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An Investigation of Comparative Advantage of Pistachio Production and Exports in Iran

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ABSTRACT

Pistachio is a major agricultural export commodity in Iran. Nowadays, it ranks first among Iran's agricultural exports. This paper focuses on the comparative advantage in pistachio production and the export market in Iran. A policy analysis matrix (PAM) framework and revealed comparative advantage (RCA) index are applied to 2000-2004 data to study Iranian government policy regarding pistachio production and export. In addition, the producer protection indices in the framework of the aforementioned matrix was calculated in order to study input and output protection policy. Results showed that Iran has a comparative advantage both in the production and export of this commodity, but the comparative advantage in pistachio production is diminishing. The RCA index showed that the comparative advantage of pistachio exports from Iran has progressed. Indices showed a high net social profitability and government protection of pistachio producers in terms of input subsidies. Then, the effects of the changing world price, exchange rate, cost of domestic factors, and cost of tradable inputs on the comparative advantage and protection indices showed that, for retaining comparative advantage in pistachio production, productivity and production costs must be both increased and decreased, respectively. In order to increase the productivity of pistachio, farmers should use scientific on-farm management and should employ modern production methods, and the government should develop research and development institutes.

Keywords: Comparative advantage, Pistachio, Policy analysis matrix, Protection indices, Revealed comparative advantage.

INTRODUCTION

The leading pistachio producing countries are: Iran, the U.S.A, Turkey, Syria, China, Greece, Italy, Uzbekistan, Tunisia, and Madagascar. Among these countries, Iran as the original home of the pistachio, has always had the largest area harvest and production (FAO, 2005).

According to the statistics reported by FAO (2005), the annual amount of pistachio production in Iran was 190,000 Mt which constitutes 62% of the world pistachio production. After Iran, the U.S.A with 140,000 Mt of production is the second major country in terms of pistachio production and Turkey with 60,000 Mt of production is in the third place. Iran has also 33% of the total harvest area among other major countries, with a 300,000 ha area harvest of pistachio. Turkey with 38,600 ha and the U.S.A with 35,000 ha lie in second and third places, respectively. In Iran, the increase in pistachio production is due to the increase in harvest area while the U.S.A, Iran's major rival, has been able to take advantage of both harvest area and yield improvement in order to increase its production. The aforementioned report also states that the yield of pistachio in Iran, particularly in recent years, has been lower than its average throughout the world. terms of yield.

Historically, Iran has been the most important exporter of pistachio in the world. After

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the Islamic Revolution in Iran, because of strained relations between Iran and the U.S.A leading to the stop of Iranian goods export to that country, as well as the accession of most countries to WTO, the position of Iran in pistachio exports has deteriorated. Iran's most important customer has changed into its major rival in the world market. However, in 2004, Iran was the major exporter of pistachio, having 138,723 Mt pistachio export, and had 41% of the total exports throughout the world.

Owing to the high importance of Iran's pistachio in terms of the economy and foreign exchange earnings, and also considering the fact that real competition is based on comparative advantage, study of comparative advantage and government protection indices for pistachio production appears necessary.

In order to study export comparative advantage, Balassa (1965) derived an index (called the Balassa Index) that measured a country's comparative advantage. The Balassa index tries to identify whether a country has a "revealed" comparative advantage rather than to determine the underlying sources of comparative advantage (Utkulu and Seymen, 2004).

Government intervention leads to the dominance of unreal costs and prices in the input and product market, and economical evaluation causes production to be distored. The policy analysis matrix (PAM) is normally used to recognize the amount of such distortions and to evaluate the production economically. Yao (1999), developed a modified PAM, and used the Thai agricultural diversification programme to demonstrate that government policy to encourage more production of legume crops at the expense of rice is not as undesirable as it has been criticized by some economists when water charging and environmental cost are taken into consideration. There have been studies applying the PAM to calculate both social profitability and protection indices (Adesina and Coulibaly, 1998; Hall *et al*., 2004).

In short, the objective of the present paper was to develop a simple framework to study private incentives, social (economic) incentives, and Iranian government intervention in Iran's pistachio market using the PAM (Monke and Pearson, 1989) and the revealed comparative advantage (RCA) index (Balassa, 1965).

MATERIALS AND METHODS

The Policy Analysis Matrix

In this study, the PAM method which is a comprehensive tool to calculate comparative advantage and protection indices was applied to assess the effect of Iranian government intervention in Iran's pistachio production and also to study the effects of protectionist policies on Iranian pistachio producers. The PAM, developed by Monke and Pearson (1989), is a partial equilibrium framework that allows the analysis of policies in terms of their impact on commodity systems, representing the results in a matrix of private and social values (Table 1).

The PAM approach requires information on accounting matrices for revenues, costs, and profits (revenues minus costs). Costs are defined in two columns as tradable inputs and domestic factors (essentially land, labour, and capital). Tradable inputs are those available at the international market level; those available domestically are potential exports. Intermediate inputs are disaggregated into tradable input and domestic factor components. The first row of the PAM contains the calculation of private profitability, which represents the competitiveness of the agricultural system given the technologies, observed market input and output costs and policy transfers. The second row defines social profitability, representing comparative advantage or efficiency in the agricultural commodity system. Social price (measured at the international market level) reflects the valuation of domestic factors; positive social profits are indicative of socially efficient usage of the resource, and negative social profits indicate production at social costs

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Table 1. The Policy analysis matrix**.**

Prices used and effect (transfers)	Revenues	Input costs		Profit
		Tradable inputs	Domestic factors	
Private price	A	B	C	D[a]
Social price	E	F	G	H[b]
Transfers	I[c]	J[d]	K[e]	L[f]

Source: Monke and Pearson (1989).

[a] Private profits, D= (A-B-C); [b] Social profits, H= (E-F-G); [c] Output transfers, I= (A-E); [d] Input transfers, J= (B-F); [e] Factor transfers, K= (C-G), [f] Net transfers, L= (D-H)= (I-J-K).

that exceed the costs of importing, resulting in social inefficiencies. The final row of the PAM represents transfers; vertical divergences must be explained by the effects of distorting policy or the existence of market failures. The net transfer caused by policy and market failures (L= D-H) is the sum of the separate effects in the factor and product markets (Hall *et al*., 2004).

This matrix includes all of the inputs necessary for the calculation of the indices shown in Table 2 such as: Nominal Protection Coefficient of Output (NPCO), Nominal Protection Coefficient of Tradable Input (NPCI), Effective Protection Coefficient (EPC), Producers Subsidy Equivalent (PSE), Subsidy Ration to Producer (SRP), Net Social Profitability (NSP), Domestic Resource cost (DRC), and Social Cost-Benefit (SCB).

NPCO indicates either the net effect of distortions or a negative protection on outputs. An NPCO>1 reveals that producers are protected for the product. Similarly, by using input costs, NPCI measures the ratio of the private cost of tradable inputs to their social cost. Where NPCI<1, producers are receiving protection or subsidy for input purchase prices.

EPC is a measure of the net effect of distortions or negative protection on outputs and tradable inputs. EPC>1 shows that the government has protected the product and that the result of government intervention in product and input prices has been benefical to the producers. EPC<1 shows that government has received an indirect tax from the producers and that the result of government intervention in product and input markets has been loss-making to the producers.

PSE and SRP are similar to each other. Their positive values show that the producers have received a subsidy and their negative values show that the producers have paid tax.

NSP is one of the indices related to comparative advantage. It shows either the value of the net social profit or loss of activity. In terms of agricultural products, it shows the difference between gross revenue and total costs of production in hectare, both measured in terms of world prices.

DRC is another index related to comparative advantage. The DRC indicates comparative advantage measured as the difference between the opportunity costs of using domestic resources (G) and the value-added generated by the activity (E-F), both measured in terms of world prices. If production

Table 2. Current indices indicating comparative advantage and agricultural protection policies based on PAM.

Comparative advantage indices	Protection indices
NSP= E-(F+G)	*NPCI= B/F*
DRC= G/(E-F)	*NPCO= A/E*
SCB= (F+G)/E	*EPC= (A-B)/(E-F)*
	PSE= L/A
	SRP= L/E

Source: Mucavela (2000).

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of a product is of social benefit, then one expects DRC<1, indicating comparative advantage over other outputs using the same inputs.

SCB is actually the relationship between cost and benefit and evaluates an activity or project from a social point of view. SCB<1 shows the existence of social advantage in the production of that product and SCB>1 shows the lack of social advantage (Mucavela, 2000).

World price, exchange rate, cost of tradable inputs, and cost of domestic factors are of high importance in the calculation of comparative advantage and protection indices. Hence, by sensitivity analysis the effects of these variables on each of the main indices (DRC, NPCI, NPCO, Private profit, and Social profit) were investigated and the sensitivity of each of the indices was measured.

Social Prices

The social prices of inputs, product, and exchange rate are basic elements of comparative advantage and protection indices in the policy analysis matrix framework. In this study, in order to calculate the social prices of tradable inputs (essentially fertilizer and toxin) and the product (pistachio), the United Nations Industrial Development Organization's (UNIDO) method was applied (Mucavela, 2000). To calculate the social prices of domestic factors, the domestic market value was used.

Since the exchange rate is of high importance in the calculation of the PAM, the social exchange rate should be used to calculate the social prices.

In the studies done by FAO so far on comparative advantage in Egypt and Kazakhstan, a method was used to calculate the social exchange rate in which the social exchange rate was calculated according to the extent of exports and imports as well as export and import tariffs (Joolaie, 2004). In this context, Social Exchange Rate (SER) is defined as *SER= OER/CF*, where OER is Official Exchange Rate, and CF (Covertion Coefficient) is defined as:

$$CF= (M+X /M^* (1+T_M) + X^* (1-T_X)$$

Where M= Total import value; X= Total export value; T_M= Average tariff rate for imports, T_X= Average tariff rate for exports.

Revealed Comparative Advantage

RCA is one of the export comparative advantage indices, which was used for the first time by Balassa (1965) to evaluate the export yield of country and different goods. Balassa (1965) proposed that it may not be necessary to include all constituents affecting a country's comparative advantage. Instead, he suggested that comparative advantage should be "revealed" by observed trade patterns, and in line with the theory, one needs pre-trade relative prices which are not observable. Thus, inferring comparative advantage from observed data is called "revealed" comparative advantage (RCA). In practice, this is a commonly accepted method of analyzing trade data (Utkulu and Seymen, 2004).

The complete form of RCA was used in the following form by Vollarth (1991):

X_a^i= Total export value of product (a) by country (i)

X_t^i= Export value of the whole industrial goods by country (i)

X_a^w= Total export value of product (a) allover the world

X_t^w= Export value of the whole industrial goods all over the world

RCA_a^i= Revealed comparative advantage.

RCA>1 shows the existence of comparative advantage and RCA<1 shows the lack of comparative advantage. In this study, RCA would be calculated for the general economic state (X_t^i= X_T= Total export value of the commodity) and agriculture sector (X_t^i= X_A= Total export value of agricultural products) in Iran.

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Given that there exists a range of RCA alternative indices suggested and employed in the literature to measure comparative advantage, some inconsistent results may occur as obtained by the use of different RCA indices. Interpretation of the RCA indices in the ordinal or cardinal senses is another field of dispute. Furthermore, the stability and the consistency of alternative measures of RCA have been questioned. It has been therefore proposed that the policy makers need cautious interpretation of RCA indices by especially underlining probabilities of revealing a comparative advantage or disadvantage (Utkulu and Seymen, 2004).

RESULTS AND DISCUSSION

The Study of Comparative Advantage and Protection Indices

In order to make the PAM results dynamic, indices were calculated for both the period of 2000-2004 and the average for the 5 years of the study (Table 3).

The first three indices in Table 3 show either the existence or lack of comparative advantage. The value of DRC indicates the existence of comparative advantage in pistachio production in Iran (if DRC<1, the comparative advantage exists), with the exception of the year 2000, in which production costs increased per kilo in pistachio due to low yield and, therefore, DRC was 1.1. On average, the value of this index during the period was calculated to be 0.64. In other words, in order to get or save 1,000 Rials foreign exchange, we had to spend 64 Rials from domestic resources.

The average value of net social profitability in the period was 9,083 Rials per kilo of pistachio which shows the existence of comparative advantage in pistachio production in Iran. The value of NSP was negative in 2001 because of a high decrease in yield (as a result of spring chilling injury) and so was it in 2003.

Since the average value of SCB for pistachio production in Iran was less than one, comparative advantage, from a social point of view, exists in pistachio production (except in 2000).

DRC, SCB, and NSP indices have fixed concession and it is possible that the values of these indices change through changing economic conditions. Although comparative advantage existed in pistachio production during 2001-2004, in 2000, with the reduction of yield as a result of spring chilling injury, lack of comparative advantage was seen in Iran's pistachio production. Therefore, using effective policies is a must for increasing yield and reducing production costs in order to support the export market.

The average value of NPCI during the period was 0.27. It shows that the private price of the inputs was less than the social price

Table 3. Calculated results of elements of PAM for pistachio in Iran (2000-2004).

	2000	2001	2002	2003	2004	Average
DRC	1.10	0.40	0.47	0.59	0.62	0.64
NSP	-1181	11876	13117	10240	11362	9083
SCB	1.04	0.58	0.63	0.74	0.77	0.75
NPCI	0.27	0.27	0.26	0.27	0.26	0.27
NPCO	0.96	0.81	0.67	0.9	0.92	0.85
EPC	1.76	1.05	0.86	1.29	1.35	1.26
PSE	0.31	0.07	-0.11	0.23	0.26	0.15
SRP	0.30	0.06	-0.08	0.20	0.24	0.14

The required data for calculation of indices have been collected from Pistachio Office and Agricultural Support Services Company of Iran's Ministry of Agricultural Jihad and the website of Iran's Customs (http://www.irica.gov.ir).

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and it means that imported agricultural inputs (such as fertilizers and toxins) used in the production process were subsidized by the government.

The value of NPCO was less than 1 during different years and this shows that the government received an indirect tax from the producers and that there was no protectionism.

EPC, which shows the effects of government intervention on product and input markets, was 1.26 for the average period. This means that the government supported the product. In 2002, EPC was negative suggesting that the result of government intervention in product and input markets was loss-making for producers.

The values of two indices (PSE and SRP) show that the producers received a subsidy during the period of the study; but in 2002 these indices were negative, indicating that government interventions in the output and input markets were destructive for producers.

Sensitivity Analysis of Comparative Advantage and Protection Indices

The results of sensitivity analysis of indices for pistachio in Iran are given in Table 4. The results show that for every 5% increase in the exchange rate, DRC increased by 10% that is to say, the index changed from 0.64 to 0.58 which shows the increase in comparative advantage for pistachio production. As a result of the change in this variable, there was no change in NPCI and private profit; however, the social profit gained per kilo of pistachio changed from 9083 Rials to 10,925.2 Rials, revealing a 2% increase. The effect of a 5% increase in the world price of pistachio on the mentioned indices was the same as the effect of a 5% increase in the exchange rate.

The results of a 5% decrease in the domestic factors cost suggest that the existence of scientific management on the farm and the increase in productivity by reducing production costs have an undisputed effect on comparative advantage, and that it has caused a 10% decrease in the DRC. The private profit and social profit increased by 4% and 7.2%, respectively, however, their indices didn't change. A 5% decrease in the cost of tradable inputs had the same results as the 5% decrease in the cost of domestic factors. However, a comparison between the 5% decrease in cost of tradable inputs and the 5% decrease in cost of domestic factors shows that the increase in private profit was more in the latter, and the social profit was more in the former.

Table 4. Sensitivity analysis of indices for pistachio in Iran (average period).

Description	Indices				Profit per kilo of Pistachio (Rial)	
	DRC	NPCO	NPCI	EPC	Private profit	Social profit
Present situation	0.64	0.85	0.27	1.26	14903.4	9083
5% increase in exchange rate	0.58	0.81	0.27	1.16	14903.4	10925.2
5% increase in world price	0.58	0.81	0.27	1.16	14903.4	10925.2
5% decrease in cost of domestic factors	0.59	0.85	0.27	1.26	15517	9742
5% decrease in cost of tradable inputs	0.60	0.85	0.27	1.22	15085	9783

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Table 5 shows the change in DRC as a result of the change in the cost of domestic factors, world price, and the cost of tradable inputs. The highest amount of decrease in DRC occurred when cost of domestic factors and cost of tradable inputs decreased by 5% and the world price increased by 5% (the variety range is considered as 5%). In this case there was a 17% decrease in DRC (present DRC changed from 0.64 to 0.53) and the highest amount of increase in DRC occured when the cost of domestic factors and the cost of tradable inputs increased by 5% and the world price decreased by 5%; in this case there was a 19% decrease in DRC (present DRC changed from 0.64 to 0.76).

Study of Iran's Comparative Advantage in Pistachio Export

Table 6 shows the results of calculated RCA for pistachio in Iran during 2000-2004. For the general economic state of Iran, RCA_{XT} was calculated. The RCA_{XT} values of greater than 1 indicate that Iran had a comparative advantage in pistachio exports during 2000-2004. During these years RCA had a rising trend due to an average increase of 1.84% per year. This shows that the share of the export value of pistachio from Iran's export value of the whole industrial goods had a 1.84% increase per year, as compared with the world. The reduction in RCA_{XT} in 2004 was due to the reduction in export value of pistachio in Iran.

RCA_{XA} for the agriculture sector was also calculated. The calculated RCA_{XA} shows that Iran had a comparative advantage in pistachio exports during 2000-2004. During these years RCA had a rising trend due to an average increase of 1.13% per year. This shows that the share of export value of pistachio from Iran's total export value of agricultural products showed a 1.13% increase per year, as compared with the world. The data derived from RCA_{XA} are in accordance with RCA_{XA} that indicate the comparative advantage of pistachio exports in Iran has improved.

Although the calculated RCA indicates the comparative advantage in pistachio exports,

Table 5. Change in DRC (for showing change in comparative advantage) as a result of the change in cost of domestic factors, world price, and cost of tradable inputs**.**

Change in cost of tradable inputs	Change in world price	Change in cost of domestic factors	
		-5%	+5%
-5%	-5%	0.63	0.71
	+5%	0.53	0.59
+5%	-5%	0.69	0.76
	+5%	0.57	0.63

Table 6. Calculated RCA for pistachio in Iran (2000-2004).

Year	2000	2001	2002	2003	2004
RCA_{XT}	128.62	140.59	161.64	201.12	118
RCA_{XA}	241.06	222.06	231.51	231	249.82

The required data for calculation of RCA were collected from the websites of WTO (http://state.wto.org/statistics/ data base) and FAO (http://faostate.fao.org).

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pistachio export market in Iran has been in the hands of a few major importers. For this reason, the pistachio export market is very vulnerable. Furthermore, in spite of the fact that Iran produces more than 200,000 tons each year (the average amount during 1990-2005), and that it has also comparative advantage, it has still not been able to have an effective role in planning the price of the world pistachio market. This fact shows our little knowledge of consumption market outside the country. In other words, Iran has not played a considerable role in advanced marketing management.

This study indicated that Iran has consistently had a comparative advantage both in pistachio production and exports. But the findings showed that the comparative advantage was reduced during 2000-2004 the reason of which can be the reduction in yield. In the pistachio production and export sectors there are problems which have had negative effects on yield and on Iran's share of the world market. The policy implication from this is that in order to increase yield and productivity through the reduction of production costs, we can use scientific on-farm management, apply modern methods, and develop research and development institutes. Also, the policy implication of increased exports is that the recognition of penetrable and final consumption markets seems necessary. The expansion of advertising activities to introduce Iranian pistachio throughout the world, investment in the packing and grading industry, and gaining accurate and complete information from world markets are other ways of increasing exports. The consequent benefit of the above policy implications could be a reduction in the vulnerability of pistachio exports.

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بررسی مزیت نسبی تولید و صادرات پسته در ایران

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چکیده

پسته یکی از محصولات عمده صادراتی بخش کشاورزی ایران بوده است. این مطالعه به بررسی مزیت نسبی در تولید و صادرات پسته ایران می‌پردازد. در این مطالعه به منظور بررسی سیاستهای دولت ایران در رابطه با تولید و صادرات پسته برای سالهای ۱۳۸۳-۱۳۷۹ از ماتریس تحلیل سیاستی و شاخص RCA استفاده شده است. علاوه بر آن شاخصهای حمایتی در قالب ماتریس مذکور جهت بررسی سیاستهای حمایتی از نهاده و محصول مورد محاسبه قرار گرفت. نتایج نشان داد که ایران در هر دو زمینه تولید و صادرات پسته از مزیت نسبی برخوردار است ولی مزیت نسبی ایران در تولید پسته در حال کاهش است. شاخص RCA نشاندهنده بهبود در مزیت نسبی صادرات پسته ایران می‌باشد. شاخصها حاکی از سودآوری خالص اجتماعی بالا و حمایت دولت از تولیدکنندگان پسته در زمینه سوبسید نهاده‌ها می‌باشد. سپس تأثیر تغییر قیمت جهانی، نرخ ارز و هزینه نهاده‌های داخلی و هزینه نهاده‌های قابل تجارت بر شاخصهای مزیت نسبی و حمایتی بررسی شد. نتایج نشان داد که برای حفظ مزیت نسبی در تولید پسته باید نسبت به کاهش هزینه‌های تولید و افزایش بهره‌وری اقدام کرد. به منظور افزایش عملکرد و افزایش بهره‌وری از طریق کاهش هزینه‌های تولید می‌توان از مدیریت علمی در مزرعه و استفاده از روشهای نوین و ایجاد و گسترش واحدهای تحقیق و توسعه بهره گرفت.

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