Why Don't People Pay Their Water Bills? Evidence of Values and Perceptions of Water Supply from Urban India

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Abstract

The sustainability of water supply reforms depends on sufficient revenues being collected from users to allow the utility to maintain and refurbish the network. Increasing tariffs will not raise revenues if a significant proportion of users do not pay their water bills. Using household survey data collected around a unique 24x7 water supply intervention in the city of Nagpur in India, this paper explores the determinants of non-compliance with water bill payments. We draw upon the Theory of Reasoned Action (TRA) to build our analytical and empirical model. In addition to the wealth and education level of the household and the total bill amount, salience of bill payment, trust in the utility and subjective norms regarding the behaviour of the reference group are found to be significant determinants of paying bills. However, sanctions by the utility or attempts by the utility to authorize all piped connections have no significant association with compliance. Our findings highlight that utilities need to focus on increasing bill frequency and accuracy and improving bill presentation alongside service improvements.

Keywords: urban water supply, bill payment, compliance, survey data, India

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1. Introduction

Urban water services in many developing countries are characterised by limited coverage, poor service quality, low levels of efficiency and dependence on subsidies from government. Water utilities become caught in a 'low-level equilibrium' of low revenues from tariffs, which in turn constrains maintenance and investment, leading to a declining level of service quality, for which customers are increasingly unwilling to pay (Clarke and Ménard 1999, Shirley and Walsh 2000, Spiller and Savedoff 1999). Policy interventions are therefore needed to break this negative cycle to increase availability of funds and to use these funds efficiently to improve and extend service.

Many attempts at reform have been conducted, from interventions like increasing tariffs or replacing pipelines to reduce leakage, to broader governance reforms like corporatisation (structuring the water utility as a publicly owned corporate entity) and public-private partnerships (PPP) which are intended to increase the autonomy of managers and strengthen their performance incentives. Many of these attempts at reform proved impossible to implement or sustain and were abandoned or reversed.

This cycle of weak performance and failed reforms is particularly stark in India. In India, almost half of urban residents have no piped water connection and no city is able to provide a continuous, 24-hour/day supply of water to its residents. India's water utilities are characterised by high rates of non-revenue water (NRW, the amount of water that is supplied to the distribution network for which no tariff revenue is collected), low billing and collection efficiency, limited metering and low labour productivity. Financial performance is equally weak: no water utilities are capable of covering both their operating and capital costs and utilities are a continuing drain on state and local government budgets (Ministry of Urban Development 2010, 2012; Tiwari and Nair 2011; World Bank and Ministry of Urban Development 2012).

In addition, water utilities in India lack transparency and accountability – there are gaps and overlaps in the allocation of responsibilities within the institutional structure; a high degree of politicisation from high-level management down to the household interface; widespread corruption and limited consultation and participation (Walters 2013).

Indicators of performance are presented in Table 1 alongside the service level benchmarks established by the central government. Utilities are clearly far from achieving national standards, let alone international benchmarks.

Households which can afford to cope with the poor service by investing in booster pumps, storage tanks and small-scale treatment systems in order to ensure themselves of a continuous supply of potable water. These coping costs are non-negligible but are made by most middle-class households (Zérah 2000). Poorer households rely on public taps and simple point-of-use filters, incurring costs in terms of time, inconvenience, stress and possible risks to health.

Table 1. Water Supply Service Performance Indicators 2011

Service parameter	Indicator	Target	Median	Mean
Coverage	% of households in service area with individual piped connection	100%	53	50.2
Quantity of supply	Daily average per capita supply	135lpcd	69	69.2
Metering	Proportion of connections with a functioning meter	100%	0	13.3
Non-revenue water	Proportion of water delivered to system for which no revenue is collected	20%	29	32.9
Continuity of supply	Average number of hours of supply per day	24	2	3.1
Quality of supply	Proportion of water samples meeting quality standards	100%	94	81.7
Redressal of complaints	Proportion of complaints redressed within 24 hours	80%	75	72.9
Cost recovery	Operating revenues as proportion of operating costs	100%	32	38.8
Collection efficiency	Revenues collected as a proportion of billed value	90%	63	58.7

Source: Ministry of Urban Development, Government of India (2012). *Service Level Benchmarking Databook 2010-2011*. Data for 1405 urban local bodies (ULB).

In the 1990s and 2000s, urban water policy interventions in India including corporatisation, decentralisation, PPP and central and state government funding allocations met with very limited success in improving service outcomes. One pervasive problem has been that the interventions have not led to improved financial sustainability. In part this has been due to the unwillingness of local governments to raise tariffs because of the particular social, cultural and religious significance of water (Asthana 2009; Shiva 2002); the high degree of politicisation of the sector (Coelho 2005; Walters 2013); and widespread corruption (Davis 2004).

These reform failures led to the development of a new model of PPP, the '24x7' water supply contract, which take into account many of the problems faced in previous rounds of reform. They are long-term performance-based contracts targeting continuous water supply, NRW control and increasing revenue from tariffs. They involve no transfer of ownership to the private sector; public sector employees retain their rights and benefits; they incorporate 'pro-poor' policies to extend coverage to low-income households; and include communications and engagement strategies for stakeholders. Investment costs are shared by the public and private parties. The private party is remunerated per unit of volume of water billed and collected, subject to penalties associated with failing to meet performance indicators. User tariffs are set by the local government independently of the fee paid to the private operator.

In order for the 24x7 PPP contracts to be sustainable, the private party needs to increase revenues from billing. It is therefore important to understand why households do or don't pay their water bills and how this relates to the tariff rate.

Numerous contingent valuation studies have examined willingness to pay for a piped water connection (Genius et al. 2008, Whittington et al. 1990, Whittington et al. 2002). The literature consistently identifies observable demographic and economic characteristics of households and cost of service as significant in determining the willingness of households to pay for piped water supply and that demand for connections is generally price elastic, although one study finds that price is not significant (Devoto et al. 2012).

Households are willing to pay for the convenience of a piped water connection (Devoto et al. 2012) but there is little evidence to show that households value higher drinking water quality (Kremer et al. 2011; Ashraf, Berry, and Shapiro 2010; Null et al. 2012). The limited evidence on willingness to pay for continuity of supply finds that households are willing to pay to reduce the frequency and duration of water service interruptions (Hensher et al. 2005). Only one case study in India, Hubli-Dharwad, examines 24x7 continuous water supply as a determinant of willingness to pay. While the validity of this study has been questioned, it finds that consumers are willing to pay for continuous water supply (Ranganathan et al. 2009, Sangameswaran et al. 2008). Limited evidence from Africa finds that the key consideration for households' with regards to regular and timely water bill payments is service quality, that is, reliability and duration of water supply (Addo-Yobo et al. 2006, Mugabi et al. 2010).

A critical factor underlying the lack of attention given to non-compliance with water bill payments in India is argued to be lack of authority given to water utility companies to penalize or sanction consumers who do not pay. By law, water utility companies cannot disconnect or restrict water supply if consumers owe them money. In fact, disconnecting water supply, whether due to non-payment of dues or otherwise, is a deprivation of the fundamental right to livelihood guaranteed under Article 21 of the Constitution (Rao 2010).

Other factors that significantly affect willingness to pay for a piped connection include household size, access to an alternative source and distance to that source (such as a neighbour's connection), and the length of time living in the location (Awad and Holländer 2010; Devoto et al. 2012).

Overall, measures of values and perceptions have rarely been included in these analyses. In one study, peer group effects are measured and are found to have a significant impact on willingness to pay for access to safe drinking water (Luoto et al. 2012). On the other hand, values and perceptions are shown to be important in household behaviour regarding other electricity bill payment (Mantel 2000) and there is a large literature on income tax compliance which finds that values, perceptions, trust in government, and peer group effects are significant in determining the likelihood that an individual will pay income tax, in addition to the tax rate (Ali et al. 2014, Devos 2014, Pickhardt and Prinz 2014).

While perceptions and values are suggested by qualitative investigations to be important in motivating behaviour, there is little existing work on this subject in relation to water services.

In this study, we address the knowledge gaps in determinants of households' willingness to pay bills in developing countries using survey data collected around a unique intervention in the city of Nagpur in India. Nagpur is a mid-sized city located in central India in the state of Maharashtra. Its per capita income is approximately US$1,900, which around the national urban average (Government of Maharashtra 2017).[1] It is the first city in India to target continuous 24x7 supply for the entire city area. The 25-year contract was awarded to a joint venture of a local company and French multinational Veolia Environnement and commenced in 2010.

[1] 1US$ = INR 64.50

The 24x7 programme is rolled out across the city and households are not asked whether they want a connection. The private partner is incentivised to provide the connection and people are provided with the connection at no cost – they just have to pay the water bills as per the revised tariffs. The intervention is thus purely exogenous to the households providing us a unique opportunity to exploit the natural variation in the quality of service across the city and across different socio-economic groups as works are completed in some parts of the city while they are still ongoing in others. Methodologically, this is a superior approach as we minimize any potential selection bias in service quality that may arise due to household and individual unobserved factors.

2. A theory of bill payment behaviour

This section develops a theoretical model to analyse payment compliance which blends together the reasoned action and integrated behavioural models from the field of social psychology.

Social psychology models are based on the idea that individuals seek to attain goals and "usually behave in a sensible manner" (Addo-Yobo et al. 2006). They take actions to attain goals based on the perceived costs and benefits of the action but their decisions are influenced by a variety of attitudes, beliefs and subjective norms. These shape the individual's intent to engage in the behaviour. One of the important behavioural theories is known as the Theory of Reasoned Action (TRA), which was developed by Fishbein and Ajzen (1975). TRA has been the dominant theoretical approach for health-related behaviour research and is well recognised amongst behavioural researchers in a range of fields (Sniehotta, Presseau, and Araújo-Soares 2014).

According to the TRA, there are primarily two components that influence an individual's behavioural intent. One is the individual's *attitude towards the action*, that is, how favourably does the individual feel about performing the action. This includes the individual's evaluation of the outcomes as well as the attributes of performing the action. The more favourable an individual feels, the more likely it is that she decides to perform the action, assuming everything else remains equal. In the context of paying for water services, this would include how much the user values the service, for example continuity, reliability, pressure and potability.

The second component in TRA is *subjective norms*, that is, the social pressure the individual feels to conform or not conform with the group attitudes towards the action. This includes both what the individual believes about the attitude of the referent group towards the behaviour as well as her own motivation to comply with the referent group's belief. In the context of payment of water bills, relevant norms include compliance with government regulation in general, for example with whether or not the individual pays property taxes and other utility bills, and norms specifically related to payment for water, which may be designated particular social and cultural significance, as noted above.

In the original TRA model, the characteristics of the individual (gender, age, income, and education level) are assumed to influence these two constructs (attitude and subjective norms) and hence, are not treated as independent variables (Fishbein and Ajzen, 1975; McCarthy et al., 2004) but in more recent scholarship, TRA is often adopted in a modified form in which these characteristics are taken to have independent explanatory power, in addition to the influence that they have on attitudes and norms. Intention, perceptions and norms are found to be quite consistent psychological predictors of behaviour in a variety of domains (McEachan et al. 2011).

The TRA model has been extended to integrate additional variables which enhance its explanatory power (Montano and Kasprzyk 2015). These factors include the ability to perform the behaviour or the absence of environmental constraints on performing the behaviour (Triandis 1979), salience (Ajzen 1985; Budd 1986), trust in government (Marien and Hooghe 2011), and likelihood of penalties and sanctions (Devos 2014). Environmental constraints relevant to paying water bills would include having enough money to pay the bill, knowing where and how to pay the bill and having sufficient time to make the payment. Salience in relation to bill payment refers to how recently the individual had received the bill or a reminder to pay the bill, bringing the behaviour to the front of the mind. Low levels of political trust is expected to undermine the legitimacy of the government, in this case, the public water utility companies, and likely result in lower levels of compliance.

The full theoretical model incorporating extensions for TRA is presented in Figure 1.

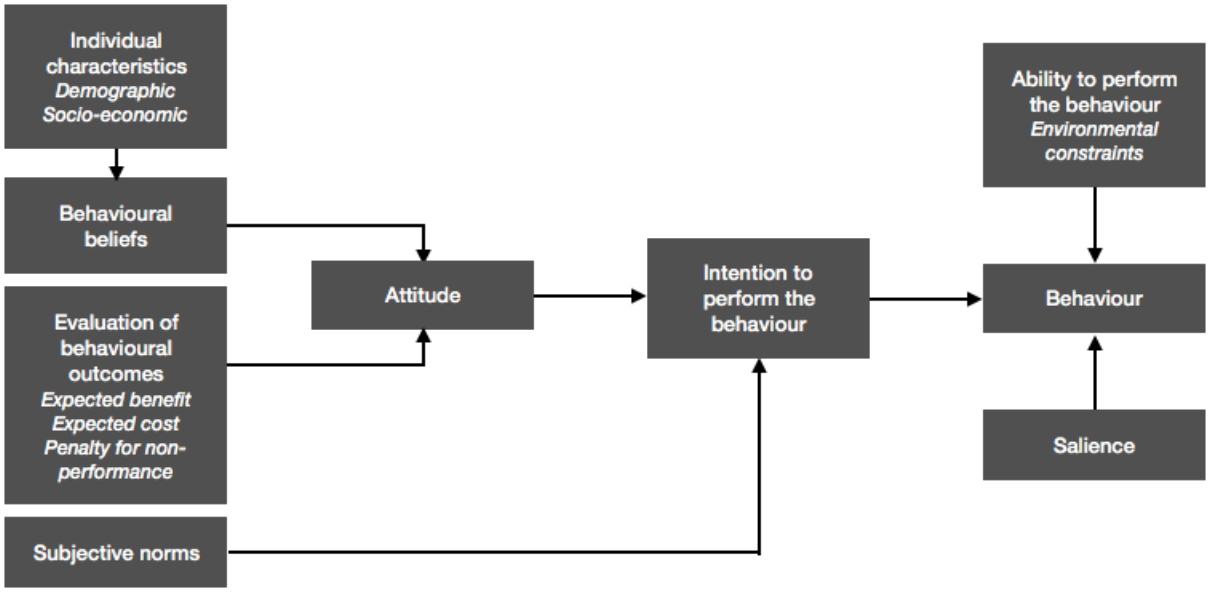

Figure 1: Extended Theory of Reasoned Action (authors' elaboration based on Montano and Kazprzyk, 2015)

3. Data

Data are drawn from a household survey of 1577 households conducted in Nagpur in October-November 2015. The households surveyed represent three categories of water users: households with a piped connection who are billed, households with a piped connection who do not receive bills, and households without a piped connection. This analysis employs data for the 568 households surveyed who receive water bills.

Prior to undertaking the survey, we conducted 20 in-depth interviews with households, utility managers and staff, advisors, and NGOs. These informed the design of the questionnaire and generated insight into perceptions and narratives relating to water use. The questionnaire contains more than 100 questions covering household characteristics, billing and payment information, quality of service, use of alternative water sources (non-piped), expenditure on equipment related to water service (such as installation of meters and pipes) and perceptions.

The sample for this study is selected following a two-stage stratified random sampling. The first stage of stratification is the status of the work undertaken by OCW. There are a total of 62 zones in Nagpur and a random sample of four zones is selected into each strata. The three strata based on the status of work are:

1. Works completed
2. Works ongoing

3. Works proposed

The second stage of stratification is household category based on the type of water connection. Households were randomly drawn from each zone up to a ceiling for each category. There are three household categories:

1. Households who have an authorized piped water connection and who receive bills
2. Households who have a piped water connection on their property but do not receive bills. These are unauthorized connections.
3. Households without a piped connection. These households rely on multiple sources of water such as public taps, tankers and wells.

Our sampling strategy thus ensures that there is a natural (exogenous) variation in service quality across the 568 households with an authorized connection.

4. Empirical strategy

Following our theoretical framework, we develop an empirical model to explore the determinants of bill payment. Our outcome of interest is a dummy indicating whether the household has paid its most recent bill received, which takes value 1 if it has and 0 otherwise. We include all observed independent variables that operationalize the various components of the TRA. First are household characteristics which include household wealth index,[2] education of household head, gender of household head, caste of household head, household size, and whether the household is in a slum.

Second are water service measures including dummy indicating whether household receives water every day, hours of water supply, dummy indicating whether household has sufficient water, self-reported water reliability (water is available in the expected time slot) on a scale of 1-5 (1=very bad and 5=very good), and self-reported overall water quality a scale of 1-5 (1=very bad and 5=very good).

[2] Household wealth index is constructed using household living standards measures such as ownership of home, number of rooms, building material for roof and flooring, access to sanitation and electricity, and ownership of mobile phone. Households are then divided into low, middle, and high wealth index categories based on quintile distribution.

Third are salience indicators. We use a bill frequency dummy as a proxy for salience, which equals 1 if the household receives a bill every two months or more frequently and 0 otherwise. We also include a self-reported measure on whether the household considers water supply to be a problem. This dummy takes value 1 if the household indicates that water is one of the three most important problems faced by the household and 0 otherwise.

Fourth are indicators of subjective norms. This includes norms about the reference group, which is a dummy indicating whether the household's neighbours pay their bills. The variable equals 1 if the household believes that all their neighbours pay their water bills and 0 otherwise. In addition, we include a dummy for whether the household pays property tax.

Fifth is trust in the utility, which we proxy using bill accuracy. This is a dummy which equals 1 if the household states that their bill is not inaccurate and 0 otherwise.

And sixth are households' perceptions about sanctions imposed by the utility and the utility authorizing all piped connections. The first perception index captures agreement with sanctions imposed by NMC. Questions ask whether the respondent disagrees or agrees (1=strongly disagree and 5=strongly agree) with (i) NMC disconnecting unauthorized connections and (ii) NMC disconnecting connections of consumers who do not pay bills for several months. A higher value of this index reflects greater agreement with NMC's sanctions. The second perception index captures agreement with NMC authorizing piped connections. Questions ask whether the respondent disagrees or agrees (1=strongly disagree and 5=strongly agree) with – (i) households refusing to allow NMC contractors to install a meter on their connection and (ii) citizens blocking NMC contractors from replacing pipes and connections. A higher value of this index reflects greater disagreement with NMC authorizing piped connections.

In addition, we use total bill amount as an indicator of environmental constraint. However, there is a high degree of measurement error in this variable, which is explained in the next section. We also include command area dummies to capture any unobserved characteristics that are common to all households within a command area such as culture or local governance.

We estimate probit regression models and our full regression specification can be formally written as:

$$\Pr(Y = 1) = \Phi(\beta_0 + \beta_1 H_i + \beta_2 W_i + \beta_3 S_i + \beta_4 N_i + \beta_5 T_i + \beta_6 P_i + \gamma_c + \varepsilon_i)$$

where, Y is the dummy indicating whether the household paid the most recent bill received. H_i is a vector of household characteristics, W_i is a vector of water service quality indicators, S_i is a vector of salience indicators, N_i is a vector capturing subjective norms, T_i is a dummy indicating trust in the utility, P_i is a vector of indices capturing perceptions on sanctions imposed by the utility, γ_c are command area fixed effects, and ε_i is the error term. We compute the marginal effect of each determinant so that the results can be interpreted as the probability change in $Y = 1$.

5. Results

Table 2 summarizes all the variables included in our regression models and estimates from our regression models are presented in Table 3. Almost one third of the respondents reported that they did not pay their most recent bill. The financial impact of such a low collection rate on the Nagpur utility would depend on whether the households that do not pay also tend to be those with higher bills, in which case the collection rate of the utility – the proportion of billed value that is collected – would be below 70%. Generally, utilities would seek to maintain a collection rate above 95%.

<Tables 2 and 3 here>

Of those households who did not pay their bills, the most common explanations given were not having enough money (43%) and not having enough time to go the office to pay the bill (18%). We investigate this further in the regression analysis. We find that the positive relationship between assets and paying the bill is affirmed. Estimates from our preferred full specification, which is model (6), suggest that households from the highest wealth group have a 12 percentage point higher probability of paying the bill when the size of the bill is not included. When measures of bill size are included the significance of wealth falls away, which is consistent with the explanation that environmental constraints significantly influence compliance behaviour.

Other household characteristics are also significant, in line with our hypotheses: households headed by an individual with at least a secondary education are more likely to pay their bills. Model (6) suggests that these households are 65 percentage points more likely to pay their bill. Slum-dwellers are less likely to pay, however, the significance of the slum effect disappears when we include additional controls and command area fixed effects. This is plausible as slums are concentrated in some command areas and therefore the fixed effects may be picking up location effects as well. We also find that female-headed households are less likely to pay their bills, even when controlling for wealth. This could reflect the greater demands on the time of female household heads who may need to complete domestic chores and care for children and the elderly in addition to revenue-generating occupations, and so find it more difficult to go to the office to make payment. However, this correlation turns insignificant with the inclusion of other controls and fixed effects.

Of the measures of service quality, the one positively and significantly associated with paying the bill is receiving water through the connection every day. Specifically, from model (6) we observe that households that receive water everyday are 64 percentage points more likely pay their bill compared to households where supply is irregular. Other measures are either not significant or are negatively associated with paying the bill. In particular, households are not more likely to pay their bills if they receive water for a higher number of hours each day. This counter-intuitive result may be explained by the sunk investments that households have made in equipment to obtain, store and treat water at the household level. 22% of households have a pump for water, which they use to boost the volume of water that can be collected during periods of supply. Respondents' average estimation for the current price of a pump would be US$57. 23% have purchased an overhead tank (estimated price of approximately US$50) and 33% have invested in an overground tank (approximately US$36). These findings are further corroborated by responses given during in-depth interviews with households, in which one interviewee stated that *"we do not need 24x7 [continuous] supply and we did not ask for it."*

Higher water sufficiency, reliability, and quality also does not appear to be service aspects to which households attach much value. Again, this may be because people are accustomed to treating water through filtering before consumption. The most common form of treatment is a cloth filter, used by 77% of the sampled households.

We find strong support for the hypothesis that salience is positively related to compliance, measured in the frequency with which household receive a water bill. In particular, as seen in model (6), households that receive less frequent bills are 24 percentage points less likely to pay their bill. This does not appear to be due to less frequent bills being higher, as frequency remains significant in models (7) and (8), which also include the size of the bill. There is considerable variation in the frequency with which bills are received, ranging from two months to six months. A small number of outliers with even longer billing periods have been excluded – these seem likely to be the result of inaccurate recording of the data. There are several channels through which regular billing may link to higher payment rates: households are frequently reminded of the need to pay for the service; they are more comfortable with and perhaps more efficient at performing the action of paying; and they may be able to plan

better to have enough cash available at the time the bill is due if the bill arrives at the same time every two months.

Households also seem to doubt the reliability of billing. 25% believed their bill to be sometimes inaccurate. Of those who believed their bill was incorrect, four-fifths sought redress either from the utility, the municipal administration or their local elected official but most – 81% – said they had not been able to get the billing rectified. Households may be justified in this regard. Interviews with the utility managers responsible for billing revealed that the utility itself was dissatisfied with the billing software and was seeking to introduce a different system. We use households' perception of billing inaccuracy as a measure of their trust and confidence in the utility and find that this is significantly related to the likelihood that they will pay their bill. Households that reported their bills to be accurate are 17 percentage points more likely to pay the bill as observed in model (6).

The analysis provides some support for the hypothesis that households follow social norms when deciding whether or not to pay their bill. From model (6) we observe that respondents who reported that not all their neighbours pay their water bill are 14 percentage less likely to pay their own bill.

One further result is strikingly counter-intuitive: households that pay property tax are significantly less likely to pay their water bill than those that do. Specifically, estimates from model (6) suggest that households who pay property tax are nearly 14 percentage points less likely to pay their bill. There are a number of possible explanations for this result. One could be that residents consider water to be a public service that should be paid for through the regular budget rather than user fees, and so consider themselves to be paying twice if they pay both property tax and the water bill. Another is that paying property is considered to be a civil obligation while social norms regarding paying for water service are not so well established. This could be linked with the argument in the literature and echoed in one of the interviews that water is a gift of nature and people should not be obliged to pay for it.

Following on from the earlier finding that households might not consider paying their water bill to be a civil obligation or having serious repercussions, another interesting insight from our regression analysis is that perceptions about sanctions and authorizing of connections is uncorrelated with probability of paying bill. As previously stated, this may be because in

India, utility companies have no authority to disconnect water connection in the case of non-payment of dues. Utilities are required to send notices to households and in the extreme event that the household does not respond to these notices, the company is required to file a court case (Rao 2010).

In general, the billing data collected in the survey were of poor quality and many responses were missing or had to be dropped, reducing the sample size considerably. It appears that both the respondents and enumerators had difficult in interpreting the bills and the time period to which they related. This was underlined both in the training of enumerators, when considerable guidance and practice was necessary for the enumerators to locate the relevant figures on the bill, and in the in-depth interviews. During the interviews, it became apparent that respondents were unclear about whether they were billed on a volumetric, flat-fee or combined basis, what 'arrears' referred to, and what the official tariff levels are for user categories (residents of areas officially designated as slums pay a lower rate than residents of other areas). When we include log of total bill amount in models (7) and (8), the sample size drops to approximately 150. While the coefficients on log of total bill and its quadratic term are in the expected direction, we treat these results with caution due to the measurement errors. The signs on the coefficients in model (8) suggest that the net effect of a 1% increase in bill amount is a reduction of approximately 80 percentage points in the probability of paying the bill. Therefore, consumers' willingness to pay bills is highly sensitive to bill amount.

6. Conclusions and policy implications

This study addresses a crucial knowledge gap, which is understanding the determinants of non-compliance with water bill payments in developing countries. Using city-representative, household survey data from the city of Nagpur, collected against the backdrop of the implementation of the 24x7 water supply intervention and thus exploiting natural variation in service quality, we find that household wealth and education of the household head matter when it comes to compliance. Households' compliance behaviour is also highly sensitive to bill amounts. Further, households respond positively to regular supply of water but not to hours of water supply, sufficiency, and quality.

We find that salience of bills, that is sending household regular bills every 2 months or less is a significant determinant of paying bills. Subjective norms regarding behaviour of reference group is also correlated with compliance. However, norms regarding compliance with other government services such as receiving electricity bills and paying property tax are either uncorrelated or not in the expected direction. Trust in the utility operationalized using bill accuracy is a significant determinant of bill payment. However, sanctions by the utility or attempts by the utility to authorize all piped connections has no significant association with compliance.

The findings have clear implications for the phasing of reforms. First, along with a focus on service quality improvement, utilities must bill their customers accurately. They must invest in metering accurately, simplifying bill presentation, and sending bills regularly so that the salience of bills is increased. Revenue realization of utilities should be decoupled from political motives where parties try to lure voters by promising water provision at extremely low or no tariffs.

Second, utilities must work on communicating messages about water bill payments and also on handling billing enquiries. Simple graphical representation of reference group bill payment behaviour can be added to the bills to reinforce norms and increase compliance.

And third, when improving water service, utilities must prioritise getting some water to every connection every day. Assuming that people already have coping mechanisms such as storage tanks and water purification devices to deal with intermittent water supply and low water quality, 24x7 potable water may be less of a priority to them, however, having uninterrupted access to water both through taps and storage tanks is of greater importance.

While the findings of this study are based on the Indian context, they suggest that further investigation of values, perceptions and peer effects in relation to payment for public services are worthy of further investigation in other contexts. Many developed and developing country utilities outside India have sought to improve their financial sustainability by raising tariffs, only to face fierce public opposition. Policy-makers have sometimes then chosen to reverse the policy, as in Ireland in 2014 and in Saudi Arabia in 2016. Understanding why people do or don’t pay their bills is important to avoid these policy debacles and to achieve the objective of sustainable financing of utilities.

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8. Tables

Table 2. Descriptive statistics

Variables	N	Mean	S.D.	Min	Max
Panel A: Outcome variable					
Household paid most recent bill received	557	0.698	0.459	0	1
Panel B: Household characteristics					
Wealth group - low	568	0.278	0.448	0	1
Wealth group - medium	568	0.421	0.494	0	1
Wealth group - high	568	0.301	0.459	0	1
HH head has secondary education	553	0.975	0.157	0	1
Female-headed household	568	0.651	0.477	0	1
Lower caste household	568	0.153	0.360	0	1
Slum household	568	0.440	0.497	0	1
Household size	568	3.796	1.421	1	13
Panel C: Water service quality					
Household receives water everyday	568	0.984	0.125	0	1
Hours of water received	568	4.752	5.984	1	24
Household receives sufficient water	568	0.896	0.305	0	1
Water reliability	568	4.315	0.815	1	5
Water quality	568	4.430	0.813	1	5
Panel D: Salience					
Bill frequency <= 2 months	568	0.313	0.464	0	1
Bill frequency > 2 months	568	0.687	0.464	0	1
Households ranks water as top 3 problem	568	0.109	0.312	0	1
Panel E: Subjective norms					
All neighbours pay bills	306	0.699	0.459	0	1
Not all neighbours pay bills	306	0.301	0.459	0	1
Household pays property tax	563	0.829	0.376	0	1
Household receives electricity bill	564	0.986	0.118	0	1
Panel F: Trust and perceptions					
Household trusts the utility	557	0.752	0.432	0	1
Agreement with NMC sanctions	568	3.946	0.949	1	5
Agreement with NMC authorizing connections	568	2.779	1.125	1	5
Panel G: Environmental constraints					
Log of total bill amount	221	5.862	0.933	3.932	9.191

Table 3. Determinants of compliance with water bill payment

	Outcome variable = Household paid most recent bill received							
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Panel A: Household characteristics								
Wealth group – middle	0.093**	0.059	0.134**	0.141**	0.145**	0.062	-0.069	-0.082
	(0.046)	(0.049)	(0.056)	(0.058)	(0.057)	(0.057)	(0.083)	(0.086)
Wealth group – high	0.157***	0.123**	0.230***	0.236***	0.241***	0.118*	0.074	-0.032
	(0.048)	(0.051)	(0.056)	(0.056)	(0.056)	(0.071)	(0.082)	(0.096)
HH head has secondary education	0.457***	0.456***	0.537***	0.491**	0.529***	0.654***		
	(0.117)	(0.119)	(0.179)	(0.202)	(0.187)	(0.183)		
Female-headed household	-0.149***	-0.141***	-0.033	-0.050	-0.057	-0.021	0.065	0.131*
	(0.042)	(0.044)	(0.064)	(0.066)	(0.066)	(0.067)	(0.077)	(0.074)
Lower caste household	-0.062	-0.027	-0.021	-0.019	-0.023	-0.040	0.023	0.013
	(0.059)	(0.060)	(0.093)	(0.092)	(0.093)	(0.095)	(0.093)	(0.070)
Slum household	-0.119***	-0.137***	-0.030	-0.007	-0.002	-0.123	0.037	-0.106
	(0.045)	(0.045)	(0.062)	(0.063)	(0.064)	(0.076)	(0.079)	(0.068)
Household size	-0.017	-0.013	0.006	0.004	0.009	-0.005	0.0103	-0.010
	(0.014)	(0.014)	(0.021)	(0.021)	(0.021)	(0.018)	(0.026)	(0.023)
Panel B: Water service quality								
Household receives water everyday		0.245	0.011	0.050	0.113	0.644***	0.644*	0.924***
		(0.189)	(0.183)	(0.201)	(0.233)	(0.194)	(0.360)	(0.027)
Hours of water received		-0.003	-0.015***	-0.013**	-0.014**	-0.011*	-0.010	-0.026
		(0.003)	(0.006)	(0.006)	(0.006)	(0.006)	(0.010)	(0.021)
Household receives sufficient water		0.068	-0.034	-0.024	-0.038	-0.039	-0.029	-0.071
		(0.075)	(0.094)	(0.093)	(0.090)	(0.091)	(0.152)	(0.048)
Water reliability		0.028	-0.048	-0.054	-0.050	-0.090	0.008	0.017
		(0.049)	(0.063)	(0.061)	(0.061)	(0.070)	(0.066)	(0.061)
Water quality		-0.092*	-0.008	-0.023	-0.019	-0.005	-0.088	-0.066
		(0.049)	(0.059)	(0.058)	(0.057)	(0.068)	(0.060)	(0.064)
Panel C: Salience								
Bill frequency <= 2 months			-0.131**	-0.139**	-0.134**	-0.244***	-0.165**	-0.295***

			(0.065)	(0.064)	(0.065)	(0.055)	(0.082)	(0.091)
Households ranks water as top 3 problem			-0.108	-0.081	-0.079	-0.073	-0.142	-0.137
			(0.089)	(0.084)	(0.085)	(0.079)	(0.140)	(0.134)
Panel D: Subjective norms								
Not all neighbours pay bills			-0.258***	-0.244***	-0.247***	-0.147*	-0.173	0.001
			(0.081)	(0.081)	(0.086)	(0.085)	(0.119)	(0.094)
Household receives electricity bill			0.047	0.116	0.153	0.165		
			(0.218)	(0.247)	(0.265)	(0.271)		
Household pays property tax			-0.156**	-0.120	-0.123*	-0.138**	-0.099	-0.102***
			(0.065)	(0.075)	(0.073)	(0.059)	(0.065)	(0.039)
Panel E: Trust and perceptions								
Household trusts the utility				0.162**	0.183**	0.169*	0.101	0.006
				(0.078)	(0.081)	(0.092)	(0.083)	(0.078)
Agreement with NMC sanctions					-0.037	-0.001	-0.045	-0.048
					(0.037)	(0.041)	(0.047)	(0.043)
Agreement with NMC authorizing connections					-0.005	-0.029	0.005	-0.012
					(0.027)	(0.029)	(0.030)	(0.030)
Panel F: Environmental constraints								
Log of total bill							-0.822**	-1.061***
							(0.344)	(0.315)
Log of total bill squared							0.060**	0.079***
							(0.027)	(0.025)
Command area fixed effects	N	N	N	N	N	Y	N	Y
Observations	542	542	298	298	298	295	151	148

Note: Estimates are marginal effects from probit regression models. Robust standard errors in parentheses. p<0.01***, p<0.05**, p<0.10*.