Comparative Advantage of Production and Measuring the Competitiveness of Major Crops of Urmia County by the Policy Analysis Matrix (PAM)

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Abstract

The purpose of this study was to investigate the comparative advantage of production and measuring the competitiveness of major crops of Urmia County by the policy analysis matrix (PAM) in 2016-2017. The results of the comparative advantage indicators indicated that Urmia has a comparative advantage in the production of irrigated wheat, rain-fed wheat, rain-fed barley, sunflower, tomato, chickpeas, and red beans, but it has no comparative advantage in the production of irrigated barley and sugar beet among the major crops of the region. The three indicators of comparative advantage applied in this study include net social profit (NSP), domestic resource cost (DRC), and social cost-benefit index (SCB). According to the NSP index, tomato production has a higher comparative advantage over other crops, and red beans, peas, sunflowers, buckwheat, buckwheat, and barley are in the next ranks, respectively. According to the cost competitiveness index, all surveyed crops had cost competitiveness. The results of reviewing the protection indicators, including net protection coefficient input (NPCI), revealed that indirect subsidies were paid to tradable inputs for all studied crops. The nominal protection coefficient output (NPCO) index for irrigated wheat, rain-fed wheat, sunflower, rain-fed pea, and red bean indicates an indirect tax on the production of these crops by the government.

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INTRODUCTION

Comparative advantages in different economic sectors are an important step towards prioritizing investment in different regions to increase demand and income. Therefore, the comparative advantage can be used in the field of economic activities to achieve the desired situation. Identifying and classifying the comparative advantage in the economic field will help enhance domestic and foreign investment in the hubs that have an advantage, which will gradually expand the economic and social welfare in regions with an advantage. On the other hand, spatial planning seeks to identify potential and actual abilities, capabilities, and talents in a sector, like agriculture, to lay the grounds for optimal development based on maximum efficiency and productivity of production factors through identifying them with the appropriate spatial distribution of investments. Given the limitations of capital, especially in the agricultural sector, special attention to regional planning is necessary to regulate and coordinate various socio-economic programs with local needs and facilities to achieve sustainable progress and development (Dagignia & Mazloom, 2018).

The agricultural sector is very important and needs a new approach due to its strategic role in the food security of the community. The importance of the agricultural sector is clear for a country like Iran, which is in the early stages of its growth and development process (Hashemi Bonab, 2005). Given the importance of crop production to meet the food requirements of people and the raw material requirements of other economic sectors, very strong management and large-scale planning in the field of exploitation of productive resources in this sector seems to be quite necessary. Nevertheless, the developments that are taking place in Iran's economy cannot be ignored to properly and completely plan at the macro level. One of these developments is the accession of most countries to the World Trade Organization (WTO). With the inclusion of crops in the World Trade Agreement, the need to pay attention to crop production and trade has increased. It is, thus, necessary to plan for the production of large-scale crops and supply on a larger (international) level. In other words, planning for the production of crops that have a comparative advantage is one of the important and vital factors that will help the trade of agricultural products (Karbasi et al., 2005).

The principle of comparative advantage implies that if a country produces a commodity at a lower cost than other countries, it has a comparative advantage in the production of that commodity. In addition, this principle is one of the most useful criteria for the optimal allocation of resources in countries with open economies and plays an important role in international trade (Karbasi et al., 2005). The inefficiency of agricultural policies or their incompatibility with the comparative advantage of agricultural production is one of the most important obstacles against crop production in different countries, especially in developing countries. The government has provided various protection to support agriculture and increase production, which has led to reasonable growth in the production of this sector. Since the interventions of the government have unavoidable effects on the final and actual costs of crop production, economic policymakers get into trouble with the actual costs and prices of crops. What is certain is that the prevalence of unrealistic prices and costs in the market of product and input deviate the economic reviews and evaluation of the production of most government-sponsored activities (Tusi & Ardestani, 2009).

Policymakers mainly aim to maximize social profit. Social profitability is maximized when the produced crops have a high comparative advantage. Therefore, the development of the cultivated area and crop production in the region should be based on the principle of the comparative advantage given the limitations of the production factors for the optimal use of these factors and achievement to maximum production. Identifying the comparative advantages of differ-

ent economic sectors in the regions and provinces of the country is useful and necessary for economic planning, especially now that the issue of trade globalization and membership or non-membership of the country has been raised in the WTO (Najafi & Mirzaei, 2003). In principle, the protection of domestic products to rehabilitate domestic producers to participate and compete in the international arena is one of the important tasks of the government. This important issue is especially true for the agricultural sector because the agricultural sector is protected by the government even in developed and leading countries in the agricultural industry (such as the United States and Canada). Governments, in addition to their commitment to the protection of the agricultural sector, must design and implement protective policies that will improve the agricultural sector in two areas of supplying the domestic demand and strengthening the competitiveness of products in international markets (Ofogeh et al., 2013).

Agriculture in West Azerbaijan province is one of the most important indicators of economic development in this province. In recent years, the cultivation of drought-tolerant plants has drawn attention due to the drying of Lake Urmia, which has introduced a platform for economic prosperity, but nothing great has happened yet.

According to the economic literature, identifying the competitive advantage of major products in any sector, including agriculture can play a significant role in achieving the goals of non-oil export development programs. The current state of Iran's competitive advantage and its apparent effects on the economy and economic variables is such that the need for fundamental transformation in the economic structure and related reform policies is inevitable. If Iran is supposed to effectively move beyond the initial stage of industrialization in line with the 20-Year Vision Document as a member of the global community, it is necessary to provide an effective and balanced combination of competitive advan-

tage promotion policies (Bayzidnejad, 2017).

Studies have been conducted regarding the competitive advantage, effects of protective policies, the comparative advantage of the production, and the competitiveness of various products, including crops. Dagignia and Mazloom (2018) used the domestic resource cost (DRC) index as the main feature in the study of the comparative advantage of red meat in Tabriz city, Iran. The results showed that the same trend has prevailed since the implementation of the targeted subsidies plan, with the difference that the comparative advantage has significantly decreased. Moreover, red meat producers' need for government protection has increased after the implementation of the targeted subsidies plan. Despite the current comparative advantage, it did not seem likely that this trend would continue in the future with the current situation. Bahta and Willemse (2016) examined the comparative advantage of production and the factors affecting it and soybean exports in 1996-2015. The results of the study showed that soybeans did not have a comparative advantage based on the predicted negative index. Fathi et al. (2015) evaluated the dairy industry of the company (A) using the political analysis matrix (PAM). They concluded that according to the comparative advantage indicators, all products studied by the company (A) had a comparative advantage except for 649-cc pasteurized high-fat milk. Moreover, all the studied crops, except for breakfast cream, could compete with global competitors. The results of the nominal protective coefficient of the input and product showed that the producers of these products pay some kind of indirect tax. Pakravan et al. (2012) used the DRC index in their study and showed that barley did not have a comparative advantage, but spring soybeans, rice, canola, and wheat had a comparative production advantage. On the other hand, the study of government intervention in agriculture using the EPC index revealed that only in rapeseed, the total input and product of the government is in favor of farm-

ers, while this effect is negative for wheat, rice, and soy. Hallat (2005) evaluated the South African advantage in oilseeds using the net exports index (NEI), revealed comparative advantage (RCA), and revealed trade advantage (RTA). The results indicated that South Africa had an advantage in sunflower and peanut seeds. Ugochukwu and Ezedinma (2011) assessed the costs and benefits of rice production in southeastern Nigeria using the Policy Analysis Matrix (PAM). The results showed that there is a high level of social and economic profitability in rice production systems with different technologies. Recent import policies in Nigeria have had a positive effect on local rice production. Therefore, effective and beneficial policies are very important to increase the motivation to improve production technology. Aghaei and Gholizadeh (2011) investigated the comparative advantage of saffron production in Iran using a PAM in 2008. The results indicated that Iran had a high comparative advantage in saffron production. Furthermore, the calculation of domestic and export competitiveness indicators showed that Iranian saffron had competitive potential in global markets. Saei (2011) used a PAM to examine the comparative advantage and protective capacity of major bulk products in the Jiroft region for potatoes, cucumbers, and tomatoes. Based on this study, cucumbers and tomatoes had a comparative advantage and indirect subsidies were paid to the production of potatoes. Dagignia and Mazloom (2018), Alizadeh and Rostamian (2018), Sepehrdoust and Emami (2017), Googerdchian et al. (2014), Mahmoudi et al. (2014), Ali and Khan (2012), and Hussain et al. (2006) conducted studies on comparative advantage, competitive advantage, market support for production and inputs, and the existence of domestic and export competitiveness.

A review of previous studies shows that to fully analyze the policies governing crop production, it is better to consider the indicators of relative advantage, support, and competitiveness. This study aimed to investigate the comparative advantage, the effects of government support policies, and the competitiveness of major crops in Urmia county.

METHODOLOGY

The discussion of the absolute advantage was first opened up in 1776 by Adam Smith in his classic book *The Wealth of Nations*. Forty years later, Ricardo introduced the law of comparative advantage to explain an important part of world trade. The law of comparative advantage is one of the most well-known economic laws that remain unquestionable (Salvatore, 1995). Monk and Pearson (1989) in *The Policy Analysis Matrix for Agricultural Development* developed a policy analysis matrix (PAM) method for comprehensive policy review and calculated the comparative advantage through the elements of this matrix.

Given the government's policies and interventions in the production of crops and considering that the prices of production factors and products are also unrealistically determined by these policies, it is necessary to use a method that can be used to analyze the policies governing the production along with calculating the comparative advantage indicators. The Policy Analysis Matrix (PAM) method is one of the most comprehensive methods of measuring comparative advantage, which also has the above capabilities. This method also evaluates the effects of government policies on a particular sector or product in addition to calculating the comprehensive advantage. This approach is particularly important in examining the effects of government intervention on the agricultural production process to make decisions on continuing current policies or developing efficient programs (Pearson et al., 2003).

PAM is essentially a double accounting technique that summarizes the budgeting information for on-farm and off-farm activities. This method relies on the familiar alliance of cost-income = profit. In this sector, costs are divided into two tradable sectors (inputs that can be exchanged in the international market,

Table 1
Policy Analysis Matrix Framework

The basis of calculation	Income	Cost		Profit
		Exchange inputs	Domestic inputs	
In terms of market prices	A	B	C	D
In terms of shadow prices	E	F	G	H
Difference	I	J	K	L

Source: (Shujie, 1997)

such as chemical fertilizers, modified seeds, and fuel) and domestic or non-tradable resources such as land, labor, and capital (Monk & Pearson, 1989). The PAM framework is shown in Table 1.

PAM can be used to calculate three groups of comparative advantage indicators, including net social profit (NSP), domestic resource cost (DRC), social cost-benefit (SCB), protection indicators, including the net protection coefficient input (NPCI) and the nominal protection coefficient output (NPCO), and effective protection of crops (EPC), internal competitiveness index (Ucd) and the export or international competitiveness index (Ucx).

Domestic Resource Cost (DRC) index
The DRC index is calculated in the PAM framework as follows:

$$DRC = \frac{G}{E-F} \qquad (1)$$

This index is dimensionless. If the value is between 0 and 1, it indicates the comparative advantage. If the value is greater than 1 or less than 0, it indicates the lack of comparative advantage.

Social cost-benefit (SCB) index
This index is another form of social profitability, which is dimensionless. This index compares the social cost of producing each product with social benefit.

$$SCB = \frac{F+G}{E} \qquad (2)$$

If the value is between 0 and 1, it is considered socially profitable, and if it is greater than 1, it is not socially profitable (Azizi & Zibaei, 2001).

Net social profit (NSP) index
NSP is the profit from the production of a product according to the shadow prices, which is calculated by the following equation:

$$NSP = (E - F - G) \qquad (3)$$

Any activity whose NSP is positive has a comparative advantage, while a negative NSP implies that there is no comparative advantage in the relevant activity.

Nominal protection coefficient output (NPCO) index
NPCO is calculated within a PAM as follows:

$$NPCO = \frac{A}{E} \qquad (4)$$

A: If NPCO<1, the market price of the product is higher than its shadow price, so an indirect subsidy is given to the producer.
B: If NPCO>1, the shadow price of the product is more than its market price. In fact, the indirect tax has been imposed on the producer.
C: NPCO=1 indicates that the product is not protected.

Net protection coefficient input (NPCI) index

NPCI shows the protection of tradable or exchange inputs in the production process of this product, which is calculated by the following equation:

$$NPCI = \frac{B}{F}$$ (5)

A: If NPCO<1, the cost of marketable inputs is greater than the cost of the shadow price, i.e. the producer pays an indirect tax on the use of these inputs.

B: If NPCO>1, the shadow price of inputs is greater than the market price, and indirect subsidy is paid for tradable inputs.

C: NPCO=1 indicates that the product is not protected.

Effective protection of crops (EPC)

This criterion measures the value-added ratio of production in terms of market price to value-added in terms of shadow prices. Government interventions in the market and the product can be examined simultaneously through this coefficient. This index is calculated in the PAM framework as follows:

$$EPC = \frac{A - B}{E - F}$$ (6)

A: If EPC<1, government policies protect the production process of the product.

B: If EPC>1, government interventions have acted to the detriment of the production of this product.

C: If EPC=1, no product policy is applied by the government.

Internal competitiveness capability index (Ucd)

This index indicates whether the producer can compete in the domestic market in the current situation despite deviations in the price of the product and the factors of production. The method of calculating this index is as follows:

$$UCd = \frac{B + C}{A}$$ (7)

A: If Ucd<1, the producer does not have internal cost competitiveness.

B: If Ucd>1, the producer can compete internally in producing its products.

C: If Ucd=1, the producer is at a break-even point in domestic markets.

Export or international competitiveness index (Ucx)

This index states whether a producer's products can compete in international markets with current inputs and domestic prices. The index is estimated as follows:

$$UCx = \frac{B + C}{E}$$ (8)

A: If Ucx<1, the producer does not have the export cost competitiveness.

B: If Ucx>1, the producer has the export competitiveness in the production of its products.

C: If Ucx=1, the producer is at a break-even point in international markets.

Shadow prices

The shadow price is the true value of a product or an input, which is the price of that product or input in terms of free and competitive trade without the influence of factors outside the market forces. It is very difficult to provide these conditions within a country, especially for crops, because most countries divert the prices of crops from what they really should be with their protective and tax policies and push them in certain directions. In such a situation, they use the tradable global price of products and inputs as their shadow price.

Calculating income and cost in terms of shadow prices:

Shadow income comes from multiplying performance per unit area by the price of import CIF[1] or export FOB[2].

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[1] Cost, insurance and freight

[2] Free on board

International Journal of Agricultural Management and Development, 11(1), 35-47, March 2021.

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Shadow prices of products

The social valuation of products is based on their global prices. The economic price (away from deviations and policy disruptions) of an agricultural commodity is the border-adjusted price of the product based on which foreign suppliers deliver the goods to the domestic market at that price or it is the price that foreign consumers pay to domestic suppliers. These prices are the opportunity cost of that product. Since products can be imported or exported, their method of calculating reference prices (economic or shadow) varies. If a product is imported, its border-adjusted price is CIF plus all the costs of transporting them from the border to the domestic market, which would indicate the shadow price of the product. If the product is exported, all the costs of transporting them from the domestic market to the border are deduced from the FOB or the border-adjusted price to obtain the shadow price of that product.

The shadow price of tradable inputs

Since most tradable inputs, such as toxins, fertilizers, and machinery, are imported from abroad, the shadow price of these inputs is equal to their CIF price plus all the costs of transporting them from the border to the domestic market. The shadow price of chemical fertilizers and pesticides is the same as their price at the Iranian border in addition to all their transportation costs to the farm.

Calculations have shown that the actual cost per hour of using agricultural machinery in the domestic market was 36450 IRR[1] with subsidies and 61830 IRR without subsidies. In other words, the cost without subsidies was 1.70 times more than the subsidized cost. This value can be used to calculate the shadow price of agricultural machinery. The cost of each machine operation is multiplied by a factor of 1.70 to estimate its social cost

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[1]According to ISO-4217 standard, Iranian Rial is indicated by the abbreviation IRR in global transactions.

(Mahmoudi et al., 2014). The shadow price of the machinery is assumed to be equal to its average cost per hectare of the product (Nouri, 2002). Indeed, 64 percent of the cost of machinery was considered foreign and 36 percent was considered domestic (Hashemi Bonab, 2005). The market price of seeds is considered the shadow price.

The shadow price of non-tradable inputs

Since it is not possible to supply domestic inputs at the international level regarding their global prices, it is more difficult to calculate the shadow prices. On the other hand, the use of their market prices also causes problems in conclusions and planning due to the deviations in the market. Therefore, an estimate of the shadow price of each input should be obtained according to the market prices that have been observed, and adjustments should be made. If a resource or input has a competitive market inside, its market price can be considered as its shadow price, but otherwise, the opportunity cost of production factors could be closer to its shadow price. The shadow price of lands is the average rent land for competing products in terms of the area. The shadow price of the labor force is obtained from the highest wages paid to the workers of the agricultural sector in the province. The shadow price of water is calculated according to the cost of water extraction (Qaderzadeh et al., 2013).

Method of calculating the shadow exchange rate

The exchange rate is a very important factor in calculating comparative advantage and shadow prices. As mentioned, the border-adjusted price is used to calculate the shadow prices of tradable inputs and products. Thus, the exchange rate should be used to convert those prices into domestic currency, which is estimated as follows (Hashemi Bonab, 2005):

$$E = \frac{P_{di}}{P_{wi}} \times E_0 \tag{9}$$

in which E is the shadow exchange rate, is the exchange rate in the base year, is the consumer price index in Iran, and is the consumer price index in the United States.

Statistics and data related to the amount and cost of inputs used in the 2016-2017 crop year have been collected from the Agricultural Jihad Organization of the Urmia city and Customs Administration.

RESULTS

The three groups of comparative advantage indicators, protection indicators, and competitiveness indicators were calculated according to the objectives of the present study. The results are presented in Table 2 for different crops.

According to the calculations, only the irrigated barley and sugar beet have no comparative advantage in production. Their DRC index values are 1.58 and 1.02, respectively. The other seven crops including tomatoes, rain-fed-pea, rain-fed wheat, red beans, sunflowers, rain-fed barley, and irrigated wheat with the DRC index values of 0.07, 0.17, 0.23, 0.34, 0.54, 0.6, and 0.68, respectively, have the highest comparative advantage. According to the DRC index in tomato production per unit of foreign currency earned, only 0.07 unit

cost is spent on domestic resources. In other words, 91% of domestic resources are saved domestically with tomato production, and only seven foreign currency units are spent from domestic sources instead of spending 100 foreign currency units to import tomatoes. Therefore, its production inside the country is more economical than its import due to the existence of foreign exchange savings.

According to the social cost-benefit index (SCB), the irrigated barley and sugar beet have no production advantage, and tomato with an index value of 0.11 has the highest relative advantage among the studied crops of the city. The value of this index (SCB) indicates that only 0.11 units are spent on inputs and the producer makes a profit of 0.89 units in the production and export of this crop for each unit of shadow income. The other six crops including rain-fed peas, red beans, rain-fed wheat, sunflower, irrigated wheat, and rain-fed barley with index values of 0.28, 0.4, 0.44, 0.65, 0.75, 0.77, respectively are the second to seventh ranks in terms of values (SCB) among the crops. Producers benefit by %, 60, 56, 35, 25, and 23 percent in the production and export of these crops, respectively.

Table 2

Results of Calculating Comparative Advantage Indicators, Protection Indicators, and Competitiveness Indicators

Crop	Comparative advantage indicators			Protection indicators			Competitiveness indicators	
	DRC	SCB	NSP	NPCO	NPCI	EPC	UC_d	UC_x
Irrigated wheat	068	0.75	20438884.33	0.59	0.49	0.61	0.76	0.44
Rain-fed wheat	0.23	0.44	18628995	0.59	0.55	0.60	0.50	0.30
Irrigated barley	1.58	1.38	15711196.01-	1	0.52	1.25	0.68	0.68
Rain-fed barley	0.6	0.77	3740375	1	0.44	1.43	0.47	0.47
Sugar beet	1.02	1.01	1144838.33-	1	0.49	1.46	0.75	0.75
Sunflower	0.54	0.65	44547041.34	0.78	0.40	0.91	0.59	0.46
tomato	0.07	0.11	940348990	0.15	0.38	0.14	0.64	0.10
Pea	0.17	0.28	44955561	0.44	0.62	0.41	0.53	0.23
Red beans	0.34	0.40	115316761.7	0.57	0.57	0.57	0.52	0.30

The third indicator of comparative advantage is net social profitability (NSP). Only the irrigated barley and sugar beet with a net social loss value of 5,711,196.01 and 1,144,838.33 IRR have no advantage in production and export among the studied crops. According to this index, tomatoes with social profitability of 940348990 IRR have the highest rank among the studied crops. In other words, in the conditions of free trade, that is, in the conditions in which the government does not interfere in the product and input market, the amount of net social profit of the producer from tomato production will amount to 940,348,990 IRR. Other crops including red beans with a profit of 115,316 thousand IRR, peas with a profit of 449,575 thousand IRR, sunflowers with a profit of 445,470 thousand IRR, irrigated wheat with a profit of 204,380 thousand IRR, rain-fed wheat with a profit of 186,280 thousand IRR, and barley with a profit of 3,740 thousand IRR, respectively are the second to seventh ranks in terms of NSP index.

Other indicators studied in PAM are protective indicators for input and output markets. The first indicator is the nominal protection coefficient output (NPCO) index. According to the results, the NPCO index is equal to 1 for irrigated barley, rain-fed barley, and sugar beet. This means that there is no government protection policy for these crops. The NPCO index value for the irrigated and rain-fed wheat, sunflower, tomato, pea, and red bean is 0.59, 0.78, 0.15, 0.44, and 0.57, respectively. This means that the shadow price of the crops is higher than the market price and the producer has been forced to pay indirect taxes. In other words, these products face negative protection for the crop market. The highest amount of negative protection occurred in the tomato market with a value of 0.15 so that the market income of this crop is only equal to 15 percent of its shadow income. In other words, the market income of the producer market is 85 percent lower than the real and global rate. Government policies on this crop imply an implicit tax on the do-

mestic producer. Among the other crops, red bean, irrigated and rain-fed wheat, and sunflower with the values of 0.57, 0.59, and 0.78, respectively are in the next ranks in terms of negative protection for the crop market. The market income of the producer of the above crops is 43, 41, and 22 percent lower than the real and global levels, respectively.

The second protective index is the net protection coefficient input (NPCI) index. The value of this indicator for the studied crops was smaller than one, which indicates that the shadow price of the inputs is higher than their market price and indirect subsidies are paid to inputs. In other words, the NPCI index indicates the protection of the market for the studied crops in their production process. In other words, the government has been able to help reduce the cost of producing these crops. Based on the values of this index, the highest protection is related to the tomato input market with an index value of 0.38. In other words, the producer pays 62 percent less than the real value of the inputs by consuming inputs in tomato production and somehow receives 62 percent indirect subsidy.

The crops include sunflower, rain-fed barley, sugar beet, irrigated wheat, irrigated barley, and rain-fed barley with index values of 0.4, 0.44, 0.49, 0.52, 0.55, 0.60, and 0.62, respectively, are placed in the second to seventh ranks in terms of the market protection values for tradable inputs in the production process. In other words, the producers of these crops receive 60, 5%, 51, 48, 45, 40, and 38 percent of the indirect subsidies, respectively.

Simultaneously, the effective protection of crops (EPC) index was evaluated for nine studied crops to measure the amount of government intervention in the market and product. The value of this index was 0.61, 0.6, 0.91, 0.14, 0.41, and 0.57 for irrigated wheat, rain-fed wheat, sunflower, tomato, rain-fed pea, and red bean, respectively. This shows that the simultaneous interventions of the government in the input and output market have caused loss to the production of these crops. The severity of this harmful interven-

tion on tomatoes has been higher than on other crops. The value of this index was 1.25, 1.42, and 1.46 for irrigated barley, rain-fed barley, and sugar beet, respectively. These values indicate that government policies protect the production process of these crops. In other words, the government's subsidy for inputs for these three crops is more than the tax that the government has indirectly imposed on the crops. In fact, government intervention in the market of these crops has allowed producers to make larger profits from the production of these crops compared to the free market.

Cost competitiveness indicators are the last indicators examined in this study. The internal competitiveness index (Ucd) for irrigated wheat, rain-fed wheat, irrigated barley, rain-fed barley, sugar beet, sunflower, tomato, rain-fed pea, and red bean is 0.76, 0.50, 0.68, 0.47, 0.75, 0.59, 0.64, 0.53, and 0.52, respectively. These values indicate that the producer can compete internally in the production of these crops to compete with other domestic producers. In other words, the amount of product revenue in terms of market values for all the studied crops is greater than the total cost of inputs in terms of market values. Competitiveness in rain-fed barley, rain-fed wheat, red bean, pea, sunflower, tomato, irrigated barley, sugar beet, and irrigated wheat is 0.47, 0.50, 0.52, 0.53, 0.59, 0.64, 0.68, 0.75, and 0.76, respectively, reflecting greater intensity in this regard.

Export competitiveness index (UCx) is another indicator of cost competitiveness. According to the calculated values for nine major crops of the city, the producers can compete in exporting these crops. This means that the amount of product income in terms of shadow values is greater than the total cost of inputs in terms of market values. Competitiveness is more intense in tomato, rain-fed pea, red bean, rain-fed wheat, irrigated wheat, sunflower, rain-fed barley, irrigated barley, and sugar beet with values of 0.10, 0.23, 0.30, 0.30, 0.44, 0.46, 0.47, 0.68, 0.75, respectively.

CONCLUSION

This study was conducted to determine the comparative advantage and measure the competitiveness of major crops of Urmia. To this end, the triple PAM including the comparative advantage indicators, protective indicators, and cost competitiveness indicators was calculated. The analysis of the policy matrix results on the selected crops showed that only irrigated barley and sugar beet had no advantage among the nine crops and tomato had the highest comparative advantage among the studied crops. The net protection coefficient input (NPCI) index indicated that the producers of these crops receive some form of indirect subsidy. In other words, the government could help reduce the cost of producing these crops. According to the NPCI index, the highest protection is related to the tomato market. The nominal protection coefficient output (NPCO) index for irrigated and rain-fed wheat, sunflower, tomato, rain-fed pea, and red bean showed that the producers of these crops paid some kind of indirect tax. According to the NPCO index, the most negative protection is related to the tomato market. Measuring the simultaneous effects of intervention in the input and output market illustrated that irrigated and rain-fed wheat, sunflower, tomato, rain-fed pea, and red bean were negatively protected by the government, and irrigated barley, rain-fed barley, and sugar beet were positively protected by the government. The highest negative protection was related to tomatoes and the highest positive protection was related to sugar beet. The calculation of the internal competitiveness index (Ucd) for the nine studied crops showed that all produced crops could compete with other domestic growers. The values of the export competitiveness index (Ucx) showed that all the studied crops had the ability to compete with global competitors. According to the results, the following are recommended:

According to the values of DRC, SCB, and NSP indicators, all the crops except for the irrigated barley and sugar beet had a compar-

ative advantage. Therefore, their production inside the country is more economical than their import due to the foreign exchange savings. So, their domestic production can not only save foreign exchange but also create a labor market and employment as domestic production is in line with the policy of protection of national production, labor, and Iranian capital. Irrigated barley and sugar beet can be imported to prevent the wastage of domestic capital due to the inability to produce them.

It should be noted that more arrangements are required (increasing irrigation efficiency, reducing waste, increasing mechanization coefficient, etc.) regarding the cost management before starting the accession process to be prepared to face the effects of Iran's membership in the World Trade Organization with the current situation in the field of crops that do not have a comparative advantage. The net protection coefficient input (NPCI) value for all studied crops showed that the producers of these crops pay less than the real value of the inputs, which is a kind of indirect subsidy. The protection of the input market, in the long run, will lead to the efficient allocation of the produced inputs and proper orientation in producing these crops. Therefore, the government should help economic production by targeting supportive policies and implementing more efficient programs to reduce production costs. The nominal protection coefficient output (NPCO) index for some crops, including irrigated and rain-fed wheat sunflower, tomato, rain-fed peas, and red beans, showed that the market income of all these crops is less than their global and real value, which implies an implicit tax on domestic producers. Obviously, the persistence of these conditions in the medium term can destroy the incentives of production in producers with similar conditions and create adverse consequences for the country's food security. In a situation where political optimization is considered as the headline of policy in most developed and developing countries of the world in line with positive in-

tervention and in favor of producers in the agricultural sector, the persistence of this trend regarding the studied crops is not desirable and proportional to the national interest. Therefore, reviewing the portfolio of input market-related policies and pricing is one of the main priorities regarding the modification of the current condition.

The values of the export competitiveness index (Ucx) for the nine studied crops showed the cost competitiveness with global competitors in all studied crops. Therefore, their export competitiveness can be increased by managing and reducing the production costs of the studied crops. The results showed that the studied crops have high export competitiveness and comparative advantage, but only the comparative advantage and competitiveness of the studied crops are not a reason for success in joining the World Trade Organization. Paying attention to international product marketing and improving it in line with the non-oil export development policy can guarantee the success of these products in terms of accession while maintaining the comparative export advantage before joining. Production costs are considered the most important factors affecting the comparative advantage of products. First, the consumption of each input should be optimized and secondly, superior technology should be used to reduce the costs. This will increase the competitiveness of the products and, consequently, its comparative advantage. In other words, the productivity and efficiency of each input increases, and the cost of each production unit decreases with the optimal use of inputs.

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