



Future prospects of Iran, U.S and Turkey's Pistachio exports

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Abstract

In this study, the situation of Iran, U.S and Turkey's Pistachio export is investigated. to this purpose, Revealed Comparative Advantage (RCA) Index is calculated based on Agricultural and total economy export, separately, then forecasted by using Auto-Regressive Integrated Moving Average (ARIMA) approached, for 2008-2013. The results show that considering both commodity baskets, Turkey and Iran had comparative advantage in Pistachio export in 1982-2007, but U.S did not. Also, forecasting RCA index, based on both commodity baskets, show the improvement of U.S Pistachio export situation, unlike the values of RCA index forecasting for Iran and Turkey is falling. Therefore, it is recommended that Iran and Turkey attempt to identify new consumer markets in order to retain their market shares in pistachio export. Following the U.S imposed policies during last six years which improved its pistachio export, Iran and Turkey can increase their market shares.

Keywords:
Comparative Advantages, ARIMA, Pistachio, Iran, Turkey, U.S.A.

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INTRODUCTION

Pistachio is one of the most important exported agricultural products during the recent year in Iran (Mehrabi Boshrabadi, 2002, p. 86). Among agriculture products, pistachio has a good position and it is the most important non-petroleum export, in Iran, that ranks second to carpet and provides the income currency; also, it shares about 14 percents in non-petroleum export product (Pakravan and *et al.*, 2010, p, 3). Iran is the greatest pistachio exporter in the world, for many years (Mehrabi Boshrabadi and Neshat, 2010, p, 4). So, 60 to 65 percents of harvest area of this product is belonged to Iran (FAO, 2008). This great amount of area harvest share caused Iran to remain still the greatest producer of pistachio, despite the low operation of it, in regarded to some countries like United States (Mehrabi Boshrabadi, 2007, p. 143). Study of amount of pistachio production, shows that the production was increased from 6 tons in 1961 to 230 thousand tons in 2007 (FAO, 2008). And the studies on pistachio exports shows that amount of world's pistachio export was increased from 188 thousand tons in 1995 to 293 tons in 2006 (FAO, 2008). We can name Iran, U.S and Turkey as the major pistachio exporter. The Research in 2007 Shows that Iran holds the first place in production of pistachio in the world for its 230 thousand tons of production and 45 percents of the world's total pistachio production. The United States ranks second for producing of 108 thousand tons and 15 percents of the world's total production; and Turkey is in the next places for 73 thousand tons of production and 14 percents of the world's total production. Due to changes in the pistachio export market as well as the variable policies of U.S and Turkey, as the main rivals, in business of this product, so, Necessary action should be taken in order to apply policies, which depends on various factors, to increase export of this product. One of these effective policies is forecasting the Situation of future values of trade and export of this product. Nowadays, importance of forecasting variables is not concealed from economic programmers, policy makers. Therefore, in the present study, comparative advantage index of

pistachio export for Iran, U.S and Turkey is forecasted for the next six years. The comparative advantage refers to the ability of a country to produce a particular good or service at a lower marginal cost and quality, in regard to other countries (Poor Moghim, 2007, p. 85). Adam Smith developed the principle of comparative advantage in order to account for the international trade. According to the smith's theory, both of the countries, the one exports the products in which they have comparative advantage and another one imports the products in which they don't have comparative advantage, benefit in this trading. Numerous researches on the comparative advantage have been conducted in the world and Iran. For example, Utkulu and Seymen (2004) studied the comparative advantage and export competition of turkey's exports to the European Union. In this research, Balassa's approach in measuring the comparative advantage was used. The result shows that if the consumption of the exported goods increases, between turkey and European Union creases, it has a great effect on the comparative advantage and export competition. In another research by AnvyehTegyeh (2007) the comparative advantage in apple export was studied in Iran during 1995 to 1999. He concluded that there is no constancy in apple export in Iran; and Iran's comparative advantage for this product has been weakened. Ashrafi & *et al.*, (2007) by the use of RSCA and RCA factors measured the comparative advantage for raisin in Iran. The result revealed that in the studied years (1982-2001), Iran has comparative advantage for raisin export. In Iran's market exporting this product during the post-revolution period has gained more security for entering to the world markets. Azizi and Yazdani (2006) studied the Iran's apple export market by considering the comparative advantage. The research concluded though according to the RSCA and RCA there is comparative advantage for Iran's apple, its export competition has shown a falling tendency. Also, many studies have been done in the field of economic variables forecasting. For example, Zu and *et al.*, (2007) in their research, compared performance prediction of linear combining models, artificial

neural networks and ARMA to predict the market price of edible seeds in China. The experimental results showed that the combined model can improve predict performance, significantly. Henry C & Boosarawongse (2007) were investigating predicting the export of Thailand rice by using ARIMA models and neural network paid. Heravi & et al., (2004), by Prediction of economic time series for North U.S and Europe, showed that linear models often predict the final sample more accurate rather than models of neural networks in the more than a year. In the present study, comparative advantage index of pistachio export for Iran, U.S and Turkey are calculated by using RCA indices and forecasted by using ARIMA model in 2013-2008. Needed information for 1967-2007 has been collected through the FAO website database.

MATERIALS AND METHODS

Revealed Comparative Advantage index (RCA)

Revealed Comparative Advantage is the first empirical study in the area of RCA. The proposed simple measure of RCA by Leisner (1958) is the following:

$$RCA = \frac{X_{ij}}{X_{nj}} \tag{1}$$

Where X represents exports, i is the country, j is the commodity (or industry), and n is a set of countries (e.g. the EU).

Another index that is used for computing the comparative advantage, in terms of trading, is Michelle index.

$$RCA = \frac{X_{ij}}{\sum_i X_{ij}} - \frac{M_{ij}}{\sum_i M_{ij}} \tag{2}$$

In fact, the mentioned index shows comparative export in a part and even a commodity and it is expressive of direction and volume of trading among similar industries. On the account that Iran does not import pistachio and its pistachio export comparative advantage has been investigated in this study therefore this index is not used in this case. In this investigation, revealed comparative advantage index and revealed symmetric comparative advantage Balassa index

are used which is widely used. The popularity of this index lies in its simplicity, and it is also easily comparable by using trading data that are available and it is scientifically reliable. This index is formed based on the pattern in which trading data of each country express its competitive situation in the world markets. Revealed comparative advantage index is defined as:

$$RCA_{ij} = \frac{X_{ijt} / \sum_a X_{ajt}}{X_{iwt} / \sum_a X_{awt}} \tag{3}$$

i represents the product, j is the country, X is export, a is agriculture products of a country, w is whole world and t is that specific year (Balassa, 1965).

X_{ijt}: Exports of product i from country j in time t

X_{iwt}: Exports of product i at global level and in time t

X_{ajt}: Exports of agriculture products by country j in time t

X_{awt}: Exports of agriculture products at global level in time t

In this equation, top numerator shows share percentage of one supposed product in national export and the denominator shows share percentage of that product at global level. In other word, this factor investigates the structure of national product export versus the structure that product export at global level. Reference to this fact that all the components of RCA index are positive, therefore, this index very from 0 to infinity. According to given information about the above index, if value of this index, for some product, is more than 1, the considerable the mentioned country has comparative advantage in export of that product. Also, the more value of the index show the higher the priority and comparative advantage of products one the country. On the contrary, if this index for some product is less than 1, the country has comparative disadvantage in export of that product. Hillman shows that this index is not the proper one to compare with the comparative advantage. Yeats (1985), by presenting some empirical examples, shows that the index of export yield is capable in presenting a suitable serial or numerical index in order to investigate the revealed comparative

advantage of countries. Hillman, in his studies, proves that according to relative price before trading, to have comparative advantage for country j in product i, it should satisfy the following condition (Fathi, 1999, p. 138).

$$\left(1 - \frac{X_{ii}}{X_{iw}}\right) > \frac{X_{ij}}{X_{Tj}} \left(1 - \frac{X_{iw}}{X_{Tw}}\right) \quad (4)$$

Hillman index compute as:

$$HI = \left(1 - \frac{X_{ij}}{X_{iw}}\right) / \frac{X_{ij}}{X_{Tj}} \left(1 - \frac{X_{iw}}{X_{Tw}}\right) > 1 \quad (5)$$

In above equations, i represents product, j is a country, T is the total exports of country, W is the whole world and X is export. It should be pointed out that one of the major defects of RCA index is that the scope of its changes is extensive, and also it can not show the intensity and the level of comparative advantage or its absence. Larson and Brasely presented another form of this index. They called it named revealed Symmetric comparative advantage (RSCA). In this new index for solving the problem, they suggested to converse index to symmetric or normal index by using a steady conversion. The new revealed symmetric comparative advantage index is defined in this way:

$$SRCA = \frac{RCA - 1}{RCA + 1} \quad (6)$$

With due attention to this fact that RCA is between 0 and infinity, it can be understood that variance is adjusted and symmetric will be from -1 to +1. In other words, if RCA is more than 1, SRCA ranges from 0 to 1, and if RCA is less than 1, SRCA is a negative number, ranges from 0 to -1. Because the limited scope of the adjusted index is similar to correlation coefficient, it can be stated that the closer SRCA to 1 is, comparative advantage will be more. On the contrary, when it approaches to -1 from 0, it means the absence of comparative advantage has been intensified.

ARIMA Model

The theory of ARIMA models has been de-

veloped by many researchers and its wide application was due to the work by Box and Jenkins (1976) that developed a systematic and practical model building method. Through an iterative three-step model building process: model identification, parameter estimation and model diagnosis, the Box–Jenkins methodology has been proved to be an effective practical time series modeling approach (Chu and Zhang, 2003, p. 220). Frequently used are the Autoregressive Integrated Moving Average models, denote d as ARIMA (p,d,q) models, where p and q are, respectively, the autoregressive and moving average orders and d is the order of differentiation, that is the number of differentiations operated on the original series to handle possible non-stationarities (Bras and Rodriguez- Iturbi, 1985). The differencing reduces the ARIMA to simple Autoregressive Moving Average (ARMA) models, describing each observation of a time series x as a weighted sum of p previous data and the current as well as q previous values of a white noise process. Using the Box and Jenkins notation, the ARMA (p,q) model can be written symbolically in the compact form:

$$\phi(B)x_t = \Theta(B)\eta_t \quad (7)$$

Where x_t is the zero-mean time series; η_t is a white noise, i.e. an independent zero-mean random variable that is also not correlated with the past values of x_t ; Φ and Θ are respectively the pth and qth order autoregressive and moving average components and B is the backward shift operator, defined so that $B^j x_t = x_{t-j}$. Analogously, the ARIMA (p,d,q) model can be expressed as:

$$\phi(B)(1-B)^d x_t = \Theta(B)\eta_t \quad (8)$$

Where d is the order of differentiation of the original data that is the minimum non-negative integer necessary to obtain a stationary process by differencing the original series (Barth & et al., 2002, p. 629).

RESULTS

Results of survey of the comparative advantage

indices of Pistachio export (RCA and SRCA) for Iran, U.S and Turkey are presented in Tables 1 and 2. To this purpose, HI, RCA and SRCA indices were calculated based on agricultural export and total export of Iran, U.S and Turkey. Results of Agricultural export in Table 1 show that Iran and Turkey have advantage in this product export, but the U.S's export of this product has disadvantage. Also, investigation of pistachio export relative advantage, in recent years, indicates that the amount of the index for U.S is rising and this country's pistachio trade is in better status than past. So, the average of RCA index has been more than one in last six years and which is indicator the fact that U.S's pistachio exports has advantage in recent years. Calculating RCA and SRCA indices for three countries, on the basis of total economy export, shows that Turkey and Iran pistachio export have no advantage unlike U.S. This shows that pistachio in Iran and Turkey's economy can compete with other exporting goods in whole economy. Global market always creates com-

petition among countries. In Pistachio export market, the main exporting countries are trying to have greater market share. Therefore, differences in index values of export advantage of studied countries, based on different commodity groups, suggested that the estimating of the index responds to basket of goods, strongly. So, calculating this index for one product, just based on one basket good, isn't sufficient and it is necessary to estimate it changes based on different types of commodity baskets and compares them. Investigation the export advantage index of U.S based on total export economy indicates that value of the RCA is closer to one which shows the fact that U.S pistachio has advantage in regard to many export goods in the world and has superior profitability that shows high importance of this product.

Also the survey shows that advantage of this country in pistachio export is rising in 2007-2013 and average of RCA index in these years is larger than one, although the U.S's export doesn't have advantage in 1982-2007.

Table 1: survey of the comparative advantage indices of Pistachio export (Based on Agricultural Export)

	Islamic Republic of Iran			Turkey			United States of America		
	HI	RCA	SRCA	HI	RCA	SRCA	HI	RCA	SRCA
1982	4.72	592.13	0.997	121.46	25.60	0.925	4797.5	0.80	-0.108
1983	3.51	616.59	0.997	208.12	15.82	0.881	3678.5	0.91	-0.045
1984	1.98	736.28	0.997	187.86	15.68	0.880	7005.7	0.46	-0.366
1985	1.28	577.49	0.997	81.03	19.66	0.903	5691.4	0.34	-0.497
1986	1.58	436.25	0.995	92.99	10.89	0.832	2481.6	0.43	-0.394
1987	1.42	413.14	0.995	186.48	5.19	0.677	3444.3	0.29	-0.555
1988	1.30	500.79	0.996	123.22	7.24	0.757	3509.2	0.26	-0.581
1989	1.82	449.19	0.996	159.23	4.81	0.656	2129.7	0.36	-0.474
1990	2.14	503.43	0.996	300.55	2.87	0.483	2691.3	0.32	-0.521
1991	2.43	385.72	0.995	927.28	0.75	-0.146	1807	0.37	-0.463
1992	1.89	358.30	0.994	636.18	1.04	0.022	761.94	0.79	-0.119
1993	1.95	290.81	0.993	1967.4	0.28	-0.558	1022.7	0.51	-0.326
1994	1.98	244.37	0.992	1275.8	0.53	-0.308	1135.9	0.55	-0.288
1995	2.30	278.14	0.993	616.53	1.13	0.063	1120.6	0.58	-0.266
1996	2.14	285.22	0.993	793.00	0.81	-0.106	1421.7	0.43	-0.401
1997	2.56	223.55	0.991	281.74	3.35	0.540	1103.1	0.79	-0.116
1998	1.94	250.11	0.992	1511.1	0.44	-0.391	769.64	0.78	-0.126
1999	1.37	232.15	0.991	1678.6	0.47	-0.357	878.85	0.82	-0.102
2000	1.36	233.16	0.991	2293.5	0.33	-0.500	790.59	0.86	-0.078
2001	1.24	226.54	0.991	234.05	2.82	0.477	707.16	0.85	-0.081
2002	1.03	231.31	0.991	413.53	1.52	0.207	626.29	0.90	-0.052
2003	1.05	224.75	0.991	770.81	0.69	-0.186	619.59	0.78	-0.124
2004	1.09	243.67	0.992	1228	0.52	-0.313	360.56	1.51	0.202
2005	1.33	168.66	0.988	1097	0.44	-0.386	205.36	1.92	0.315
2006	1.09	154.26	0.987	825.51	0.53	-0.311	247.09	1.50	0.200
2007	1.50	265.16	0.992	725.30	0.87	-0.070	254.20	1.98	0.328
average	1.85	350.81	0.99	720.67	4.78	0.18	1894.7	0.77	-0.19

Table 2: survey of the comparative advantage indices of Pistachio export (Based on Total Economy Export)

	Islamic Republic of Iran			Turkey			United States of America		
	HI	RCA	SRCA	HI	RCA	SRCA	HI	RCA	SRCA
1982	671.49	36.35	0.946	269.64	100.81	0.98	25946	1.3	0.131
1983	459.98	41.11	0.953	494.71	58.17	0.966	19192	1.53	0.21
1984	179.06	70.82	0.972	559.50	45.89	0.957	37731	0.75	-0.142
1985	77.25	89.81	0.978	291.56	51.23	0.962	40383	0.44	-0.385
1986	11.27	236.33	0.992	298.78	31.79	0.939	20037	0.5	-0.329
1987	15.17	177.83	0.989	733.71	13.08	0.858	27804	0.35	-0.48
1988	16.28	184.2	0.989	473.12	18.82	0.899	27801	0.33	-0.499
1989	13.52	169.58	0.988	649.31	12.02	0.846	17525	0.44	-0.387
1990	21.90	127.73	0.984	1247	7.41	0.762	23405	0.39	-0.441
1991	13.30	140.31	0.986	3359	2.19	0.373	17053	0.41	-0.415
1992	16.40	131.12	0.985	2733	2.55	0.436	7068	0.89	-0.059
1993	11.77	148.65	0.987	8296	0.74	-0.148	9929	0.58	-0.268
1994	15.95	149.65	0.987	5718	1.3	0.13	11112	0.62	-0.233
1995	13.97	188.56	0.989	3097	2.6	0.445	10511	0.71	-0.168
1996	15.84	157.99	0.987	3912	1.88	0.305	13394	0.52	-0.316
1997	53.90	127.1	0.984	1419	8.03	0.778	12135	0.87	-0.069
1998	11.64	262.92	0.992	8501	0.97	-0.015	9141	0.81	-0.102
1999	26.55	162.29	0.988	10589	1.02	0.009	11696	0.83	-0.092
2000	37.57	131.69	0.985	17573	0.68	-0.193	10920	0.96	-0.018
2001	27.47	150.53	0.987	1789	5.45	0.69	9101	0.97	-0.013
2002	24.10	143.13	0.986	4282	2.14	0.362	7806	1.05	0.025
2003	15.61	152.12	0.987	7527	1	0.002	7183	0.96	-0.02
2004	32.39	122.45	0.984	13001	0.74	-0.15	4608	1.77	0.277
2005	38.19	93.19	0.979	10446	0.74	-0.152	2836	2.2	0.375
2006	29.24	95.19	0.979	11131	0.64	-0.218	3582	1.71	0.261
2007	107.57	58.97	0.967	11875	0.85	-0.083	3183	2.52	0.431
average	75.29	136.52	0.98	5010.5	14.33	0.41	15042	0.94	-0.1

Table 3: The results of pistachio forecast based on agriculture exporting goodsport)

Country	Model	2008	2009	2010	2011	2012	2013
IRI	ARIMA (3,1,3)	174.76	172.02	169.53	167.29	165.25	163.4
TUR	ARMA(3,1)	0.42	0.41	0.4	0.4	0.39	0.38
USA	ARIMA(3,1,2)	1.04	1.06	1.07	1.08	1.09	1.1

Being Awareness of RCA index changes can help countries to apply necessary policies in order to increase market share. Therefore in this part, RCA indices of pistachio export were predicted for U.S, Turkey and Iran by using ARIMA method in 2008-2013. So, first, we check stationary of variables, and then, identify degree of Auto-Regressive and Moving Average process by using the SBC criterion, finally, we estimate appropriate model.

This model is used for forecasting of pistachio export relative advantage index for Iran, U.S and Turkey in the next six years. The results of forecasting for agriculture exporting goods and total economy are reported in Tables 3 and 4, separately.

Review of results on the basis of agricultural

export in Table 3 shows that, RCA index values of Iran and Turkey are falling and of U.S are rising during the 2008-2013. This indicates that running policies for pistachio export in U.S will be quite effective. If this country continues to apply these policies, it can obtain larger share in world market of pistachio. So Turkey and Iran, in order to prevent losing their market share in competition with U.S, should attempt to identify new markets in world.

Moreover, prediction of RCA index for three countries, on the basis of total economy export, shows that predicted Values in 2008-2013 is fixed and Indicates that this product can compete with other exporting goods in future years. Therefore, it can be one of the main sources of income for this country, like

Table 4: the results of pistachio forecast based on Total Economy Export

Country	Model	2008	2009	2010	2011	2012	2013
IRI	ARMA(2,1)	147.44	147.44	147.44	147.44	147.44	147.45
TUR	ARMA(3,2)	1.38	1.37	1.36	1.36	1.35	1.35
USA	ARIMA(3,1,3)	0.98	1	1.02	1.04	1.06	1.35

previous years. The predicted RCA index values of Turkey shows that the estimated values are reducing in the next six years. Regarding the whole export, Turkey will lose market share, gradually.

According to the results in Table 4, the predicted values of U.S pistachio export RCA index are rising. In regard to the whole export, this product can compete with other export goods and have high income.

CONCLUSION

In this study, pistachio export advantage indices of Iran, U.S and Turkey are forecasted in 2008-2013. In this context, the advantage of pistachio export of these countries calculated by using the RCA index. The results showed that, in regard to both commodity baskets of agricultural and total economics, Turkey and Iran, unlike U.S, have advantage. But, in the recent six years, U.S in the export of this product has advantage and the imposed policies to this country were effective. Therefore, continuance of these policies and familiarity with Iran and Turkey's Markets can increase U.S's share in Pistachio export market. Forecasting values of pistachio export of advantage index for the three countries shows that, in 2008-2013, Iran and Turkey's share in global pistachio market is falling. Therefore, it is recommended that, in order to prevent this reduction, Iran and Turkey need to identify new target markets. Moreover, being familiar with imposed U.S's policies, in recent years, which caused to improve the situation of pistachio export in this country, can increase the competition of Iran and Turkey against pistachio export of U.S. Therefore, investment in the processing, packaging and supporting local farmers in order to increase the quality of pistachio can attract consumer markets and increase competition in its export.

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