Middle-East Journal of Scientific Research 13 (7): 850-855, 2013
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2013.13.7.2689

Relative Advantage of Producing Agricultural Crops in Ardabil Province (Iran)

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Abstract: Existing food shortages and worldwide food problems add to the importance and necessity of the optimal operation (utilization) in the agricultural sector. Considering that the aim of the economics is optimal allocation of limited resources among different activities and also considering the existing economic problems, attention to the productivity of producing agricultural crops will be more than before. Several studies regarding the reviewing of the status of relative advantage of production and trading of various products by using the domestic resources cost method (DRC) are made in various sectors and regions of Iran and the world. In this study, also by using the aforementioned method in nine cities of Ardabil province, products with relative advantage have been reviewed by using LINDO software regarding the restrictions on production, including chemical fertilizer, seed, machinery, water, labor and agricultural land. Findings of the present study revealed that cultivation of the crops such as lentil, wheat, potatoes, tomatoes, sugar beet, cotton and brassica napusl in this province has relative advantage. While the production of barley, rice, corn, peas and beans has no relative advantage. And, observing the optimum cultivation pattern can increase the income of agricultural crops up to 80 percent in this province.

Key words: Relative advantage · Linear programming · LINDO software · Shadow price (cost) or secondary price (DUAL PRICE) · Optimal area of under cultivation · Agricultural crops

INTRODUCTION

Islamic Republic of Iran is a country where economy has been based on agriculture and its economical, social and cultural structure during past centuries has always been formed based on agriculture and animal husbandry. Population growth speed, existing food shortages and worldwide food problems add to the importance and necessity of optimum operation (utilization) of the country's manufacturing great sector. Existing vast resources of soil and labor and good potentials of production increase, extensive climate facilities and other parameters, provide opportunities to plan in providing their essential needs for future years.[1] On the other hand, dry and semi-dry climate of Iran and some other factors such as economic and social problems, imposed war, economic sanctions and investment problems and existing constraints in taking advantage of the advanced techniques in agriculture led Iran to face with restrictions in production.[2]

Considering that the aim of economics is optimal allocation of scarce resources among different activities and also considering the importance of exports and maintaining exchange resources, optimal allocation of resources and production based on advantages in production and paying attention to productivity of the products are necessary more than ever [3].

The relative advantage is one of the important criteria for planning the production, export and import, that is, capability of a country or a region to produce one or more goods with the purpose of less cost. The relative advantage explains that each country or region according to the natural capacity and production levels relatively has advantage in production of a specific group of products [4].

Islamic Republic of Iran has been accepted as member of the World Trade Organization (WTO) and is joining the WTO. Prior to joining the WTO, it is necessary to identify production advantages. Before discussing commercial advantages, reviewing the relative advantages in production is required. Applying the theory of Hekcher-Ohlyn that considers the inventory levels of resources has more application [5]. This theory hypothetically considers only two factors, in order to consider several

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factors together; a tool which uses linear programming method is required. Linear programming with simultaneous consideration of several factors can discuss the rate of optimize regarding the raised comments provided by Hekcher-Ohlyn [6]. In this study, regarding the present situation of production, the relative advantage of producing crops in Ardabil province will be determined. And that the production situation in the province is optimized or it is necessary to change the current cultivation model regarding the proposed model, in order to gain more profit.

In order to determine the cultivated pattern for Ardabil province crops, it is necessary to determine the pattern of optimal cultivation, according to the constraints of water, agricultural land, seed, fertilizer, machinery and labor. One of the important parts of the study is sensitivity analysis of model results that with examining the changes in limiting resources and the objective function the status of the priorities can be changed [7].

Relative Advantage: Relative advantage of production is the basis of economic planning for more efficient allocation of productive resources in producing the products. But the relative advantage is not a continuous and static score but is dynamically dependent on frequency and limitation of the production resources in various production process, input prices and the crops and is transmitted from a region to another region and from a product to another product (in a production system) [8].

First, advantage issue was introduced by Adam Smith (1776) to explain international trade. Based on Smith's comments, if each country attempts to export goods in which it has advantage (superiority) and import the goods that it does not have advantage, countries can benefit from these exchanges (trading). In other words, a kind of absolute advantage of this exchange will be gained, indicating the ability of a country, economic enterprise, to supply a product or service cost less than the competitor [9]. First, the relative advantage was formed around the business axis. The initial attempt to answer the question that why a country trades, began by classics about one hundred fifty years ago [10]. In absolute and relative advantage what remains unanswered, is the cause of cost differences between different countries. Answering this question can be defined based on the following theory: countries that have more finance than labor, attempt to export capital goods and countries that have abundant labor attempt to export the goods with high labor attempt. It means the relative difference that this frequency may be expressed based on the cost of the factors of production or in terms of physical quantities of production factors [11]. Reviewing and quantitative calculation of relative advantage based on the new methods is part of discussions that has entered to the economic literature since 1960s. For the first time in 1963, Michael Burno used the index of the cost of domestic resources to calculate the relative advantage of the garment industry, evaluation of projects, analysis of the cost of social and economic benefit of the policies of import substitution and export encouragement [12].

In 1966 Anakrugar investigated relative advantage of agricultural products in Turkey. In 1974, Scott Pearson and Ronald Mir reviewed relative advantage of producing coffee in some African countries by means of the ratio cost of resources (it is calculated by dividing DRC on the real exchange rate) and determined that Uganda, Ethiopia and Tanzania have relative advantage in coffee production, but Ivory Coast has no relative advantage. Two years later, Hertedlazyta with using the DRC index reviewed relative advantage of the Philippines in rice production and showed that the Philippines has a relative advantage in rice production [13, 14]. In 2006, Leonardo Gonzalez and his colleagues began to consider the relative advantage of five major agricultural products in Indonesia, including rice, corn, soy, sugar and flour by using the standard cost of domestic resources, nominal and effective protection rate and social complete (pure) profitability. Results showed that Indonesia in production of rice and corn, compared with their imports, has relative superiority but the relative advantage of corn is more than rice [15-24].

Natural Profile of Ardabil Province: Ardabil Province (Table 1) with an area equal to 17,867 square kilometers (1/1 percent of the area of Iran) is located in Iran northern plateau. Its average height is more than 1400 meters over sea level. Lowest internal point with a height of 100 meters is in Parsabad and Bilesavar and its highest peak with a height of 4811 meters is Sabalan, located in northern parts of Parsabad and Bilesavar cities with the land height of less than 100 meters from sea level. Fifty five percent of the lands of the province are pasture, 41 percent is agricultural, one percent is forest and about 9 percent is residential [25, 26, 27].

Table 1: Area of the province in terms of the land status of the year 2010 area: hectare

Cities	Total	Agricultural lands	Forest	Pasture	Residential land	Other
Province total	1786730	731170	20000	984468	15190	35902
Ardabil	249817	132597	0	105050	7137	5033
Bilesavar	175834	84977	280	85927	760	3890
Parsabad	138280	57198	380	76083	1506	3113
Khalkhal	280047	31832	17534	223903	1272	5506
Kosar	129298	51799	0	74787	224	2488
Meshkinshahr	382507	130228	120	242876	2053	7230
Ghermy	205861	120844	26	80539	1002	3450
Namin	103658	48831	1660	50037	929	2201
Nir	121428	72824	0	45 306	307	2991

Four cities of this province, 282/5 km boarder Azerbaijan. At 159 km from this border, Aras and Balharood rivers flow. Along with the border, Ardabil province is associated with Azerbaijan at two points, Aslanduz and Bilesavar. Eastern Azerbaijan province has shared borders with Parsabad, Meshginshahr, Ardabil and Khalkhal cities. Ardabil province in the south boarders Zanjan province. East of the province boarders Ghilan province through the cities of Ardabil, Khalkhal and Talysh mountain chain. Ardabil province is associated with the center of the country through Ardabil axis- Astara (Heiran) and the way to Tehran is possible through Qazvin and Rasht.

Ardabil province based on the proposal of the government and approval of the parliament separated from the political- administrative dominance of east Azarbaijan province in 1372 and became as an independent province in the country divisions [28].

Model of the Problem: To estimate the model for 9 cities of Ardabil province, LINDO software was used. This software was selected because of the ease of use and high capabilities. It is derived according to the instruction, the related data entry, the results of the solving the model with that software and also analysis of the sensitivities [29, 30]. In this study, the objective function is maximizing profit of per hectare cultivation of the various crops. Profit rate of per hectare is achieved through subtracting revenues and per hectare expenses. For each of the cities, income rate has been calculated according to the yield of per hectare for various products and unit price of products. Earned income is different in different cities. To calculate the cost of per hectare, price of production factors are considered; including cost of land, planting, harvesting and along with their rate of consumption and then the sum of all values. Unit of using inputs regarding their nature is different, but considering that all of them are multiplied by price of factors, the measure unit of production factor is the same with the other input and they are based on the value of the total cost of per currencies [31-35]. Considering that the rate of profit is reflective of costs and revenues of each product. Therefore, in this study the values of profit have been used.

Limitations: Restrictions imposed on this model involve the cases that by using them some outcomes could be achieved based on the real world. Required information and statistics of the limits are derived from the agriculture departments and also agriculture organization of Ardabil province. For this purpose, the rate of the use of the inputs has been calculated in per hectare. Used constraints were as follows [36, 37, 38].

- Chemical fertilizers
- Seed
- Machinery
- Water
- Labor
- Irrigated farming land
- Dry farming land

In this study, approximately 162 variables (15 products in nine cities) has been defined and studied. Defining the variables makes it possible to express how to solve models and analyze the results.

Sensivity Analysis of the Results: According to the results and considering sensitivity analysis of the results, the range of allowable changes in different parts has been considered. For this purpose, two parameters, VALUE and Reduce Cost, which are offered by the Lindo program, have been used. The amounts of Reduce Cost for variables that have entered into the model are zero.

And, for variables that have not entered into the model shows that the objective function coefficient to what extent should increase in order to enter the corresponding variable along with it in the model. Since the objective function coefficient is the rate of the profit from each hectare of different crops and this amount of profit is derived from the income and expense differences, therefore, either production costs should decrease or product revenue should increase (or to be carried out simultaneously) considering that each of these variables are affected by other factors such as product price, input price, yield in area unit and the amount of use of the inputs. So actually analysis of Reduce Cost parameter is very complex in this study. Part of sensitivity analysis in Lindo software is expression of the level of allowable changes in the supply of the resources that shows to what extent these resources can change without a change occurs in the composition of the products. Surveys show that the change in the supply of the major resources that has been considered here as model constraints, some cases it can be cause of change in the rate of the production. Also, for the analysis of the rate of the profit sensitivity of each product in each city variables that have been presented in Lindo software can be used. ALLOWABLE INCREASE variable means the maximum allowable amount of increasing profits of the products in the specified limit and ALLOWABLE DECREASE variable means the maximum allowable amount of reducing profits of the products in the specified limit. In fact, the mentioned variables represent that any of the products that have not entered the models (have not been chosen as optimal cultivation) their profit in per hectare should rise to what amount that they enter into the model. And also in relation to the products that have entered into the model, (They have relative advantage) their profits reduce to what amount that they will be outside of the model. DUAL PRICES known as shadow price, virtual price and semi price show final value of a unit from excess resources that are unused. If you have limited resources the shadow price of those resources will be positive otherwise this shadow price will be zero. Meanwhile, the shadow price has a direct impact on profit (objective function). Shadow prices actually reflect the economic value of per unit in the source and shows the rate of the change of the amount of objective function based on the per unit increase in a source [39, 40, 41, 42].

Research Result: Cultivation pattern model in Ardabil cities is collected by using data, information and statistics and the results of their analysis have been estimated. The purpose of estimating this model is only comparison between the current situation and optimal values. According to the existing limitations, from the total under cultivation area of the province only seven hectare surpluses have remained. The most important products obtained from cultivation model include: lentil, wheat, potato, tomato, sugar beet, cotton and brassica napusl. Based on the results of the sensitivity analysis, the most important limiting factor in the production is the input of water. Following water, labor, machinery and seed, respectively, are the most limiting production factors. Reviewing the range of the changes of the supply rate of the resource shows that the province whole machinery are consumed in a cultivation period and its reduction from current level can change the pattern of cultivation. And also considering the right values shows that the increase in the chemical fertilizer does not affect the optimum pattern. Reviewing coefficients of the objective function and sensitivity analysis of the results show that how much change must be made in the profit rate of those products that have not entered into the model in order to enter those products into the model. (Their cultivation will have a relative advantage, through increasing selling price and or reduction of related cost through various way for example providing subsidy and in any way the model. (Their cultivation will not have relative advantage). Selecting the proposed optimum cultivation model in the whole province, will cause the surplus of the production resources appear in seed, chemical fertilizer, water and labor. According to the achieved profits from current production situation in the whole province of Ardabil and based on the calculations, the profit from the production in status quo is 1073674 million rials. While the rate of the achieved profit from the production based on the optimum cultivation pattern will be 1933579 million rials that profit increasing will be 859,905 million rials close to 80 percent.

Based on these result, it can be said that the current model can not be optimal cultivation. And cultivation of the crops, such as lentil, wheat, potato, tomato, sugar beet, cotton and brassica napusl in Ardabil province has a relative advantage, while production of barley, rice, corn, pea and bean has no relative advantage. Sensitivity analysis of the results also shows that determining the relative advantages will change if the inventory of the resources and the coefficient of the objective function change, that this theory is accordance with Hekcher-Ohline theory that knows the rate of the supply of the resources, determining factor of the relative advantages. Therefore, based on the analysis done and results obtained from this investigation and in terms of maximizing profits and maximum use of the available resources in the province, it is recommended that

Table 2: Under cultivation area of different crops in the optimal model of the entire province

Name of the crops	Current under cultivated area	Optimal under cultivated area
Irrigated farming wheat	81114	29994
Dry farming wheat	263332	8595
irrigated farming barley	24010	0
Dry farming barley	67,230	0
Rice (rough rice)	1483	0
Grain corn	8924	0
irrigated farming pea	301	0
Dry farming pea	9110	0
irrigated farming be an	3164	0
Lentil	47177	378253
Cotton	5100	23880
Sugar beet	3830	35693
Brassica napusl	6144	15447
Potato	25956	69804
Tomato	1672	55536
Cucumber	282	0
Alfalfa	60,180	0
Soy	8200	0

cultivation of the crops in each of the city of Ardabil province will be done based on the area of the under cultivation of the crops in the optimal model [43-47].

Reviewing coefficients of the objective function and the rate of the supply of the resources show that producing products that have relative advantage, part of the resources has been released and the use of them are possible in producing the other sectors such as gardening products.

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