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Investigating the Effects of Social Trust and Perceived Organizational Support on Irrigation Management Performance in Rural China

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Abstract: Understanding the factors affecting irrigation management performance is crucial for sustainable resource use, especially with the decentralized management mode of irrigation systems being implemented in rural China. This paper contributes to the research field by incorporating different categories of social trust and perceived organization support (POS) into the analysis of irrigation management performance, by linking multiple elements that are based on the Institutional Analysis and Development (IAD) framework. We employed principal component analysis (PCA) and ordered probit regression to analyze a database covering 785 households in the upstream of the Yellow River basin. The results suggested that social trust and POS positively affected the irrigation management performance, and social trust strengthened the positive effect of POS on the performance. Furthermore, the results indicated that personal trust and institutional trust, as well as perceived emotional support and physical support, positively affected the performance. In addition, we also found that household characteristics, household cognition, group characteristics, physical conditions, and rules-in-use also had significant impact on the performance. This paper can be used to inform the government that social trust and POS need to be considered in the common-pool resources (CPRs) management.

Keywords: social trust; perceived organizational support; irrigation management performance; Institutional Analysis and Development framework; Yellow River basin; ordered probit

1. Introduction

China is facing severe water scarcity, especially in the Yellow River basin. The annual precipitation over one-third of the Yellow River basin is less than 400 mm, and the remainder's annual precipitation is 400–800 mm [1]. Agricultural production in northern China is highly dependent on irrigation water [2], particularly upstream of the Yellow River basin because its rainfall is low and erratic, and its evaporative demand is high. To meet the demand of agricultural production, the government invests heavily (609.96 billion yuan in 2016; the yuan is a Chinese currency unit: $1 = 6.94 yuan as of December 2016) in the construction and maintenance of irrigation systems [3,4]. However, the irrigation facilities and management services have really not been met [5]. This is largely due to the inefficiency of rural China's institutional setting and the public goods nature of common-pool resources (CPRs). Since the agricultural taxation reform and the dissolution of the collective farming system in rural China in the 1990s, the duty of irrigation management shifted from rural collectives to individual households [5,6]. Consequently, participatory management has been observed as a major type of management reform in rural northern China [7]. Nevertheless, the non-excludability and rivalry attributes of CPR make irrigation management particularly challenging [8,9], because individuals tend to employ some self-interested strategies, like free-riding, to maximize their personal benefit in irrigation. As a result, the irrigation management performance becomes poor, manifested by under-provision of irrigation water and degradation of irrigation facilities [10]. In this situation, the solution to improving irrigation management performance may ultimately rely on boosting rural households' participation. Therefore, our study seeks to explore the influencing factors that could strengthen households' participation, which would be beneficial for meeting the demand of irrigation systems and achieving the goal of efficient management.

Several factors affect irrigation management, such as the land quality, degree of land fragmentation, dependence on irrigation, trust among users, spatial order, and group size of water users [11–14]. As many scholars have noted, social trust has been recognized as an essential factor that can improve public goods management [15,16], by helping to avoid inefficient non-cooperative traps and reduce free-riding problems through increasing communication and facilitating social exchange [15]. In fact, ordinary Chinese villagers generally trust their relatives and fellow villagers, regardless of whether or not the villagers are their neighbors [17], because of acquaintanceship and frequent interactions. Previous studies revealed that individuals with high trust in others usually have more propensity to use unselfish strategies and conduct cooperative activities to avoid social dilemmas [18]. As a result, abundant collective activities and high irrigation management performance are expected.

Besides social trust, perceived organization support (POS) can theoretically positively affect management performance in many ways [19]. POS refers to organization members' perception on the degree to which the organization cares about their well-being and values their contributions [20]. With decentralizing water use management to local water user groups, locally governed organizations are assigned the responsibility of water management, fee collection and irrigation system maintenance. Thus, there is an urgent need to understand what these organizations can do to make irrigation management more efficient. In irrigation management, when water user groups care about households' well-being and give them physical assistance, it would fulfill households' socioemotional needs and would be very useful in helping households to achieve irrigation rights. In this situation, households tend to form the feeling of obligation to repay the positive treatment of these organizations [21]. Based on this feeling, they would like to participate in irrigation management under the coordination of the water user groups. In line with this view, we hypothesize that households with high POS would devote more efforts to helping the organizations through decreased withdrawal behaviors.

Theoretically, in the context of rural China, social trust and POS can also affect irrigation management performance. On one hand, social trust is generally formed based on households' geographical, kinship and affinity relationships in rural China [22,23]. Such relationship-based social trust creates possibilities to improve the flow and quality of information, as well as to smooth the communication and coordination with cooperation [24]. On the other hand, irrigation water in rural China is managed mainly by village communities and/or water user associations (WUAs). Such organizations coordinate or facilitate cooperation among villagers to achieve efficient irrigation [12]. Accordingly, households may participate in irrigation management energetically in return for the POS. In line with the above ideas, social trust and POS may motivate households to participate in the collective and supervisory activities of irrigation management. In this case, the irrigation management performance would be improved. However, the literature on CPRs has mostly focused on resource characteristics, sustainable resource use, and principles for institutional design [25–27], while neglecting the impact of social trust and POS in irrigation management. Since these roles potentially played by social trust and POS, it leads to a growing interest in their impact on the irrigation management performance in rural China.

The main contribution of our study is incorporation of different categories of social trust and POS into the analysis of irrigation management performance. In addition, the analysis of the moderating effect of social trust on the process of POS affecting the irrigation management performance, is also something innovative. Based on the Institutional Analysis and Development (IAD) framework, first, this study explicitly examines the roles that social trust and POS play in irrigation management performance. Second, it examines the potentially different impacts of personal trust and institutional trust, as well as perceived emotional support and physical support, on irrigation management performance. Third, it analyzes, in particular, the moderating effect of social trust on the process of POS affecting the irrigation management performance. Finally, it examines whether the effect of social trust and POS on irrigation management performance is robust. Following the introduction, the theoretical analysis framework of the influencing mechanism of irrigation management performance is presented in Section 2. In Section 3, we outline our materials and methods, including the data source and the estimation approach. Then the empirical results and discussion will be described in Section 4. After this, Section 5 summarizes and concludes the findings.

2. Theoretical Analysis Framework

2.1. Effect of Social Trust and POS

The literature widely recognizes that households' collective activities are deeply embedded in social and cultural contexts [28]. In fact, since Ostrom [15] introduced trust into the analysis of CPR, social trust has been increasingly emphasized. It has been commonly argued that households are more likely to participate in collective activities if they believe that others will do the same [29]. Accordingly, social trust considerably reduces opportunism and cooperative costs in collective activities [30,31]. Furthermore, it facilitates a strong cooperative relationship between members in irrigation management [32], because it encourages households to share information, knowledge, and resources [33]. In this case, they would devote fewer resources to monitoring others' behavior. This could enable partners to address problems and adapt to external changes more easily in irrigation management. Basically, the object of social trust can be individuals or institutions [34]. Households' trust towards individuals is defined as personal trust, while the trust towards institutions is defined as institutional trust in our study. The former sustains local interactions and it reduces the transaction costs of cooperation, especially at the local level [35]. The latter enables the implementation of initiatives, policies, and innovations [36]. Although the literature shows that social trust has a positive effect on collective activities, empirical evidence for the effect of social trust on irrigation management performance is weak. Since irrigation management performance is the outcome of activities, as noted early, a positive impact of social trust on it is likely to emerge.

Since Eisenberger et al. [20] came up with POS, a growing body of research has investigated the effect of POS on job performance, generally finding that the effect is positive [19,37]. Nevertheless, the research subjects of POS are more often companies or other for-profit organizations [38], while empirical evidence that is related to water user groups is rare. Given that these groups, which are village communities and WUAs, organize and support households to participate in irrigation management in rural China, the irrigation management performance would be affected. Therefore, it is quite worth studying the effect of POS on irrigation management performance in water user groups. POS can contribute to increasing members' positive attitudes and behaviors, and help the organization to achieve its goals [39]. Basically, POS is developed through members' interactions with organizational agents. It can be divided into perceived emotional support [20] and perceived physical support [40]. The former is that organizations value members' contributions and care about their wellbeing [20]. It may help to achieve performance by enhancing members' engagement [41]. The latter reflects the assistance (e.g., information, technique, training) that households receive from the water user group. It may boost households to engage in and contribute to irrigation management [21]. Therefore, in water user groups, a positive impact of POS on irrigation management performance is likely to emerge.

Unfortunately, social trust and POS have been researched separately in most of the existing literature. When the members received favorable treatment from the organization, they would feel an obligation to give something back [39]. In addition, social trust is considered to be the key indicator of favorable social exchanges [42] because it is important in the interactions among the members of the organization. Due to the predictability and reliability of social trust, when members' trust towards their organization is high, members normally believe that the organization would do the right things and act for their benefit [43]. In this case, members with POS would have more incentive to help the organization achieve its goal, when compared with those who have the same POS but have low trust towards their organization. In line with this view, as social trust grows, members with POS are more willing to reciprocate organizational care and ensure positive attitudes and behaviors [44]. Similarly, as households' trust in a village committee and/or WUA grows, households with POS would be more willing to participate in irrigation management to return something to the organization. Consequently, high irrigation management performance is expected. Therefore, potentially, social trust could stimulate the effect of POS on the performance.

2.2. The IAD Framework

Previous studies have shown that multiple elements (e.g., rules, land, water scarcity, access to water) are positively related to irrigation management [45–47]. By integrating multiple influence factors of outcome into the analysis, the IAD framework has improved the explanatory capacity of the literature. Elinor Ostrom and her colleagues proposed the IAD framework, and it can be further dated back to the 1980s [48–50]. This framework can be mainly used to analyze policy and management issues regarding CPR [51]. Specifically, the IAD framework can identify relevant explanatory factors to set components that in a foundational structure of logical relationships. In addition, this framework is focusing on the contextualization of interactive relationships among local factors leading to institutional outcomes [45]. Since these attributes of the IAD framework, it is especially suitable for analyzing irrigation management performance.

The IAD framework begins with the external variables (see Figure 1). It represents the initial condition that households face in irrigation management [52]. Many studies focus on three broad categories of initial conditions: physical conditions, rules-in-use, and community attributes [53,54]. Physical conditions affect the action situation because the characteristics of the resources might greatly affect their use [55]. Also, the rules-in-use, which comprises formal and informal prescriptions, refers to enforced prescriptions about what activities are required, prohibited, or permitted [56]. It provides the means to help actors resolve social dilemmas and collective activities [57]. Community attributes (besides the aforementioned social trust and POS), the household characteristics and cognition, and the group characteristics are considered to enrich the framework. First, whether the households participate in irrigation management would be affected by their characteristics, such as agricultural income and ratio of members' engaging in agricultural labor [58]. Moreover, the householders usually have the right to the final decision in their families in rural China, decisions that may be influenced by their characteristics, including age and educational attainment. Second, the household cognition is important in irrigation management because it affects the households' perception and reaction to the surroundings [59]. If households believed that they could benefit from irrigation management or if the expectation of farm production is optimistic, they would have positive intentions to participate in irrigation management. Finally, the group characteristics, including the group size and homogeneity, are widely expected to affect the ability to mobilize resources and the prospects for collective activities [8].

At the core of the IAD framework are action situations that are affected by the external variables. Action situations are the social spaces in which households interact, exchange goods and services, solve problems, dominate each other, or fight [56]. The external variables can affect action situations to generate interactions and outcomes that are evaluated by participants in the action situation [53]. Here, we focus on multiple external variables and how they lead to regularized irrigation management performance.

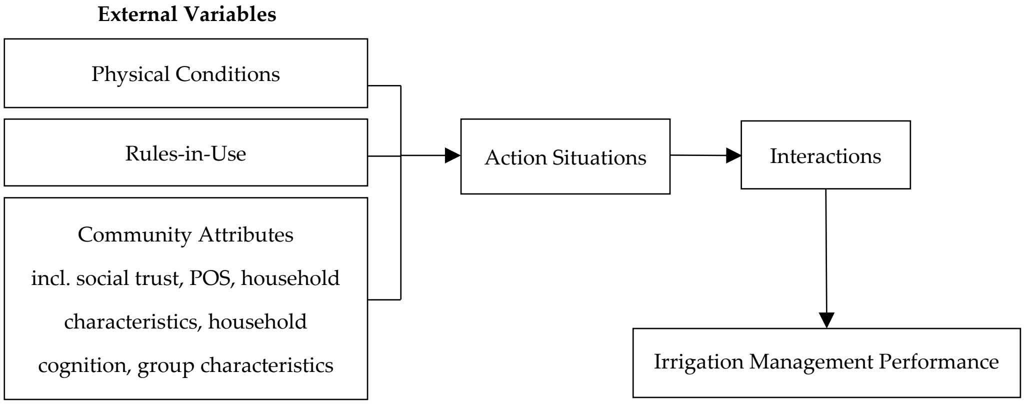

Figure 1. Theoretical framework to analyze the influence factors of irrigation management performance. Source: Adapted from Ostrom [53] and Meinzen-Dick et al. [52].

3. Materials and Methods

3.1. Area Description

Our survey was conducted in the Inner Mongolia and Ningxia Autonomous Regions in northern China. The research area is in the upstream of the Yellow River basin, which is characterized as an arid to semi-arid continental climate consisting of irregular precipitation (the annual average precipitation ranges from 50 to 450 mm in Inner Mongolia and from 150 mm to 650 mm in Ningxia). Due to water scarcity, agriculture in this area relies heavily on irrigation. Irrigation water is diverted from the Yellow River along concrete-lined or earthen canals to supply downstream fields through gravity. There are approximately 9.45 million mu (mu is a Chinese measure of land area: 1 mu = 1/15 ha) and 3.15 million mu of land irrigated by the Yellow River in Inner Mongolia and Ningxia, respectively. We chose these two provinces because they best represent the conditions of irrigation management in the upstream of the Yellow River basin.

3.2. Data Collection

Data collection was conducted from September to November of 2016 by a research team that was led by the authors. We employed participant rural appraisal, semi-structured interviews, and household interviews. In addition, we designed the survey based on a multi-stage hierarchical random-sampling procedure. We randomly selected two counties from each province. After that, according to the gross agricultural production level, we randomly chose 4–6 villages from each selected county. After arriving at the sampled villages, we obtained the necessary official documents on households and irrigation canals distributions from the leaders of village committees/WUAs. Then, based on this information, we randomly chose 20–30 households from those that are sharing the same irrigation canals in each sampled village. All of the sample households are farming families, which include pure peasant households and part-time peasant households. The analytical sample consists of 785 rural householders. The reason we chose the householders is that they usually have the final decision authority in their families. The survey used an anonymous questionnaire that was designed to match the methodology used. We used part of the information obtained from a series of in-depth interviews with 20 householders to design the questionnaire before the main survey. Note that all of the interviewees gave their answers to the questions in the questionnaire based on their own perception and judgment. Generally, the field survey aimed to collect detailed information on five aspects of the sample households: socio-demographic characteristics, conditions of agricultural production, the situation of irrigation canals management, information of social trust, and information of POS.

3.3. Methods and Econometric Model

Ordered probit regression and principal component analysis (PCA) were employed to analyze the data from the survey. The dependent variables, used to measure irrigation management performance, were generated by asking interviewees to make evaluations based on a five-point Likert scale. Since the dependent variables are limited and ordinal, ordered probit regression is appropriate for this research because it recognizes the indexed nature of various response variables. Estimated models can be written, as follows:

$$y_i^* = x_i'\beta + \varepsilon_i,\ i = 1,\ 2,\ \ldots,\ N \tag{1}$$

where y_i^* is latent variable; i is the number of each observation; x_i' is the vector of the factors influencing y_i^*; β is a vector of coefficients to be estimated; and, ε_i represents disturbances that are unobserved with $\varepsilon_i \sim N\,[0,\ 1]$ [60]. Because y_i^* cannot be measured directly, the observed outcome y_i is related to y_i^*. Our estimation of the determinants of irrigation management performance is in line with the following model:

$$\begin{aligned}\text{Performance}_i \quad = \quad & \beta_0 + \beta_1\text{SocialTrust}_i + \beta_2\text{POS}_i + \beta_3\text{HouseholdCharacteristics}_i \\ & + \beta_4\text{HouseholdCognition}_i + \beta_5\text{GroupCharacteristics}_i \\ & + \beta_6\text{PhysicalConditions}_i + \beta_7\text{RulesinUse}_i + \varepsilon_i\end{aligned} \tag{2}$$

The specialized interest of the analysis was to obtain consistent estimates of parameters β. To test the moderating effect of social trust on the process of POS stimulating the irrigation management performance, we introduced an interaction term between social trust and POS based on Equation (2) as follows:

$$\begin{aligned}\text{Performance}_i \quad = \quad & \beta_0 + \beta_1\text{SocialTrust}_i + \beta_2\text{POS}_i + \beta_8\text{SocialTrust}_i \times \text{POS}_i \\ & + \beta_3\text{HouseholdCharacteristics}_i + \beta_4\text{HouseholdCognition}_i \\ & + \beta_5\text{GroupCharacteristics}_i + \beta_6\text{PhysicalConditions}_i + \beta_7\text{RulesinUse}_i + \varepsilon_i\end{aligned} \tag{3}$$

In addition, since social trust and POS incorporate multidimensional information, we employed PCA, which can simplify information and incorporate categorical variables by transforming them into numeric ones [61]. To ensure that the data sample was suitable for the analysis, the Kaiser-Meyer-Olkin (KMO) test, Bartlett's test of sphericity and Cronbach's α coefficient were conducted. The results of the KMO and Bartlett's tests were 0.693 and 872.228 (0.000) for social trust and 0.930 and 7044.503 (0.000) for POS. Factors of social trust and POS explained about 69.72% and 62.61%, respectively, of the variances. The Cronbach's α of social trust and POS were 0.667 and 0.926, respectively. Therefore, the data of social trust and POS is suitable for PCA. These analyses were performed while using two statistical software products: IBM SPSS (IBM, New York, NY, USA) was used for PCA and STATA (StataCorp LLC, College Station, TX, USA) was utilized for ordered probit regression analysis.

3.4. Variables

3.4.1. Dependent Variables

We measured the irrigation management performance subjectively by asking households to evaluate the condition of irrigation canals and fairness of irrigation water allocation based on their perception. Generally, performance can be measured either objectively or subjectively [11]. Since households' perception of performance is important to their decisions to participate in irrigation management, it is more valuable to evaluate the irrigation management performance subjectively than objectively. Furthermore, there are two main types of activities in irrigation management: collective and supervisory activities [12]. Note that collective activities in this study are distinctly different from the term collective action in Ostrom [49]. The former means that the leader organizes the actions of villagers in irrigation management [12], while the latter means that villagers cooperate in a self-organizing way [49]. The irrigation canal systems are expected to become better through collective activities that mainly refer to maintaining irrigation canals. Moreover, irrigation water allocation is expected to become fair through supervisory activities that mainly refer to monitoring water allocation. Basically, irrigation management performance is the outcome of both collective and supervisory activities. Therefore, it can be measured in both the condition of irrigation canals and the fairness of irrigation water allocation. The former is the key representation of the households' contribution in the maintenance. The latter is a critical manifestation of the rational allocation mechanism and a households' compliance with the irrigation rules. Based on these reasons, we developed the subjective irrigation management performance indicators, including condition of irrigation canals and fairness of irrigation water allocation.

3.4.2. Focused Independent Variables

The explanatory variables of primary interest are social trust and POS of households. Following Koutsou et al. [16] and He et al. [62], we interviewed householders to get their level of trust in individuals and institutions, on a five-point Likert scale (from 1 = distrust completely to 5 = trust completely). Specifically, items include relatives, neighbors, and non-neighboring villagers, as well as regulations and water user groups represented by the leaders of village committees/WUAs. Note that social trust in this study is not the traditional meaning of the term, but the households' rational behavior expectation and affective commitment to others based on their own interests [62]. The items were transformed considering the understanding ability and receptivity of households in the survey (see Table 1). To shed more light on the effect of social trust, we disaggregated it into personal trust and institutional trust by using PCA (see Table 1). The former is based on the relationship among people, while the latter depends on the political and institutional environment [16].

Table 1. Factors of social trust.

Factor		Component Loadings	
Personal Trust	I trust my relatives: If my relatives participate in irrigation management, I will participate.	0.852	0.040
	I trust my neighbors: If my neighbors participate in irrigation management, I will participate.	0.862	0.095
	I trust my non-neighboring villagers: If my non-neighboring villagers participate in irrigation management, I will participate.	0.719	0.285
Institutional Trust	I trust the Farmland Water Conservancy Regulations: I believe villagers will follow the Farmland Water Conservancy Regulations.	0.110	0.834
	I trust the leaders of my village committee/WUA: If leaders of my village committee/WUA organize villagers participate in irrigation management, I will participate.	0.137	0.826

As to POS, it was measured by using scales from Eisenberger et al. [20] and Ling et al. [40], which were adapted in this study. Specifically, we measured the extent to which households perceive how much the organizations care about their well-being and offer them assistance based on a five-point Likert scale (from 1 = disagree strongly to 5 = agree strongly). Interviewees indicated the extent of their agreement with each item. To acquire further information of the impact of POS, we broke the POS into perceived emotional support and perceived physical support through PCA (see Table 2). The former fulfills several socioemotional needs of households, while the latter provides the information, materials, and rules to households in irrigation management [21].

Table 2. Factors of perceived organization support (POS).

	Factor	Component Loadings	
Perceived Emotional Support	My village committee and/or WUA care(s) about my opinions.	0.874	0.115
	My village committee and/or WUA really care(s) about my well-being.	0.770	0.355
	My village committee and/or WUA strongly consider(s) my goals and values.	0.846	0.231
	Help is available from my village committee and/or WUA when I have a problem.	0.553	0.180
	My village committee and/or WUA would forgive an honest mistake on my part.	0.866	0.238
	If given the opportunity, my village committee and/or WUA would take advantage of me. (R)	0.664	0.371
	My village committee and/or WUA show(s) very little concern for me. (R)	0.721	0.438
	My village committee and/or WUA are/is willing to help me if I need a special favor.	0.675	0.402
Perceived Physical Support	My village committee and/or WUA would provide water-related information to me.	0.054	0.743
	My village committee and/or WUA would provide irrigation training to me.	0.236	0.759
	My village committee and/or WUA would inform illegal use of irrigation water to me.	0.314	0.691
	My village committee and/or WUA would inform damages and leakages of irrigation canals to me.	0.256	0.579
	My village committee and/or WUA would offer cohesion for realizing collective activities.	0.350	0.747
	My village committee and/or WUA would arrange a water-intake-quota.	0.476	0.613

Note: (R) indicates the item is reverse scored.

3.4.3. Control Variables

The choices of control variables are based on the IAD framework. As noted early, we incorporated five aspects of control variables in the analysis. The variables of household characteristics include householders' age, education, off-farm employment, leadership, agricultural income, and the ratio of members' engaging in agricultural labor. The variables of household cognition include the effect of irrigation management on the condition of irrigation canals, the effect of irrigation management on household income and the expectation of farm production. The variables of group characteristics include the number of related households and the ratio of cereal crops (wheat, rice, and maize). The variables of physical conditions include scarcity of irrigation water, irrigated land area, and location of the plot. The variables of rules-in-use include formal rules, water intake order, and punishment. The variables used are specifically defined in Table 3.

Table 3. Definitions and summary statistics of variables.

Variable	Definition	Mean	Std. Dev.	Min	Max
Irrigation Management Performance					
Condition of Irrigation Canals	1 = very poor; 2 = poor; 3 = normal; 4 = good; 5 = very good	3.670	0.966	1	5
Fairness of Irrigation Water Allocation	1 = not fair at all; 2 = not fair; 3 = normal; 4 = fairly fair; 5 = very fair	3.378	1.065	1	5
Social Trust					
Overall Trust	Measured by the mean of 5 components of social trust	3.983	0.552	1.600	5
Personal Trust	Measured by the mean of 3 components of personal trust	4.506	0.537	1.667	5
Institutional Trust	Measured by the mean of 2 components of institutional trust	3.199	0.896	1	5
POS					
Overall Support	Measured by the mean of 14 components of POS	3.443	0.660	1.143	4.929
Perceived Emotional Support	Measured by the mean of 8 components of perceived emotional support	3.238	0.710	1	5
Perceived Physical Support	Measured by the mean of 6 components of perceived physical support	3.717	0.731	1.167	5
Household Characteristics					
Age	Age of the householder in years	54.971	9.512	26	80
Education	Education level of householder: 1 = primary school or below; 2 = middle school; 3 = high school; 4 = college/university; 5 = graduate school or above	1.628	0.685	1	5
Off−Farm Employment	Whether the householder has off-farm employment: 1 = yes; 0 = no	0.464	0.499	0	1
Leadership	One or more family members worked/are working as village committee/WUA leaders: 1 = yes; 0 = no	0.206	0.405	0	1
Agricultural Income	Logarithm of household agricultural income in 2015 in yuan	10.482	1.023	6.579	13.271
Ratio of Agricultural Labor	Ratio of household members engaging in agricultural labor	0.645	0.258	0	1
Household Cognition					
Effect on Condition of Irrigation Canals	Whether condition of irrigation canals could be improved if a household participated in irrigation management: 1 = yes; 0 = no	0.831	0.375	0	1
Effect on Household Income	The effect of irrigation management on the household income: 1 = decreased strongly; 2 = decreased slightly; 3 = normal; 4 = improved slightly; 5 = improved strongly	4.288	0.801	1	5
Expectation of Farm Production	1 = not optimistic at all; 2 = not optimistic; 3 = normal; 4 = fairly optimistic; 5 = very optimistic	2.532	0.965	1	5
Group Characteristics					
Number of Related Households	Number of households sharing the same lateral canal	24.029	13.603	5	60
Ratio of Cereal Crops	Ratio of cereal crops area to total farming area	0.566	0.420	0	1
Physical Conditions					
Water Scarcity	1 = not scarce at all; 2 = not scarce; 3 = normal; 4 = fairly scarce; 5 = very scarce	3.558	1.004	1	5
Irrigated Land Area	Total area of irrigated land cultivated by a household in mu	38.151	35.937	1	250
Location of Plot	The distance from the plot to the lateral canal: 1 = 0–100 m; 2 = 101–200 m; 3 = 201–300 m; 4 = 301–400 m; 5 = 401 m and above	1.236	0.762	1	5

Table 3. *Cont.*

Variable	Definition	Mean	Std. Dev.	Min	Max
Rules-in-Use					
Formal Rules	Whether formal irrigation management rules exist: 1 = yes; 0 = no	0.387	0.487	0	1
Water Intake Order	Whether water intake order is specified: 1 = yes; 0 = no	0.819	0.385	0	1
Punishment	Whether punishment is specified in irrigation management: 1 = yes; 0 = no	0.452	0.498	0	1

Note: $1 = 6.48 yuan based on exchange rate in December 2015; 1 mu = 1/15 ha.

3.5. Descriptive Statistics

Table 3 provides the definition of the variables used in the ordered probit model with some basic statistics, such as mean, standard deviation, minimum, and maximum. The condition of irrigation canals was between "normal" and "good", indicating that they still need to be improved, probably because the earthen canals dug into the ground lead to significant water losses in the survey area. Moreover, the fairness of irrigation water allocation was between "normal" and "fairly fair," indicating that the illegal use of irrigation water was not frequent. As for social trust, households had quite a high level of social trust, as well as personal and institutional trust. However, the households had a higher level of personal trust than institutional trust, most likely because interviewees built relatively intimate relationship with relatives, neighbors, and non-neighboring villagers based on kinship and geography. The POS of households was high, as was perceived emotional and physical support. This indicates that households recognize and acknowledge the organizational support.

In terms of the control variables, the mean age of the sample householder was 55, and the average educational attainment was between "primary school or below" and "middle school". Moreover, more than half of the householders were full-time farmers. In addition, most of the observed farmers were farm laborers. Only 20.6% of the households had family members who had worked or were working as village committee/WUA leaders. The average agricultural income in 2015 for the sample household was about 57,118 yuan ($1 = 6.48 yuan as of December 2015). In addition, most of the households thought that the condition of irrigation canals and their household income could be improved if they participated in irrigation management. In contrast, the households were generally not optimistic about their prospects for farm production. About 24 households shared the same lateral canal, and the mean distance from the plot to the lateral canal was between 0 and 200 m. Cereal crops were cultivated on more than half of the farm land. Water was scarce, indicating that irrigation is important for agricultural production. The mean area of irrigated land was about 38.151 mu, indicating that most of the sample households have smallholdings. Only 38.7% of the households considered that the formal rules of irrigation management existed. In contrast, most of households thought the water intake order was specified and about half of them thought that the punishment was specified.

4. Results and Discussion

The test for multicollinearity among the explanatory variables was measured by variance inflation factors (VIF) to ensure that the ordered probit regression was correctly specified. The results of the test were all below 3 (see Appendix A).

4.1. Estimation Results: Social Trust

Overall trust had a significant and positive effect on the condition of irrigation canals and the fairness of irrigation water allocation at the 1% level (see Table 4 for Model 2). There are two possible reasons. First, households with high social trust would feel more social pressure because they value the fellowship of their friends and associates, and their social status, personal prestige, and self-esteem [63]. Thus, they tended to avoid free-riding in collective activities, which was beneficial for the condition of irrigation canals, under the constraint of negative selective incentives [64]. Second, high social trust could help spread information faster and more efficiently through the establishment of information-sharing systems between households, which could provide mutual supervision of households' behavior [49]. Consequently, this could help to reduce the illegal use of irrigation water and ensure its fair allocation. In short, these functions of social trust could help to improve the irrigation management performance.

To investigate the effects of the components of social trust on irrigation management performance, we replaced the overall trust with personal trust and institutional trust in Model 3 in Table 4. Personal and institutional trust also had a significantly positive effect on the condition of irrigation canals and the fairness of irrigation water allocation at the 1% level, for the following possible reasons. First, personal relationship that is established through kinship and geography is the important link for households to cooperate. The intimate interaction between households and their relatives, neighbors, and non-neighboring villagers might enhance mutual recognition and reduce the transaction costs of reaching concerted action. In this case, collective activities would be achieved to improve the condition of irrigation canals. In addition, this intimate interaction could promote the sufficiency and symmetry of information. This could ensure effective household supervision of the use of irrigation water to achieve its fair allocation. Second, institutional trust refers to households' trust towards the leaders of the village committee/WUA and policy. On the one hand, households would have a positive psychological expectation of the water user group if they trusted the leaders [65,66]. This would help to form an informal risk reduction system and enhance household confidence in irrigation management. Consequently, households would tend to participate in collective activities to ensure that irrigation canals work well. On the other hand, households would follow the regulations if they believed that others would do it. This would help to reduce the illegal use of irrigation water and ensure the fairness in irrigation water allocation.

Table 4. The effects of social trust and POS on irrigation management performance.

Variables	Model 1		Model 2		Model 3		Model 4	
	(1) Condition	**(2) Fairness**	**(3) Condition**	**(4) Fairness**	**(5) Condition**	**(6) Fairness**	**(7) Condition**	**(8) Fairness**
Social Trust								
Overall Trust			0.388 ***	0.207 ***			0.407 ***	0.217 ***
			(0.061)	(0.059)			(0.062)	(0.060)
Personal Trust					0.193 ***	0.118 ***		
					(0.042)	(0.041)		
Institutional Trust					0.223 ***	0.159 ***		
					(0.046)	(0.045)		
POS								
Overall Support			0.290 ***	0.394 ***			0.336 ***	0.425 ***
			(0.068)	(0.067)			(0.069)	(0.069)
Perceived Emotional Support					0.150 ***	0.121 ***		
					(0.045)	(0.044)		
Perceived Physical Support					0.152 ***	0.391 ***		
					(0.049)	(0.050)		
Interaction Item								
Overall Trust * Overall Support							0.280 ***	0.198 ***
							(0.073)	(0.072)
Household Characteristics								
Age	−0.001	−0.005	0.001	−0.004	0.0002	−0.005	0.002	−0.003
	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Education	0.140 **	−0.003	0.162 ***	0.0003	0.162 ***	−0.0001	0.158 ***	−0.003
	(0.060)	(0.059)	(0.060)	(0.059)	(0.060)	(0.059)	(0.061)	(0.059)
Off−Farm Employment	0.154 *	0.037	0.106	−0.011	0.113	−0.003	0.121	−0.001
	(0.086)	(0.084)	(0.087)	(0.085)	(0.087)	(0.085)	(0.087)	(0.085)
Leadership	0.541 ***	0.402 ***	0.418 ***	0.289 ***	0.414 ***	0.281 ***	0.393 ***	0.268 **
	(0.106)	(0.103)	(0.109)	(0.105)	(0.109)	(0.105)	(0.109)	(0.105)
Agricultural Income	0.035	0.045	0.023	0.041	0.020	0.048	0.028	0.046
	(0.060)	(0.059)	(0.060)	(0.059)	(0.060)	(0.059)	(0.060)	(0.059)
Ratio of Agricultural Labor	−0.004	0.181	−0.028	0.164	−0.005	0.221	−0.044	0.158
	(0.162)	(0.160)	(0.164)	(0.160)	(0.164)	(0.162)	(0.164)	(0.161)
Household Cognition								
Effect on Condition of Irrigation Canals	0.417 ***	0.526 ***	0.263 **	0.361 ***	0.246 **	0.294 **	0.261 **	0.357 ***
	(0.118)	(0.118)	(0.121)	(0.120)	(0.122)	(0.121)	(0.122)	(0.120)
Effect on Household Income	0.247 ***	0.203 ***	0.187 ***	0.177 ***	0.177 ***	0.145 **	0.191 ***	0.179 ***
	(0.055)	(0.055)	(0.057)	(0.057)	(0.058)	(0.057)	(0.057)	(0.057)
Expectation of Farm Production	0.057	0.069	0.003	0.029	−0.002	0.039	−0.004	0.025
	(0.043)	(0.042)	(0.044)	(0.043)	(0.044)	(0.044)	(0.044)	(0.043)

Table 4. *Cont.*

Variables	Model 1		Model 2		Model 3		Model 4	
	(1) Condition	**(2) Fairness**	**(3) Condition**	**(4) Fairness**	**(5) Condition**	**(6) Fairness**	**(7) Condition**	**(8) Fairness**
Group Characteristics								
Number of Related Households	−0.008 ***	−0.019 ***	−0.008 **	−0.018 ***	−0.008 **	−0.016 ***	−0.008 ***	−0.019 ***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Ratio of Cereal Crops	0.475 ***	0.160	0.466 ***	0.105	0.461 ***	0.079	0.441 ***	0.084
	(0.114)	(0.111)	(0.116)	(0.113)	(0.116)	(0.113)	(0.116)	(0.113)
Physical Conditions								
Water Scarcity	0.258 ***	0.054	0.262 ***	0.032	0.259 ***	−0.019	0.279 ***	0.040
	(0.043)	(0.042)	(0.044)	(0.043)	(0.045)	(0.044)	(0.044)	(0.043)
Irrigated Land Area	0.004 **	0.002	0.003 *	0.001	0.003 *	0.001	0.003 *	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Location of Plot	−0.188 ***	−0.153 ***	−0.173 ***	−0.138 **	−0.170 ***	−0.137 **	−0.156 ***	−0.125 **
	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)
Rules-in-Use								
Formal Rules	0.298 ***	−0.014	0.354 ***	0.025	0.357 ***	0.061	0.357 ***	0.024
	(0.091)	(0.089)	(0.092)	(0.090)	(0.093)	(0.091)	(0.093)	(0.090)
Water Intake Order	0.158	0.355 ***	0.069	0.260 **	0.075	0.302 **	0.052	0.253 **
	(0.119)	(0.117)	(0.121)	(0.119)	(0.122)	(0.119)	(0.122)	(0.119)
Punishment	0.265 ***	0.533 ***	0.188 **	0.432 ***	0.196 **	0.367 ***	0.207 **	0.447 ***
	(0.092)	(0.092)	(0.095)	(0.094)	(0.097)	(0.097)	(0.095)	(0.095)
Number of Observations	785	785	785	785	785	785	785	785
Prob > χ^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R^2	0.1618	0.1382	0.1924	0.1609	0.1937	0.1749	0.1997	0.1643
Log Likelihood	−848.5163	−929.8262	−817.4784	−905.3402	−816.2201	−890.1525	−810.0887	−901.5812

Note: Standard errors are reported in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

4.2. Estimation Results: POS

Overall support had a significantly positive effect on the irrigation management performance at the 1% level (see Model 2 in Table 4). Since an irrigation system has the nature of a public good, support from a water user group is essential to its management. On the one hand, overall support could reduce the investment pressure of individual households in irrigation management through organized collective activities. On the other hand, it could make households perceive that the organization attaches importance to the management of the irrigation system [21]. Both of these would enhance the households' expectations for irrigation management and promote the implementation of collective activities. Thus, the condition of the irrigation canals would improve. Furthermore, water user groups could reduce the illegal use of irrigation water by restricting or punishing measures. Thus, households could fully realize their irrigation rights and ultimately achieve the fair allocation of irrigation water.

To shed more light on the influence of POS, we replaced the overall support with perceived emotional support and physical support in Model 3 in Table 4. The results revealed that both had a significantly positive effect on the performance at the 1% level, for the following possible reasons. First, perceived emotional support from a water user group would help households to fulfill their socioemotional needs in irrigation management. In this case, households would be willing to reward organizational identification based on reciprocity and affective commitment [67]. In other words, they would like to actively participate in irrigation management to make irrigation canals better. On the other hand, strong emotional support could stimulate households' role behavior, organizational citizenship behavior and altruistic behavior [68]. All of these would effectively decrease households' illegal use of irrigation water to ensure its fair allocation. Secondly, households would increase their recognition of the water user group if they perceived that it provided them with material support or technical assistance in irrigation. Households with high recognition tended to contribute more to irrigation management to improve the condition of irrigation canals. Moreover, the good physical support provided by the water user group to the households could guarantee their supervision of irrigation. This would be useful for a fair allocation of irrigation water.

4.3. Estimation Results: Moderating Effect

The estimation results suggested that social trust significantly and positively strengthened the positive effect of POS on the irrigation management performance at the 1% level (see Model 4 in Table 4). The possible reasons are as follows. If the households trusted the water user group, they would believe that it would do the right things and act for their benefit. In this case, households with high POS were more likely to engage in irrigation management as their social trust increased. In other words, if households trusted the members and institutions, households with POS would actively participate in collective activities under the coordination of the leaders in order to achieve the effective maintenance of irrigation canals. In addition, they would actively participate in supervisory activities to guarantee the fairness of irrigation water use.

4.4. Estimation Results: Control Variables

The final results have to do with the impacts of control variables, as shown in Table 4. The results indicated that two variables in household characteristics, namely education and leadership, had a significantly positive effect on the condition of irrigation canals. However, only leadership had a significantly positive effect on the fairness of irrigation water allocation. This might be because households with a high educational level and rich leadership had a deeper understanding of the importance of irrigation canals. This would be helpful for households to participate in collective activities. As a result, the condition of irrigation canal would become better. Moreover, households with leadership would have strong negotiation power, which could lead them to achieve the fair allocation of irrigation water. Age cannot statistical significantly affect irrigation management performance. The reason might be that, regardless of the age of the householders, they all can be physically and mentally competent to participate in irrigation management. As for agricultural income, its non-significant coefficients might due to the fact that households with different agricultural income are financially qualified for participating in irrigation management. Thus, their contribution in irrigation management and, subsequently, irrigation management performance will not vary along with the variation of householders' age and agricultural income.

For household cognition variables, the fact that irrigation management could improve the condition of irrigation canals and household income had a significantly positive effect on the irrigation management performance. Because irrigation systems are necessary to deliver irrigation water that is crucial to agricultural production, if households considered irrigation management to be important for the condition of irrigation canals and their income, they would try to participate in the irrigation management driven by self-value realization and benefits.

Regarding the group characteristics variables, the number of related households had a significantly negative effect on the irrigation management performance. In addition, the ratio of cereal crops had a significantly positive effect on the condition of irrigation canals. This might be because the problem of free-riding would become severe with the increase in the households while using the same lateral canal. Free-riding behavior could exacerbate households' feeling that irrigation water use is unfair and weaken their enthusiasm for participating in irrigation management. This would lead to the deterioration of irrigation canals. Moreover, the types of cereal crops cultivated by households in the same village were generally the same. The households growing the same cereal crops would have a consistent demand for irrigation water, indicating a high degree of homogeneity [58]. This could boost households' participation in collective activities to maintain the irrigation canals.

For the physical conditions variables, water scarcity and irrigated land area had a significant and positive effect on the condition of irrigation canals. In contrast, location of plot had a significantly negative effect on irrigation management performance. When the irrigated land size and the water scarcity increased, demand for reliable irrigation water supply increased. Thus, much effort was required to maintain irrigation canals well enough to reduce the loss of irrigation water. Nevertheless, tail-enders, whose plots were far away from the lateral canal, experienced more water stress than their counterparts at the head of the carnal [69]. What is worse was that head-enders could afford to ignore the demands and well-being of tail-enders, when head-enders perceived that they did not need the help from tail-enders [70]. Consequently, tail-enders would believe water allocation was unfair and have no incentive to maintain the irrigation canals.

With regard to rules-in-use variables, the formal rules and punishment had a significantly positive effect on the condition of irrigation canals. Similarly, water intake order and punishment had a significantly positive effect on the fairness of irrigation water allocation. The reason might be that the establishment of the formal rules could create incentives to make cooperation a rational choice [71], which might, as a result, improve the condition of the irrigation canals. Furthermore, the specified water intake order would help realize the fairness of water allocation because it could avoid the possibility of depriving water from those who start irrigating late or are tail-enders. In addition, households might try to participate in the maintenance of irrigation canals and get access to irrigation water legally in order to avoid punishment.

4.5. Robustness Test Results

To assess the robustness of the estimation results, we re-estimated Model 2 in Table 4 while using two alternative methods (see Models 5–6 in Appendix A). Model 5 estimated the samples after removing elderly people over 60 years old while using ordered probit regression. Because the elderly people are physically frail, the disadvantages are more obvious when they engage in irrigation management. Model 6 replaced the overall trust and overall support variables with other measurement variables. Overall trust was measured by the question "Generally speaking, would you say that most people can be trusted?" [72]. We used a five-point Likert scale from "1 = most people cannot be trusted" to "5 = most people can be trusted." Overall support was also measured by the responses to the statement "The village committee and/or WUA actively seek financial subsidies for the construction and maintenance of irrigation canals" [21]. We used a 5-point Likert scale from "1 = strongly disagree" to "5 = strongly agree." As indicated in Model 5 and Model 6, the results that were obtained by these two alternative methods were consistent with the results in Model 2.

5. Summary and Conclusions

With the decentralized management mode of irrigation being implemented in rural China, understanding the factors affecting irrigation management performance in a new mode is crucial for the use of sustainable resources. Given that households' behavior is motivated by social trust and POS, we focused on their impact on irrigation management performance in the upstream of the Yellow River basin in China. Furthermore, we investigated the moderating effect of social trust on POS impacting the performance. Specifically, we examined the impact of personal trust and institutional trust, which were the major components of social trust concluded through PCA, on the performance. Similarly, we examined the effect of perceived emotional support and physical support, major components of POS concluded through PCA. Moreover, we followed the IAD framework to examine the impact of other multiple factors on irrigation management performance. Then, we employed ordered probit regression to analyze the database covering 785 sample households in the survey area. The empirical results showed that irrigation management performance, including the condition of irrigation canals and the fairness of irrigation water allocation, could be promoted by social trust and POS as well as their major components. Moreover, social trust could stimulate the effect of POS on the performance. In addition, household characteristics, household cognition, group characteristics, physical conditions, and rules-in-use had significant effect on the performance.

In this context, several interesting points arise. First, although a plethora of studies document that social trust is important for households' cooperation in irrigation management [16,18], our findings provide complementary insights into this issue. Specifically, social trust can positively affect irrigation management performance. As opposed to previous studies, we analyze the effect of different categories of social trust, including personal and institutional trust, on the performance. Second, we contribute to the research field by bringing POS into the analysis of irrigation management performance. This is an extension of previous research on POS, because the subjects have been mostly companies or other for-profit organizations [38], while empirical evidence regarding water user groups is rare. However, in rural China, the leaders of village committees and/or WUAs organize the collective and supervisory activities of households in irrigation management [12]. Note that the WUAs usually are not established based on hydrological boundaries, but village administrative boundaries [73]. Therefore, the WUA is usually incorporated into a village committee rather than a dependent organization and the leaders of WUAs usually consist of village leaders in rural China. Even so, this does not prevent households from being actively involved in irrigation management to achieve irrigation efficiently when they perceive support from the village committee/WUA. Moreover, our analysis of the impact of different categories of POS on irrigation management performance is also a major innovation. Third, we show the combined influence of social trust and POS on irrigation management performance. To the best of our knowledge, this is the first study on this subject. Furthermore, in practice, our findings provide a useful guide for managers. If a water user group sets out to make CPR management more efficient and sustainable in the long run, then the managers need to take social trust and POS into account.

Despite its contributions, there are several limitations that need to be acknowledged about this research. First, the sample provinces are located in the upstream of the Yellow River basin, therefore representing the arid and semi-arid areas of China. Nevertheless, further research is needed to ascertain whether our findings are applicable to other areas as well. Secondly, the cross-sectional design is also a limitation, because the social trust and POS are formed and developed during a gradual process. Thus, future research for enriching our findings could potentially proceed with longitudinal design.

As far as the China context is concerned, future extensions to this research should encompass additional issues. An important issue of irrigation management that needs to be considered is its weak irrigation management mechanism. This study shows that the formal rules, water intake order, and punitive institution positively affect irrigation management performance. However, the irrigation management of many villages do not have sound formal rules or a punitive institution. Due to the lack of an efficient irrigation management mechanism at the village level, the irrigation management performance mainly depends on the ability of the water user group leaders. Consequently, it varies according to village, leadership, and time. Even worse, since many villages lack a punitive institution for wrongdoing (e.g., non-participation in maintenance of irrigation canals and non-compliance with water intake order), the households that do not follow the rules can still enjoy the same irrigation conditions and rights as those that do. This phenomenon, obviously, can increase the latter's perception of unfairness, which is not conducive to irrigation management. Therefore, it is clearly crucial to investigate how to build a well-developed irrigation management mechanism at the village level, according to the local conditions, in order to achieve effective and sustainable irrigation management. This could be a fruitful area for future research.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Multicollinearity diagnosis.

		Collinearity Statistics			
		1/VIF	**VIF**	**1/VIF**	**VIF**
	Social Trust				
	Overall Trust	0.847	1.180		
	Personal Trust			0.919	1.088
	Institutional Trust			0.776	1.288
	POS				
	Overall Support	0.675	1.481		
	Perceived Emotional Support			0.796	1.257
	Perceived Physical Support			0.652	1.533
Age	Household Characteristics				
	Education	0.960	1.042	0.960	1.042
	Off-Farm Employment	0.875	1.142	0.871	1.148
	Leadership	0.893	1.119	0.891	1.123
	Agricultural Income	0.427	2.342	0.426	2.346
	Ratio of Agricultural Labor	0.944	1.060	0.939	1.065
	Household Cognition				
	Effect on Condition of Irrigation Canals	0.753	1.328	0.743	1.346
	Effect on Household Income	0.767	1.303	0.756	1.322
	Expectation of Farm Production	0.913	1.095	0.902	1.109

Table A1. *Cont.*

		Collinearity Statistics			
		1/VIF	**VIF**	**1/VIF**	**VIF**
Age	Group Characteristics				
	Number of Related Households	0.920	1.087	0.889	1.125
	Ratio of Cereal Crops	0.689	1.450	0.688	1.453
	Physical Conditions				
	Water Scarcity	0.865	1.156	0.826	1.211
	Irrigated Land Area	0.476	2.101	0.474	2.109
	Location of Plot	0.850	1.176	0.849	1.177
	Rules-in-Use				
	Formal Rules	0.800	1.250	0.796	1.257
	Water Intake Order	0.709	1.411	0.707	1.415
	Punishment	0.711	1.407	0.683	1.464

Table A2. Robustness test.

Variables	**Model 5**		**Model 6**	
	(9) Condition	**(10) Fairness**	**(11) Condition**	**(12) Fairness**
Social Trust				
Overall Trust	0.476 ***	0.195 ***	0.144 ***	0.140 ***
	(0.077)	(0.074)	(0.044)	(0.044)
POS				
Overall Support	0.328 ***	0.443 ***	0.175 ***	0.282 ***
	(0.084)	(0.083)	(0.051)	(0.051)
Household Characteristics				
Age	0.006	0.003	−0.001	−0.006
	(0.007)	(0.007)	(0.005)	(0.004)
Education	0.234 ***	−0.036	0.155 **	0.010
	(0.074)	(0.071)	(0.060)	(0.059)
Off−Farm Employment	−0.007	−0.111	0.155 *	0.032
	(0.106)	(0.103)	(0.086)	(0.085)
Leadership	0.426 ***	0.474 ***	0.513 ***	0.366 ***
	(0.140)	(0.135)	(0.107)	(0.104)
Agricultural Income	0.047	−0.045	0.022	0.029
	(0.074)	(0.072)	(0.060)	(0.059)
Ratio of Agricultural Labor	−0.071	0.019	−0.042	0.141
	(0.213)	(0.206)	(0.163)	(0.161)
Household Cognition				
Effect on Condition of Irrigation Canals	0.361 **	0.384 **	0.324 ***	0.390 ***
	(0.156)	(0.153)	(0.121)	(0.120)
Effect on Household Income	0.178 **	0.180 ***	0.258 ***	0.225 ***
	(0.070)	(0.069)	(0.056)	(0.056)
Expectation of Farm Production	0.016	0.017	0.032	0.045
	(0.055)	(0.054)	(0.044)	(0.043)
Group Characteristics				
Number of Related Households	−0.007 **	−0.019 ***	−0.007 **	−0.018 ***
	(0.004)	(0.004)	(0.003)	(0.003)
Ratio of Cereal Crops	0.560 ***	0.198	0.402 ***	0.050
	(0.140)	(0.135)	(0.116)	(0.113)
Physical Conditions				
Water Scarcity	0.298 ***	0.028	0.238 ***	0.012
	(0.052)	(0.050)	(0.044)	(0.043)
Irrigated Land Area	0.002	0.002	0.004 **	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Location of Plot	−0.162 **	−0.160 **	−0.161 ***	−0.125 **
	(0.073)	(0.071)	(0.057)	(0.057)

Table A2. *Cont.*

Variables	Model 5		Model 6	
	(9) Condition	(10) Fairness	(11) Condition	(12) Fairness
Rules-in-Use				
Formal Rules	0.452 ***	−0.028	0.316 ***	0.0002
	(0.111)	(0.107)	(0.092)	(0.090)
Water Intake Order	0.062	0.390 ***	0.113	0.299 **
	(0.148)	(0.143)	(0.120)	(0.118)
Punishment	0.212 *	0.445 ***	0.197 **	0.433 ***
	(0.113)	(0.112)	(0.095)	(0.094)
Number of Observations	552	552	785	785
Prob > χ^2	0.0000	0.0000	0.0000	0.0000
Pseudo R^2	0.2238	0.1832	0.1736	0.1583
Log Likelihood	−547.8748	−620.6902	−836.4805	−908.0669

Note: Standard errors are reported in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

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