Which Consumers Consult their Water Bill?
Evaluating Knowledge, Expectations, and
User Type as Factors of Information Search in Costa Rica

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Abstract

Water and electricity utility companies are increasingly looking for ways to communicate and convey information to customers, including on issues of resource scarcity, resource-saving tips, billed quantity and tariffs, among others. Evaluating residential customers' attention to billing information, and how it varies among customers, is relevant to understanding consumption behavior, responses to changes in tariffs, and to improve utility-customer communication channels. Despite this importance, no previous studies have evaluated this question. This research applies attention theory and builds on previous empirical work to evaluate the determinants of residential search for their water billing information. We take advantage of the transition to a digital water-billing program in the city of San Jose, Costa Rica; we surveyed a representative sample of 850 households and matched this information to their water billing records. We apply multivariate regression analysis to evaluate whether residential consumers consulted their bills following the introduction of this new digital system. Results show that bill consultation is correlated with several factors: satisfaction with, and accessibility of, new communication channels; customers' expectations on water prices; baseline water use, expenditure on water, and knowledge of the information provided in the bill. These variables are better predictors of bill consultation than socio-demographic variables. In addition, adaptation to new communication channels appears to be related to the same factors that influence information search, and also to socio-demographic characteristics, such as household head's age, gender, education and household income.

1. Introduction

Water and electricity utility companies are increasingly incorporating demand management strategies into their long-term sustainability – resource and financial – plans. Utility companies thus look for ways to effectively convey information and communicate with their customers on billing matters, issues of scarcity and conservation interventions, water-saving tips, among others. In providing such information, utilities seek to improve resource distribution, address supply limitations, and collect revenue from customers' payments, in order to maintain the financial sustainability of service provision. Yet there is no guarantee that information provided by the utility reaches the consumer. Clearly, the communication channels deployed will influence whether customers are able to search and access the information provided by the utility. Yet, little is known about the communication channels that foster better consumer understanding of their water use and utilities' resource management, and what other factors play a role in customers' information search. This study examines the factors that determine residential consumers' attention to water billing information in particular.

Recent studies that evaluate customers' knowledge about the information provided in their water or electricity bill find that customers often lack awareness of the quantity of water or electricity they use, as well as the price that they pay for these services (Brent and Ward 2019; García-Valiñas, Martínez-Espiñeira and Suárez-Varela Maciá 2021; Beal *et al.* 2011; Beal, Stewart and Fielding 2013; Martins and Moura E Sá 2020; Martins and Moura E Sá 2011). However, these studies have generally not examined what determines customers' attention to bill information. Two exceptions are Brent and Ward (2019) and García-Valiñas, Martínez-Espiñeira and Suárez-Varela Maciá (2021), who tried to model knowledge of bill information and misperceptions of bill information, respectively. Brent and Ward (2019) reported that knowledge of information about the bill is related to the quantity of water use, and García-Valiñas et al. (2021) reported that customers' perception of lack of detailed information in the bill and customers' knowledge of the utility's website were correlated to misperception of bill information. Other studies in this literature provide mostly anecdotal information on the lack of awareness of billing details.

Previous work has highlighted the fact that water management strategies cannot rely on individual customers' attitudes and beliefs because these perceptions and the facts of consumption are often in opposition. For example, Beal et al. (2011) and Beal, Stewart and Fielding (2013) show that higher use consumers may erroneously perceive themselves to have low water use, and vice-versa. Since water quantity and tariffs are often shown in bills, evaluating how residential customers use this bill information, and the extent to which this use varies, is relevant to understanding how consumers respond to this information, and to improve utility-customer communication channels. Unfortunately, research on the factors that determine consumer's attention to bill information is limited. Such factors could include characteristics of the communication channels, consumers' socio-demographic characteristics, variables related to consumers' perceptions and knowledge of their water services. This research applies theories of information search (Stigler, 2961) and rational inattention (Sallee,

2015) and builds on previous empirical work to evaluate the determinants of residential customers' attention to bill information.

Specifically, we analyze survey data from of a representative sample of 850 households living in the city of San Jose, Costa Rica, collected in the context of a digitalization program of all water bills. This program totally changed the communication channels for providing billing information to utility customers, which allows us to evaluate how residential consumers reacted to the change and adapted their information search behaviors. Besides characteristics of the communication channel and service aspects, we evaluate the role of customer characteristics, including sociodemographic factors, as well as consumer perceptions and water use behaviors. We collected information on these characteristics through a customer survey that was matched to utility billing records. Leveraging these data, the statistical analysis also examines heterogeneity in these characteristics, and in their influence on bill consultation.

Results show that bill consultation depends on several factors: satisfaction with, and accessibility of, the digital communication channel (including customers' sense of the ease of use of the platforms available and customers' access to required technology). Once the characteristics of the communication channel are controlled for, other key factors, include customers' expectations on future water prices and perspective on the comparison between the price per cubic that customers pay versus what it costs to deliver the service, baseline knowledge of information provided in the bill (such as the understanding of the unit that the utility uses to calculate the bill -in this case cubic meters-, or knowledge of the tariff structure), household expenditures on utility services, and water service experience (in particular their exposure to rationing and water quality issues). These variables are better predictors of bill consultation than socio-demographic variables. In addition, when evaluating customers' adaptation to the new invoice digitalization program, the importance of the same factors that influence information search is emphasized, along with several socio-demographic characteristics, including gender, age, and education of the household head, as well as household income.

The next section of the paper reviews the existing literature from information search theory, with a particular focus on customers' lack of awareness of bill information. The third section presents a description of the water and sanitation services in San Jose. The fourth and fifth sections present the data and empirical analysis. The sixth section presents results. The seventh section presents a discussion and policy implications, and the eight section concludes.

2. Background (Literature Review)

This section summarizes findings from prior literature, concerning what residential customers' know about their bills, as well as how the theory of rational inattention can be used to conceptually frame the question of bill consultation.

Lack of awareness of residential consumers about the bill information

Much research has focused on consumers' lack of awareness of price and tariff structures, as well as the quantity of water (or electricity) used. Work focused on price and tariff structures has considered lack of knowledge about pricing information; however, some have reported that knowledge of the total bill is better than knowledge of pricing structure. Agthe and Billings (1988) evaluated the effects of rate structure knowledge on household water use with data collected from 332 households surveyed in Tucson Arizona in 1980. They found that 75% of the sample did not know that the utility that provided them water had used an increasing block rate pricing structure for seven years, 22% were aware of the block rates and believed they reduced water use, and 3% were aware but believed the rate structure had no effect on water use. Brent and Ward (2019), in a study of 30,000 households (single family homeowners) in Melbourne, evaluated consumers' knowledge about water billing information and the costs of water supply. They found that consumers have 'reasonably accurate knowledge of the total bill'*;* however, they had very poor knowledge about the marginal price of water. García-Valiñas, Martínez-Espiñeira and Suárez-Varela Maciá (2021) surveyed 1,465 households in Granada and analyzed consumers' perceptions of price and quantity in their past water bill and compared these perception to actual data from the water utility. They reported that consumers tend, on average, to highly overestimate the amount of their bill (by more than double on average). Approximately half of respondents considered their bill 'not detailed enough', a third of respondents reported knowing the type of tariff structure[1], and around a fifth reported knowing the supplier's website. Martins and Moura E Sá (2011) collected consumer survey data in eight municipalities of the Portuguese autonomous region of Madeira. They found that a 50% of domestic users could not identify the type of tariff applied and the components charged along with water consumed. These authors argued that this lack of knowledge distorts the ability of domestic consumers to relate the size of the bill to the volume of the water purchased.

Regarding the quantity of water used, most studies that evaluate consumers' knowledge on this information report a lack of awareness, and a great deal of misperception of whether they are high or low water users compared to others. Brent and Ward (2019) reported that respondents can overestimate and underestimate water use. They reported a mean error[2] of 374% for total water used, 2% for the total bill, 172% for the average water price. They concluded that the quantity of water use was not salient for many consumers in their study setting. Most consumers could not identify the water use

[1] The authors noted that the variable on tariff structure "[did] not indicate knowledge of the price of each block and the amount of the fix component but only a very basic awareness of the type of tariff structure."
[2] Brent and Ward (2019) use the term 'mean error' to refer to the average percentage difference from the estimate and the correct answer.

reductions that would result from specific conservation actions, and most consumers exhibited low confidence in their answers. Beal *et al.* (2011) and Beal, Stewart and Fielding (2013) in a study that included 252 households in Queensland Australia in 2010, reported results about differences between perceived and actual residential water use, leveraging survey and smart meter data. In that study, the total sample mean actual water use was 370.7 L/hh/d[3]. However, the mean actual water use by households who perceived themselves as low water users was higher (407 L/hh/d) than the total sample mean. On the other hand, the mean actual water use of households who perceived themselves as high water users was lower (301 L/hh/d) than the overall mean. Finally, the mean actual water use of households who perceived themselves as medium water users was higher (452 L/hh/d) than the overall sample mean. García-Valiñas, Martínez-Espiñeira and Suárez-Varela Maciá (2021) concluded that Granadan consumers´ knowledge of the quantity of water they used and their water bill was poor, and that on average, consumers underestimate their water use.

A small number of studies have modeled customers' knowledge and/or misperceptions of bill information, or have evaluated why customers have little interest in such information. Brent and Ward (2019) modeled consumers' knowledge of billing information but struggled to identify a suitable model for their analysis. However, one of the variables that consistently appeared to be significant in explaining such knowledge was water use, finding that households who use more water had more accurate knowledge[4]. García-Valiñas, Martínez-Espiñeira and Suárez-Varela Maciá (2021) in their analysis of misperceptions of water bill information in Granada used a latent class model to differentiate "better performers" and "worse performers", according to their level of misperception. They found that some of the factors that explain misperceptions include perceived lack of detail in the water bill customers' receive and knowledge of the supplier's website. They also observed that being billed collectively for hot water seemed to increase misperceptions (frequency of billing in that case is different from that of the main water bill). Martins and Moura E Sá (2020) reported, based on survey data from 159 residential consumers of the Centre Region of Portugal, that the information provided in bills was regarded as complex, and that this complexity might be associated with the terminology used. Many consumers criticized the extensive usage of acronyms and abbreviations that were hard to understand. The majority of consumers wanted water bills that were as informative as possible, rather than simplifying and transferring information to websites.

The studies reviewed here find a generally low level of awareness of water bill information (price, rate structure, quantities). However, this prior work has not formally examined what factors drive residential water consumers to consult their bills. Although it is perhaps not surprising that consumers would have misperceptions about the information in their water bills, given the complexity of many rate structures, the magnitude of misperceptions and the consistency of results across studies should give

[3] L/hh/d: liters per household per day.

[4] Also, when Brent and Ward (2019) modeled overestimation of the bill information, they found that those with high water use were less likely to overestimate almost all components of the costs of using water (low water users were more likely to overestimate costs).

utility managers pause. These misperceptions are typically quite large (Brent and Ward, 2019; Martins and Moura E Sá, 2020; Agthe and Billings 1988). Previous studies have identified factors that could influence this lack of awareness of the information in water bills, such as limited and difficult to understand information content (Agthe and Billings 1988; Mayol and Staropoli 2021), time and cognitive costs associated with understanding and reviewing bills (Jessoe and Rapson, 2014), complexity of rate structures (Agthe and Billings, 1988; Martins e Sa 2020), and inclusion of extra charges in the water bill (e.g. connection or sewage charges, sometimes even garbage collection charges). Thus, prior literature has helped identify potential factors that influence the lack of awareness, but has stopped short of formal and holistic evaluation using multivariate regression methods. This study aims to fill this gap.

Rational inattention theory and the process of information search

Rational inattention theory describes processes of information search, largely focusing on its benefits and costs. An extensive literature in behavioral economics considers how consumers deal with or use information to make choices. Theories of rational inattention have provided very rich foundations about the mechanisms behind agents' decisions to pay attention to information, and on the conditions that foster greater attention. Theories of rational attention as well as information search propose that consumers look for just the right amount of information in order to maximize utility. In other words, consumers weigh the costs and benefits of efforts to search for and process information, and only pay attention if the expected benefits outweigh costs. Sallee (2015) and Houde (2018) explain that "consumers have limited resources to spend on processing information, and therefore they allocate attention such that learning about attributes has the highest expected returns." Also, in the process of minimizing the level of effort exerted in information search, consumers tend to apply simplified heuristics to complex problems. For example, we have observed from prior work that residential consumers are often inattentive to water use and billing. The theory of rational attention provides a basis for evaluating what factors customers consider when evaluating the benefits and costs of searching for information about their water bill.

Analyses of information search behavior have focused on aspects of the information provision, such as the salience, complexity, and accessibility of information. Individual characteristics could also influence attention to information, in particular factors related to customers' experience with the good/service.

3. Description of Water and Sanitation Services in San Jose, Costa Rica

The National Institute of Aqueducts and Sewer's (AyA's) Water and Sanitation Services in the Metropolitan Area of Costa Rica

The greater metropolitan area (GMA) is the largest urban area in Costa Rica, and includes the capital, San Jose, and surrounding urban areas. Its population is about 2.2 million inhabitants. Various water providers are located in this area, with the major provider being the National Institute of Aqueducts and Sewers (AyA), which provides water to about 65% of the GMA. AyA provides water and sewage services to its customers with a coverage of about 95% for water services and 60% for sewage; over 90% of AyA customers are metered. The majority of customers believe the quality of service is good, although some customers experience problems. Nonetheless, water reliability has remained a challenge over the last 20 years, with rationing occurring often during summer – spanning February to April – and affecting between 10% and 40% of AyA customers, depending on the severity of the dry season each year. Affected neighborhoods have principally been those located far from distribution centers or at higher altitudes, and include neighborhoods of all economic strata. Average household water use is about 15 cubic meters per month.

AyA has applied an eight-block increasing block tariff (IBT), and the tier breakpoints over the period of analysis remained constant at 15 m^3, 25 m3, 40 m3, 60 m3, 8 0m3, 100 m3 and 120 m3 per month. Between 2014-2019 (the study period), price changes have been applied to consider inflation, but there have also been other real tariff increases to reflect increases in costs over time. Table 1 below shows AyA's tariff structure in 2014 and 2019 for water and sewage services.

Table 1: AyA Water and Sanitation Tariff Structure for Residential Customers in 2014 and 2019 [2014 Constant Prices]*

Consumption Block (m^3/month)	2014				2019			
	Water (₡/ m^3)	Fixed Charge Water (₡/ month)	Sanitation (₡/ m^3)	Fixed Charge Sanitation (₡/ month)	Water (₡/ m^3)	Fixed Charge Water (₡/ month)	Sanitation (₡/ m^3)	Fixed Charge Sanitation (₡/ month)
0 - 15	330	1,500	132	600	331	1865	254	1119
16 - 25	661		264		662		508	
26 - 40	727		289		732		554	
41 - 60	861		342		862		659	
61 - 80 / 81 - 100 / 101 - 120	1,582		629		1,590		1,209	
> 120	1,663		662		1,670		1,273	

* Exchange rate: 1 USD = 538.3 ₡ (2014 prices)

Digitalization of the Billing System in the GMA

In 2014, AyA changed the way it delivered billing information to customers. Prior to 2014, all AyA's customers received their bill in printed format. AyA's workers would hand deliver these printed bills to every customer's home. Beginning in January 2014, AyA started to rollout a program to steadily convert all customers to receive their bill in digital format. To access these digital bills, customers had to sign up to receive their bill by email, or alternatively, they could use other platforms to access their bills, including the utility website and text messaging. They could also visit customer service offices in person. After 2016 (two years after the digitalization first started), additional platforms were introduced (mobile app, WhatsApp and Facebook). Table 2 shows the percentage of users of each platform in the years before and after the bill digitalization program.

Table 2: Channels to Deliver Billing Information to Customers and Percentage of Users

BILL INFORMATION MECHANISM	HOW USER HAD ACCESS	PERCENTAGE USERS							
		2012	2013	2014 Digital Rollout	2015	2016	2017	2018	2019
MAIN BILL DELIVERY MECHANISM									
Printed invoice	Bills were distributed door by door	**100%**	**100%**	**Rollout**					
Invoice by e-mail	Customers need to register to get the bill by e-mail			**Testing**	**7%**	**14%**	**22%**	**25%**	**30%**
COMPLEMENTARY INFORMATION MECHANISMS									
Customer service	Customers go to agencies for in person service	3%	3%	3%	3%	4%	2%	2%	2%
AyA web page	Customers get online and consult their bill with their Customer ID	2%*	3%*	6%*	8%*	13%*	13%*	16%*	n.a.
800 phone line	Customers call the phone line	2%	2%	2%	2%	1%	2%	4%	n.a.
SMS	Customers dial a number to request the information		10% ¥	10% ¥	10% ¥				
Mobile app	Customers dowload the app and then check the app for new bills.							8%ψ	
WHATSSAP	Customers can request the bill information by whatssap message							1%	
FACEBOOK	Customers can request the bill information by facebook message								0.1%

* No precise information is available. Estimated based on information about the number of accesses and assumptions about number of times the same customer revise this information in the web.

¥ No precise information on this platform has been confirmed yet. These estimates are based on interviews to the utility's Communication Dept. officers.

ψ This percentage is estimated based on the number of users that have installed the mobile application.

Own elaboration. Sources: Interviews and information provided by AyA Communication and Customer Services Departments.

The transition of the bill delivery system changed two main factors for customers: i) the costs of information search, and ii) the information that was made available to them. Information search costs changed in two directions. On the one hand, for customers that had to learn a new way to access their information, this imposed a new, and potentially significant learning cost. On the other hand, customers who liked and were already familiar with digital tools may have faced few if any search costs under the new system. Once a customer accessed their water bill, different platforms provided different

information. If a customer received their water bill by email, it had the same information as the old printed bill. However, the other platforms, including website and apps did not have readily available all the information on the printed bill. For example, customers would have to go through more steps to access their water use history or see a breakdown of the various charges in their water bill).

4. Data Collection

Three focus groups and a survey was implemented to collect information on customers' access and attention to billing information, as well as water use perceptions, household water appliances, and households' socio-economic and demographic characteristics. In addition to the survey questions, data from utility billing records were matched to the surveyed sample.

Focus groups

Three focus groups of 6, 6, and 5 people respectively were conducted in April 2019. All the participants where heads of households and they were selected based on variability on socio-economic backgrounds, gender, age, location of the city, as well as with different problems of water outages. The focus groups sessions were recorded with the permission of the participants. A remuneration of USD 35 was provided to every participant for a session that took about 2 hours each. During these focus groups, qualitative information was collected to evaluate and test the theoretical background about households' attention to their water use and water bill information, water use habits and appliances, their experiences with water outages and water quality, their opinion about the water utility, and their experience during the invoice digitalization program. The information collected during focus groups was a key input for the survey instrument design.

Sampling for Survey Implementation

The population is the full set of households of the GMA who are residential customers of the national water utility (AyA), and who have private (non-shared) meter connections (about 308,000 customers).

The sampling method used consisted of simple random sampling from the list of all residential customers of AyA that have private meters, stratified by socio-economic stratums (SES). The percentage of census blocks by socio-economic status (SES) categories in the study area corresponded to: *High SES level*: 19%, *Medium SES level*: 63%, and *Low SES level*: 18%. We identified the socio-economic stratum category of AyA customers by matching SES strata category (high, medium and low) by census block, with AyA customers GIS location. SES strata category were defined by using census data at the micro-level (household and individual level) along with principal component analysis to develop a wealth index and categorize census blocks in the study area into high, medium, or low socio-economic stratums.

The sampling strategy was designed with the aim of achieving a distribution of respondents in each stratum that was similar to that specified above. This approach ultimately yielded the following percentages: *High SES level*: 14%, *Medium SES level*: 66%, and *Low SES level*: 20%. These percentages are very close to the original target, with slightly fewer high SES respondents and slightly more medium SES respondents. AyA provided customers' contact information to enable phone or email survey modes. Importantly, the final sample was drawn only from the list of customers who had provided AyA with their contact information. This list comprises approximately 62% of all AyA customers, and represents a possible source of bias relative to a representative sample of such customers.

To assess the potential bias, we compare the population characteristics of the general area to the characteristics of sample respondents and their households. The statistics presented in Tables A1 and A2 in Appendix A show that the sample is similar and therefore appears to be representative of the population in terms of water billing records, as well as the socio-economic and demographic data.

Survey implementation

The survey was programmed in Qualtrics to be implemented by phone and internet. The survey was administered from October to December 2020. Interviews were conducted with the person in the household in charge of settling the water bill. The total survey time was about 20 minutes. For the phone mode, enumerators were instructed to replace the interview after 5 failed attempts, or if the contacted person declined the invitation to participate. For the online implementation mode, 5 reminders were sent by email. The aggregate response rate was approximately 18%. For replacements, a randomly selected customer from the same stratum was selected, for both modes of implementation. The survey was designed and implemented under Institutional Review Board (IRB) approval at UNC-Chapel Hill.

5. Modeling Strategy

The theory and analysis of information search was first developed in the 1960s with pioneering work by Stigler (1961). Both rational inattention and information search theories explain that consumers weight the costs and benefits of search effort when seeking information, and that they only engage in search if the expected benefits outweigh the costs as these contribute to utility. Thus, the consumer will look to optimally allocate search effort, to the point where the marginal cost of search equates to its expected marginal return.

From the literature and informed by focus groups in the study location, we categorized factors that might influence how customers analyze these benefits and costs, including: characteristics of the communication channel (information provision), characteristics of

the service, and characteristics of the customer, which include socio-demographic factors, as well as customer perceptions of the service. Equation (1) below provides a simple model of bill consultation:

$$BC = \boldsymbol{W}'\beta_1 + \boldsymbol{E}'\beta_3 + \boldsymbol{K}'\beta_2 + \boldsymbol{C}'\beta_4 + \boldsymbol{\Lambda}'\beta_5 + \boldsymbol{S}'\beta_6 + \varepsilon \qquad (1)$$

Where, $\boldsymbol{BC}$ is a variable of bill consultation (in this analysis, this variable takes three forms, each representing a different dependent variable for bill consultation). $\boldsymbol{W}'$ is a vector of user types, measured in terms of consumption levels and expenses on water. $\boldsymbol{E}'$ is a vector of expectations of price increases and perception of cost vs. price, and $\boldsymbol{K}'$ is a vector that indicates baseline knowledge of information provided in the bill. $\boldsymbol{S}'$ is a vector of customers' socio-demographic characteristics. $\boldsymbol{\Lambda}'$ is a vector of the water service characteristics. $\boldsymbol{C}'$ is a vector of characteristics of the communication channel.

According to equation (1), consumers are more likely to be rationally attentive to the water bill information if 1) the costs of accessing information are lower (accessible communication channels); 2) there have been additional costs of the service through problems of quality or continuity; 3) a customer is a high water user; 4) expenditures on water as a share of income or other basic expenditures is higher; 5) a customer expects price increases or expects the price to be higher than the cost of service delivery; and 6) the cost of cognition to understand the attribute is lower (this is related to the baseline knowledge that customers have on the information presented in the bill). Socio-demographic variables may also influence attention. Table 3 summarizes and defines all variables included in the model.

Table 3: Variables included in Model of Search for Water Bill Information

Characterization			Variable in Model	Definition of Variable	Time Dimension of Data
Dependent Variables (Forms of Search)					
[redacted]			**Bill consultation**	Binary variable that takes the value of 1 if the consumer consults the bill and 0 otherwise.	Collected during survey for present time and by recall: • 'Within the last two years' (2018-2019) • 'More than two years ago' (2016 – 2017) • 'When the invoice digitalization started' (2014-2015) • 'When received printed invoices (pre-digitalization)
			Frequency of bill consultation	Categorical variable with three categories describing the frequency in which a consumer consults the bill: never (base outcome), some months, and every month.	
			Adaptation group	Categorical variable that classifies customers according to how fast they re-started consulting the bill after the digitalization program: never (base outcome), right after digitalization, a couple of years after digitalization, or several years after digitalization.	n.a.
Explanatory Variables					
Characteristics of the consumer	In relation to the service	User type	**Consumption level**	Continuous variable representing customers' average consumption level (m3/month). This variable can also be categorical (e.g. high-level users vs. low level users).	Constructed from utility billing records time series
			Expenditure	Continuous variable for customers' share of water expenditure as a fraction of income, or share of water expenditure as a fraction of utility service expenses [water +electricity]).	Collected for survey's time
		Expectations on Prices & Cost vs. price	**Price increases**	Categorical variable that indicates whether customers have been concerned about water price increases in recent years.	Collected for survey's time
			Cost vs. price	Categorical variable that indicates customers' perspective on the comparison between the price per cubic that customers pay and what it costs to AyA to deliver a cubic meter of water. Categories: higher price than cost, higher cost than price, about the same, or not sure.	Collected for survey's time
			Efficient Utility	Categorical variable that indicates whether customers' think that water utility manages operations efficiently.	Collected for survey's time
		Baseline Knowledge	**Of cubic meters**	Categorical variable that indicates whether they understand what a cubic meter means in terms of water use (how many liters a cubic meter has).	Collected for survey's time

			Of tariff structure	Categorical variable that indicates whether customers know what tariff structure the water utility uses to calculate their bill.[5]	Collected for survey's time
			How to find price information	Categorical variable that indicates whether customers know how to find information[6], in this case, the price information.	Collected for survey's time
			Exhaustible Resource	Categorical variable that indicates whether customers believe that water is an exhaustible resource.	Collected for survey's time
	Socio-demographic		**Education level**	Household head education level (defined as 10 levels).	Collected for survey's time
			Gender	Household head gender / gender of person who pays the water bill.	Collected for survey's time
			Age	Household head age (discrete variable).	Collected for survey's time
			Income	Household income (self-reported, in a scale of 7 range-levels).	Collected for survey's time
			SES level	Categorical variable that indicates 3 levels of socio-economic stratum (high, medium, low).	Constructed from Census Blocks (2011)
Characteristics of the Service			**Continuity**	Categorical variable that indicates customers' rationing exposure (evaluated by customers' location and districts that were affected by rationing).	Collected for survey's time
			Water Quality Issues	Categorical variable that indicates customers' reported frequency of water quality problems.	Collected for survey's time
Characteristics of the Information Provision System			**Satisfaction Consultation Platforms**	Categorical variable that indicates customers' satisfaction with the consultation -platforms available.	Collected during survey for present time and by recall: 'when the digitalization started', and 'when received printed invoices
			Easy Access	Categorical variable that indicates ease of access to the information channel.	
			Type of Contact	Categorical variable that indicates the type of contact information that customers had provided to the utility company, either home phone, cell phone, email, or a combination of those.	Collected from utility records for 2019
			Where Pay Water Bill	Categorical variable that indicates the payment channel that customers use: in-person, manually in online banking, or automatic payment.	Collected during survey for present time and by recall: 'when the digitalization started', and 'when received printed invoices

[5] This question only asked if customers knew that the water charges applied to calculate their bill changed with the level of consumption.
[6] Given that the tariff structure is not specified in the water bill, respondents were asked to indicate where they could find such information on the digital platforms.

6. Results

In this section, we present results on four topics. First, we evaluate customers' preferences over the communication channels for information. This analysis takes advantage of the change to invoice digitalization that was implemented in San Jose, to compare preferences over information channels. Second, we examine customers' characteristics, especially as they relate to their expectations, baseline knowledge, and user types (defined by their level of water use and water expenditure). Third, we evaluate what determines customers' bill consultation and consultation frequency. Fourth, we analyze how customers in San Jose adapted to the digital billing system.

Results about Bill Consultation After Digitalization

Bill consultation was defined in the survey as "review of your water bill in either your email, AyA's website, AyA's mobile app, Facebook/WhatsApp, 800 phone line, or customer service office." Results from the survey sample show that when the digitalization of the billing system was implemented in San Jose, there was a steep decline in the share of customers who consulted their bill. By 2015, all customers had transitioned to the digital system. During 2014, bill consultation dropped from over 80% (in the pre-digitalization period) to about 25% in the year of the digitalization rollout (2014), increasing to 43% in 2017 and to 65% by 2020. The consultation frequency also declined in the years after digitalization, and the percentage of customers who reviewed their bills every month did not increase to its pre-digitalization rate. Results from the survey (Table 4) also show that the uptake of different digital platforms increased gradually in the years after digitalization of the billing system.

Table 4. Descriptive Statistics Bill Consultation Pre & Post Digitalization

		Pre-Digitalization	Post-Digitalization		
Period		**2012-Part2014**	**Part2014-2015**	**2016-2017**	**2018-2020**
Consultation		83	25	43	65
Frequency	None	17	75	57	35
	Few/Some times	13	17	21	29
	Every month	70	8	22	36
Platform Type*	None	17	75	57	35
	Conventional	83	9	10	8
	Digital	0	16	33	57

* (Phone line, SMS, and customer service office are considered conventional platforms).

The percentages in Table 4 do not include customers who may have consulted their bills only sporadically (for example, some customers might have consulted in 2016-2017 but did not consult again after those years). The share of customers who consulted in some

periods and not others after digitalization is about 16%, and the percentage of customers who never consulted during any period after digitalization is 19%.

During focus groups, participants reported that the characteristics of the communication channel that they cared about included ease of use and satisfaction with the available platforms, as well as access to required technology. From the information collected in the survey, we know that these factors were less positively regarded right after digitalization. Nevertheless, by 2020 (when the survey was conducted), more customers were satisfied with these platforms, and many had gained access to the necessary technology.

Table 5 shows that in 2020 (six years after the digitalized invoice system started), when respondents were asked about their experience with the digital platforms, 69% were satisfied with the digital platforms, and about 62% thought that access to technology was easy. Various questions were asked about the initial periods of digitalization as well. Some respondents (27%) reported that they had difficulties due to not having a computer, phone or internet to use the digital platforms. 41% reported that they had difficulties in understanding how to use the platforms, 39% disliked them, 30% missed information from the printed system, and 50% missed the ease of the printed system. In addition, by 2020, 74% of the surveyed customers had provided email only or email plus other type of contact information. The remaining 26% had provided only a home phone, cellphone, or both[7]. There was also a considerable increase in the payment channels used, including online banking or automatic payment. When comparing to the pre-digitalization period, by 2020, the usage of these new payment modalities had increased by 86% in the case of online banking and 70% in the case of automatic payment.

Table 5: Consumers' Perspectives on Characteristics of the Communication Channel: Percentage Sample & Test of Proportions for Consult vs. Not Consult Groups

		Period		
		Pre-Digit Period	Period Inmediate After Digit	4/More Years After Digit
Satisfaction with available platforms	Yes	71	51	69
Easy access to technology	Yes	100	53	62
Where Pays	InPerson	67	-	41
	BankManual	22	-	41
	BankAutomatic	10	-	17

[7] We should remember that these 74% of the sample in fact represent 44% of the population. This is because 40% of the total population had not provided any contact information to the utility, and the sample was taken from the 60% of remaining population.

Customers' Characteristics: Knowledge, Expectations, and User Types

From survey data as well as utility data, we are able to characterize customers based on their perceptions on their water service, their water use level and their water expenditure. Data on baseline knowledge and expectations are cross-sectional and were collected through the survey. Utility records are panel data and therefore vary across all periods. Tables 6 and 7 summarize these variables.

Table 6. Expectations on Prices & Baseline Knowledge of Bill Information: % Sample & Test of Proportions for Consult vs. Not-Consult Groups

			% of Sample
Expectations	Expect Price Increases	Yes	56
	Cost vs. Price	Higher cost for AyA	15
		Higher price consumer pay	30
		About the same	22
		Not sure	33
	Efficient Utility	Agree	47
		Don't Agree	40
		Not Sure	14
Baseline Knowledge	Know Tariff Structure	Yes	51
		No	14
		Not sure	36
	Know M3	Yes	24
	Know find Price Information	Yes	30
	Water Exhaustible	Agree	79
		Not Sure	4
		Don't Agree	18

In Table 6, we observe that customers are generally unaware of their billing information. Half of customers do not know that the water tariff used to calculate their water bill changes with the quantity of water used; 70% do not know how to find the current tariff structure; and 76% cannot identify the unit that the utility uses to measure water consumption (cubic meter). Total bill misperception[8] has an average of 49% and a median of 27%. Finally, 22% of the sample believes that water is an inexhaustible resource. Regarding customers' perception of price vs. cost of the service, there is substantial variation in customers' beliefs about the relationship between the cost and average price of piped water: 31% of customers believed that the price paid per cubic meter is higher than what it costs AyA to deliver, 32% percent were not sure, 22% thought that it is about the same, and 15% thought that it costs AyA more to deliver than what the customer pays. Over half of respondents (53%) think that the water utility does not operate efficiently. A further characterization of customers relates to the level of water use, as well as expenditure on water. Mean values of water use, total water bill, and water and sewage charges are presented (Table 7).

[8] Here, bill misperception is calculated in percentage and is calculated as the absolute value of the difference between the average monthly bill –from billing records- and self-reported average bill, divided by the actual average bill. [all of these values were evaluated for 2019].

Table 7: Characterization of Type of Water User By Consumption Level & Expenditure

	Unit	Statistic	Statistic for 2019
Monthly Water Use Level (m3)	m3	mean	17
Monthly Total Bill	₡	mean	15,277
Avg. Annual Water Charge	₡	mean	8,476
Sewage Dummy		% of sample	0.54
Avg. Annual Sew. Charge	₡	mean	3298
Variables from survey data			
Water Expenditure as Share of Utilities		% of expenditure	0.36
Water Expenditure as Share of Income		% of income	0.03

Results of bill consultation probability models

We ran probability models for bill consultation separately for each of the four periods of analysis in this study (before digitalization and three periods after digitalization), as well as for the entire panel spanning four periods. The analyses are not causal, but they more clearly reveal the associations of specific variables with bill consultation behavior, controlling for the other factors. Therefore, in these results we analyze statistical significance of coefficients, their sign and magnitude, as well as the robustness of these associations[9]. In Tables 8 and 9 we indicate the results that are statistically significant and consistent among regressions [Refer to Tables B1 – B2 in Appendix B for the detailed results of all regressions and variables in these models (those statistically significant and those that are not].

[9] Consistency of the magnitude of coefficients is evaluated for all periods and the panel with random effects models; however, this is not compared to the panel with fixed effects, because the fixed effects regression considers only variables that change over time, and therefore, is a very different model from those in the other regressions.

Table 8: Summary of Results of Probability Models of Bill Consultation and Consultation Frequency

	Bill Consultation (Dependent Variable: Consult Bill, Base Outcome (Don't Consult)						Frequency of Consultation (Dependent Variable: Consultation Frequency, Base Outcome (Never)											
	Pre-Digit Period	Period inmediate After Digit	2/3 years After Digit	4/More Years After Digit	Panel Random Effects	Panel Fixed Effects	Pre-Digit Period		Period Inmediate After Digit		2/3 Years After Digit		4/More Years After Digit		Panel Random Effects		Panel Fixed Effects	
							Some Times	Every Month	Some Times	Every Month	Some Times	Every Month	Some Times	Every Month	Some Times	Every Month	Some Times	Every Month
Average annual water use	0.0386*				-0.0268***	-0.0515***		0.0478*							-0.0241**	-0.0213**	-0.0606***	-0.0494***
Water total Bill	-5.23e-05**				1.62e-05**	4.14e-05***		-6.13e-05**							1.57e-05**		4.51e-05**	1.39e-05***
Sewage Dummy			-0.346**			-0.536*						-0.690***						-0.816**
District Annual Rationing					0.378**	1.207***										0.489***	1.154***	1.157***
Self Rep Rationing						0.342**											0.446**	0.359*
Self Rep Water Quality				0.498***			0.633**						0.379*	0.598***				
Water share out of utilities' expense				1.286*	0.705**									1.580*	0.780*			
Expectation Price Increases	0.543***	0.381**	0.293*		0.319***		0.650**	0.526**		0.688**		0.454**			0.222**	0.349***		
Cost vs. price comparison (Price Higher)									-0.418*		-0.627***				-0.244**			
EfficientUtility		-0.391**			-0.181*				-0.503**							-0.225**		
Knowledge Meaning Cubic Meters		0.570***			0.266**				0.615***						0.311**	0.201*		
Understanding Platforms Available	1.141***	0.698***	0.789***	0.803***	0.751***	1.674***	0.792***	1.218***	0.531**	1.135***	0.478*	1.279***	0.535**	1.125***	0.514***	0.857***	1.071***	2.259***
Access to Technology Comm. Channel		0.633***			1.073***	1.665***			0.561**	0.816**		0.542**		0.541**	0.357***	1.530***	0.642***	2.543***
Email Contact Provided		1.603***	0.586***	0.581***	0.530***				1.840***	1.215***		0.856***		1.067***	0.336***	0.665***		
Beleive Water Exhaustible Resource					0.209*								0.597**		0.316**			
SES level Low (Base: Medium)			-0.380*		-0.243**						-0.496*				-0.332**			
SES Level High (Base: Medium)	-0.744**							-0.798**										
Automatic Payment (base in person)					-0.447***	-1.124***	0.763*									-0.771***		-1.404***ψ
Bank Manual Payment (base in person)					-0.515***	-1.485***								-0.425*		-0.695***		
PayHeadSpouse						0.873**												1.177***

ψ For the panel fixed effects, the variable on payment mechanism was evaluated by combining automatic payment and bank manula payment in comparison to the base outcome (in-person payment).

Sign of relationship highlighted: (+) (-)

In Table 8 we highlight results that are most robust across different model specifications, signs, and coefficient values. It is also interesting to compare the differences among periods. Certainly, variables that are significant throughout all four periods are robust and strongly related to bill consultation. The variables that show this pattern include characteristics of the communication channel as well as customers' expectations: understanding of the platform, expectations of price increases, and the type of contact information that the customer has provided to the utility (whether customers have provided email versus cellphone or home phone).

There are also variables that are significant predictors of bill consultation right after digitalization, in addition to the variables that are significant for all periods. These variables include access to the required technology, knowledge about the unit that the utility uses to measure their water consumption (cubic meter), perspective on the utility efficiency, and the perspective of cost versus price (if they think that the price is higher than what it costs to the utility to deliver the services). Given that in this period a new communication channel was implemented, these variables might have played an important role in decreasing (or increasing) significantly the cost of information search, which was itself modified by the replacement of an old communication channel with a new one.

There are also other variables that show statistical significance in years after digitalization. These variables can be understood as variables that become predictors, once customers have already adapted to a communication channel. They include various characteristics of the service, such as quality of the service, as well as characteristics of the customer, such as knowledge that water is an exhaustible resource, and the share of households' water expenses out of all utility expenditures.

Finally, it is useful to observe the results of the panel models. The fixed effects model shows that after controlling for individual characteristics, an increase in the probability of bill consultation and frequency of bill consultation is associated with understanding of platforms, access to technology, higher total bills, the household head paying the bill, as well as rationing. This latter factor is statistical significant based on self-reports as well as with utility data. On the other hand, a decrease in the probability of bill consultation is associated with higher levels of consumption after digitalization, having sewage service, as well as with payment through online banking or automatic payment (versus in-person payment), some factor that has previously been reported in the context of electricity (Sexton, 2015). The fixed effects estimation only considers variables that were collected for different points in time. In contrast, the random effects model considers all variables and helps to confirm the associations identified for the single periods analyses discussed above.

Results of customers' adaptation to digital bills

We further classified surveyed customers according to when they adapted to consult their bills after digitalization: group 1: customers that did not ever consult (including customers that never consulted the bill and those who consulted only printed bills prior to digitalization), group 2: those customers who started consulting in the year after digitalization, and group 3: customers that started consulting years after digitalization. Table 9 presents a summary of the results. [Refer to Tables B3 in Appendix B for the entire results of the probability model estimation].

Table 9 presents the evaluation in two periods: the period right after the digitalization, and the period 4/more years after digitalization. While there are some time-invariant variables in our data set, other variables, such as water use level or payment time vary across time. This is why it was important to estimate this model over two different time periods.

Table 9: Probability Model of When Customers Adapted to Digital Bills

Multinomial Logit **Dependent Variable:** Group By Adaptation to Digitalization **Base Outcome:** (Did not Consult After Digitalization)	**Evaluated in the Period Right After Digitalization**		**Evaluated in the Period 4/More Years After Digitalization**	
	Group that started consulting right after digitalization	Group that started consulting years after digitalization	Group that started consulting right after digitalization	Group that started consulting years after digitalization
Average annual water use	-0.0519*			
Water total Bill	6.00e-05*	5.71e-05*		
Expectation Price Increases	0.591**		0.678**	
Knowledge Meaning Cubic Meters	0.737**		0.714**	
Understanding Platforms Available	1.179***	0.699**	2.054***	1.255***
Access to Technology Comm. Channel	1.316***	0.814***	0.869***	0.639**
Email Contact Provided	2.356***	1.159***	2.025***	0.895***
Beleive Water Exhaustible Resource			0.587*	
Income USD				0.000290*
Age Household Head	-0.0325***	-0.0386***	-0.0288**	-0.0355***
Female Household Head		0.693**		0.731**
Bank Manual Payment (base in person)				-0.576*
Sign of relationship highlighted:	(+)	(-)		

When evaluating what group of customers adapted or not to consult the bill after the invoice digitalization program, similar variables as those in the models on bill consultation and frequency of bill consultation appear relevant. This is especially the case for variables related to accessibility of the communication channel (understanding on platforms, access to technology, type of contact method, and type of payment method), knowledge of bill information and expectations of price increases. Some socio-demographic variables also appear important: gender of household head, age of household head, and income level. Also, in the model estimated in the period right after digitalization, water use level and total bill are significantly associated with consulting

bills right after digitalization (with the same signs as the models explained earlier). On the other hand, in the model evaluated in the period several years after digitalization, the variables of payment type and income are significantly associated with take-up of consultation later on.

7. Discussion

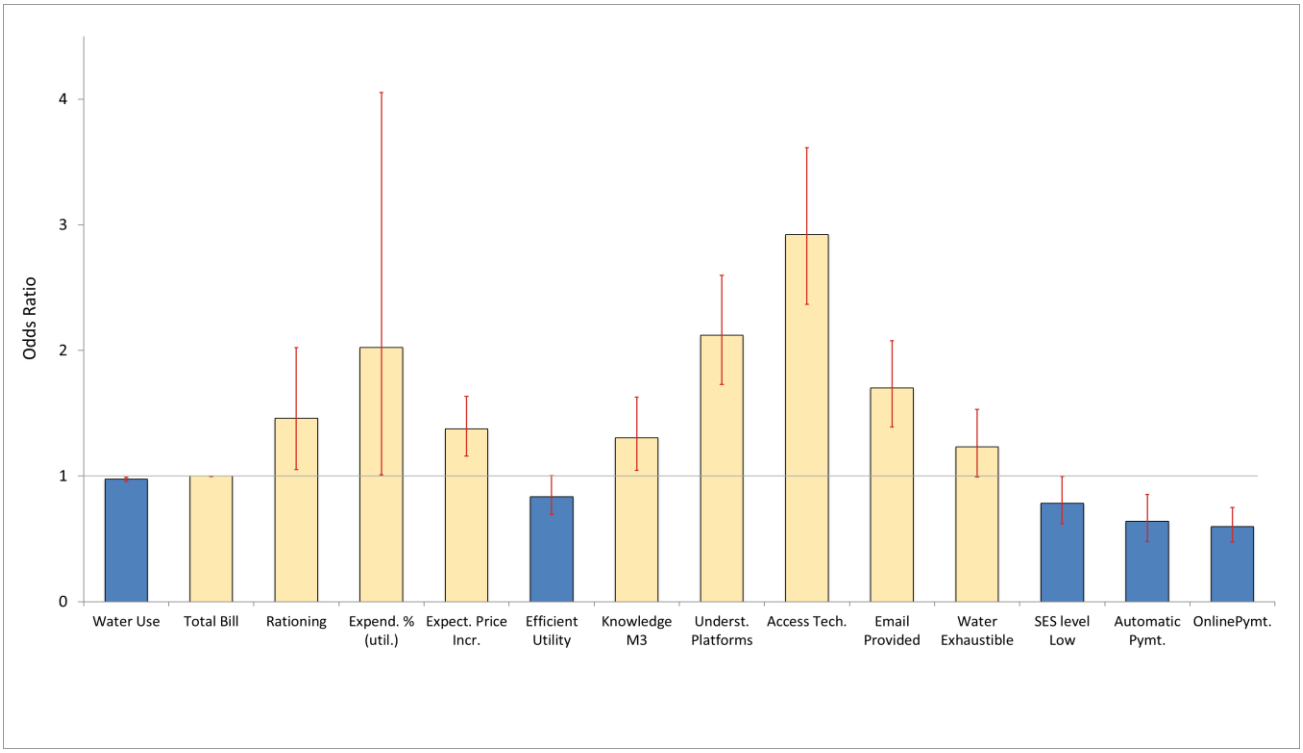
Magnitude of the Determinants

This study highlights the importance of the communication channel, including customers' satisfaction and easy access to information platforms, to promote bill consultation. Also, one of the most interesting results of this study is the relevance of the variables of customers' expectations and baseline knowledge in the probability of bill consultation. Interestingly, these variables are strong predictors of bill consultation and consultation frequency, more than any socio-demographic variable.

To evaluate more clearly, Figure 1 shows the odds ratio of the bill consultation model, selecting only the variables that are statistically significant and which results are robust. Similar results are presented in Figures 2 and 3 for the relative risk ratios of the consultation frequency model. Odds ratios and relative risk rations presented in this Figures 1 - 3 correspond to panel estimations with random effects or pooled[10], in order to include the dimensions of time-varying and non-time varying variables.

[10] Panel with random effects in the case of bill consultation, and panel pooled estimation in the case of consultation frequency.

Figure 1: Odds Ratio of Statistically Significant Variables of Bill Consultation Model



In Figure 1 we observe that variables that characterize customers' relation to the information provision system, particularly access to the required technology, satisfaction with communication platforms, type of contact information provided by customers to the utility company, and payment channel are most relevant. This result is logical given that this study evaluates a period of a change in the communication channel mechanism, when customers were mandatorily transferred from printed to digital bills. After these variables on the communication channel, there is another set of variables on customers' individual characteristics, particularly on their expectations on prices and costs, knowledge of bill information, and type of user (related to expenditure in water and level of water use).

Figure 2: Relative Risk Ratio of Statistically Significant Variables of Frequency of Consultation: 'Some months' in Comparison to Base Outcome ('Never')

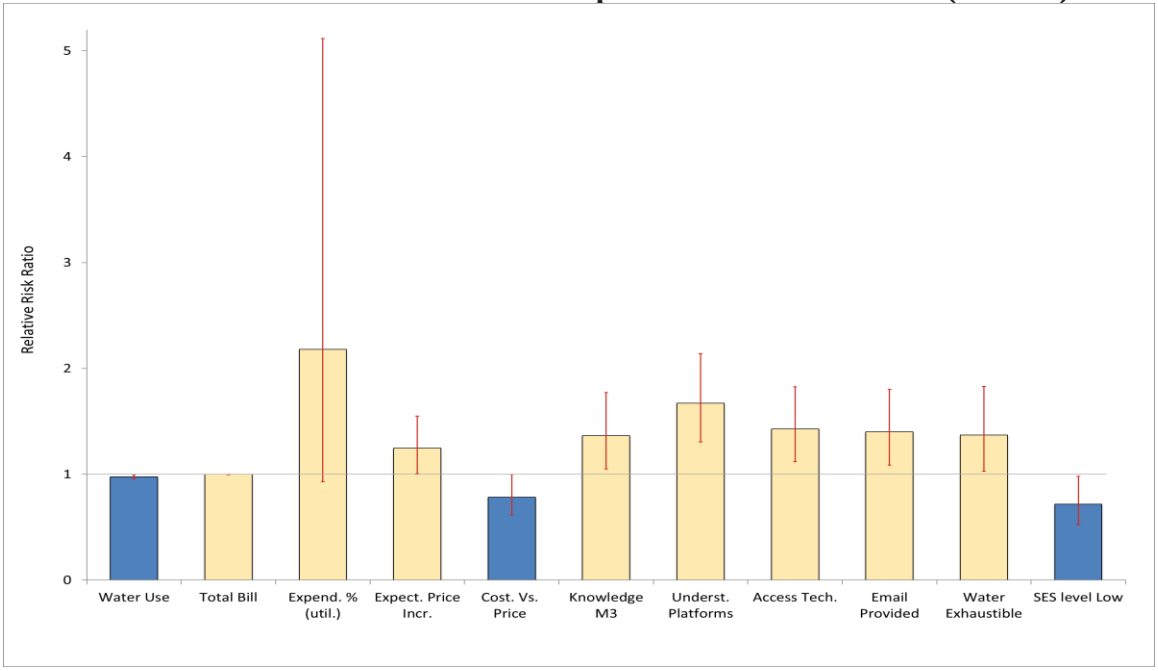
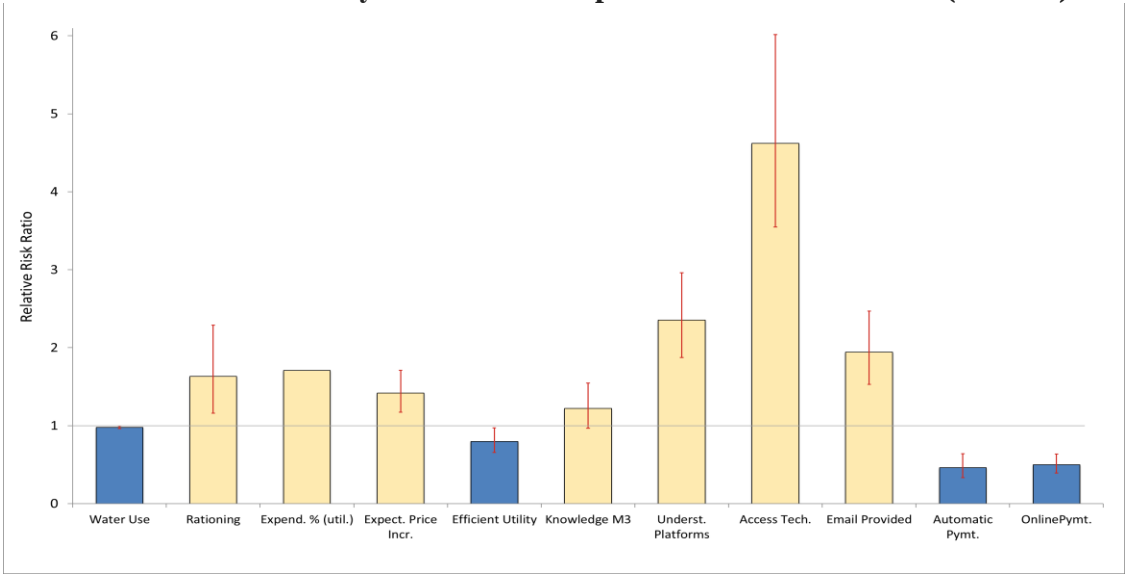


Figure 3: Relative Risk Ratio of Statistically Significant Variables of Frequency of Consultation: 'Every Month' in Comparison to Base Outcome ('Never')



In Figures 2 and 3 we disaggregate the analysis and look at the relative risk ratios of frequency of consultation: 'some months' and 'every month' evaluated in comparison to the base outcome (never). The probability of higher frequency of bill consultation (every month) is more strongly related to technology access than it is when analyzing a lower frequency of consultation. Another variable more strongly related to every month consultation is related to the payment mechanism: paying in person is a better predictor of consulting the bill with more frequency than when using online or automatic payment.

On the other hand, the perspectives on the comparison of cost versus price and exhaustibility of the resource are more strongly correlated to consulting some months (versus not at all). In addition, the variables on expectations on price increases as well as knowledge of cubic meters are strong predictors of bill consultation either at higher or lower frequency.

The relevance of customers' characteristics based on their expectations, knowledge and type of user to the probability of bill consultation, highlights the importance of understanding these determinants to improve billing information provision strategies. We derive from this analysis two important policy-relevant conclusions: First, promoting a higher customers' baseline knowledge about pricing policy, unit to measure quantity of water used, and resource availability, could increase the probability of bill consultation. Second, understanding better how different types of users (e.g. customers based on their water use levels and reference water expenditure) react to information could also help improving information provision strategies.

Moreover, given the digitalization of invoices in San Jose, this study helped us evaluate customers' adaptation to new communication channels. The results on odds ratios and risk relative ratios show the dimension of importance of technology access and satisfaction with platforms for bill consultation. The communication channel acts like an entry point to bill consultation. However, there is heterogeneity on what channels are considered accessible and practical by customers. These heterogenous preferences are also associated by characteristics of gender, education, age (as described in Appendix C, Table C1, which shows p-values of socio-demographic characteristics by preferences on customers perspectives of satisfaction with platforms). This conclusion is consistent with our results that adaptation to new channels depends on socio-demographic characteristics. In addition, the results presented in Table 9, we observe that the variables on expectations and knowledge also impact how fast customers adapt to new communication channels.

Further Evaluation on Specific Variables

- *Household share of water expense out of utilities' expenditure:*

In this study, households' share of water expenditure out of utilities' expenditure (which considers water and electricity) has shown a relevant association to bill consultation, observed also in its magnitude (Figures 1 – 3). Interestingly, households' share of water expenditure out total household income has not shown such significant results. This is not surprising, as per the very modest income elasticities that have been reported in the residential water demand literature. On the other hand, rational attention theories have reported that attention to a particular good (or attribute) could be influenced by comparison to similar goods. In that sense, if electricity and water bills are references to each other, it is logical that a higher share of water expenditure out of the total household's utilities expense would increase attention to the water bill.

- *Baseline knowledge of price information*

Contrarily to our expectations, the variables on customers' knowledge about the tariff structure and knowledge on where to find price information were not significant in our analysis. On the other hand, the variable on knowledge of cubic meters showed a strong and robust correlation to bill consultation and consultation frequency. Even though these results were surprising, they make sense for the San Jose case study. AyA does not show the information on the price structure in the bill; it did not show this information in either the printed bill, nor it does in the digital bill. Hence, these results once more show that the baseline information that customers have is what matters in current information search decisions. In addition, we included in the first modeling the variable on total bill misperception. However, this variable was not statistically significant in any model. The variable on misperception was a cross-section variable calculated only for the year 2019, as the average self-reported monthly bill was collected for that year. Therefore, it did not make sense to run this variable in the panel or for previous periods. Nevertheless, the variable was not statistically significant either for the period corresponding to 2019 (4/more years after digitalization).

- *About perception of price vs. cost of the water service*

The variable on the comparison of price versus cost is statistically significant in the consultation frequency model. The variable that is used in the model measures the comparison of the customers who believe that price is higher than cost. Results of the model show that the probability of consulting some months (in comparison to not consulting at all) decreases for customers that believe that price is higher than cost. This result might appear as counter-intuitive at first sight. However, digging further into the data, we observe that this difference is driven mainly by the group of customers who are not sure. Therefore, the group that are not sure has more probability to review the bill sometimes each year in comparison to the group that believes that pays a higher price than what it costs to the utility company.

- *Quantity & Total Bill*

The variables of quantity and total bill are also significant in some of the models. On average, it might seem that there is no statistical difference on these variables between groups that consult versus those that do not consult. However, when looking more closely at the data and when differentiating by groups of consumers (lower-level consumers, average-level consumers, and higher-level consumers[11]), we understand better the results from the regressions presented in Table 8. We observe that for lower-level and higher-level consumers, there is a significant difference between the groups that consult and don't consult. Before digitalization, the group of customers that consulted would have, on

[11] These groups of customers are defined as 13 cubic meters or less for low-level and 14 – 25 cubic meters for average-level, and more than 25 cubic meters for higher-level.

average, a higher level of consumption, while after digitalization the group of customers that did not consult would have higher level of consumption. These trends are mostly driven by consumers with no sewage, especially in the group of lower-level consumers. Also, these trends are more marked for the periods of before digitalization and right after digitalization, in later periods these tendencies are not clear. [Refer to Appendix D: table D1 for the statistics on level of consumption by groups of customers, periods, and categories of consultation]. However, in later periods there is a difference for groups that have sewage and who do no. In general, in the later periods after digitalization, customers who tend to consume more water and who also have sewage system would be less attentive. Because we control for sewage in the regressions, then the sign of total bill is opposite to the sign of water use. Therefore, after digitalization, customers that have higher bills (after controlling for sewage) would have higher probability to consult the bill.

- *Customers' Perceptions on Bill variance and Water Quality*

Self-reported bill variance and water quality are statistically significant variables in the period of 4/more years after digitalization. These are cross-sectional variables, and therefore they are not evaluated in the fixed effect model. Also, these are variables that are not easily assumed to be constant across the previous periods, but they mostly apply to the period where the data was collected (that is precisely the last period of 4/more years after digitalization). Therefore, we consider logical that these variables show statistical significance in this last period. They have the correct sign, indicating that as customers perceive more problems of water quality and as customers perceive that their total bill has vary more among months their probability of bill consultation is higher.

Limitation of the Study

A limitation of this study is that the data on bill consultation has been collected through a survey. Because of the process of invoice digitalization, it was easy and straightforward for interviewed customers to answer if they consulted or not the bill in each period. Nevertheless, further analysis could be implemented by collecting revealed-preference data on bill consultation.

8. Conclusions

If water utilities plan to develop water management strategies based on information provision policies, more effective strategies will consider the determinants of customers' attention to such information. A digitalization process might present some challenges at its beginning. However, as utility companies innovate towards digitalization, there might be opportunities to in fact improve information access to customers. However, there are two key messages. First, customers' attention to bill information is heterogeneous, and it

is associated with various factors related to customers' experience with their water service, their expectations on prices, and their baseline knowledge of the information provided in the bill. Second, accessibility and satisfaction with the communication channel is a key determinant of bill consultation. Not all customers respond in the same way to all communication channels, and adaptation to new channels might be related to those same factors that influence information search as well as to other factors of socio-demographic characteristics, such as age, gender, education and income. The diversification of platform options and the evaluation of consultation preferences might be key in reaching customers.

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APPENDICES

Appendix A:

Comparison of Population & Sample
For Water Utility Billing and Socio-Economic Variables

Table A1: Summary of Water Utility Billing Variables for Population & Sample

	POPULATION (Jan 2012 - July 2020)						SAMPLE (Jan 2012 - July 2020)					
Variables (data by month)	% Zero Obs	Median	Mean	Std.Dev	Q25	Q75	% Zero Obs	Median	Mean	Std. Dev	Q25	Q75
Water Use (m3)	7%	14	18	94	8	22	6%	15	17	20	9	22
Water Charge (USD)	6%	8.9	18.7	167.8	5.0	17.7	5%	9.0	15.4	46.3	5.4	17.5
Sewage Charge (USD)	48%	0.8	5.1	87.8	0.0	4.7	48%	0.7	3.8	14.1	0.0	4.6
Hydrants Charge (USD)	6%	0.4	0.6	3.0	0.2	0.7	5%	0.5	0.6	0.6	0.3	0.7
Water Fixed Charge (USD)	7%	2.7	3.0	2.3	2.7	3.6	7%	2.7	2.9	1.3	2.7	3.6
Sewage Fixed Charge (USD)	47%	1.1	0.8	1.1	0.0	1.1	49%	1.1	0.8	0.9	0.0	1.1
Total Bill (USD)	0.5%	15.9	28.8	253.5	9.6	27.6	0.6%	16.2	23.9	59.3	9.9	27.4

* Number of customers in the population database varies in each year (e.g. In 2012 there were ~ 268,000 customers, while in 2020 there were 308,000 customers)

* The data on the population includes bills with errors, that is why there are considerable differences in the st. dev.

Table A2: Census Block Variables Included in the Final Database for Population & Sample

	POPULATION			SAMPLE		
	Percent of households in census block			Percent of households in census block		
	median	mean	std.dev	median	mean	std. dev
Spouses & children	0.38	0.38	0.12	0.38	0.38	0.12
Spouses & no children	0.10	0.11	0.07	0.09	0.11	0.06
One parent & Children	0.15	0.16	0.07	0.15	0.16	0.07
One person	0.10	0.12	0.08	0.11	0.12	0.08
Households with other relatives	0.20	0.20	0.10	0.20	0.20	0.09
Other type of household type	0.04	0.05	0.05	0.04	0.05	0.05
Electricity provider CNFL	1.00	1.00	0.01	1.00	1.00	0.01
Electricity provider ESPHoJASEC	1.00	1.00	0.01	1.00	1.00	0.00
Electricity provider Other	0.00	0.00	0.01	0.00	0.00	0.01
Independent house structure	1.00	0.95	0.14	1.00	0.95	0.12
House in condominium	0.13	0.27	0.30	0.16	0.27	0.30
Other type of house structure	0.00	0.02	0.09	0.00	0.03	0.08
House ownership: RENTED	0.22	0.24	0.13	0.23	0.25	0.14
House ownership: FINANCED	0.12	0.17	0.17	0.11	0.15	0.15
House ownership: OWN	0.58	0.57	0.17	0.58	0.57	0.16
House ownership: PRECARIOUS	0.03	0.14	0.24	0.06	0.16	0.24
House ownership: OTHER	0.03	0.04	0.05	0.03	0.04	0.05
Septic tank	0.46	0.52	0.40	0.52	0.53	0.40
Sewerage	0.84	0.66	0.36	0.83	0.64	0.37
Other sanitary system	0.00	0.02	0.06	0.00	0.02	0.06
Have water heat system	0.10	0.19	0.24	0.14	0.22	0.23
Have water store tank	0.06	0.12	0.16	0.09	0.14	0.16
Crowded Rooms	0.00	0.03	0.06	0.02	0.04	0.06
Scarcity Level_0	0.89	0.86	0.14	0.89	0.84	0.15
Scarcity Level_1	0.12	0.14	0.10	0.12	0.15	0.11
Scarcity Level_2	0.00	0.02	0.05	0.00	0.03	0.06

Appendix B:

Results of Regression Models for Bill Consultation, Consultation Frequency and Adaptation to Digitalization

Table B1. Results of Probability Models of Bill Consultation

Logit Model: Dependent Variable: Consult Bill Base Outcome (Don't consult)	Pre-Digit Period	Period Inmediate After Digit	Couple Years After Digit	4/More Years After Digit	Panel Random Effects	Panel Fixed Effects
Average annual water use	0.0386*	-0.0131	-0.0173	-0.00653	-0.0268***	-0.0515***
	-0.099	(0.483)	(0.266)	(0.713)	(0.000948)	(0.000265)
Water total Bill	-5.23e-05**	1.17e-05	8.37e-06	-3.73e-06	1.62e-05**	4.14e-05***
	(0.0481)	(0.527)	(0.577)	(0.783)	(0.0118)	(0.00277)
Sewage Dummy	-0.256	-0.147	-0.346**	0.257	-0.149	-0.536*
	(0.263)	(0.464)	(0.0470)	(0.202)	(0.133)	(0.0663)
Bill Variance	3.24e-10	-2.00e-09	-3.14e-10	-5.61e-11	-0	-7.47e-11
	(0.551)	(0.148)	(0.258)	(0.317)	(0.424)	(0.194)
Perceived Bill Var	0.180	0.129	-0.0658	0.417*	0.116	
	(0.521)	(0.590)	(0.749)	(0.0628)	(0.323)	
Perc Elect Bill Var	-0.00612	-0.0935	0.0472	0.0838	0.000932	
	(0.978)	(0.627)	(0.774)	(0.632)	(0.992)	
District Annual Rationing	-0.243	-0.193	-0.105	0.244	0.378**	1.207***
	(0.535)	(0.556)	(0.747)	(0.362)	(0.0232)	(1.63e-05)
Self Rep Rationing	0.0528	0.0494	0.140	-0.103	0.132	0.342**
	(0.866)	(0.838)	(0.444)	(0.556)	(0.211)	(0.0411)
Self Rep Water Quality	0.320	-0.157	-0.158	0.498***	0.0763	
	(0.169)	(0.425)	(0.355)	(0.00826)	(0.422)	
Water share out of utilities' expense	0.977	0.380	0.544	1.286*	0.705**	
	(0.201)	(0.584)	(0.357)	(0.0722)	(0.0469)	
Water share out of income	0.0150	-0.482	-1.033	0.856	0.392	
	(0.996)	(0.873)	(0.689)	(0.743)	(0.742)	
Expectation Price Increases	0.543***	0.381**	0.293*	0.0942	0.319***	
	(0.00976)	(0.0499)	(0.0728)	(0.577)	(0.000285)	
Cost. Vs. Price	0.283	-0.242	-0.261	0.157	-0.0872	
	(0.241)	(0.228)	(0.133)	(0.395)	(0.361)	
EfficientUtility	0.0873	-0.391**	-0.107	-0.0197	-0.181*	
	(0.689)	(0.0452)	(0.523)	(0.911)	(0.0548)	
Knowledge Meaning Cubic Meters	0.125	0.570***	0.309	-0.0699	0.266**	
	(0.639)	(0.00657)	(0.109)	(0.735)	(0.0186)	
Knowledge Tariff Structure	-0.106	-0.0344	-0.0379	0.189	-0.0245	
	(0.606)	(0.850)	(0.807)	(0.248)	(0.781)	
Understanding Platforms Available	1.141***	0.698***	0.789***	0.803***	0.751***	1.674***
	(5.65e-08)	(0.00127)	(0.000322)	(0.000273)	(0)	(0)
Access to Technology Comm. Channel		0.633***	0.310	0.304	1.073***	1.665***
		(0.00565)	(0.118)	(0.143)	(0)	(0)
Email Contact Provided	0.219	1.603***	0.586***	0.581***	0.530***	
	(0.349)	(1.05e-07)	(0.00300)	(0.00293)	(2.27e-07)	
Number Toilets	0.161	-0.135	-0.0505	-0.0110	-0.00837	
	(0.270)	(0.298)	(0.642)	(0.926)	(0.896)	
Number Laundry Machine	-0.285	0.365	0.565**	-0.250	0.116	
	(0.401)	(0.201)	(0.0289)	(0.352)	(0.475)	
Beleive Water Exhaustible Resource	0.155	0.363	0.206	0.294	0.209*	
	(0.543)	(0.156)	(0.311)	(0.156)	(0.0569)	
SES level Low (Base: Medium)	-0.337	-0.215	-0.380*	-0.148	-0.243**	
	(0.215)	(0.401)	(0.0769)	(0.508)	(0.0477)	
SES Level High (Base: Medium)	-0.744**	0.0174	-0.139	-0.0531	-0.141	
	(0.0138)	(0.951)	(0.565)	(0.831)	(0.282)	
Income USD	-1.08e-05	-3.35e-05	-5.78e-06	0.000126	6.01e-05	
	(0.934)	(0.769)	(0.954)	(0.246)	(0.310)	
Education Household Head	-0.00483	-0.0644*	-0.0180	-0.0212	-0.0162	
	(0.909)	(0.0884)	(0.584)	(0.546)	(0.389)	
Age Household Head	-0.00386	-0.00510	0.00274	-0.0137*	-0.00278	
	(0.652)	(0.525)	(0.689)	(0.0593)	(0.460)	
Female Household Head	0.0188	-0.247	-0.410*	0.500**	-0.00494	
	(0.946)	(0.361)	(0.0695)	(0.0331)	(0.971)	
Household Size	0.0530	-0.0346	-0.0543	0.0928	0.00548	
	(0.446)	(0.553)	(0.293)	(0.100)	(0.846)	
Female Manage Bill	-0.195	0.110	0.147	-0.195	-0.000756	
	(0.481)	(0.676)	(0.504)	(0.392)	(0.995)	
Automatic Payment (base in person)	0.0971	-0.155	-0.164	0.146	-0.447***	-1.124***
	(0.793)	(0.585)	(0.506)	(0.582)	(0.00243)	(0.00202)
Bank Manual Payment (base in person)	-0.170	-0.172	0.0809	-0.211	-0.515***	-1.485***
	(0.531)	(0.456)	(0.679)	(0.315)	(8.05e-06)	(4.53e-09)
PayHeadSpouse	0.447	0.0959	-0.0620	-0.244	0.109	0.873**
	(0.149)	(0.732)	(0.793)	(0.338)	(0.404)	(0.0222)
Constant	-0.169	-2.506***	-1.547**	-0.756	-1.535***	
	(0.859)	(0.00447)	(0.0370)	(0.345)	(0.000225)	
Observations	789	807	810	807	3,213	2,560
Number of ServiceID					812	645

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B2: Results of Probability Models of Consultation Frequency

Multinomial Logit: **Dependent Variable:** Consultation Frequency **Base Outcome** (Never)	Pre-Digitalization Period		Period Inmediate After Digitalization		Couple Years After Digitalization		4/More Years After Digitalization		Pooled Panel		Panel Fixed Effects	
	Some Times	Every Month	Some Times	Every Month	Some Times	Every Month	Some Times	Every Month	Some Times	Every Month	Some Times	Every Month
Average annual water use	0.00577	0.0478*	-0.0131	0.0128	-0.00582	-0.0283	0.00518	-0.0174	-0.0241**	-0.0213**	-0.0606***	-0.0494***
	(0.847)	(0.0504)	(0.518)	(0.742)	(0.777)	(0.129)	(0.817)	(0.388)	(0.0121)	(0.0180)	(0.000738)	(0.00261)
Water total Bill	-2.14e-05	-6.13e-05**	1.92e-05	-4.40e-05	3.69e-06	1.42e-05	-1.30e-05	5.31e-06	1.57e-05**	1.05e-05	4.51e-05**	4.39e-05***
	(0.507)	(0.0253)	(0.302)	(0.382)	(0.859)	(0.429)	(0.484)	(0.724)	(0.0303)	(0.199)	(0.0105)	(0.00696)
Sewage Dummy	-0.460	-0.208	-0.113	-0.0480	0.0184	-0.690***	0.358	0.171	-0.0680	-0.161	-0.193	-0.816**
	(0.133)	(0.374)	(0.621)	(0.888)	(0.933)	(0.00136)	(0.141)	(0.457)	(0.573)	(0.125)	(0.634)	(0.0166)
Bill Variance	4.69e-10	2.45e-10	-1.69e-09	-3.87e-09	-7.00e-10	-1.97e-10	-0	-8.37e-11	-0	-0	-0	-1.26e-10
	(0.438)	(0.683)	(0.216)	(0.311)	(0.318)	(0.507)	(0.612)	(0.243)	(0.548)	(0.503)	(0.649)	(0.120)
Perceived Bill Var	0.105	0.197	0.0979	0.222	-0.00744	-0.159	0.462*	0.365	0.147	0.0972		
	(0.779)	(0.490)	(0.722)	(0.561)	(0.976)	(0.548)	(0.0704)	(0.153)	(0.307)	(0.434)		
Perc Elect Bill Var	0.248	-0.0633	0.144	-0.589*	0.293	-0.223	0.0386	0.127	0.142	-0.0954		
	(0.403)	(0.775)	(0.512)	(0.0576)	(0.150)	(0.282)	(0.850)	(0.525)	(0.228)	(0.329)		
District Annual Rationing	-0.473	-0.200	-0.0945	-0.325	-0.381	0.112	0.0110	0.477	0.0752	0.489***	1.154***	1.157***
	(0.390)	(0.617)	(0.802)	(0.529)	(0.373)	(0.771)	(0.973)	(0.116)	(0.710)	(0.00482)	(0.00160)	(0.000273)
Self Rep Rationing	-0.485	0.141	0.0455	0.0558	0.236	0.0224	-0.0480	-0.137	0.195	0.0595	0.446**	0.359*
	(0.283)	(0.657)	(0.869)	(0.883)	(0.290)	(0.922)	(0.812)	(0.493)	(0.119)	(0.593)	(0.0356)	(0.0669)
Self Rep Water Quality	0.633**	0.252	-0.143	-0.226	-0.128	-0.191	0.379*	0.598***	0.0519	0.0801		
	(0.0400)	(0.287)	(0.523)	(0.465)	(0.547)	(0.370)	(0.0845)	(0.00480)	(0.665)	(0.427)		
Water share out of utilities' expense	1.320	0.892	0.871	-0.845	0.640	0.394	0.878	1.580*	0.780*	0.536*		
	(0.197)	(0.251)	(0.270)	(0.452)	(0.382)	(0.595)	(0.296)	(0.0540)	(0.0733)	-0.0999		
Water share out of income	0.617	-0.0483	-4.684	7.037*	-4.730	2.745	1.585	0.139	-1.050	1.289		
	(0.878)	(0.987)	(0.269)	(0.0745)	(0.206)	(0.372)	(0.607)	(0.963)	(0.467)	(0.361)		
Expectation Price Increases	0.650**	0.526**	0.244	0.688**	0.143	0.454**	0.105	0.0913	0.222**	0.349***		
	(0.0248)	(0.0140)	(0.273)	(0.0259)	(0.479)	(0.0278)	(0.595)	(0.641)	(0.0442)	(0.000282)		
Cost. Vs. Price	0.310	0.278	-0.418*	0.142	-0.627***	0.0496	0.00597	0.325	-0.244**	0.0371		
	(0.328)	(0.258)	(0.0754)	(0.640)	(0.00621)	(0.813)	(0.978)	(0.120)	(0.0479)	(0.714)		
EfficientUtility	0.383	0.0233	-0.503**	-0.184	-0.113	-0.124	0.0637	-0.113	-0.0975	-0.225**		
	(0.196)	(0.916)	(0.0254)	(0.548)	(0.586)	(0.553)	(0.756)	(0.579)	(0.404)	(0.0258)		
Knowledge Meaning Cubic Meters	0.105	0.132	0.615***	0.497	0.314	0.300	-0.00890	-0.115	0.311**	0.201*		
	(0.768)	(0.625)	(0.00992)	(0.120)	(0.183)	(0.201)	(0.970)	(0.629)	(0.0198)	(0.0948)		
Knowledge Tariff Structure	-0.160	-0.0934	-0.203	0.326	0.107	-0.180	0.0795	0.288	-0.0421	-0.00445		
	(0.568)	(0.656)	(0.331)	(0.254)	(0.577)	(0.352)	(0.678)	(0.127)	(0.706)	(0.962)		
Understanding Platforms Available	0.792***	1.218***	0.531**	1.135***	0.478*	1.279***	0.535**	1.125***	0.514***	0.857***	1.071***	2.259***
	(0.00724)	(1.60e-08)	(0.0318)	(0.00190)	(0.0715)	(4.65e-05)	(0.0389)	(2.03e-05)	(4.32e-05)	(0)	(0.000201)	(0)
Access to Technology Comm. Channel			0.561**	0.816**	0.0897	0.542**	0.0963	0.541**	0.357***	1.530***	0.642***	2.543***
			(0.0323)	(0.0303)	(0.713)	(0.0343)	(0.693)	(0.0244)	(0.00427)	(0)	(0.00444)	(0)
Email Contact Provided	-0.158	0.299	1.840***	1.215***	0.371	0.856***	0.162	1.067***	0.336***	0.665***		
	(0.625)	(0.213)	(2.72e-06)	(0.00685)	(0.124)	(0.00149)	(0.475)	(1.20e-05)	(0.00925)	(4.87e-08)		
Number Toilets	0.325*	0.119	-0.00454	-0.402*	-0.0536	-0.0349	-0.0143	-0.0254	0.0238	-0.0407		
	(0.0885)	(0.422)	(0.975)	(0.0538)	(0.689)	(0.799)	(0.917)	(0.852)	(0.758)	(0.557)		
Number Laundry Machine	0.00947	-0.347	0.364	0.444	0.843***	0.235	-0.173	-0.328	0.294	-0.0293		
	(0.983)	(0.317)	(0.256)	(0.323)	(0.00531)	(0.471)	(0.579)	(0.296)	(0.126)	(0.862)		
Beleive Water Exhaustible Resource	0.0361	0.170	0.468	0.160	0.136	0.264	0.597**	0.0151	0.316**	0.112		
	(0.918)	(0.513)	(0.125)	(0.684)	(0.586)	(0.318)	(0.0209)	(0.949)	(0.0319)	(0.346)		
SES level Low (Base: Medium)	-0.582	-0.299	-0.281	-0.120	-0.496*	-0.271	-0.153	-0.147	-0.332**	-0.161		
	(0.151)	(0.278)	(0.344)	(0.761)	(0.0719)	(0.312)	(0.569)	(0.564)	(0.0380)	(0.211)		
SES Level High (Base: Medium)	-0.518	-0.798**	0.0409	-0.0171	0.0147	-0.269	-0.109	0.0348	-0.0652	-0.181		
	(0.196)	(0.0103)	(0.898)	(0.970)	(0.960)	(0.377)	(0.706)	(0.905)	(0.699)	(0.182)		
Income USD	7.07e-06	-1.33e-05	-0.000142	0.000186	-4.44e-05	2.41e-05	0.000151	8.71e-05	2.35e-05	7.86e-05		
	(0.967)	(0.920)	(0.294)	(0.271)	(0.722)	(0.844)	(0.221)	(0.487)	(0.734)	(0.227)		
Education Household Head	0.0180	-0.0105	-0.0738*	-0.0505	-0.0139	-0.0200	0.00629	-0.0467	-0.0117	-0.0233		
	(0.757)	(0.807)	(0.0846)	(0.394)	(0.732)	(0.623)	(0.880)	(0.238)	(0.613)	(0.252)		
Age Household Head	0.00257	-0.00536	-0.00198	-0.0132	0.00795	-0.00336	-0.00737	-0.0188**	0.00222	-0.00638		
	(0.826)	(0.539)	(0.829)	(0.300)	(0.353)	(0.696)	(0.387)	(0.0243)	(0.639)	(0.108)		
Female Household Head	-0.563	0.140	-0.247	-0.226	-0.299	-0.479*	0.439	0.555**	-0.104	0.0757		
	(0.148)	(0.626)	(0.416)	(0.612)	(0.276)	(0.0961)	(0.114)	(0.0408)	(0.492)	(0.611)		
Household Size	0.0567	0.0520	-0.0609	0.0263	-0.0543	-0.0548	0.0958	0.0957	0.00435	0.00389		
	(0.548)	(0.461)	(0.369)	(0.768)	(0.394)	(0.400)	(0.146)	(0.131)	(0.906)	(0.892)		
Female Manage Bill	0.102	-0.265	0.198	-0.0881	0.182	0.0768	-0.263	-0.141	0.0352	-0.0459		
	(0.787)	(0.352)	(0.502)	(0.839)	(0.500)	(0.781)	(0.331)	(0.594)	(0.815)	(0.753)		
Automatic Payment (base in person)	0.763*	-0.0696	-0.161	-0.105	-0.0257	-0.352	0.461	-0.226	0.128	-0.771***	0.184	1.404***
	(0.0903)	(0.854)	(0.618)	(0.812)	(0.933)	(0.254)	(0.128)	(0.462)	(0.442)	(3.15e-06)	(0.420)	(0)
Bank Manual Payment (base in person)	0.0632	-0.221	-0.251	0.0116	0.0646	0.0782	0.0273	-0.425*	-0.0694	-0.695***		
	(0.863)	(0.424)	(0.338)	(0.975)	(0.790)	(0.747)	(0.913)	(0.0767)	(0.605)	(1.20e-08)		
PayHeadSpouse	0.368	0.470	0.0539	0.202	0.00256	-0.0961	-0.343	-0.151	-0.0278	0.206	0.737	1.177***
	(0.412)	(0.137)	(0.864)	(0.656)	(0.993)	(0.745)	(0.240)	(0.606)	(0.857)	(0.167)	(0.108)	(0.00565)
Constant	-2.743**	-0.196	-3.159***	-3.493**	-2.656***	-2.062**	-1.762*	-1.438	-2.435***	-2.059***		
	(0.0351)	(0.840)	(0.00210)	(0.0122)	(0.00396)	(0.0271)	(0.0611)	(0.117)	(2.60e-06)	(3.04e-06)		
Observations	789	789	807	807	810	810	807	807	3,213	3,213	2,925	2,925

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B3: Results of Probability Models of Adaptation to Digital Bills

Multinomial Logit:	**Evaluated Before Digitalization**			**Evaluated in the Period Right After Digitalization**			**Evaluated in Period a Couple Years After Digitalization**			**Evaluated in the Period 4/More Years After Digitalization**			**Pooled Panel**		
Dependent Variable: Group By Adaptation to Digitalization **Base Outcome:** Never Consulted Digital Bill	Group that started consulting right after digitalization	Group that started consulting after couple years	Group that started consulting years after digitalization	Group that started consulting right after digitalization	Group that started consulting after couple years	Group that started consulting years after digitalization	Group that started consulting right after digitalization	Group that started consulting after couple years	Group that started consulting years after digitalization	Group that started consulting right after digitalization	Group that started consulting after couple years	Group that started consulting years after digitalization	Group that started consulting right after digitalization	Group that started consulting after couple years	Group that started consulting years after digitalization
Average annual water use	0.00542	0.0352	-0.0111	-0.0519*	-0.0386	-0.0449	-0.0497	-0.0302	-0.0277	-0.0224	-0.0239	-0.0126	-0.0266	-0.0170	-0.0208
	(0.868)	(0.320)	(0.683)	(0.0925)	(0.228)	(0.106)	(0.221)	(0.465)	(0.484)	(0.501)	(0.476)	(0.685)	(0.352)	(0.485)	(0.398)
Water total Bill	-2.63e-06	-4.25e-05	2.60e-05	6.00e-05*	4.14e-05	5.71e-05*	4.78e-05	3.03e-05	3.89e-05	2.91e-05	2.58e-05	2.79e-05	3.28e-05	2.08e-05	3.81e-05
	(0.947)	(0.343)	(0.404)	(0.0987)	(0.285)	(0.0879)	(0.381)	(0.587)	(0.470)	(0.369)	(0.430)	(0.371)	(0.324)	(0.425)	(0.145)
Sewage Dummy	0.240	0.137	0.200	-0.101	-0.212	0.193	-0.135	-0.149	0.328	0.0343	-0.104	0.369	-0.0331	-0.112	0.246
	(0.430)	(0.655)	(0.455)	(0.736)	(0.479)	(0.483)	(0.680)	(0.647)	(0.282)	(0.920)	(0.762)	(0.242)	(0.906)	(0.677)	(0.329)
Bill Variance	3.54e-10	1.02e-09	5.61e-10	-2.11e-09	-2.31e-09	3.89e-10	3.47e-09	3.46e-09	3.83e-09	-0	0	-5.95e-11	-1.03e-10	0	-5.14e-11
	(0.747)	(0.318)	(0.578)	(0.154)	(0.201)	(0.403)	(0.300)	(0.303)	(0.252)	(0.733)	(0.773)	(0.490)	(0.513)	(0.732)	(0.430)
Perceived Bill Var	0.108	-0.141	0.195	0.263	-0.0156	0.259	0.182	-0.0373	0.243	0.196	-0.0624	0.221	0.220	-0.0378	0.259
	(0.762)	(0.699)	(0.537)	(0.444)	(0.964)	(0.392)	(0.606)	(0.917)	(0.436)	(0.576)	(0.861)	(0.476)	(0.493)	(0.909)	(0.367)
Perc Elect Bill Var	0.0315	0.256	0.159	0.0873	0.299	0.209	0.101	0.287	0.230	0.133	0.333	0.256	0.103	0.301	0.228
	(0.912)	(0.366)	(0.538)	(0.752)	(0.271)	(0.398)	(0.720)	(0.299)	(0.361)	(0.636)	(0.229)	(0.309)	(0.697)	(0.250)	(0.343)
District Annual Rationing	-0.581	-0.173	-0.0287	-0.409	-0.262	-0.280	-0.792	-0.473	-0.733	-0.550	-0.524	-0.385	-0.612	-0.369	-0.353
	(0.267)	(0.728)	(0.949)	(0.340)	(0.524)	(0.457)	(0.130)	(0.357)	(0.120)	(0.186)	(0.209)	(0.302)	(0.104)	(0.312)	(0.263)
Self Rep Rationing	0.222	0.296	-0.0998	-0.118	-0.123	-0.207	0.436	0.373	0.373	-0.0979	0.160	-0.00870	0.0599	0.157	0.000573
	(0.584)	(0.454)	(0.792)	(0.736)	(0.725)	(0.521)	(0.174)	(0.242)	(0.203)	(0.726)	(0.561)	(0.972)	(0.816)	(0.537)	(0.998)
Self Rep Water Quality	0.0803	0.309	0.450*	0.339	0.497*	0.620**	0.0942	0.335	0.451*	0.184	0.357	0.535*	0.187	0.387	0.529**
	(0.790)	(0.303)	(0.0996)	(0.249)	(0.0912)	(0.0203)	(0.753)	(0.261)	(0.0967)	(0.544)	(0.238)	(0.0510)	(0.501)	(0.178)	(0.0397)
Water share out of utilities' expense	0.608	0.500	0.371	0.654	0.689	0.263	0.713	0.581	0.0933	0.183	0.357	-0.301	0.509	0.475	0.0538
	(0.542)	(0.608)	(0.675)	(0.495)	(0.464)	(0.756)	(0.474)	(0.551)	(0.916)	(0.873)	(0.753)	(0.770)	(0.599)	(0.613)	(0.951)
Water share out of income	0.581	-2.989	1.060	-0.785	-2.280	0.0639	0.276	-2.756	-0.00751	-0.298	-2.906	0.449	-0.394	-3.037	0.0922
	(0.883)	(0.475)	(0.739)	(0.844)	(0.583)	(0.985)	(0.947)	(0.523)	(0.998)	(0.946)	(0.520)	(0.898)	(0.919)	(0.487)	(0.979)
Expectation Price Increases	0.482*	0.126	0.202	0.591**	0.244	0.252	0.663**	0.275	0.245	0.678**	0.290	0.260	0.583**	0.219	0.220
	(0.0847)	(0.641)	(0.415)	(0.0280)	(0.350)	(0.290)	(0.0160)	(0.303)	(0.315)	(0.0133)	(0.278)	(0.282)	(0.0192)	(0.383)	(0.339)
Cost. Vs. Price	-0.126	-0.141	0.158	-0.184	-0.159	0.184	-0.205	-0.214	0.110	-0.204	-0.198	0.104	-0.166	-0.164	0.155
	(0.676)	(0.644)	(0.561)	(0.526)	(0.588)	(0.478)	(0.486)	(0.475)	(0.679)	(0.486)	(0.507)	(0.692)	(0.548)	(0.564)	(0.543)
EfficientUtility	-0.471*	-0.0567	-0.180	-0.384	0.0762	-0.0198	-0.294	0.106	-0.0223	-0.297	0.109	-0.00525	-0.323	0.0907	-0.0305
	(0.0985)	(0.840)	(0.484)	(0.167)	(0.781)	(0.937)	(0.299)	(0.704)	(0.930)	(0.293)	(0.697)	(0.983)	(0.230)	(0.737)	(0.903)
Knowledge Meaning Cubic Meters	0.723**	0.130	0.266	0.737**	0.0804	0.235	0.767**	0.109	0.221	0.714**	0.0903	0.211	0.691**	0.0752	0.207
	(0.0349)	(0.716)	(0.418)	(0.0261)	(0.818)	(0.461)	(0.0228)	(0.759)	(0.495)	(0.0332)	(0.798)	(0.513)	(0.0277)	(0.825)	(0.508)
Knowledge Tariff Structure	0.0292	0.0190	0.252	0.217	0.136	0.372	0.255	0.195	0.376	0.240	0.154	0.379	0.225	0.152	0.374
	(0.913)	(0.943)	(0.297)	(0.401)	(0.594)	(0.110)	(0.330)	(0.449)	(0.111)	(0.361)	(0.554)	(0.108)	(0.372)	(0.551)	(0.104)
Understanding Platforms Available	2.596***	1.537***	1.780***	1.179***	0.340	0.699**	2.108***	1.170***	1.270***	2.054***	1.155***	1.255***	1.975***	1.121***	1.326***
	(0)	(1.51e-08)	(0)	(0.000179)	(0.284)	(0.0158)	(1.18e-08)	(0.000639)	(3.23e-05)	(2.17e-08)	(0.000763)	(3.91e-05)	(0)	(8.19e-06)	(3.35e-09)
Access to Technology Comm. Channel				1.316***	0.977***	0.814***	0.817**	0.595*	0.584**	0.869***	0.636*	0.639**	0.554***	0.379*	0.297*
				(4.94e-05)	(0.00229)	(0.00557)	(0.0135)	(0.0734)	(0.0498)	(0.00855)	(0.0575)	(0.0323)	(0.00695)	(0.0628)	(0.0922)
Email Contact Provided	2.288***	0.665**	1.042***	2.356***	0.713***	1.159***	2.095***	0.518*	0.922***	2.025***	0.444	0.895***	2.175***	0.590**	1.003***
	(7.18e-10)	(0.0192)	(6.43e-05)	(0)	(0.00962)	(5.03e-06)	(4.85e-09)	(0.0667)	(0.000374)	(1.55e-08)	(0.118)	(0.000557)	(3.47e-10)	(0.0330)	(0.000130)
Number Toilets	-0.284	-0.182	-0.294*	-0.375**	-0.170	-0.346**	-0.337*	-0.183	-0.319*	-0.360*	-0.202	-0.322*	-0.337*	-0.193	-0.323*
	(0.129)	(0.322)	(0.0817)	(0.0399)	(0.343)	(0.0351)	(0.0691)	(0.316)	(0.0576)	(0.0571)	(0.278)	(0.0586)	(0.0600)	(0.283)	(0.0500)
Number Laundry Machine	0.161	0.252	-0.512	0.316	0.401	-0.380	0.214	0.352	-0.450	0.326	0.466	-0.350	0.264	0.396	-0.405
	(0.712)	(0.558)	(0.227)	(0.445)	(0.323)	(0.344)	(0.607)	(0.386)	(0.262)	(0.447)	(0.265)	(0.393)	(0.520)	(0.296)	(0.298)
Beleive Water Exhaustible Resource	0.657*	0.0201	0.180	0.478	0.0351	0.171	0.525	0.0234	0.154	0.587*	0.0327	0.198	0.544	0.0314	0.162
	(0.0599)	(0.950)	(0.538)	(0.151)	(0.909)	(0.542)	(0.124)	(0.941)	(0.592)	(0.0857)	(0.917)	(0.491)	(0.100)	(0.914)	(0.562)
SES level Low (Base: Medium)	-0.210	-0.323	0.0337	-0.266	-0.321	0.0405	-0.378	-0.437	-0.0789	-0.364	-0.432	-0.0846	-0.334	-0.401	-0.0374
	(0.572)	(0.381)	(0.917)	(0.453)	(0.364)	(0.895)	(0.295)	(0.224)	(0.803)	(0.312)	(0.229)	(0.788)	(0.333)	(0.249)	(0.900)
SES Level High (Base: Medium)	-0.687*	-0.624	-0.505	-0.137	-0.277	-0.144	-0.332	-0.407	-0.252	-0.376	-0.497	-0.214	-0.358	-0.429	-0.239
	(0.0901)	(0.123)	(0.162)	(0.720)	(0.469)	(0.675)	(0.395)	(0.296)	(0.473)	(0.338)	(0.209)	(0.541)	(0.339)	(0.262)	(0.487)
Income USD	0.000273	0.000188	0.000364**	0.000108	8.98e-05	0.000209	0.000202	0.000127	0.000252	0.000208	0.000179	0.000290*	0.000176	0.000128	0.000256
	(0.119)	(0.286)	(0.0233)	(0.524)	(0.597)	(0.180)	(0.243)	(0.465)	(0.113)	(0.243)	(0.317)	(0.0747)	(0.344)	(0.482)	(0.139)
Education Household Head	-0.0893	0.0146	-0.0267	-0.0723	0.00824	-0.0223	-0.0401	0.0247	0.00297	-0.0585	0.00880	-0.0176	-0.0691	0.00860	-0.0193
	(0.109)	(0.792)	(0.599)	(0.191)	(0.883)	(0.660)	(0.481)	(0.665)	(0.955)	(0.304)	(0.878)	(0.736)	(0.214)	(0.869)	(0.713)
Age Household Head	-0.0290**	-0.0146	-0.0336***	-0.0325***	-0.0210*	-0.0386***	-0.0276**	-0.0166	-0.0354***	-0.0288**	-0.0172	-0.0355***	-0.0300***	-0.0180	-0.0360***
	(0.0120)	(0.194)	(0.00106)	(0.00464)	(0.0601)	(0.000151)	(0.0196)	(0.146)	(0.000794)	(0.0154)	(0.137)	(0.000774)	(0.00906)	(0.105)	(0.000403)
Female Household Head	0.223	0.154	0.863**	0.0937	-0.0965	0.693**	0.122	0.00260	0.709**	0.0888	-0.00716	0.731**	0.163	0.0322	0.772**
	(0.554)	(0.671)	(0.0109)	(0.800)	(0.785)	(0.0349)	(0.747)	(0.994)	(0.0343)	(0.813)	(0.984)	(0.0291)	(0.657)	(0.924)	(0.0169)
Household Size	-0.0696	-0.0694	0.00460	-0.0294	-0.0376	0.0252	-0.0657	-0.0584	-0.00834	-0.0820	-0.0412	-0.00379	-0.0513	-0.0417	0.0141
	(0.428)	(0.430)	(0.953)	(0.729)	(0.662)	(0.742)	(0.447)	(0.500)	(0.913)	(0.362)	(0.649)	(0.962)	(0.529)	(0.609)	(0.848)
Female Manage Bill	-0.142	-0.0683	-0.343	0.161	0.226	-0.0828	-0.0136	0.111	-0.188	0.0824	0.206	-0.144	0.00381	0.109	-0.205
	(0.696)	(0.845)	(0.297)	(0.651)	(0.509)	(0.795)	(0.970)	(0.748)	(0.563)	(0.819)	(0.552)	(0.657)	(0.991)	(0.744)	(0.521)
Automatic Payment (base in person)	0.317	0.0481	0.447	0.0189	-0.0837	0.298	0.00846	-0.179	0.165	0.0187	-0.170	0.165	0.278	-0.00656	0.383
	(0.506)	(0.921)	(0.308)	(0.965)	(0.849)	(0.447)	(0.985)	(0.691)	(0.682)	(0.966)	(0.706)	(0.680)	(0.490)	(0.987)	(0.310)
Bank Manual Payment (base in person)	0.338	-0.149	-0.211	-0.466	-0.106	-0.465	-0.605*	-0.340	-0.723**	-0.483	-0.254	-0.576*	-0.173	-0.116	-0.386
	(0.340)	(0.684)	(0.534)	(0.150)	(0.737)	(0.114)	(0.0748)	(0.309)	(0.0207)	(0.152)	(0.447)	(0.0628)	(0.523)	(0.667)	(0.122)
PayHeadSpouse	-0.759	-0.633	-0.792*	-0.255	-0.423	-0.395	-0.465	-0.515	-0.552	-0.306	-0.422	-0.483	-0.407	-0.472	-0.521
	(0.117)	(0.191)	(0.0767)	(0.530)	(0.281)	(0.280)	(0.268)	(0.203)	(0.146)	(0.464)	(0.295)	(0.198)	(0.264)	(0.179)	(0.115)
Constant	-1.033	-0.253	1.251	-0.369	0.279	1.697	-1.067	-0.164	1.442	-1.148	-0.333	1.248	-0.909	-0.127	1.367
	(0.423)	(0.840)	(0.276)	(0.766)	(0.814)	(0.121)	(0.403)	(0.893)	(0.200)	(0.385)	(0.793)	(0.282)	(0.467)	(0.911)	(0.209)
Observations	789	789	789	807	807	807	810	810	810	807	807	807	3,213	3,213	3,213

pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix C:

Table C1: Statistical Difference of Customers' Preferences on Consultation Platforms f By Socio-Demographic Variables

Evaluated Socio-Demographic Variable	Test	Groups of Customers By Each Perspective (P-Value of Means Test or Test of Proportions)		
		Believe platforms is (is not) practical	Understand (or not) platforms	Like (or not) platforms
Age Household Head	Means Test	(0.000)	(0.000)	(0.000)
Education Household Head	Means Test	(0.106)	(0.000)	(0.000)
Gender Household Head	Test of Proportions	(0.305)	(0.189)	(0.188)
Household Income	Means Test	(0.302)	(0.000)	(0.000)

Appendix D:

Table D1: Average Monthly Water Use by Type of User Based on Consumption Level, and by Bill Consultation

		Lower-level User			Average-level User			Higher-level User		
		N	Mean	Median	N	Mean	Median	N	Mean	Median
Average Monthly Water Use: All Sample										
Pre-Digit Period	Consult	73	8.3	9.1	46	17.7	17.7	27	41.4	36.9
	Do Not Consult	215	7.8	8.0	323	18.0	17.3	127	35.0	31.6
Period Inmediate After Digit	Consult	198	7.6	7.9	288	18.0	17.6	128	35.9	32.1
	Do Not Consult	82	8.7	9.3	90	18.2	18.5	40	36.9	34.8
Couple Years After Digit	Consult	154	8.0	8.4	215	18.1	17.9	96	36.7	32.4
	Do Not Consult	125	7.7	8.0	171	17.9	17.8	68	37.5	31.9
4/More Years After Digit	Consult	115	7.7	8.6	130	18.1	17.6	44	36.9	31.8
	Do Not Consult	180	7.7	7.9	253	18.0	17.6	92	36.2	32.1
Average Monthly Water Use: Customers with Sewage										
Pre-Digit Period	Consult	41	8.4	8.9	30	17.4	18.2	17	40.7	36.5
	Do Not Consult	119	8.2	8.4	177	18.3	18.1	62	33.8	29.7
Period Inmediate After Digit	Consult	111	7.8	8.0	172	18.0	17.5	67	35.1	32.4
	Do Not Consult	44	9.2	9.5	53	18.2	18.7	18	36.8	30.7
Couple Years After Digit	Consult	89	8.5	9.0	129	18.1	17.7	54	34.4	31.6
	Do Not Consult	68	8.1	8.1	96	18.0	17.9	24	36.4	32.1
4/More Years After Digit	Consult	61	8.0	8.6	68	17.9	17.4	14	38.0	34.2
	Do Not Consult	101	7.8	8.1	159	18.3	17.9	45	33.9	31.3
Average Monthly Water Use: Customers without Sewage										
Pre-Digit Period	Consult	32	8.1	9.4	16	18.1	17.6	10	42.6	42.5
	Do Not Consult	96	7.2	7.6	146	17.5	16.6	65	36.1	33.8
Period Inmediate After Digit	Consult	87	7.4	7.7	116	18.0	17.6	61	36.7	30.7
	Do Not Consult	38	8.0	9.1	37	18.2	18.0	22	37.0	37.2
Couple Years After Digit	Consult	65	7.3	7.6	86	18.2	18.0	42	39.6	34.5
	Do Not Consult	57	7.2	7.9	75	17.8	17.8	44	38.0	31.3
4/More Years After Digit	Consult	54	7.2	8.0	62	18.2	17.9	30	36.4	31.5
	Do Not Consult	79	7.6	7.7	94	17.5	16.6	47	38.4	33.7