SPATIAL PRICE INTEGRATION FOR PISTACHIO IN IRAN'S TROPICS

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Abstract

Pistachio is the most important agricultural crop cultivated extensively in Iran's tropics/semi-tropics. The country earns sizable income from Pistachio export to many countries. This paper aims to study the spatial price integration of Iran's pistachio prices with USA prices as a major rival country of Iran in world market. Time series data on domestic and export prices collected for the time periods 1982-2003 and 1991-2004 respectively. Co-integration analysis and Dickey-Fuller test were employed for the aim of current study. The price series used for comparison were Iran's producer and export prices, Iran and USA export prices and Iran and USA producer prices. Results reveal that none of the price series are co-integrated. This shows that the LOP can not be hold, and so the prices are not moving together in long run.

Key Words: market integration; co-integration; spatial integration; stationary; integration degree

INTRODUCTION

Iran is the world's largest producer and exporter in pistachio industry accounted for 52.89, 58.00, 64.79, and 65.84 percent of world production, cultivation area, export quantity and export value, respectively (FAO, 2003).Currently Pistachio export earnings stand next to petroleum. Around 10 percent of non-petroleum export value is realized from pistachio. USA is the major rival country competing with Iran in both production and export of Pistachio. Summing together, around 75 percent of world export is from Iran and USA.

Pistachio is cultivated in Iranian dry regions with low rainfall of nearly 100 mm /year with also extreme geographical climate and temperatures. High salinity level of agricultural water and inadequate irrigation are the main restrictions that farmers are facing (Sedaghat, 2006).Recently the productivity of Pistachio orchards has declined and also the share of Iran in Global Market has decreased significantly (Sedaghat, 2002 and Sedaghat 2006).As such areas are not suitable to produce other crops economically; hence Pistachio plantation remains the only opportunity of farmers. Pistachio is one of the major exported produce of the country with a crucial role in providing livelihood and employment for many people, so the study of market integration and price behavior is one of the major areas of research to know whether the domestic and world market prices are moving together in long run, if so the inland pricing system is doing efficiently and Vice-Versa. Moreover, the world market information can be used to decide about the prices in domestic market if the price series are co-integrated.

The main objective of this paper is to study the spatial price integration and price behavior of Pistachio. The review of literature shows that co-integration analysis is widely used for the aim of studying spatial price integration. Engle and Granger (1987) applied seven statistics test to find the co-integration of some series of variables, Mamatha (1995) studied market integration for selected spices in India, Behura and Pradhan (1998) attempted to find the co-integration and market integration in Marine fish market in Orissa, Ghosh (2000) studied both inter-state and intra-state spatial integration of Rice market in India, Niemi (2003) used Co integration and error correction modeling to study the agricultural commodity trade between ASEAN and European Union, Shafi (2005) conducted a study on trade and environment interface in Indian tea sector-macro level changes and micro level impacts.

MATERIAL AND METHODS

Data sources

Time series data on domestic prices collected from Rafsanjan Pistachio cooperative (2004) and USDA (2004) for the time period 1982-2003. Also time series data on export prices collected from FAO (2003) and Government of Iran (2004) for the time period 1991-2004.

Analytical tools

Co- integration Analysis

Markets, which are spatially price efficient rules out the possibility of profits through arbitrage, as the profits gradually, get competed away. International trade literature postulates the existence of the representative price, i.e., a price which prevails at all markets, which is known as the low of one price (LOP).

In two regions engaged in trade of one commodity , the law of one price states that the price of the commodity should be the same after necessary adjustment are made for transfer costs and if necessary exchange rate. The analysis is based on the concept of co- integration. Traditionally, tests of LOP applied the procedure in which one price is regressed on the other price, and then the slope coefficient is restricted to be equal to unity. If this restriction is valid, the conclusion is that the LOP holds. However, this procedure seems to have been faulted (Richardson, 1978). Ardeni (1989) tested LOP using co integration analysis. The technique suggested by him is also used in the present study.

In an ideal international Pistachio market the price movements should be synchronized with each other

and behave as one market system. The price in one market should be determined by making use of the information from other markets. Hence, the concept of one price is used to study price behavior, the study examine whether the low of one price exists in respect of Iran and USA Prices.

The starting point of testing the low of one price is the determination of the order of integration of the price series. If the series is stationary, this means that the series has a mean which dose not change over the period

$$P_t = P + e_t$$

Where, P_t is the observed value of the series at time't', **P** is the mean value of the series and **et** a random disturbance term**.** The series P_t is said to be stationary as expressed as **I (0).**

But often the series tend to display an increase or decrease, which violates the above condition. In such case successive differencing reduced the series to stationary, thus,

$$P_t - P_{t-1} = e_t \quad \textbf{or} \quad P_t = P_{t-1} + e_t$$

A series which becomes stationary after first differencing is said to be integrated of order 1 and it is expressed as **I (1).** In general, a series which must be differenced' times to become stationary is expressed as **I (d).** A major difference between **I(0)** and **I (d) , d>0** series is that the **I (0)** series has a finite mean and variance, while in **I (d)** series this magnitudes do not exist.

Consider the price of Pistachio in two countries or markets at time't' expressed as P_{1t} and P_{2t} then, three situation can be identified,

a) P_{1t} **I (0**) and P_{2t} **I (0)**. Since both price series are **I (0)**, their means and variances exist. This in turn implies that the LOP holds on a long run relationship as both the prices fluctuate around their mean. Differences in these means are possible; this reflects the fix component such as middleman's profit, etc. In such a situation it is valid to regress P_{1t} and P_{2t} and test the restriction that the slop coefficient equals one and the intercept term equal to zero.

b) P_{1t} **I (d**) and P_{2t} **I (b)**, **d≠b.** in this case, prices have different orders of integration and the LOP dose not hold because at least one of either P_{1t} or P_{2t} will exhibit explosiveness. This can be understood if P_{1t} is **I (0). ** P_{2t} contains an explosive component which can not be explained by P_{1t} alone.

c) P_{1t} **I (d**) and P_{2t} **I (d)**, **d>0**. Here both price series have the same order of integration which is greater than zero. Hence, additional information is needed to examine the validity of the LOP. Such information is obtained from the theory of co- integration (Engle and Granger, 1987). In other words co-integration states that even though same explosive pattern characterizes both prices, there must exist a parameter which brings them together in the long run, so that their linear combination is of a lower order of integration than the original series. In such a case P_{1t} and P_{2t} are co-integrated and the following regression is formed:

$$P_{1t} = a + b P_{2t} + e_t$$

Where **'a'** and **'b'** are the parameters to be estimated. If e_t is integrated of order **b (b<d)** , P_{1t} and P_{2t} are said to be co integrated. When **b=0** , the LOP holds since both prices move together in the long run. In particular, the LOP postulate that the co-integration parameters **b=1**. Thus, co integration test is transformed into a stationary test of difference between the two prices. This has been proved by Baffes (1991) as follows:

Let P_{1t} and P_{2t} denote (non stationary prices) of Pistachio in market 1 and 2, let P_{2t} be price in market 2 expressed in market 1. Because of LOP P_{1t} and P_{2t} form a co integration system.

Let $P_{1t} = b P_{2t} + e_t$ be the co integration regression where 'b' represents the co integration parameter, b is unity or the long run counter part of the association between the two prices. Expressing P_{2t} in terms of market 1 price as

$$P_{2t}^* = b P_{2t}$$

And substituting in the co integration regression, yields

$$P_{1t} = P_{2t}^* + e_t$$

This has the co integration parameter of one. Thus a stationary test of e_t is a sufficient test of co integration which can be expressed as

$$P_{1t} - b P_{2t} = e_t$$

This is the sufficient condition for co integration.

Dickey –Fuller Test:

To determine the order of integration the following procedure referred to as the Dickey – Fuller method was employed which is based on the relation

$$\Delta P_t = a + b P_{t-1} + e_t$$

Where, P_t denotes the variable being tested and Δ denotes the difference operator i.e., $P_t - P_{t-1}$, **'a' and 'b'** are parameters to be estimated .

The hypothesis tested is

H0 = P_t is not I(0), against
H1= P_t is I(0)

H0 is rejected if the estimate of b is negative and significantly different from zero

RESULTS AND DISCUSSION

The results of Dickey-Fuller test for Stationarity of price series of Pistachio in different markets are presented in Table 1. The order of integration was 1,2,0 and 1 for Iran's producer prices, Iran export prices, USA producer prices and USA export price series respectively. As could be seen, the ADF values accounted were more than the critical value (10%). The results of Dickey-Fuller test for co-integration of price series shown in Table 2.The price series used for comparison were Iran's producer and export prices Iran and USA export prices and Iran and USA producer prices. None of the price series were co-integrated, since the ADF values calculated were less than the critical values. This shows that the LOP can not be hold in these markets. Moreover the prices of Pistachio in the two mentioned markets will not be moving together. To facilitate the comparison, the price series are plotted in Figures 1, 2 and 3.

The export price series for Iran and USA (Figure 1) show that Iran's export prices had followed a constant trend in contrast with the USA export prices which fluctuated favorably during the period 1991-2004. The USA export prices those were nearly equal to Iran export prices in the first two years, declined to a lower level in the next couple of years and again started increasing to a higher level for the following 7 years. In the last two years of the period, they again came down and reached a lower level. The major reasons for the fluctuation in the USA export prices against a constant trend of Iran's export prices are:

a) Damping in the market by USA in some years to capture the main markets of Iran's Pistachio especially in new growing markets.

b) Political pressure from USA resulted in strict standards and banning of Iran's Pistachio by the European Union, which has a close political relationship with USA. In the sense, the highest USA export price in the year 1997 was mainly as a reaction of market to the banning of Iranian Pistachio by the European nations.

Looking at the exports and producers' price series of Iran (Figure 2), we can conclude that even though the export prices followed a fixed trend, the nominal producer prices had experienced an increasing trend during the period 1991-2004.The export prices are normally determined in global market but the producer price is determined by local authorities, with some level of consideration to production costs, viability of production and supply-demand balance in domestic market.

Looking at the producer price series for Iran and USA (Figure 3) shows that, even though the USA producer prices followed a constant trend over the period 1982-2003, Iran producer prices experienced an increasing trend during the same period. The increasing producer prices in Iran against a constant trend for USA does not indicate a better situation in favor of producers in Iran, as the economy experienced a higher inflation rate than USA during the same period.

CONCLUSION AND POLICY IMPLICATION

The co-integration analysis showed that none of the price series; Iran's producer and export prices, Iran and USA export prices, Iran and USA producer prices were co-integrated, indicating that the cited price series were not moving together in long run .Moreover it shows an inefficient pricing system in the country.

Iran's export prices were lower than USA prices in many years. Despite an increasing trend, producer prices have experienced tremendous fluctuations in many years. Also the prices were not sufficient to promote the profitability of Orchards in the last decade. As there is no much scope to increase the producer prices which are mainly affected by world market prices which are following a constant trend, the focus may be given to increase yields and to reduce production costs through a better management system of Orchards. The country may try to achieve more value added from Pistachio by investing more on processing industries and benefiting from a more effective advertisement in global market.

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Tab. 1. : Stationary of pistachio price series: Results of Dickey-Fuller test

Price series	Order of integration	ADF value	Assy. critical value (10%)
Iran's producer price	1	-2.80	-2.57
Iran's export price	2	-2.74	-2.57
USA producer price	0	-3.24	-2.57
USA export price	1	-3.40	-2.57

Note: ADF value – Asymmetric Dickey Fuller value

Tab. 2. : Co-integration of pistachio price series: Results of Dickey-Fuller test

Price series	ADF value	Assy. critical value (10%)
Iran's producer and export prices	-0.77	-3.04
Iran and USA export prices	-2.13	-3.04
Iran and USA producer prices	-0.46	-3.04

Note: ADF value – Asymmetric Dickey Fuller value

Fig. 1. : Pistachio export price Fluctuation of Iran and USA during 1991-2004

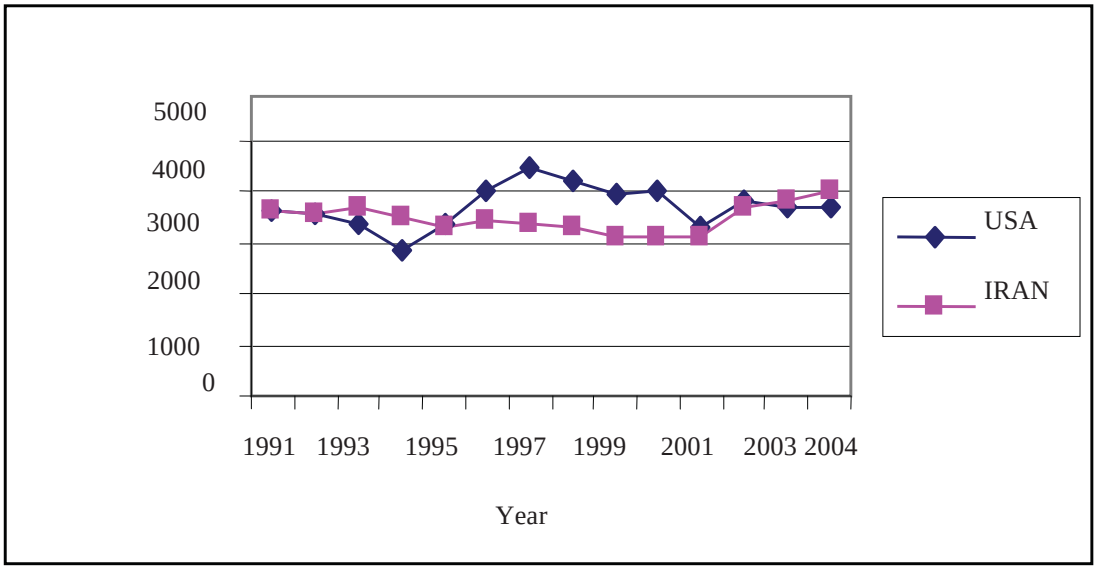


Fig. 2. : Pistachio export and producer price fluctuation in Iran during 1991-2004

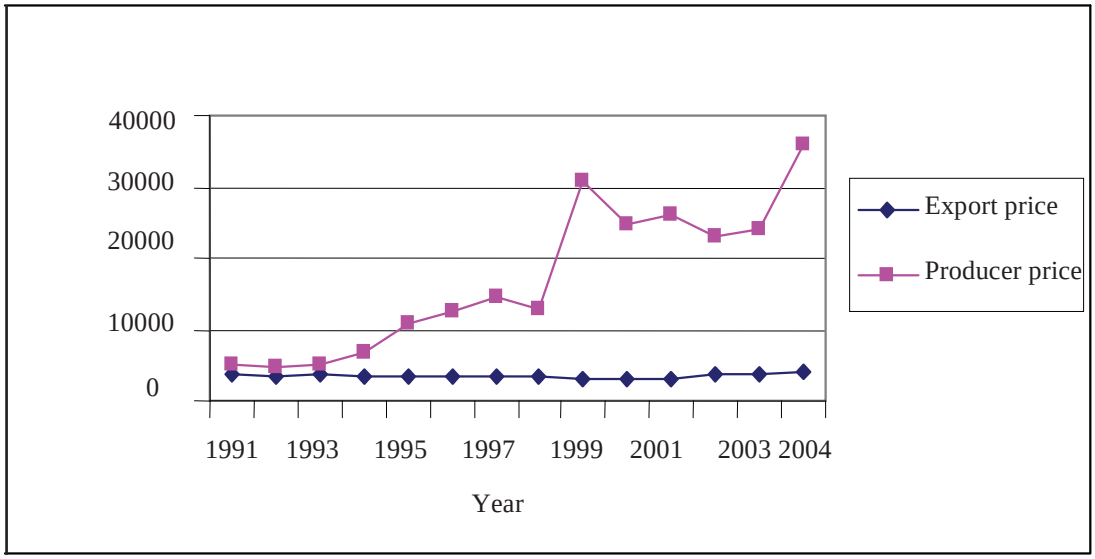
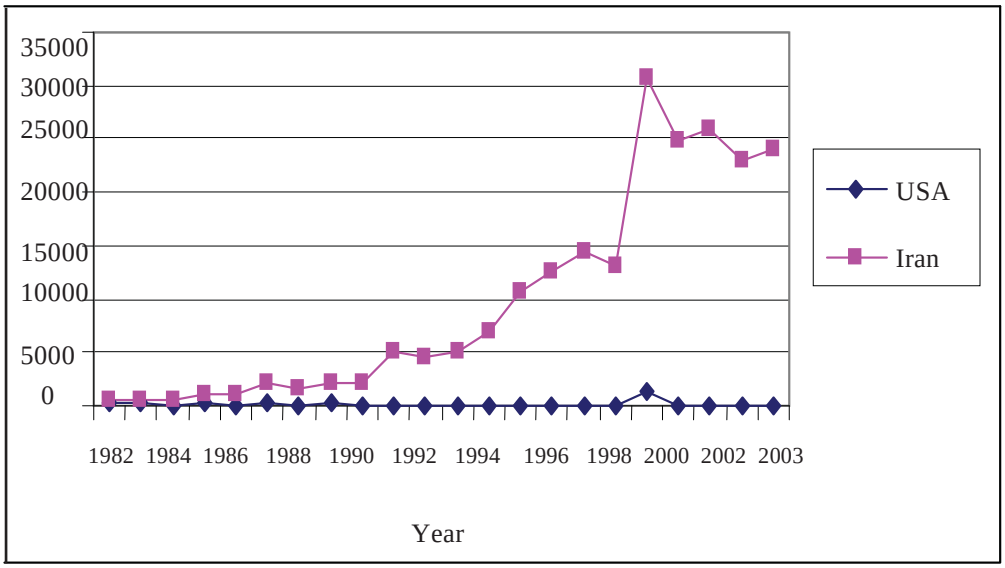


Fig. 3. : Pistachio producer price fluctuation in Iran and USA during 1982-2003



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