

Analysis Economic of Medicinal Plants production in tropical Area

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Abstract

In this study, the comparative advantage of medicinal plants production in tropical regions of Iran was investigated using Advantage comparative index and policy analysis matrix (PAM) in 2015. The result, based on the comparative advantage indices, indicate that has a comparative advantage in the production of Carla, Ajowan, Cumin, Anise, Licorice, Dill and has not comparative advantage in Plantago production. Based on comparative advantage indices crops of Carla, Licorice, Anise, Ajowan, Dill and Cumin respectively ranked first to sixth. The amount of nominal protection coefficient on output (NPC), indicated that there is an indirect subsidy on the producer of Cumin, Anise, Plantago and Dill; means that government policies support the domestic production. And also indirect taxation on outputs Carla, Ajowan and Licorice. Amount of nominal protection coefficient on input (NPI) represented the indirect subsidy on tradable inputs of all crops, which means that the government policies supported the supply of production inputs. Effective protection coefficient index (EPC) for Cumin, Anise, Plantago and Dill was more than 1, showed that the government's policies support production process. Net social profit (NSP) for all crops was positive and indicating social profitable of crops in area. Social Cost Benefit (SCB) showed that this area in production and trade of all crops except Plantago have comparative advantage.

Keywords: Policy analysis matrix, Comparative Advantage, Medicinal Plants, Tropical Area.

1. INTRODUCTION

Agriculture is one of the most important parts of the economy. On the one hand, it is a supplier of the food security and community health and on the other hand, it can be a supplier of the currency during the development through exporting agricultural products. Development of non-oil exports and thereby releasing the single-item income is one of the countries' goals to be independence, self-sufficiency and to obtain currency. In this regard, considering the goods such as medicinal plants that there is a potential possibility to export them, is necessary.

According to economic fundamentals and from a macro perspective, maximizing social benefit and efficient use of domestic resources should be considered in the production. But, the maximum social benefit will be realized in the production when the product has high comparative advantage. Investigating the comparative advantage of different products provides the opportunity for the politician to guide the manufacturer to produce a product with maximum social profitability by designing and providing a proper model.

Measuring the comparative advantage was firstly performed in 1972 by Bruno. He used the Domestic Resource Cost (DRC) index to assess the comparative advantage of clothing industry, to

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evaluate the projects and to analyze the social and economic cost-benefit of alternative import policies and to encourage the manufacturer to export in Israel.

Monke and Pearson [11] , [12] in their book entitled “Policy Analysis Matrix (PAM) for Agricultural Development”, devised the Policy Analysis Matrix for a comprehensive review of policies and calculated the comparative advantage through the elements of this matrix. Their proposed method for the calculation of comparative advantage was welcomed by researchers. Since then, researchers such as Mohanty and *et.al* [10], Shahabuddin and Dorosh [15], Huang and *et. al* [4], Hussain and *et. al* [5], Master and Winter- Nelson [8], Shujie Yao [16], Fung [3], Saei [14], Rastegaripour *et. al* [13] considerate comparative advantage some of industrial and agricultural crops in different countries.

2. MATERIAL AND METHOD

There are many ways to investigate the comparative advantage of a product but one of the best and most complete methods is “Policy Analysis Matrix (PAM)”. This method enables the researchers to perform policy analysis and to provide appropriate policy recommendations in addition to calculating the values of estimators. In fact, with a comprehensive view, this method can provide realistic analysis of government policies about the products and inputs in addition to calculating and estimating the comparative advantage index. Also, this method provides the possibility of policy and susceptibility analyses. The overview of this matrix is shown in Table1. [5]

Table1. Basic format of PAM

	cost			Profit
	Revenues	Domestic inputs	Tradable inputs	
Private price	A_i	C_{ik}	B_{ij}	D_i
Social price	E_i	G_{ik}	F_{ij}	H_i
Effects of divergences and efficient policy	I_i	K_{ik}	J_{ij}	L_i
Domestic cost ratio	$DRC = G / E - F$			
Nominal protection coefficient	$NPC = A / E$			
Social Cost Benefit	$SCB = G + F / E$			
Net social profit	$NSP = E - F - G$			
Nominal protection input coefficient	$NPI = B / F$			
Effective protection coefficient	$EPC = A - B / E - F$			

where is: (A) revenue based on private price, (E) revenue based on social price, (I) output transfers, (B) tradable input cost based on private price, (F) tradable input cost based on social price, (J) input transfers, (C) domestic input cost based on market price, (G) domestic input cost based on social price, (K) factor transfers, (D) private profits, (H) social profits, (L) net transfers [11] , [12].

The structure of the PAM allows a double calculation in the table. On the first line of the PAM is the calculation of private profitability (D), defined revenue (A) minus total costs (B+C). Where, B

and C are tradable and domestic inputs, respectively. In other words, the first line of the PAM contains the value for the accounting identity measured at private prices, which is the price actually used by different agents to purchase their inputs and sell their outputs. The second line of the PAM calculates the social profit which reflects social opportunity costs. Social profits measure efficiency and comparative advantage. Social profitability (H) measures revenue valued at social prices less value of tradable and domestic input both valued at social price. The third line of the matrix represents transfers that come into changes in government policy. The differences between revenues, costs and profits in private and social prices can be both negative and positive. A negative output transfers ($I < 0$) or positive input ($J > 0$) and factor transfers ($K > 0$) means worsening of the situation in a sector through state policies. Transfers by costs and revenues can equilibrate each other. Net transfers (L) show an impact of government influence on a farm income.

A few additional indices can be calculated from the PAM. The most used are: The *Domestic cost ratio* (DRC) measures the efficiency of utilization of domestic factors in the analyses of production systems. The DRC is widely used as an indicator of competitiveness. The index calculated is a ratio of social costs for domestic factors to their value added. If the $DRC < 1$, the production in a country is competitive. If the $DRC > 1$ it signifies that the country has a disadvantage in production of the analysed goods.

The *Nominal protection coefficient* (NPC), which is defined by the ratio of domestic price to the social price, can be calculated for both output and input. NPC greater than 1 indicates implicit nominal protection or subsidy by producers, and implicit nominal tax, when NPC is less than 1.

The *Effective protection coefficient* (EPC) another coefficient of incentives is the ratio of value added in private prices to value added in social prices. This coefficient measures the degree of policy transfer from product market-output and tradable-input policies. EPC value greater than 1 indicates positive protection of value added by producers, while effective taxation of value added by producers is indicated when EPC is less than 1.

The *Social Cost-Benefit ratio* (SCB) is estimated by dividing shadow costs by shadow income. The activities whose SCB is between zero and one, are profitable activities and the activities whose SCB is greater than one, have no profitability and comparative advantage. Another used index is net social profit index. [7], [2].

The *Net social profit* (NAP); if the calculated amount of this index is greater than zero, there is a comparative advantage in the production of that product and if it is less than zero, the production of that product will not have any comparative advantage and net social profit [9].

The *Nominal protection input coefficient* (NPI) is greater than one; the cost of tradable inputs based on market prices is greater than the cost of tradable inputs based on shadow price. It means indirect taxes were levied on the tradable inputs. And if NPI is less than one, the government paid indirect subsidy to the inputs that the farmers have used in the production process and they are cheaper than the boundary price. And if it is equal to one, these inputs have been not supported

To calculate the comparative advantage by the use of mentioned indices, calculating the shadow price of the inputs used in the production and also the shadow price of products and exchange rate is necessary. The social (efficiency) prices for domestic factors of production (land, labor, and capital) are estimated also by application of the social opportunity cost principle. Because domestic factors are not tradable internationally and thus do not have world prices, their social opportunity costs are estimated through observations of rural factor markets [12].

3. RESULT

To determine the indices of policy analysis matrix of medicinal plants, the production cost and income of production should be calculated. Based on cross-sectional data and the cost of production of the crop year 2014-2015 provided by Agricultural Jihad, and also, part of the information published in the Statistical Yearbook of Foreign Trade Customs and the website of the Ministry of Commerce, Iran Customs Administration, the information related to cost and production of medicinal plants was calculated.

The studied medicinal plants are Momordica, Cumin, Hibiscus tea, Fennel, Ajwain, Sand plantain and Dill which were selected due to compatibility of the cultivation of these plants with hot and arid regions. Using market and shadow prices of medicinal plants for each tradable and non-tradable input, the parameters of policy analysis matrix are listed in Table2 for one hectare of mentioned products.

Table 2: Products Comparative Advantage indices calculated

	Dill	Plantago	Anise	Licorice	Ajowan	Cumin	Carla
D_i	46	8	67	198	26	14	326
H_i	2	-12	59	331	40	1.5	1439
L_i	44	20	7	-133	-13	13	-1113
K_{ik}	-0.8	-0.5	-1.2	-0.7	-0.7	-0.5	-1.2
J_{ij}	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.6
I_i	43	19	6.3	-133	-14	12	-1115
DRC	0.96	1.41	0.44	0.14	0.54	0.96	0.04
NPI	0.84	0.89	0.79	0.84	0.84	0.89	0.8
NPC	1.76	1.58	1.05	0.6	0.84	1.26	0.26
EPC	1.86	1.69	1.07	0.66	0.85	1.30	0.26
NSP	100	69	155	446	138	83	1577
SCB	0.96	1.36	0.47	0.16	0.56	0.96	0.04

The value of DRC (Domestic Resource Cost) index for all products except Sand plantain was estimated less than the unity; it means that there is comparative advantage in the production of all products except Sand plantain.

DRC index shows how much money has been paid per 1000 Rials savings due to not importing the product. The value of this index for Hibiscus tea shows that 140 Rials has been paid per 100 Rials savings and 14 cents of domestic cost are needed to obtain one dollar, but, for Sand plantain, 141 Rials of domestic resource are needed per 1 Rial of added-value in the conditions of free trade, it means that producing Sand plantain in Iran, 141 Rials has been paid per 100 Rials savings due to not importing Sand plantain. In the other words, to obtain one dollar, one dollar and 41 cents must be paid.

In terms of NPC, the values of this index for Carla, Licorice and Ajowan are less than one, in the other words, Government policies on these products suggest that their prices in Iran are less than the boundary price in the shadow exchange rate which represents the imposed implicit taxes on the manufacturers of these medicinal plants. For Cumin, Anise, Plantago and Dill, the value of this index is greater than one.

The values of NPI (Nominal Protection Coefficient of Input) are less than one for all products and this index says that the manufacturers have been supported in terms of tradable inputs in the

production process of medicinal plants and these inputs have been purchased with the price less than their boundary prices and used in the production of these products.

EPC index shows the effects of government policies in the market of product and input simultaneously. The values of this index were estimated greater than one for Cumin, Anise, Plantago and Dill and less than one for Carla, Ajowan and Licorice. This means that government policies have not affected the production process of these products. Therefore, Cumin, Fennel, Sand plantain and Dill have been just supported effectively in terms of income and inputs by the government.

The values of NSP (Net Social Profitability) index are positive for all products. This means the social profitability of these products in the region. So, the production of these medicinal plants is economically feasible and affordable. About Sand plantain, despite the lack of comparative advantage, the production and export of it will be profitable for producers through government supports.

The values of SCB are less than one for all products except Sand plantain and this shows that the studies regions have comparative advantages in the production and trade of these products and also, have no comparative advantages in the production of Sand plantain. Table4 shows the amount of government support for the production of mentioned medicinal plants.

Table 3: Summarized Results of the protection Coefficients for Agricultural Farming Systems in Iran

Crop/Result	NPCI	Effect	NPCO	Effect	EPC	Effect
Carla	20%	subsid	-74%	Tax	-74%	Tax
Cumin	11%	subsid	26%	Subsid	30%	Subsid
Ajowan	16%	subsid	-16%	Tax	-15%	Tax
Licorice	16%	subsid	-34%	Tax	-34%	Tax
Anise	21%	subsid	5%	Subsid	7%	Subsid
Plantago	11%	subsid	58%	Subsid	69%	Subsid
Dill	16%	subsid	76%	Subsid	86%	Subsid

Ranking of crops for base DRC and SCB indexes

Table5 shows the ratings of studied products based on the indices of DRC and SCB in Sistan region. The results of estimation shows that Momordica, Hibiscus tea, Fennel, Ajwain, Dill and Cumin are placed in the first to sixth ranks, respectively. The order and priority of the products in the region show that Momordica has the maximum production advantage in term of production in the region. The least production advantage is related to the medicinal plant of Cumin.

Table 4: Comparative Advantage Ranking by crops

Crops	SCB	DRC	Ranking
Carla	0.04	0.04	1
Licorice	0.16	0.14	2
Anise	0.47	0.44	3
Agowan	0.56	0.54	4
Dill	0.96	0.96	5
Cumin	0.96	0.96	6

3.1 sensitivity Analysis

Global price is a factor that increase in it can enhance the comparative advantage and it fluctuates a lot, analyzing it can be enlightened. In table6, changes in both positive and negative ranges are considered between zero and 50 percent.

Table 5: Effect of Global price change on the DRC index

Percentage effects/crops (\$/kg)	-50%	-40%	-30%	-20%	0	20%	30%	40%	50%
Carla	0.09	0.076	0.065	0.057	0.045	0.038	0.035	0.032	0.03
Cumin	2.16	1.73	1.44	1.2	0.96	0.78	0.72	0.66	0.62
Ajowan	1.15	0.94	0.79	0.69	0.54	0.45	0.41	0.38	0.35
Licorice	0.73	0.61	0.52	0.45	0.36	0.3	0.28	0.25	0.24
Anise	0.93	0.76	0.64	0.56	0.44	0.36	0.33	0.31	0.28
Plantago	3.38	2.65	2.17	1.84	1.41	1.15	1.05	0.96	0.89
Dill	2.15	1.72	1.43	1.23	0.96	0.78	0.72	0.66	0.61

Table 6: Effect of exchange rate change on the DRC index

Percentage effects/crops (\$/kg)	-50%	-40%	-30%	-20%	0	20%	30%	40%	50%
Carla	0.09	0.07	0.06	0.05	0.045	0.038	0.035	0.032	0.03
Cumin	2.01	1.65	1.4	1.21	0.96	0.79	0.73	0.68	0.63
Ajowan	0.72	0.6	0.51	0.44	0.54	0.29	0.27	0.25	0.23
Licorice	0.73	0.61	0.52	0.45	0.36	0.3	0.28	0.26	0.24
Anise	0.9	0.74	0.63	0.55	0.44	0.36	0.33	0.31	0.29
Plantago	3.02	2.46	2.08	1.8	1.41	1.16	1.07	0.99	0.92
Dill	1.99	1.63	1.39	1.21	0.96	0.79	0.73	0.68	0.63

4. CONCLUSION

The results of calculating the indices of comparative advantage show that there is a comparative advantage in the production of Carla, Ajowan, Cumin, Anise, Licorice and Dill and there is no comparative advantage in the production of Plantago. This means in the production with comparative advantage, shadow cost is less than shadow income. It should be noted that DRC index assesses the feasibility of the production only economically (in terms of cost-benefit) and it doesn't address other aspects such as being a strategic product or production in order to reduce dependency and create self-sufficiency.

In the studies and economic theories, it is expressed that the production of the goods which have comparative advantages and trading them in free global prices improve resource allocation and increase the profitability and sustainability in the production and since, according to the findings, production of medicinal plants in hot and arid regions has economic advantage, producing medicinal plants in such regions has high comparative advantages and it is economically feasible in terms of resource allocation. So, given the high government support of tradable inputs in production, it is recommended that in order to create and enhance effective protection of medicinal plant production in these areas, increasing price supports, especially for the products such as Carla, Licorice and Ajowan which are economically more feasible, is placed in the government's political priorities to attain the increased cultivation of these plants in such areas.

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