WATER BILLS
– ARE THEY CLEAR TO RESIDENTIAL USERS[1]?

AS FATURAS DE ÁGUA SÃO CLARAS PARA OS UTILIZADORES RESIDENCIAIS?

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ABSTRACT/RESUMO

The aim of this paper is to assess the clarity of water bills based on the views of residential users gathered by means of a questionnaire survey administered to a sample of 386 households in the Portuguese autonomous region of Madeira.

The main rational behind this study lies on the argument that the opacity of water bills suggested by the characteristics of existent water tariffs schemes might be jeopardising the effectiveness of price signalisation.

Findings indicate that the vast majority of users has a very incomplete perception of the items that bills comprise and even fewer are aware of how much water they are consuming and how much they are paying. Evidence shows that more knowledgeable consumers tend to be more conscientious of the importance of adopting environmental friendly behaviours.

Overall, the study supports the view that simplifying water bills is an important area calling for the intervention of regulators.

Keywords: Water Supply Services; Tariffs; Bills' Clarity; Regulation; Madeira; Portugal

O objetivo deste artigo é avaliar a clareza das faturas de serviços de águas com base em respostas de utilizadores residenciais recolhidas através de um inquérito por questionário administrado a uma amostra de 386 famílias na Região Autónoma da Madeira.

A motivação do estudo reside na opacidade das faturas de água, aparente nos tarifários praticados, poder estar a inviabilizar a desejável sinalização, via preços, de comportamentos racionais de consumo.

Os resultados indicam que a maioria dos utilizadores tem uma perceção incompleta dos itens contidos na fatura, sendo mais escassos ainda os que têm noção das quantidades consumidas e dos encargos suportados. Consumidores mais conhecedores nestas matérias revelam-se também mais conscientes da importância da adoção de comportamentos mais amigos do ambiente.

O estudo aponta para a necessidade de intervenção dos reguladores no sentido da simplificação das faturas de água.

Palavras-chave: Serviço de Abastecimento de Água; Tarifários; Clareza das Faturas; Regulação; Madeira; Portugal.

JEL Codes: L51, L95, Q25

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1. INTRODUCTION

Water supply services, the focus of the current study, are Services of General Interest (SGI), which are subject to specific public service obligations. Existing European legislation indicates a number of common elements including: universal service, continuity, quality of service, affordability, as well as user and consumer protection, which must be imposed upon SGI operators (CEC, 2004). Bills clarity is an important topic to be addressed within user and consumer protection concerns. The role of national regulatory bodies in this regard is crucial, in view of the monopolistic conditions under which most of such services are provided (Armstrong *et al.*, 1999).

The context of the current research is particularly interesting since water is simultaneously a scarce resource (making it essential to promote its rational use) and, in what concerns certain volumes of water for basic needs ["decent minimum", Buchanan (1985)], a basic condition for living (calling for the definition of a price that is simultaneously accessible to everyone and fairly understandable). In fact, in many parts of the world water is regarded as a scarce resource (water was acknowledged as an economic good in 1992 in the International Conference on Water and Environment, organized by the United Nations). Moreover, environmental damages caused by excessive water consumption are recognized as external costs for the society. Therefore, it is of primordial importance to promote the parsimonious use of water resources.

After a long period in which supply side policies prevailed, there is nowadays a relatively wide consensus on the importance of demand-based strategies given the need to respond to increasing water consumption. Tariffs are considered key instruments for encouraging "adequate" behaviours on users and operators alike. In fact, in the European Union (EU), the Water Framework Directive (Directive 2000/60/EC) and Portuguese legislation (Water law – Law nr. 58/2005) recommend the use of tariffs, in conjunction with other methods, such as information/education campaigns, as mechanisms to be employed within a demand-based strategy.

In any case, it is crucial that prices and other relevant information are clearly passed on to residential users through water bills. The current study investigates residential users' perceptions regarding the clarity of water bills, which has been an underestimated topic in both theoretical and empirical literature. Most of the demand side studies have been focused on the estimation of water demand functions, mainly based on macro-level data, with the need to adopt simplistic assumptions in order to generate data for representative households.

The Madeira Region (a Portuguese autonomous territory) was selected to carry out this study given its natural and economic diversity. This context is interesting since, as it happens in many other places of the world, there is an unbalance between water resources origins location and population and economic activities water needs. In fact, more than two-thirds of the population lives in Funchal, Santa Cruz and Câmara de Lobos, three south municipalities of the ten municipalities existent in Madeira. On the other hand, it is in the north of the island, where water resources are larger, that we find the municipalities with lowest population density. Considering that tourism is a highly consumption activity and simultaneously the main economic activity in Madeira, it is worthwhile to notice that the vast majority of touristic infrastructures are situated in the three municipalities mentioned before. Despite enjoying a considerable degree of autonomy in what concerns the planning of water resources (as a result of being an autonomous region, Madeira has its own Water Plan, Plano Regional da Água da Madeira – PRAM), the organisation of the industry follows the key features of the Portuguese market as a whole and, therefore, findings can, with some caution, be generalised to a wider setting.

The remainder of the paper is structured as follows: in Section 2, a clear rationale for this research is provided based on a short review of the main topics addressed in the field of water demand literature and that point to the need of further investigating users' perceptions. Next, the main features of the water supply industry in Portugal are described, giving a particular emphasis to the characteristics of tariff schemes. Then, in Section 4, the methodological approach is presented and the key research questions clearly stated. Section 5 is dedicated to the discussion of the main findings. Finally, in the conclusion, some policy implications of the study are presented, specially those that relate to the role of the regulatory body in promoting the transparency of water bills.

2. UNCOVERING LITERATURE ISSUES THAT POINT TOWARDS THE NEED FOR BILLS CLARITY INVESTIGATION

The vast majority of the economic literature related to household water consumption gives emphasis to the estimation of demand functions as a way to analyse the effects of price and income on water consumption. The study of water pricing is particularly relevant since the industry has been experiencing price increases. Empirical evidence shows that economic determinants alone do not fully drive consumers' behaviours and other factors need to be taken into account. The effectiveness of price mechanisms, as well as of educational campaigns, depends upon the clarity of the information disclosed through water bills.

Most of the studies focus on the estimation of water demand to derive price and income elasticities. Arbués *et al.* (2003), and more recently Schleich and Hillenbrand (2009), offer interesting surveys on the estimation of residential water demand functions. In what concerns the assessment of economic determinants of residential water consumption, there is some consensus on the existence of

negative (though small) impacts of price and of positive effects of income on water consumption.

Apart from the weak price-elasticity, typical of goods that are essential to life and that have no immediate substitutes, the characteristics of local monopolistic market structures that prevail in the water industry, almost without any type of tariff regulation mechanisms, further explain the fragility of tariffs in driving consumer behaviours.

The principle of economic efficiency suggests that prices should equal marginal costs, which is an argument in favour of uniform water pricing rates. Yet, as water pricing sets out to pursue a multiplicity of other relevant objectives, in the literature on optimal water pricing non-linear schemes with two parts are commonly proposed, mainly for reasons of efficiency and of producers' concerns with financial viability (see, e.g., Elnaboulsi, 2009). In practice, however, water tariff schemes often deviate widely from these simple structures. Indeed, among the different types of water price structures implemented (see, e.g., OECD, 2009, 79), increasing block tariffs (IBT) are worldwide by far the most common (Rogers *et al.*, 2002; OECD, 2010). Economic literature raises arguments in defense of IBT, such as the promotion of sustainable use and conservation of water resources (OECD, 2009; Griffin, 2007). The rationale behind the implementation of this kind of tariffs lies on the attempt to dissuade, penalizing *via* higher prices, excessive consumption. Moreover, IBT are usually justified in light of equity concerns. As a matter of fact, one can assume that in general users who consume more water are those who have higher incomes. The range of consumption for the first block should be set taking into consideration the quantities needed to satisfy basic needs (Bolland and Whittington, 2000). For this block, price should thus be low, being the respective quantities subsidized by higher consumption levels.

Simplicity is a criterion suggested in the literature (e.g. Bolland and Whittington, 2000; Griffin, 2007; OECD, 2009) to be taken into account when setting water tariff schemes. Literacy can be, thus, regarded as a requirement to shape the desired behaviours and to effectively promote the sustainable use of water. However, as a consequence of the multiobjective context (frequently water pricing aims to promote greater economic efficiency together with equity, public health, environmental sustainability, financial stability and public and political acceptability), tariffs design is a complex procedure and the resulting pricing schemes are expected to be difficult to understand. Moreover, the inclusion of several elements in water bills (related with wastewater and solid waste services) also compromises the desired simplicity criteria. The complexity of water tariff schemes, as it happens in the Portuguese case (Martins and Fortunato, 2007), raises the suspicion that water bills might be difficult to understand by residential users and, consequently, that prices are not correctly signalising parsimonious water consumption behaviours.

Given the limitations of single strategies based on economic factors, other non-economic strategies arise.

There are examples of education campaigns[2] promoting rational usage of water resources focused on the environmental implications of excessive and wasteful water consumption. A OECD survey (OECD, 2011) of more than 10 000 households in 10 countries (Australia, Canada, the Czech Republic, France, Italy, Korea, Mexico, the Netherlands, Norway and Sweden) analyses what type of policies measures really work, looking at what factors affect people's behaviours in five environment areas including water usage. Policies oriented to strengthening knowledge and awareness through information and educational campaigns ("softer" instruments) are highlighted as pro environmentally-friendly consumer and household behaviour drivers (OCDE, 2011). The survey findings indicate not only that the role of "softer" instruments is more significant than earlier assessments of policy instruments had found, but also can substantially induce changes on the demand side. One interesting finding of the study is that while water pricing clearly matters, environmental awareness and households' concerns are also important.

However, empirical evidence from European countries on the actual effectiveness of such instruments for managing water is still scarce.

Van den Bergh (2008) provides a review of econometric studies in three areas related to households consumption that are environmentally relevant, including residential water use. One important general finding of this literature survey is that there are very few empirical studies that systematically combine socio-economic and psychological determinants such as attitudes, knowledge, perceptions and values. The author states that the design of policies oriented towards sustainable consumption requires information about the sensitivity of consumption to factors that can be influenced or controlled by policies. A OECD report (OECD, 2011) acknowledges that general consumer behaviour (awareness, rationality) as well as attitudinal variables should be taken into account in designing effective sustainable consumption policies.

Corral-Verdugo (2002) and Kuhnen *et al.* (2009) claim that the greater the level of information, the easiness to obtain and to organize it, the bigger will be the perceived value of the service (in this case the water supply service) and consequently the incentive to parsimoniously use the water resource.

Yet, for any strategy to be effective, the way the information is disclosed is essential. Too much information in water bills adds complexity and tends to increase users' illiteracy. Thus, opacity in water bills can jeopardize the desired simplicity requirement.

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[2] For example, in the United States, "local governments financed the development of an advertising campaign on *Water: Use it Wisely* which highlights effective ways to save water in and around the home with the tagline "There are a number of ways to save water and they all start with you. You are water-saving device No. 1" (OECD, 2007, 10).

In line with this argument, the current study investigates households' perceptions on water bills contents and tries to establish whether better informed residential users are more concerned with saving water.

3. WATER SUPPLY INDUSTRY: MARKET STRUCTURE AND PRICE SCHEMES

The market structure for the Portuguese water industry can be characterised as multiple local (municipal) monopolies. Some operators work only at the wholesale level, providing bulk water to other utilities, while other utilities distribute water to final users, operating at the retail level. Our research focuses on the utilities operating at the retail level, i.e. providing water to households and to other non-residential customers.

Table 1 provides information regarding the supply industry players in Madeira. As it can be observed, water services in Madeira are directly provided by municipalities and, as it happens at the national level, there is a single provider in each municipality. Among these utilities, some are in charge of the entire process, from origins to tap, while others buy part or the total volume of water to wholesale operators. Investimentos e Gestão da Água (IGA) acts as the main wholesale operator. IGA was created in 1991 with the purpose of concentrating in a single entity the competences regarding the management of water resources in Madeira. Later, in 1999, IGA became a society 100% owned by public funds.

TABLE 1. WATER UTILITIES BY MUNICIPALITIES IN MADEIRA REGION

Municipalities	Wholesale operator	Retail operator
Calheta	IGA	Municipality
Câmara de Lobos	Municipality	Municipality
Funchal	IGA	Municipality
Machico	IGA	Municipality
Ponta do Sol	IGA	Municipality
Porto Moniz	Municipality	Municipality
Ribeira Brava	IGA	Municipality
Santa Cruz	IGA	Municipality
Santana	Municipality	Municipality
São Vicente	Municipality	Municipality

Each operator sets its own tariff scheme that usually comprises several items: one is related to the supply system, another to sanitation services (wastewater drainage and treatment as well as solid waste), and a third component refers to taxes.

Specifically related to water supply, each utility applies a water tariff divided into one fixed part and one volumetric or variable part. Concerning this volumetric component, water is sold under increasing block rates. Thus, Madeira residential users face a multi-part tariff scheme which consists of several elements: a fixed charge *(FC)* for being connected to the water supply system (which must be paid even if no water is consumed), and various elements resulting from several prices per cubic meter (usually known as volumetric rates) multiplied by the corresponding quantities of each block, as shown in equation[3] (1).

$$WaterBill =$$
$$= FC + q_1 \times p_1 + (q_2 - q_1) p_2 + (q_3 - q_2) \times p_3 + \ldots + (q_n - q_{n-1}) \times p_n \quad (1)$$

where q_i represents the upper volume of water consumption in the i block, and p_i represents the price of the consumption in the i block.

The multiplicity of items related to water delivered (with excessive number of blocks), sewerage, and solid waste and taxes makes bills complex and, therefore, difficult to understand. Besides, another source of difficulty in interpreting water bills and adjusting consumption to water prices comes from the mixture between fixed and variable parts charged to residential users (Martins and Fortunato, 2007). All in all, these non-volumetric components represent, in some cases, more than half of the total water bill.

This complexity might be the result of the competences assigned to municipalities to set tariffs schemes, without needing approval by the regulator. Sometimes tariffs are simply a legacy from previous local administrations and seem to reflect political objectives instead of economic rationality.

4. METHODOLOGICAL APPROACH

The overall aim of this research is to analyse residential users' awareness of water bills' contents and to investigate whether they behave in a way that shows some environmental concerns.

From this purpose, three research questions were identified:
- At what extent do domestic users know the main features of tariff schemes and the multiplicity of other service charges that are being charged along with the water consumed?
- Do domestic users have a perception of how much water they consume and how much they are paying for the water supply service?
- Are price and quantity awareness contributing to a greater environmental concern and, thus, to a more sustainable use of the resource?

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[3] Each household has its own water meter and receives a bill every month.

In order to address these questions, data was collected from a sample of domestic users in the Madeira region by means of an original questionnaire administered in the last quarter of 2008.

The sample was obtained through a snowball process, by which a set of persons directly contacted by the researchers was asked to pass it through to persons they were in contact with (either relatives or co-workers). The questionnaire was personally handed out by one of the researchers and the responses were collected by him/her a few days later. The tendency, in a snowball sample, is that of replicating the characteristics of the respondents, since people tend to interact with persons who are similar to them, in terms of background, interests, economic and social status, etc. In order to reduce such bias, at an intermediate point in the data collection process, some corrective procedures[4] were carried out.

Three hundred and eighty six valid questionnaires (from eight municipalities) were thus obtained.

Theoretically, it would be better to use a random stratified sample based on a sampling frame built upon a complete list of household addresses. Yet, time and economic constraints made this strategy impossible to follow. The alternative of sending the questionnaire along with water bills would lead to biased results, since we wanted the respondents to recall the information items contained in their water bills (rather than answer the questions by checking the bills they have just received).

By means of an initial filter question, only persons who were responsible for paying the bills were asked to fill in the questionnaire. The data collection instrument was specifically designed for this research and comprised several parts. One part related to the respondents' profile, another referred to perceptions on water bills contents and a final one addressed consumers' behaviours.

Data analysis included the computation of basic statistics for different questionnaire items, as well as some inferential statistics to assess differences between consumer groups. To evaluate potential price effects on water consumption, information obtained from the Portuguese water economic regulator (IRAR, currently designated ERSAR) on water tariff schemes applied in each municipality was used. Such information included fixed charge, number of blocks, dimension of each block and block rates.

5. MAIN FINDINGS

From the data collection stage, three hundred and eighty six usable questionnaires were obtained.

As shown in Table 2, women represent more than two thirds of the sample and the vast majority of the respondents are between 25 and 65 years old. The majority of the households has three or four members.

[4] Further details related to these procedures are available upon request.

TABLE 2. DEMOGRAPHIC PROFILE OF THE SAMPLE

Gender	*Female* 68.1%	*Male* 31.9%	
Age	*< 25 years* 7.5%	*> 25 and < 65 years* 86.2%	*> 65 years* 6.2%
Education Level	*Basic* 22.7%	*Secondary* 40.8%	*BSc or higher* 37.3%
Household dimension	*Up to 2* 30.8%	*3 or 4* 54.4%	*5 or more* 14.8%
Income level	*< € 1000* 30.2%	*> € 1000 and < € 2500* 54.3%	*> € 2500* 15.5%
Total number of respondents	386		
Calheta	12		
Câmara de Lobos	52		
Funchal	137		
Machico	45		
Ribeira Brava	14		
Santa Cruz	60		
Santana	61		
São Vicente	5		

As Table 3 indicates, respondents consider water bills to be quite clear, as the mean of 3.53 (out of 5) suggests.

TABLE 3. OVERALL PERCEPTION OF THE BILL CLARITY

	Mean	**Standard deviation**
Perception of bill clarity	3.53	1.297

Yet, this result might be misleading and the finding needs to be further inspected, namely by assessing the awareness of several specific items that the bill comprises.

The high percentage of individuals (28.2%) who do not know which is the provider of water service in their municipality is a first indication of this lack of knowledge. One should notice, as described earlier, that there is a single operator in each municipality and therefore it should be rather obvious to recognize that utility. For some reason, water customers seem to be neglecting information included in the bill.

Rather more insightful indications of the users' difficulty in understanding water bills can be found in Table 4.

As a matter of fact, 19.9% of the respondents think that they face a uniform price for each cubic meter of water consumed, when all water suppliers apply increasing block tariffs. It is also remarkable that around 30% of the users do not answer this question.

Additionally, many users are not aware of other components included in water bills, which tend to be quite relevant. This finding is even more unexpected given that

two main components of water bills – sewerage and solid waste – were explicitly suggested in the questionnaire. It is quite meaningful that more than 15% of the respondents affirm that bills do not include any other item besides the value charged for the water (m³) consumed.

TABLE 4. LEVEL OF KNOWLEDGE ON WATER BILLS ELEMENTS

Which type of tariff scheme do you face? Nr of respondents (percentage)		Do you think that your bill comprises other charges apart from water supply services? Nr of respondents (percentage)	
Uniform rate	77 (19.9%)	Yes Only sewerage Only solid waste Both	215 (55.6%) 14 (6.5%) 90 (41.9%) 111 (51.6%)
IBT	191 (49.5%)	No	59 (15.2%)
Do not know/ Do not answer	118 (30.6%)	Do not know/ Do not answer	112 (28.9%)

All these findings corroborate our suspicion regarding the lack of residential water users' awareness of key information included in water bills.

Taking into account that European legislation strongly suggests the use of prices as one of the instruments to promote adequate levels of water consumption, it is important to ensure that consumers are aware of their volumes of water consumption and of how much they pay for the water supply service.

TABLE 5. AWARENESS OF WATER SUPPLY CHARGES AND VOLUMES CONSUMED

Do you have an idea of how much you pay for water supply service per month? Nr of respondents (percentage)		Do you have an idea of how much water you use per month? Nr of respondents (percentage)	
No	35 (9.3%)	No	332 (86%)
Yes	351 (90.7%)	Yes	54 (14%)
Up to € 5	37 (10.5%)	Up to 5m³	7 (12.9%)
From € 5 to € 10	127 (36.2%)	From 5m³ to 10m³	25 (46.4%)
From € 10 to € 15	138 (39.3%)	From 10m³ to 15m³	12 (22.2%)
More than € 15	49 (14.0%)	More than 15 m³	10 (18.5%)

Findings reported in Table 5 reveal that the vast majority of the respondents (more than 90%) has a perception (either right or wrong) of how much they spend per month with water supply services. The same does not apply to the quantities consumed. Indeed, only 14% of the domestic users indicate how much they think they consume per month.

The picture that emerges from the analysis carried out can be partially explained by the great complexity and diversity in tariff schemes, applied by water utilities. Such diversity is visible in terms of number of blocks (from 3 to 10) and prices charged for water supply services. Data obtained from IRAR reveals that water prices are highly disparate from one municipality to another. The estimated marginal and average prices (for a monthly consumption of 5 m³) range from € 0.12 to € 0.5 and from € 0.25 to € 1.55, respectively.

With the purpose of further analysing residential users' perceptions on bills clarity two subsamples were built. The subsample S1 comprises the respondents that are simultaneously aware of quantities (m³) and water bill (€). Fifty individuals form this set. S2, on the other hand, refers to the subsample that includes the remaining respondents (386 – 50 = 336).

To check the respondents' accuracy in reading the information included in the bill, an analysis was conducted, whose results are shown in Table 6.

TABLE 6. RESPONDENTS WATER BILLS LITERACY

Subsample	Indicate water provider	Recognize existence of additional components	Know IBT are applied
S1	90%	92%	78%
S2	69%	50.3%	45.2%
Fisher Test	p approx.0*	p approx.0*	p approx.0*

* Differences significant at 1% level.

As expected, data reveals that the S1 group of consumers interpret water bills with more understanding than the S2 group and might therefore be more prepared to adopt rational consumption behaviours. In fact, at 1% significance level, the differences in the knowledge level regarding key bill contents (such as water provider, existence of additional components and kind of tariff scheme applied) are all statistically significant.

A more in-depth analysis was performed to verify whether the quantities (m³) and water bills (€) indicated by respondents were in accordance with the tariff schedules implemented by their respective water provider/municipality. Specifically three values were compared:
– the water bill's user perception *(WBperceived)*;
– the minimum possible water bill *(minvalue)*;
– the maximum possible water bill *(maxvalue)*;

To obtain the *minvalue* and *maxvalue* we started by placing the volume indicated by the respondent *(WBperceveid)* into the corresponding tariff block. Then, using the information provided by IRAR, we computed the *minvalue* and *maxvalue* as the bottom and the upper water bill values, respectively, for the correspondent block of consumption and according to equation (1).

If *WBperceived* was comprised in *[minvalue; maxivalue]*, it was assumed that a possible correspondence between quantities and prices perceived and charged exists;

otherwise, it was assumed that the user is wrong, since the water bill value he/she indicated is impossible to obtain for the given consumption.

The procedure was applied to each individual of S1 (obviously, this analysis is not possible for S2). The results are shown in Table 7. As depicted, overall, 48% of the respondents indicate a *WB* that is compatible with the volume consumed (self-reported).

TABLE 7. CORRESPONDENCE AMONG QUANTITIES & PRICES PERCEIVED AND CHARGED

Subsample S1	S1 Respondents whose water consumption belongs to the 1st block (n = 7)	S1 Respondents whose water consumption belongs to the 1st or 2nd block (n = 31)
48%	28.5%	40%

The level of possible matches is significantly lower for the respondents whose consumption levels belong to the first block. The finding is quite logical. The weight of fixed charges increases has the volume of water decreases. Therefore, in particular in what concerns the first block, individuals tend to have a more distorted perception of the amount paid for the water supply service. This evidence might jeopardise the intended signalisation of rational consumption by price.

Finally, an analysis was conducted to assess whether consumers belonging to the S1 group also have a higher propensity to adopt certain behaviours that can be regarded as preliminary indications of environmental concerns. The S1 and S2 groups were then compared in terms of their awareness of the need to save water and of their predisposition to adopt some attitudes that might be a consequence of sustainability worries.

TABLE 8. SUSTAINABILITY CONCERNS

		S1 Subsample (n = 50)	S2 Subsample (n = 336)	Diff
Awareness (mean values in a five point Likert scale)	Possibility of consuming less	2.77	3.89	-1.12*** (t_{stat} = 5.064)
	Save water to pay less	2.85	3.04	-0.19 n.s. (t_{stat} = 59.2)
	Save water to preserve the environment	4.23	3.86	0.37 ** (t_{stat} = -5.064)
Behaviours	Shower duration < 5 minutes	24%	14.6%	Fisher test p = 0.09**
	Saving water equipments	11.9%	18%	Fisher test n.s. (p = 0.253)
	Reutilization	30.4%	32%	Fisher test n.s. (p = 0.864)

n.s.: non significant
* significant at 10%; ** significant at 5%; *** significant at 1%

As revealed in Table 8, although all respondents agree that they could use water more parsimoniously, there seem to be slightly different aims associated with this concern. Paying less is more important to the general group (3.01, against 2.85 for the restricted group). As expected, saving water to preserve the environment is a top priority to the more informed group (4.26 out of 5). Statistics confirm that the perceptions of the two groups (S1 and S2) are significantly different (with a confidence of at least 95%).

The more intensive use of water saving equipments and the reutilization of water may be interpreted as practical consequences of greater environmental consciousness. Another indication of adjustments in behaviours driven by the need to rationalize water use can be found on the willingness to shorten the time spent in shower.

When looking at the differences between the two groups of consumers, one can also see that only for the shower duration is the difference statistically significant at 10% level. It is important to notice that the overall level of implementation of saving water equipment by the Portuguese households is still low. Probably, most of the respondents live in dwellings which have been built some decades ago when this was not compulsory and only recently have educational campaigns addressed the issue. In what concerns water reusage, even the percentage indicated in Table 8 might be misleading. Water reusage is generally negligible in what quantities are concerned, especially in the absence of technical solutions (which require investments that most people are still not prepared to make).

In any case, all in all, a clearer understanding of water bills seems to be contributing to a more sustainable use of the resource.

6. CONCLUSION: POLICY IMPLICATIONS

In order to foster the rational use of an increasingly scarce resource, economic theory suggests that having a correct perception of water charges and quantities consumed is essential.

Given the Portuguese water industry characteristics (such as the high level of fragmentation and the monopolistic conditions in place) along with the almost lack of tariff regulation in what retail activities are concerned, there is a wide diversity of water tariff schemes. This diversity comes from the existence of a single operator in each municipality that sets a tariff scheme with the aim of promoting a variety of potentially conflicting goals, including political ones. With reference to the Madeira region, although every operator applies increasing block tariffs and fixed charges, average and marginal prices are highly disparate. Water bills include components related to wastewater and solid waste, which adds complexity to the matter. Although IBT are defensible, mainly to promote sustainability, in this scenario their merits become questionable.

The survey administered to Madeira residential users corroborates the initial suspicion that water bills lack clarity. Indeed, data reveals that a large percentage of domestic users does not even identify the type of tariff applied or the majority of the components charged together with the water consumed.

The tariff complexity distorts the ability of residential users to relate the water bill to the volume of water consumed, as the almost complete absence of knowledge regarding quantities demonstrates. The weight that fixed charges have on water bills, especially for low and medium levels of consumption, might be weakening the efficacy of price in driving demand.

Environmental concerns and behaviours seem to be affected by the users understanding of several bill items. In fact, it was found that more informed individuals tend to be more aware of the need to preserve water resources and adopt some environmental-friendly behaviours. Thus, the opacity of bills may jeopardise key purposes of water policy directives by preventing users to understand prices and comprehend budgetary and environmental consequences of "inappropriate" consumption behaviours/patterns.

Some policy implications can be derived from this research. One important task for governments and other decision makers may be to bolster information campaigns in order to raise people's environmental awareness and induce behavioural changes. Increased awareness of the environmental impacts of consumption choices is considered to be a main driver of water-saving behaviours (OECD, 2007, 2011) and may also increase the political acceptability of policies, facilitating their implementation. The specific scenario studied, which can be easily transposed to other contexts, also calls for a more active attitude on the part of the economic regulator that should act on behalf of consumers protection imposing some procedures that would make bills clearer and more comprehensible. Indeed educational and information campaigns will not be well succeeded if tariffs are not understandable.

Simplifying water tariff schemes is essential. In this regard, reducing the number of blocks and increasing transparency regarding the consequences of the volume of water consumed on the total amount of the bill are crucial measures to be taken.

These concerns are, at some extent, reflected on the tariff recommendations that the Portuguese regulator published after our data collection process took place. In fact, only after the revision of its statutes in 2009, the economic regulator acquired extended powers in price regulation and started to produce recommendations on tariff schemes to be applied to all operators. The IRAR Recommendation nr. 01/2009 establishes that all water utilities should apply a tariff scheme that comprises a fixed charge and a volumetric part with no more than four increasing blocks. Overall, it is worthwhile to acknowledge that there has been an effort on the part of economic regulators (especially in the OECD countries) to reduce diversity and provide some guidelines to price setting procedures.

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