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Policy Implications of Tariff Preferences in Rural Water Management: Insights from Chile

Francisco J. Fernández,^{1,2,3}, Felipe Vásquez-Lavín^{2,4,5}, Diego Rivera³, Francisco Hernández⁶, Carlos Bopp⁷, Nélyda Campos-Requena^{3,4}, Roberto D. Ponce^{2,3,4}

¹ Center of Economics for Sustainable Development (CEDES), Faculty of Economics and Government, Universidad San Sebastián, Santiago, Chile

² Center of Applied Ecology and Sustainability (CAPES), Chile

³ Water Research Center for Agriculture and Mining (CRHIAM), Universidad de Concepción, Concepción, Chile

⁴ School of Business and Economics, Universidad del Desarrollo, Concepción, Chile

⁵ Center for Climate and Resilience Research, Chile

⁶ Departamento de Economía y Finanzas, Facultad de Ciencias Empresariales, Universidad del Bío-Bío, Concepción, Chile

⁷ Department of Agricultural Economics, Universidad de Talca, Chile

Corresponding author email: francisco.fernandez@uss.cl

Abstract

A tariff is a crucial tool for managing rural water supply services. It helps cover the costs of operation, maintenance, and repair, ensuring the sustainability of these services. Unfortunately, due to suboptimal tariff structures, rural water systems lack the financial liquidity to handle unforeseen events. This puts them in a difficult position, especially with the increasing water demand and resource scarcity driven by climate change. Therefore, adjusting the current tariff settings is necessary to achieve financial and operational sustainability, balancing cost recovery with other social, economic, and environmental objectives. This study aims to determine how pricing components, such as fixed charges and variable costs, influence consumer acceptability of different tariff systems. Using a choice experiment, we evaluated Chilean rural water consumers' preferences for different tariff schemes. The results show that individuals are highly conservative regarding the price structure. Participants preferred maintaining existing tariffs, consistently favoring the status quo over alternative tariff structures. Significantly, the likelihood of selecting a new tariff structure is influenced more by alterations in the variable component than by changes in the fixed price of water. These findings provide valuable insights for achieving a balanced and sustainable approach to rural water management and help policy design.

JEL Codes: D12, D63, H23, Q10



Introduction

The implementation of tariffs in Rural Water Supply Services (RWSs) is crucial for the sustainability of these organizations since they need to cover the operation costs and maintenance of the infrastructure and cover the eventual repairs in case of failures or incidents (Harvey, 2007; Koehler et al., 2015). Water system administrations must also balance financial stability with other social, economic, and environmental objectives, such as universal resource access (Leflaive & Hjort, 2020; Silva Pinto et al., 2021; Whittington, 2006). Therefore, water tariffs are frequently controversial due to the trade-offs in achieving these different objectives, making financially sustainable RWSs one of the significant challenges in rural areas (Mohanty & Rout, 2023). Additionally, this is becoming an even more significant challenge in the context of rising water demand and resource scarcity brought on by climate change.

Most RWSs cannot deal with unforeseen events as they do not have sufficient financial liquidity, which is mainly explained by suboptimal tariffs for drinking water users (Donoso & Molinos-Senante, 2017; Harvey, 2007). This financial stress can lead to a reduction in water quality and distribution problems (Abramson et al., 2011; Singh et al., 1993), increasing dependence on tank trucks (Chloé et al., 2022), and eventually, the stoppage of the drinking water supply service (Fuster & Donoso, 2018; Malima, 2021). Therefore, Rural Water Services must carefully consider changing the tariff structure to attain the service provision's financial and operational sustainability.

However, defining and implementing a change in the water tariff level or structure that consumers find acceptable can be daunting. Most of the literature on the subject has examined users' willingness to pay for changes in the supply, which is usually framed as an increase in the water tariff level, in exchange for service improvements (Abramson et al., 2011; Briscoe et al., 1990; Burt et al., 2017; Cho et al., 2005). However, RWSs are experiencing challenges that require changing their tariff structure system to ensure the sustainability of their services, even if that does not imply any improvement in the quality. In this context, there is a lack of comprehensive studies about how changes in the tariff structure will alter the demand for the service. The acceptability of these tariff changes may vary among consumers, resulting in differing tolerance levels towards such modifications.

This study aims to evaluate the satisfaction level of rural water consumers and their preferences towards different prospective tariff structures. Specifically, we focus on the Central South region of

Chile, which has been affected by a megadrought for the past 13 years, making it vulnerable to rural domestic water security (Fernández et al., 2023; Garreaud et al., 2019; MMA, 2023). Furthermore, the Chilean RWSs are undergoing legal modifications to revise their tariff structures to meet consumers' needs better and achieve environmental and social objectives (Donoso & Molinos-Senante, 2017). We assessed the current satisfaction levels of consumers by examining their perceptions of water quality, pressure, and supply continuity, which are critical factors influencing their acceptance of tariff changes. Furthermore, we used a choice experiment (CE) to evaluate rural water consumers' preferences for tariff attributes, including fixed charges and the structure's components, as variable costs by use.

This study makes several key contributions to the literature on rural water management and tariff preferences. Firstly, it analyzes rural water consumers' satisfaction levels with their current service. This area has been underexplored in the context of Chile's prolonged megadrought and its implications for water security. Secondly, by employing a CE methodology, we offer novel insights into consumers' trade-offs between different tariff attributes, such as fixed charges and marginal costs. Thirdly, the study contributes to the policy discourse by assessing a mixed tariff structure that balances the need for financial sustainability of Rural Water Supply systems with the consumers' demand for affordability and fairness. With this, we look to provide useful recommendations for policymakers to deal with the dual challenges of ensuring water service sustainability and meeting the needs of rural communities in Chile.

Water Tariffs and Their Evolution in Chilean Rural Water Supply System

Water Tariff Types

According to the typology of different water tariff structures made by Whittington and Wildered (2011a), most of the tariff alternatives fall within the category of *single-part tariffs*, where a consumer's monthly water bill is based on a single type of calculation, or a *two-part tariff*, where consumer's water bill is based on the sum of two components. Among the *single-part tariff*, there are two kinds of calculations: *fixed pricing*, a fixed charge independent of water consumption, and *variable pricing*, which depends on the level of water consumption. Among the *two-part tariffs*, the consumer's water bill is based on a combination of fixed charge and variable pricing. Literature has

identified the *two-part tariff* as one of the most attractive structures due to the high cost of the capital investment necessary to build a water system (Whittington, 2006, 2011b). Additionally, it ensures a balance between the needs of users and the need to protect the resource (Enqvist & van Oyen, 2023; Macchiaroli et al., 2023).

Among the several tariff structures implemented, two are the most common: the unitary volumetric tariff (UVT) and the increasing block tariff (IBT). For the first one, the consumer's water bill is the quantity of water used times the price defined per water unit. Its major advantages are the ease of consumer understanding and its usefulness in communicating the short-run marginal price. For the second one, customers pay a low price up to a certain amount or block. After that, if they use more water, they must pay more up to the limit of the second block, then even more for the third, and so on. The IBT has been widely considered because it will help to internalize the scarcity value of water (Molino-Senante, 2018), promoting water use efficiency and allowing poor households to keep consumption within lifeline block, securing cheap access to basic water volumes (Leflaine & Hjort, 2020). Additionally, it can generate adequate revenue to recover costs, making it financially sustainable (Whittington, 2006).

Regulatory Evolution in Chile's Rural Water Supply

The drinking water supply in Chile, which serves both urban and rural populations, displays significant differences in its management and accessibility. In urban areas, where 99.9% of the population can access safe drinking water (MMA, 2021), medium- to large-scale sanitation service companies are responsible for the water supply. On the other hand, the situation in rural areas is different, where 47.7% of the inhabitants lack regular and formal water supply (Molino-Senante & Donoso, 2021). Local users manage the distribution in these areas because larger companies do not cover them. The rural population is organized into rural drinking water committees or cooperatives, which utilize small-scale public infrastructure provided by the State of Chile. These community organizations are crucial in operating and maintaining the drinking water delivery system.

To become operators of RWSs, interested individuals from rural areas must complete an application form. Two types of RWSs are distinguished by their scale of operation and level of formality. Some committees operate framed into the Neighbourhood Councils Law; on the other hand, there are cooperatives that the Cooperatives Law regulates. Nevertheless, both types of RWS adhere to

similar guidelines and regulations and are technically supported by Sanitary Service Companies from urban areas.

The Chilean RWSs have recently faced several legal modifications that involve changes in their current tariff setting. Unlike urban service providers, the rural water supply and sanitation sector has not been subject to official regulation for years. Since pricing was unregulated, each RWS organization devised a distinct approach to setting prices. Unfortunately, in many cases, the current tariffs do not allow full cost recovery and adequate investment and maintenance to satisfy growing demand (Donoso, 2018; Donoso et al., 2015; Navarro et al., 2007). Furthermore, the tariffs applied in the Chilean rural regions did not reflect the scarcity value of the water resource, so they did not provide the signals to achieve sustainable consumption locally (Donoso & Molinos-Senante, 2017).

In 2017, the Congress established a new legal and institutional framework for Chile's rural water and sanitation sector by adopting Law No. 20,998. This regulatory body defines the operation rules of the RWS, the conditions in which water services should be provided, and the procedures to set water and sanitation tariffs in rural settings (MOP, 2022). However, due to the COVID-19 pandemic, the implementation of Law 20,998 has achieved less progress than expected. Law No. 21,401 was implemented in December 2021 to address this scenario, extending some of the tariff deadlines. For November 2022, a second modification to the law was approved, making the requirements and deadlines more flexible in several areas, including extending the period for the first tariff setting. Finally, Law No. 21,520, enacted in December 2022, postponed the start of the tariff processes, which will be carried out for services classified as Major and Medium segments between 2024 and 2029¹.

The Rural Sanitation Services Law governs the management and provision of drinking water in rural areas. It is enforced by the General Water Directorate (DGA) under the Ministry of Public Works (MOP). This law imposes more stringent obligations and regulations on RWSs, including mandatory registration in the National Registry of Operators, technical training, and tariffs for users².

¹ Article 70 of law Nº 20998 divides operators into Major, Medium, and Minor categories. This classification considers their technical, administrative, and financial management, population served, proximity to urban areas, socio-economic and isolation conditions, indigenous community legal status, water resources, geographic and topographic factors, and agricultural community and small farmer status.

² <https://doh.mop.gob.cl/SSR/index.html>

Methodology

Study area

The data for this study was gathered from surveys conducted in the communes of Ránquil and San Nicolás, located in Chile's Ñuble region (Figure 1). Both Ránquil and San Nicolás are located in central Chile and experience a temperate climate that ranges from dry to rainy. According to the 2017 Population and Housing Census, Ránquil has a population of 5,755, with 72% residing in rural areas. San Nicolás, on the other hand, has a population of 11,603, with 6,716 (57.9%) living in rural areas. Since 2010, this region has been facing a severe drought, which has led to acute water scarcity and shortages. The Ñuble region has seen a progressive increase in the number of people affected by water deficit and/or access problems to water in rural areas. By 2022, it was reported that over 26,216 people were affected by this condition across 21 communes. As a result, it has become necessary to hire tank trucks to distribute drinking water to these families for their subsistence (SENAPRED, 2022). Further, as of 2022, the poverty rate in this region was the highest in the country at 12.1%, according to the National Socioeconomic Characterization Survey (CASEN) by the Ministry of Social Development and Family (MDSF, 2022).

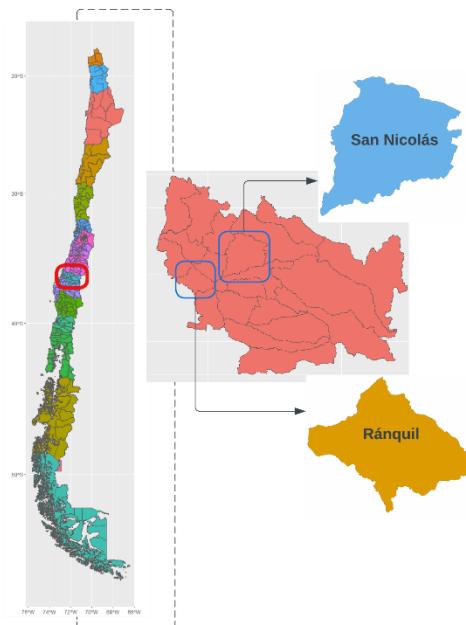


Figure 1. Communes of study

Furthermore, based on the Climate Risk Atlas for Chile (ArClim), it is expected that rural water users from Ránquil and San Nicolás will suffer one of the major negative variations in the risk index due to the change in the incidence of meteorological droughts (MMA, 2023). ArClim calculates a risk index representing adverse effects on rural domestic water security generated by meteorological drought, considering historical and future climatic conditions and social and institutional circumstances. A comparison between 1980-2010 and 2035-2065 shows that Ránquil and San Nicolás will change their risk index by more than 0.62 points between both periods, reaching risk indexes greater than 0.82 points³. Figure 2 describes the change of this index in different communes of the Ñuble region.

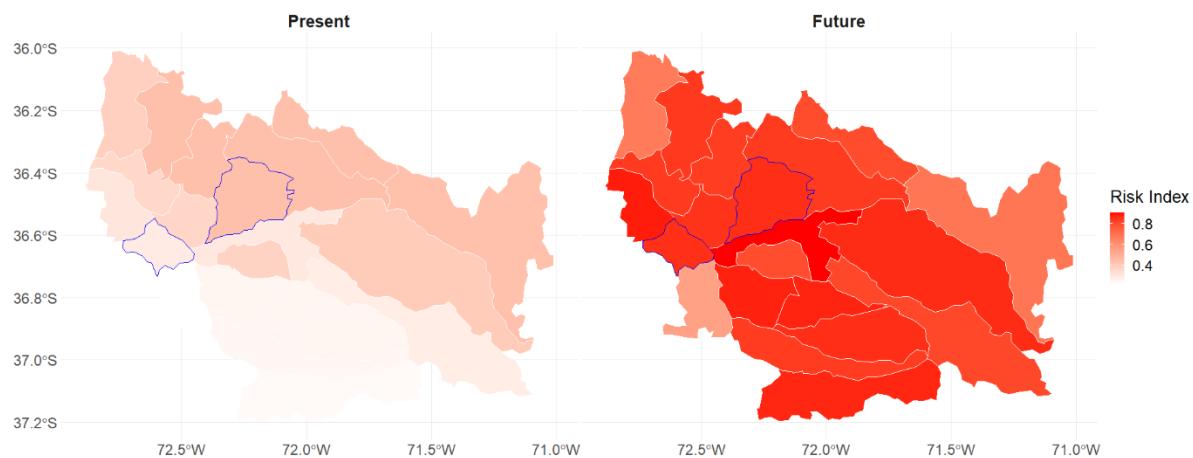


Figure 2. Risk Index in Ñuble Region. Adverse effects on rural domestic water security generated by meteorological drought. The communes of San Nicolás and Ránquil are highlighted. Source: Own elaboration based on ARCLIM

Data collection process

The survey involved 881 users across nine RWSs. The RWSs were chosen through a discretionary process, with invitations extended via the respective Communal Unions of RWSs. Participants in the survey were primarily heads of households, their representatives in the RWSs committee, or those responsible for the monthly drinking water fee. The focus was on permanent residents of the organization, deliberately excluding temporary occupants. After the data treatment process, the final database ended with 875 observations.

³ The Risk index takes values between 0 and 1, where 1 means greater risk.

The questionnaire was applied in person at the property where the rural drinking water network connection of interest (i.e., rural drinking water systems in Ránquil and San Nicolás) between December 2021 and August 2022. The measurement instrument included an evaluation section where the current RWSs were evaluated. In this section, on a scale of 1 to 7, users evaluated the quality of the rural domestic drinking water service delivered by the RWSs according to water quality, water pressure, and supply continuity for drinking water. Another survey's section included a choice exercise where respondents had to choose between two "two-part tariff structures": the status quo (that represents a current alternative) and the tariff alternative (that represents the prospective alternatives). The first is a fixed charge with a variable charge of one block (status quo) after using 10 m³. At the same time, the alternatives correspond to different tariff structure configurations based on increasing block tariffs (IBT) or uniform volumetric tariffs (UVT) (Table 1).

Table 1. Description of alternatives and status quo characteristics

Form/structure	Fixed charge	Variable charge 1	Variable charge 2
Status quo			
IBT	\$4,000	\$0	\$400
Alternatives			
Form A: UVT	\$3,000	\$200	\$200
Form B: IBT	\$4,000	\$100	\$200
Form C: IBT	\$3,500	\$150	\$200
Form D: UVT	\$2,000	\$300	\$300
Form E: UVT	\$5,000	\$100	\$100
Form F: IBT	\$1,000	\$200	\$500

The current tariff (or the status quo) is a representative tariff of all the RWS surveyed, as each RWS organization devised its distinct approach to set prices. The prospective alternative tariff consisted of six forms randomly presented to respondents and attached to the survey as an annex. Additionally, five of the six alternatives present different fixed charges. The survey also collected sociodemographic information on alternative water supply sources and ways of disposing of wastewater. Supplementary material presents a graphical representation of the water pricing structures used for this study.

Econometric approach

The conceptual foundations of the CE are based on Lancaster's Theory of Value (Lancaster, 1966) and the Random Utility Theory (McFadden, 1974). Random utility theory states that an individual's utility function has two components: a systematic or deterministic component (i.e., observed by the researcher) and a random term, which is independent of the deterministic part and follows a given distribution (i.e., unobservable by the researcher). This error component implies that predictions cannot be made with certainty.

In this CE, respondents were asked to choose one tariff option among two options, which are defined in terms of two tariff structures that could be used for the design of the new structure proposed in the new law No. 20,998 of rural water services (e.g., fixed charge plus a uniform charge or fixed charge plus increasing variable charge per block). Each respondent was presented with two choice scenarios and had to choose an alternative between the two proposed tariff structures (alternative tariff proposal and the status quo), which are differentiated by the values associated with each tariff component. Thus, the utility obtained by respondent i by selecting alternative j with $j=1,2$ alternatives is given by:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (1)$$

Where V_{ij} is the observable or deterministic component of utility, and ε_{ij} is the random unobserved term. The conventional assumption about the functional form of V_{ij} is to define it as separable, additive, and linear. In this case it is given by:

$$V_{ij} = \alpha * ASC + \delta * FC_{ij} + \beta * VC1_{ij} + \theta * VC2_{ij} \quad (2)$$

where: ASC represents the alternative-specific constant for each alternative. In this case, we only use a ASC for the status quo (SQ) option; FC is the fixed charge attribute (FC_{ij}), VC1 and VC2 represent the variable rate proposal, that is, the variable charge attribute 1 ($VC1_{ij}$) and the variable charge attribute 2 ($VC2_{ij}$), respectively. In terms of the parameters, α represents the marginal utility of choosing the SQ, reflecting a trend towards the current situation if positive, δ represents the marginal utility parameter of fixed charge, and β and θ represent the marginal utility parameters of attributes variable charge 1 and 2, respectively.

The probability that individual i chooses option j of the tariff proposal over option k in the choice situation, for any $j \neq k$ is given by:

$$\begin{aligned}
 P_{ij} &= \text{Prob}(U_{ij} > U_{ik}; \forall j \neq k)P_{ij} \\
 &= \text{Prob}(V_{ij} + \varepsilon_{ij} > V_{ik} + \varepsilon_{ik}; \forall j \neq k)P_{ij} \\
 &= \text{Prob}(\varepsilon_{ij} - \varepsilon_{ik} < V_{ij} - V_{ik}; \forall j \neq k)
 \end{aligned} \tag{3}$$

The probability that each random term $\varepsilon_{ij} - \varepsilon_{ik}$ is below the observed quantity $V_{ij} - V_{ik}$ is a cumulative distribution (Train, 2009). Assuming that the utility of the random component ε_{ij} follows extreme value type I distribution, the probability that an individual i chooses alternative j in the choice situation takes the general form (Train, 2009):

$$P_{ij} = \frac{e^{V_{ij}}}{\sum_{j=1}^J e^{V_{ij}}} \tag{4}$$

Under the assumption that the random component is distributed identically and independently and assuming homogeneous preferences among water users, equation (1) can be estimated using a Conditional Logit Model (CL) where the values obtained are the average preferences for the individuals of the sample (Hensher et al., 2015).

Results

The members-users of the service evaluate the current system favorably regarding quality, quantity, and continuity of the supply service. Figure 2 shows that most responses fall within the highest categories (6 and 7), indicating that most users perceive the water quality, quantity, and continuity to be very good. Many users seem to be content with the present performance of RWS, even though there is a record of water scarcity and shortages in the region. This could suggest that the current water deficit and access issues are not attributed to the RWSs by the water users and could anticipate a very conservative attitude towards price changes (selecting the SQ in most of the choice sets).

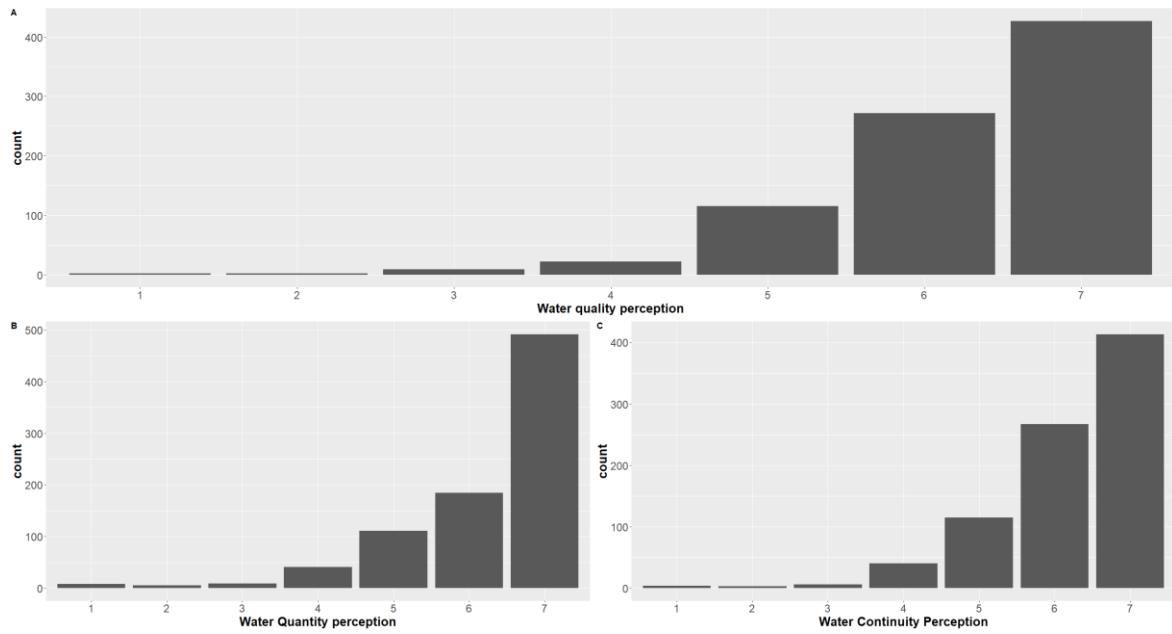


Figure 3. User's perception of water standards (quality, quantity, continuity) in the study area

The econometric model confirms this hypothesis. Column (1) of Table 1 presents an estimate of the conditional logit for all users included in the survey. Column (2) estimates a subsample for which we also have information on their past water consumption. The results indicate a tendency of water users towards the status quo (ASC coefficient is positive and statistically significant), that is, to maintain the current tariff structure instead of making changes in the tariff structure or any of its components. In this sense, resistance to change is particularly relevant, emphasizing the need to understand the social acceptability of tariff changes. Policymakers should consider this result problematic since it implies a strong social opposition to the new legislation that defines new procedures for setting water tariffs in rural settings.

For the tariff components, it is observed that the higher the fixed charge, the lower the probability of choosing the new tariff. The same is true for the marginal prices (VC1, VC2), which are all statistically significant except for the VC1 in the first regression. In this regard, the second price (VC2), or the over-consumption price (higher price for consumption over 10 m^3), is highly relevant for the respondents even though there are only three alternatives with an IBT (the others are UVT). This result could be problematic from a policy perspective since people are stating they do not like to have a punishment for over-consumption. The low cutoff point (10 m^3) level could also explain this opposition since the mean consumption level is around 11.5 m^3 , but we did not test for different cutoff points. We only observed that people with higher consumption are more prone to choose

new price structures because, depending on the type of tariffs. In our experimental design, both alternatives, the SQ and the new tariff are equivalent in terms of the total payment at 15m³ (options A, B, and C), 16.6m³ (option D), and 20m³ (options E and F). Therefore, people consuming about those thresholds should prefer to move away from the status quo.

Table 2. Conditional logit results

Variables	(1)	(2)
Fixed charge (FC)	-0.000786*	-0.00161**
	(0.000419)	(0.000675)
VC1	-0.00226	-0.0101*
	(0.00322)	(0.00519)
VC2	-0.00731**	-0.0120**
	(0.00325)	(0.00523)
ASC * Consumption		-0.0437**
		(0.0177)
ASC	0.847*	1.756**
	(0.466)	(0.758)
Observations	1,640	648

Robust standard errors in parentheses: In column (2), the average water consumption variable interacts with the alternative specific constant for the status quo. *** p<0.01, ** p<0.05, * p<0.1

Figure 4 shows the probability of choosing Tariff A and SQ in response to changes in each tariff component. Panels A, B, and C show how the predicted probability of choosing Tariff A and SQ changes as the fixed charge (Panel A), variable charge 1 (Panel B), and variable charge 2 (Panel C) change. The point where both probabilities of choice intersect is known as the indifference point, representing a 50% chance of choosing either tariff at that specific charge. By comparing the probabilities of choice of Tariff A and SQ, we can see that the indifference points for the fixed charge, variable charge 1, and variable charge 2 are \$5,250, \$1,000, and \$400, respectively. Panel D displays

the indifference point for all three charges, considering the probabilities of choosing SQ versus the probabilities of choosing the other tariffs (from tariff A to F).

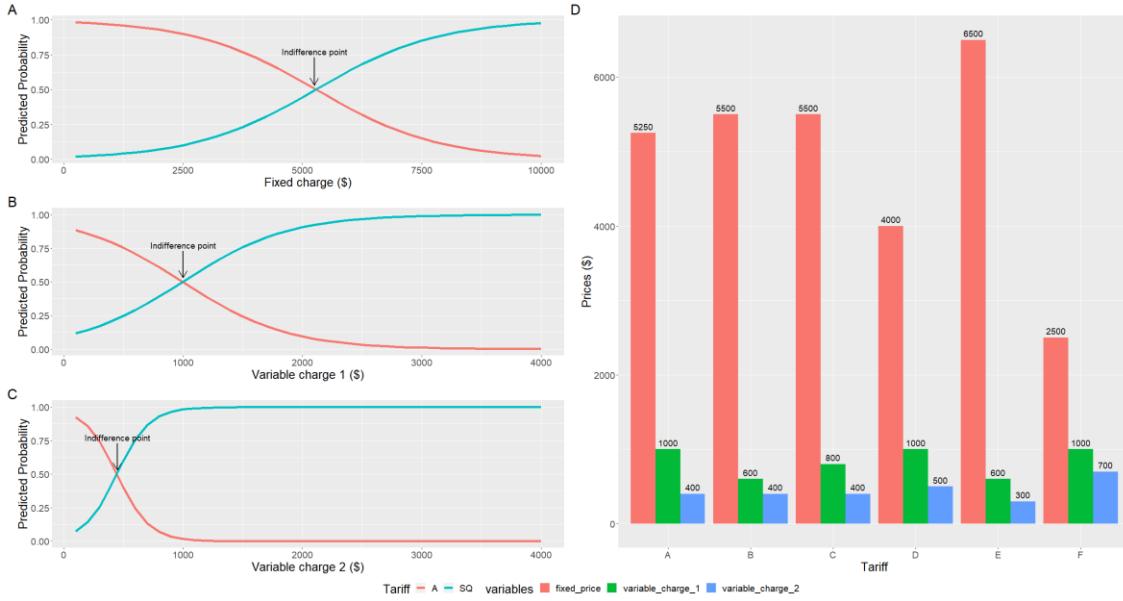


Figure 4. Indifference price ($p = 0.5$) as a function of tariff components. Panels A, B, and C present the predicted probability for Tariff A and SQ for the three tariff components. Panel D presents the indifference points for each tariff alternative.

The analysis indicates that water users are sensitive to increases in the fixed charge component of tariffs; however, their preferences are more profoundly influenced by changes in variable charges, with a particular emphasis on variable charge 2. The data in Table 2 supports this conclusion, showing that the coefficient for variable charge 2 (-0.0120) is seven times larger than that for the fixed charge (-0.00161). This suggests that, when comparing the effects of a marginal increase in either the fixed charge or variable charge 2 on the probability of choosing the status quo (SQ) tariff over an alternative tariff, the impact of variable charge 2 is sevenfold greater than that of the fixed charge. This significant disparity highlights the critical role that variable charges, especially variable charge 2, play in shaping tariff preferences among rural water consumers.

We also analyzed users' preferences for different tariff structures as alternatives to the current tariff (SQ). According to Table 3, within the Uniform Volume Tariff (UVT) structure, an increase in the fixed charge and the VC2 significantly reduces the likelihood of users selecting the UVT option over the SQ. This suggests that users prefer lower fixed charges and are averse to higher marginal prices for consumption beyond the established threshold ($w=10$). Conversely, the coefficients for the Increasing Block Tariff (IBT) structure are not statistically significant, indicating that the data from

this Choice Experiment does not provide clear evidence of a relationship between changes in the tariff components (fixed charge, VC1, and VC2) and the users' preference for the alternative IBT structures over the SQ.

Table 3. Conditional logit result by tariff structure

Variables	UVT	IBT
Fixed charge (FC)	-0.0008*	-0.0012
VC1	-0.0048	-0.0163
VC2	-0.0055**	-0.0061
Observations	782	858

We also approximated the annual revenue generated under each tariff alternative. Given the changes in prices implied by comparing the tariff alternatives with respect to the SQ, along with the price elasticity estimated by Vásquez et al. (2017), we assessed the impact of changes in each component of the tariff proposals on the quantity demanded of water. This approach enabled us to estimate the average annual revenue from water service provision by considering the demand elasticity in response to tariff adjustments. Table 4 shows that an efficient tariff from the collection point of view would be the proposed Tariff F, yielding an average annual collection of approximately \$29,844,710. This represents a significant improvement over the revenue potential of the SQ. Moreover, when compared directly, Tariff F outperforms Tariff A by approximately 28% in revenue generation, with the latter being the least lucrative model for service provision.

Table 4. Revenue by form (\$CLP thousand)

RWSs	n	SQ	Form A	Form B	Form C	Form D	Form E	Form F
Aguas buenas	21	1,279.2	1,216.4	1,308.9	1,261.2	1,194.4	1,472.0	1,423.9
Dadinco	86	9,408.0	7,053.2	7,615.5	7,323.4	7,598.2	7,144.7	8,922.4
El Centro - Cementerio	107	5,136.0	5,773.4	6,078.2	5,920.9	5,510.6	7,289.1	7,791.7
Lomas de Lucamávida	3	144.0	161.874	170.4	166.0	154.5	204.4	218.5
Los Sauces	2	96.0	107.9	113.6	110.7	103.0	136.2	145.6
Portal de la Luna	111	11,169.6	8,546.4	9,243.1	8,881.3	9,116.5	8,886.7	10,687.3
Puente Ñuble	9	432.0	485.6	511.3	498.0	463.5	613.1	655.4
Total	339	27,664.8	23,345.0	25,041.3	24,161.6	24,140.8	25,746.2	29,844.7

While Tariff F demonstrates the highest revenue potential, a closer examination reveals that even this optimized tariff structure falls short of covering the operational expenses incurred by most RWSs. It is important to note the substantial limitations in our data concerning the specific

operational and maintenance costs of RWSs. Nonetheless, we have accessed cost details from a larger-scale RWS within the same region, which serves as a reference point. By standardizing these costs across the number of active connections (819), we derived an average operational cost per connection of \$281,411. In contrast, the average annual revenue per connection for Tariff F is estimated at \$88,037—highlighting a significant shortfall in the revenue necessary to meet operational demands.

Moreover, it is important to highlight that the RWS utilized for cost analysis benefits from economies of scale, suggesting that its cost per connection is potentially lower than what smaller-scale RWSs—such as those in our subsample—might incur. This provides weight to our findings, underscoring the need for external financial support. Therefore, despite the rough approximation due to data constraints, this cost comparison further confirms that transitioning to more financially sustainable tariff structures, like Tariff F, would still necessitate supplementary funding for these services.

Discussions and policy implications

According to our research, rural water users from the study area are highly satisfied with the current system. They have positive opinions about the quality, pressure, and continuity of the water supply, making it difficult to compare with previous studies where people's acceptance of a new tariff system depended on service improvements (Abramson et al., 2011; Briscoe et al., 1990; Burt et al., 2017; Cho et al., 2005). Studies have shown that most individuals are willing to pay a higher service bill if they see a corresponding improvement in the quality and reliability of the water supply (Cho et al., 2005; Del Saz-Salazar et al., 2015; Genius et al., 2008; Yacob et al., 2011).

Despite the above, the unsustainability of the current tariff setting of most of the RWS in Chile is documented (Donoso & Molinos-Senante, 2017; Fuster & Donoso, 2018). In the context of climate change, water scarcity and the increase in water demand need to change the current financial state of most of them urgently. The positive opinion of the current service could be an extra barrier to a change in a tariff setting, added to the reluctance of members and users to increase rates in rural areas (FESAN, 2018; Fuster & Donoso, 2018).

Our results also show valuable insights into consumers' preferences regarding different tariff structures. Based on them, we can infer that consumers are sensitive to prices regarding the fixed charge and the marginal price for higher consumption blocks. This suggests that consumers prefer a tariff model that minimizes fixed costs and does not penalize higher consumption blocks too much. This is especially important for rural areas where accessibility to the service is crucial. However, policymakers must balance consumer preferences with the financial sustainability of water service providers, where the efficiency of service provision is poor for reasons attributable to a tariff that does not allow cost recovery and a lagging tariff adjustment practice (World Bank, 2021).

Additionally, when IBT and UVT structures were compared, our results suggest that the highest collection is achieved by using an increasing block structure, where the optimal design of fixed and variable charges is fundamental. From an environmental and social policy perspective, a tariff structure that promotes water conservation and social equity would be ideal. Thus, a rate that increases with the level of consumption can encourage users to reduce their water consumption. At the same time, this approach allows policymakers to implement cross-subsidies within the tariff structure, where users with higher consumption subsidize those with lower consumption. If consumption-based rates are less popular but necessary from a sustainability perspective, policymakers may need to train water users on the

importance of water conservation and the rate structure. Similar findings have been highlighted by authors such as Guerrini et al. (2018), who state that education efforts can help raise awareness and understanding of the need for conservation.

Conclusions

Water utilities have various options to generate funds, such as borrowing, project finance, equity, public funds, and tariff growth. In this study, we examined the acceptability of RWS users towards tariff growths and changes in their structure using a choice experiment approach. We estimated the impact of the tariff's characteristics on the users' level of acceptability. Our findings suggest that consumers prefer maintaining the existing tariff structure, indicating a general resistance to changes in tariff components. However, given the current challenges, such as climate change, increased demand, and population growth, it is essential to balance accessibility and sustainability. If consumption-based rates are less popular but necessary from a sustainability perspective, policymakers may need to educate users on the importance of water conservation and the rate structure.

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