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Adoption of irrigation water policies to guarantee water supply: A choice experiment

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ABSTRACT

More efficient and sustainable use of water is increasingly becoming an urgency in drought prone parts of the world. In particular, in water scarce regions such as the Mediterranean, water supply is expected to become more uncertain because of climate change. Consequently, pro-active policy initiatives are proposed to increase supply reliability. Local context is important when the effectiveness of policies is assessed. The aim of this paper is to evaluate farmers' acceptance of policy strategies to increase water supply reliability in the Segura, a water scarce river basin in the south-east of Spain. Results from a choice experiment suggest that farmers are willing to pay twice as much as their current irrigation water price to ensure water supply reliability through government supply guaranteed programs. However, they are averse to any institutional changes that might assist the government to achieve increased water supply.

1. Introduction

Efficient and sustainable use of water is one of the biggest challenges that policy makers all around the world face, especially in water scarce countries. To this end, Information on the economic value of water has to be taken into consideration in decision-making through the use of decision-support tools such as cost–benefit analysis. In the absence of water markets, shadow prices, determined through economic valuation methods, should be employed in such decision-making to avoid misallocation or sub-optimal allocation of scarce resources from a social welfare perspective (Turner et al., 2004). Water pricing is seen as one possible, economically efficient option to enhance the sustainable use of water (Turner et al., 2004; Dinar and Mody, 2004) as these prices provide monetary incentives for users to save water. In line with economic theory, farmers in irrigated areas are expected to respond to the increase in water prices by reducing consumption (Gómez-Limón and Riesgo, 2004a). However, this assumption has been disputed by various

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authors (Gómez-Limón and Berbel, 2000; Gómez-Limón and Riesgo, 2004a,b), who argue that water pricing may not be sufficient to stimulate the desired changes in water use. When opportunities to increase water productivity exist, farmers may even switch to more market oriented and high-value crops that are more water intensive (Dinar and Mody, 2004). In these cases, the demand for water is more inelastic (Fernández-Zamudio et al., 2012).

Strategies ranging from supply augmentation to demand management have been advocated for more effective management of scarce water resources in agriculture, including a number of policy instruments and economic incentives (Tiwari and Dinar, 2002). While several options are available to create economic incentives for water savings (Tsur, 2005), equity issues are critical in developing effective and politically acceptable instruments. It is generally expected that pricing approaches which build upon local experiences and include local stakeholders have a better chance of acceptance (Martín-Ortega, 2012). Economic policy instruments often perform complementary roles, they do not operate on their own, and are embedded in an institutional context (Sterner, 2003). Thus, developing socially appropriate instruments to govern water resources in a fair, equitable and environmentally sustainable manner should factor in local institutional settings and the relevant choice set of alternative incentives and enabling environments to modify human behavior. Water supply reliability is key to the survival of irrigated agriculture. However, the task of balancing water demand and supply is not an easy one.

To address the issue of water supply reliability, no single source of supply seems to be able to remedy the problem of water scarcity, but rather an integrated approach and set of actions are needed to ensure water availability (Jaber and Mohsen, 2001). Water administrators have traditionally followed the supply management philosophy of high investments in waterworks and inter-basin water transfers despite the fact that the latter have been subject to a lot of political discussion and social conflicts, especially in Spain (Priscoli and Wolf, 2009). More recently, the utlization of non-conventional supply sources such as treated wastewater from urban residential areas or desalinated water have been considered as complementary sources of water to alleviate the shortage of conventional water supply, particularly in regions where the use potential of fresh water resources has been fully depleted. For this reason, in water scarce regions, the reuse of treated wastewater is considered a promising measure to mitigate the effect of water shortages (Carr et al., 2011).

On the demand side, there are a number of management alternatives which a farmer can take to improve his position in balancing his water requirements with the available water supply. This includes the adoption of more efficient irrigation technology such as drip irrigation technology (Cason and Uhlaner, 1991; Skaggs, 2001); and the adoption of deficit irrigation (DI) (English, 1990). The latter maximizes water use efficiency[1] and stabilizes, rather than maximizes yield (Geerts and Raes, 2009). Moreover, the use of water markets in some areas has led the exchange of water-use rights, facilitating the reallocation of such rights both within and across sectors (Saleth and Dinar, 2000), and thus leading to an economically more efficient allocation of water. In addition, stricter government control is required to manage illegal groundwater abstraction and prevent over-exploitation of aquifers (Gómez and Perez, 2012).

In this context, our paper aims to evaluate farmers' acceptance and adoption of supply and demand policy strategies to improve water allocation, taking into account their specific demand for water and the institutional and economic context in which water is supplied in a choice experiment. The use of the choice experiment allows us to explore whether farmers are willing to pay a premium for irrigation water reliability, following Rigby et al. (2010), and how several institutional factors such as water supply guarantee and water delivery options, that could assist the government to guarantee water supply, affect their preferences. This study provides insights into how farmers trade-off the attributes of irrigation water management by analysing individual choices of water delivery options, taking into account both farmer and farm characteristics. This is to our knowledge one of the first studies in which both water allocation and institutional-economic components are considered and analyzed simultaneously in one policy framework to obtain a more comprehensive and comparative perspective on key factors in irrigation water management. Findings from this research will enable policy makers to make more informed decisions about future policy proposals taking into account local farmer preferences for adopting water supply and demand management policies.

2. Methodology

2.1. *Case study description*

The Segura River Basin (SRB), located in the south-east of Spain, is the case study region (Fig. 1). The SRB is a semi-arid basin with the lowest amount of renewable water among all the Spanish river basins. Water demand for agriculture is around 85% and water supply is made up of surface water (43%), groundwater (15%), water reuse (7%) and water transferred from the Tajo River (35%) (PHCS, 1998). The SRB has the third highest level of water stress in Europe with a water exploitation index (ratio of total fresh water abstraction in relation to total renewable resource) of 130% (EEA, 2009).

The irrigation communities (ICs) selected for the case study are among the economically most important ones in the study area, i.e. the Campo de Cartagena and Pantano de la Cierva. The cropped area consists of 41,325 ha for fruit and 1946 ha for vegetables. Farmers in both ICs use water from more than one water source. While 87% of the irrigation water in Campo de Cartagena comes from the Tajo, in Pantano de la Cierva this source only supplies 27% of total water demand. These ICs have distribution networks based on pressure pipes, and water allocation is based on a computerized system for water conveyance and monitoring. Water delivery efficiency is hence high. Farmers have widely adopted drip irrigation in both irrigated areas.

[1] Measured as the relationship between marketable yield and evapotranspirated water.