Assessing water services affordability: macro and micro approaches

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Abstract

Regulation of water services is increasingly important worldwide. Consumer protection and particularly the promotion of affordable prices is a critical duty of water regulators, regardless the type of the regulatory regime. However, in developed countries affordability issues are frequently seen as an already solved problem.

The purpose of this paper is two-fold. First, contribute to the debate on how much water must be affordable for all by discussing complementary approaches on the affordability concept. Second, using the Portuguese case as an empirical example, and weighting whether residential water charges are affordable for the most vulnerable groups, to assess if water affordability concerns should be reinforced/reoriented.

To address the question of the quantities that might be relevant when discussing water affordability, we estimate potential macro affordability ratios for Portuguese mainland municipalities. This analysis is supplemented with the empirical assessment of micro affordability, using primary data collected from a household sample of residential users in mainland Portugal.

The water affordability analysis at the macro level shows that, on average, this does not seem to be an important issue in Portugal. But, on the contrary, at the micro level it reveals affordability problems for significant shares of the households’ sample. Further, regarding low income households, there are affordability problems in a very significant number of Portuguese municipalities, even when considering low water consumption levels.

An integrated analysis, complementing macro and micro approaches, helps to identify who is at risk, revealing that water services’ affordability for poor households should be a focus of concern, also in developed countries. Accordingly, the accomplishment of the social sustainability goal requires water services regulation to review and improve current approaches on affordability issues.

Keywords: Affordability; Economic regulation; Water tariffs; Portugal

JEL codes: I38, L51, L95, Q25
Assessing water services affordability: *macro and micro approaches*

**Introduction**

Regulation of water services is increasingly important worldwide. Consumer protection and in particular the promotion of affordable prices is a critical duty of water regulators, regardless the type of the regulatory regime. However, in developed countries affordability issues are frequently seen as an already solved problem.

The purpose of this paper is two-fold. First, contribute to the debate on how much water must be affordable for all by discussing complementary approaches on the affordability concept. Second, using the Portuguese case as an empirical example, and weighting whether residential water charges are affordable for the most vulnerable groups, to assess if water affordability concerns should be reinforced/reoriented.

The main rational behind this research relies on the argument that macro affordability provides only a basis for a deeper affordability assessment. Indeed, macro affordability analysis gives a general picture on the issue, but a single numeric criterion (based on average figures) is frequently misleading and therefore the assessment of water services affordability should be complemented with the analysis of micro affordability figures, particularly concerning the most vulnerable households’ case. For this, following this introductory section, the paper presents the main methodological issues, the dataset and the variables used to estimate the (macro, micro and poverty) affordability ratios. Next, the results are presented and discussed, and the last section concludes.

**Methodology and data**

Water affordability is often measured as the share of household income spent on water charges (e.g. Garcia Valiñas et al., 2010; Reynaud, 2010). Despite differences, around 2% to 5%, a 3% threshold affordability ratio (AR) is often considered in the literature for water services (Fankhauser and Tepic, 2007; Smets, 2009; Martins et al., 2013b).

To address the question of the quantities that might be relevant when discussing water affordability, we start by estimating potential or *ex-ante* macro affordability ratios (AR) for
Portuguese mainland municipalities. This procedure provides a range of values, which allows to critically commenting on the suitability of the concepts.

The estimation of macro affordability indicators, for 2011, is performed by computing the water services bill value in each of the 275 (of the 278) Portuguese mainland municipalities, for a hypothetical consumption level of 70 liters per capita per day (WHO, 2011), for the average household size (hereafter QWHO), and according to the tariff schemes in charge, with the local average household income. To mitigate potential limitations of the value judgment implicit in the definition of an ‘appropriate’ amount of water, we further estimate the AR considering the corresponding water charges for two other benchmark household consumption scenarios: 12m³ per month (QERSAR) – the approximate annual average consumption by Portuguese households; and 200m³ per year – 16,6m³ monthly equivalent (QIWA) – often used for international comparisons (e.g., OECD, 2010; IWA, 2014). In what concerns to these macro AR, data on tariff structures in charge, in Portuguese mainland municipalities, was collected from the Water and Waste Services Regulation Authority (ERSAR) and from water utilities webpages (see Figure 1 for the representation of a ‘typical’ water supply and wastewater tariff scheme - following the Portuguese Regulator recommendations). Other items may be included in the water bill, such as VAT and the Water Resources Levy. The average household disposable income was obtained from the Directorate-General for Taxation and the average household size per municipality from the 2011 Census.

Next, the analysis is supplemented with the empirical assessment of micro affordability, with household level disaggregated data. As disaggregated household level data is not available,
primary data was collected from a household sample of residential users in mainland Portugal by means of a questionnaire-based survey. The random sampling frame was built upon a complete telephone list of customers from 13 water utilities, located in the 5 Portuguese hydrographical regions. A total of 2440 valid questionnaires was obtained. In order to compute the observed micro AR, the household survey data on income was matched with actual records (from the water utilities) on the monthly consumption and bills paid by the same customers.

Besides the need to go deeper on the assessment of water affordability by confining it to water consumption inelastic levels, corresponding to the satisfaction of essential needs (Q_{WHO}), it is particularly relevant to analyze this issue for the most vulnerable groups (Martins et al., 2013a). Indeed, according to the Portuguese Statistical Office (INE), in 2011, almost a quarter of the Portuguese households were at risk of poverty or social exclusion. Accordingly, for the 3 levels of water consumption considered, we estimated the potential AR in each municipality considering the Portuguese poverty threshold (a poverty scenario) income level.

Table 1, complemented with figures 2 and 3, summarizes the structure and the details on the dataset used to estimate the 3 categories of affordability ratios considered, i.e. for assessing the potential or \textit{ex ante} macro affordability, the observed micro affordability and the affordability for the most vulnerable households.
Table 1 – Main variables and data sources (*2011 cross-section data*)

<table>
<thead>
<tr>
<th>AR</th>
<th>Water consumption</th>
<th>(a) Water charges</th>
<th>(b) Income</th>
<th>Sample/coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro</td>
<td><strong>3 potential consumption scenarios:</strong> i) 70 l/pp/day (WHO, 2011): ( Q_{\text{WHO}} ) ii) 12m(^3)/month (Portuguese average consumption, ERSAR): ( Q_{\text{ERSAR}} ) iii) 17m(^3)/month (residential international reference, IWA): ( Q_{\text{IWA}} )</td>
<td>ERSAR, Utilities' websites and own calculations</td>
<td>DS - IRS</td>
<td>275 out of 278 mainland municipalities</td>
</tr>
<tr>
<td>Micro</td>
<td>Actual household consumption</td>
<td>Water utilities</td>
<td>Household survey</td>
<td>2240 respondents (from 13 municipalities)</td>
</tr>
<tr>
<td>Poverty</td>
<td><strong>Primary data</strong></td>
<td>ERSAR and own calculations</td>
<td>Equivalised household disposable income below the risk-of-poverty</td>
<td>275 municipalities</td>
</tr>
</tbody>
</table>

Fig. 2 – Hierarchy of water requirements  
*Source: WHO, 2011:1*

Fig. 3 – 13 Municipalities surveyed

Notes:
- (Household size \( X \)) \( X \) (Q.) \( X \) (30 days) = Water services charges
- Portuguese average household annual consumption (ERSAR: 140m\(^3\) = 12m\(^3\)/Month)
- International average household annual consumption (IWA: 200m\(^3\) = 16,6(6)m\(^3\)/Month)
Results and discussion

This section presents and discusses the results concerning the i) macro, ii) micro, and iii) poverty affordability ratios estimated for the Portuguese mainland municipalities.

i. Potential macro affordability

The macro AR estimations indicate that water charges do not represent a disproportionate burden. Indeed, the estimated potential macro AR is below the 3% threshold for all municipalities regarding the minor amount of water consumption considered (Q_{WHO}). Even considering the water charges for the Portuguese national average consumption (Q_{ERSAR}) only in 7 municipalities (less than 5% of the Portuguese population) the ratio exceeds the 3%. Regarding the residential international reference equivalent to 16.6(6)m³/month (Q_{IWA}) the threshold is exceeded in 56 municipalities.

![Fig. 4 – Potential macro AR: Spatial distribution by Municipality.](image)

Figure 4 shows that the AR varies considerably across municipalities, though with higher figures more concentrated in the North and Centre regions of Portugal, as shown by darker areas.

ii. Observed micro affordability

A complementary analysis with real figures (the observed water consumption level and the actual income) at the household level of disaggregation reveal different pictures.
Indeed, the estimations summarized in Table 2 indicate that the observed average household water consumption is about 9m$^3$ per month; and that the affordability threshold is exceeded for an important share of the households’ sample.

### iii. Poverty Scenario

The analysis for the most vulnerable households reveals that water services’ affordability should be a focus of concern to the public and decision makers.

As illustrated in Figure 5, even for consumption levels of 70l/pc/pd, potential water affordability problems can be found in 88 (32%) Portuguese municipalities (and, noteworthy, the use of social tariffs is not considered in the water tariff structures on 50 of them).

Further, taking into account their spatial distribution throughout the country, it becomes clear that several of the municipalities where the AR for poor households is above the threshold are
among the ones with higher average income, thus emphasizing the need to assess beyond averages.

**Conclusions**

The water affordability analysis at the macro (potential) level shows that, on average, it does not seem to be an important issue in Portugal. On the contrary, at the micro (observed) level it seems to be a problem for significant shares of the households’ sample. Further, regarding low income households, there are affordability problems in a very significant number of Portuguese municipalities, even when considering low water consumption levels.

The proposed integrated analysis, complementing macro and micro approaches, helps to identify who is at risk, revealing that water services’ affordability for poor households should be a focus of concern, also in developed countries, particularly when there are significant income distribution inequalities. Accordingly, the accomplishment of the social sustainability goal requires water services regulation to review and improve current approaches on affordability issues.

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