2015

Nonpayment of water bills in Guatemala: Dissatisfaction or inability to pay?

William F. Vasquez-Mazariegos
Fairfield University, wvasquez@fairfield.edu

Published Citation

Vásquez, William F. "Nonpayment of water bills in Guatemala: Dissatisfaction or inability to pay?." Water Resources Research 51.11 (2015): 8806-8816. 10.1002/2014WR016610

AGU PUBLICATIONS

Water Resources Research

RESEARCH ARTICLE
10.1002/2014WR016610

Key Points:
- This paper investigates nonpayment behavior in Guatemala
- Nonpayment behavior is a demonstration of consumer dissatisfaction
- No relationship was found between nonpayment behaviors and income

Correspondence to:
W. F. Vásquez,
wvasquez@fairfield.edu

Citation:
Vásquez, W. F. (2015), Nonpayment of water bills in Guatemala: Dissatisfaction or inability to pay?, *Water Resour. Res.*, *51*, 8806–8816, doi:10.1002/2014WR016610.

Received 30 OCT 2014
Accepted 28 JUL 2015
Accepted article online 21 SEP 2015
Published online 6 NOV 2015

Nonpayment of water bills in Guatemala: Dissatisfaction or inability to pay?

William F. Vásquez[1]

[1]Department of Economics, Fairfield University, Fairfield, Connecticut, USA

Abstract This paper investigates nonpayment behavior in Guatemala. Determinants of nonpayment behavior are identified through zero-inflated negative binomial regression models in order to take into account particular distributional characteristics of the amount of outstanding payments. Findings indicate that nonpayment behavior is a demonstration of consumer dissatisfaction with current water services. The amount of outstanding bill payments also responds to system unreliability. Results also suggest that nonpayment behaviors are more prominent in community-managed systems than in municipal systems. No evidence was found on a potential relationship between nonpayment behavior and household income. Policy implications are discussed.

1. Introduction

Cost recovery has become a major challenge for many water utilities in developing countries [e.g., *Guevara Jerez*, 2007; *Nyarko et al*., 2007; *Secretaría de Planificación y Programación de la Presidencia* (*SEGEPLAN*), 2006; *Zhong and Mol*, 2010]. System revenues are often not enough to operate water systems, treat water for drinking purposes, and adequately maintain water infrastructure. Insufficient cost recovery also represents a major obstacle for service extension, and may lead to suboptimal usage of water resources [*Nyarko et al*., 2007]. Thus, acute imbalances between revenues and supply costs jeopardize the sustainable provision of water services.

Water fees are the primary form of recovering water supply costs, especially for community-managed utilities that do not receive financial transfers from central or local governments. Unfortunately, in many developing countries, widespread nonpayment of water bills is an impediment for water utilities to recover water supply costs [*Aguilar-Benitez and Saphores*, 2008; *Mugabi et al*., 2010; *Van Schalkwyk*, 2012]. Institutional underdevelopment and lack of managerial capacity could partially explain low collection rates of water fees [e.g., *Zhong and Mol*, 2010]. However, household payment behaviors may also affect the effectiveness of water utilities in collecting water fees. Improved understanding of underlying factors influencing water bill payment behavior may help to design appropriate policies for recovering water supply costs, which in turn would enhance the sustainability of water systems.

The analysis of nonpayment behavior requires moving beyond the presumption that households tend to be late in their payments due to their inability to pay. The scant literature on nonpayment behavior suggests that there could be factors other than income constraints that can influence households to adopt nonpayment behaviors. For instance, *Mugabi and Kayaga* [2010] and *Mugabi et al*. [2010] present empirical evidence from Uganda suggesting that nonpayment intentions, which are related to actual nonpayment behaviors, are mainly based on the perceived control that a person has on performing bill payments, as well as on attitudes and social pressures. *Gorton et al*. [2009] found in Macedonia that payment behavior is related to the satisfaction that farmers derived from being members of community organizations for irrigation. In contexts of institutional underdevelopment where water utilities do not have mechanisms to enforce bill payments, households may adopt nonpayment behaviors as a means to demonstrate their dissatisfaction with the quality of water services [*Kayaga et al*., 2004]. More empirical research is needed to identify determinants of nonpayment behaviors at the household level, particularly within existing utility-consumer relationships in developing countries [*Aguilar-Benitez and Saphores*, 2008; *Mugabi et al*., 2010].

This paper investigates why households do not pay their water bills in a timely fashion using a random sample of 500 households that are served by municipal and community-managed water utilities in the small

town of San Lorenzo, Guatemala. Particular emphasis is placed on income constraints and consumer satisfaction with current water services. Determinants of nonpayment behaviors are identified through zero-inflated negative binomial regression models in order to take into account particular distributional characteristics of the amount of outstanding payments. Findings indicate that nonpayment behavior is a demonstration of consumer dissatisfaction with the low quality of water services. The frequency of service interruptions is found to be another determinant of nonpayment behavior. Results also suggest that nonpayment behaviors are more prominent in community-managed systems as compared to municipal systems. This analysis did not find evidence supporting a potential relationship between nonpayment behavior and household income.

The rest of the paper is organized as follows. Section 2 overviews the institutional framework of drinking water services in Guatemala. Section 3 describes the study site. Section 4 describes the survey design and sampling procedure. Section 5 introduces the econometric approach used to identify determinants of nonpayment behaviors. Section 6 shows survey and estimation results. Section 7 concludes the paper with a discussion of results and some policy implications.

2. Drinking Water Services in Guatemala

Guatemala does not have an integral, comprehensive law to regulate the use of water resources or the provision of safe drinking water. In contrast, the existing water legislation is ambiguous and fragmented across a number of codes, agreements, and regulations [*Ballestero et al*., 2005]. The Guatemalan Constitution, as well as the Municipal and Health Codes, decentralizes the responsibility of providing safe drinking water to the 335 municipalities in the country. According to the Health Code, the Ministry of Public Health and Social Assistance (MSPAS, for its initials in Spanish) is responsible for regulating and supervising water utilities in order to guarantee the universal provision of safe drinking water in urban and rural areas. In addition, the Institute of Municipal Development (INFOM, for its initials in Spanish) is mandated to invest in water infrastructure and help to develop the technical and managerial capacities of water utilities. Unfortunately, the water legislation does not define clear relations among stakeholders (i.e., water utilities, MSPAS, and INFOM, among others), which partially explains the lack of coordination in the water sector and the institutional isolation of water utilities [*Ballestero et al*., 2005].

The municipalities have the legal right to transfer the management of water systems to private entities, which legitimizes the existence of community-based water organizations (CBWOs) and private utilities in the country. The municipalities, private utilities, and CBWOs have total autonomy on setting water prices, enforcing consumer compliance with bill payments, operating water systems, and maintaining water infrastructure. Given the lack of a comprehensive institutional framework, municipal and private utilities, as well as CBWOs, operate their water systems according to their own internal regulations and local traditions with minimal support from government agencies [*D'Andrea*, 2012].

Municipalities are the main supplier of drinking water in urban areas, serving approximately 70% of urban households as of 2011 [*Vásquez*, 2014]. In contrast, CBWOs are the primary providers of water in rural areas serving about 40% of rural households. Municipalities provide water to 15% of rural households. Private utilities provide water to approximately 5% of urban and rural households. Unfortunately, water systems tend to be unreliable, services are frequently interrupted, and tap water is not tested on a regular basis to guarantee that it is safe to drink [*Vásquez*, 2014]. Several studies have reported that many urban and rural systems provide water that is contaminated, thus representing a significant health risk at the national level [e.g., *Galindo and Molina*, 2007; *Instituto de Agricultura, Recursos Naturales y Ambiente* (*IARNA*), 2005; *Vásquez*, 2013].

Water utilities seem unable to generate enough revenues to cover the costs of water supply [*SEGEPLAN*, 2006]. *IARNA* [2005] estimates that households pay US$0.25 to US$2.00 for 30 cubic meters of water. As a base of comparison, the cost of water supply in Guatemala City is estimated at US$0.25 to US$0.30 per cubic meter of water [*IARNA*, 2005]. According to *Economía, Sociedad, Ambiente, Ingeniería Consultores* [2005] , system operation costs are higher in urban centers that depend on groundwater, due to the use of energy for water pumping. Water utilities are expected to operate in financial deficits given that the costs of water supply surpass water tariffs. However, assessing the economic performance of water systems is difficult given that many water utilities do not keep updated records of water consumers and ignore the amount of water

produced. Moreover, municipalities, which could be expected to keep better financial information than community-managed utilities, usually aggregate water system revenues and costs into their general accounting systems [*IARNA*, 2005].

Low compliance with bill payments is considered as a key obstacle for cost recovery. According to *IARNA* [2005], the percentage of water consumers with outstanding payments can be as high as 70% in some municipalities. Water utilities seem to lack enforcement mechanisms, although some of them use penalties and service suspensions to enforce bill payments. However, communities show strong, sometimes violent opposition when water operators attempt to suspend water services to households that are late in their payments [*Vásquez*, 2011]. Against this backdrop, identifying the underlying factors driving nonpayment behavior among water consumers can be relevant to design policies for cost recovery and sustainable provision of water services.

3. Study Site

The study site, San Lorenzo is a small municipality of less than 11,000 inhabitants located 243 kilometers west of Guatemala City. Approximately 90% of San Lorenzo's population live in rural areas and the local economy is primarily based on agriculture. Poverty levels in the area are considerably high [*SEGEPLAN and INE*, 2006]. More than 83% of San Lorenzo's inhabitants live below the national poverty line. Extreme poverty is estimated at 32.6%, almost three times higher than the national average of 13% (according to national extreme and non-extreme poverty lines of 3206 (about US$414) and 6574 (about US$849) quetzals, respectively [see *INE*, 2006]). Labor markets are underdeveloped, so some citizens need to emigrate to urban centers, as well as to other countries, for job opportunities. According to the 2002 national census [*INE*, 2002], 12.6% of households in San Lorenzo reported that at least one member of the household had emigrated in the last 10 years.

Approximately 76% of San Lorenzo's inhabitants have access to water [*INE*, 2002]. The municipality provides water to a total of 300 households in the urban center. In rural San Lorenzo, 10 CBWOs provide water to more than 2300 households. The smallest CBWO serves 82 households. The largest CBWO reports to have almost 600 connections. Both municipal and community-managed water services are frequently interrupted. In addition, tap water is not tested on a regular basis so there is no guarantee that the water is safe to drink. Three water utilities (the municipality and two of the largest CBWOs) report to test their water for chlorine residual once per month, and one CBWO report to do so once per year. The rest does not test their water supplies for chlorine residual, presumably because they do not treat the water supplied.

The municipality of San Lorenzo seems to struggle in collecting revenues that could be used to improve water services. In 2010, the town had revenues of 8.35 million quetzals (about $1.1 million US dollars), mostly from government transfers. Less than 11% of municipal revenues were locally generated through taxes and service fees. This ranks San Lorenzo amongst the municipalities with least capacity to generate local revenues in the state of San Marcos [*FUNCEDE*, 2011].

Households connected to the municipal system have waters meters so their water bills are determined according to their consumption. The municipality implements some enforcement mechanisms to promote on-time bill payments, starting with mailing reminders to households that are 1 month late in their payments. If the household does not pay its outstanding bills after that reminder, the municipality sends a second reminder and charges a penalty equivalent to 50% of the total outstanding amount. The service to uncompliant households is suspended only as a last resort. The municipality reports that the service has been suspended in a few occasions only, because households usually pay after being notified on their late payments.

On the other hand, CBWOs charge a fixed fee for their water services, regardless of the level consumption, because water meters have not being installed in rural areas. The smallest CBWO does not charge water fees and depends exclusively on voluntary provision of inputs to perform system repairs when needed. Although CBWOs do not keep updated records of water bill payments, they report that several water consumers have outstanding water bills and that it is difficult to enforce on-time bill payment. Their enforcement mechanisms are limited to verbal reminders in general assemblies. Penalties are not imposed and services are not suspended presumably because CBWOs expect strong community opposition to those

measures. Enforcement mechanisms have been identified as a requirement for financial health of community-managed systems [*Madrigal et al*., 2011]. Thus, household nonpayment behavior may put the sustainability of water systems at risk, especially in rural areas of San Lorenzo.

4. Survey Design and Sampling Procedure

A household survey was implemented to gather primary data on opinions, behaviors, and preferences regarding water services in San Lorenzo. The survey design included one-on-one semistructured conversations and focus groups with local residents implemented through different iterations in order to incorporate feedback. Individual conversations and a focus group with eight local residents were initially conducted using a semistructured approach to identify the most pressing water issues in the eyes of the local population, and to learn about water behaviors adopted to cope with those issues. That feedback was used to design the survey questionnaire. Subsequently, two groups of local residents were asked to assess an initial version of the questionnaire for clarity, readability, and representativeness of local water problems and potential solutions. Their feedback was incorporated into the questionnaire, which was pretested through a pilot survey implemented by trained interviewers (local residents) with a random sample of 30 households. The final survey instrument was administered through in-person interviews in June–August 2012.

The survey questionnaire was divided into four sections. The first section collected information regarding service performance and household practices. More specifically, respondents were asked to report the number of days in the week prior to the interview in which they experienced service interruptions. The second section asked respondents to report their satisfaction with different service characteristics. The third section included a number of economic valuation questions used to elicit household preferences for improved services. The final section elicited respondents' sociodemographic information and household characteristics. Interviewers were instructed to evaluate the interview quality, including their perception on whether the respondent was truthful in their responses or not.

Although comprehensive assessment tools have been proposed to measure consumer satisfaction with water characteristics, responsiveness of water utilities, billing, and consumer services [e.g., *Fattahi et al*., 2011; *Franceschini et al*., 2010], several studies have shown that a small number of qualitative questions can depict consumer satisfaction with water services with a considerable degree of validity [*Deichmann and Lall*, 2007; *Vásquez and Trudeau*, 2011; *Vásquez et al*., 2011]. A similar approach was applied in this study to avoid respondent fatigue. Respondents were asked to report their satisfaction with four service characteristics using a four-tiered scale: (1) very unsatisfied, (2) unsatisfied, (3) satisfied, and (4) very satisfied. Water prices, pressure levels, water treatment, and service hours were selected to be evaluated based on preliminary focus group discussions that revealed that water consumers are particularly dissatisfied with those attributes.

The survey elicited information about nonpayment behavior of water consumers. The (translated) question reads as follows: How many of your water bills are pending of payment, if any? The question was carefully worded, and tested in focus groups. In addition, respondents were assured that their answers were anonymous and confidential, and that they would be used in aggregate analyses that would not identify them in any way. Responses to the nonpayment behavior question provide count data on outstanding payments of water bills. Given that the municipality and sampled CBWOs do not have reliable records of outstanding payments, the self-reported number of outstanding payments elicited by the survey instrument represents an alternative, dependable measure of nonpayment behavior.

The survey was administered to a total of 500 households in the urban center and the rural village of Santa Rosa. Both the smallest and largest CBWOs coexist in this village to provide water services. Out of the 500 sampled households, 52 are served by the smallest CBWO, 264 by the largest CBWO, and 184 are connected to the municipal system. A simple protocol was implemented to select the sampled households. In order to identify the next house to be interviewed, interviewers were instructed to generate a random number in the field. Appointments were arranged with sampled households that did not have time to respond the questionnaire in the first visit. Interviewers were instructed to replace a few households that could not be interviewed after a second visit. This study excluded the 52 households served by the smallest CBWO because this organization does not charge water fees. Consequently, the analysis of nonpayment behavior is conducted using 448 valid responses.

Table 1. Variables Definition and Descriptive Statistics

Variables	Definition	Mean	S.D.
PAYMENTS	Number of outstanding payments	1.143	2.294
SATISFINDEX	Standardized index of satisfaction	0	1
UNRELIABLE	Days per week with service interruptions	2.577	2.083
COMMUNAL	If the water service is provided by a community-based organization (1 = Yes; 0 = Otherwise)	0.593	0.492
HHINCOME[a]	Monthly household income (in 1000's quetzals)	1.493	1.788
REMITTANCES[a]	Monthly remittances (in 1000's quetzals)	0.414	0.852
WATERBILL	Monthly water bill (in quetzals)	21.452	10.636
COLORED	If the tap water is colored (1 = Yes; 0 = Otherwise)	0.192	0.394
HHSIZE	Household size	5.707	2.369
LIVING	Number of years living in current housing unit	20.444	13.510
ROOMS	Number of rooms in the housing unit	3.704	1.672
OWN	If the household owns the housing unit (1 = Yes; 0 = Otherwise)	0.941	0.236
CATHOLIC	If the respondent is catholic (1 = Yes; 0 = Otherwise)	0.243	0.429
PROTESTANT	If the respondent is protestant (1 = Yes; 0 = Otherwise)	0.611	0.488
FEMALE	If the respondent is female (1 = Yes; 0 = Otherwise)	0.723	0.448
EDUC	Respondent's years of schooling	6.123	4.579
BOTTLED	If the household consumes bottled water (1 = Yes; 0 = Otherwise)	0.286	0.452

[a]Income and remittances intervals are: 0 = no income; 1 = less than 1000 quetzals; 2 = 1000–2000 quetzals; . . .; 10 = 9000–10,000 quetzals; and 11 = more than 10,000 quetzals.

5. Econometric Modeling

From a conceptual perspective, the distribution of outstanding payments reported by sampled households can be influenced by two groups: complaint and noncompliant consumers. The latter can report a non-negative amount of outstanding payments as some of them could be on time with their payments at the moment of the survey. On the other hand, compliant consumers would always report to have no outstanding payments, which would increase the number of zeros in the distribution (i.e., excess zeros). The distribution of outstanding payments analyzed here shows a considerable concentration at zero (72%), as well as some overdispersion. The zero-inflated negative binomial (ZINB) regression model is suitable to address the overdispersion and excess zeros usually observed in count data. In the ZINB model, the response variable Y_i, outstanding payments in this study, has a probability mass function as follows:

$$\Pr(Y_i=y_i)=\begin{cases} p_i+(1-p_i)\left(\dfrac{\phi}{\mu_i+\phi}\right)^{\phi}, & y_i=0 \\ (1-p_i)\dfrac{\Gamma(\phi+y_i)}{\Gamma(y_i+1)\Gamma(\phi)}\left(\dfrac{\mu_i}{\mu_i+\phi}\right)^{y_i}\left(\dfrac{\phi}{\mu_i+\phi}\right)^{\phi} & y_i=1,\ 2,\ .. \end{cases} \quad (1)$$

where p_i is the probability that individual i is a compliant water consumer, ϕ is the reciprocal of the dispersion parameter with $\phi>0$, μ_i is the mean of the negative binomial specification (i.e., when $p_i=0$), and $\Gamma(.)$ is the gamma function. The parameters p_i and μ_i are assumed to depend on vectors of explanatory variables X_i and Z_i as follows:

$$\log\left(\frac{p_i}{1-p_i}\right)=Z_i\delta \text{ and } \log(\mu_i)=X_i\beta;\ \ i=1,\ 2,\ \ldots,\ n \quad (2)$$

where δ and β are vectors of parameters to be estimated using a maximum likelihood technique. It is assumed in this study that vectors X and Z include the same variables (i.e., $X=Z$).

Table 1 shows the covariates used to estimate the ZINB model presented in equations (1) and (2). A satisfaction index (SATISFINDEX) is included to test the hypothesis that outstanding payments are a demonstration of dissatisfaction with current water services (i.e., $\beta_{\text{SATISFINDEX}}<0$). The variables UNRELIABLE, COLORED, and COMMUNAL are also included to investigate how households respond to different service characteristics in their decision of paying late their water bills. Households are expected to have more outstanding payments as service interruptions are more frequent (i.e., $\beta_{\text{UNRELIABLE}}>0$). Water appearance may also affect households' decision to pay late their water bills. Hence, the binary indicator COLORED is included to investigate how households respond to water appearance. Households reporting that their water is colored are expected to have more outstanding payments than households that do not report so (i.e., $\beta_{\text{COLORED}}>0$), as a protest for the low quality of water.

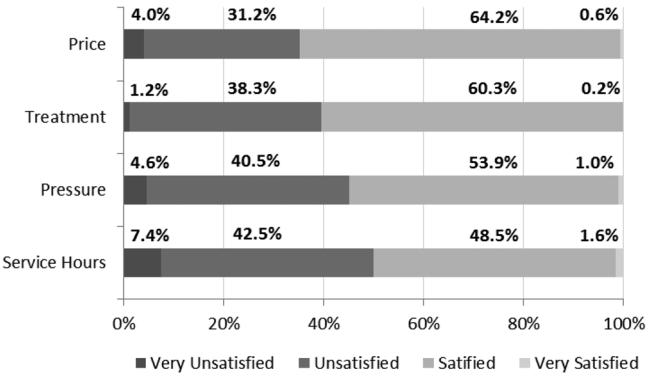

Figure 1. Consumer satisfaction with current water services.

The binary indicator COMMUNAL is included to investigate potential differentials in nonpayment behaviors between households with municipal services and households served by community-managed systems. Nonpayment behaviors are expected to be more prevalent in community-managed systems than in the municipal system (i.e., $\beta_{\text{COMMUNAL}} > 0$) given that, compared to the municipality, CBWOs in San Lorenzo seem to lack managerial skills (as shown, e.g., by inexistent or outdated records of water consumers) and payment enforcement mechanisms. The vector of covariates also includes the variables WATERBILL, HHINCOME, and REMITTANCES to test the hypothesis that households have outstanding payments due to their inability to pay for water services. The variable WATERBILL is expected to have a positive effect on the number of outstanding payments (i.e., $\beta_{\text{WATERBILL}} > 0$) given that it can be more difficult for households to pay higher water bills. On the other hand, the number of outstanding payments is expected to decrease with household income (i.e., $\beta_{\text{HHINCOME}} < 0$) and remittances (i.e., $\beta_{\text{REMITTANCES}} < 0$) because richer households have more ability to pay. Other household and individual characteristics are also included to control for the heterogeneity of respondents and their households. No prior expectations on the effect of those characteristics are held so those effects remain to be empirically estimated.

6. Survey and Estimation Results

Descriptive statistics presented in Table 1 provide a profile for the average respondent. Approximately 72% of the respondents were females, presumably because interviews were held during working hours when males are more likely to be out of home. The average respondent has barely finished elementary school, and has lived in their current home for about 20 years. More than 94% of sampled households are homeowners of housing units that have an average of (almost) four rooms. On average, households have almost six members, earn a monthly income of 1114 quetzals (143.74 US dollars), and receive 268 quetzals (34.58 US dollars) from relatives living in another city or country. These low levels of income and remittances are consistent with the high levels of poverty prevalent in the area.

Table 1 also shows some indicators on system reliability. Approximately 59% of the sampled households receive water from a community-managed system. The rest is served by the municipal system. Respondents reported experiencing service interruptions approximately three days per week. In addition, water pressure seems to vary across the town presumably because the system is inappropriate to serve households in more elevated areas. About 24% of respondents indicate that water pressure is low, almost 45% report regular pressure in their water flows, and 31% report having water services with high pressure. Monthly water bills are relatively low with an average of 21.45 quetzals (about 2.77 US dollars). The average bill is equivalent to 1.93% of the average household income (or 1.55% if remittances are added), which is below internationally accepted thresholds of water affordability [see *Organization for Economic Co-operation and Development*, 2003].

Figure 1 shows reported levels of satisfaction with prices, treatment, pressure, and service hours. A majority of respondents report that they are satisfied with current service characteristics. However, there exist a significant percentage of respondents who show some dissatisfaction particularly with the number of hours per day they receive water services. A significant percentage of respondents are also dissatisfied with current levels of water pressure (approximately 45%) and water treatment (almost 40% of respondents). Water price is the service characteristic that generates less dissatisfaction among respondents. Table 2 shows that reported levels of satisfaction with price, treatment, pressure, and service hours are associated to a single, latent satisfaction scale. Therefore, factor analysis of all four characteristics is conducted to uncover the

Table 2. Factor Analysis of Consumer Satisfaction

	Factor Loadings	KMO
Service hours per day	0.931	0.578
Water pressure	0.966	0.577
Water treatment	0.589	0.639
Water price	0.558	0.909
Single satisfaction scale		0.6245

single satisfaction scale and thus estimate a standardized satisfaction index. Satisfaction with daily service hours and water pressure show the highest factor loadings. Item-total correlations and Cronbach's alpha coefficients also show a considerable association between reported levels of satisfaction and a latent single scale.

Figure 2 shows the distribution of outstanding payments. A majority of respondents are on time with their payments. However, a substantial amount of respondents (28%) report to be late in their payments. The average of outstanding (monthly) payments among noncompliant households is 3.62 and the variance is equal to 7.73. This represents a considerable obstacle for water utilities that could use those revenues to improve infrastructure maintenance and service sustainability. The overdispersion and high concentration of respondents that are on time with their payments are particular characteristics of a zero-inflated negative binomial process.

Table 3 shows a zero-inflated negative binomial model estimated using STATA 13.1 in order to identify some determinants of nonpayment behavior. Likelihood ratio tests of the dispersion alpha coefficient indicate that negative binomial regression outperforms Poisson regression in modeling the overdispersed data at hand. In addition, *Vuong*'s [1989] test indicates that the data follows a zero-inflated process. The concentration of zero outstanding payments can be due to two types of respondents: (1) the compliant respondent that is always on time with her payments, and (2) the noncompliant respondent (i.e., prone to have outstanding payments) who happened to be on time with her payments at the moment of the survey. Therefore, a zero-inflated negative binomial model was used to estimate the marginal effects on the number of outstanding bill payments and on the probability of being a compliant consumer.

The marginal effects of SATISFINDEX are statistically significant (see Table 3), which suggests that consumer satisfaction with water services is a determinant of nonpayment behavior. Estimated marginal effects indicate that the number of outstanding payments would decrease by approximately 0.3 outstanding payments if consumer satisfaction is increased by one standard deviation. *Kayaga et al.* [2004] also found a significant relationship between consumer satisfaction and nonpayment behavior in Uganda. The marginal effects of UNRELIABLE are positive and statistically significant indicating that the number of outstanding payments increases with the frequency of service interruptions. Also, estimated marginal effects of COMMUNAL suggest that households served by community-managed systems have more outstanding payments than households with municipal services. This is expected given that the municipality has more managerial skills and enforcement mechanisms than CBWOs. It is worth to note that none of the budgetary variables (i.e., household income and remittances), nor the water bill, are found to be statistically significant for outstanding payments. This suggests that nonpayment behavior is not a reflection of inability to pay.

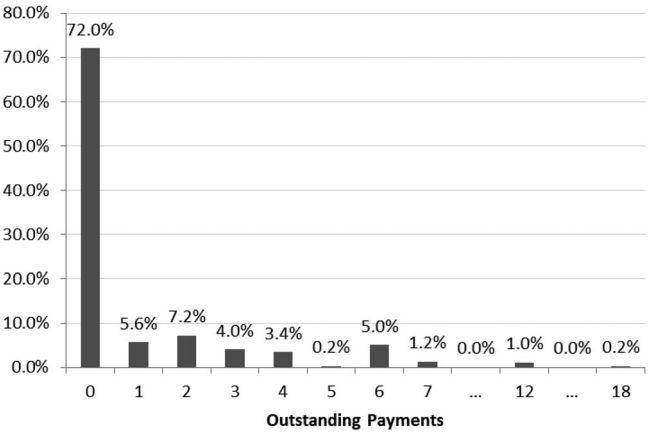

Figure 2. Outstanding payments of water bills.

Results also show that the number of outstanding payments decreases with each additional household member. Compared to smaller households, larger households have more members who can take the time to pay their water bills. Home ownership has a positive effect on the number of outstanding payments. On average, homeowners have almost one more outstanding payment than home renters. Rental contracts may hold accountable whoever is responsible for paying the water bill, landlord, or renter. Regardless of who agreed to pay the water bill, both of them may have few outstanding payments, if

Table 3. ZINB Model of Outstanding Payments (Marginal Effects)[a]

	Number of Outstanding Payments	Probability of Being a Compliant Consumer
SATISFINDEX	−0.302 (0.114)***	0.074 (0.016)***
UNRELIABLE	0.366 (0.066)***	−0.043 (0.016)***
COMMUNAL	0.788 (0.130)***	−0.216 (0.080)***
WATERBILL	−0.004 (0.006)	−0.002 (0.001)***
HHINCOME	0.148 (0.165)	−0.009 (0.054)
REMITTANCES	0.020 (0.246)	−0.018 (0.022)
COLORED	0.078 (0.294)	0.015 (0.035)
HHSIZE	−0.041 (0.001)***	0.018 (0.020)
LIVING	−0.010 (0.007)	0.003 (0.001)***
ROOMS	0.053 (0.030)*	0.015 (0.027)
OWN	0.842 (0.192)***	−0.070 (0.054)
CATHOLIC	0.184 (0.100)*	0.018 (0.060)
PROTESTANT	0.355 (0.185)*	0.006 (0.040)
FEMALE	0.010 (0.109)	0.161 (0.101)
EDUC	−0.060 (0.032)*	−0.010 (0.013)
BOTTLED	−0.442 (0.021)***	0.004 (0.127)
Zero observations	300	
Positive observations	139	
AIC	964.51	
BIC	968.60	
Alpha coefficient	0.316***	
Vuong test (Z score)	4.09***	

[a]Notes: ***, **, * imply significance at 1%, 5%, and 10% levels, respectively; numbers in parentheses are corresponding standard errors clustered by COMMUNAL. Vuong tests are performed without clustering errors.

any, to fulfil their rental contract. More educated individuals and respondents who consume bottled water report to have a smaller number of outstanding payments. It can be presumed that those individuals are more aware of the benefits of having access to water and, consequently, tend to adopt better bill payment behaviors than individuals who are not aware of those benefits.

Interestingly, findings indicate that respondents with catholic or protestant affiliation have more outstanding payments than respondents who reported not to practice any religion. This is unexpected given that religious norms tend to emphasize honesty and compliance. Given that the number of outstanding payments is self-reported, this result may suggest that catholic and protestant respondents were more truthful in reporting their outstanding payments than individuals with no religious affiliation. Other covariates seem to have little influence, if any, on the number of outstanding payments.

The ZINB model also allows for estimating marginal effects on the probability that the average individual is always on time with her payments (i.e., being a compliant consumer). Estimated effects of SATISFINDEX suggest that individuals with higher levels of satisfaction with current water services are more likely to be compliant consumers than respondents with lower satisfaction levels (see Table 3). In contrast, the probability of being a compliant consumer decreases with service interruptions. Results also indicate that the probability of being a compliant consumer is lower in CBWOs than in the municipal system by almost 22 percentage points. While WATERBILL is insignificant for the number of outstanding payments, its marginal effect on the probability of being a compliant consumer is negative and significant. This suggests that individuals are less likely to comply with their payments when water bills increase. Estimated marginal effects of LIVING indicate that the likelihood of being a compliant consumer increases with the number of years that individuals have lived in their housing unit. Individuals tend to create stronger links with their neighbors over time and those relations may function as social pressure mechanisms to comply with payments of water bills. Other variables seem to have little influence on the probability of being a compliant consumer.

As a robustness check, Table 4 presents two zero-inflated negative binomial models that follow the same specification to the model in Table 3 but are estimated using different subsamples of seemingly truthful respondents as an attempt to mitigate potential underreporting of outstanding payments. The first model was estimated using a subsample of respondents who seemed to be truthful in the eyes of the interviewers. A total of 19 respondents were excluded given that the interviewers perceived some degree of dishonesty in their responses. In addition, a subsample of religious respondents was used to estimate the second model under the assumption that catholic and protestant respondents would be more truthful in reporting the amount of outstanding bill payments than respondents who do not practice any religion. Both models yielded marginal effects that are comparable, in terms of sign and significance, to the model estimated using the full sample of respondents. An exception is that the marginal effect of LIVING becomes significant in both models (see Table 4). This result suggests that the number of outstanding payments decreases with the time that an individual has lived in their current housing unit.

Endogeneity is often a concern in cross-sectional data. In the context of this study, the consumer satisfaction index could be endogenous because some attitudinal variables (e.g., trust on water utilities) that are

Table 4. ZINB Models of Outstanding Payments Using Subsamples of Seemingly Truthful Respondents (Marginal Effects)[a]

	Respondents Who Seemed Truthful to Interviewers		Respondents With Religious Affiliation	
Subsample	Number of Outstanding Payments	Probability of Being a Compliant Consumer	Number of Outstanding Payments	Probability of Being a Compliant Consumer
SATISFINDEX	−0.302 (0.096)***	0.071 (0.019)***	−0.250 (0.096)***	0.073 (0.037)**
UNRELIABLE	0.361 (0.052)***	−0.039 (0.012)***	0.407 (0.090)***	−0.038 (0.013)***
COMMUNAL	0.809 (0.160)***	−0.272 (0.072)***	0.607 (0.158)***	−0.214 (0.025)***
WATERBILL	−0.005 (0.007)	−0.002 (0.001)**	0.001 (0.011)	−0.002 (0.001)***
HHINCOME	0.150 (0.128)	−0.015 (0.049)	0.093 (0.199)	0.005 (0.058)
REMITTANCES	0.017 (0.234)	−0.008 (0.009)	0.052 (0.285)	−0.041 (0.0003)***
COLORED	0.042 (0.319)	0.010 (0.042)	0.152 (0.286)	−0.023 (0.028)
HHSIZE	−0.042 (0.003)***	0.017 (0.018)	−0.049 (0.017)***	0.017 (0.020)
LIVING	−0.011 (0.007)*	0.003 (0.001)**	−0.013 (0.007)*	0.003 (0.002)*
ROOMS	0.062 (0.021)***	0.017 (0.027)	0.084 (0.061)	0.010 (0.006)*
OWN	0.974 (0.151)***	−0.116 (0.044)***	0.791 (0.164)***	−0.007 (0.040)
CATHOLIC	0.180 (0.046)***	−0.006 (0.105)		
PROTESTANT	0.338 (0.121)***	−0.034 (0.018)*	0.225 (0.125)*	−0.005 (0.010)
FEMALE	0.013 (0.104)	0.146 (0.101)	0.010 (0.109)	0.223 (0.118)*
EDUC	−0.058 (0.025)**	−0.010 (0.010)	−0.052 (0.037)	−0.011 (0.014)
BOTTLED	−0.461 (0.023)***	−0.017 (0.095)	−0.550 (0.005)***	0.060 (0.067)
Zero observations	286		257	
Positive Observations	134		119	
AIC	932.83		828.37	
BIC	936.87		832.30	
Alpha coefficient	0.300***		0.347***	
Vuong test (Z score)	4.11***		4.06***	

[a]Notes: ***, **, * imply significance at 1%, 5%, and 10% levels, respectively; numbers in parentheses are corresponding standard errors clustered by COMMUNAL. Vuong tests are performed without clustering errors.

unobservable may be related to both consumer satisfaction and outstanding payments. In that case, marginal effects of consumer satisfaction could be biased. The possibility of endogeneity, however, seems to be minimal because estimated marginal effects are stable across different model specifications. Nevertheless, a control function approach was applied to test for potential endogeneity of consumer satisfaction [see *Terza et al*., 2008]. A binary indicator on whether a child had experienced at least one episode of diarrhea in the last month was used as instrument (significant at 5% level). Estimated coefficients on residuals predicted from a first-stage regression model of consumer satisfaction were found to be statistically insignificant, ruling out the potential endogeneity of consumer satisfaction.

7. Discussion and Conclusions

This paper investigated the determinants of nonpayment behaviors using household survey data from the small, poor town of San Lorenzo, Guatemala. Survey results indicate that a majority of respondents is on time with their payments of water bills. However, 28% of respondents report to have an average of 3.62 outstanding (monthly) payments, which can put the sustainability of water service provision at risk. Results also show a considerable degree of dissatisfaction with current water services, particularly with service interruptions and pressure levels. Given the considerable percentage of seemingly compliant consumers (i.e., zero outstanding payments) and data overdispersion, zero-inflated negative binomial regression models were estimated to identify determinants of nonpayment behaviors. Estimation results indicate that consumer satisfaction and service interruptions are the primary determinants of nonpayment behavior, and that nonpayment behavior is more prevalent in community-managed systems than in the municipal utility. It was also found that the probability of being a compliant consumer decreases when water bills increase. No evidence was found to support the hypothesis that nonpayment behavior is a result of inability to pay. These results suggest that future analyses of nonpayment behavior need to move beyond the presumption that households do not pay their bills because they are poor. Other factors such as dissatisfaction with service performance can be more influential in adopting nonpayment behaviors, particularly in contexts with weak institutions.

The prevalence of nonpayment behaviors may generate a vicious circle with poor cost recovery, low-quality services, and further incentives for not paying water bills. Findings suggest that water utilities have control on some determinants of nonpayment behavior that can help breaking that vicious circle. For instance, a reduction in the number of outstanding bill payments can be expected from reducing the frequency of service interruptions. Furthermore, enhancing the balance between water prices and service quality (i.e., the number of daily hours with water services, pressure levels, and water quality) would help rising consumer satisfaction levels, which in turn would promote compliant payment behaviors. Improving water pressure and increasing the number of daily hours with water services would have the biggest impact on consumer satisfaction, so water utilities in San Lorenzo could prioritize potential investments to improve those service characteristics. Government agencies such as the Ministry of Health and the Institute of Municipal Development could assist municipal and community-managed utilities to improve their infrastructure and the quality of water services.

CBWOs seem to be less effective than the municipality in collecting bill payments. The lack of payment enforcement mechanisms is a primary concern for the financial sustainability of community-managed systems elsewhere [e.g., *Madrigal et al*., 2011]. This is particularly true in Guatemala where CBWOs are institutionally isolated [*Vásquez*, 2014]. CBWOs may lack administrative capacities and legal mechanisms needed to enforce water bill payments. It may also be more difficult for CBWOs to collect water payments due to social pressures. Future studies may further investigate the reasons why CBWOs are less effective in collecting bill payments than municipalities. Logical extensions to this study include analyzing the role of other behavioral and normative factors that were unobserved in this study. For instance, trust in water utilities, as well as household perceptions of fairness in water fees and sanctioning mechanisms, can affect nonpayment behaviors. It is hoped that this study will motivate further contributions to the scant literature on nonpayment behavior in the water sector, particularly in developing countries.

Acknowledgment
This study uses primary data that were collected through a household survey. The data are available from the author upon request.

References

Aguilar-Benitez, I., and J. D. Saphores (2008), An analysis of nonpayment of water services in Nuevo Laredo, Mexico, *Water Resour. Res.*, *44*, W08414, doi:10.1029/2007WR006225.

Ballestero, M., E. Brown, A. Jouravlev, U. Küffner, and E. Zegarra (2005), Administración del agua en América Latina: Situación actual y perspectivas, *Ser. Recursos Nat. Infraestructura 90*, Com. Econ. Am. Lat. Caribe, Santiago de Chile, Chile.

D'Andrea, A. (2012), Legal pluralism and customary water resources management in Guatemala, *Water Int.*, *37*(6), 683–699.

Deichmann, U. and S. Lall (2007), Citizen feedback and delivery of urban services, *World Dev.*, *35*, 649–662.

Economía, Sociedad, Ambiente, Ingeniería Consultores (2005), *Los servicios de agua potable y saneamiento para los pobres en Centro América, México, República Dominicana, y Haití*, Honduras.

Fattahi. P., A. Kherikhah, R. Sadeghian, S. Zandi, and S. Fayyaz (2011), An evaluation model for measuring customer satisfaction levels in a water supply domain: Case study—water supply in Hamedan. *Water Policy*, *13*, 490–505.

Fjeldstad, O. (2004), What's trust got to do with it? Non-payment of service charges in local authorities in South Africa, *J. Mod. Afr. Stud.*, *42*(4), 539–562.

Franceschini, F., M. Galetto, and E. Turina (2010), Water and sewage service quality: A proposal of a new multi-questionnaire monitoring tool, *Water Resour. Manage.*, *24*, 3033–3050.

FUNCEDE (2011), *Comportamiento Electoral Municipal En Guatemala: Elecciones General 2007, Ser. Estud. 22*, Guatemala.

Galindo, H., and J. Molina (2007), *Valoración estratégica sobre la importancia del agua potable y el saneamiento básico para el desarrollo, la salud y la educación en Guatemala*, Red de Agua Potable y Saneamiento de Guatemala, Guatemala.

Gorton, M., J. Sauer, M. Peshevski, D. Bosev, D. Shekerinov, and S. Quarrie (2009), Water communities in the Republic of Macedonia: An empirical analysis of membership satisfaction and payment behavior, *World Dev.*, *37*(12), 1951–1963.

Guevara Jerez, F. (2007), A thirsty country with lots of wáter, *Rev. Envío 310*, Univ. Centroamericana, Managua, Nicaragua.

INE (2002), *Censos Nacionales XI de Población y VI de Habitación 2002*, Guatemala.

INE (2006), *Encuesta Nacional de Condiciones de Vida: ENCOVI 2006: Diseño de la Muestra*, Guatemala.

Instituto de Agricultura, Recursos Naturales y Ambiente (IARNA) (2005), Situación del recurso hídrico en Guatemala, in *Documento Técnico del Perfil Ambiental de Guatemala*, Univ. Rafael Landívar, Guatemala.

Kayaga, S., R. Franceys, and K. Sansom (2004), Bill payment behavior in urban water services: Empirical data from Uganda, *J. Water Supply Res. Technol.*, *53*(5), 339–349.

Madrigal, R., F. Alpízar, and A. Schlüter (2011), Determinants of performance of community-based drinking water organizations, *World Dev.*, *39*(9), 1663–1675.

Mugabi, J., and S. Kayaga (2010), Attitudinal and socio-demographic effects on willingness to pay for water services and actual payment behavior, *Urban Water J.*, *7*(5), 287–300.

Mugabi, J., S. Kayaga, I. Smout, and C. Njiru (2010), Determinants of customer decisions to pay utility water bills promptly, *Water Policy*, *12*, 220–236.

Nyarko, K. B., S. Oduro-Kwarteng, and I. Adama (2007), Cost recovery of community-managed piped water systems in Ashanti region, Ghana, *Water Environ. J.*, *21*, 92–99.

Organization for Economic Co-operation and Development (2003), *Social Issues in the Provision and Pricing of Water Services*, Paris, France.

Secretaría de Planificación y Programación de la Presidencia (SEGEPLAN) (2006), *Hacia el cumplimiento de los objetivos de desarrollo del milenio en Guatemala: II informe de avances*, Guatemala.

SEGEPLAN and INE (2006), *Mapas de Pobreza en Guatemala 2002*, Guatemala.
Terza, J. V., A. Basu, and P. J. Rathouz (2008), Two-stage residual inclusion estimation: Addressing endogeneity in health econometric modeling, *J. Health Econ.*, *27*(3), 531–543.
Van Schalkwyk, A. (2012), A case study of non-payment for municipal services in the Vhembe district municipality, *Med. J. Soc. Sci.*, *3*(12), 90–105.
Vásquez, W. F. (2011), Municipal water services in Guatemala: Exploring official perceptions, *Water Policy*, *13*(3), 362–374.
Vásquez, W. F. (2013), Rural water services in Guatemala: A survey of institutions and community preferences, *Water Policy*, *15*(2), 258–268.
Vásquez, W. F. (2014), La Gestión de los Servicios Comunitarios de Agua Potable en Guatemala, in *Guatemala: Gobierno, Gobernabilidad, Poder Local y Recursos Naturales*, edited by G. Sánchez Medero and R. Sánchez Medero, Tirant lo Blanch, Valencia, Spain.
Vásquez, W. F., and J. Trudeau (2011), External and internal consistency of user evaluations, *Int. J. Publ. Admin.*, *34*, 918–925.
Vásquez, W. F., J. Trudeau, and D. Franceschi (2011), Can user perception influence the quality of water services? Evidence from León, Nicaragua, *Int. Rev. Admin. Sci.*, *77*, 481–503.
Vuong, Q. (1989), Likelihood ratio tests for model selection and non-nested hypotheses, *Econometrica*, *57*, 307–333.
Zhong, L., and A. Mol. (2010), Water price reforms in China: Policy-making and implementation, *Water Resour. Manage.*, *24*, 377–396.