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Research article

European attitudes to water pricing: Internalizing environmental and resource costs

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ABSTRACT

Efficient use of the water resource requires internalization of all costs in the price of water, including environmental and resource costs. However, water resource management tends to be highly political and increasing water prices are a sensitive and complicated policy matter. Hence, there is a need for increased understanding of the implementation process and the attitudes towards implementation among the general public. This paper explores the spatial heterogeneity in the public attitude towards internalizing environmental and resource costs in the price of water across the EU regions. Within an extensive spatial dataset constructed for the purpose, we estimate the effect of individual information levels and affordability concerns on the attitude towards environmental water pricing. Information about water problems is found to have a significant and positive effect on attitudes as is affordability concern, which may be explained by expectations of inequity measures to come in place in parallel with increasing water prices. Overall these results support the hypothesis that lack of information and affordability concern could lead to resistance towards efficient water pricing among the general public.

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1. Introduction

With increasing economic growth, population pressure and the current and expected future impacts of climate change, it is becoming ever more evident that water should be regarded as a scarce and valuable resource. Thus, from a socio-economic point of view, an optimal allocation of water resources between human use and other purposes should be aimed for. Allocation of scarce water resources for human use should be promoted through policy initiatives, since open access to the water resources or fixed fees not related to water use is likely to result in overexploitation and inefficient use of the resource (Neher, 1990; Arbués et al., 2003; Binet et al., 2014). A major problem in water management is that water prices to a large extent are socially constructed rather than based on principles of efficient water pricing reflecting the resource scarcity. In many areas, management of the water resource is highly political and increasing water prices tends to be a sensitive and complicated policy matter (Olmstead, 2010).

In the last third of the twentieth century, pioneer nations started to implement national environmental policies. Over the last two decades, global and regional environmental governance have become a larger part of environmental management, but still the national state is central in the implementation of policies *e.g.* within the EU. Thereby, global as well as local successes are dependent on national commitment, policies, institutions and capacity (Fiorino, 2011). The concept of efficient water pricing has been introduced as part of the European Water Framework Directive (WFD) (European Commission, 2000). It is the first EU legislation of its kind that explicitly demands economic principles to play a significant role in water management. One of the objectives of the WFD is to ensure efficient water pricing by internalizing environmental and resource externalities in the price of water.[1] Even though the WFD explicitly states that economic principles and instruments should have been part of the national water pricing strategies from year 2010 and onwards, it has proven to be a major challenge in national water regulation. The translation of water pricing principles into national policies remains unclear and until this day, none of the EU member states fully comply with these obligations, though some states have advanced further than

[1] Resource costs are defined as; *'the opportunity costs of using water as a scarce resource in a particular way (e.g. through abstraction or wastewater discharge) in time and space'* and environmental costs are defined as; *'the environmental damage costs of aquatic ecosystem degradation and depletion caused by a particular water use (e.g. water abstraction or the emission of pollutants)'* (Drafting Group ECO2, 2004).

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others (European Environmental Agency, 2013).

National environmental policies have previously been found to mirror individual attitudes *e.g.* within national climate change policies (Tjernström and Tietenberg, 2008). To our knowledge, no studies have investigated public attitudes towards water pricing and environmental and resource costs, in spite of the findings on climate change policies. According to the European Environmental Agency (2013), general barriers to implementation of efficient water pricing include resistance to increasing water prices from the end-users. This resistance may come from lack of information or from social issues such as affordability concerns and inequity aversion (European Environmental Agency, 2013). Empirical literature on increasing information of the environmental consequences of water use has found a positive effect on individual water use behavior (Ferraro et al., 2011; Aisbett and Steinhauser, 2014), although price based instruments are found to be more effective (Halich and Stephenson, 2009). Thus, to facilitate and promote the future implementation of environmental pricing, it is essential to improve our understanding of the economic and political incentives in the member states. First, what are the drivers behind the attitude formation and second, do lack of information and affordability concern explain the public attitude in the European member states towards water pricing and in particular the inclusion of environmental and resource costs?

The present study investigates public attitudes to water pricing by combining an extensive study of the attitudes towards water and related issues of 25,524 European citizens from 27 member states (European Commission, 2013a) and the spatial data of region of residence for each respondent (GISCO – Eurostat 2010). First, the spatial patterns in the attitudes towards including environmental and resource costs in the price of water are analyzed, using a Moran's I cluster analysis. Second, an ordered probit model suggesting that public attitudes can be explained by a set of underlying factors of sociodemographic characteristics is estimated. To account for the spatial heterogeneity, we control for member state effects and test the effect of information level and affordability concern on the attitude towards internalizing environmental and resource costs in water pricing.

The paper proceeds as follows: Section 2 presents the econometric approach and section 3 provides an overview of the empirical data used for estimation. Section 4 presents estimation results and partial effects of the variables. Section 5 discusses the results and section 6 highlights important conclusions while pointing towards further opportunities for research.

2. Empirical models

2.1. The attitude model

The individuals' attitudes towards internalizing environmental and resource costs in the price of water are based on the following random utility model:

$$y_i^* = \beta' x_i + \varepsilon_i \; i = 1, \ldots, n, \quad \varepsilon_i | x_i \sim Normal(0,1) \tag{1}$$

in which the dependent variable y_i^* is an underlying continuous variable. The continues scale of attitudes is unobserved and the respondent does not provide y_i^*, but rather a censoring into alternatives, choosing the one which is closest to the preferences of the underlying latent variable y_i^* (Greene and Hensher, 2010). $\beta' x_i$ is an observed component of utility depending on a set of attributes x_i and a set of marginal utilities β. ε_i is an unobserved component of utility interpreted as taste heterogeneity of the respondent. The errors ε_i are assumed to be standard normal distributed. Since y_i^* is unobservable, it is represented by the observable variable y_i taking on the value j=1,…,J representing the ordered response categories in Eq. (2). The bounds given by the thresholds $\alpha_j < \alpha_{j+1} < \ldots < \alpha_J$ of the latent variable y_i^*:

$$y_i = \begin{cases} 1 & if \quad \alpha_0 < y_i^* \le \alpha_1 \\ 2 & if \quad \alpha_1 < y_i^* \le \alpha_2 \\ & \vdots \\ J & if \quad \alpha_{J-1} < y_i^* \le \alpha_J \end{cases} \tag{2}$$

The probabilities associated with the observed outcomes are given by Eq. (3) which estimates the marginal utilities β and thresholds α_j using the sample of n observations indexed by i=1,…,n.

$$Prob[y_i = j | x_i] = F(\alpha_j - x_i\beta) - F(\alpha_{j-1} - x_i\beta) \tag{3}$$

In Eq. (3) the respondent chooses the alternative j that maximizes the utility y_i^* given the set of explanatory variables, x_i.

2.2. The member state specific attitude model

The Member state specific attitude model is an expansion of the Attitude model from section 2.1 controlling for member state specific effects. Thereby it is possible to control for the unobserved member state specific spatial heterogeneity in the attitudes. The member states are defined as a spatial entity with the individuals being the multiple observations generating a panel structure. The term $\propto_g$ expresses the member state specific effects as a difference from the reference group, for each respondent i in each member state g (with $g = 2, \ldots, G$).

$$y_{ig}^* = \propto_g \partial_{ig} + x_i'\beta + \varepsilon_{ig} \; for \; i = 1, \ldots, n, \; g = 1, \ldots, G, \tag{4}$$

Where ∂_{ig} is an indicator variable (∂_{ig}=1 for g = h when $i \in h$ and ∂_{ig}=0 otherwise) (Anselin and Arribas-Bel, 2013). Thereby the differences of the mean between the member states are controlled for.

2.3. Partial average effects

The partial effects of each attitude level will depend on the values of all other variables and their coefficients as specified in Eq. (5). To test for the partial average effects of the intermediate categories the change in the predicted probability from a discrete change in x_k from starting value x_S to end value x_E is found using the delta method, holding all other variables at their mean (Long, 1997).

$$\frac{\Delta \Pr(y = j|x)}{\Delta x_k} = \Pr(y = j|x, x_k = x_E) - \Pr(y = j|x, x_k = x_S) \tag{5}$$

Where $\Delta Pr(y = j|x)$ is the change in the probability of the respondent choosing j given the set of explanatory variables x. Δx_k is the discrete change in the variable of interest, x_k.

3. Data

The present study is based on a survey of Attitudes of Europeans towards water and related issues referred to as the Flash Eurobarometer 344 (European Commission, 2013a). Each respondent is linked to a region using a spatial dataset of the European regions referred to as the GISCO NUTS (Geographic Information System of the European Commission) (GISCO – Eurostat 2010). The Flash Eurobarometer 344 was carried out in March 2012 by the European Commission as a telephone based survey involving 25,524 European respondents who were each asked 17 questions related to water quality in their member state of residence. Furthermore, they were asked about socioeconomic characteristics concerning age,

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