Editorial

Volume 6 Issue 1 (January 2020)

Renan U. Goetz

Universitat de Girona, Girona, Spain
renan.goetz@udg.edu

Published 23 January 2020

1. Introduction

Questions related with demand, supply and trading of water are at the heart of Water Economics. Volume 6 Issue 1 of *WEP* offers, for all three questions, not only methodological advances but also insights for the design of water-related policies. In the following sections, we provide an overview of the different papers found in this issue.

2. Overview of the Papers

This issue of *Water Economics and Policy* brings together five interesting papers. The paper by Adusumilli *et al.* employs propensity score matching (PSM) for causal inference. This matching method offers a novel application for evaluating the effectiveness of federal land reservation programs. The following two papers by Isaaks and Colby and by Hérivaux *et al.* analyze the underlying factors that explain the intensity of groundwater trading. Isaaks and Colby focus on the negotiation process associated with water trading and define proxies that allow identifying the advantageous and disadvantageous characteristics for buyers and sellers. Hérivaux *et al.* concentrate on the stakeholders' perception of obstacles that may impede water trading. In this way, their analysis offers guidance for enhancing the acceptance and operability of water markets. The final two papers by Mekonnen

et al. and Stone *et al.* offer new insights on the driving factors for water demand. Mekonnen *et al.* elicited the marginal willingness to pay (MWTP) for different attributes of water supply (e.g., reliability of supply or the number of supported growing seasons). In this way, their study opens the door for novel pricing policies of irrigation services based on its specific characteristics. Stone *et al.* notes that traditional approaches for the estimation of water demand do not take into account the characteristics of households that are highly heterogeneous and their water demand is often not constant over time. In contrast with the traditional literature, the authors propose an econometric approach where changes in the demand function over time are determined endogenously (latent classes) and not exogenously by the researchers.

2.1. “Effect of Cost-Sharing Federal Programs on Adoption of Water Conservation Practices: Results from Propensity Score Matching Approach” by Adusumilli *et al.*

The paper by Adusumilli *et al.* analyzes the effect of enrollment in two working federal land conservation programs on irrigation water conservation practices — Environmental Quality Incentives Program and the Conservation Stewardship Program. However, since the socioeconomic and farm-specific characteristics of the participants and non-participants are not identical, the observed differences in the irrigation water conservation practices cannot be attributed solely to the participation in the conservation program. To correct this shortcoming, Adusumilli *et al.* employed the method of PSM as it allows the evaluation of the effects of the program on farmers that have similar observable socioeconomic and farm specific characteristics. Based on the probability of enrollment (propensity score), they create a counterfactual group of farmers that is homogenous with respect to the observable characteristics. By comparing the average adoption rate of irrigation water conservation practices between the enrollees and their constructed counterfactuals or matched cohort, the authors find the average treatment effect of the two conservation programs. Their findings show that the evaluation of the effects of the two programs is significantly different for the matched and unmatched cohorts. However, even after correcting for differences in socioeconomic and farm-specific characteristics, both programs achieve positive and significant levels of adoption of conservation practices.

This paper offers an interesting perspective on the application of a matching method for causal inference. Although PSM is the most prominent exponent of matching methods in Economics, the statistical literature analyzes and compares different approaches that might offer new insights (Stuart 2010).

2.2. ““Empirical Application of Rubinstein Bargaining Model in Western U.S. Water Transactions” by Isaaks and Colby

The paper by Isaaks and Colby offers a novel look at the economic analysis of water transactions. The literature considers them as an important policy tool to improve allocative efficiency and as an instrument to mitigate the effects of regional droughts or regional water shortages due to other reasons. However, water markets differ significantly from competitive markets where there are many buyers and sellers, and where demand and supply are a functions of the market price. These conditions do not hold in the case of water markets. Water transactions often take place where some or all agents involved can influence price, and transactions are limited by legal, geographical and/or technical constraints. For these reasons, the authors suggest to model water transactions as individual, spot-market agreements suitable to be modeled by bargaining games. While normative approaches in the form of cooperative games investigate how the surplus of the bargaining game should be shared, the positive approach in the form of non-cooperative games studies how the surplus will be shared. Since the authors put the negotiation process at the heart of their research, the paper focuses on the aspect of how the surplus will be shared in the form of a non-cooperative game. Taking account of the back-and-forth nature of the bargaining process, Isaaks and Colby frame the analysis within the bilateral Rubinstein Bargaining Model where the buyer and the seller take turns as proposers. The final outcome of the bargaining process depends upon how strongly the buyer and the seller prefer current versus future payments. Likewise, it depends on the outside option and on the water supply risk. In a unique empirical analysis, the authors design proxies for these three explanatory variables and show that risk-aversion and a high discount rate constitute a disadvantage for the buyer, while the effect of the outside option is ambiguous. The paper is unique as it determines suitable proxies that allow testing game-theoretic predictions. Yet, as recognized by the authors, empirical variables differ substantially from ideal measures and as such the authors signal the definition of empirical variables as a key challenge for further empirical analysis of water transaction.

2.3. “Valuation of Access to Irrigation Water in Rural Ethiopia: Application of Choice Experiment and Contingent Valuation Methods” by Mekonnen *et al.*

The paper by Mekonnen *et al.* offers an interesting view on the value of irrigation water. It departs from the previous literature by focusing not only on the value of the water itself but also on the fundamental attributes of irrigation water. Based on a pilot study and a discussion with experts, the authors identified the number of

supported growing seasons, the reliability of irrigation within a season, the admitted crops for cultivation, and the annual payment as the most important attributes. On grounds of a Choice Experiment (CE) and the elicited willingness for annual payments, the authors estimate the MWTP for the first three attributes. Among these three attributes, the MWTP for the reliability of irrigation water during the growing season stands out. The CE opens the door for novel pricing policies as it allows devising pricing policies for irrigation services based on specific attributes — for example based on the watering frequency during the growing season and crop type. Another interesting aspect of these experiments is that farmers were asked to relate their answer to the baseline condition when no irrigation water is available. In this way, the authors could include users and non-users of the current irrigation system. In addition to the CE, the author realized a Contingent Valuation (CV) to elicit the operation and maintenance costs of irrigation water provision. The results of the double bounded CV format show that farmers are willing to pay about 5% of their average annual crop income to operate and maintain water provision. With respect to irrigation water pricing, the authors adopted a new course that is in between volumetric and non-volumetric water measuring. They proposed “per area pricing”, also known as semi-volumetric pricing, which takes into account the type of the cultivated crop. For countries like Ethiopia, this approach seems to stipulate an equilibrium between incentives for an efficient use of scarce resources and its implementation at reasonable costs.

2.4. “Variation in Water Demand Responsiveness to Utility Policies and Weather: A Latent-Class Model” by Stone *et al.*

The paper by Stone *et al.* takes a new path for the estimation of water demand. The authors noted that traditional approaches, based on an average consumer behavior, do not take into account that household demand varies over time. Even when controlling for individual level (time invariant) sources of heterogeneity via fixed-effects, the authors observed significant heterogeneity in household demand as a response to changes in the pricing policy of the water utility. A possible explanation for this heterogeneity might be the changes in household preferences over time, due to drought and related perceptions of the problem influenced by public media, pressure groups and private environment. To overcome this problem, past researchers (Kenney *et al.*, 2008) considered that households’ demand function varies with time periods. The authors assume that the researcher can identify the time periods with specific water demand functions. However, the incorporation of shift parameters or the estimation of separate demand functions requires that a *priori* assumptions about the timing of the changes in the households’ demand

function are introduced. In contrast to this approach, Stone *et al.* propose to employ a latent class model with fixed effect where the changes in the demand function (class) are determined endogenously. The authors identified demand shifts as a result of changes in the rate-structure of the water utility and in the climatic conditions (drought or post-drought periods). The results show that household demand is less sensitive to price changes in the peak of a drought than during the immediate post-drought period. The authors attribute this finding to a higher sensibility within households as they are conscious of the water shortage. In later post-drought periods, the authors observe significant household responses towards changes in the structure of the water tariffs. Stone *et al.* found that households become less responsive to water tariff changes but more responsive towards weather conditions and droughts. The latter observation is important for policy design as it reduces the utilities' ability to promote conservation by pricing policies.

2.5. "Exploring the Potential of Groundwater Markets in Agriculture: Results of a Participatory Evaluation in Five French Case Studies" by Hérivaux *et al.*

Economists have widely advocated the development of water markets to improve water use efficiency. However, past experiences with the setup and functioning of water markets showed that several barriers impede their development and operability. The last paper of this issue focuses on these obstacles from a different perspective than the previous literature. Hérivaux *et al.* do not realize an *ex-post* analysis but concentrate on the *ex-ante* situation. In particular, based on a participatory approach, they analyze the farmers' and institutional stakeholders' perceptions of different groundwater management scenarios. This paper thereby fills a gap in the existing literature as it assesses how water markets can be embedded in existing groundwater management policies. The authors define two key issues for the successful implementation of groundwater markets: the design and implementation of water markets (i) should adapt to the existing legal, economic, social and agronomic preconditions and (ii) should be based on a long-term perspective.

Based on this conceptual framework, Hérivaux *et al.* design tailor-made groundwater cap and trade policy scenarios and evaluated its acceptance by the stakeholders. The results show that, on average, 45% of the stakeholders were against groundwater trading while 43% were supportive of the idea, subject to certain conditions. The shares of supporters and opponents varied largely with inertia of the aquifer and the type of the stakeholder (farmer or institutional agent).

Stakeholders have serious reservations with respect to the general context (e.g., heterogeneity of the farming systems, water scarcity, availability of knowledge), the capping process (e.g., initial assignment, fixation of the cap) and the trading regulations (e.g., participants, concentration of rights, ethical concerns). Even if these reservations were taken into account for the design of water market scenarios, stakeholders often focused more on the risks than on the possible gains of future water markets. Despite the observed agents' reservations, Hérivaux *et al.* believe that some water markets with favorable starting conditions come into play and their success may help pave the way for other aquifers to start water markets as well. Thus, this paper highlights the importance of the participation and action of local actors for the design of groundwater management instruments. The results of this study show that a participatory action approach is essential for successful implementation of water market.

3. Synthesis and Policy Implications

The collection of papers in this issue of *Water Economics and Policy* addresses key elements related to demand, supply and water trading and indicates how to overcome methodological or empirical shortcomings. The findings presented in this issue help practitioners and researchers to orientate and improve future studies.

In particular, they offer advances in

- (1) Evaluating the effectiveness of policy program for water conservation based on PSM and causal interference;
- (2) Identifying advantageous and disadvantageous positions for buyers and sellers in the water trade negotiation process;
- (3) Guidance to improve the acceptability and operability of water markets;
- (4) Eliciting the MWTP for different characteristics of water supply, which opens the door for novel pricing policies; and
- (5) Estimating the time-variant water demand across heterogeneous users.

References

- Kenney, DS, C Goemans, R Klein, B Lowrey and K Reidy (2008). Residential water demand management: Lessons from Aurora, Colorado. *Journal of the American Water Resources Association*, 44(1), 192–207.
- Stuart, EA (2010). Matching methods for causal inference: A review and a look forward. *Statistical Science*, 25(1), 1–21.