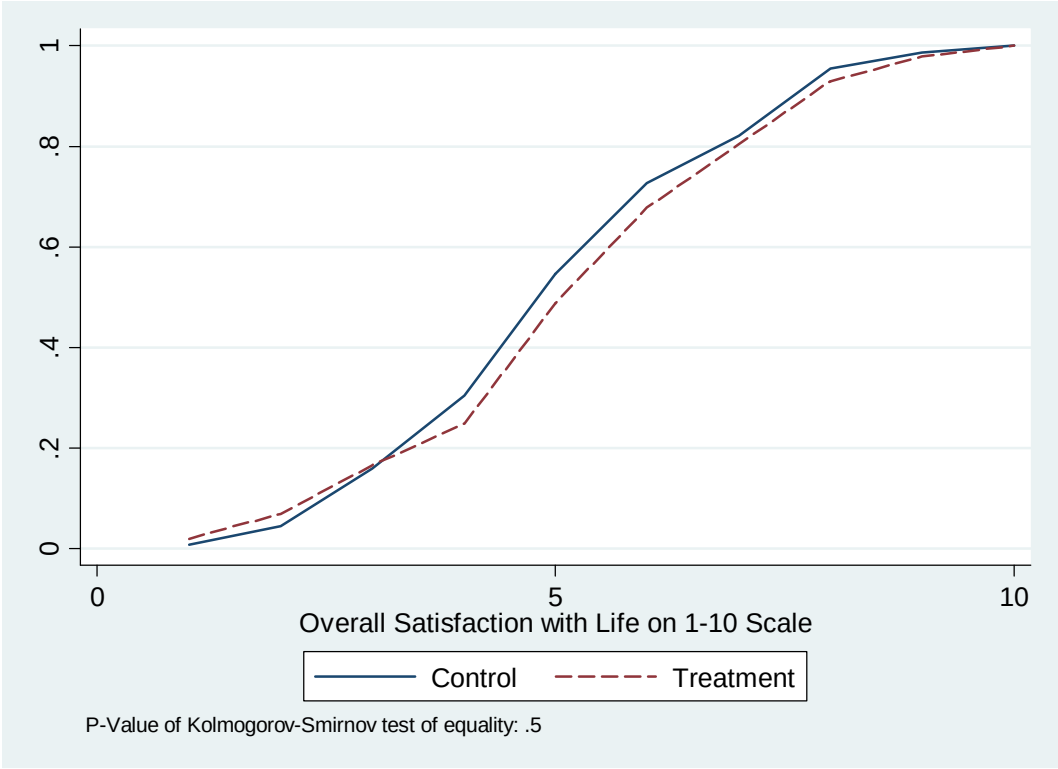
Panel B. Take-up by Baseline Water Source



Note: Data collected in August 2008. No household had a connection to the piped water system at baseline (August 2007). The encouragement intervention took place between February and April 2008.

Figure 2. Subjective Assessment of Life Quality at Endline

Panel A. Life Satisfaction



Panel B. Health Satisfaction

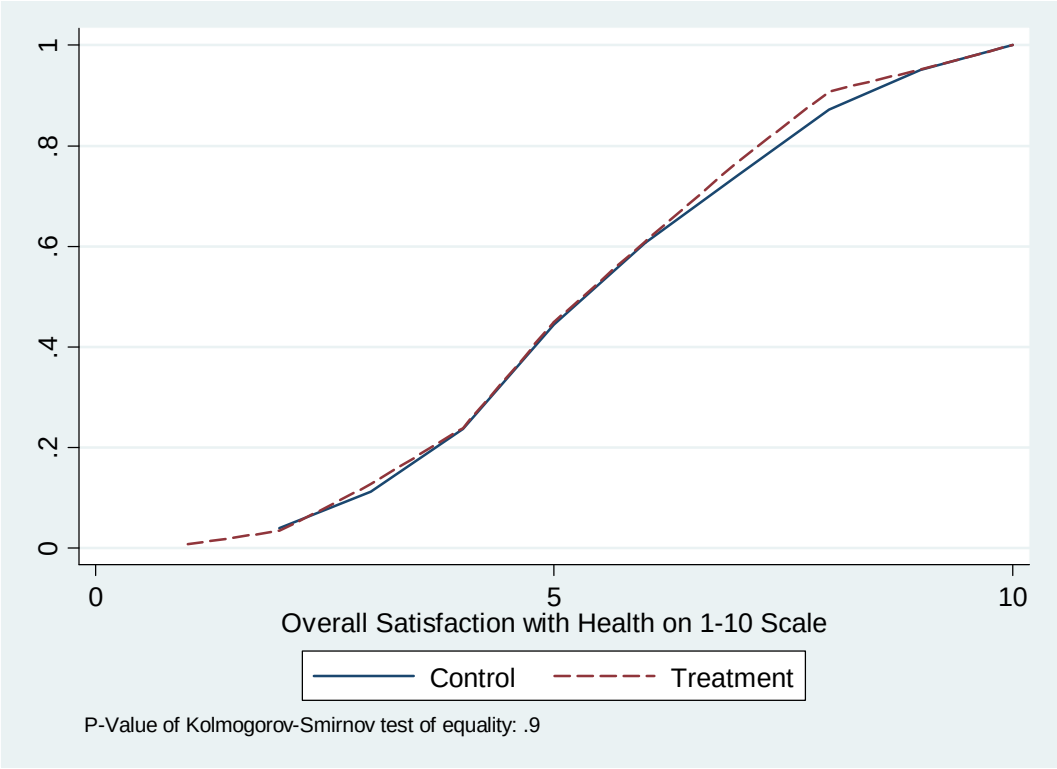


Table 1: Summary Statistics

	Comparison Households		Treatment Households		Diff	*P-value* Treatment = Control	Obs.
Household composition	Mean	Sd	Mean	Sd			
Household size	4.55	*2.54*	4.74	*2.47*	0.19	0.272	840
Number of members 15 or older	3.23	*2.03*	3.41	*2.01*	0.19	0.187	836
Number of female members 15 or older	1.61	*1.17*	1.61	*1.15*	0.00	0.980	835
Number of members under 15	1.14	*1.45*	1.21	*1.34*	0.07	0.446	832
Number of female members under 15	0.54	*0.86*	0.62	*0.86*	0.08	0.169	832
Number of children under 5	0.40	*0.73*	0.43	*0.70*	0.02	0.675	831
Is this an extended family?	0.23	*0.42*	0.23	*0.42*	0.00	0.966	832
Head of the household							
Male head	0.74	*0.44*	0.79	*0.41*	0.05	0.122	831
Head's age	50.90	*15.00*	49.63	*14.02*	-1.27	0.217	799
Head married	0.66	*0.48*	0.69	*0.46*	0.04	0.233	831
Head has no education	0.46	*0.50*	0.43	*0.50*	-0.03	0.438	831
Head has 1 to 6 years of education	0.39	*0.49*	0.41	*0.49*	0.02	0.528	831
Household members involved in economic activities							
Number of adults, in past 30 days	1.07	*0.97*	1.16	*0.95*	0.09	0.193	831
Number of children, in past 30 days	0.01	*0.10*	0.00	*0.05*	-0.01	0.158	831
Socio-economic status							
Number of rooms in the house	3.20	*1.34*	3.31	*1.46*	0.11	0.251	838
Income index	4.21	*2.52*	4.42	*2.50*	0.21	0.256	759
Assets index	-0.14	*1.96*	-0.07	*1.97*	0.07	0.596	842
Hygiene and health							
Index of knowledge of causes of diarrhea	1.25	*1.09*	1.23	*1.12*	-0.02	0.784	842
Ranking of own's health	6.58	*2.50*	6.38	*2.33*	-0.20	0.248	806
Expenditures for individual hygiene	67.33	*78.03*	74.03	*95.21*	6.70	0.297	745
Expenditures for house cleaning	57.28	*100.74*	74.23	*90.53*	16.95	0.011	838
Number of times respondant bathed in previous 7 days	4.27	*3.77*	4.30	*3.27*	0.02	0.923	818
Number of times respondant washed hands yesterday	2.84	*1.50*	2.97	*1.60*	0.13	0.237	837
Index of cleanness of the house (surveyor's observation)	0.67	*0.20*	0.66	*0.19*	-0.01	0.516	623
Social insertion							
Participation of the respondent to a group	0.05	*0.22*	0.06	*0.23*	0.01	0.690	837
Total number of activities with others listed	0.38	*0.68*	0.41	*0.68*	0.02	0.617	845
Total number of friends listed when asked for 5 names	1.73	*1.41*	1.86	*1.47*	0.14	0.169	845
Has someone to talk to about one's problems	0.67	*0.47*	0.71	*0.46*	0.03	0.290	831
Satisfaction level with one's life (on a scale from 1 to 10)	8.38	*17.28*	7.08	*12.84*	-1.30	0.214	839
Water and storage							
Are you storing water right now?	0.82	*0.38*	0.85	*0.36*	0.03	0.308	838
In how many containers are you storing water?	3.72	*4.33*	3.58	*3.62*	-0.14	0.618	840
Will you treat water?	0.07	*0.25*	0.05	*0.21*	-0.02	0.217	706
Presence of chlorine in water sample	0.56	*0.50*	0.63	*0.49*	0.07	0.290	250
Water Source and Collection							
Main water source = public tap, using containers	0.45	*0.50*	0.42	*0.49*	-0.04	0.289	797
Main water source = public tap, using hose	0.13	*0.34*	0.16	*0.37*	0.03	0.257	797
Main water source = neighbor's tap, using containers	0.22	*0.42*	0.21	*0.41*	-0.01	0.770	797
Main water source = neighbor's tap, using hose	0.17	*0.37*	0.17	*0.38*	0.01	0.794	797
Distance to the public tap (in meters, self-reported)	212	*284*	252	*414*	41	0.220	467

continued next page

Table 1: Summary Statistics (continued)

	Comparison Households		Treatment Households		Diff	*P-value* Treatment = Control	Obs.
Time spent fetching water over the past 7 days (minutes)	233	*420*	228	*482*	-5	0.886	824
Time spent in social activities while fetching water over the pa	8.2	*44.1*	7.6	*37.9*	-0.6	0.845	822
# of Containers filled with water over the past 7 days	35.4	*53.0*	34.2	*50.9*	-1.2	0.745	824
Volume of water consumed over the past 7 days (liters)	334	*591*	385	*816*	51	0.309	821
Payment made to get water over the past 7 days (dirhams)	20.05	*70.67*	19.79	*55.88*	-0.26	0.95	829
Number of times a child (< 15) fetched water in the past 3 da	0.53	*2.09*	0.48	*1.88*	-0.05	0.729	841
Number of times a grown-up (>= 15) fetched water in the pas	3.68	*5.23*	3.87	*6.06*	0.19	0.623	841
Number of times a male fetched water in the past 3 days	1.86	*3.56*	2.35	*4.86*	0.50	0.094	841
Number of times a female fetched water in the past 3 days	2.35	*4.91*	2.00	*4.29*	-0.35	0.271	841
Households with main source of water = public tap, using containers							
Distance to the public tap (in meters, self-reported)	239	*306*	305	*377*	66	0.081	332
Time spent fetching water over the past 7 days (minutes)	445	*533*	481	*657*	37	0.575	331
Time spent in social activities while fetching water over the pa	5.6	*26.5*	7.8	*35.5*	2.3	0.512	329
# of Containers filled with water over the past 7 days	55.3	*53.9*	53.3	*50.3*	-2.0	0.733	331
Volume of water consumed over the past 7 days (liters)	361	*336*	433	*467*	72	0.107	328
Payment made to get water over the past 7 days	4.42	*39.06*	2.08	*10.37*	-2.34	0.458	336
Number of times a child (< 15) fetched water in the past 3 da	0.78	*2.30*	0.90	*2.54*	0.12	0.654	346
Number of times a grown-up (>= 15) fetched water in the pas	6.91	*6.14*	7.42	*7.52*	0.52	0.486	346
Number of times a male fetched water in the past 3 days	3.40	*4.22*	4.74	*6.35*	1.34	0.021	346
Number of times a female fetched water in the past 3 days	4.29	*6.50*	3.58	*5.77*	-0.71	0.284	346

Notes: Household averages collected during baseline survey (August 2007).

Table 2: Impact on Quality and Quantity of Water

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Quality of Drinking Water				Quantity of Water							
	Number of *E Coli* detected in drinking water		Chlorine detected in drinking water		Number of baths or showers in the past 7 days?				Number of times washed hands in the past 7 days?			
Panel A. ITT					Respondent		Youngest Child		Respondent		Youngest Child	
Treatment	2.72	2.61	0.14	0.15	0.72	0.85	0.49	0.64	0.00	-0.10	0.10	0.05
	(3.04)	(3.06)	(0.06)***	(0.06)***	(0.47)	(0.43)**	(0.46)	(0.44)	(0.12)	(0.11)	(0.08)	(0.07)
Quintile in asset distribution						0.24		0.22		-0.01		0.02
						(0.14)*		(0.16)		(0.04)		(0.02)
Number of children under 15 at baseline						0.21		-0.15		0.16		0.49
						(0.13)		(0.14)		(0.04)***		(0.03)***
Neighbor's connection at baseline		-2.27		0.03		0.24		0.11		0.33		-0.11
		(3.48)		(0.07)		(0.55)		(0.56)		(0.14)**		(0.09)
Observations	365	365	374	374	751	722	428	412	845	768	843	766
R-squared	0.00	0.00	0.02	0.02	0.00	0.02	0.00	0.01	0.00	0.05	0.00	0.39
Mean in Control Group	10.64	10.64	0.43	0.43	5.86	5.86	6.14	6.14	3.14	3.14	0.69	0.69
Panel B. IV												
Connected	4.30	4.09	0.23	0.23	1.19	1.43	0.75	0.96	0.00	-0.17	0.17	0.09
	(4.84)	(4.84)	(0.09)***	(0.09)***	(0.78)	(0.73)**	(0.69)	(0.66)	(0.19)	(0.18)	(0.14)	(0.12)
Quintile in asset distribution						0.17		0.19		0.00		0.02
						(0.14)		(0.16)		(0.04)		(0.03)
Number of children under 15 at baseline						0.14		-0.16		0.17		0.48
						(0.13)		(0.14)		(0.04)***		(0.03)***
Neighbor's connection at baseline		-2.64		0.01		0.29		0.16		0.33		-0.11
		(3.52)		(0.07)		(0.54)		(0.56)		(0.14)**		(0.09)
Observations	365	365	374	374	751	722	428	412	845	768	843	766
R-squared	10.64	10.64	0.43	0.43	0.02	0.02	0.01	0.01	0.00	0.04	0.01	0.39
Mean in Control Group	0.00	0.00	0.04	0.04	5.86	5.86	6.14	6.14	3.14	3.14	0.69	0.69

Notes: Clustered standard errors in parentheses.
IV specification: "Connected" instrumented with "Treatment"

Table 3: Impact on Time and Financial Costs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A. ITT	Number of times a child (< 15) fetched water in the past 3 days		Number of times a grown-up(>= 15) fetched water in the past 3 days		Minutes Spent Fetching Water in the past month		Minutes Spent Socializing while Fetching Water in the past month		Monthly water expenditures (in dirhams)		Fixed Water Costs paid by Household in past year (dirhams)	
Treatment	-0.47	-0.47	-2.21	-2.21	-891	-894	-36	-38	70.7	66.5	397.8	405.1
	(0.17)***	(0.17)***	(0.26)***	(0.26)***	(136.99)***	(140.07)***	(16.81)**	(18.02)**	(16.91)***	(17.88)***	(41.81)***	(43.69)***
Quintile in asset distribution		-0.07		-0.23		-117		4		26.2		37.3
		(0.05)		(0.10)**		(48.33)**		-8		(6.15)***		(14.00)***
Household Size		0.11		0.03		122		1		3.6		17.0
		(0.04)**		(0.05)		(35.68)***		-3		-2.6		(8.07)**
Observations	767	765	767	765	797	763	797	763	848.0	765.0	848.0	765.0
R-squared	0.01	0.03	0.10	0.10	0.06	0.09	0.01	0.01	0.02	0.04	0.13	0.15
Mean in Control Group	0.54	0.54	2.88	2.88	1073	1073	45	45	73.0	73.0	76.1	76.1
Panel B. IV												
Connected	-0.78	-0.80	-3.68	-3.71	-1479.96	-1498.31	-60.49	-63.18	119.09	111.53	670.28	679.26
	(0.28)***	(0.28)***	(0.42)***	(0.42)***	(229.66)***	(233.91)***	(27.86)**	(30.10)**	(27.10)***	(28.95)***	(56.28)***	(59.34)***
Quintile in asset distribution		-0.05		-0.10		-65.38		6.08		22.34		13.67
		(0.05)		(0.09)		(45.04)		(9.25)		(5.74)***		(12.02)
Household Size		0.14		0.14		165.30		2.91		0.31		-3.06
		(0.05)***		(0.06)**		(39.22)***		(2.71)		(2.93)		(7.71)
Observations	767	765	767	765	797	763	797	763	848	765	848	765
R-squared	0.01	0.04	0.14	0.15	0.05	0.09	0.01	0.01	0.07	0.08	0.36	0.37
Mean in Control Group	0.54	0.54	2.88	2.88	1072.66	1072.66	45.39	45.39	73.05	73.05	76.11	76.11

Notes: Standard errors clustered at the "cluster" level

IV specification: "Connected" instrumented with "Treatment"

Table 4. Impact on child health: Data from Health Diaries (1 month each)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	Average Weekly Number of days with intense diarrhea†: Children 0 to 6 years old at baseline									Average Weekly Number of episodes of intense diarrhea†: Children 7 to 15 years old at baseline								
Panel A: ITT	1st follow-up: Mai 2008			2nd follow-up: Aout 2008			3rd follow-up: November 2008			1st follow-up: Mai 2008			2nd follow-up: Aout 2008			3rd follow-up: November 2008		
Treatment	0.06	-0.01	-0.01	-0.06	-0.10	-0.09	0.06	0.02	0.03	0.03	0.00	0.00	-0.06	-0.09	-0.09	0.04	0.01	0.02
	(0.08)	(0.08)	(0.08)	(0.10)	(0.08)	(0.08)	(0.10)	(0.08)	(0.08)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)**	(0.04)**	(0.06)	(0.05)	(0.05)
Number of episodes of diarrhea at baseline		0.29	0.27		0.00	-0.02		0.12	0.11		0.24	0.23		0.08	0.08		0.25	0.25
		(0.13)**	(0.13)**		(0.04)	(0.05)		(0.07)*	(0.07)		(0.09)**	(0.09)**		(0.05)	(0.06)		(0.07)***	(0.07)***
Number of episodes of fever at baseline		0.04	0.04		0.03	0.03		0.01	0.02		0.05	0.05		0.07	0.06		0.03	0.03
		(0.03)	(0.03)		(0.05)	(0.05)		(0.05)	(0.05)		(0.02)**	(0.02)**		(0.03)*	(0.04)*		(0.04)	(0.03)
Number of episodes of vomiting at baseline		0.03	0.03		-0.06	-0.05		0.09	0.08		0.02	0.01		-0.04	-0.04		0.03	0.03
		(0.05)	(0.05)		(0.04)	(0.05)		(0.08)	(0.08)		(0.03)	(0.03)		(0.04)	(0.04)		(0.06)	(0.06)
Neighbor's connection at baseline			0.05			0.04			0.16			0.04			0.02			0.06
			(0.11)			(0.11)			(0.12)			(0.06)			(0.05)			(0.07)
Age at baseline			-0.05			-0.02			-0.04			-0.02			-0.01			-0.01
			(0.02)***			(0.02)			(0.02)*			(0.00)***			(0.01)*			(0.01)**
Female			0.01			-0.13			0.06			-0.01			-0.01			0.03
			(0.08)			(0.08)			(0.08)			(0.04)			(0.04)			(0.04)
Quintile in asset distribution			-0.03			0.01			0.03			0.00			-0.01			0.02
			(0.04)			(0.04)			(0.03)			(0.02)			(0.02)			(0.02)
Observations	420	366	365	428	363	362	416	352	351	915	825	823	928	815	813	907	797	795
R-squared	0.00	0.12	0.14	0.00	0.01	0.02	0.00	0.06	0.09	0.00	0.13	0.15	0.00	0.03	0.04	0.00	0.11	0.13
Mean in Control Group	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.18	0.18	0.18	0.21	0.21	0.21	0.21	0.21	0.21
Panel B: IV																		
Connected	0.10	-0.01	-0.02	-0.09	-0.15	-0.14	0.09	0.03	0.05	0.05	0.00	0.01	-0.10	-0.13	-0.13	0.06	0.02	0.02
	(0.13)	(0.12)	(0.12)	(0.16)	(0.13)	(0.12)	(0.15)	(0.12)	(0.12)	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)*	(0.07)*	(0.09)	(0.07)	(0.07)
Number of episodes of diarrhea at baseline		0.29	0.27		-0.01	-0.02		0.13	0.11		0.24	0.23		0.09	0.08		0.25	0.25
		(0.13)**	(0.12)**		(0.04)	(0.05)		(0.07)*	(0.07)		(0.09)**	(0.09)**		(0.05)*	(0.05)		(0.06)***	(0.07)***
Number of episodes of fever at baseline		0.04	0.04		0.03	0.03		0.01	0.02		0.05	0.05		0.06	0.06		0.03	0.03
		(0.03)	(0.03)		(0.05)	(0.05)		(0.05)	(0.05)		(0.03)**	(0.02)**		(0.03)*	(0.03)		(0.04)	(0.04)
Number of episodes of vomiting at baseline		0.03	0.03		-0.05	-0.04		0.09	0.08		0.02	0.01		-0.04	-0.04		0.03	0.02
		(0.05)	(0.05)		(0.04)	(0.05)		(0.09)	(0.08)		(0.03)	(0.03)		(0.04)	(0.04)		(0.06)	(0.06)
Neighbor's connection at baseline			0.05			0.05			0.15			0.04			0.02			0.06
			(0.11)			(0.11)			(0.11)			(0.06)			(0.06)			(0.07)
Age at baseline			-0.05			-0.02			-0.04			-0.02			-0.01			-0.01
			(0.02)***			(0.02)			(0.02)*			(0.00)***			(0.01)*			(0.01)**
Female			0.01			-0.12			0.06			-0.01			-0.01			0.03
			(0.08)			(0.08)			(0.08)			(0.04)			(0.04)			(0.04)
Quintile in asset distribution			-0.03			0.01			0.03			0.00			-0.01			0.02
			(0.04)			(0.04)			(0.03)			(0.02)			(0.02)			(0.02)
Observations	420	366	365	428	363	362	416	352	351	915	825	823	928	815	813	907	797	795
R-squared	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.18	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Clustered standard errors in parentheses. IV specification: "Connected" instrumented with "Treatment"

† *Intense diarrhea defined as follows: at least three loose stools within 24 hours*

Table 5: Perceived Time Availability

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	Compared to last year, do you have less/as much as/more time to …																	
	.. do housework?		…go to the market?		...watch tv?		...visit your family?		...visit friends/ neighbors?		...receive the visit of your family?		...receive the visit of friends/ neighbors		…go the mosque or pray		...spend time with members of your household?	
Treatment	0.10	0.08	0.13	0.12	0.17	0.17	0.12	0.13	0.08	0.08	0.08	0.09	0.03	0.04	0.05	0.04	0.16	0.16
	(0.05)**	(0.05)	(0.05)**	(0.05)**	(0.05)***	(0.05)***	(0.04)***	(0.05)***	(0.05)*	(0.05)*	(0.04)*	(0.04)**	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)***	(0.04)***
Female	-0.17	-0.18	-0.09	-0.09	0.04	0.02	0.07	0.09	0.10	0.10	0.07	0.06	0.06	0.06	-0.05	-0.02	0.13	0.12
	(0.08)**	(0.08)**	(0.08)	(0.08)	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)*	(0.08)
HH head/spouse	0.13	0.14	0.04	0.05	0.02	0.02	0.05	0.08	-0.13	-0.11	-0.04	-0.04	-0.14	-0.13	-0.03	-0.03	0.10	0.11
	(0.08)*	(0.08)*	(0.08)	(0.08)	(0.09)	(0.09)	(0.06)	(0.07)	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)*	(0.07)*	(0.08)	(0.08)	(0.06)*	(0.06)*
Active at baseline±	-0.08	-0.07	-0.05	-0.05	-0.03	-0.02	0.00	-0.02	0.00	0.00	-0.01	-0.01	0.00	0.00	0.01	0.01	-0.02	-0.03
	(0.02)***	(0.02)***	(0.02)***	(0.02)***	(0.02)*	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)*
Age in years (*0.1)	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.02	-0.02	-0.01	-0.01	-0.01	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)***	(0.01)***	(0.01)*	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Years of Education	-0.19	-0.16	-0.21	-0.20	-0.24	-0.21	-0.07	-0.06	-0.06	-0.07	-0.06	-0.05	-0.11	-0.10	0.03	0.04	-0.10	-0.10
	(0.07)***	(0.07)**	(0.06)***	(0.06)***	(0.07)***	(0.07)***	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)**	(0.06)*	(0.06)	(0.06)	(0.06)*	(0.06)
HH Assets quintile		0.03		0.00		0.00		0.00		-0.01		0.01		0.00		-0.01		0.01
		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)
# of children		0.00		-0.01		0.03		-0.03		0.00		-0.01		-0.01		-0.01		-0.01
		(0.02)		(0.02)		(0.02)*		(0.02)**		(0.02)		(0.02)		(0.01)		(0.01)		(0.01)
Observations	725	702	651	628	694	671	748	723	600	576	747	721	602	576	464	454	696	670
R-squared	0.05	0.04	0.04	0.04	0.05	0.05	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.01	0.01	0.04	0.04
Mean in Control Group	-0.02	-0.02	-0.12	-0.12	-0.05	-0.05	-0.17	-0.17	-0.17	-0.17	-0.09	-0.09	-0.07	-0.07	-0.05	-0.05	0.04	0.04
Panel B. IV																		
Connected	-0.02	-0.02	-0.12	-0.12	-0.05	-0.05	-0.17	-0.17	-0.17	-0.17	-0.09	-0.09	-0.07	-0.07	-0.05	-0.05	0.04	0.04
	(0.08)**	(0.08)	(0.08)**	(0.08)**	(0.09)***	(0.09)***	(0.07)***	(0.08)***	(0.08)*	(0.08)*	(0.07)*	(0.07)**	(0.07)	(0.07)	(0.08)	(0.08)	(0.07)***	(0.07)***
Respondent Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH Controls		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Observations	725	702	651	628	694	671	748	723	600	576	747	721	602	576	464	454	696	670
R-squared	0.07	0.06	0.06	0.06	0.06	0.07	0.01	0.01	0.01	0.02	0.02	0.02	0.04	0.03	0.02	0.02	0.05	0.05

Notes: Standard errors clustered at the "cluster" level

Answers to the questions were coded as follows: less time: -1; same time: 0; more time: +1.

± active at baseline = 1 if respondent had earned income in the 30 days prior to the baseline survey.

IV specification: "Connected" instrumented with "Treatment". Respondent controls are gender, head/spouse status, age and education, as in Panel A. Household controls are assets quintile and number of children, as in Panel A.

Table 6: Actual Time Use

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Over the past 7 days, did you…															
	...do housework at least once a day?		…go to the market at least once?		...watch tv at least once a day?		...visit your family two or more times?		...visit friends/ neighbors two or more times?		...receive the visit of your family two ore more times?		...receive the visit of friends/ neighbors two or more times?		…go the mosque at least once?	
Treatment	0.04	0.04	-0.06	-0.06	0.07	0.07	-0.03	-0.03	0.06	0.05	0.10	0.09	0.14	0.16	0.00	0.00
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)*	(0.04)	(0.05)	(0.05)	(0.09)	(0.09)	(0.06)*	(0.06)*	(0.10)	(0.10)	(0.02)	(0.02)
Female	0.30	0.27	0.02	0.01	0.12	0.09	-0.28	-0.28	-0.42	-0.41	-0.06	-0.08	-0.09	-0.10	-0.56	-0.55
	(0.07)***	(0.07)***	(0.06)	(0.06)	(0.07)*	(0.07)	(0.09)***	(0.09)***	(0.10)***	(0.10)***	(0.11)	(0.11)	(0.16)	(0.16)	(0.05)***	(0.05)***
HH head/spouse	-0.07	-0.08	0.02	0.04	-0.04	-0.03	0.09	0.11	-0.13	-0.13	0.06	0.06	-0.06	-0.07	0.04	0.06
	(0.05)	(0.06)	(0.06)	(0.07)	(0.06)	(0.07)	(0.09)	(0.09)	(0.12)	(0.13)	(0.09)	(0.09)	(0.13)	(0.13)	(0.04)	(0.04)
Active at baseline±	-0.03	-0.01	-0.02	-0.02	-0.04	-0.04	-0.03	-0.04	0.02	0.02	0.01	0.00	0.01	0.01	0.02	0.00
	(0.01)**	(0.02)	(0.01)	(0.01)	(0.02)**	(0.02)**	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.01)*	(0.01)
Age in years (*0.1)	-0.01	-0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	0.00	0.00
Years of Education	-0.08	-0.07	0.10	0.10	-0.11	-0.09	-0.10	-0.13	-0.22	-0.21	0.02	0.04	-0.01	0.01	0.03	0.02
	(0.05)	(0.05)	(0.05)**	(0.05)**	(0.06)*	(0.06)	(0.07)	(0.08)*	(0.10)**	(0.11)**	(0.08)	(0.08)	(0.13)	(0.13)	(0.04)	(0.04)
HH Assets quintile		0.04		0.02		0.03		-0.01		-0.04		0.02		-0.01		0.00
		(0.01)***		(0.01)		(0.02)**		(0.02)		(0.03)		(0.02)		(0.03)		(0.01)
# of children		0.01		-0.01		0.00		-0.01		0.02		-0.04		0.03		-0.02
		(0.01)		(0.01)		(0.01)		(0.02)		(0.04)		(0.02)		(0.04)		(0.01)***
Observations	675	652	770	744	610	588	401	386	121	117	312	304	124	118	770	744
R-squared	0.08	0.09	0.01	0.02	0.04	0.05	0.03	0.04	0.14	0.16	0.02	0.03	0.03	0.04	0.32	0.32
Mean in Control Group	0.68	0.68	0.54	0.54	0.55	0.55	0.45	0.45	0.60	0.60	0.30	0.30	0.48	0.48	0.20	0.20
Panel B. IV																
Connected	0.68	0.68	0.54	0.54	0.55	0.55	0.45	0.45	0.60	0.60	0.30	0.30	0.48	0.48	0.20	0.20
	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)*	(0.07)	(0.08)	(0.08)	(0.14)	(0.15)	(0.10)*	(0.10)	(0.18)	(0.20)	(0.04)	(0.04)
Respondent Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH Controls		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Observations	675	652	770	744	610	588	401	386	121	117	312	304	124	118	770	744
R-squared	0.08	0.09	0.00	0.01	0.04	0.04	0.04	0.04	0.12	0.14	0.00	0.00	0.00	0.00	0.32	0.32

Notes: Standard errors clustered at the "cluster" level

Answers to the questions were coded as follows: less time: -1; same time: 0; more time: +1.

± active at baseline = 1 if respondent had earned income in the 30 days prior to the baseline survey.

IV specification: "Connected" instrumented with "Treatment"

Table 7: Labor Market and School Participation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Male Head had an income generating activity in past 30 days		Female Head had an income generating activity in past 30 days		A child under 15 had an income generating activity in past 30 days		Income generated by Male Head in past 30 days		Income generated by Female Head in past 30 days		Boy under 15 completed school year		Girl under 15 completed school year	
Panel A. ITT														
Treatment	0.00	0.00	-0.02	-0.02	-0.01	-0.01	13.97	16.63	-27.52	-27.92	-0.03	-0.03	-0.03	-0.02
	(0.03)	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(67.96)	(66.24)	(34.54)	(34.68)	(0.04)	(0.04)	(0.04)	(0.04)
Respondent controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH controls		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Observations	746	746	746	746	746	746	722	722	741	741	237	237	233	233
R-squared	0.21	0.26	0.15	0.15	0.01	0.06	0.19	0.24	0.10	0.10	0.04	0.04	0.03	0.07
Mean in Control Group	0.49	0.49	0.14	0.14	0.02	0.02	685.46	685.46	155.46	155.46	0.89	0.89	0.87	0.87
Panel B. IV														
Connected	0.000	0.000	-0.040	-0.040	-0.020	-0.020	23.160	27.600	-45.610	-46.210	-0.040	-0.040	-0.040	-0.020
	(0.06)	(0.05)	(0.04)	(0.04)	(0.02)	(0.02)	(112.50)	(109.76)	(57.23)	(57.40)	(0.05)	(0.05)	(0.07)	(0.07)
Respondent controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH controls		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Observations	746	746	746	746	746	746	722	722	741	741	237	237	233	233
R-squared	0.21	0.26	0.15	0.15	0.00	0.06	0.19	0.24	0.09	0.10	0.03	0.04	0.03	0.07
Mean in Control Group	0.49	0.49	0.14	0.14	0.02	0.02	685.46	685.46	155.46	155.46	0.89	0.89	0.87	0.87

Notes: Standard errors clustered at the "cluster" level. Respondent controls and households controls as in Table 5.
IV specification: "Connected" instrumented with "Treatment"

Table 8: Social networks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
			The respondent is in conflict or disagreement with:										Over past 30 days:			
	Do you belong to a social group or association?		People from his/her family on water matters		People from his/her family on property matters		People from his/her family on heritage matters		Neighbors on water matters		Neighbors on property matters		A HH member was entrusted with valuables		A HH member was asked for advice on a family matter	
Panel A. ITT																
Treatment	0.02	0.02	-0.11	-0.11	-0.02	-0.01	-0.02	-0.02	-0.08	-0.08	0.01	0.01	0.04	0.04	0.24	0.26
	(0.01)*	(0.01)*	(0.02)***	(0.03)***	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)***	(0.02)***	(0.01)	(0.01)	(0.02)**	(0.02)**	(0.13)*	(0.13)**
Respondent controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH controls		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Observations	770	744	771	745	771	745	771	745	768	742	770	744	769	743	766	740
R-squared	0.01	0.01	0.05	0.05	0.01	0.01	0.00	0.00	0.04	0.04	0.01	0.01	0.02	0.03	0.02	0.03
Mean in Control Group	0.02	0.02	0.15	0.15	0.06	0.06	0.10	0.10	0.12	0.12	0.01	0.01	0.07	0.07	0.38	0.38
Panel B. IV																
Connected	0.03	0.03	-0.18	-0.19	-0.03	-0.02	-0.04	-0.04	-0.13	-0.14	0.02	0.02	0.07	0.07	0.39	0.43
	(0.02)*	(0.02)*	(0.04)***	(0.04)***	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)***	(0.04)***	(0.01)	(0.01)	(0.04)**	(0.04)*	(0.21)*	(0.21)**
Respondent controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH controls		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Observations	770	744	771	745	771	745	771	745	768	742	770	744	769	743	766	740
R-squared	0.01	0.01	0.07	0.07	0.02	0.02	0.01	0.01	0.06	0.06	0.00	0.00	0.01	0.01	0.01	0.02
Mean in Control Group	0.02	0.02	0.15	0.15	0.06	0.06	0.10	0.10	0.12	0.12	0.01	0.01	0.07	0.07	0.38	0.38

Notes: Standard errors clustered at the "cluster" level. Respondent controls and households controls as in Table 5.
IV specification: "Connected" instrumented with "Treatment"

Table 9: Satisfaction and Well-Being

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	Respondent mentions water as major source of concern		HH has enough water for bathing		HH has enough water for cleaning		Home is cleaner than a year ago		Water tastes good		Overall, the life of the household has improved compared to a year ago		Within past 7 days, respondent often felt: Angry		Exhilarated		Tired	
Panel A. ITT																		
Treatment	-0.43	-0.43	0.20	0.19	0.16	0.15	0.21	0.21	0.01	0.01	0.26	0.26	-0.01	-0.02	0.00	0.01	0.00	0.00
	(0.04)***	(0.04)***	(0.03)***	(0.03)***	(0.03)***	(0.03)***	(0.03)***	(0.03)***	(0.02)	(0.02)	(0.04)***	(0.04)***	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
Respondent controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH controls		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Observations	764	738	772	746	771	745	760	734	770	744	725	699	769	743	764	738	768	742
R-squared	0.20	0.22	0.09	0.10	0.07	0.08	0.07	0.08	0.01	0.01	0.11	0.12	0.01	0.01	0.03	0.03	0.04	0.04
Mean in Control Group	0.65	0.65	0.67	0.67	0.71	0.71	0.13	0.13	0.57	0.57	0.24	0.24	0.19	0.19	0.40	0.40	0.46	0.46
Panel B. IV																		
Connected	-0.71	-0.71	0.33	0.32	0.27	0.25	0.35	0.35	0.02	0.02	0.44	0.45	-0.02	-0.04	-0.01	0.02	0.00	0.00
	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.05)***	(0.03)	(0.03)	(0.06)***	(0.06)***	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
Respondent controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH controls		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes
Observations	764	738	772	746	771	745	760	734	770	744	725	699	769	743	764	738	768	742
R-squared	0.37	0.37	0.20	0.21	0.17	0.18	0.18	0.18	0.01	0.01	0.22	0.23	0.01	0.01	0.03	0.04	0.04	0.04
Mean in Control Group	0.65	0.65	0.67	0.67	0.71	0.71	0.13	0.13	0.57	0.57	0.24	0.24	0.19	0.19	0.40	0.40	0.46	0.46

Notes: Standard errors clustered at the "cluster" level. Respondent controls and households controls as in Table 5.

IV specification: "Connected" instrumented with "Treatment"