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Efficiency and acceptance of new water allocation rules - The case of an agricultural water users association

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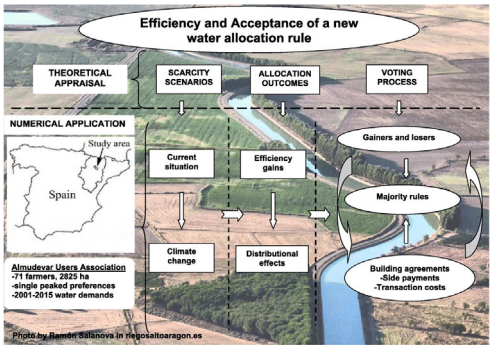
HIGHLIGHTS

- Collective decision making (social choice) and the definition of water allocation rules in agriculture.
- Allocation rules based on social choice theory improve economic efficiency without introducing distributional inequality.
- The voting system of a water users association often does not support the adoption of new water allocation rules.
- Small side payments are able to tip the balance towards the adoption of new water allocation rules in the voting process.

GRAPHICAL ABSTRACT



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ABSTRACT

Water scarcity is one of the major environmental problems in Southern Europe. High levels of water stress and increasing frequency of droughts, along with a greater environmental protection, make it necessary to design water management strategies that are allocative efficient and balance supply and demand. When functioning markets cannot be developed, the allocation rules proposed in the literature of social choice have been recognized as a suitable alternative. However, the application of new water allocation rules can be impaired by a lack of acceptance and implementation problems. This paper examines these obstacles for the case of an agricultural water users association (WUA), situated in the basin of the River Ebro, in relation to the governance structure and collective decision rule of the WUA. It analyzes the extent to which the gains and losses of the farmers affect their acceptance, and examines conditions for building agreements with side payments that provide incentives for the majority of the farmers to form part of a possible agreement. The results show that the uniform and sequential rules improve the allocative efficiency under normal conditions compared to the status quo and the sequential rule even in the case of droughts. In the presence of side payments this rule is likely to be accepted and has only an insignificant impact on distributional inequality.

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1. Introduction

Water scarcity and droughts in Europe, measured in terms of the water exploitation index (WEI),[2] are an increasing phenomenon that affects at least 11% of the population and 17% of the territory (European Commission, 2010). Water resources in Cyprus, Bulgaria, Belgium, Spain, Italy and Malta are exposed to constant water stress as these countries are currently using up 20% or more of their long-term supplies every year (WEI > 20%).

In Spain, for instance, the demand for water for irrigation purposes is about 15,000 Hm^3 per year and represents about 80% of the total national consumptive demand. Water scarcity is extreme in river basins such as the Segura, Júcar, Sur, and the upper Guadiana River (INE, 2016).

Water scarcity and droughts are expected to increase in the near future as a consequence of the concurrence of a variety of factors (European Commission, 2015). On one hand, the consumptive use of water is likely to increase as a result of the expansion of irrigated land, the intensification of tourism and higher transpiration ratios of crops due to climate change. On the other hand, the amount of available water is likely to decrease in the wake of a decrease in precipitations as well as a change of seasonal and geographical patterns.

The increasing level of water stress along with a more demanding regulation of the groundwater and surface water bodies at a European level (Water Framework Directive, 2000/60/EC), motivated and obliged the member states of the European Union to promote water management practices that allow a "good status" of all surface water, groundwater and coastal waters in terms of quality and quantity to be accomplished (Albiac et al., 2007).

Numerous studies have assessed the potential of water markets, or of administrative water pricing where private and social costs are considered. Both approaches aim at balancing the supply and demand of water and sustaining the efficient use of water, i.e., allocating water such that it provides the highest social welfare. Traditionally, the establishment of markets has been considered as a measure that allows the allocating of water among users in a decentralized manner and attenuates the effects of water scarcity. Similarly, administrative water pricing allows a reduction in the demand of water but there is no guarantee that the chosen price maximizes social welfare. Administrative water pricing is based on the costs and as such it takes only the supply side into account. In contrast, the demand side that is driven by the marginal utility of the consumers is not considered and therefore, the maximal social welfare cannot be realized. However, the existing economic literature shows that water markets offer the most efficient allocation of water and maximize social welfare (Easter and Hearne, 1995; Howe et al., 1986; Lee and Jouravlev, 1998).

The experience with water markets is, however, far from the theoretical ideal. In some cases, for example in the Murray-Darling basin in Australia (Bjornlund, 2003), the introduction of water markets even worsened the efficiency of water allocation. The reasons behind the failure of water markets are complex. It may be caused by the existence of political, institutional and/or physical barriers, which prevent vivid exchanges between sectors (Carey et al., 2002). Similarly, high transaction costs may be behind the difficulties in developing local water markets (Easter et al., 1998). Moreover, bureaucratic and legal problems, such as poorly defined water rights, may also prevent the functioning of water markets (Calatrava and Garrido, 2005). If functioning markets cannot be introduced or developed, allocation rules proposed in the literature of social choice may be a good alternative (Barberà, 2005). Goetz et al. (2005, 2008) analyzed the application of various allocation rules with Spanish data and concluded that their application could lead to significant water savings and improvements in the allocation efficiency.

A recent study by the Organization for Economic Cooperation and Development (OECD, 2015) states that, besides water availability, governance is a crucial issue for the management of water resources. According to the OECD (2015) poorly delineated multi-level governance structures and decision processes lead to an unclear allocation of roles and responsibilities. Consequently, improvements in water governance present a key challenge for better water management.

By the same token, the adoption of the above-mentioned allocation rules might not take place due to problems that are related to the process of collective decision making and water governance structures. Accordingly, this paper examines the conditions under which these allocation rules improve the allocation efficiency and are likely to be adopted by the members of an agricultural water users association. For this purpose, the study determines the number of gainers and losers and their associated gains and losses if these allocation rules were adopted. It also analyzes to what extent the gains and losses of the different farmers affect the outcome of the collective decision process to adopt or not a new water allocation rule. Based on the literature on the formation of coalitions (Feldman and Serrano, 2006; Serrano, 2004) we analyze if gainers can build agreements with side payments that provide incentives for the majority of the farmers to form part of an agreement to adopt a new water allocation rule. An empirical analysis based on the water allocation of the Almudevar irrigation district in the Ebro basin provides insights into driving factors for the acceptance or rejection of a new water allocation rule. Our study aims to contribute to the OECD's Principles on Water Governance which encourage evidence-based assessment of the distributional consequences of different water allocation rules (OECD, 2015).

The results show that water allocation rules exist which, in terms of water allocation efficiency, are always superior to the existing water allocation rule. However, if there is a moderate or severe drought only one of these rules is superior to the existing rule. The analysis of the decision process of the Almudevar irrigation district shows further that the established voting process would support the adoption of the most efficient water allocation rule provided that a small part of the overall gains is used to compensate the losers. Moreover, the adoption of the new water allocation rule does not lead to an increase in inequality between farmers.

2. Theory of voting and allocative efficiency

Collective decision making has been analyzed intensively in the economic literature. The results show that if side payments are permitted it is always possible to achieve allocative efficiency. It guarantees that the outcome provides the highest social welfare which in turn allows the gainers to compensate the losers (side payments) without using up all of their gains. Yet, it is an open question to what extent this general result still holds if the governance structure and the decision process itself are taken into account. The wide diversity of governance structures and rules of decision processes foreclose the possibility of obtaining a general answer to the question. Thus, one is left with the analysis of specific situations. For the case of water management and the acceptance of new allocation rules we concentrate on the most decisive characteristics of the collective decision process: the number of votes per person (governance structure) and the voting process (rules of the decision process).

An early finding in the field of cooperative governance and the efficiency of company takeovers was that the rule "one vote one share" will produce efficient outcomes if several bidders compete (Burkhart and Lee, 2008; Grossman and Hart, 1980; Grossman and Hart, 1988; Harris and Raviv, 1988). In a more recent article, Dekel and Wolinsky (2012) confirm this rule, and establish that vote buying may improve efficiency provided that votes and shares are traded simultaneously.

[2] The water exploitation index (WEI) indicates the amount of water abstracted each year as a proportion of total long-term freshwater resources. It is an indicator of the pressure or stress on freshwater resources. A WEI above 20% implies that a water resource is under stress, and values above 40% indicate severe water stress and clearly unsustainable use of the water resource.

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