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Other-Regarding Preferences and Different Institutional Arrangements in Exploitation of the River: Experimental Economics Results in Iran

Mohamad Mahdi Kamal[a], Hadi Amiri[a*], Vahid Moghadam[b], Dariush Rahimi[c]

a. Department of Economics, University of Isfahan, Isfahan, Iran.

b. Faculty of Theology and Ahl-al-Bayt (Prophet's Descendants), University of Isfahan, Isfahan, Iran.

c. Department of Physical Geography, University of Isfahan, Isfahan, Iran.

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Abstract

The Dictator Game can describe many environmental challenges. That is the conditions where exploiters have asymmetric power in exploitation. For solving such environmental problems, solutions have been proposed, several of which focus on exogenous factors and others on characteristics of users. In this research, we are looking for a solution to one of these problems in the field of water for Iranian exploiters. To do this, we used experimental economics in the context of institutional analysis and development framework. The game was played in 19 groups of 5 participants with 1767 observations and then estimated using an econometrics model. This study showed that creating a club good downstream of the river and supporting local regulation (along with intra-system monitoring) can enable water distribution to occur more uniformly among users.

Additionally, supporting local regulation has more substantial effects than the creation of club goods in water distribution. Furthermore, the data analysis obtained through the experiment and Ring Game shows that if the upstream exploiters have an other-regarding social value orientation, it produces positive effects on the exploit of other people so that the downstream exploiters also benefit from water. Thus, this research can have some implications for solving Iran's environmental problems similar to the dictator game.

Highlights

- When resource exploiters do not have symmetrical power, governments try to solve the problem by direct intervention.
- We offer two institutional innovations, creating club goods and guaranteeing the implementation of internal rules, creating a dependency between exploiters while not possessing the disadvantages of direct intervention.
- Our result shows that water distribution among exploiters will be more proportionate if the other-regarding people are upstream.

* h.amiri@ase.ui.ac.ir

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1. Introduction

Today, the Water Crisis affects billions worldwide due to drought, population growth, declining groundwater levels, and climate change (Alavian et al., 2009; Foster & Chilton, 2003; World Economic Forum, 2019). The water crisis has impacted areas with rivers, especially in areas where rivers play an essential role in water supply for farmers (Mekonnen & Hoekstra, 2016; Nouri et al., 2019). Rivers can shape the spatial pattern of villages in linear form. The linear spatial pattern causes asymmetry in exploiting river common pool resources, greatly exacerbated by drought conditions. The asymmetric power problems in exploitation that are hard to solve occur when exploiters do not have equal power in exploiting rivers (Marco et al., 2012).

Examples of asymmetric power in exploitation from rivers can be found all over the world, from large scales such as the Jordan river basin, Nile river basin, or Tigris-Euphrates river basin (Ju'ub & Azzam, 2011) to small scales such as the Nakdong River basin in South Korea (Yoon et al., 2015) or Haihe River Basin in china (Otto & Wechsung, 2014). However, due to most parts of Iran's mountainous nature and the consequent linearity of the spatial pattern of rural settlements, this problem is very severe in Iran (Ebrahimnia & Jafari Bibalan, 2017; Mansouri et al., 2019).

Conventional definitions of the selfish economic man expect that the head-enders do not share the water with the tail-enders (Janssen et al., 2011). However, there are multiple cases of common-pool resources where exploiters have acted contrary to the assumption of the economic man (Anderies & Janssen, 2016). Furthermore, it has also been proven through economics experiments that the selfish rational choice model cannot always explain human behavior (Camerer & Fehr, 2006). However, how can this behavior of exploiters be explained?

One reason for explaining this behavior is interdependency (Janssen et al., 2011). For example, in some canal irrigation systems, the upstream and downstream farmers' ability to exploiting the system is different. For instance, upstream farmers need downstream labor to maintain the canal, making the upstream and downstream farmers interdependent (Ostrom & Gardner, 1993). This interdependency can lead the upstream, allowing the downstream to use the river water. Otherwise, the downstream exploiters also have the power to compensate in maintaining the irrigation system. For example, they do not provide the labor force in maintaining the canal.

Lansing et al. (2004) modeled this interdependency via a game-theoretical framework, where head-enders and tail-enders actors were interdependent in water and pest control. Janssen et al. (2011) has also modeled a situation in which downstream players depend on upstream players to obtain water, and upstream players depend on downstream players to provide infrastructure. Most subsequent studies on power asymmetry in exploitation have been based on Janssen et al. (2011) model (Anderies & Janssen, 2016; Anderies et al., 2013; Baerlein, et al., 2015; Ibele et al., 2017; Janssen et al., 2015; Janssen et al., 2012; Janssen et al., 2011; Otto & Wechsung, 2014; Pham et al., 2019). Botelho et al. (2015) have all used public good in their model to create interdependency.

This behavior is not only limited by interdependency but can also be explained by the characteristics of individuals. Villena and Zecchetto (2011) have pointed to an information structure that might explain emerging cooperative behavior in social dilemmas. Some researchers have used framing theory to describe the misbehaving of economic men in the public good, and other social dilemmas (Cookson, 2000; Cox, 2015; Cubitt et al., 2011; Dufwenberg et al., 2011; Fosgaard et al., 2014; Fosgaard et al., 2017; Khadjavi & Lange, 2015; Park, 2000; van Dijk & Wilke, 2000). Ostrom has also identified trust as a significant factor in building cooperation between players in social dilemmas (Ostrom, 1998, 2009; Ostrom & Walker, 2005). Ledyard (1995) has called some of these endogenous variables “systemic” variables. They are variables such as beliefs, economics training, altruism, and fairness, which are challenging to control but influential in establishing the cooperation level in a social dilemma. Andreoni (1995), Saijo and Nakamura (1995), and Croson (2007) have found some implications of individual difference variables when it comes to cooperation.

Given the importance of individual human factors in solving environmental problems, Ostrom and Walker (2005) have considered these factors in an element called the “actor” in the IAD framework, defining which three assumptions must be made. How they deal with information, how they select actions, and how they evaluate actions and outcomes (Ostrom, 2005). One way to describe a participant's valuation system is by Social Value Orientation (SVO). SVO is about how people weigh their outcomes depending on other people's outcomes (Griesinger & Livingston, 1973). For example, with actual results, it has been shown that in 60% of cases of the dictator game, people consider a share for the rest (Forsythe et al., 1994). SVO can be explained by $u(\pi_s,\pi_0)=\pi_s+\alpha*\pi_0$. In this general function, the utility of the decision-maker is a function of his own gain π_s, and the gain of other players π_0. α is the degree to which others are considered (Moisan et al., 2018).

In Iran, due to the mountainous nature of most areas and, as a result, the problem of power asymmetry in exploitation, it is essential to understand the factors affecting the exploitation of farmers. Moreover, understanding the exogenous and endogenous factors influencing Iranian exploiters' behavior can assist politicians in providing better institutional arrangements. Consequently, in this study, the behavior of exploiters in different exogenous conditions (such as dependency through club goods and internal supervision) and endogenous conditions (intensity of other-regarding) will be evaluated.

Janssen et al. (2011), Anderies et al. (2013), Baerlein et al. (2015), Ibele et al. (2017), Janssen et al. (2015), Otto and Wechsung (2014), and Pham et al. (2019), have studied asymmetric power in water resource exploitation. Still, they did not pay attention to the value structure of participants. On the other hand, other-regarding studies have not explicitly focused on river water exploitation (Ackermann & Murphy, 2019; Fleiß et al., 2020; Luccasen, 2012; Moisan et al., 2018; Murphy & Ackermann, 2015; Murphy et al., 2006; Offerman et al., 1996). In this study, we seek to study the problem of power asymmetry in exploitation by considering the value diversity of individuals.

In the remainder of the paper, we first explain the methodology of the research in section 3. We also introduce the base experiment as well as the treatments in this section. Then, in section 4, we present the quantitative results of the experiment. Finally, the discussion and conclusion are presented in section 5.

2. Methodology

2.1 Framework

Neither endogenous nor exogenous factors alone can explain the cooperation in interactions (Ackermann & Murphy, 2019). Therefore, to dissect the "black box" of interactions or, in other words, the "action situations" (McGinnis, 2011), the effects of these two types of variables must be examined together.

Frameworks help researchers understand challenges by identifying, categorizing, and organizing the most relevant factors (McGinnis, 2011; Ostrom et al., 1994). This study used the institutional analysis and development (IAD) framework, which contains a problem-solving orientation (Schlager & Cox, 2018). Ostrom invented this framework to facilitate analysis by offering the researcher's factors for understanding institutional context.

In this framework, participants interact in an "action situation," where their decisions result in an "outcome" (McGinnis, 2011). Action situation is shaped by three sets of exogenous variables: material conditions, community attributes, and rules. These variables are essential in all institutional arrangements (Ostrom, 2011). The various components of this framework are shown in Figure 1.

Material conditions are factors such as the nature of the irrigation system's goods, infrastructure, and size (McGinnis, 2011; Meinzen-Dick, 2007). Agrawal (2001) has pointed to appropriate leadership, successful experience, shared norm, heterogeneity, and interdependency as community characteristics that are effective in the sustainability of the commons. Rules are prescriptions about what individuals are allowed or obliged to do (Ostrom, 2019).

In this framework, participants animate action situations (Schlager & Cox, 2018). Due to this, it is essential to consider assumptions about the mental model of participants. These assumptions are about: 1- participants' method of dealing with information, 2- participants' valuation of actions and outcomes, and 3- processes of selecting actions (Ostrom, 2005). These assumptions shape endogenous variables.

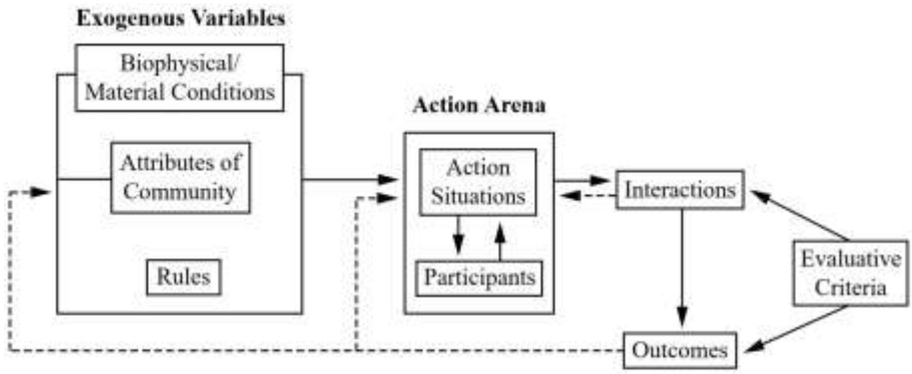

Figure 1. For institutional analysis and development framework
Source: *(Ostrom, 2005).*

Our study considers five exploiters who are located along a river and compete for the river water. Due to the river structure, exploiters do not have symmetrical power in exploitation, making their rivalry over the river a zero-sum dictator game (Villamayor-Tomas et al., 2019). We also did not consider all players to be the same and selfish, which means that not all of them are selfish, and some are deemed other-regarding. Our study examines the effect of different rules on participants' behavior with non-identical characteristics to determine the outcome of such variables for Iranian exploiters.

2.2 Research Method

Different methods are used to analyze the action situation in this framework, where case studies, lab experiments, field experiments, game theory, and agent-based modeling methods being among them (Poteete et al., 2010).

Experimental economics has special features that are a unique method for understanding institutions (Grechenig et al., 2010) because it contradicts expectations from formal models in which actors are entirely self-interested (Poteete et al., 2010). This study used data from experiments to understand individual's different valuation processes and their role in local river water distribution using a different rule. Most experimental studies on common-pool resources are based on the assumption that users have the same power in exploitation. However, multiple asymmetric common-pool resources exist (Janssen et al., 2011; Ostrom & Gardner, 1993).

2.3 Conceptual Model of the Research

As shown in Figure 2, we reviewed the literature on the subject during the first step of the study. In the second step, based on the data of the first step, the course of action was contemplated, and two new institutional arrangements were proposed. In the third phase, the proposed institutional arrangements were coded for implementation via the web. Also, students who were familiar with the problem of asymmetry in their residential areas were selected. The experiments were performed with these students. The data extracted from this step was then analyzed in the fourth step using the statistical regression method.

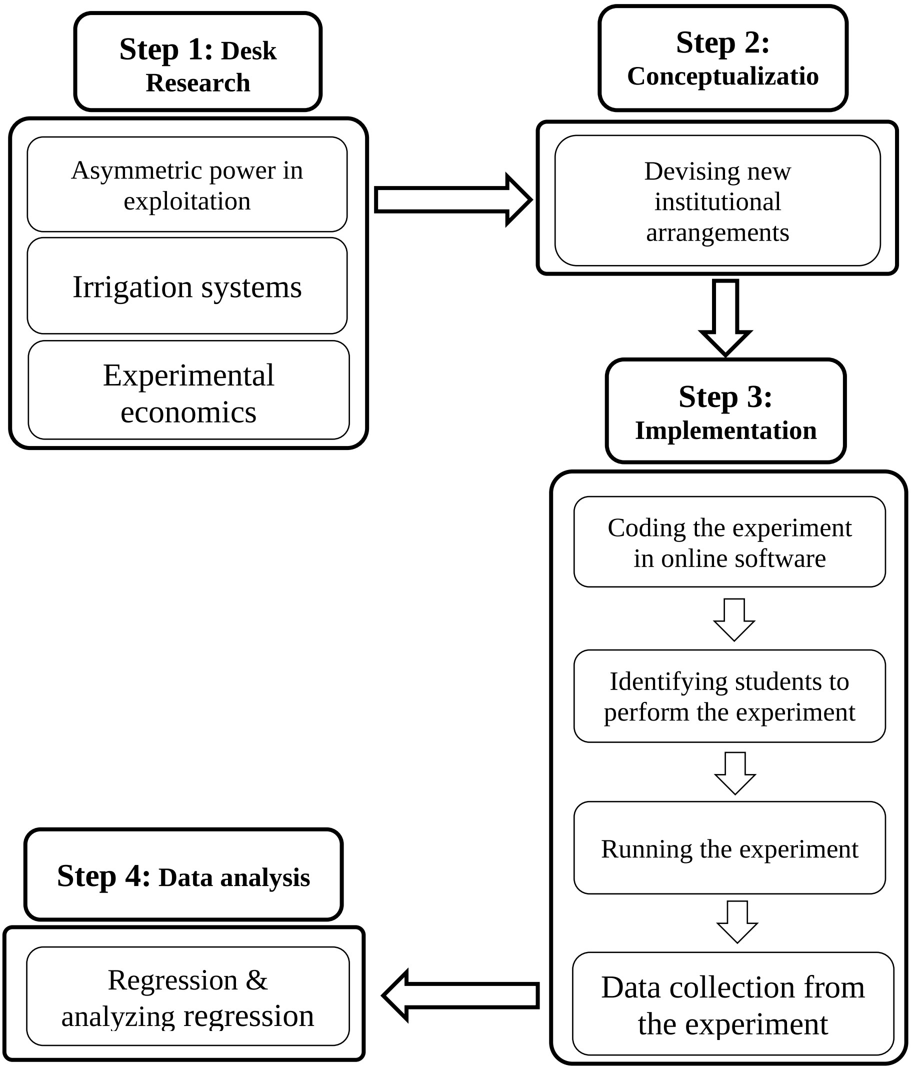

Figure 2. Overview of research methodology

2.4 Experimental Design

2.4.1 Experimental Design Generalities

The experiment design is based on the experiments conducted by Janssen et al. (2011), Anderies et al. (2013), Otto and Wechsung (2014), Baerlein et al. (2015), Janssen et al. (2015), Ibele et al. (2017), and Pham et al. (2019) but with modifications, explained below. The experiment is a 5-player game whose positions are shown in Figure 3. The players' positions along the river are located as A, B, C, D, and E. Player A is at the head-end, while player E is in the tail-end position. Therefore, they do not have symmetrical power in exploiting the river water. This experiment consists of three stages: The base game stage, the treatment stage, and the ring game. The base game and the treatment stage each have ten rounds of play.

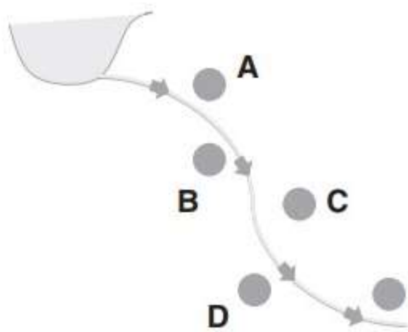

Figure 3. Position of players along the river
Source: *Otto & Wechsung, 2014*

The amount of available water for the first player is 100 units. Each player has to decide the amount of water to exploit from the river and the amount left for the next player. The decisions are made from the head-ender to the tail-ender. The first decision is made by the first player, i.e., the player in position A. He must decide how much water to exploit from the river and how much to leave for the next player. The next player has to make the same decision. Exploiting one unit of river water will earn one unit of pay-off for the players. All receipts and payments of this game are based on this criterion. Decisions in this game are confidential, and only players will be informed about the outcome of the collective decision.

All players initially played ten rounds of the base game. Afterward, some groups played the treatment 1 (self-monitoring) game, and others played the treatment 2 (club good) game. Different treatments are for testing the role of other-regarding people in different situations with a different rule. The overview of the experiment is shown in Figure 4.

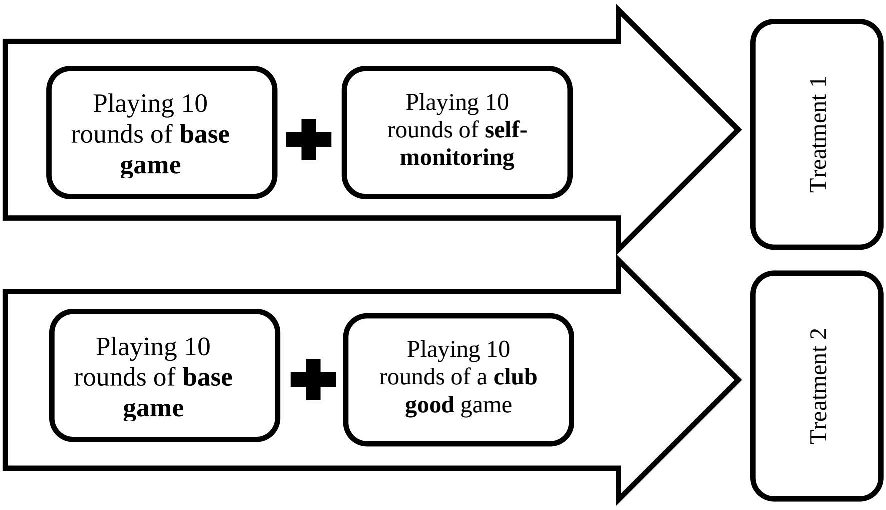

Figure 4. Overview of experiment sequence

Due to the prevalence of the coronavirus epidemic, this test was performed virtually using the ClassEx (Giamatte et al., 2020) and WhatsApp web applications. ClassEx is a novel software that allows researchers to carry out experiments via the web. First, each player played a single round to learn how to play and then asked their questions in the WhatsApp group.

2.4.2 The Base Game

In this game, players were randomly placed in a position from one to five along the river and remained in that position until the ten rounds. The capacity was randomly selected from the numbers 60, 50, 50, 40, and 40 and then assigned to players. The players cannot exploit more than their capacity from the river. In this game, there are no dependencies between upstream and downstream, contrary to the Janssen et al. model (2011), creating a dependency between the players through the contributions of the downstream players to the public maintenance fund (Otto & Wechsung, 2014). The Nash equilibrium in the experiment for all players is to exploit water from the river for as much as possible. As a result, all river water is distributed between the first two or three players based on the exploitation capacity for each player.

2.4.3 Treatment 1: Self-Monitoring Game

After ten rounds of playing the base game, half of the players engaged in treatment one. Like the base game, the players were randomly placed in positions one to five along the river and remained in that position until the end. The exploiting capacity for the players were selected randomly from among 60, 50, 50, 40, and 40 units. In this game, the players were both making rules internally and monitoring the implementation of the rules internally. For example, they voted on a fair rule for water division before starting the game. The amount of fair-share of the river water is defined based on the selected rule determining how to allocate 100 units of river water. Voting on these rules allowed the players to reach an agreement faster. This type of institutional formation can be suitable for a society that can form collective action, solve their problem by internal regulation, and monitor accordingly. Various studies have shown that in self-organized systems where users can actively participate in governing the system, the management of the CPR would be successful. This factor is also one of eight principles of Nostrum's Common Pool Resource institution (Ostrom, 1990). Cardenas et al., (2000) have also proven this with experimentation.

The rules are:

1. Equal share for all players: Each player exploits 20 units of water ($\frac{100}{5}$=20).
2. More share for upstream players: As calculated in Table 1, the players take 30, 25, 20, 15, and 10, respectively.
3. Share in proportion to capacity: players with a 60 capacity will have 26 units, 50 will have 21, and 40 will have 16 units. Calculations are shown in Table 2.

Table 1. Calculation of the second exploitation rule. Each player's share of 100 units of water is weighed according to their position

Position	Weight	Proportion	Share
1	5	$\frac{5*100}{15}$	≅30
2	4	$\frac{4*100}{15}$	≅25
3	3	$\frac{3*100}{15}$	≅20
4	2	$\frac{2*100}{15}$	≅15
5	1	$\frac{1*100}{15}$	≅10
	sum= 15	**sum= 100**	**sum= 100**

Source: *Authors*

Table 2. Calculation of the third rule of exploitation. Each player's share of 100 units of water is weighed according to their capacity

capacities	Proportion	Share
60	$\frac{60*100}{240}$	≅26
50	$\frac{50*100}{240}$	≅21
50	$\frac{40*100}{240}$	≅21
40	$\frac{40*100}{240}$	≅16
40	$\frac{40*100}{240}$	≅16
sum= 240	**sum= 100**	**sum= 100**

***Source**: Authors*

Before starting each round of the game, each player can pay for randomly monitoring the exploitation of one or two players by paying 5 or 10 units. In addition, the offending player will be fined 1.5 times their excess exploitation.

2.4.4 Treatment 2: The Club Good Game

The players who did not engage in treatment one will play in treatment two. In this game, players were placed randomly at the beginning of the game and remained in that position until the end. The exploitation capacity of the players were selected randomly from among 60, 50, 50, 40, and 40 units. In this game, if ten units or more of water reaches the 5th player, the amount of 0.4 units of water received by the last person was added to all of the players. For forming a social dilemma, this coefficient must be less than one. The extra income is due to the last player having a water mill that requires at least ten water units to work, and its outcome concerns all the players.

In this game, to eliminate the asymmetry between the villages, club goods were created in the last village, which was helpful for all villages. In this situation, the upstream players also became dependent on the downstream players, and the initial asymmetry was moderated. This type of institutional arrangement can be suitable for a society that cannot form a collective action, and as a result, their problem needs to be solved from the outside. However, as Villamayor-Tomas et al. (2019) mentioned, these situations (asymmetric power in exploitation from the river) are a zero-sum game where the government needs to make pay-off changes through economic tools, namely command-and-control.

The Nash equilibrium in the experiment for all players was to exploit river water as much as they could. Therefore, all river water was distributed between the first three players based on the exploitation capacity of each one.

2.4.5 Ring Game

We used the ring game to measure how other-regarding people are. Offerman et al. (1996), Luccasen (2012), and Buckley et al., (2001) have used this game to elicit value orientations. In the ring game, players make a series of choices to allocate some resources between themselves and a random partner. The arrangement of choices is shown in Table 5 in the appendix section. We used the same random Luccasen (2012) ordering for all players. The participant had to choose either A or B in each choice number.

Adding up all the participants' chosen vectors will show us an estimate of the individual's social value orientation vector. this vectors' horizontal axis measures allocation to oneself (x), and the vertical axis measures allocation to others (y) in which $x^2 + y^2 = 100$. $\cot^{-1}(\frac{x}{y})$ shows the angle assigned to each person, which is explained in Table 3.

Table 3. Ring game and personality description (Offerman et al., 1996). The summation of player selections forms the vectors of X and Y. The calculation of $cot^{-1}(\frac{x}{y})$ ***shows the angle assigned to each person, and puts them in one of the personality types***

Interval changes of π	**Type of personality**	**Description of personality**
$67.5^\circ < \pi < 112.5^\circ$	Altruistic	"Want to do best for others, regardless of the outcome for themselves."
$22.5^\circ < \pi < 67.5^\circ$	Cooperative	"Pursue the best for both themselves and the others."
$-22.5^\circ < \pi < 22.5^\circ$	Individualistic	"Tries to do best for themself."
$-67.5^\circ < \pi < -22.5^\circ$	Competitive	"Usually wants to be better off than their neighbors."
$-112.5^\circ < \pi < -67.5^\circ$	Aggressive	"Wants to do worst for others, regardless of the outcome for themselves."

Source: *Authors*

Figure shows $\boldsymbol{x^2 + y^2 = 100}$, which is a function of a circle with $(\mathbf{0}, \mathbf{0})$ center, and a radius of 100. The Ring Game choices are 24 points on the circle, separated by a π/12 angle.

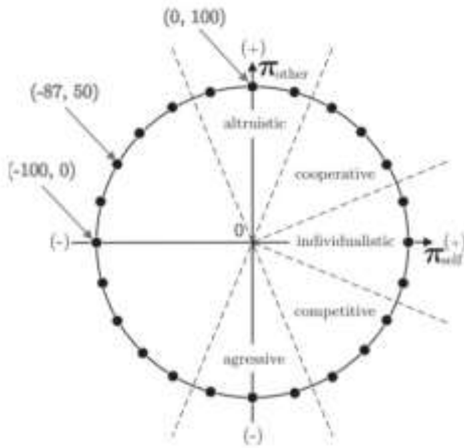

Figure 5. The value orientation circle with radius r = 100. The choices are 24 points on the ring, separated from each other by a π/12 angle
Source: *Mahe & Muller, 2007.*

3. Results

The experiments were performed between October and November 2020 via the web and among economics undergraduate students in Iran. The participants were mostly from cities in Iran with such a problem, and the participants were familiar with asymmetric power in water exploitation within their towns. The participants were included in 19 groups, and each group had 5 participants. We ran different treatments in our experiments to examine how external and internal variables affected individuals' choices.

Each game consisted of a base game followed by a treatment game which lasted for about 2 hours. For creating a competitive atmosphere, it was agreed before the game that the students would be given a grade based on the ratio of points they scored. 58% of the players were male.

Figures 6 and 7 show the average measure of exploitation for each player during the different treatments. The left side of Figure 6 shows the average level of exploitation for various players in the base game rounds. The exploitation of the first and second players is almost the same. However, with the passing of the rounds, the first player's average exploitation level became less than that of the second player. This was due to the first person knowing that if they exploit too much, the second person will figure this out. Nevertheless, the second person knows that if he exploits too much, the third person is unsure that if this was the first persons doing or the second person. For this reason, the second person is more inclined to over-exploit.

The average exploitation level of the last two players increased over ten rounds but was the lowest compared to the other players. The right side of Figure 6 shows the level of exploitation for the same players in the self-monitoring treatment. As shown on the right of Figure 6, the variations in the different players' exploitation levels decrease compared to the first ten rounds. The mean of the

Gini[1] coefficient of exploitation in the base game is 0.5314, and in the self-monitoring treatment is 0.3223, which their difference with T-statistic of 31.3279 is not rejected.

In Figure 7, the same general trend of Figure 6 can be seen. The average exploitation levels of the first and second players are almost equal. The left side of this figure shows the average exploitation levels of different players in the base game. The farther we go from the head of the river, the lower the average exploitation level. The right side shows the exploitation levels of the same players in the club good treatment. As with the first form of treatment, this treatment also brought the exploitation of different positions closer together. The mean of Gini coefficient exploitation in the base game is 0.5169, and in the club good treatment is 0.3662, which their difference with T-statistic of 22.2649 is not rejected.

Figure 6. Comparison of average exploitation in different positions in the base game (rounds 1 to 10) and the self-monitoring treatment (rounds 11 to 20)

Note: As it turns out, from round 11 to round 20, in which self-monitoring treatment is running, the players' choices are getting closer.

[1] Taking y to mean the players choices, for a population uniform on the values y_i in which $i = 1 \ to \ n$, and $y_i < y_{i+1}$, Gini is $\frac{2\sum_{i=1}^{n} i y_i}{n\sum_{i=1}^{n} y_i} - \frac{n+1}{n}$

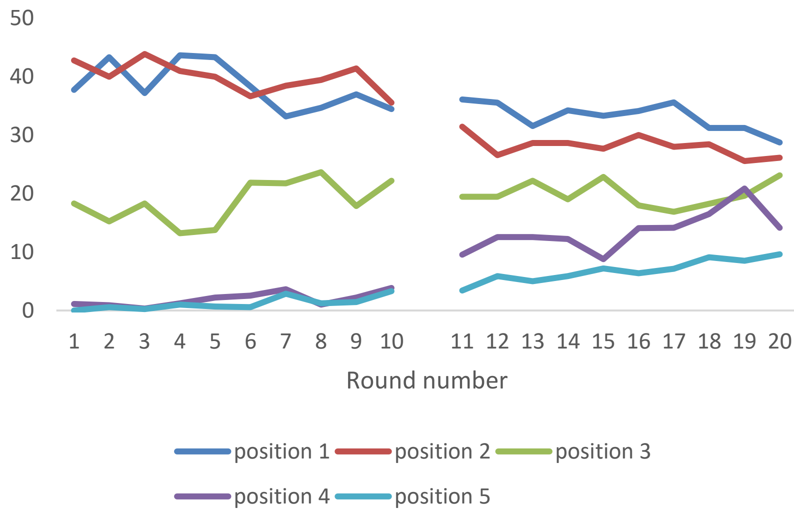

Figure 7. Comparison of average exploitation of different positions in the base game (rounds 1 to 10) and the club good treatment (rounds 11 to 20).
Note: The establishment of the club good treatment has also caused the downstream player to benefit from more water

As shown in Figure 8, most of the participants in the experiment had an individualistic personality. The relative percentage of each personality group is shown in Figure 8.

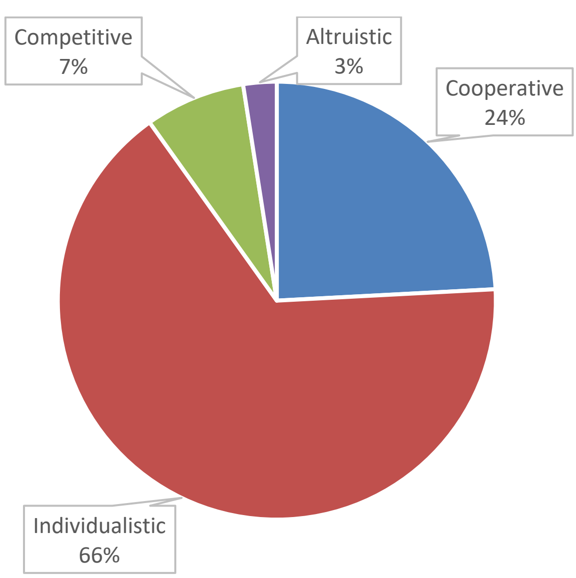

Figure 8. Relative Frequency of SVO

Individual difference has also been effective in distributing water among exploiters. In general, other-regarding people (cooperative and altruistic) exploit an average of 53.52% of the total water they could exploit, while self-regarding people (individualistic and competitive) exploit an average of 61.71% of the total water they could exploit. As shown in Figure 9, the other-regarding people exploited less than the self-regarding in the base game. However, in self-monitoring treatment and club good treatment, the difference in exploitation between the two groups is not apparent (Figure 10 and Figure 11).

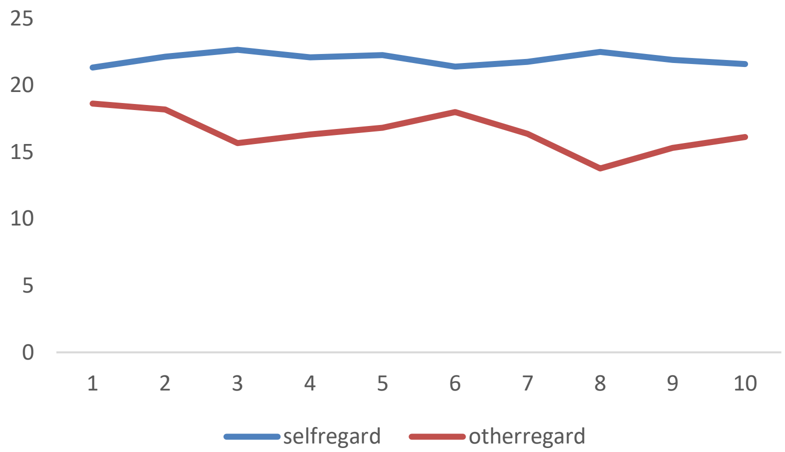

Figure 9. Average exploitation of different type of people in different rounds in the base game

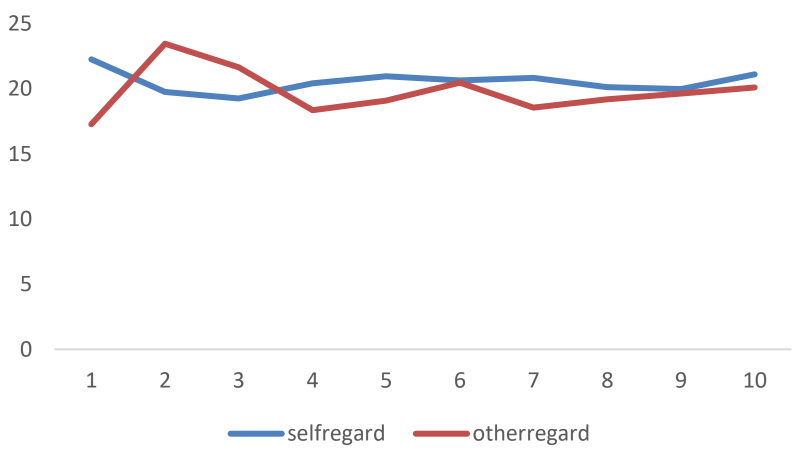

Figure 10. Average exploitation of different type of people in different rounds in self-monitoring treatment

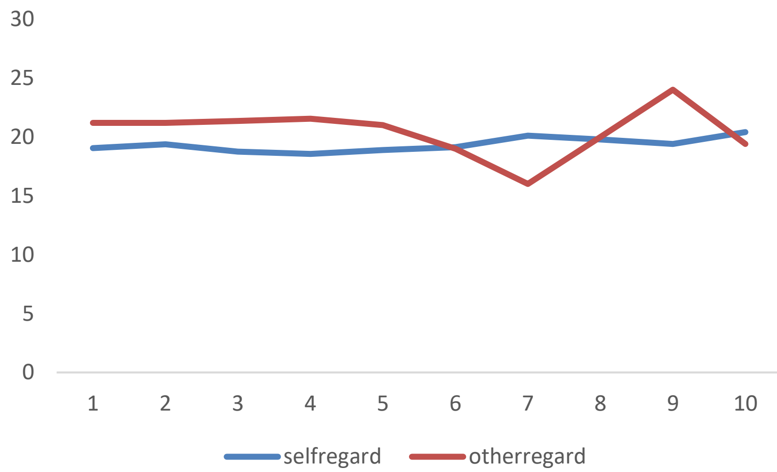

Figure 11. Average exploitation of different type of people in different rounds in club good treatment

Using experimental data, we estimated the following model via the OLS method. All variables used in this model, except the $AbsChoice_{it}$variable, are dummy variables.

$AbsChoice_{it} = c_1 + c_2 * PST1OTHER_{it} + c_3 * TRT2_{it} + c_4 * TRT3_{it} + c_5 * PST1OTHER_{it} * TRT2_{it} + c_6 * PST1OTHER_{it} * TRT3_{it} + u_{it}$

In this model, i, and t represent the players, and the game round, respectively. c_i is the coefficient of the model. $AbsChoice_{it}$, as the dependent variable, equals $|choice_{it} - 20|$. $choice_{it}$ is the amount of water exploitation by each person in each position. We use this index as a symbol of the uniform distribution of water. The exploitation of more or less than 20 units of water is known as a non-uniform distribution in this model. We could have used the Gini coefficient instead of this index, similar to Javaid and Falk (2015), Janssen, M. A. et al. (2011), and Janssen et al. (2015). However, using the Gini coefficient would have reduced the data. The index, which is used as a dependent variable, represents the uniform distribution of water among exploiters. If the index reduces to zero, water distribution will be uniform, and as a result, everyone has water. As the fifth player has no option, and other players impose their choice, we did not use their data.

$PST1OTHER_{it}$ is a dummy variable that shows whether the person in the first position of the group is other-regarding or not. $TRT2_{it}$ shows whether the model is in self-monitoring treatment or not., and also, $TRT3_{it}$ shows whether the model is in club good treatment or not. Multiplying these two types of variables makes an interaction variable that is $PST1OTHER_{it} * TRT2_{it}$, and $PST1OTHER_{it} * TRT3_{it}$ and indicates whether the player in the first position is other-regarding or not in self-monitoring and club good treatments. If all independent variables are zero, the model's intercept is the mean of the dependent variable in a situation in which the first player is not other-regarding, and the base game is running.

The above model makes it possible to test the role of different conditions in water distribution statistically. After validating the data, we ran this model with EViews 12 based on the Least Squares method with 1622 observations. Table 4 shows the regression results.

Table 4. Regression model results with OLS method

Variable	Coefficient	Std. Error	t-Statistic	Prob.
c_1	18.44314	0.402571	45.81336	0.0000
$PST1OTHER_{it}$	-4.376477	1.211134	-3.613537	0.0003
$TRT2_{it}$	-10.90375	0.609846	-17.87952	0.0000
$TRT3_{it}$	-6.981876	0.596260	-11.70944	0.0000
$PST1OTHER_{it} * TRT3_{it}$	3.237083	2.151090	1.504857	0.1326
$PST1OTHER_{it} * TRT3_{it}$	-1.834790	2.232686	-0.821786	0.4113

***Source**: Authors*

The F-statistic of the model is 75.695, with a probability of 0.00. To avoid heteroscedasticity, we made the variance-covariance matrix robust with the Huber-White-Hinkley covariance method. As a result, the intercept of the model is significant.

It is implied that in the base game, when the first player is not other-regarding, players exploit an average of 18.44 points less or more than a uniform distribution of water (which is 20 units for each one). However, if the first position player is other-regarding, the water exploitation will be 4.37 units more uniform. The implementation of the second and third treatments also helps the uniform distribution of water by 10.9 and 6.98 units. However, due to the insignificance of coefficients, it cannot be confirmed that the presence of the other-regarding person in the first position during treatments has been influential on the uniform distribution of water.

We used the Wald test to check which treatments had the most significant effect on the uniform distribution of water among the exploiters. The result of the Wald test with a probability of 0.00 indicates a more vital role of the self-monitoring treatment in the uniform distribution of water.

4. Concluding remark

One example of environmental and social dilemmas is the water distribution issue among upstream and downstream exploiters. Numerous studies have been conducted in the field, where interdependence between the upstream and downstream players was considered by default. Janssen et al. (2011), Anderies et al. (2013), Baerlein et al. (2015), Ibele et al. (2017), Janssen et al. (2015), Otto and Wechsung (2014), and Pham et al. (2019), being among them.

However, there are many examples where the interdependence between upstream and downstream exploiters has disappeared in reality. Like Iran, where the government has created irrigation infrastructure for the villagers, with abundant oil revenues, and eliminated the dependence of upstream players on the workforce of downstream players. Institutional analysis of such situations can help policymakers devise the best policy in the face of Iranian exploitation.

It is deemed necessary to consider endogenous and exogenous variables, which the Ostrom institutional framework is suitable for, to perform such an analysis. For this reason, we used the framework of institutional analysis, development, and experimental economics tools to investigate the impact of external rules on the Iranian exploiters. Furthermore, contrary to the rational human assumption, we considered various social value orientations for the exploiters in this model, which has been done before in Ackermann and Murphy (2019), Luccasen (2012), Fleiß et al. (2020), Moisan et al. (2018), Murphy et al. (2006), Murphy and Ackermann (2015), and Offerman et al. (1996) studies, however, none of these concerned river water exploitation.

This study showed that in the absence of interdependency between upstream and downstream exploiters, downstream exploiters would be deprived of water flow. Still, there is an exception. If the upstream player has an other-regarding social value orientation, water will be distributed uniformly among the actors. In addition, institutional conditions such as internal monitoring or interdependency with club goods can also improve water distribution among players. The policy implications of this study indicate that even when there are no rules between exploiters, there is no license for direct governmental interference in institutional arrangements. However, due to the personality traits of some exploiters contributing to the fair distribution of water, in situations where there is a conflict between exploiters, the government can help uniform water distribution by creating interdependencies between exploiters through local regulation (with internal monitoring) and club good. This study also showed that the impact of local regulation is more significant than previously thought.

Due to the pandemic, we were unable to perform this experiment in a field setting. That is why we experimented with the web. The virtual nature of the experiments meant it took longer than regular experiments, and as a result, participants became fatigued. This research can be repeated with field experiments or with the establishment of other institutions and rules.

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Appendix

Table 5. Pair of options, and its order in experiment

	Options				
	A		B		
Choice number	Own earnings	Other earnings	Own earnings	Other earnings	Order used in experiment
1	100	0	97	26	6
2	97	26	87	50	23
3	87	50	71	71	8
4	71	71	50	87	10
5	50	87	26	97	4
6	26	97	0	100	1
7	0	100	-26	97	22
8	-26	97	-50	87	7
9	-50	87	-71	71	21
10	-71	71	-87	50	11
11	-87	50	-97	26	19
12	-97	26	-100	0	24
13	-100	0	-97	-26	12
14	-97	-26	-87	-50	16
15	-87	-50	-71	-71	13
16	-71	-71	-50	-87	5
17	-50	-87	-26	-97	17
18	-26	-97	0	-100	3
19	0	-100	26	-97	15
20	26	-97	50	-87	2
21	50	-87	71	-71	9
22	71	-71	87	-50	20
23	87	-50	97	-26	18
24	97	-26	100	0	14

***Source**: Luccasen, 2012*