Assessing the benefits of different groundwater protection levels: results and lessons learnt from a contingent valuation survey in the Upper Rhine valley aquifer, France

Stéphanie Aulong, Jean-Daniel Rinaudo[1]

Abstract:

Following the publication of the Water Framework Directive (2000/60/EC) in 2000, European Member States are currently initiating very ambitious water protection programmes aiming at restoring good ecological and chemical status for all water bodies before 2015. Whilst the directive defines environmental objectives for *surface* water bodies, it has not been considered appropriate to define new *groundwater* quality standards which would be applied uniformly to all groundwater bodies across Europe. Instead, the legislator has preferred to leave up to each Member State to determine concentration threshold values for all major polluting substances. According to the recent groundwater Daughter Directive, such thresholds values can be set at regional or local levels in order to reflect local natural or economic specific characteristics. The Directive explicitly recognises that the costs of groundwater protection actions should remain proportionate with the environmental and economic benefits they generate. As a result, policy makers express a growing demand for economic assessment of costs and benefits associated to different levels of groundwater protection. However, existing studies generally focuses on a unique groundwater protection or restoration scenario and rarely assess the benefits associated with different protection scenarios. This study presents an attempt to fill this gap through a case study where the benefits of two groundwater protection scenarios (and corresponding environmental quality standards) are assessed through a contingent valuation survey.

The study was conducted in the French part of the Upper Rhine valley, where a large alluvial aquifer (4000 km²) fulfils respectively 50% and 80% of industrial and drinking water needs. This aquifer is increasingly affected by industrial pollution in particular with chlorinated solvents. The objective of the study was to assess population willingness to pay for restoring two alternative levels of groundwater quality. The contingent valuation survey was carried out

[1] BRGM – French Geological Survey – Environmental Economics Unit, 1039 rue de Pinville, 34000 Montpellier, France. Tel : +33 467 157 981. s.aulong@brgm.fr

between March and July 2006. The business as usual scenario described in the questionnaire (reference situation) assumes that, in the absence of specific groundwater protection and remediation action, pollution plumes would extend, leading to the contamination of urban drinking water wells. An action scenario, consisting restoring groundwater quality up to current drinking water standards, is first considered and assessed by respondents. A second scenario consisting of restoring natural quality (removal of all traces of solvents) is then assessed by respondents. Following a pre-test of the questionnaire through 140 face to face interviews, the questionnaire was sent out by mail to 5000 households selected in rural localities (2000), urban areas (2000) and in municipalities located outside the aquifer and using other water resources (1000). The data collected were then used to model households' decision to pay for the two scenarios (Logit model where the explained variable is a binary variable taking the value one if the households accept to pay, zero otherwise). The stated willingness to pay amount was then modelled using a linear regression (excluding protest answers) and a Tobit model (including and excluding protest answers). Based on the results of the multivariate analysis, an assessment of the total benefits of each groundwater protection scenario is carried out, based on assumptions related to the population concerned by groundwater protection in the region.

A total of 668 usable questionnaires were returned out of the 5000 sent by mail. The response rate (13.4%) is conforming to similar methods. The survey first allows understanding of the perception of groundwater pollution problem by the population. Concerning the perception of groundwater pollution, 22% of the respondents never heard about Upper Rhine pollution aquifer cases whereas 54% did. According to the respondents, the main causes of groundwater pollution are agriculture and industry. When asked to identify within a list the polluting substances which are present in the aquifer, respondents mainly quote nitrates (86%) and pesticides and herbicides (84%). They are fewer to quote heavy metals (44%), chlorides (45%) and hydrocarbons (33%). Chlorinated solvents are quoted by 53%, putting them in third position after nitrates and pesticides. After having read the description of the current situation in terms of water quality in Alsace, 82% declare that they were not well (or not at all) informed about it before reading the text. Most respondents (80%) consider the two proposed hypothetical scenarios as credible.

Sixty two percent of the respondents accept to contribute to the first scenario: the mean WTP declared is 42€/households. In the case of the second scenario, 54% of the respondents are willing to contribute. The corresponding mean WTP is 76€/household. Unexpectedly and in both scenario cases, the average willingness to pay of respondents living above with aquifer is not higher than WTP declared by respondents living outside the aquifer – which was one of the assumptions to be tested. These values can be compared with the 94€ found in a 1993 contingent valuation assessing WTP for groundwater protection in the same region (Stenger

and Willinger, 1998). A major finding is the relatively high protest rate close to 53% for the first scenario (17% for the second). This attitude is mainly due to the fact that the scenario is perceived as inconsistent with the polluter pays principle. Other respondents reject the scenario due to the proposed payment vehicle and assert that they would be willing to pay but not through an increase of their water bill.

The results of the linear Logic model shows that the main significant variables are the realism of the described scenarios, the number of children in the household, the income and the number of known polluting substances. The frequency of tap water consumption does not appear as a significant variable as found by Stenger and Willinger. Two models were tested to explain stated WTP amounts. Unexpectedly, the knowledge of the water bill has a negative impact on the WTP amount. Significant variables are quite different from the Logit model: income, knowledge of water bill, concern about groundwater pollution, practice of water activities (leisure), and use and non-use values of groundwater advocated as motivations to pay. The predicted WTP range between 19 and 29€ per household for the first scenario and between 54 and 79€ per household for the second scenario according to the regression model used and the inclusion of protest answers or not..

Finally, the total benefits of the Upper Rhine Valley aquifer are estimated after a sample bias correction. The total benefits of groundwater protection is estimated at 29 million € for the scenario 1 (drinking quality level) and 46.5 million € for scenario 2 (natural water quality level).

Keywords: Contingent valuation, Willingness to pay, groundwater, quality thresholds

Acknowledgement: This paper is based on results of FP6 European Research project BRIDGE: “Background Criteria for the Identification of Groundwater Threshold” 006538 (SSPI).