Factors Affecting Pistachio Export Earnings Instability and its Effect on Agricultural Exports

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Abstract

Among agricultural products in Iran, pistachio is one of the major export products that can produce foreign currency. The present study evaluated factors affecting pistachio export earnings instability and its effect on agricultural export during the studied period. For this purpose, export earnings instability index was calculated using "average absolute difference between export earnings and its trend". The Vector Error Correction Model (VECM) was used for estimating models over period 1973-2010. The results indicated that pistachio commodity concentration index had negative effect, but pistachio product instability and gaps of exchange rate had direct relationship with pistachio export earnings instability. Also, the results of the estimation of agricultural export function indicated that pistachio export earnings instability had negative and significant impact on export agriculture.

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INTRODUCTION

Stability of earning is among the factors that can affect planning and enable us to lay the best plans in the country. In developing countries, export earnings can be considered as one of the important sources of earning. Basically, export nature of the developing countries is in such a way that they are more dependent on exports of raw materials and minerals. On the other hand, export of developing countries is mainly limited to the issuance of one or a few products, which weakens their reaction to the events that may occur, and this destabilizes the foreign exchange earnings.

One of the important goals of any economic system is to ensure high and sustainable economic growth. To achieve such a growth rate, it is important to create and maintain a safe and stability environment at macro level. In other words, such an environment is the main prerequisite for sustainable economic growth. On the other hand, the current earnings are one of the determinants and keys in achieving the short and medium term goals. Most developing countries have single export crop; and the export of raw materials is the major source of currency. Thus, any instability in foreign exchange earnings creates problems for this country in achieving the above objectives (Samadi, 2004). Relying on oil exports has been the main cause of instability in foreign exchange earnings; therefore,it is necessary to expand non-oil export. The agricultural sector has always played a significant role in the non-oil export and foreign exchange earnings of Iran. Among agricultural products, pistachio is economicallyimportant, so it is named as green gold.It enjoys a special niche among horticultural crops as an important export crop. Consequently, Iranian agriculture is recognized with this crop in the world (Yazdani and Azizi, 2006). But despite the fact that Iran is the biggest pistachio producer and exporter in the world, there are many problems in the production, marketing and export of pistachio such as low productivity of lands, ignoring sanitation process and correct storage, and export market inefficiency. Of course, in the field of export there are other issues such as unsuitable market structure (oligopoly purchase), the absence of accurate and complete information from the world market prices, the absence of a central agency to control and monitor export and to coordinate pistachio exporters to control export prices, and also the entrance of America into the global market of pistachio as a major producer (Amirteimuri, 2008).

In general, several studies have been carried out on instability and agricultural exports. A few of them are mentioned below:

Amjadiand Mohamadzadeh (2010) analyzed factors influencing export demand of pistachio and dates, export demand elasticity coefficients for these crops, and target markets for 1971-2007 using the screening method. Their result showed that non-Asian countries with higher earnings are more suitable market for dates and that Asian and non-Asian countries with higher earnings are more suitable target market for the export of Iranian pistachio. In a study on the impact of export and export earnings instability of agriculture, industry and mining, and service sectors on their economic growth, Samadi (2002) used the proper indicators for measuring instability and the proposed introduced by Feder and Khalilian and Ardestaniforthe period of 1968-1995. He concluded that export instability in agriculture, industry and mining sectors have negative, significant impact and in oil sector has positive, significant impact on the economic growth of these sectors. He argues that the economy needs to diversify commodity vertically and geographically in order to reduce the negative impact of export instability on economic growth.

Borumand *et al.* (2009) investigated the effects of export instability on investment and growth by using the dynamic time series techniques. Their results showed that in the longrun, the instability of export has negative impact on investment and economic growth. But in the short-run, the economic growth is not so affected. Samadi (2004) used Coppock'sinstability index to analyze price, product and multiplicative interaction of their instability indices to find instability sources of export value of 26 crops and import values of 22 agricultural crops. His findings suggest that some of these crops, such

as dates and oil seeds, have a high degree of competitiveness in foreign markets. As a result, instability of the interaction strengthens instability of export value. Norouzi and Ghamtiri (1995) discussed the effect of instability on the export earnings of the domestic economy during the period of 1959-1991. According to the statistical limitations of their study, "the diversion of real value of parameters from their estimation trends" was used to measure the instability of total exports. The results of estimating models of export instability on macroeconomic variables revealed that the time delay of the instability export earnings had positive impact on private consumption spending, total investment and economic growth, but it had negative impact on net national saving rate. Also, the effect of the index of export instability on total investment instability, total expenditures instability, consumption expenditures and government capital expenditures was reported to be positive.

Bilquees and Mukhtar (2011) investigated the relationship between export instability, foreign exchange earnings instability and economic growth in India by using co-integration test and vector error correction model over the period of 1960-2008. Results showed a long-run relationship between instability of export earnings, trade instability, investment and economic growth. Granger causal showed the one-way relationship between export earnings instability and trade instability to economic growth and investment. The results also indicated that in the shortrun, there was a need to create foreign currency reservations to reduce the fluctuations in export earnings. Wasim (2003) studied the relationship between economic growth and instability of export by economic classification, using time series over the period of 1973-2001 in Pakistan. The results were based on a positive relationship between economic growth and instability of export earnings. Duration was divided into two periods including 1973-1987 and 1988-2001. Export instability in semi-industrial goods and raw materials to industrial exports was higher in the second period than in the first period. Wilson (1994) studied the magnitude of export earnings instability for Singapore between 1957 and 1988 and how the pattern of instability had changed over the time. The results showed that between 1957 and 1971 overall mean instability was approximately 10%, and between 1972 and 1988 instability was higher by about 15.8% and was strongly affected by the shock of the international economy between 1972 and 1975.

Ming Wong (1986) examined models of export instability using empirical tests for less-developed countries. In this study, the relative advantage over the 1957–1972 was examined through multiple regression analysis for a sample of 50 LDCs. The results suggested that export instability originates mainly from foreign sources – especially variations of market shares in foreign markets and commodity groups. However, domestic supply and demand fluctuations are the dominant factors for countries dependent on food exports and markets of the developed-countries. Santos-Paulino (2000) examined the impact of trade liberalization on export growth for a sample of developing countries using the export demand function approach. He applied dynamic panel data models based on fixed effects and Generalized Methods of Moments (GMM) estimators. In addition, heterogeneous panels for the complete sample were estimated by using a time series/cross section. The results showed that exports react negatively to an increase in relative prices and positively to the world earnings growth. Furthermore, export duties have a detrimental effect on export growth, though the impact is relatively small, while trade liberalization emerges as a significant positive determinant of export performance.

Overall, agricultural exports have a significant share in non-oil exports, and also it has an important position to produce foreign currency. Among agricultural products, pistachio is one of the major export products in Iran with a remarkable portion of area under cultivation, production and exports. Also, no similar studies were found in this context. Therefore, the aim of this paper is to investigate factors affecting export earnings instability of pistachio and its effects on agricultural exports. After this introduction, the theoretical foundations and stipulation model are specified in the second section. Then,

in the third section, the estimated model and its results are interpreted. Final section is devoted to general conclusions and suggestions.

MATERIALS AND METHODS
Export instability index

Researches on instability and the factors affecting it go to the Coppock book (1962). After Coppock'spioneering work in experimental and theoretical studies, instability issue is seen from three main perspectives: 1) calculating instability indices, 2) effect of instability on macroeconomic variables, and 3) factors affecting instability. Indices used for calculating instability include Coppock, Mac Bean, mean square of ratio of real export earnings, average absolute difference between actual export earnings and its trend, regression coefficient of variation of export earnings, Lam (1980), deviation of actual values from its trend, Love (1985), etc. (Samadi, 2004 and Lotfalipour *et al.*, 2007). In this study, mean absolute difference between actual export earnings and its trend is used to calculate instability index that has normalized on the amount of export earnings trend:

$$Inst = \frac{1}{N}\sum_{t=1}^{N}\frac{x_t - \hat{x}_t}{\hat{x}_t} \qquad (1)$$

where, x_t is actual export earnings, and $\hat{x}_t$ is the trend of export earnings. The trend of export earnings is estimated with regression of natural logarithm of x_t on time and time square. N is the number of studied years (Shahsavar and Dehghan, 2009). Also, the following criterion is used to calculate the instability index when the data are time series. Using this benchmark, variables instability is measured for each year:

$$IX_t = \frac{x_t - \hat{x}_t}{\hat{x}_t} \qquad (2)$$

where, IX_t is instability index, X_t is the actual value of variable at time t, and $\hat{x}_t$ is estimated value of natural logarithm according to time and time square. $T= 1, 2… N$ shows the number of years.

The specificationsof the model

In this part of the study, two models are introduced. The first model investigates factors affecting export earnings instability of pistachio. Regression model is used as follows:

$$IX_t = F(LC_x, IP_t, GLER) \qquad (3)$$

where, IX_t is export earnings instability index of pistachio, LC_x is commodity concentration index, IP_t is production instability index of pistachio, and GLER is gaps of exchange rates.

Commodity concentration index is calculated by the following equation:

$$C_X = \sqrt{\Sigma\left(\frac{x_{it}}{x_t}\right)^2} \qquad (4)$$

where, X_{it} is the value of the export earnings of the pistachio, and X_t is the value of the export earnings of the agricultural sector. This index varies between 0 and 1. The higher the index, the higher the concentration. This index is known as Hirschman index.

Production instability index of pistachio (IPt) is calculated as follows:

$$IP_t = \frac{p_t - \hat{p}_t}{\hat{p}_t} \qquad (5)$$

where, P_t is natural logarithm of pistachio production, and $\hat{P}_t$ is estimated of natural logarithm of Pt according to time and square time.

It is important to note the gaps of exchange rate because exchange rates in the two parallel and official markets are related to many important economic variables such as inflation, employment and production. Usually a policy that will affect the exchange rate in the two markets and will creates a gap between two exchange rates will inevitably impact other economic variables and will creates a chain of reactions. So the gaps of exchange rate cause unsuitable distribution of resources, performance destruction of the different economic sectors and increasing capital flight, reducing economic efficiency and growth, and

rising inflation (Zubeiri and Elmi, 2009). Gaps of exchange rate (GLER) are obtained by the following equation:

GLER= (non-official exchange rate)-(official exchange rate)/(official exchange rate) (6)

The second model introduces agricultural export function. In this model in addition to the standard variables in the export function, export earnings instability variable of pistachio is entered as an endogenous variable to the model. The model is as follows:

LEXA=F(LVA,LRER,LPEXA,IX$_t$,DU) (7)

where, *LEXA* is export agriculture (in dollars), *LVA* is agricultural value-added (in dollars), LRER is real exchange rate, *LPEXA* is price index of export agriculture, *IX$_t$* is export earnings instability index of pistachio, and *DU* is dummy variable of war and economic adjustments.

Variables in both models are the natural logarithm and the base year is 2000. In this study, the data were collected from the Central Bank of Iran, the World Bank, and Food and Agricultural Organization (FAO).

One of the most important economic sectors in developing countries is the agricultural sector. In addition to food security, this sector plays an effective role in the economic development, employment and non-oil export in these countries. If this sector is strengthened, the country can be self-sufficient in the production of strategic goods and on the other hand, foreign exchange receipts from export of these products can be increased significantly. So, it is expected that the agricultural value added variable have a positive, significant impact on agricultural exports.

Real exchange rate is known as one of the most important macroeconomic variables whose variations affect the balance of payment and competitiveness of a country in global market because as a criterion of equality of national money of one country against other country's money, exchange rate reflects economic conditions of that country in comparison with economic conditions of other countries. This variable is one of the principal variables in exports studies.

The export price is considered as a factor influencing the non-oil exports and foreign exchange earnings. So, taking care of the export price index in export function is inevitable.

VAR model

This study used Econometric methodology and vector autoregressive model to estimate functions. This is a common model in time series data and it is as follows:

$$Y_t= A_1Y_{t-1}+ A_2Y_{t-2}+ ...+ A_pY_{t-p}+e_t \qquad (8)$$

where, Y_t and its lags, and also e_t are vectors *(k*1)*. A_i *(i=1, 2... p)* are coefficient matrixes *(k*k)*. The above equation is the standard form and Yt is the vector of endogenous variables.

RESULTS AND DISCUSSION
Instability index

In this study, the following index is usedto measure the export earnings instability index of pistachio. To facilitate the comparison of this index for various economic periods, the years studied were divided into four periods. The results are described in Table 1.

As results show, the average instability was very lowthroughout the studied period. The instability index shows that during the war, export earnings instability of pistachio was increased. But by the end of the war and the improvement of the economic conditions, the instability was reducedduring the economic adjustment period (1989-1998).

Estimation Model

The existence of a long-run balancing relationship requires the variables to be stationary. So if variables of a model are stationary, their

Table 1: Quantities of export earnings instability index pistachio

Period	1973-1980	1981-1988	1989-1998	1998-2010
Index	0.006	0.036	0.029	0.007

Table 2: Unit root test

variable Test	LEXA	LVA	LRER	LPEXA	IX_t	LC_x	IP	GLER
Series in level								
ADF	-2.26	-3.16	-3.13	-3.3	-2.86	-1.69	0.43	-1.84
PP	-2.21	-3.14	-2.17	-3.5	-2.86	-0.87	0.79	-2.17
KPSS	0.16	0.19	0.16	0.38	0.29	0.18	0.21	0.16
Series in first order difference								
ADF	-6.34	-7.68	-5.38	-5.93	-8.04	-9.88	-6.99	-5.66
PP	-6.32	-8.94	-5.35	-8.95	-7.98	-9.47	-10.38	-5.35
KPSS	0.05	0.1	0.09	0.06	0.04	0.06	0.08	0.09
Degree cointegration								
	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)

Note: the null hypothesis in the ADF and PP tests shows that the series has a unit root, but null hypothesis in the KPSS test shows that the series is stationary. Critical value in the ADF and PP tests is -3.53 (%5), and it is 0.14 (%5) in the KPSS test

linear combination will be stationary, too. As a result, a long-run relationship between the variables of a model will occurs when fits residual-term is stationary and the degree of co-integration becomes zero. In this case, the shock on time-series variables will not be stable. Augmented Dickey Fuller (ADF), Philips-Perron (PP) and Kwiatkowski – Philips – Schmidt - Shin (KPSS) tests are used to check the stationary of variables. Results are reported in Table 2.

The unit root test results show that all co-integration degrees of variables are 1. Thus, the necessary condition is providedfor using a vector autoregressive model. Therefore, the optimal degree and number of co-integration vectors are determined.

This study used co-integration Johansen-Juselius method for estimating long-run relationship between variables. This method requires determining optimal degree in vector autoregressive model. To determine the optimal number of lags, Schwarz-Bayesian, Hannan-Quinn and Akaikestatistics were used. Schwarz-Bayesian test results indicate that optimal lag length is equal to two. Also, the maximum eigenvalue and trace test statistics were used to determine the number of vector integration. Results show that there are two optimal vectors.

At this stage, long-run equilibrium relationship between the variables was estimatedby vector error correction model. The normalized vector of the endogenous variables is obtained as shown in Table 3.

Results show that all variables are significant at the one percent level. Due to F statistic, significance of the model is verified too. The describing power of model is also appropriate.

Results suggest that the focus of pistachio commodity index is negatively correlated with export earnings instability. Because most pistachio productsare sent to global markets, it is one of the purely commercial and strategic export crops. This issue causes the focus of the government policies on this crop. In fact, the government tries to control the market and create a stable market for this cropby adopting policy.

Also, according to the results, the pistachio production instability index had a direct relationship with export earnings instability. Because this crop is a commercial product, most of its production is exported and only a small portion is spent on domestic consumption. Production

Table 3: The long-run equilibrium relationship

Variables	C	LC_x	IP_t	LGER
Coefficient	-37.57	-2.03*	2.93*	2.08*
t-statistic	---	3.32	2.17	2.24
R^2	0.41			
F	2.1			

* p<0.01

and price variables affect export earnings. As a result, production instability causes export earnings instability.

Due to the results, gaps of exchange rate have direct relationship with pistachio export earnings instability. Increasing gaps of exchange rate shows that the difference of official and non-official exchange rate is increased. Thus, government policy has not been adopted in this issue correctly, creating uncertainty and increasingthe risk for exporters, and therefore resulting in instability of export earnings.

At last stage, coefficient of the error correction model was estimated as to be -0.046. This coefficient is between zero and one. So existence of long-run equilibrium relationship between variables is verified. Also, this coefficient reveals that short-run error adjustment to long-run equilibrium is low.

The estimation of the effect of pistachio export earnings instability on agricultural export

To estimate the long-run relationships between pistachio export earnings instability and agricultural exports, variables were used from co-integration Johansen-Juselius method. The results of Schwarz-Bayesian, Hannan- Quinn and Akaike criteria show that optimal lag length is equal to one. Also, co-integration test based on Johansen's maximum likelihood method accepted two co-integration vectors under maximal eigenvalue test statistic.

Longrun equilibrium relationship between the variables in the model using vector error correction model is as presented in Table 4.

Based on the estimation, the coefficient of agricultural value-added is positive and significant. Results show that the growth of this sector can be improved by strengthening production fundamentals and increasing its production po-

tential, which will result in higher export supply in addition to providing domestic demand.

Results show that the relationship between agricultural export prices and agricultural export is positive and significant. It implies that if agricultural export prices rise, producers export earnings and their export will increase as well.

Also, the results show that the effect of real exchange rate on exports is significant and negative. This variable is the most important macroeconomic variable that can affect the performance of the economy and economic variables, and it is affected by the domestic and foreign policy and economic changes too. Since the studied years were concurrent with the years of war and various sanctions, suitable economic and political policies have not been adopted; therefore, economy has not been obtaining sufficient currency.

As a result, the effect of pistachio export earnings instability on agricultural export is negative and significant. These results indicate that the increasing pistachio export earnings instability declines agricultural export. Because among the horticultural crops, pistachio as an important export crop has a special situation and is important economically, so it is considered as the most important component of the country's non-oil exports.

In the last step, the coefficient of short-run error adjustment is estimated equal to -0.05. According to the absolute value of coefficient, it is between zero and 1. Therefore, the long-run equilibrium relationship between the variables of model is confirmed. Also, the coefficient states that the short-run error adjustment towards long-run equilibrium relationship has been done slowly.

CONCLUSIONS AND RECOMMENDATIONS

Pistachio is one of the main export products

Table 4: Long-run causality pattern

Variables	C	LVA	LPEXA	LRER	IX$_t$	DU
coefficient	-151.04*	7.75*	0.91*	-0.96*	-7.48*	-21.73*
t-statistic	(-6.26)	(7.12)	(3.7)	(-5.41)	(-2.83)	(-5.54)
R^2	0.5					
F	2.93					

Note: t-statistic given parenthesis with *, indicate significance at %1 probability level respectively

of agricultural sector and, it is very important because of obtaining currency, creating jobs, creating value added, and other economic aspects. This crop has a large share of agricultural export. Therefore, this study aimed to measure instability index, instability factors affecting pistachio export earnings, and its effect on the export of agricultural sector. In order to calculate the instability index over the period 1973-2010, the average absolute value of the difference between the actual export earnings and its trend was used. To facilitate the investigation, the studied years were divided to four periods. Our results indicate that the amount of instability during the war (1981-1988) was higher than in other period due to its critical situation, but in general, we had low instability in the whole period. Both models were applied to estimate vector error correction model. Pistachio commodity concentration index, pistachio product instability and gaps of exchange rate were used to investigate factors affecting pistachio export earnings instability. The results indicate that pistachio commodity concentration index has negative effect, but pistachio product instability and gaps of exchange rate have direct relationship with pistachio export earnings instability. Also, in the agricultural export function, agricultural value added, agricultural export prices, the real exchange rate and pistachio export earnings instability (Love index) variables were considered. The results show that pistachio export earnings instability has a significant and negative effect on agricultural export.

In this study, the following recommendations can be drawn:

Due to the negative and significant effect of pistachio export earnings instability on agricultural export, it is suggested that government adjust its agricultural and export policies in order not to lose its position in the international pistachio marketplace.

Because of the effect of exchange rate on pistachio export earnings instability and agricultural export, it is recommended that the government orient its domestic and foreign policies so that the changes of exchange rate match with economic evolutions and cause improvement of export markets.

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