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The determinants of sustainable irrigation water prices in Iran

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Abstract

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Iran is one of the world's arid and semi-arid regions, and optimal use of water is one of the challenges facing policymakers in the country. This study seeks to evaluate the economic, social and environmental effects of determining irrigation water prices of areas under the irrigation system of Qazvin plain in Iran. Water demand management has manifested itself as an approach to this problem, especially in the recent decades, and water pricing is considered as a mechanism for its management. Using pricing policies for water resource management does not only impact demand, but also brings about economic, social and environmental effects. In this study, the Positive Mathematical Programming (PMP) was used to simulate the behavior of farmers and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) and Analytic Hierarchy Process (AHP) were used to determine the weight-criteria for ranking prices. The results show that economic and social criteria have the highest weight in the selection of water price in Iran compared with environmental criteria. Also, we will expect that with the increase of environmental concerns in Iran, the government needs to select the higher prices for irrigation water.

Keywords: water demand management; water pricing; environmental criteria; TOPSIS; Iran

Introduction

Increasing population growth, the global warming, and the increase in water demand and consumption will lead to further deterioration of water resources in the future (Vörösmarty et al., 2000). Considering the doubling of the world population in the next fifty years, the large grain-exporting countries such as the U.S. and Canada may not have enough stocks to be able to export grains, and countries with money may not even be able to buy and import food. Taking into account the fact that production of 72 million tons of food is needed for a country with a population of 75 million (the Ministry of Agriculture), Iran has no option but to improve and enhance water demand management.

The climate conditions do not allow an increase in the water supply, and considering the restrictions on food imports, the only way to save water resources in the present situation is non-structural policies such as water demand management and optimal water pricing that help enhance the efficiency and productivity of water. However, optimal water pricing, besides reducing water consumption, also has other conflicting economic, social and environmental consequences (Gómez-Limón and Riesgo, 2004a; Latinopoulos, 2008). For example, considering the environmental perspective to select the right price for irrigation water, it will lead to negative economic and social impacts such as reduced profitability of farms and a decline in demand for the labor force (Berbel et al., 2009; Gallego-Ayala, 2012). This can be of special importance in the rural areas, considering the significance of employment and income in the rural areas (Messner et al., 2006). On the other hand, considering the economic indicator of cost recovery of water as the only factor in choosing the optimal price for irrigation water will exacerbate the socio-economic problems of deprived areas (Latinopoulos, 2008). Thus water pricing in the agriculture sector is an extremely sensitive and essential determinant of the effects of all these policies (Manos et al., 2006; Gallego-Ayala, 2012).

Hence, water resource policy makers and planners need a scientific framework to select an optimal pricing scheme for irrigation water. There is a need to have their policies and pricing scenarios be tested before implementation within the framework of a scientific model in order to assess the effects on economic, social and environmental indicators, adopting a pricing policy that addresses and solves the problems of the farming communities (Gallego-Ayala, 2012). The multi-faceted and interdisciplinary nature of the problem of water resources requires the integration of economic, social and environmental problems into an integrated analytical framework (Serageldin, 1995). In this study, the PMP, TOPSIS, and AHP are used to simulate the behavior of farmers and determine the weight-criteria for ranking water prices.

The aim is to use a positive mathematical programming model that simulates farmers' behavior and compares some pricing methods in order to measure their effects on the economic, social and environmental criteria and final determinants of sustainable irrigation water prices. The hypothesis underlying this research is that reforming water pricing policy based on sustainability is sufficient to significantly affect sustainable water management. In other words, the analysis is focused on testing the basis of farmers' reactions towards radical changes in the water policy, and to encourage policy makers introduce challenging water policy reform to balance and improve the economic, social and environmental concerns. The various stages of this process are as follows:

1. Estimating different production functions for the main products of the region, and selecting the best model based on the desired statistics.

2. Calculating the economic value of water (i.e., estimation of a point on the water demand function).

3. Calculating the cost of water supply and transportation (i.e., estimation of a point on the water supply function).

4. Simulation of the PMP model.

4.1. Estimation of the LP and shadow prices

4.2. Calibration of the production function

4.3. Simulation of the model

5. Calculating the economic, social and environmental effects of different water pricing scenarios.

6. Calculating farmers' responses to different water pricing scenarios

7. Calculating the weight criteria (AHP).

8. Ranking prices (TOPSIS).

9. Sensitivity analysis

The main steps of the methodological framework are shown in Fig. 1.

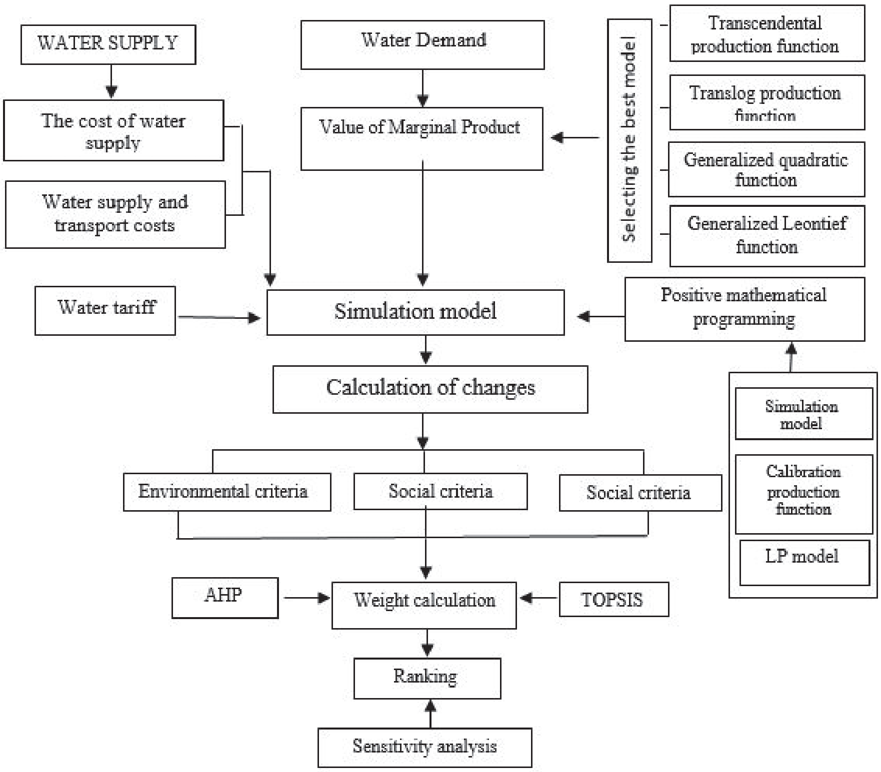

Fig. 1. The main steps in the methodological framework

The contribution of this paper is two-fold. Firstly, there is no paper that has evaluated the irrigation water prices in Iran. Secondly, for the first time, we attempt to use the value of marginal product of water (obtained from the production function), cost of water supply, water supply, and transport costs, water tariff as alternatives of the irrigation water prices that use in the simulation model of positive mathematical programming.

Aidam (2015) used a model of mathematical programming, Multi-Analysis Tool for the Agricultural Sector (MATA), to explore the impact of water-pricing policy on water demand that influences crop pattern and revenue change. The results showed that water-pricing policy has a negative effect on water demand in Ghana, but this impact happens only if water prices are increased significantly. Giannoccaro et al. (2010) used a linear programming model based on the expected utility theory to find the impact of alternative water pricing schemes on income distribution. Giannoccaro et al. (2010) also compared some pricing methods to measure their impacts on income distribution and probed income distribution among different types of farms and groups. The results indicated that water pricing schemes do not affect the income distribution among farm types, although a significant impact emerges on the distribution among social groups, and in particular on the wages of temporary workers.

Cortignani and Severini (2009) used a positive mathematical programming method to investigate farmers' behavior. The results showed that enlarging water costs do not motivate the adoption of deficit irrigation techniques. Farmers are motivated to save water by altering full irrigation to deficit irrigation when water availability is reduced and/or the irrigation prices are increased. Latinopoulos (2008) developed a methodology suitable for estimating the potential environmental, economic, and social impacts of water pricing by utilizing the Multi-Attribute Utility Theory, which is a simulated agricultural decision-making tool used for various water pricing scenarios. In that study, water demand functions were elicited and the differential impact of water pricing in each region was analyzed. Bell and Griffin (2008) summarized available methods of unbiasing the price index. New indices of marginal water price changes were shown to explain consumption variation better than average water price changes.

Gomez-Limon and Riesgo (2004b) expanded the methodology for different types of farms in an irrigable area that can analyze the differential effect of pricing policy for water irrigation. For this purpose, also, the Multi-Attribute Utility Theory mathematical programming was used. The results showed demand for labor and agrochemicals depend on water pricing. Berbel and Gómez-Limón (2000) used linear programming for calculating water pricing impact in Spain. The results showed water pricing did not have valid means of significantly reducing agricultural water consumption, and also had a negative impact on agricultural employment and farm income. They also showed there would be a reduction in the number of crops in the crop pattern, and when water consumption decreased as a consequence of substitution of crops with higher demand for water, there would be a significant loss of employment both directly on farms and indirectly in processing facilities. Munasinghe (1990) focused on improving efficiency in the water and sewerage sectors through long-run marginal cost pricing adjusted for financial needs, externalities, second best considerations, lifeline tariffs and cross-subsidization within an integrated water resource planning framework. Supply efficiency suggested that for a given price structure, an optimal long-run investment increased net social benefits.

The case study: Qazvin plain

This research focuses on the Qazvin plain, which is located in the center of the Northern Iran (Fig. 2). The crop pattern in this irrigated 30910 ha include: wheat (66%), barley (6%), alfalfa (8%), maize (11%), tomato (3%), colza (7%), sugar-beet (2%), potato and bean (1%), and other crops (2%). The official water allocation is around 7597 m^3/ha per year. The most widely used irrigation system is the traditional irrigation. Water pricing is currently based on a fixed tariff for each cubic meter of water. In the year 2013, it was 196 Rials/m^3. It should be noted that the modern irrigation systems are rarely used in this area and these systems belonging to government farms. These farms don't accept any trace of water pricing policies. Therefore, in this study, we have considered only the surface irrigation system.

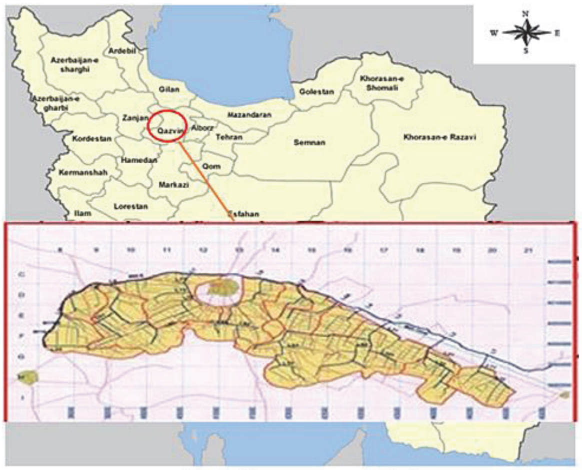

Fig. 2. The study area: Qazvin plain

Methodology

Policy makers, especially those in the agriculture sector are expected to be aware of the consequences of different policies and take into account farmers' reactions to various policy situations and look for a model simulation that can ultimately help them make better decisions. The conventional method to simulate the decisions of economic agents is to create a model which reflects the limitations, opportunities, and the goals for the current situation (Arfini et al., 2003). The PMP, which is an empirical analysis method, is of particular importance in the political economy analysis that incorporates all the available information no matter how rare. The increasing need for model simulation of behavioral functions under various technical, economic, political and environmental conditions has strengthened using the PMP with calibration capabilities that do not have the problem of excessive specialization and results in models with more parameters validation and flexibility (Howitt, 2005). These models have been widely used in applied research and policy analysis (House et al., 1987; Kasnakoglu and Bauer, 1988; Miller and Lence, 1998; Preckel et al., 2002; Röhm and Dabbert, 2003; Cai, 2008). On the other hand, the non-linear yield and cost functions are correct to calibrate models.

The step of creating positive mathematical programming can be summarized as follows: First, a linear programming model is designed for the purpose of maximizing gross profits, dual values are obtained in this stage through calculation of shadow price of products. Assuming maximizing net return of the producer, the basic model can be stated as follows:

$$\begin{aligned} &\max z = p'x - c'x \\ &\text{St} \\ &Ax \le b\ [\lambda] \\ &x \le x_0 + \varepsilon\ [\rho] \\ &x \ge 0 \end{aligned} \tag{1}$$

where z is the objective function value, p is product price matrix (n * 1), x is activity production matrix (n * 1) levels, c is cost per unit of activity matrix (n * 1), A is technical coefficients matrix (m * n) for resource limitations, b is available resource values matrix (m * 1) , x_0 is matrix (n * 1) of production activities of observed levels, ε includes small positive numbers to avoid linear dependence between structural constraints and calibration constraints, λ is matrix (m * 1) of dual variations related to resource constraints, ρ is matrix (n * 1) of dual variations related to calibration constraints.

In the second stage, dual values are obtained from the first stage, which are used to calibrate yield function (Paris & Howitt, 1998; Mittelhammer et al., 2000). This function can be expressed as in equation (2) (Jordan, 2012):

$$y_i = \sum_i x_{ij}\,\alpha_{ij} - \frac{1}{2}\sum_{k=1} \beta_{ijk} x_{ij} x_{ij} \tag{2}$$

where, i, k, and j are, respectively, crop type, and production inputs, y_i is the production function for the ith crop, x is the level of activity, and α_{ij} and β_{ijk} are the coefficients of production functions that are calibrated in the second stage of PMP.

One of the problems in the above methodology is that of ill-posed, which is created when the number of variables is larger than the number of observations in the model (Paris & Howitt, 1998). Paris and Howitt (1998) proposed the use of maximum entropy method for solving this problem. In this study, this method was used for estimation of the production function in equation (2).

In the third stage, vector and matrix in nonlinear production function are replaced by resource limitations of nonlinear programming pattern, as shown in equations (3 to 7):

$$MAX\ TGM = \left(\left\{ \sum_j p_i \left[\sum_i \alpha_{ij} - \frac{1}{2} \sum \beta_{ijk} x_{ij} \right] * x_{ij} \right\} - \left\{ \sum_{Labour, land, machinery, fertilizer} \sum_i x_{ij} . c_{ij} \right\} - t_{water} \sum_{water} \sum_i x_{ij} . q_{ij} \right) \tag{3}$$

$$\sum_{j=land} \sum_i x_{ij} \le b_{land} \tag{4}$$

$$\sum_{j=land} \sum_i \frac{w_i}{ef_i} x_{ij} \le b_{water} \tag{5}$$

$$\sum_i a_{ij} x_{ij} \le b_j \tag{6}$$

$$x_{ij} \ge 0 \tag{7}$$

where, sub-indices i, k and j are respectively, crop type, and production inputs (labor, land, machinery, fertilizer – nitrogen and phosphate fertilizer). Equation (3) is the objective function, which shows total gross margin (TGM), t_{water} is price of inputs water, q_{water} is the total amount of inputs consumed (water) by the i^{th} crop. The first constraint (in equation 4) represents total area cultivated must be less than or equal to the total amount of land available (b_{land}) available on the farm. The next constraint (in equation 5) limits the water available for irrigation. Here w_i , ef_i and b_{water} are the water requirements of the i^{th} crop, its technical efficiency, and total water available, respectively. Equation (6) is a constraint for other input factors. Here a_{ij} and b_i are Leontief coefficients and total inputs available, respectively. Constraint (7) places the non-negativity condition on land use.

The input data needed to feed the models and calculate the economic, social and environmental criteria were gathered both from official statistical sites and also from a survey in the irrigated area studied. This research used economic factors such as total gross margin (TGM) and contribution to the regional GDP (CONGDP), social factors like farm employment (EMPL), and environmental factors such as water consumption (WAT), soil covering (SCOV), nitrogen balance (BALN), phosphorus balance (BLAP), and energy balance (ENGE) (Gómez-Limón and Sanchez-Fernandez, 2010). The required information such as land devoted to each crop, yield, input fixed and variable costs by crop, crop prices, and technical coefficients were complemented from a direct survey of farmers. This survey was executed during 2012-2013 agricultural year for a sample of 260 farmers chosen in a random process.

To select the price of irrigation water to consider the economic, social and environmental effects, the importance of each of the criteria and sub-criteria in the agriculture of Qazvin Plain must be determined. In this study, the AHP was used to rank the importance of each indicator and sub-indicator. For calculation of the weighted criteria, a panel of 20 experts from the ministry of agriculture and energy was formed. The results are presented in Table 1. The weights were used in the TOPSIS for selecting the optimal price (Gallego-Ayala, 2012). In this study, for ranking the best prices, we use TOPSIS method (Lai et al., 1994).

Simulation results

Farmers use a planting pattern which has high economic benefits compared to other products in response to different water pricing policies (Gallego-Ayala, 2012). In fact, the policy of raising the price of irrigation water leads to reduced water consumption and some changes in planting patterns. It is expected that this policy will lead to a reduction in the planting levels which yield the largest decline due to this policy. The farmers' attitude toward changes in water price is that the planting patterns of those products which their economic profit has the least changes to this policy are open to minimal effects. The results of changes in crop patterns and different water pricing scenarios are shown in Table 2.

As it was predicted cultivated land area showed a reduction along with an increase in irrigation water price in Qazvin plain. In fact, increase in irrigation water price leads to increase in production cost in agriculture sector which consequently pushes a reduction in the total gross margin of products in Qazvin plain. This result is supported by the findings of Ghaderzadeh et al. (2017), Ghorbani and Hezareh (2017), Hezareh et al. (2017).

The results indicate a different response from farmers to variations in crop pattern. For example, potato and colza showed the least variation in response to increase in water price; because of high profit, this is mainly earned from potato cultivation and low water requirement for colza cultiva-

Table 1. The weights criteria

Criteria	Weights of criteria dimensions %	Criteria	Measurement units	Weights of criteria %	Normalized weights of criteria %	Polarity of criteria
Economic	48	TGM	million Rials/ha	69.70	33.45	+
		CONGDP	million Rials/ha	30.30	14.54	+
Social	14.80	EMPL	h/ha	14.80	14.80	+
Environmental	37.20	WAT	m^3	34.90	12.98	–
		SCOV	–	13.60	5.05	+
		BALN	kg/h	15.40	5.72	–
		BLAP	kg/h	10.50	3.90	–
		ENGE	–	25.70	9.56	+

Table 2. The changes in crop patterns

Water price	wheat	barley	maize	sugarbeet	potato	tomato	colza	bean	forage maize
196	20407	2055.30	226	612.30	50	1075.50	2202.30	267	1103
228	20039.75	2019.01	221.27	602.99	48.85	1072.17	2186.13	260.98	1088.99
243	19843.01	1999.57	218.74	598.01	48.24	1070.39	2177.47	257.76	1081.48
430	17390.30	1757.25	187.16	535.87	40.62	1048.20	2069.52	217.61	987.94
620	14898.25	1511.03	155.08	472.73	32.88	1025.66	1959.84	176.61	892.89
810	12406.20	1264.82	123.00	409.60	25.13	1003.11	1850.16	136.01	797.89
1000	9914.15	1018.61	90.92	346.46	17.39	980.56	1740.47	114.17	702.80
1190	7422.10	772.39	58.84	283.33	12.60	958.02	1630.79	114.17	607.75
1396	4720.19	505.45	41.31	214.88	12.60	933.57	1511.87	114.17	504.70
1482	3592.21	394.00	41.31	186.30	12.60	923.37	1462.2	114.17	461.67

tion. Contrary to what was observed for potato and colza, wheat and barley affected to increase in water price the most.

The calculated decision matrix results are shown in Table 3, which includes economic, social and environmental criteria for different prices. An increase in water prices brings about negative effects on economic and social indicators in the region, whereas environmental indicators are improved. This result is in line with the findings of Berbel and Gómez-Limón (2000), Iglesias and Blanco (2008), Sadiddin (2009), Chebil et al. (2010). However, ENGE criterion decreases a little at higher prices. Hence, water pricing causes both negative and positive effects in the region and water prices must be considered according to their effects and importance.

The TOPSIS approach is used to rate prices as already mentioned. The first step in this approach after the establishment of decision matrix is to use normalized matrix and normalized weighted matrix to integrate matrix units. The normalized matrix and normalized weighted matrix are shown in the Tables 4 and 5. As the units for economics, social and environmental criteria were different from each other, normalized matrix and normalized weighted matrix were conducted.

Table 3. The decision matrix: model results for the selected attributes for each irrigation water pricing alternative

Water price	TGM	CONGDP	EMPL	WAT	SCOV	BLAN	BLAP	ENGE
196	12.57	32.54	140.11	234.83	0.45	147.00	58.16	1.90
228	12.34	32.23	138.22	230.94	0.45	144.89	57.83	1.90
243	12.22	32.07	137.21	228.85	0.45	143.76	57.65	1.91
430	10.77	29.91	124.58	202.86	0.46	129.63	55.47	1.95
620	9.49	27.55	111.75	176.44	0.48	115.28	53.25	1.98
810	8.38	25.00	98.92	150.02	0.49	100.93	51.03	2.01
1000	7.52	22.31	86.22	123.94	0.51	86.48	48.44	2.03
1190	6.70	19.47	74.06	98.28	0.55	71.88	45.36	2.03
1396	6.07	16.24	60.98	70.98	0.60	56.14	41.74	2.00
1482	5.87	14.85	55.54	54.41	0.63	49.63	40.16	1.97

Table 4. The normalized decision matrix

Water price	TGM	CONGDP	EMPL	WAT	SCOV	BALN	BLAP	ENGE
196	0.42	0.40	0.41	0.44	0.28	0.42	0.36	0.31
228	0.41	0.39	0.41	0.43	0.28	0.42	0.36	0.31
243	0.41	0.39	0.40	0.38	0.28	0.41	0.36	0.31
430	0.36	0.36	0.37	0.33	0.28	0.37	0.34	0.31
620	0.31	0.33	0.33	0.28	0.30	0.33	0.33	0.31
810	0.28	0.30	0.29	0.33	0.30	0.29	0.31	0.31
1000	0.25	0.27	0.25	0.23	0.32	0.25	0.30	0.31
1190	0.22	0.24	0.22	0.18	0.34	0.21	0.28	0.31
1396	0.20	0.20	0.18	0.13	0.37	0.16	0.26	0.32
1482	0.19	0.18	0.16	0.10	0.39	0.14	0.25	0.32

Table 5. The normalized weighted decision matrix

Water price	TGM	CONGDP	EMPL	WAT	SCOV	BALN	BLAP	ENGE
196	0.14	0.06	0.06	0.07	0.01	0.02	0.01	0.03
228	0.14	0.06	0.06	0.05	0.01	0.02	0.01	0.03
243	0.14	0.06	0.06	0.05	0.01	0.02	0.01	0.03
430	0.12	0.05	0.05	0.04	0.01	0.02	0.01	0.03
620	0.11	0.05	0.05	0.04	0.01	0.02	0.01	0.03
810	0.09	0.04	0.04	0.03	0.02	0.02	0.01	0.03
1000	0.08	0.04	0.04	0.03	0.02	0.01	0.01	0.03
1190	0.07	0.03	0.03	0.02	0.02	0.01	0.01	0.03
1396	0.07	0.03	0.03	0.02	0.02	0.01	0.01	0.03
1482	0.07	0.03	0.02	0.01	0.02	0.01	0.01	0.03

Table 6 shows the degree of the importance of each of the indicators along with the relative proximity and the result of the ranking of prices in accordance with the economic, social, and environmental effects. As observed, 196.23 Rials (the establishment law water price) and 243 Rials (the cost of water supply regardless of the cost of the dam) were determined as the two suitable prices in the region. Also, lower prices were chosen as the best prices, while higher prices such as the cost of water supply taking into account the cost of dam and network (1396 Rials) and the water economic value (1,482 Rials) did not acquire a good position in the ranking. The increase in water prices causes a negative effect on EMPL, CONGDP, TGM, and partly ENGE indicators, and these indicators make up for 70 percent of the indicators' weight. Therefore, lower prices are prioritized in pricing in the region due to their lower effects in comparison to higher prices. As it is seen, 196 Rials (current situation) is chosen as the appropriate price.

Sensitivity analysis

This part of the study focuses on the sensitivity analysis of weight of economic, social and environmental indicators and sub-indicators in choosing reasonable prices in the study area. As was seen in the last part, the weight of economic, social and environmental indicators and each one of their sub-indicators had a significant effect on appropriate irrigation water pricing. Lower prices were chosen as appropriate prices due to 62.8% weight of the economic and social indicators. The current price is set in accordance with water price establishment law and the cost of water supply without the cost of the dam. The weight of indicators and sub-indicators play an important role in irrigation water pricing in the study area. To this end, 15 experiments were carried out to investigate the effect of the weight of indicators and sub-indicators on setting the price of irrigation water (Table 7). In the first experiment, the weight of all three economic, social and environmental criteria was considered equally.

In experiment 2, the economical criterion weight was set at 50% and social and environmental criteria weights at 25% each. In experiment 3, the social criterion weight was set at 50% and economical and environment criteria weights at 25% each. In experiment 4, the environmental criterion weight was set at 50% and economical and environment criteria weights at 25% each. In experiment 5, all criteria dimensions had the same weight in witch economical criterion weight was 33%, social criterion weight 33%, and

Table 6. The relative closeness and rank of the water prices

Water price	S_i^+	Si^-	Ci	Rank
196	0.04	0.08	0.65	1
228	0.04	0.08	0.65	2
243	0.04	0.08	0.65	3
430	0.04	0.06	0.60	4
620	0.04	0.05	0.52	5
810	0.05	0.04	0.43	6
1000	0.06	0.03	0.37	7
1190	0.07	0.03	0.33	9
1396	0.08	0.04	0.33	10
1482	0.08	0.04	0.34	8

Table 7. The results of the sensitivity analysis

Experiments	Rank of the price			Experiments	Rank of the price		
	1	2	3		1	2	3
1	196	228	242	**2**	196	228	242
3	196	228	242	**4**	196	228	242
5	1190	1396	1482	**6**	196	228	242
7	196 228 242	430	620	**8**	196	228	242
9	1190	1396	1482	**10**	1190	1396	1482
11	1190	1396	1482	**12**	1190	1396	1482
13	1190	1396	1482	**14**	196	228	242
15	1190	1396	1482				

environmental criterion weight 33%. In experiment 6 to 13 the weight of each criteria is 25% and each of other criteria 10.70%. For example, in experiment 6, the weight of TGM criterion was 25% and each of other criteria 10.70%. In experiments, 14 positive polarity criteria had the weight of 14% and negative polarity criteria had the weight of 10%. In experiments, 15 negative polarity criteria had the weight of 23.33% and positive polarity criteria had the weight of 6%.

As the results show in the Table 7, the prices of 119, 228, 243 Rials were selected as reasonable prices in experiments 1, 2, 3, 4, 6, 7, 8, and 14. In fact, this result shows the compatibility of the results in the previous section. In fact, the equality of the importance of the criteria and the gain weight of two social and economic criteria doesn't affect the rankings. As it resulted from experiments 5, the same criteria weight has resulted in 1485 Rials, 1396 Rials, and 1190 Rials as the best prices. It was predicted in Experiments 9 to 13 that the price of 1842, 1396 and 1199 Rials were the best prices, the same with what was observed in Experiments 5. In Experiment 14, low prices and in Experiments 15 high prices were determined as the best prices.

Conclusions

In many countries such as Iran, water prices are low and determined administratively, reflecting neither the supply cost of water nor its scarcity. In this situation, farmers do not have any incentive to reduce water consumption. But there are the main questions, why do not authorities select the higher prices for water? When can they increase the water prices? What criteria can affect their selection? For the answer to these questions, we identify the economic, social, and environmental criteria.

Drawing from the analysis made in this research, it is noted that an increase in water prices leads to a reduction in TGM criterion, and also negatively contributes to the regional GDP. In other words, when water price increases it leads to a reduction in the economic criterion.

However, this study demonstrates that there will be an increase in the environmental criterion through changes in the crop patterns of farmers, as more productive crops are introduced. Therefore, when water prices increase, it has two opposite effects: the positive environmental effect and negative economic and social effects. As regards weight of economic and social criteria were approximately two-thirds. As results, the authorities have selected the lower water prices despite the lack of water in the region. Because the higher water prices have the negative and significant effect on farmer's income and unemployment growth. In addition, the framers always are poor hence these policies can have the negative effects on food production, and food securities. We will expect that the increase of environmental concerns in Iran such as the decline of the underground water surface, soil pollution, and etc. the government need to select the higher prices for irrigation water.

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