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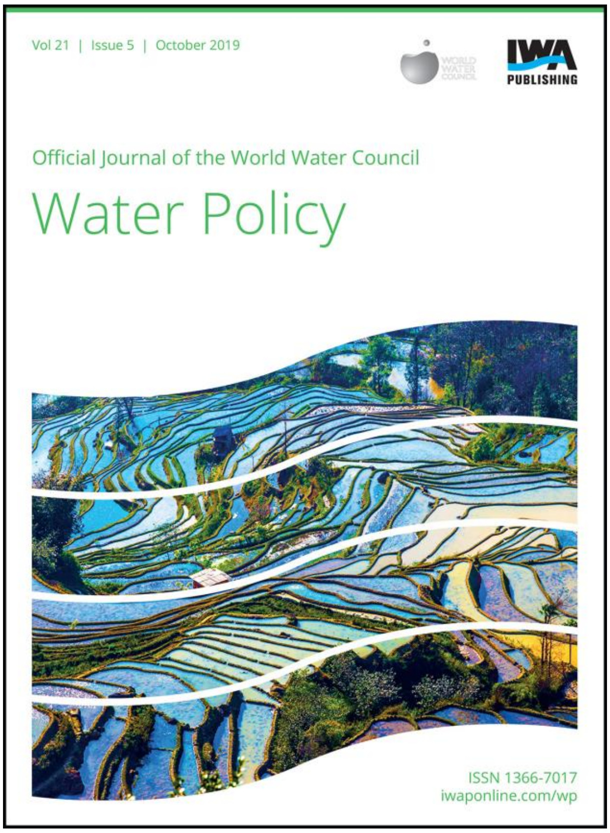

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Determinants of water lobbying: irrigators' behavior in a water-stressed basin

Encarna Esteban[a], Ariel Dinar[b] and José Albiac[c]

[a]*Corresponding author. Department of Economic Analysis, School of Humanities and Social Sciences & IA2, University of Zaragoza, Calle Atarazanas 4, 44003 – Teruel, Spain. E-mail: encarnae@unizar.es*

[b]*School of Public Policy, University of California, Riverside, 900 University Avenue, Riverside, CA 92521, USA*

[c]*Department of Agricultural Economics, Agrifood Research and Technology Center (CITA-DGA) & IA2, Avenida Montañana 930, 50059 – Zaragoza, Spain*

Abstract

The design and implementation of water policies to address scarcity problems are largely shaped by the behavior of interest groups and their ability to influence policymakers. Different and opposed interests of stakeholders regarding policies trigger water conflicts and, frequently, lead to the failure of the implemented regulation. Departing from political economy theory, we empirically estimate the determinants that affect the level of lobbying effort and effectiveness by water interest groups for influencing water policy. The findings are based on data collected by a survey administered among different irrigators' groups, in a water-stressed river basin (the Jucar River Basin in Spain) that vie to increase their water allocations. Our results demonstrate how lobbying effort depends on the involvement of the interest groups, the energies exerted to sway water authorities, and on the variation among the group members. Lobbying effectiveness is a function of the effort exerted. Furthermore, both functions depend on the intrinsic characteristics of the group's members. While the empirical results corroborate several main statements of the theory of lobbying and interest groups, some deviations based on the empirical application remain.

Keywords: Effort function; Influence function; Irrigators' perceptions; Lobbying; Political economy; Water policy

1. Introduction

The increased scarcity and quality deterioration of water resources have led to the introduction of various policy interventions in many river basins. Policy options that protect and restore water resources include instruments such as taxes and subsidies, water allocation rules, or the promotion of water trading. However, these instruments frequently fail because of political obstacles. The existence of opposing interests, differences in the influence and clout of interest groups, and the malfunctioning

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of existing institutions are important reasons that hinder the implementation and effectiveness of water reforms (Dinar, 2000). Additionally, the negative effects of climate change, especially in areas already experiencing water stress, will exacerbate the pressures on water resources and will increase political tensions associated with water reforms (Nordas & Gleditsch, 2007; Gizelis & Wooden, 2010; Böhmelt *et al*., 2014).

Successful implementation of a water policy reform requires addressing the politics of sharing scarce water resources among users with opposed interests. However, water policy reform outcomes result from negotiation processes between elites that neither represent the interest of all user groups nor respond to efficient water allocation criteria (Allan, 2006). In this context, the study of the political economy of water reforms is critical to understanding current water problems, and the poor performance, or even failure, of water policy reforms (Dinar, 2000).

Political economy models deal with the application of economic principles to public policy management. A primary objective of political economy is to model the dynamics of policy reforms by analyzing how the relative power of different groups of stakeholders can influence the performance of a public regulator (World Bank, 2008). Political economy models have been largely used in political science and several fields such as water resources management (Madhoo, 2004; Feitelson, 2006; Swatuk, 2008; Swyngedouw, 2009; Rausser *et al*., 2011, 2012, pp. 306–327; Metz & Ingold, 2017; Thomas & Zaporozhets, 2017). However, while political economy has been recognized as a determinant in water policy reforms, yet future increased scarcity has set new and different challenges for water policy reforms (World Bank, 2007; Rosegrant, 2016). To the best of our knowledge, there is still a gap in empirical studies that analyze the capacity of influence of water actors and how their political interactions affect water allocations detrimental to efficient economic performance.

In this paper, we apply the common understanding of political economy to analyze problems related to water management and allocation in the agricultural sector. We contribute to this literature by proposing an empirical model that attempts to estimate the political behavior of the various stakeholders involved in lobbying for water allocation. The research question we attempt at answering is as follows: *How different is the effectiveness derived from and the efforts of lobbying across opposed stakeholder groups in a particular river basin?* The stakeholders, organized by the interest groups' lobbying styles, encounter the effort and effectiveness associated with exerting pressure on water authorities and policymakers to increase their water assignments. We develop an empirical model, based on existing political economy theory (Becker, 1983), and identify several relevant variables that affect the stakeholders' effort for and effectiveness of lobbying. To obtain the empirical estimates, we collected primary data regarding irrigators' perceptions to empirically estimate explicit functions of effort for and effectiveness of lobbying in the Jucar River Basin in Spain. The results of the lobbying effort and effectiveness, based on our empirical context, have allowed us to corroborate several theoretical statements in the political economy literature. While most of the results are in agreement with political economy statements, some deviations have been found.

The remainder of this paper is organized as follows. Section 2 provides insights into political economy theory. Section 3 presents a brief characterization of the Jucar basin study area and the principal water conflicts between the main water users in the region. Section 4 describes the data collection procedure and variables used in the empirical estimation. Section 5 presents the econometric models and some hypotheses that we infer in the empirical part. The results are presented in Section 6. Finally, Section 7 discusses the relevant political implications of the estimation outcomes and Section 8 presents the main conclusions.

2. Theoretical framework

The political economy literature analyzes the selection or implementation of public regulations when different interest groups seek to maximize their private welfare or income. The basis of a political economy model centers on the idea that regulators and policymakers are pressured and influenced by agents with political interests. These agents are organized in groups that share similar objectives. Interest groups compete among themselves to obtain greater benefits in terms of higher public resources or favorable regulations of monetary benefits (Becker, 1983; World Bank, 2008). This competition determines the equilibrium structure of the allocated resources and other political goodies, which are the subject of the reform. However, to be politically effective at maximizing their private benefits, interest groups incur a significant cost in terms of time, expenses, and other types of efforts invested in the lobbying process.

We depart from Becker's (1983) model of competition among interest groups for political influence. The model considers two interest groups that compete for funding from the government budget. Each of these interest groups is comprised of agents with similar concerns but varying political preferences. The effectiveness of an interest group is determined by the amount of resources invested in political activities and their ability to effectively pressure the regulators (policymakers, government agencies, and institutions).

We use the building blocks suggested by Becker (1983) to estimate the political influence (effectiveness) function and the political cost (effort) function in the context of water policy reform. The effectiveness of lobbying is explained by the resources invested in political activities and the lobbyists' ability to effectively influence the targeted regulator. Lobbying efforts are explained by the interest group's organization and the level of effort exerted. Becker (1983) states that lobbying effort (EFO) is a function of the expenditure of resources spent on mobilization (E), the size of the group (S), the concentration of the group's members' or the homogeneity across the members (CO), and a set of other variables ($\underline{\boldsymbol{Y}}$) relevant in the empirical context. Similarly, lobbying effectiveness (EFF) is a function of the effort exerted by the group's members (EFO) and of other variables relevant in the empirical context ($\underline{\boldsymbol{X}}$). Therefore, the analytical lobbying effort function is $\text{EFO} = f(E,\ S, \text{CO},\ \underline{\boldsymbol{Y}})$ and the analytical lobbying effectiveness is $\text{EFF} = g(\text{EFO}, \underline{\boldsymbol{X}})$.

Following Becker (1983), it is expected that $\partial\text{EFO}/\partial E > 0$, $\partial\text{EFO}/\partial S >< 0$, $\partial\text{EFO}/\partial\text{CO} < 0$ and that $\partial\text{EFF}/\partial\text{EFO} > 0$. The size of the group has an undetermined effect on the level of effort, starting with gains in efforts for small group sizes, and facing inefficient efforts for large group sizes due to possible free-riding regulation costs (Becker, 1983, p. 380). There are no *a priori* expectations regarding the direction of the impact of $\underline{\boldsymbol{Y}}$ on EFO and of $\underline{\boldsymbol{X}}$ on EFF.

Furthermore, the literature on lobbying behavior and lobbyists' influence on regulators is rather extensive, and certain statements have been widely recognized (Sloof, 1998, p. 9). Selected elements have been traditionally identified as fundamental criteria for determining lobbying capacity: (1) the interest groups' physical and intrinsic characteristics (Esty & Caves, 1983; Helland, 2008; Zheng *et al.*, 2010; Halpin & Fraussen, 2017); (2) the degree of concentration and political involvement (Sorensen, 1998; Meinzen-Dick & Raju, 2002; Halpin & Fraussen, 2017); and (3) the pressure or expenditure exerted or dedicated by the interest groups to influence the regulators (Sadrieh & Annavarjula, 2003, 2005; Helland, 2008; Böhmelt *et al.*, 2014).

We apply the general framework of effort and effectiveness of active lobbying and estimate the functions based on data from a specific river basin. The case study is relevant because of the presence of two interest groups with opposing interests and differences in their political influence and interactions with various water policy agencies (regulator).

3. Interest groups and water conflicts: the case of the Jucar basin

We now elaborate on a general form of the effort and effectiveness of water policy lobbying in the Jucar River Basin in southeastern Spain (see Supplementary Information, Figure A1). Although the results of our analysis are specific to the Jucar basin, we test general hypotheses that address the general elements of lobbying in the context of water resources. It is important to realize that the results are based on the perceptions and opinions of the stakeholders in the study area regarding the group effort and the effectiveness in influencing the regulator.

3.1. The Jucar River Basin

The Jucar basin extends over 22,000 km^2 covering the drainage area of the Jucar River and its tributaries and also includes the largest aquifer in Spain, the Eastern La Mancha aquifer that is linked to the river. Water resources in the basin provide urban water to nearly 2.4 million inhabitants, feed around 200,000 ha of intensive irrigated agriculture, sustain power generation, and support a quite rich ecosystem biodiversity. The basin is characterized by Mediterranean climate where weather events, such as droughts and floods, are frequent in the basin.

Two main irrigation areas located in different parts of the basin, that is upstream and downstream, can be identified in this region (Supplementary Information, Figure A1). The farmers in each irrigation area use the water resources in the basin to support their operations. However, the large expansion of irrigation activities in both regions has triggered water demands beyond the water system's capacity, especially during dry years. Conflicts between the farmers in the two irrigation areas for greater water allocations are common and both groups have pressured authorities to increase their allocations.

The irrigators in downstream Jucar are located in the Valencia area, where more than 20,000 growers manage 70,000 ha of irrigated agriculture. This area is characterized by a traditional irrigation system, dating centuries back, which confers senior water rights and advantageous political power to these irrigators. Although a wide part of the area under irrigation in the downstream region is equipped with traditional irrigation system components since the 1970s new irrigation areas (downstream modern irrigators) have been developed. The downstream interest group is characterized by their large heterogeneity in terms of crop mix and size of landholding. In addition, the downstream irrigators are organized in many water user associations (nearly 50) across the downstream region.

Irrigation in upstream Jucar was initiated during the 1970s using a large groundwater aquifer (the Eastern La Mancha aquifer) located in this region. At present, this upstream region spans over more than 100,000 ha of irrigated agriculture and includes nearly 1,000 irrigators. In response to water stress in the basin and the subsequent threats from downstream users, the upstream irrigators started to organize in the 1990s into one water user association that regulates and manages groundwater extractions.

3.2. Water conflicts in the Jucar River Basin

Conflicts over water resources have, for ages, been widespread in the region. In the XIII century, King Jaime I of Aragon granted exclusive rights for use of the Jucar River to the Valencia irrigators (downstream traditional irrigators). Valencia irrigators have used these river resources ever since and the irrigation area increased during the 1970s (the downstream modern irrigators).

In 1970, a development in irrigated agriculture occurred in Jucar's upstream region. The improvement in irrigation technology and reduction in pumping costs made it possible to use the large aquifer located under this region (the Eastern La Mancha aquifer) by upstream irrigators. Groundwater withdrawals for irrigation surged from 50 to 400 million cubic meters (Mm^3) between 1980 and 2000 and made a critical impact on the aquifer's water level and the whole Jucar basin.

In the early 1990s, a severe drought caused the water level of the Jucar River to drop several meters and dry out part of the river. Two processes were linked with the large decrease in the Jucar flow: (1) the intensity of the drought, and (2) the considerable depletion of the Eastern La Mancha aquifer, which is linked with the hydrology of the Jucar River. Due to the aquifer's depletion, the water flowing from the aquifer into the Jucar River was reduced from 250 to 50 Mm^3 over the past 40 years. The increased water scarcity in the basin has intensified the level of the conflicts and disparities between the up- and downstream irrigators.

Another player in the water policy politics in the basin is the Jucar River Basin Authority (JRBA), which is the regulator responsible for institutional arrangements and water management in this basin. The JRBA is a federal government agency with an autonomous statue in charge of the water governance, management, planning, cooperation, and construction and operation of the water infrastructures in the Jucar River Basin (Estrela, 2004). An important element of the JRBA is the active role played by the different water stakeholders in the decision-making and enforcement processes at both basin and local watershed levels. Irrigators, organized in Water User Associations, have representation in the JRBA and they influence the water management of the basin.

4. Data

We conduct the empirical analysis of the lobbying efforts and effectiveness by evaluating the behavior of the two user groups in the basin. We have employed a primary dataset of the users' perceptions about water institutions management, their group involvement, and their group capacity for lobbying. We surveyed actors from the two main irrigation areas (upstream and downstream), and we assessed the perceptions of both irrigators and water users' associations managers.

4.1. Data collection procedures

We developed a questionnaire (Supplementary Information) that was administered in the Jucar basin from April to June 2016 by approaching irrigation districts in the up- and downstream regions of the basin. The questionnaire was designed to measure the users' perceptions about relevant political issues related to water policy. The survey was field-tested with a small sample of stakeholders in the basin, including experts from different levels of government (individual users, water users' associations, regional authorities, and the Basin Authority). The revised questionnaire was emailed and hand-delivered to increase the chances of obtaining feedback from all the irrigation districts. Individuals were randomly selected within both regions, and a total of 334 valid observations, out of 435 sent questionnaires, were analyzed (i.e., 201 downstream and 133 upstream). Both irrigators and water users' association managers, in charge of the administration and operation of the different water associations, were randomly interviewed to collect their perception on the water allocations in this basin. A further and more exhaustive discussion about the sample and data collection procedures can be found in Esteban *et al*. (2018).

The questionnaire raises a number of issues to determine users' concentration and the capacity for mobilization of each interest group (users' involvement with regulators). Another set of questions concerns the main strategies used to approach the water regulator and defend each group's water rights (in terms of increasing or maintaining their water allocations). Finally, a block of questions refers to the main users' perceptions on the effort and effectiveness of the selected strategies that irrigators (collectively with their water users' associations) have used to overcome the water authorities' policies. The data from the questionnaire helped us understand the main characteristics and perceptions of the two interest groups regarding their lobbying activities.

4.2. Data analysis and variables

Two models were estimated that explain effort (EFO) toward and effectiveness (EFF) of lobbying for the up- and downstream irrigator interest groups. In addition, we also estimated an aggregate lobbying effectiveness and effort functions by combining the data from the up- and downstream regions (basin-wide estimation).

The variables EFO and EFF are defined by the irrigators' appreciation of the efforts and effectiveness of using various strategies to influence the water authorities. The irrigators were asked about the effectiveness (reducing or increasing their water allocations) and the effort (costs of time or money invested) of different measures used by the group to approach the water regulator. The measures were selected based on several studies on interest groups, political tactics (McBeth *et al*., 2010), and on interviews with the different stakeholders in the region. A total of six measures were suggested in the questionnaire. The suggested measures used by the interest groups to claim for their water allocations are: (1) formal or informal meetings with water authorities, (2) demonstrations, (3) publicity in the media to pressure regulators, (4) official letters to water authorities, (5) reports to the court when their rights or water assignments were violated, and (6) collaboration with political parties. Irrigators were asked to select from these measures those that their water user associations have used to approach, or influence, the water regulator. Additionally, the users were asked for their opinion about the effectiveness and effort of each of the used measures by their group to increase their benefits in terms of water allocations (see Supplementary Information, items 10 and 11). The aggregate score of the effectiveness and effort measures form the dependent variables EFF and EFO.

The independent variables that we have used in the model are classified into three groups:

1. Private characteristics: basin location, hectares under irrigation, type of crops, type of users (irrigator or water user associations manager), and water source (surface water or groundwater).
2. Capacity of the group to reach water authorities: engaging and active participation with the water regulator and the water user associations, and the number of used measures for influencing the water regulator.
3. Size of the group: total number of irrigators in the water user associations and number of hectares managed by the water user associations.

Because of the differences between the two interest groups, divergences in the independent variables can be observed among the three model estimations (upstream, downstream, and basin-wide). Some of these differences are related to the existence of several water user associations in downstream compared with only one association in upstream. Descriptive statistics of the variables show the *a priori* important differences between the two irrigation regions (see Supplementary Information, Table A1).

Some of the variables are comprised of several components and to perform the econometric estimations such components were aggregated. To obtain a single observation for the dependent variables (EFO and EFF) and also for some independent variables, *Involvement* (users' participation with water authorities and organizations) and *Measures* (strategies used to approach authorities), we have used the Principal Components Analysis (PCA) and the Categorical Principal Component Analysis (CATPCA). The PCA is a multivariate statistical methodology for compressing multiple correlated variables into a single variable by replicating as much variance in the original variables as possible (Abdi & Williams, 2010). This technique is broadly used to reduce the number of variables from a dataset. The CATPCA is a nonlinear application of the PCA that allows us to aggregate ordinal or categorical variables (Linting *et al*., 2007)[1].

The dependent variables, effort and effectiveness of lobbying (EFO and EFF), have been aggregated using the CATPCA procedure. The aggregation has been made by using the data for each irrigation region (upstream and downstream) and by combining the observations from both regions to obtain a full dataset for the basin-wide model. The principal components' scores for both variables and the three models are presented in Supplementary Information, Table A2. Similarly, the independent variable '*Involvement*' has been compressed by following the same approach. We also report in Table A2, the Cronbach's alpha coefficient that allows us to test the consistency of the aggregation for all the variables. The Cronbach's alpha for all the variables in the downstream and the basin-wide models has values between 0.8 and 0.9, which is considered a strong and robust approximation (Taber, 2017). In the case of the upstream region, the Cronbach's alpha shows acceptable values between 0.6 and 0.7 (Taber, 2017).

Finally, PCA has been used to aggregate the variable '*Measures*', which includes the total number of measures or strategies used by the users in order to sway agencies and organizations. Because the dichotomy characteristic of this variable (1 if the measure was used or 0 if the measure was not used) the CATPCA was not successfully working. The principal components' scores are presented in the Supplementary Information, Table A3. The results also indicate that the PCA shows better results (percentage of variance explained) in the aggregation of the downstream and basin-wide models compared with the upstream model (see Supplementary Information, Table A3). All the variables from processing the data used in our empirical application are summarized in Table 1. This table contains a brief description of each specific variable.

5. Econometric model and hypotheses

The econometric functions for both lobbying effort and effectiveness follow the political economy statements considered in Section 2. We have used our empirical variables as proxies for the different elements that political economy suggests as main elements in these functions. Additionally, based on several political economy insights regarding interest groups' behavior, we deduce several hypotheses to come up with some general policy recommendations.

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[1] 'Nonlinear PCA achieves the very same objective as linear PCA for quantified categorical variables. If all variables in nonlinear PCA are numeric, the nonlinear and linear PCA solutions are exactly equal…' (Linting *et al*., 2007, p. 337).

Table 1. Variables' description.

Variable	Units	Description
$\text{BasinLoc}_{\text{D}}$[a]	Dummy	Location in basin: Upstream or Downstream (Dummy variable: 1 – Downstream; 0 – Upstream)
$\text{IrrigatorType}_{\text{D}}$	Dummy	Type of water user: water manager or irrigator (Dummy variable: 1 – irrigator; 0 – manager)
$\text{WaterSource}_{\text{D}}$	Dummy	Main source of water for irrigation (Dummy variable: 1 – surface; 0 – groundwater)
$\text{WUA}_{\text{Members}}$[b]	no agents	Number of members that conform a Water User Association
WUA_{THa}[b]	ha	Total number of hectares that comprise the Water User Association
Ha	ha	Number of owned hectares per individual member
ShareTrees	Fraction	Share of hectares with fruit-trees on the farmland per member
Involvement		Active participation or involvement with agencies and water authorities at any government level (local, basin, national) Variable aggregated using CATPCA
Measures		Number of instruments and/or mechanisms used to approach the water authorities (capacity of mobilization) Variable aggregated using PCA
EFO[c]		Effort: users' perception of the effort associated with the proactive lobbying of water authorities Variable aggregated using CATPCA
EFF		Effectiveness: users' perception of the effectiveness associated with the proactive lobbying of water authorities Variable aggregated using CATPCA

[a]Variable tested in the basin-wide model only.
[b]Variables tested in the model for downstream irrigators only.
[c]EFO is the dependent variable in the lobbying effort function. However, we use this variable as an independent variable in the estimation of the lobbying effectiveness function (a two-stage least square procedure has been used to avoid endogeneity problems).

The estimated equation for lobbying effort is as follows:

$$\begin{aligned}\text{EFO} =&\gamma_0 + \gamma_1 \cdot \text{BasinLoc}_{\text{D}} + \gamma_2 \cdot \text{IrrigatorType}_{\text{D}} + \gamma_3 \cdot \text{WaterSource}_{\text{D}} \\ &+ \gamma_4 \cdot \text{WUA}_{\text{Members}} + \gamma_5 \cdot \text{WUA}_{\text{THa}} + \gamma_6 \cdot \text{Involvement} + \gamma_7 \cdot \text{Measures} + u\end{aligned} \tag{1}$$

where EFO is the lobbying effort, γ_0 is the intercept, γ_1 to γ_7 are the estimated coefficients for the independent variables, and u is the error term.

Following Becker's (1983) model stated in Section 2 [$\text{EFO} = f(E,\ S,\ \text{CO},\ \boldsymbol{Y})$], the independent variables related to the private users' characteristics ($\boldsymbol{Y}$) are: $\text{IrrigatorType}_{\text{D}}$, $\text{WaterSource}_{\text{D}}$, and $\text{BasinLoc}_{\text{D}}$. On the other hand, the independent variables related to the size and number of the Water Users' Associations ($\text{WUA}_{\text{Members}}$ and WUA_{THa}) are representative of the size of the group (S). We have used the dummy variable $\text{BasinLoc}_{\text{D}}$ as a proxy of the group homogeneity or concentration (CO) because of the particular characteristics of our study area. We have observed a higher homogeneity in the upstream group due to these irrigators belonging to a single Water User Association and, in general, they show a more homogeneous opinion on the basin water management (Esteban *et al.*, 2018). By contrast, downstream irrigators belong to more than 50 different Water Users' Association and present a higher deviation in their opinions on the water management of the basin (Esteban *et al*., 2018). The number of measures used by the irrigators and their involvement with water authorities or regulators will be analyzed by the independent variables *Involvement* and *Measures*. These variables have been used as a proxy of the amount of resources spent on mobilization (E).

Some of the independent variables are only used in part of the regressions. For example, the variable $\mathrm{BasinLoc_D}$ (users' location in the basin) is only included in the basin-wide model. The irrigators' private characteristics, $\mathrm{WaterSource_D}$, $\mathrm{WUA_{Member}}$, and $\mathrm{WUA_{Ha}}$, are tested in both the basin-wide and the downstream models. We cannot test these variables in the upstream model due to these irrigators belonging to a single water user association and they are just using groundwater resources.

The estimated equation for lobbying effectiveness is as follows:

$$\mathrm{EFF} = \beta_0 + \beta_1 \cdot \mathrm{EFO} + \beta_2 \cdot \mathrm{BasinLoc_D} + \beta_3 \cdot \mathrm{Ha} + \beta_4 \cdot \mathrm{ShareThrees} + \varepsilon \tag{2}$$

where EFF is the lobbying effectiveness, β_0 is the model intercept, β_1 to β_4 are the estimated coefficients, and ε is the error term.

In the case of the lobbying effectiveness function, and following Becker's approach [$\mathrm{EFF} = g(\mathrm{EFO}, X)$], we use the previous estimated variable as the effort dedicated to sway water authorities (EFO). Additionally, the variables related to the users' private characteristics are approximated by using the information on the basin location (up- or downstream), on the number of hectares of individuals' farmlands, and on the share of fruit-trees ($\mathrm{BasinLoc_D}$, Ha, and ShareTrees). Like the above effort estimation, the variable $\mathrm{BasinLoc_D}$ is only included in the basin-wide model.

Using the stated econometric regressions and based on the analytical framework developed in Section 2, we propose the following hypotheses to be tested:

Hypothesis 1 (H1): The greater the amount of resources spent by an interest group on lobbying, the higher is its effort.

Hypothesis 2 (H2): The size of the group determines the effort of the lobbying activities. However, as explained in Section 2, this effect could vary from gains to losses in effort spent due to the use of scale economies of big interest groups and the lower coordination and transaction costs of small interest groups.

Hypothesis 3 (H3): The marginal effort decreases as the interest group is more homogeneous.

Hypothesis 4 (H4): Marginal effectiveness increases as the level of effort increases. The effectiveness of lobbying depends on the effort exerted in influencing the regulator.

6. Results

We report the results of three models for each of the two dependent variables: a model for the upstream group, a model for the downstream group, and a basin-wide model that includes a dummy variable representing the two interest groups (upstream and downstream). We apply the ordinary least square (OLS) procedure to estimate the EFO. In the case of the effectiveness function, and to avoid endogeneity problems[2], the regressions for the three models have been estimated by using the

[2] The effectiveness function includes the variable effort (EFO) as an independent variable. Note that this variable is the dependent variable in the effort function estimation (Equation (1)). We use the observed, rather than the calculated values of EFO in the estimation of EFF.

Table 2. Estimates of the lobbying effort (EFO) function[a,b,c].

Variables	Upstream	Downstream	Basin-wide
$BasinLoc_D$	–	–	−13.7641**
			(6.4645)
$IrrigatorType_D$	0.0919	−0.7016	0.1273
	(0.3697)	(0.9096)	(0.4383)
$WaterSource_D$	–	0.8889	0.7634*
		(0.5760)	(0.4411)
$WUA_{Members}$	–	0.0007**	0.0006**
		(0.071)	(0.0003)
WUA_{Ha}	–	−0.0002**	−0.0002**
		(0.0001)	(0.0001)
Involvement	−0.1000**	0.2899***	0.1317***
	(0.0548)	(0.0808)	(0.0477)
Measures	0.7397***	1.6010***	1.5246***
	(0.1160)	(0.1256)	(0.0853)
Intercept	3.2439***	−0.9694	12.9613**
	(0.6386)	(1.1756)	(6.5226)
Adjusted R^2	0.2320	0.5759	0.5840
P-value (F)	0.000	0.0000	0.0000
Obs.	125	135	259

Notes: [a]dependent variable: lobbying effort; [b]estimation method is OLS; significance: $*p < 0.10$, $**p < 0.05$, $***p < 0.01$; and [c]standard errors in parenthesis.

two-stage least square procedure (2SLS). The variables' descriptive statistics (Supplementary Information, Table A1) present small values for the VIFs (Variance Inflation Factor), which demonstrate low levels of multicollinearity of the explanatory variables.

6.1. Results of the lobbying effort function

Table 2 reports the first set of estimated regressions of the efforts invested in lobbying in the study areas. We present the results for upstream, downstream, and the entire basin (basin-wide).

A relevant result in the three models analyzed is the significance of the variable *Measures* that represents the number of instruments used to approach water authorities. This variable is a proxy for the resources spent by the group's members to pressure water authorities. The positive sign and significance ($p < 0.01$), consistent with the theoretical expectations, demonstrate how the greater the number of instruments used to sway the water authorities and policymaking organizations, the higher the lobbying effort. Similarly, another significant variable is the members' involvement, or engagement, with policymaking organizations at all government levels (*Involvement*). This variable, which represents the mobilization of the group's members, is also used as a proxy of the energies dedicated by the lobbying groups to influence the regulator. While this variable is positive and significant in both the downstream and basin-wide models, the results for the upstream model reveal a significant negative impact. The unexpected negative impact of this variable indicates that the higher the involvement, the lower the effort. In our opinion, a possible explanation of this surprising result is the current large involvement of upstream irrigators. These actors realize their impossibility of being a relevant lobbying group to defend their water assignments without being perfectly organized against '*a priori*' more political influential stakeholders (downstream group). Active involvement and participation of upstream members allow them to reduce their lobbying effort that could be otherwise very costly.

Regarding the variables related to the empirical context, the variable $\text{IrrigatorType}_{\text{D}}$ is not significant in any of the regressed models. By contrast, the variable $\text{WaterSource}_{\text{D}}$, which is tested in the basin-wide and downstream models, is not significant in the downstream model, but becomes significant and positive for the basin-wide model. This result, in the basin-wide model, suggests that irrigators using surface water tend to perceive effort as higher. In our opinion, this result is coherent and responds to the greater regulation of surface water bodies compared with underground resources.

The variables representing the size of the group, as the size of the water user association (WUA_{THa}) and the number of members in each water user associations ($\text{WUA}_{\text{Members}}$), are significant in both the downstream and basin-wide models. The significance of both variables shows that the size of the group is a relevant component in the lobbying effort function. However, the results show that while the size of the group (WUA_{Ha}) has a negative sign, the number of members in the water user association ($\text{WUA}_{\text{Member}}$) is positively correlated with the lobbying effort. This result is in line with the political economy literature that states the non-clear relationship between the size of the group and the lobbying effort (scale economies of large groups versus lower transactions costs of small groups).

Finally, a notable result is the interpretation of the dummy variable representing the two interest groups ($\text{BasinLoc}_{\text{D}}$). The significance of this variable, tested in the basin-wide model, suggests the existence of relevant differences in the perceptions regarding the lobbying effort between the two interest groups. This variable has been used as a proxy of the group homogeneity because of the higher uniformity between upstream stakeholders compare with the diversity in the downstream group. While the significance of this variable was expected, the negative sign that indicates how lobbying effort is considered as being lower by downstream irrigators is an unpredicted result. The negative impact of this variable shows how the *a priori* more uniform group perceived effort as being higher compared with the more divergent group. A tentative explanation of this result is the existence of a higher traditional political power in downstream (existence of historical water rights), which confers to this group guarantee of water allocations.

6.2. Results of the lobbying effectiveness function

Table 3 presents the results of the lobbying effectiveness for the three estimated models. Although sizable differences are observed between the three regressions, the variable EFO is relevant in determining the effectiveness of lobbying in all three models ($p < 0.01$). The positive sign of this variable confirms that a higher level of effort in lobbying leads to higher effectiveness of the pressure exerted.

In the estimations of the lobbying effectiveness, the selected variables for the empirical context (Ha and ShareTrees) are not significant except for the own-land size (Ha) in the upstream model. In this case, the negative significance of this variable means that the higher the number of hectares, the lower the effectiveness. A possible explanation of this contradictory result can be related to the sizeable mean and standard deviation (Table A1) of this variable in the upstream model compared with the values for the downstream and basin-wide models. In our opinion, a possible explanation lies in the fact that upstream irrigators' perceive their lobbying effectiveness as being lower compared with downstream users, which have small land holdings in comparison.

Finally, the dummy variable representing the irrigators location along the basin, $\text{BasinLoc}_{\text{D}}$, is significant ($p < 0.01$) and positive. This result suggests the existence of important differences in the lobbying

Table 3. Estimates of the lobbying effectiveness (EFF) function.

Variables	Upstream	Downstream	Basin-wide
$BasinLoc_D$	–	–	2.1624***
			(0.4042)
Ha	−0.0014***	−0.0447	0.0001
	(0.0006)	(0.0699)	(0.0013)
ShareTrees	0.0437	0.0797	−0.0400
	(0.2671)	(0.7631)	(0.0060)
EFO	1.6335***	0.9072***	0.8769***
	(0.1049)	(0.0839)	(0.0594)
Intercept	−3.9558***	3.1018***	1.7283***
	(0.4426)	(0.8382)	(0.4701)
Adjusted R^2	0.6545	0.4665	0.5043
P-value (F)	0.0000	0.0000	0.0000
Obs.	133	133	263

Notes: [a]dependent variable: lobbying effectiveness; [b]estimation method is 2SLS; significance: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$; and [c]number in parenthesis is the standard error.

effectiveness between the two interest groups. The positive sign indicates how downstream irrigators perceive effectiveness to be higher compared with upstream irrigators. The existence of a higher political power for downstream irrigators could explain the better perception about the lobbying effectiveness by this group compared with upstream irrigators.

7. Discussion: analysis of the political economy hypotheses

A better understanding of the behavior of interest groups is necessary to avoid, or at least reduce, the failure of policy reforms. While several studies have analyzed interest groups' behavior, the study of lobbying in the water sector is still limited. By analyzing the outcomes of the three estimated models, we identified several important factors that determine the lobbying efforts and effectiveness of water interest groups. To test general hypotheses about the interest groups' behavior, we will use the results obtained in the basin-wide model that aggregates the data of the two interest groups. Although the results are specific to the Jucar basin study area, several generalizations can be made based on the empirical hypotheses.

Based on the literature on the behavior of interest groups, we hypothesized that the lobbying effort depends on the resources, in terms of money and/or time, spent (**H1**). This hypothesis is tested by analyzing the positive significance of the variable *Measures*, which is related to the number of strategies used to approach or influence water authorities. Additionally, we have also analyzed other proxy variables for the energies or resources dedicated to influence regulators (**H1**) such as the variable '*Involvement*'. This variable represents the active participation and mobilization of the different agents. The positive and significant sign of these variables shows how the higher the involvement and participation with water authorities or water organizations, the greater the effort. However, while the general hypotheses are tested in the basin-wide model, it is important to analyze the contradictory impact of this variable in the upstream model. The negative significance of this variable in upstream means that the higher the involvement, the lower the effort. This *a priori* unexpected result can be explained due to the high participation and involvement levels of the upstream irrigators. The higher the involvement with their water user association (in upstream one single association that includes all irrigators) allows this group to reduce the cost faced by approaching authorities. While the involvement and active mobilization incur several types of costs, this involvement also allows actors to have the chance to influence authorities. This result clearly highlights how the agents' behavior largely depends on the specific characteristics and the context of the group.

Under **H2**, we have stated that the size of the group determines the lobbying effort. The results show how both the number of total hectares of the water user associations (WUA_{THa}) and the number of members in each association ($WUA_{Members}$) are significant variables in determining lobbying effort. However, these variables present opposite signs. The outcomes show how the higher the number of members in the water user association, the higher the effort. This result can be interpreted as the higher the number of members, the more difficult the coordination between the group members, and also the greater the chance of having 'free-rider' behavior. This result can be associated with the larger transaction costs of coordinating big groups. Several studies have already demonstrated that small groups are more efficient in exerting political pressure (Kristov *et al.*, 1992). By contrast, the size of the water user association in terms of total hectares (WUA_{THa}) presents a negative impact. This effect can be interpreted as the positive impact of scale economies of being a 'big-size' group. Large groups can use the scale economies of political lobbying and pressure exerted. Following these results, we can conclude that the model outcomes validate the political economy literature statement that two contradictory impacts are related to the group size and the political influence (Becker, 1983; Potters & Sloof, 1996).

In **H3**, we stated that the group homogeneity or concentration affects the lobbying effort. We expected, following Becker (1983), that more similarities between the group members will allow them to decrease their lobbying effort. This hypothesis has been tested by using the variable representing the two regions up- and downstream ($BasinLoc_D$). We have assumed that the upstream group is more homogeneous due to the existence of a unique water user association that includes all irrigators. Additionally, the results of the perceptions of the different survey items reveal a higher homogeneity between upstream irrigators (Esteban *et al.*, 2018). Based on the negative and significant impact of this variable, we conclude that effort is perceived as lower by downstream irrigators. This effect contradicts what we hypothesized about the lower effort faced by more homogeneous agents, and then, **H3** has not been corroborated in this model. In our opinion, there may be two main lessons from this unexpected result. On one hand, in our study area, the water users' association in upstream was born to defend the use of the underground water resources in this region. The lower political power in upstream, due to the existence of historical water rights in downstream, causes that even being a more homogeneous group they perceived that their effort to influence water authorities is much higher. On the other hand, while heterogeneous groups could face higher coordination costs, they also have more arguments and particular influences to sway the regulator. In this sense, while coordination costs are lower in more uniform groups, the possibilities of arguments and influences of heterogeneous groups could allow them to decrease their lobbying effort.

The last hypothesis (**H4**) establishes that the higher the effort, the higher the effectiveness. The variable effort is significant and positive in all the three regressions. The positive correlation shows how the higher the effort dedicated to influence water authorities, the bigger the resulting effectiveness.

The outcomes suggest the existence of notable and significant differences among the perceptions of lobbying effort and effectiveness between the two irrigator groups, as general political economy suggests. The significance of the basin location in both lobbying effort and effectiveness shows how downstream irrigators perceive effort as being lower and effectiveness as being higher compared with the perceptions of the upstream irrigators. This result can indicate how more participative and involved users are more 'pessimistic' not only about the benefits from their lobbying but also about the cost faced by exerting that lobbying.

The demonstrated existence of differences between interest groups, in both their perception of the lobbying effort and effectiveness, should be internalized for policymakers to diminish the failure of water reforms. This is a very relevant issue, especially in regions currently experiencing water stress, and where the efficiency of water regulation is an essential element. The existence of a positive relationship between lobbying coalitions and policy change (Nelson & Yackee, 2012) could intensify the conflicts between opposing groups and lead to the failure of the water policy implemented.

8. Conclusions

Increasing fresh water scarcity is a critical issue for environmental and resource regulation across many river basins in the world. Several policy instruments have been implemented to overcome water problems, especially the water shortages in arid regions. However, the existence of political interactions and opposing interests between policymakers, regulatory agencies, and interest groups affect the efficacy of these regulations. Although several studies have analyzed the effectiveness of various instruments to address water scarcity, studies on the political elements that affect water policy efficacy are still scarce. The analysis of what makes water stakeholders influential in determining water policies and water allocations is a key element in water governance (Mancilla García & Bodin, 2018). In this paper, we highlight several elements that affect the capacity of influence of water stakeholders in complex institutions. We based our analyses on the agents' perceptions regarding their benefits and costs of influence or lobby water institutions.

The main objective of this paper is to analyze the factors that influence the effort and effectiveness of water users lobbying. We formalize the effort exerted and the effectiveness of water stakeholder lobbying in a water-stressed basin – the Jucar River Basin in southern Spain. Water stakeholders, who are organized in interest groups with opposite objectives, work at increasing their water allocations, which means a reduced allocation to other groups. The pressure exerted by each group influences the water authority, in charge of the water management and allocation among all stakeholders in the basin. Data have been collected using a survey developed for the study area, and these data have been analyzed to determine the interest groups' perceptions about the effort and effectiveness of their active mobilization. Even though the results are specific to our study area, we have analyzed how the outcomes are also consistent with general political economy theories about the interest groups' behavior.

The achieved outcomes demonstrate how lobbying effectiveness is significantly related to the effort exerted by the groups. On the other hand, lobbying effort shows a significant correlation with the resources spent on lobbying (namely, the number of instruments used to approach or influence water authorities) and the active mobilization and involvement of the group members with water organizations. Additionally, the empirical estimation confirms that physical and private users' characteristics influence both the lobbying effort and effectiveness. However, while most of our findings are in agreement with political economy and interest group statements, some deviations and unexpected results have also been found. For example, the results confirm the idea that the size of the group has an undetermined impact on the lobbying effort and may not be sufficient to explain its capacity to exert political pressure (Becker, 1983; Potters & Sloof, 1996;

Nosenzo *et al.*, 2015). While large groups can use the scale economies of political lobbying, small interest groups can more easily control the free-riding behavior and reduce the transaction costs of coordination. Additionally, the hypothesis that more homogeneous interest groups face lower lobbying efforts has not been confirmed. By contrast, the results suggest that less homogeneous groups perceived the lobbying effort as lower. This finding can be related to the fact that heterogeneous groups can take advantage of more diverse arguments and particular influences to sway policymakers.

The outcomes from this research highlight some important implications in terms of interest groups and lobbying behavior of water stakeholders. Improving the understanding of the behavior of water interest groups is useful for policymakers who need to decide on the best combination of instruments to be employed when managing water scarcity. Policymakers can minimize the risks of being pressured by interest groups, thus increasing the efficacy of the proposed water regulations.

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References

Abdi, H. & Williams, L. J. (2010). Principal component analysis. *Computational Statistics 2*(4), 433–459.

Allan, J. A. (2006). IWRM: The new sanctioned discourse? In: *Integrated Water Resources Management: Global Theory, Emergency Practice and Local Needs*. Mollinga, P. P., Dixit, A. & Athukora, K. (eds). SAGE Publications, New Delhi, India, pp. 38–64.

Becker, G. (1983). A theory of competition among pressure groups for political influence. *The Quarterly Journal of Economics 9*, 371–400.

Böhmelt, T., Bernauer, T., Buhaug, H., Gleditsch, N. P., Tribaldos, T. & Wischnath, G. (2014). Demand, supply, and restraint: determinants of domestic water conflict and cooperation. *Global Environmental Change 29*, 337–348.

Dinar, A. (2000). *The Political Economy of Water Pricing Reforms*. Oxford University Press, London.

Esteban, E., Dinar, A., Albiac, J., Calera, A., García-Mollá, M. & Avellá, L. (2018). Interest group perceptions on water policy reforms: insight from a water stressed basin. *Water Policy 20*(4), 794–810.

Estrela, T. (2004). *Jucar Pilot River Basin: Provisional Article 5 Report*. Oficina de Planificación Hidrográfica. Confederación Hidrográfica del Júcar. Ministerio de Medio Ambiente, Valencia, Spain.

Esty, D. C. & Caves, R. E. (1983). Market structure and political influence: new data on political expenditure, activity and success. *Economics Inquiry 21*(1), 24–38.

Feitelson, E. (2006). Impediments to the management of shared aquifers: a political economy perspective. *Hydrogeology Journal 14*, 319–329.

Gizelis, T. I. & Wooden, A. E. (2010). Water resources, institutions, & intrastate conflict. *Political Geography 29*, 444–453.

Halpin, D. R. & Fraussen, B. (2017). Conceptualizing the policy engagement of interest groups: involvement, access and prominence. *European Journal of Political Research 56*(3), 723–732.

Helland, L. (2008). Lobbying with conflicts interest: Norwegian local-central relations. *European Journal of Political Research 47*, 184–205.

Kristov, L., Lindert, P. & McClelland, R. (1992). Pressure groups and redistribution. *Journal of Public Economics 48*, 135–163.

Linting, M., Meulan, J. J., Groenen, P. J. F. & van der Kooij, A. J. (2007). Nonlinear principal components analysis: introduction and application. *Psychological Methods 12*(3), 336–358.

Madhoo, Y. N. (2004). Political economy of water pricing policy: empirical evidence from public utilities in Mauritius. *Water Resource Research 40*, W07301, doi:10.1029/2003WR002903.

Mancilla García, M. & Bodin, Ö. (2018). Participation in multiple decision making water governance forums in Brazil enhances actors' perceived level of influence. *Policy Studies Journal*.

McBeth, M. K., Shanahan, E. A., Hathaway, P. L., Tigert, L. E. & Sampson, L. J. (2010). Buffalo tales: interest group policy stories in Greater Yellowstone. *Policy Sciences 43*, 391–409.

Meinzen-Dick, R. & Raju, K. V. (2002). What affects organization and collective action for managing resources? Evidence from canal irrigation systems in India. *World Development 30*(4), 649–666.

Metz, F. & Ingold, K. (2017). Politics of precautionary principle: assessing actors' preferences in water protection policy. *Policy Science 50*, 721–743.

Nelson, D. & Yackee, S. W. (2012). Lobbying coalitions and government policy change: an analysis of federal agency rule-making. *The Journal of Politics 74*(2), 339–353.

Nordas, R. & Gleditsch, N. P. (2007). Climate change and conflict. *Political Geography 26*, 627–638.

Nosenzo, D., Quercia, S. & Sefton, M. (2015). Cooperation in small groups: the effect of group size. *Experimental Economics 18*, 4–41.

Potters, J. & Sloof, R. (1996). Interest groups: a survey of empirical models that try to assess their influence. *European Journal of Political Economy 12*, 403–442.

Rausser, G. C., Sayre, S. S. & Simon, L. K. (2011). Property rights and water transfers: bargaining among multiple stakeholders. *Strategic Behavior and the Environment 1*, 1–29.

Rausser, G. C., Swinnen, J. & Zusman, P. (2012). *Political Power and Economic Policy: Theory, Analysis, and Empirical Applications*. Cambridge University Press, London, UK.

Rosegrant, M. W. (2016). Challenges and Policies for Global Water and Food Security. *Federal Reserve Bank of Kansas City, Special issue*: 5-20.

Sadrieh, F. & Annavarjula, M. (2003). Antecedents of corporate lobbying participation and intensity: a review of the literature. *Public Administration Quarterly 26*(4), 465–502.

Sadrieh, F. & Annavarjula, M. (2005). Firm-specific determinants of corporate participation and intensity. *International Journal of Public Administration 28*(1–2), 179–202.

Sloof, R. (1998). *Game-Theoretic Models of the Political Influence of Interest Groups*. Kluwer Academic Publishers, Boston.

Sorensen, R. J. (1998). Targeting the lobbying effort: the importance of local government lobbying. *European Journal of Political Research 34*, 301–327.

Swatuk, L. (2008). A political economy of water in southern Africa. *Water Alternatives 1*(1), 24–47.

Swyngedouw, E. (2009). The political economy and political ecology of the hydro-social cycle. *Journal of Contemporary Water Research & Education 142*, 56–60.

Taber, S. T. (2017). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*. doi:10.1007/s11165-016-9602-2.

Thomas, A. & Zaporozhets, V. (2017). Bargaining over environmental budgets: a political economy model with application to French Water Policy. *Environmental Resource Economics 68*(2), 227–248.

World Bank (2007). Several factors that drive the politics of water reform are changing. Chapter 3 In: *Making the Most of Scarcity: Accountability for Better Water Management Results in the Middle East and North Africa*. World Bank, Washington, DC, pp. 59–95.

World Bank (2008). *The Political Economy of Policy Reform: Issues and Implications for Policy Dialogue and Development Operation*. Report No. 44288-GLB. Social Development Department, The World Bank, Washington, DC.

Zheng, W., Yang, B. & McLean, G. N. (2010). Linking organizational culture, structure, strategy, and organizational effectiveness: mediating role of knowledge management. *Journal of Business Research 63*, 763–771.

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