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Comparative Advantages and Support Indices of Orange: Case Study of Mazandran Province of Iran

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Abstract: Orange is one of most important crops in Mazandran Province of Iran, to improve farmers' income from production and marketing of orange. Designing and implementing proper strategy is a necessity. Pre-condition for designing such a policy framework is analyzing current policies. In this study using Policy Analysis Matrix (PAM) an attempt is made to study competitiveness of Mazandran orange. Results suggest that orange production in Mazandran province is competitive, with DRC is being equal to 0.49. Worked out NPC is 0.97 which is an indicator of fact that domestic policies reduced farmers' income compared with the income they could earn based on international prices. Computed NPI is 0.53 which shows that government supported producers of orange in Mazandran Province by the mean of subsidizing inputs used in the process of production. The exact amount of support is 47% as explained by NPIR index. Effective Protection Coefficient (EPC) explains consequent of domestic policies regarding farmers' income and input price. EPC for Mazandran orange figured out to be equal to 1.1 which connotes government support this product by support both farmers' income and lowering input prices. The rate of this support is 10% as shown by EPR index.

Key words: Policy Analyszing Matrix · Domestic Resources Cost · Nominal protection coefficient · Effective Protection Coefficient

INTRODUCTION

Agriculture is one of the main economic sectors in Iran that on the one hand provides physical food security and on the other hand by the mean of export and earning foreign exchange contributes to the development of the country. Thus, attention to this sector and supporting it in the face of international competitors in a world of free trade is one of the main government tasks. Considering high export potential of horticultural crops there is need for ranking these crops in the forefront of government attention. Principally, production of any crop in the country in addition to profitability for producers should be profitable for the country as a whole. In other words the cost of producing a crop in the country must be less than income earned from export or money paid for importing that crop. If production of a crop can fulfills this basic condition one can say production of the crop enjoys competitiveness.

In recent years discussions around joining World Trade Organization (WTO) aside from political consideration resulted in importance of research about competitiveness of different industrial as well as agricultural crops. The research works which have been evolved about competitiveness reveal prospects of production and degree of compatibility of crop under consideration after joining World Trade Organization and entering international market.

With Iran's notable potential and ability in production of orange as a horticultural crop designing and implementing proper strategy and program for export of this crop is essential. Conducting detail and in depth studies about competitiveness and support indices of orange can provide required information for future planning and decision making for agricultural planners and decision makers.

The sweet orange *Citrus aurantium* is a hybrid of ancient cultivated origin, possibly between pomelo (*Citrus maxima*) and mandarin (*Citrus reticulata*). Orange is produced in different provinces in Iran. Mazandran province is the largest producer of this crop in the country with the production of 54% of country's total

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orange output. According to the FAO statistics in the year 2008, 68599338 tons of orange produced in the world. The largest producer of orange in the world is Brazil with the production of 18538084 tons produced 27% and Iran with the production of 2619735 tons produced 3.81 % of world total production of orange. This data placed Brazil at the top of list of orange producers and Iran at 8th position.

In this paper keeping in mind importance of orange for farmers in Mazandran province of Iran an endeavor is made to gauge competitiveness of this product.

Review Literature: Gonzales *et al.* [1] studied Indonesian food crop production, Using Policy Analyzing Matrix. They concluded that Indonesian agriculture as a result of support policies experienced rapid growth in 1980s but their results proved that these policies were costly.

A Study by Huang *et al.* [2] using Policy Analysis Matrix (PAM), indicated that there is huge difference between market profitability and social profitability in production of sweet potato. The study also showed that if the government intervention removed production of sweet potato will become more profitable and production of sweet potato even in existing circumstances was more profitable compare with corn in Ci Chuan Province.

Yao [3] applied Policy Analyzing Matrix to the agricultural sector of Thailand in order to study government policies to promote diversified cropping pattern instead of specialized cropping pattern.

FAO [4] studied competitiveness of Egypt agriculture using Policy Analysis Matrix the study showed comparative advantage in production of wheat, cotton, sugarcane, sugar beet, summer potato and winter tomato while revealed that Egypt was in comparative disadvantage in production of forage corn, maize.

Hussain *et al.* [5] using Policy Analysis Matrix studied compatibility of sugar cane in Punjab and Sindh of Pakistan. Results showed that the above two states lacked competitiveness as far as production of sugar cane is concern.

Mousanejad [6] studied competitiveness of selected agricultural crops in Iran. He found that regional competitiveness is bigger than whole country's competitiveness i.e. while major producing areas in the country are competitive compared with the rest of country as far as production is concerned the country is not competitive when compared with international market. Therefore, he suggested consideration of regionalization of production of agricultural crops in national level planning.

There are also studies that carried out to study citrus crops competitiveness. Jolaei [7] studied competitiveness of citrus crops in Jahrom district of Fars province of Iran, his study showed that with DRC of 0.31 Jahrom enjoys competitiveness as far as citrus production is concerned and he further states that with EPI of 0.64 it is revealed that Government supported citrus production at the time of study.

Jacque *et al.* [8], assessed the competitive position of Trinidad and Tobago's citrus industry and explains the declining productivity. It covers supply chain and agricultural trade policy issues and involves assembling two Policy Analysis Matrices, either with full cost of production or excluding establishment costs. Domestic and trade policy support showed significant for the sector. Production was internationally competitive, or possessed comparative advantage, only if costs of establishment were excluded.

Rabab Snouber [9] studied comparative advantage of fresh orange and juice concentrate in Syria result of this study showed that there was a substantial comparative advantage in packaging fresh orange for regional and world markets. Results of this study also revealed that Syria has comparative advantage in orange concentrate production when its concentrate factories work under normal capacity.

Neda Trifkoviæ and Wusheng Yu [10], studied competitiveness: of Moroccan citrus sector using Revealed Comparative Advantage (RCA) index to measure comparative advantage and relative unit value (RUV) index to measure competitiveness and Constant Market Share Analysis (CMSA). They found that when it comes to the EU market, Morocco incurred losses in quantities and value of citrus fruit exported. Morocco was neither able to maintain market shares and competitiveness, nor to distribute citrus to high-growing markets in the EU. While, in trade with non-EU countries, Morocco was able to increase its market presence and increase quantities exported. This amount does not surpass the quantity loss in the EU market, which indicates that Morocco was not able to shift all the excess of citrus fruit from the EU to non-EU markets.

MATERIALS AND METHODS

The policy analysis matrix is a double entry accounting technique which presents economic information of in farm activities and off farm activities in summarized form. Usage of Policy Analysis Matrix is very simple but it is very strong from theoretical point of view.

The origin of Policy Analysis Matrix is from the topic of social cost –benefit in theory of International trade. This method is based on basic accounting equation i.e. profit is equal Revenue minus cost [11].

Policy Analysis Matrix is calculated based on two types of prices. These prices include private prices and social prices. Private values or market values are prices that on the bases of them goods and services are exchanged in the market. Private prices are used for budgeting of farm activities. These prices are determined domestically and affected by government policies and intervention and or market failure. These prices that also called actual prices, market prices or financial prices are prices which are paid in reality by the farmers Jolaei [12]. Social prices are prices that are made up of elimination of effect of policy distortions (such as taxes and subsidies) or market imperfections (such as monopoly) from private prices. These prices are reflecting of social values rather than private values, social values are used in economic analysis in order to maximize national income. Social values sometimes are referred to as shadow prices, efficiency values, economic price, opportunity cost or real price. In the Monke-Pearson PAM framework, policy interventions are associated primarily with divergences between the private and social prices of tradable outputs and inputs. Private prices are those observed in domestic markets; social prices are the domestic equivalents of the international prices of tradable commodities. The latter represent the true opportunity cost of tradable to the economy.

The data entered in the first row of Policy Analysis Matrix provide a measure of private profitability. The term private refers to observed revenues and costs reflecting actual market prices received or paid by farmers, merchants, or processors in the agricultural system. The private or actual market prices thus incorporate the underlying economic costs and valuations plus the effects of all policies and market failures. The private profitability calculations show the competitiveness of the agricultural system, given current technologies, output values, input costs and policy transfers i.e. subsidies or direct as well as indirect taxes.

The second row of the accounting matrix uses social prices, as indicated in Table 1. These valuations measure comparative advantage or efficiency in the agricultural commodity system. Efficient outcomes are achieved when an economy's resources are used in activities that create the highest levels of output and income. Social profits are an efficiency measure because outputs and inputs are valued in prices that reflect scarcity values or social opportunity costs. Social profits like their private analogue are the difference between revenues and costs, all measured in social prices.

Table 1: Policy Analysis Matrix

		Value of inputs		
	Profit	Domestic factors	Tradable	Revenue
Market Prices	D	C	B	A
Social prices	H	G	F	E
Divergences	L	K	J	I

While private profitability can be used as an indicator of competitiveness under existing policy intervention, the social profitability is an indicator of efficiency or competitiveness. When social profits are negative, a system cannot survive without assistance from the government. Such systems waste scarce resources by producing at social costs that exceed the costs of importing [11].

The policy analysis matrix is a product of two accounting identities, one defining profitability as the difference between revenues and costs and the other measuring the effects of divergences (distorting policies and market failures) as the difference between observed parameters and parameters that would exist if the divergences were removed. By filling in the elements of the PAM for an agricultural system, an analyst can measure both the extent of transfers occasioned by the set of policies acting on the system and the inherent economic efficiency of the system.

In the PAM, profitability is measured horizontally, across the columns of the matrix, as demonstrated in Table 1 Profits, shown in the right-hand column, are found by the subtraction of costs, given in the two middle columns, from revenues, indicated in the left-hand column. Each of the column entries is thus a component of the profits identity-revenues less costs equals' profits.

Each PAM contains two cost columns, one for tradable inputs and the other for domestic factors. Tradable inputs are those inputs which could be traded in international markets such as fertilizers, improved seeds, fuel etc. and domestic resources such as land, labor and capital.

Elements of policy analysis matrix are calculated based on two types of prices including private prices and social prices. The term private refers to observed revenues and costs reflecting actual market prices received or paid by farmers, merchants, or processors in the agricultural system. The private, or actual, market prices thus incorporate the underlying economic costs

and valuations plus the effects of all policies and market failures. These prices are also called actual prices, market price and financial price. Sometimes social prices are called shadow prices, efficiency values, opportunity costs, economic price and real price.

Method of Calculation of Social Prices (Shadow Prices): The international market prices form backbone of calculation of social prices and analysis of efficiency of agricultural system. Social price of an agricultural commodity is boarder price of that commodity that international suppliers by that price deliver the commodity under consideration to the national market or it is price that is paid by foreign consumer (outside national boundaries) for the commodity under consideration which is supplied to them by national suppliers. In fact, these prices are opportunity cost of the commodity under consideration. As any product can be exported or imported the method of calculation of shadow prices differs for exported and imported crops.

Shadow price of imported crops is their Cost, Insurance & freight price (C.I.F price) plus the cost of transporting these commodities to the farm gate. Shadow price of exported price is their Free on Board price (F.O.B price) on country's boarder minus cost of transporting them to the boarder.

To calculate Shadow prices of inputs, we can divide them into tradable and non tradable inputs. Tradable inputs are those inputs which can be traded in international markets e.g. pesticides, chemical fertilizers, seeds etc. non-tradable inputs are those inputs which can not be sold in international market e.g. land, water, labor and capital. Shadow price of tradable inputs is their C.I.F. prices plus cost of transporting them to the domestic market, in fact this price is the price by which foreign suppliers deliver inputs to the national market.

To calculate opportunity cost of water a pervasive crop with proper profitability is chosen. In the case of Iran this pervasive crop is wheat which is harvested all around country and then the value of profitability of use of 1 m^3 water in production of wheat is calculated and used as opportunity cost of 1 m^3 water. In order to calculate value of profitability of 1 m^3 water we subtracted profitability of 1hec unirrigated wheat from profitability of 1hec irrigated wheat. Then the difference divided to the volume of water used in production of 1 hectare of irrigated wheat assuming that efficiency of water application is % 40. Data required for calculating profitability of 1 hectare of irrigated as well as unirrigated wheat is obtained form ministry of agriculture which gather and maintain cost of production of agriculture and horticultural crops.

One of the most important points in construction and calculation of Policy Analysis Matrix (PAM) is converting international foreign exchange rate to the national rate of exchange. Due to the reason that official exchange rate in Iran is controlled by government and if we use this official exchange rate we will have digression in our result, therefore, we will not use this exchange rate as basis for our conversion. Instead we use the methoid which is used by FAO in Egypt and Kazakhstan to calculate shadow exchange rate [4].

$$CF=\frac{(M+X)}{MO'(1+T_M)+XO'(1+T_X)} \quad (1)$$

The equation (1) which is used by FAO to calculate shadow exchange rate is as follow:

In which:

CF : Conversion coefficient
M : C.I.F Value of total import of country.
X : F.O.B value of total export of country.
T_M : Average import tariffs.
T_X : Average export tariffs.

After Calculation of Conversion Coefficient Shadow Exchange Rate Can Be Calculated Using Equation (2):

$$SER = OER \quad (2)$$

In which : CF
SER : Shadow Exchange Rate.
OER : Official Exchange Rate.
CF : Conversion coefficient obtained from equation (1).

Policy Analysis Indices:
The PAM is a computational framework, developed by Monke and Pearson [11] and augmented by Masters and Winter-Nelson [13], for measuring input use efficiency in production, comparative advantage and the degree of government interventions. The basis of the PAM is a set of profit and loss identities that are familiar to any businessman [14]. The basic format of the PAM as shown in Table 1 is a matrix of two-way accounting identities.

The data in the first row provide a measure of private profitability (D), defined as the difference between observed revenue (A) and costs (B+C). Private profitability demonstrates the competitiveness of the agricultural system, given current technologies, prices for

inputs and outputs and policy. The second row of the matrix calculates the social profit that reflects social opportunity costs. Social profits measure efficiency and provide a measure of comparative advantage in this matrix social profi (H) is defined as difference between (E) and shadow prices of inputs (F+G). In addition, comparison of private and social profits provides a measure of efficiency. A positive social profit indicates that the country uses scarce resources efficiently and has a static comparative advantage in the production of that commodity at the margin.

Similarly, negative social profits suggest that the sector is wasting resources, which could have been utilized more efficiently in some other sector. In other words, the cost of domestic production exceeds the cost of imports suggesting that the sector cannot survive without government support at the margin. The third row of the matrix estimates the difference between the first and second rows. The difference between private and social values of revenues, costs and profits can be explained by policy interventions.

The PAM framework can also be used to calculate important indicators for policy analysis. The nominal protection coefficient (NPC), a simple indicator of the incentives or disincentives in place, is defined as the ratio of domestic price to a comparable world (social) price. NPC can be calculated for both output (NPCO) and input (NPCI). The domestic price used in this computation could be either the procurement price or the farm gate price while the world reference price is the international price adjusted for transportation, marketing and processing costs. The NPCI in above PAM is (B÷F). Nominal Protection coefficient (NPC) is an index which determines impact of government policies on farmers' income NPC in our PAM is (A÷G). Less than 1 NPC is an indicator of implicit tax on farmers' income and NPC more than 1 is indicator of implicit subsidies which government gives to the farmers.

The other two indicators that can be calculated from the PAM include the effective protection coefficient (EPC) and domestic resource cost (DRC). EPC is the ratio of value added in private prices (A?B) to value added in social prices (E?F). An EPC value of greater than one suggests that government policies provide positive incentives to producers while values less than one indicate that producers are not protected through policy interventions.

DRC, the most useful indicator of the three, is used to compare the relative efficiency or comparative advantage between agricultural commodities and is defined as the shadow value of non-tradable factor inputs used in an activity per unit of tradable value added (G/(E -F). The DRC indicates whether the use of domestic factors is socially profitable (DRC<1) or not (DRC>1).

RESULTS AND DISCUSSION

The most important part in working with Policy Analysis Matrix PAM is to calculate shadow prices of inputs. In case of tradable inputs which are traded in international market shadow prices could be calculated by using their prices in the international market. However, calculation of shadow prices of domestic or non tradable inputs is not as simple as tradable ones. One of the main methods used to calculate shadow price of domestic resources is computing their opportunity cost. This method is appropriate in case of inputs such as land and labor which have competitive uses and farmers receive no subsidies from government for their usage. However, this approach can not be employed in case of inputs such as water that has no market price or agricultural machinery that government pays subsidies for their purchase. Therefore, for such inputs other methods such as final value of marginal product,, cost of acquiring or computation of subsidies is used as method of calculation of shadow prices.

Since the labor price is determined in a competitive market and Iranian government is not interfering in labor market, market price of labor can be taken as its shadow price. Like labor land has a competitive market that government has no interference in which, therefore market price of land can be taken as its shadow price.

As the price of agricultural machinery is subsidized by government calculation of their shadow price is not as simple as land and labor. Before 2006 government of Iran paid subsidize to the factories producing agricultural machinery in lieu of each tractor sold to the farmers. After 2006 government changed its policy direct subsidy to the farmers through compensating factories to the policy indirect subsidy. In this new policy scheme government pays subsidy to the farmers in the form of subsidized credit to by tractor and other agricultural machinery. In this policy scheme farmers pays only 15% of price of agricultural machinery which he/she intends to purchase for the rest he/she gets credit at the rate interest of 12%, out of interest rate of 12% farmers pays only 5% and the rest which is 7% is paid by government to the donor bank. The pay back period of these loans is 5 years.

The average price of tractor in the year 2007 was 105000 thousand Rials which in accordance to new government scheme farmers required to pay 15% of which in cash and the rest which was equal to 89250 thousand

Table 2: Policy Analysis Matrix for Mazandran Orange.

		Orange-Mazandran		
		Production costs		
	Revenue	Tradable	Non-tradable	Profit
Private prices	7,280,066	881,085	2,802,882	3,596,100
Social prices	7,470,953	1,675,315	2,847,401	2,948,236
Divergence	-190,886	-794,230	-44,519	647,863

Source: Research Findings

Table 3: indicators of comparative advantage and support indices.

NPC =	0.97	NPR =	-3%
NPI =	0.53	NPIR =	47%
EPC =	1.10	EPR =	10%
DRC		0.49	

Source: Research Findings

Rials was paid through subsidized credit. Hence farmers only pays 5% of original 12% interest rate the price which is paid by he/she to purchase tractor can be calculated using engineering economics equation equal to 91460 thousand Rials, in other words farmers received 13530 thousand Rials as credit subsidy to purchase tractor.

As far as fuel subsidy is concerned farmers receive gasoline at the rate of 16.5 Rials while its price in the international market is 4000 Rials, each tractor consumes on average 6 liter of gasoline per hour therefore we can calculate fuel subsidy easily. Our calculation showed that per hour cost of application of subsidized machinery is equal to 36450 Rials which increases to 61830 rials while the application is unsubsidized. In other word cost of machinery with out subsidy is 1.7 times of cost subsidized machinery. Therefore to obtain shadow price of machinery it is enough to multiply cost of each mechanical operation to 1.7 and calculate social cost of machinery.

As water in Iran neither has competitive market nor it is sold based on volume used, the exact price of water is not available, therefore calculation of shadow price of water is very difficult. On the other hand the officials of energy ministry of Iran that is in charge of water resources announced that the cost of water which is used in agriculture sector is much higher than the money paid by farmers as water charges. These officials in several broadcasted statements have announced that cost of harvesting agriculture water is between 600 to 800 Rials per m^3 while the real amount that is paid by farmers is 100 Rials per m^3 however, cost of harvesting water can be used as good measure of water price but it can not show real value of water. As a result in this study we have used concept of opportunity cost of water to calculate shadow price of water. Profit per hectare for irrigated wheat stands at 2632880 Rials and that of unirrigated wheat is equal to 634000 Rials. Therefore, the opportunity cost of water is equal to 218 Rials.

Information gathered through questioner provides water cost for 1 hectare of horticultural crops. Considering the fact that efficiency of irrigation is 40% and the amount of water is required for 1 Hectare of horticultural crop is given we can calculate water cost per m^3 for each crop. Using the above mentioned information per m^3 water cost is worked out to be 91 Rials per m^3 for study area. Thus we can see that the opportunity cost of water is 2.4 times of water price farmers paid for the production of orange in Mazandran Province of Iran

Using information given in table 2 we can calculate indicators comparative advantage as well as support indices. Table 3 demonstrates these indices in tabular form.

In table 2 last column shows social and private profitability along with their divergence, this column indicate that production of orange in Mazandran is profitable based on both social and private prices and its private profitability is higher than social profitability.

DRC index for Mazandran orange is equal to 0.49 (Table 3) which means production of orange enjoys comparative advantage.

Worked out NPC for Orange of Mazandran is 0.97 which is an indicator of fact that domestic policies reduced farmers' income compared with the income they could earn based on international prices. In other word, government collects implicit tax from farmers who are producing orange in Mazandran provinces. However, this tax is negligible (-3 percent) as shown by NPR index (Table 3).

NPI illustrates the effect of government policies on inputs. Computed NPI for Mazandran orange is 0.53 which means that government supported producers of orange in Mazandran Province by the mean of subsidizing inputs

used in the process of production. The exact amount of support is 47% as explained by NPIR index.

Effective Protection Coefficient (EPC) explains consequent of domestic policies regarding farmers' income and input price. EPC for Mazandran orange figured out to be equal to 1.1 which connotes government support this product by support both farmers' income and lowering input prices. The rate of this support is 10% as shown by EPR index.

DISCUSSIONS AND SUGGESTIONS

Policy accounting matrix provides static analysis of present situation. With the passage of time the situation changes and as a result economic factors that affect competitiveness of a product or set of products will change. Some economists and policy makers think if a product is uncompetitive means that product shall not be produced. This is one side of discussion on analysis of competitiveness. The other side however is making policy effort to change an uncompetitive product to competitive one. The products which are not competitive or the degree of their competitiveness is low are alarming bells for policy makers in order to pay attention to them. In the cases like Mazandran province orange that the product seems to be competitive there is need for policy makers to maintain status quo situation or even strengthening competitiveness by the mean of policy instruments.

In addition to efficiency of producers there are other factors that determine competitiveness of product some of them include price of commodity under consideration in the international market and domestic price of inputs which are used in the production of product. As we know these prices are not stable and always fluctuates in accordance to prevailing economic, social and political conditions. If the statesmen and policy makers look at the indices of competitiveness with simplicity it could results in economic catastrophe and tragedy for producers as well as consumers. In fact, analyzing and scrutinizing each index of economic competitiveness needs in depth look in order to recognize vulnerabilities and strengths of product under consideration in the context of production, marketing and export.

Result of this research work shows apt situation as far as comparative advantage and production ability of producers of orange in Mazandarn Province is concern. Since domestic price of this product shows no meaningful difference with export prices and on the other hand its producers received input subsidies we can conclude that aggregate domestic policy measures favored production of this crop. Despite the fact that Iran is 8th orange producers in the world it is 32nd exporter of this product, which means little efforts have been done for marketing of Mazandran orange in the world which means to promote export of this crop designing and implementing proper export strengthen marketing strategy is required. Another problem related to production of Mazandran orange is the fact that average yield per hectare of orange in Mazandran of Iran is 15.2 tons while world level yield of orange is 17 tons per hectare which means productivity of Iranian Farmers is much lower comparing with the world average. This in turn means beside export marketing strategy designing and implementing apposite strategy for closing the yield gap between Iran and world average is a necessity.

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