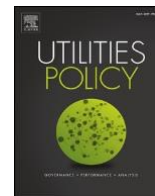


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Raising consumers, interest in their water invoices: Challenges and opportunities

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ABSTRACT

Given the importance of invoices in conveying key information to consumers, regulatory authorities worldwide have been issuing recommendations on their content and format. The aim of the current paper is to assess a detailed invoice model, which stresses accuracy and exhaustiveness concerns. The study is based on the perceptions of domestic consumers collected through the administration of a survey questionnaire. Findings reveal that the detailed invoice model proposed is regarded as complex, including unnecessary information and making use of a language that is not easy to understand. Some recommendations to make their content more intuitive and appealing are derived.

1. Introduction

The protection of consumers' interests is one of the missions of water industry regulatory authorities, as well as of other essential services regulators. This mission is justified, among other reasons, by the fact that there are asymmetries of information between service providers and consumers. On the supply side, water services are provided under monopoly conditions, becoming impossible to change the service provider in case of dissatisfaction. On the demand side, there is increasing pressure for price increases coming from demanding quality concerns, water scarcity issues and climate changes. In Europe, the Water Framework Directive advocates the implementation of the full-cost (including scarcity and environmental ones) recovery principle through water pricing. Such conditions call for regulatory authorities' intervention to ensure greater transparency and to reduce asymmetries of

households had a broad knowledge of the actual average prices (29%), of the actual marginal prices and of the price rate structure in general (12%). More recently, Perez-Urdiales et al. (2016) report that only 35% of domestic users in the city of Granada, Spain, know the price schedule they face.

Given this lack of knowledge, and due to the essential nature of water, it is not surprising that the estimation of residential water demand functions shows that demand is income and price inelastic (see, e. g., the surveys by Arbues et al. (2003) or Worthington and Hoffman (2008)). Nonetheless, when detailed price information is given on the bill, price elasticity tends to increase (Gaudin, 2006). Ferraro and Price (2013) also found that elasticities are higher subsequently to the provision of some type of information on invoices, for example one that enables consumers to compare their consumption level with that of similar households.

According to Moura e Sa and Martins (2016), consumers might

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information between service providers and users regarding tariffs, service provision and quality parameters, among other aspects.

Invoices are particularly important in this regard as they are a regular and universal vehicle for communicating relevant information (Moura e Sa and Martins, 2016). According to some empirical evidence, most water consumers are not aware of the price they pay (Carter and Milon, 2005; Frondel and Messner, 2008; Perez-Urdiales et al., 2016) and of how much they consume (Hamilton, 1985; Troy and Randolph, 2006). Troy and Randolph (2006) report that only 19% of respondents in their sample from New South Wales in Australia said they knew the value of their last water bill and about the same percentage claimed to know their water consumption. For Leipzig, Germany, Frondel and Messner (2008) reveal that only a minority of the surveyed

have a say in defining the attributes and characteristics of an informative and attractive bill. Based on a qualitative study and on the use of the Quality Function Deployment (QFD) methodology, the authors emphasise the importance of using plain language, improving the clarity and comprehensiveness of the invoice document, adopting an adequate format and giving better indications to foster parsimonious consumption.

In Portugal, as in other countries, the water services regulator has been issuing recommendations on price structures and/or invoices, both to harmonise tariff schemes and to make the invoices' contents similar among operators. One recent orientation resulting from this type of concern is the detailed billing model, which sets out in detail the contents that invoices must contain.

The purpose of this paper is to assess whether the detailed invoice model, as defined by the Portuguese regulator, in terms of content and format, meets the mission of delivering relevant information that is clear to consumers, including the most vulnerable, so that they can behave rationally.

With this purpose in mind, a survey instrument was designed and administered to a sample of domestic consumers of the Centre region of Portugal during the second semester of 2018.

This research is expected to contribute to the body of knowledge on the water industry by providing some parameters to assess the quality of invoice documents and by putting forward some recommendations on how to make invoices more useful and appealing to consumers. In this paper, when referring to quality of invoices the definition of Juran is adopted, which means that quality is regarded as ‘fitness for use’ (i.e. the ability of a product or service – in this case the invoice document – to respond to the user’s needs, which may vary according to the context, making quality relative rather than absolute (Bisgaard, 2007)).

By fostering the consumer interest in invoices, it is possible to enhance their role as vehicles for promoting rational behaviour. Otherwise, the opportunity to make the most of the potential of invoices as effective drivers of the success/effectiveness of water policies by the demand side is lost.

In an independent report prepared for UK government, Walker (2009) argues transparency and accountability concerns are essential to achieve a fair charging system. Several recommendations are made on the report to incentivise the efficient use of water, many of them calling for the consultation and active involvement of consumers. Therefore, in line with the arguments that provide a foundation for the current study, Walker’s report calls attention to the importance of looking at the way operators and regulators communicate with customers if the goals of rational water use are to be accomplished. Also Galaitsi et al. (2016) emphasise the need to take into consideration consumer/individual responses that fall outside the direct influence of public policies since they have been found as important determinants of water consumption behaviours.

The remainder of this paper is structured as follows. After the Introduction where the relevance of the research was justified and its main purpose identified, the following section describes the context where the study took place by characterising the Portuguese regulatory framework and highlighting some initiatives implemented by the industry regulator to improve the format and content of water invoices. Then, in the third section, the research design is briefly presented, specifying the data and methods used. Next, the main findings are described and discussed, covering both the assessment of the detailed invoice model and the preliminary evaluation of some foreseeable changes. Finally, some recommendations to raise consumers’ interest in water invoices are provided and a few concluding remarks presented.

2. Water invoices: Portuguese regulatory framework

The Portuguese water industry constitutes a typical case of a network industry with characteristics of natural monopoly. The industry is very fragmented, with roughly one local monopoly/service provider, with different organizational arrangements, per municipality. Regulation began in 1997 with the establishment of an economic regulatory body with limited competencies, which was replaced, in 2009, by the Water and Waste Services Regulation Authority (ERSAR) with reinforced competencies in the regulation of all the water services providers (regardless of the management model) and, for the first time, with powers to regulate also solid waste management services.

Information disclosure has been regarded by the Portuguese regulator as an important issue, both to monitor the performance of the operators and to ensure that consumers have access to information to make adequate decisions regarding the way they consume an essential but increasingly scarce resource. Thus, the provision of sound information to end-users by water utilities and regulatory authorities is crucial for consumer protection and empowerment, while fostering accountability of service providers towards users and citizens in general.

Since invoices are a key channel to provide information on tariff schemes, assist consumers in monitoring their consumption over time and foster water

saving behaviours, the regulator has been taking several initiatives to harmonise their content and format.

Before 2009, each water utility was free to set its own tariff scheme, resulting in multiple and very diverse tariff structures. To reduce such disparities throughout the country, the Portuguese economic regulator issued three main Recommendations, two of them with specific guidelines for tariff structures (Recommendations IRAR no. January 2009 and ERSAR no. 2/2010) and another regarding invoices content (Recommendation ERSAR no. 1/2010). Recommendation no. January 2009 proposes that multipart tariff schemes should be applied to residential users, always comprising a fixed charge and a volumetric component (with four increasing block tariffs). The variable part should be differentiated, progressively, according to four levels of monthly consumption (setting the upper limits of the first three blocks in 5, 15 and 25 m³, respectively). Additionally, the content of the invoices sent to users should also reflect greater harmonization and transparency principles, which were reinforced by ERSAR Recommendation January 2010. This latter recommendation identifies the main contents of water and waste services invoices, further contributing to the harmonization of tariff schemes. Additionally, ERSAR’s Recommendation February 2010 requires operators to display the charges for each specific service (water supply, wastewater and solid urban waste) in a separate and clear way, to avoid cross-subsidization practices among these different services. However, the main novelty of this recommendation lies in the definition of criteria, calculation formulas and coefficients to be used in determining the tariffs’ level.

More recently, the Law of Detailed Invoice (Law n. 12/2014) has established the precise contents of water invoices (see Table 1). The Decree-Law 114/2014 has identified the specific procedures and obligations that operators have to comply with when issuing their invoices. In the preamble, the same legislation draws attention to the fact that “invoices [...] should use a simple and clear language and adopt a format that facilitates their reading and the understanding of the various components and charges associated with them”. This sounds like a clear evidence of the regulator concerns with transparency and access to information. It remains to be seen whether or not the actual implementation of the Law of Detailed Invoice is a step forward in achieving such goals.

The provision of information in all the items listed in Table 1 complies with the requirement of giving users all the elements needed to reconstitute the amount charged (bill value).

Subsequently to the Law of Detailed Invoice the regulator issued an invoice template similar to the one depicted in Fig. 1. It is possible to observe that the front page is dedicated to the provision of aggregated data on the various services charged along with some visual aids. On the reverse page, the consumer can find all the details related to the tariff schemes applied.

It must be noticed that the regulator acknowledges that invoices are not the single channel to convey important information to consumers and that other alternatives should be considered. In this regard, the

Table 1
Information to be disclosed in water invoices (according to the Law of Detailed Invoice).

Services		
Water supply	Wastewater	Solid waste
Unit value of the water supply service fixed charge (per day) and the value resulting from its application to the billing period (28, 30, 31 days)	Unit value of the wastewater service fixed charge (per day) and the value resulting from its application to the billing period (28, 30, 31 days)	Unit value of the solid waste service fixed charge (per day) and the value resulting from its application to the billing period (28, 30, 31 days)
Method of measuring the volume of water consumed (meter-reading by the utility or by the users or estimated quantity)	Method of measuring the volume of wastewater (metering or indexation to water consumed)	Method of measuring the volume of solid waste (indexation to water consumed or “pay as you throw”)
Quantity of water consumed (broken down by consumption blocks when applicable)	Quantity of wastewater collected (broken down by consumption blocks when applicable)	Quantity of solid waste

Prices per blocks, when applicable	Prices per blocks, when applicable	Variable price
Value of the volumetric charge per blocks of consumption, when applicable, distinguishing possible adjustments due to volumes or amounts already billed	Value of the volumetric charge per blocks of consumption, when applicable, distinguishing possible adjustments due to volumes or amounts already billed	Value of the volumetric charge
Tariffs applied to any auxiliary services provided	Tariffs applied to any auxiliary services provided	Tariffs applied to any auxiliary services provided
Water Resources Rate	Water Resources Rate	Solid waste management rate
VAT	VAT	VAT
Bulk service average unit cost	Bulk service average unit cost	Bulk service average unit cost

Invoicing period
 Warnings about repairs and other service interruptions
 Operator contacts (telephone, email ...)
 Assessment of the detailed invoice model (12 items)
 Preferences regarding some foreseeable changes (7 items)
 Respondents' profile (6 items)

Most of these items were assessed on a 5-points Likert scale. Exceptions are the respondents' profile and the preferences. In this latter case, seven scenarios were presented and the respondent had the chance to choose among three options: 'Yes', 'No', and 'Do not Care'. The detailed invoice assessment was based on the template included as an appendix to the questionnaire and depicted in Fig. 1. Respondents had therefore access to a typical invoice and were asked to give their views on several issues, including clarity and relevance of the information provided.

The self-administered questionnaire was applied to a sample of domestic consumers living in the Centre region of Portugal. The research team distributed the questionnaires both in rural and urban areas of different municipalities, collecting the data in different public places (town hall premises, fire stations, coffee shops, etc.). Such venues are frequented by people with various backgrounds (education levels, age, occupations, etc.). Therefore, the sample is non-probabilistic but efforts were made to include respondents with different characteristics.

Portuguese Law for the municipal water and waste sector (Decree-Law no. 194/2009) establishes operators' duties on information disclosure to the end-users of these services, including the providers' obligation to make available in their websites information on tariff schemes.

3. Data and methods

In the current study, the detailed invoice model proposed by the Portuguese regulator was used as an example of the recommendations that regulatory authorities in different countries are issuing to make water invoices clearer, more harmonised and, ultimately, capable of conveying the right signals to drive parsimonious water consumption behaviours.

Having in mind the aim of understanding how domestic consumers assess a model that, as described in the previous section, stresses accuracy and exhaustiveness concerns, a survey instrument was designed and administered to a sample of Portuguese customers who have contact with water invoices.

The questionnaire collected domestic consumers' views on the following dimensions:

- Awareness of the amount and volume of water consumed (2 items)
- Role of water invoices (4 items)
- Importance of including in the invoice some elements (14 items), as follows:
 - Total amount to be paid
 - Amounts charged per service (water, wastewater and solid waste)
 - Fixed and variable charges
 - Average price of water consumed
 - Marginal price of water consumed
 - Taxes and other charges
 - Price of bulk water
 - Information per blocks (cubic meters and prices)
 - Past consumption information (historical)
 - Average level of consumption of a household living in the same area
 - Volume of water consumed Last meter reading
 - Warnings concerning water scarcity
 - Indicators of quality of water (physical, chemical and bacteriological parameters)

4. Main findings

In this section the main results of the survey administered to a sample of domestic consumers are reported. One hundred and fifty-nine questionnaires were successfully completed. As shown in Table 2, the majority of the respondents are female, have attended at least secondary school and are currently working. Most of the participants are between 31 and 55 years old, even if the proportion of respondents in the 56–75 age band is also relevant. The average size of the participants' households is 2.75.

In line with previous studies (Troy and Randolph, 2006; Frondel and Messner, 2008; Martins and Moura e Sa, 2011; Monteiro et al., 2014; Perez-Urdiales et al., 2016), the consumers' level of knowledge regarding key elements of their water bills is not very high (see Fig. 2). In fact, when questioned at what extent they were aware of how much they paid on average per month, it is possible to see that the vast majority of the respondents (120 out of 159) agree or totally agree with the item "I do have a clear idea of how much I pay per month". However, the same does not apply to the quantities consumed. In this latter case, more than one-third (64 out of 159) recognise they do not even have any idea of how many cubic meters they consume on average per month (totally disagree/disagree that they know the number of cubic meters consumed). Given the importance of encouraging water saving behaviours, it would be important for consumers to be aware of how much water they consume and assess if such level is appropriate according to the characteristics of their households.

Even if the consumers who participated in the survey do not look very familiar with the contents of their water bills, they tend to stress the importance of invoices, both as vehicle to convey information regarding the amount to be paid and as a way to promote a sustainable use of water resources. Table 3 shows that (out of 5 possible points), the respondents

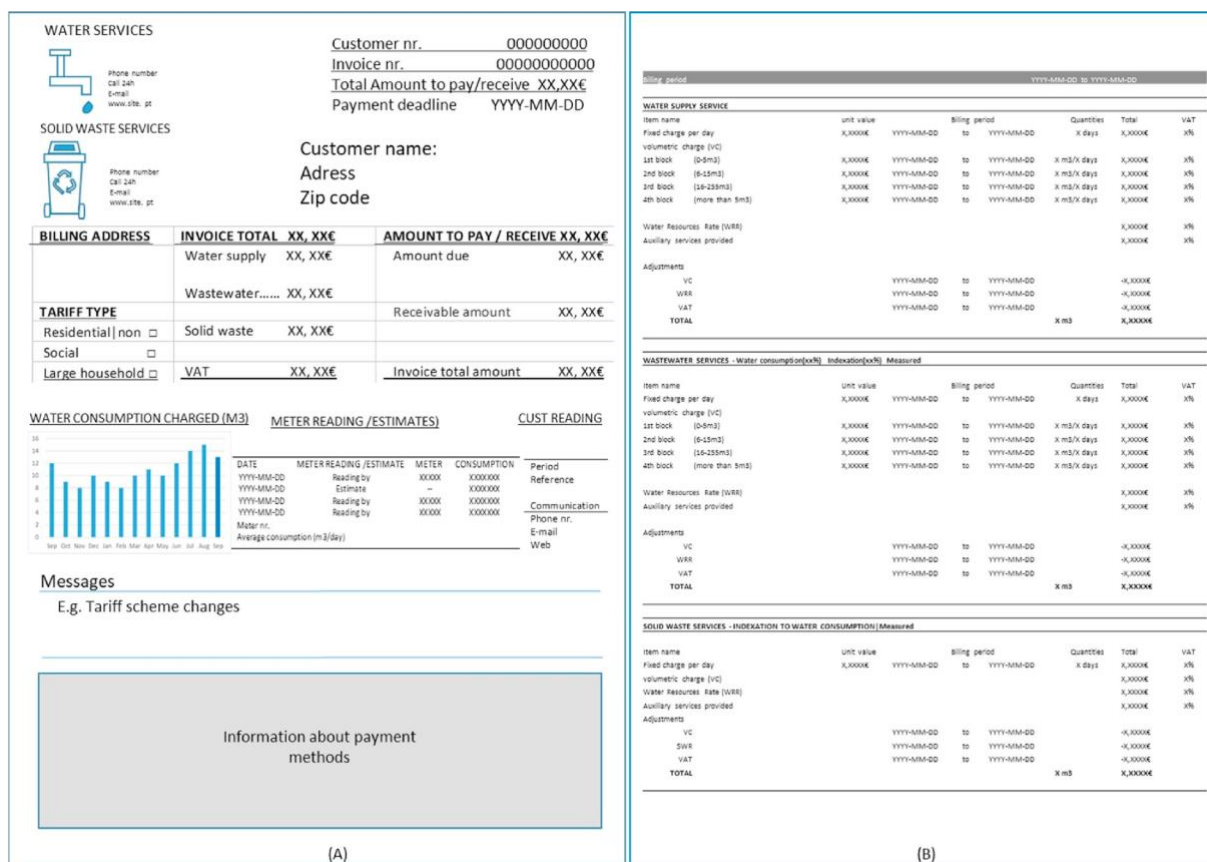


Fig. 1. Invoice template proposed by ERSAR (front page (A) and reverse (B)).

Table 2
 Respondents' profile.

Gender	Qualifications level	Age band	Working condition
Female	Elementary School	Under 31	Student
Male	Secondary School	31-55	Employed
Didn't answer	Higher Education	56-75	Unemployed
	Didn't answer	Over 76	Retired
		Didn't answer	Didn't answer

Average size of households: 2.75 Total number of respondents: 159

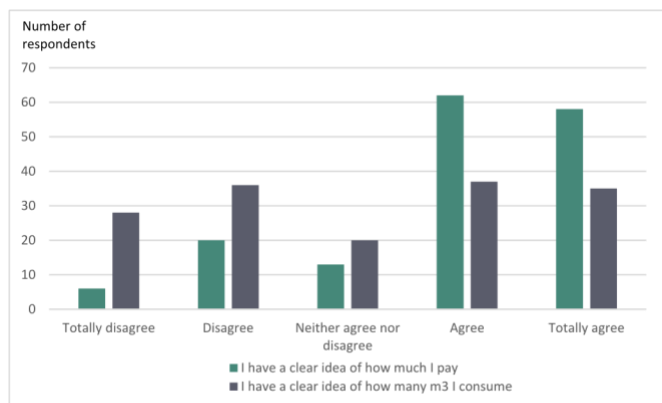


Fig. 2. Self-reported awareness of amount paid (€) and quantity of water consumed per month (m³).

those items in their invoices. With the exception of the marginal price of water, the bulk water price per cubic meter and the average level of consumption of a household living in the same area, all the remaining items got a score over 4 points (out of possible 5). Even such exceptions received a score between 3.3 and 4, which is remarkable. As depicted in Table 1, many of the items proposed must, according to the Portuguese Law of Detailed Invoice, be included in water invoices. These items both cover very basic data (such as the amount to be paid, the billing period or the most recent metering reading) and very technical information (e.

g. bulk water cost per cubic meter). Most respondents indicated that this technical information should be included in invoices too. This came as a surprise given that, due to the apparent difficulty of understanding the meaning of such information (even by people with high qualification levels), one would expect that the respondents would not value the provision of such data. The marginal price and the similar household benchmark (which were included in the questionnaire based on literature recommendations) were the ones that got the lowest scores, revealing that respondents do not regard such information as so essential as the items that are currently included in their bills.

The domestic consumers who participated in the study have also assessed the invoice template proposed by the regulator (see Fig. 1), in what concerns its contents and format, by indicating their level of agreement with each of the twelve items selected as indicators of the quality of the document. The results are reported in Table 4.

Findings reveal that consumers have in general a positive opinion of the detailed invoice template since most items average falls into the

Table 4
Assessment of the detailed invoice template.

Item	Mean value	Standard deviation	Proportion of respondents that totally disagree or disagree
The invoice appropriately highlights the most relevant items	3.95	0.906	8.8%
The invoices uses a language that is easy to understand	3.59	1.041	19.6%
Abbreviations and acronyms used are easy to understand	3.32	1.258	25.3%
Looking at the way information is displayed, it is easy to figure out what is charged by service (water, sewage and solid waste)	3.68	1.204	17.7%

give on average 4.50 points and 4.19 points, respectively, to the roles of water invoices in giving information to understand the total amount that is being charged and to assess if the quantity of water consumed is adequate.

As described earlier, the questionnaire included a section where fourteen invoices items were listed (see section 3) and it was asked the respondents opinion concerning the importance of including each of

Table 3
Potential roles of water invoices.

	Average Score
Invoices are important to understand the total amount that is being charged	4.50
Invoices are important to assess if the quantity of water consumed is adequate	4.19
Invoices are important to monitor the consumption pattern of the household	4.16
Invoices are important to warn about the importance of the water resource	4.01

(1–5) 3.5–4 points range. Yet, respondents tend to consider that the invoice presented is a relatively complex document (63.1% agree or totally agree with the sentence “I would say that overall the invoice presented is a complex document”). The average score of 2.32 (out of 5) after reversion means that this an issue that is not well regarded by many respondents and that calls for improvement. That might also reflect the fact that the invoice uses, according to the views of consumers, a language that is not easy to understand and, in particular, includes quite a lot of acronyms and abbreviations whose meaning is not clear for many respondents. In what concerns the way fixed and variable charges are presented, although the mean value is relatively high (3.42), it is rather worrying to notice that over one-fourth of the participants feel that the distinction between them is not easy to make. Additionally, consumers consider that invoices include some unnecessary data. On the positive side, consumers who participated in the study consider that the invoice highlights the most important information and that the graphic showing past consumption levels is useful and not hard to understand.

Even if the detailed invoice template is relatively recent, some potential changes have been discussed lately. One of such modifications concerns replacing cubic meters by litres, the idea being of using a unit of measurement of the water consumed that consumers are more familiar with and that, for small volumes, is easier for consumers to have an idea of the amount of water that it represents. The reaction of the consumers surveyed was moderately enthusiastic with 47% favourable to that scenario and a significant proportion (40%) indicating that they do not have a strong opinion on the matter (see Fig. 3). In 2018, this change was put into place within a pilot initiative.

Looking at the way the information is displayed, it is easy to distinguish fixed and variable charges	3.42	1.150	25.8%
The invoice presents the information in a well-organised manner	3.60	1.042	14.0%
The invoice includes unnecessary data (REVERSE)	3.25 ^a	1.079	21.9% ^b
Displaying the charges to be paid using four decimals is adequate	3.28	1.148	25.5%
The graphic presented is useful	3.90	0.982	10.1%
The graphic presented is easy to understand	3.78	1.154	16.5%
The document level of detail seems adequate	3.57	1.008	16.6% 63.1% ^b
I would say that overall the invoice presented is a complex document (REVERSE)	2.32 ^a	1.144	

^a The value reported reflects the reversion of the scale (1 was converted to 5, 2 to 4 and so on). Therefore, the higher the mean value, the better is the evaluation. ^b The percentage reported corresponds to the proportion of respondents that indicated they agree or totally agree with the original item (before reversion).

The use of four decimals is a clear example of the tendency to take the concern for accuracy to the extreme. As expected, consumers do not value such option with a clear majority (55%) in favour of rounding the amounts to centimes and only 11% against it (see Fig. 4).

Making the consumers aware of the financial impact of consuming less water is important to foster the desired saving attitudes. In this regard, clearly showing that the price per cubic meter associated with higher levels of consumption is much higher might be relevant. As shown in Fig. 5, when asked about the possibility of receiving an invoice with the full tariff scheme, the majority of the respondents (55%) were receptive to the idea. Only 19% indicated that would prefer not to get it.

The operators' internet sites have been increasingly regarded as important channels to disclose information to consumers. As mentioned earlier, the Portuguese law defines a set of elements that need to be available through this channel. Participant consumers were asked to give their views on the possibility of transferring some information from invoices to the websites. As depicted in Fig. 6, most respondents (51%) are against this possibility with only 18% being in favour of such idea.

Taking into account that each municipality has its own service provider and specific tariff level, respondents were grouped per municipality in order to explore whether living in different municipalities influence the way respondents regard the detailed invoice model. Findings for municipalities with more than 10 responses are reported in

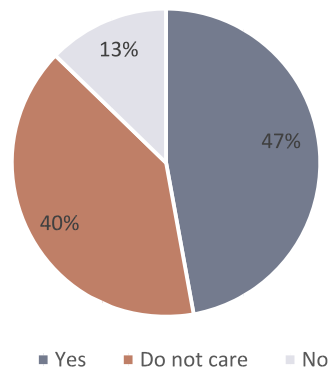
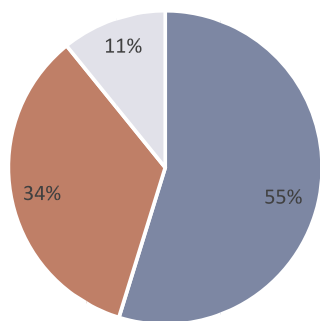
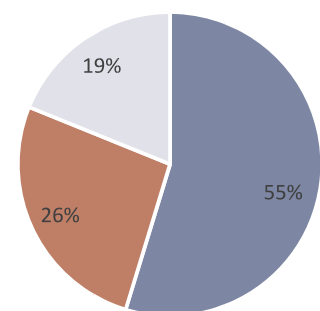


Fig. 3. Preferences regarding the replacement of m³ by litres.



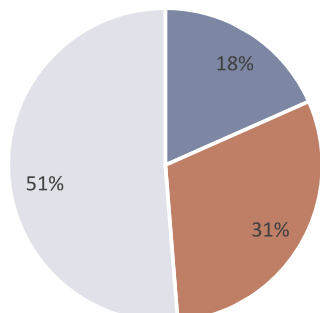
■ Yes ■ Do not care ■ No

Fig. 4. Preferences regarding the possibility of rounding to centimes the amounts instead of four decimal digits.



■ Yes ■ Do not care ■ No

Fig. 5. Preferences regarding the inclusion of the full tariff scheme.



■ Yes ■ Do not care ■ No

Fig. 6. Preferences regarding the transfer of some information from invoices to websites.

Table 5.

It is possible to notice that some variability exists. Respondents from some municipalities have more favourable opinions of the proposed invoice model than respondents of some others municipalities. Despite not being possible to analyse, *ceteris paribus*, why such differences might exist, it is interesting to observe that the lowest average score (3.0 out of 5 possible points) is given by the respondents who face the highest prices charged (municipality of Figueira da Foz) and the highest average score comes from the respondents of Pombal, where prices charged are the lowest.

Furthermore, previous research has called attention to the fact that not all consumers have the same information skills and competencies.

Table 5
Detailed invoice assessment and value charged per municipality.

Municipalities	Respondents' evaluation of detailed (for 10m ³) ^a	Value charged in € invoice
Coimbra	3.4	2.6
Figueira da Foz	3.0	1.7
Leiria	3.3	2.4
Montemor-o-Velho	3.5	2.4
Pombal	4.2	2.8
Santa Comba Dao ~	3.5	1.8

	Average of the 12 assessment items	Min	Max
Coimbra	3.4	2.6	3.8
Figueira da Foz	3.0	1.7	4.0
Leiria	3.3	2.4	3.95
Montemor-o-Velho	3.5	2.4	4.2
Pombal	4.2	2.8	4.5
Santa Comba Dao ~	3.5	1.8	4.0

^a Source: Information collected from the regulator and the service providers' websites regarding the amount to be paid for a monthly consumption of 10 m³.

Given the vulnerability drivers typically suggested in the literature (Berg, 2015; Jilke, 2015; Brennan and Coppack, 2008; Hogg et al., 2007), it was decided to consider as potentially vulnerable consumers those who comply at least with one of the following criteria: (1) have a low level of qualification (attended no more than elementary school) and (2) are unemployed. As indicated in Table 6, thirty-eight respondents have fallen into the potentially vulnerable group.

Averages for each assessment item were computed for each group. Overall, both groups have similar opinions regarding the detailed invoice model. As shown in Table 6, there is, however, a significant difference in what the perception of complexity is regarded. PVC tend to see invoices as more complex documents.

In what the size of the households is concerned, we formed two groups (families with at least four members vs. families with less than 4 members) and compared the means between these two independent samples regarding the way they evaluate the various aspects of the invoice model. The justification to explore potential differences between these two groups being larger families consume more water and because increasing block tariffs are in place such families pay higher bills.

As displayed in Table 7, large and small households have identical views when evaluating the various items of the detailed invoice model. Once again, complexity emerged as the only item for which differences are statistically significant. According to the responses obtained, larger families seem to be simultaneously more aware of how much water they consume.

5. Conclusions and recommendations

Water invoices are a tool to communicate on a regular and universal basis with all customers, allowing the provision of information on

Table 6
Detailed invoice assessment – vulnerable vs. non-vulnerable group means comparison.

	Group 1 – Potential consumers (PVC)	Group 2 – Non vulnerable vulnerable consumers (NVC)
Size	38 respondents	121 respondents
Criteria	Low level of (elementary school) And/or Unemployed people	The remaining individuals (who do not comply with any of the criteria to be included in group 1)
Average of the 12 assessment items displayed in Table 4	3.474	3.471
	t-test for the equality of means: 0.049 (n.s)	
I would say that overall the invoice presented is a complex document. (REVERSE)	2.05	2.40
	t-test for the equality of means: 1.655 (sig at 0.1)	

Table 7
Detailed invoice assessment – large vs. small households means comparison.

	Group 1 (large households)	Group 2 (small households)
Size	37 respondents	114 respondents
Average of the 12 assessment items	3.478	3.485
	t-test for equality of means: 0.084 (n.s)	
I would say that overall the invoice presented is a complex document (REVERSE)	2.69	2.25
	t-test for equality of means: 2.113 (sig at 0.05)	

quantities, prices and total amount due, as well as conveying other important messages. Communicating such information is especially relevant to protect consumers' rights when it comes to essential services as water services and no 'exit' behaviours are possible, due to the natural monopoly characteristics of the industry. However, communication between essential services providers and customers is an under-researched topic in the literature. In addition to being scarce, the related existing literature does not capture the water services users' perspective, contrasting with current concerns of regulators and other international bodies.

The purpose of this paper was to assess, according to the views of residential consumers, to what extent the Portuguese detailed invoice model conveys relevant and clear information to consumers, something that is regarded as essential for invoices to meet their mission of driving adequate consumption behaviours. Understanding how consumers evaluate their invoice documents in terms of their content and format is crucial to derive useful recommendations on how to raise consumers' interest in water invoices. With such purpose in mind, a survey instrument was designed and administered to a sample of domestic consumers of the Centre region of Portugal.

Findings reveal that overall consumers positively evaluate the detailed invoice proposed by the regulator. Yet, there is a large proportion of participants indicating that the document is complex. The perception of complexity might be associated with the kind of language used, with many consumers criticising the extensive usage of acronyms and abbreviations that are hard to understand. Therefore, these results are a sound indication that clarity is at stake. Moreover, it was interesting to notice that, despite thinking that some information conveyed in water invoices is unnecessary, when questioned about the inclusion of various items, the vast majority of the participants indicates that invoices should comprise all those data and are particularly reluctant to the possibility of transferring some of the information currently conveyed in invoices to the websites. This might be an indication that consumers feel they might lose some control over their expenditures if some information is dropped from the invoice document.

The study also asked consumers to give their opinions regarding some recent changes and other foreseeable modifications to the invoice model. Even if a significant proportion of the surveyed users do not have strong opinions on the matter, there is a tendency to positively evaluate alterations that enhance invoices simplification. Replacing cubic meters by litres, a unit of measurement that consumers are more familiar with, is an example of such changes.

Taking into account that consumers are very diverse, the current research compared the perceptions of different groups of consumers. With the exception of complexity, consumers' perceptions were roughly the same across the groups. In what complexity is regarded, potential vulnerable customers make a more negative evaluation of water invoices and the same applies to households with more members.

Based on the research findings, it is possible to conclude that the priority given by the regulator to (extreme) accuracy and exhaustiveness when designing the detailed invoice does not seem to be highly valued by domestic consumers and might be contributing to the consumers' lack of knowledge concerning consumption levels (particularly in what the quantities is regarded). In fact, an example of such concern with rigour is the compulsory use of four decimal digits, which was negatively assessed by consumers. On their turn, exhaustiveness worries have led to the inclusion of items – such as the price of bulk water – that the vast majority of consumers hardly knows what they mean. A relatively complex and very detailed invoice might thus have counterproductive effects making the document unappealing and undervalued by consumers.

Some recommendations can be derived from the study. Firstly, it is advisable to make changes in invoices to stress the quantities consumed. In fact, when looking at invoices, quantities are the variable that consumers can have more control over, even if, given the essential nature of water, demand tends to be highly inelastic. At the same time, fostering consumers' awareness of the volume of water consumed, for example by displaying in invoices the full range of prices for different volumes, is essential to promote saving behaviours. Moreover, it would be important to assist consumers in assessing whether or not their current consumption levels are acceptable, for instance by providing figures of comparable households' consumption, as suggested in some field experiments. Secondly, plain language should be used in water invoices. It is highly recommendable to avoid acronyms and abbreviations consumers are not familiar with. The terminology used should also facilitate the distinction between variable and fixed components. Thirdly, graphics should be improved. Findings have shown that consumers greatly value graphics. The units of measurement used in such figures should be clear. Since graphics typically describe consumption patterns, this clarification might have a positive impact in consumers' awareness of the volumes of water consumed throughout the year. A final word of caution to stress that such changes (some of them already enshrined in the regulator recommendations) should be applied throughout the country, contrarily to what sometimes happens in practice with operators using different invoice templates.

It must be acknowledged that the study carried out has some limitations. The most relevant relate to the data and methods used. The sample size is relatively small and cannot be described as statistically representative. Yet, it is diverse and its features roughly correspond to the overall picture of the Portuguese households. Generalising the findings to the national context was not, in any case, the main purpose of this research, which has an exploratory nature. Increasing the sample can in the future contribute to further validate our findings. Furthermore, by applying a self-administered questionnaire information collected is obviously constrained by the extensive use of closed questions. Further studies might consider applying more qualitative research designs, which enable collecting in-depth views on the matter. On a different tone, it must be also acknowledged that any invoice simplification effort is restricted by the existence of complex tariff schemes, which are a consequence of the tendency to accommodate multiple and often conflicting purposes.

The originality of the current paper should be emphasised. To the best of the authors' knowledge, this is the first empirical study that analyses domestic consumers' perceptions regarding the content and format of an invoice model proposed by the industry regulator. Moreover, it gives important hints on how to increase consumers' interest in water invoices, thus having policy implications. Finally, it can provide a foundation to further studies aiming at analysing the impact of invoices simplification/clarification on consumers' awareness of their consumption patterns, thus contributing to the validation of some of the measures proposed.

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