European Online Journal of Natural and Social Sciences 2015; www.european-science.com
Vol.4, No.1 Special Issue on New Dimensions in Economics, Accounting and Management
ISSN 1805-3602

The Study of the Impact of Iran's Exchange Rate Shock on Pistachio Export Prices of Major Pistachio Exporting Countries

Iman Najafi[1], Reza Moghaddasi[2], Seyed Yaghoub Zeraatkish[2]
[1]PhD student, Department of Agricultural Economics, Science and Research Branch, Islamic Azad University, Tehran, Iran; [2]Associate Professor, Department of Agricultural Economics, Science and Research Branch, Islamic Azad University, Tehran, Iran

Abstract

The purpose of the present research is to study the impact of Iran's exchange rate shock on export prices of major pistachio exporting countries over the period 1984-2012. The selected countries for this study are China, Iran, Italy, Greece, Turkey, Syria, and the United States of America. For this purpose, the Global VAR (GVAR) method has been employed. The results suggest that in the long run, pistachio export prices of Syria and the US are the least affected by exchange rate volatility in Iran, while the export prices in Italy are the most affected.

Keywords: exchange rate shock, export prices, GVAR model, pistachio exporters

Introduction

Considering the important and essential role of trading and commerce in societies' economic growth, for the purpose of national development, most countries have focused on trade with other countries in the past decades. Hence, it can be said that among economic activities, foreign trade has one of the highest growth rates; this rate has even grown more after the Second World War. In Iran, due to the recession of petroleum exports and the decrease of its sales income, and concerning the past experiences regarding exchange income fluctuations, it is crucial the policies are made for increasing non-oil exports, especially for agricultural products export.

Among different agricultural products with relative competitive advantage in Iran, pistachio is a valuable commodity whose development of production and exports can be realized efficiently due to its especial features and advantages. Major pistachio exporting countries are Iran, United States, Turkey, Syria, China, Greece, and Italy, among them Iran and the United States hold more than half of its global market. One of the factors which can affect a country's share of global market is the export price. During recent years especially after 1990, the nominal and real prices of Iranian pistachio are on the decline (FAO, 2008). Borensztein and Reinhart (1994) believed that the decline of agricultural commodity prices in recent years is a natural phenomenon. As for pistachio market, some of this price decrease can be due to the emergence of new producers and exporters such as the US and China which has shrunk Iran's share of the global market.

New discussions on trade suggest a relationship between exchange policies and pricing procedure. These theories which are based on the assumption of market-based pricing as proposed by Krugman et al. (1997) suggest that in a non-competitive market, large commercial entities can change the prices according to the exchange rate fluctuations. Various studies have been conducted on the impact of exchange rate on exports and export prices. The study by Ashk Torab (2011) suggests that the exchange rate and the relative export prices of other pistachio exporting countries have a negative and significant impact on the demand for Iranian pistachio export. Piri and Saboohi study the impact of exchange rate fluctuations on export prices of agricultural products. The results indicate that real exchange rate has a positive and significant effect on export prices in the long run. Mortazavi et al (2011) believe that exchange rate volatility has a negative impact on export prices of pistachio. Also Cheong et al. (2005) believe that along with the rise of exchange rate volatility,

exporters try to increase the prices while decreasing the volume of exports. The study conducted by Fang et al. (2006) indicates that exchange rate depreciation on exports for eight Asian economies encourages exports for most countries, but its contribution to export growth is weak. The results of the studies done by Keith et al (2008), Fogarasi (2010), and Hall et al. (2010) indicate that exchange rate volatility has a negative and significant impact on exports. Considering the discussed issues, it is perceivable that exchange rate volatility is a factor affecting export prices. The purpose of the present research is to study the impact of the shocks caused by exchange rate in Iran on export prices of major pistachio exporting countries. In the past few years, programs have been implemented for adjusting the economy and establishing a stable economic environment. For instance, in order to establish real exchange rate, the Iranian government implemented multiple foreign exchange rates and then tried to implement a single unified exchange rate; following that exchange rate volatility and fluctuations which had always been intense were to some extent reduced.

Methodology

In recent years, Pesaran et al. (2004), Dies et al. (2007), and Dies et al. (2008) have designed a practical method to evaluate macroeconomic relationships by using certain Vector Auto-Regression (VAR) models. To be specific, the global VAR model (which will be referred to GVAR) is constructed by using vector auto regression model of a country or region in which all internal and external variables can simultaneously interrelate.

Suppose that N+1 countries (or regions) are involved in global economy. For country I, there is a full VARAX $(\ddot{p}_i\,,\ddot{q}_i)$ model as bellow:

$$x_{i\,,t} = a_{i\,,0} + a_{i\,,1}t + \sum_{j=1}^{\ddot{p}_i} \Phi_{i\,,j} x_{i\,,t-j} + \sum_{j=0}^{\ddot{q}_i} \Psi_{i\,,j}\, x^*_{i\,,t-j} + \sum_{j=0}^{\ddot{s}_i} \Gamma_{i\,,j} d_{t-j} + \varepsilon_{i\,,t} \qquad (1)$$

Where: $x_{i\,,t}$ is vector of domestic variables, $x^*_{i\,,j}$ is vector of foreign variables, and d_t is a vector of external global variables such as oil prices.

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$\varepsilon_{i\,,t}$ refers to a vector of independent shock particular to country i with zero mean and $\sum_{ii} \varepsilon$ variance-covariance matrices.

Following Pesaran et al. (2004), the foreign variables of country i are average trade weight of the country constructed by other variables:

$$x^*_{i\,,t} = \sum_{j=0}^{N} w_{i\,,j}\, x_{j\,,t}\,, with\ \ w_{ii} = 0\ \ and\ \sum_{j=0}^{N} w_{i\,,j} = 1 \qquad (2)$$

Where $w_{i\,,j}$ is the trade weight of country j in the total trade (exports plus imports) of country i, measured in US dollars. Global models such as equations (1) and (2) present a complete system of N+1 countries which should be simultaneously evaluated in order to obtain desirable results. To overcome this problem, a two-staged method of estimation has been proposed by Pesaran et al. (2004) and Dees et al. (2007). In the first step, external and observable global variables are considered as weak exogenous variables; hence, the equation (1) is used independently and on a country-specific basis. The first step of this method begins with the application of a simple VARZ (1, 2) model on country i:

$$x_{i\,,t} = a_{i\,,0} + a_{i\,,1}t + \Phi_{i\,,1} x_{i\,,t-1} + \Phi_{i\,,2} x_{i\,,t-2} + \Psi_{i\,,0} x^*_{i\,,t} + \Psi_{i\,,1} x^*_{i\,,t-1} + \Gamma_{i\,,0} d_t + \Gamma_{i\,,1} d_{t-1} + \varepsilon_{i\,,t} \quad (3)$$

This secondary country-specific model provides the following error correction:

$$\Delta x_{i\,,t} = a_{i\,,0} + a_{i\,,1}t - (A_i - B_i) z_{i\,,t-1} + \left(\Gamma_{i\,,0} + \Gamma_{i\,,1}\right) d_{t-1} - \Phi_{i\,,2} \Delta x_{i\,,t-1} + \Psi_{i\,,0} \Delta x^*_{i\,,t} + \Gamma_{i\,,0} \Delta d_t + \varepsilon_{i\,,t} \qquad (4)$$

$z_{i,t} = W_i x_t \quad , \qquad i = 0,1, \dots N$

Where W_i is defined as matrices of constant and identified numbers in terms of trade weight of a specific country i.e. $\omega_{i,j}$. For instance, we rewrite VARX (1, 2) model for country i as below:

$\hat{A}_i z_{i,t} = \hat{a}_{i,0} + \hat{a}_{i,1} l + \hat{C}_i z_{i,t-1} + \hat{D}_i z_{i,t-\frac{z}{2}} + \hat{\Gamma}_{i,0} d_t + \hat{\Gamma}_{i,1} d_{t-1} \hat{\varepsilon}_{i,t}$

Via simultaneous integration of all these country-specific equations we have:

$\hat{A} x_t = \hat{a}_0 + \hat{a}_1 t + \hat{C} x_{t-1} + \hat{D} x_{t-2} + \hat{\Gamma}_0 d_t + \hat{\Gamma}_1 d_{t-1} + \hat{\varepsilon}_t$

Where in:

$$\hat{a}_0 = \begin{bmatrix} \hat{a}_{0,0} \\ \hat{a}_{1,0} \\ \vdots \\ \hat{a}_{N,0} \end{bmatrix} \quad , \quad \hat{a}_1 = \begin{bmatrix} \hat{a}_{0,1} \\ \hat{a}_{1,1} \\ \vdots \\ \hat{a}_{N,1} \end{bmatrix} \quad , \quad \hat{\Gamma}_0 = \begin{bmatrix} \hat{\Gamma}_{0,0} \\ \hat{\Gamma}_{1,0} \\ \vdots \\ \hat{\Gamma}_{N,0} \end{bmatrix} \quad , \quad \hat{\Gamma}_1 = \begin{bmatrix} \hat{\Gamma}_{0,1} \\ \hat{\Gamma}_{1,1} \\ \vdots \\ \hat{\Gamma}_{N,1} \end{bmatrix}$$

And

$$\hat{A} = \begin{bmatrix} \hat{A}_0 W_0 \\ \hat{A}_1 W_1 \\ \vdots \\ \hat{A}_N W_N \end{bmatrix} \quad , \quad \hat{C} = \begin{bmatrix} \hat{C}_0 W_0 \\ \hat{C}_1 W_1 \\ \vdots \\ \hat{C}_N W_N \end{bmatrix} \quad , \hat{D} = \begin{bmatrix} \hat{D}_0 W_0 \\ \hat{D}_1 W_1 \\ \vdots \\ \hat{D}_N W_N \end{bmatrix} \quad , \quad \hat{\varepsilon}_t = \begin{bmatrix} \hat{\varepsilon}_{0,1} \\ \hat{\varepsilon}_{1,t} \\ \vdots \\ \hat{\varepsilon}_{N,1} \end{bmatrix}$$

Hence, x_t is formulates as:

$x_t = \hat{A}^{-1}\left(\hat{a}_0 + \hat{a}_1 t + \hat{C} x_{t-1} + \hat{D} x_{t-2} + \hat{\Gamma}_0 d_t + \hat{\Gamma}_1 d_{t-1} + \hat{\varepsilon}_t\right)$

Which can be solved auto-regressively so that other values of $x_t$are obtained.

The main assumption of GVAR estimation is the weak exogeneity of $x^*_{i,t}$ considering the co-integrating relationships ofβ_i. Following Johansen (1992) and Harbor et al. (1998), a formal examination of this assumption has been statistically evaluated by using an auxiliary regression:

$$\Delta x^*_{i,t} = k^*_{i,t} + \sum_{j=1}^{\ddot{p}_i} \alpha^*_{i,j}\, \hat{\delta}_{ij,t-1} + \sum_{j=1}^{\ddot{p}^*_i} \Phi^*_{i,j}\, \Delta x_{i,t-j} + \sum_{j=1}^{\ddot{q}^*_i} \Psi^*_{i,j}\, \Delta x^*_{i,t-j} + \varepsilon^*_{i,t} \qquad (5)$$

Where:

$\hat{\delta}_{ij,t-1} = \hat{\beta}'_{ij}\left(\varepsilon_{i,t-1} - \hat{k}_{i,1}(t-1)\right)$

$j = 1, 2, \dots \ddot{r}_i$, are error correction terms related to $\ddot{r}_i$ co-integrations for the model of country i. And $\hat{\beta}_i$ refers to co-integration vector j of the country$i$. For the dynamic analysis of the global model the study by Pesaran et al. (2004) is drawn upon and general functions of impulse response (GIRF) are used. In the present study, the GVAR model is applied to seven major pistachio exporting countries i.e. Iran, US, Turkey, Syria, Italy, Greece, and China. The countries incorporated into GVAR model hold over 90% of pistachio exports worldwide. Since the present article studies the impact of Iran's exchange rate shock on export prices of pistachio in major exporting countries, the results are focused in this subject.

Discussion and conclusion

Introduction of research variables

The country-specific models used in this study incorporate the following domestic variables:

$y_{it} = Ln(GDP_{it} / CPI_{it})$,

$\rho_{it} = DP_{it}$

$er_{it} = Ln(Er_{it}) - L_n(CPI_{it})$

$PP_{it} = Ln(PP_{it})$

Where y_{it},dp_{it}, er_{it}, pp_{it} represent real gross domestic product, inflation rate, real exchange rate, and pistachio export price respectively.

The variables GDP_{it}, CPI, Er_{it} represent nominal gross domestic product, customer price index, and nominal exchange rate in terms of US dollars respectively. It should be noted that with the exception of the United States, all country-specific models contain the above-mentioned domestic variables. In the case of US, the variable of real exchange rate is not included.

Aside from domestic variables, country-specific models also include foreign variables pertaining to competitor countries and logarithm of global oil price. All country-specific models incorporate foreign variable of PP^*_{it}, dp^*_{it}, y^*_{it} and price of oil logarithm. It should be noted that United States country-specific model also includes er_{it} as a foreign variable.

Before estimation of country-specific models, the variables should be first tested in terms of stationary. In order to examine the stationary of variables, Augmented Dickey Fuller's unit roots test and Philips Perone's test have been employed. The results indicate that the sets of variables in all countries become stationary by first difference taking at lag 1 I (1).

Country-specific estimation

In this step, the purpose is to estimate country-specific models and identify co-integration level with the assumption that the foreign variables are weakly exogenous I (1). For these models, the lag orders of the corresponding individual country models are selected by using the Akaike Criterion with p_{max}, q_{max} less than 2. Table (1) demonstrates model's lag and number of co-integrating vectors.

Table 1: VARX order and number of co-integration relationships

VARX(p*, q*)	CHINA	IRAN	ITALY	Greece	TURKEY	SYRINA	USA
P^*	2	2	2	2	1	2	2
q^*	1	1	1	1	1	1	1
Co-integration	3	1	2	2	2	1	2

Source: research results

One of the basic assumptions of GVAR model is that the foreign variables should be weakly exogenous. The weak exogeneity is examined by the F-test of the hypothesis that the coefficient of co-integrating relationships in equation (5) is close to zero. The results of test of weak exogeneity for the set of selected countries are demonstrated in table (2).

Table 2: Test for weak exogeneity at the 5 % significance level

Country	F-test	Fcrit-%5	y_s	er_s	pp_s	dp_s	Poil
CHINA	F(3,14)	3/343	0/130	–	2/382	0/085	0/836
IRAN	F(1,21)	4/324	0/032	–	3/805	3/898	0/429
ITALY	F(2,11)	3/982	0/521	–	0/036	0/421	0/320
Greece	F(2,20)	3/492	0/494	–	1/452	0/0275	0/438
TURKEY	F(2,20)	3/492	0/169	–	0/447	0/231	0/868
SYRIA	F(1,21)	4/324	0/774	–	0/241	0/097	1/038
USA	F(2,11)	3/982	0/471	1/170	0/187	1/276	0/324

Source: research results

The results presented in table (2) indicate that the hypothesis of weak exogeneity of all foreign variables in selected countries is not rejected. Therefore, foreign variables are considered to be weakly exogenous.

Impact Elasticity

With the estimation of the country-specific VARX models, it is possible to examine the feedback coefficient of foreign-specific variables on their domestic counterparts. These coefficients are known as impact elasticity and they measure the contemporaneous variation of a domestic variable due to a 1% change in its corresponding foreign-specific counterpart.

Table 3: Contemporaneous effects of foreign variables on their domestic counterparts

country	Y	er	pp	Dp
CHINA	0/7490* [2/671]	–	1/221* [2/851]	0/721* [3/225]
IRAN	0/525 [1/708]	–	0/054 [0/540]	1/106* [4/092]
ITALY	0/076 [0/686]	–	0/358 [0/952]	0/030 [0/908]
Greece	0/851* [6/066]	–	0/791* [2/347]	0/244 [0/747]
TURKEY	0/810* [2/312]	–	0/512* [2/239]	0/301 [0/480]
SYRIA	−0/112 [−0/360]	–	0/142 [0/796]	−0/277 [−0/965]
USA	0/180 [1/614]	–	0/436* [3/268]	0/095* [3/59]

Source: research results

Note: * denotes statistical significance at the 5 % level.

Whit's heteroskedastic – robust t-ration are given in square brackets.

The results of impact elasticity are represented in table (3). As demonstrated, the values of real GDP (gross domestic product) of China, Iran, Greece, and Turkey are significant at the 95% confidence level. China's real GDP impact elasticity indicates that contemporaneous to 1% variation in GDP of major pistachio exporting countries, China's GDP changes to 0.749. The values of impact elasticity for Iran, Greece, and Turkey are 0.525, 0.851, and 0.810 respectively. The values of impact elasticity of pistachio export prices for China, Greece, Turkey, and US are significant at the 5%. The coefficient of China's export price of pistachio is 1.22; this means that contemporaneous to 1% increase in other countries' export price, China's export price of pistachio increases by 1.22%. For Greece, Turkey, and the US, this coefficient is 0.791, 0.521, and 0.436 respectively.

The values of impact elasticity of inflation rate for China, Iran, and US are 0.721, 1.106, and 0.095 respectively which are significant at 95% confidence level. These values indicate that inflation in Iran is to a greater extent affected by inflation in other countries; and inflation in the US is least affected by inflation in other countries.

Analysis of response to Iran's exchange rate shock

Figure (1) demonstrates estimated GIRFs based on the effect of decreased standard error shock to real exchange rate of Iran on export prices of selected countries. Figure (1-a) represents the effect of negative shock to Iran's exchange rate on China's export price. As demonstrated, due to the negative shock to Iran's exchange rate, China's pistachio export prices fluctuate in a sine wave pattern in short term; and in the 9th cycle it leads to 6% increase in China's export price. As in long-term, this shock leads to 17% increase in pistachio export price.

Figure (1-b) represents the effect of shock to Iran's export price. Due to this shock, Iran's export price gradually rises until the fifth cycle, and after that it starts to decrease. In the short term, this shock has the greatest impact on Iran's pistachio export price in the fifth cycle, which is equal to 0.026. The long-run impact of this shock on Iran's pistachio export price equals 19%.

Figure (1-c) represents the effect of shock on Italy's export price. Due to this shock, Italy's pistachio export price is constantly rising at all cycles with 4% increase. The long-run impact of this shock on Italy's pistachio export price is 46%.

Figure (1-d) represents the effect of shock to Iran's exchange rate on Greece's pistachio export price. The impact of this shock on Greece's pistachio export price is at its peak in the first cycle with 2.5%. Then in a gradual process it decreases and reaches its lowest level which is 1.4% in the tenth cycle. The long-run impact of this shock on Greece's pistachio export price is 0.21%.

Figure (1-e) represents the effect of negative shock to Iran's exchange rate on Turkey's export price of pistachio. The response of Turkey's export price to this shock is to increase until the fifth cycle, so that it reaches to a peak of 23.3%; then in a gradual process it decreases. In the long-run, the response of Turkey's export price of pistachio to the shock to Iran's exchange rate equals 22%.

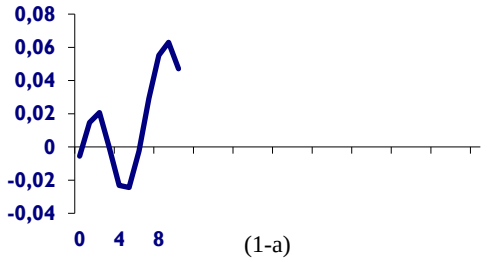
Figure (1-F) represents the response of Syria's export price of pistachio to the shock to Iran's exchange rate. As demonstrated, it rises until the third cycle and then gradually goes to decline until the tenth cycle when it reaches zero. The long-run of this shock has no effect on Syria's export price of pistachio.

Figure (1-G) represents the effect of negative shock to Iran's exchange rate on United States export price of pistachio. As a response to this shock, United States export price of pistachio fluctuates between zero and 1.5 in a sine wave pattern. The long-run impact of this shock on United States pistachio export price is 8%.

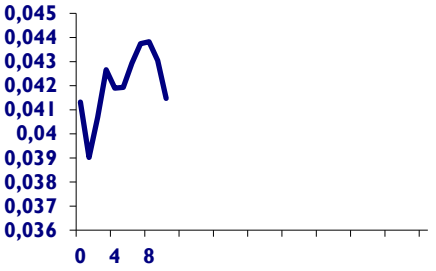
Among the selected countries, in the long-run, with respective values of 0, and 8, pistachio export prices of Syria and the US are the least affected by exchange rate shock in Iran, while the export prices in Italy are the most affected. After that, Turkey, Greece, and China are ranked next in a respective manner.

Suggestions

Concerning Iran's major role in determination of export prices of pistachio due to this country's immense volume of production in comparison to other countries, establishment of a stable exchange system can significantly help stabilize and strengthen Iran's position in global market of pistachio.



(1-a)



(1-b)

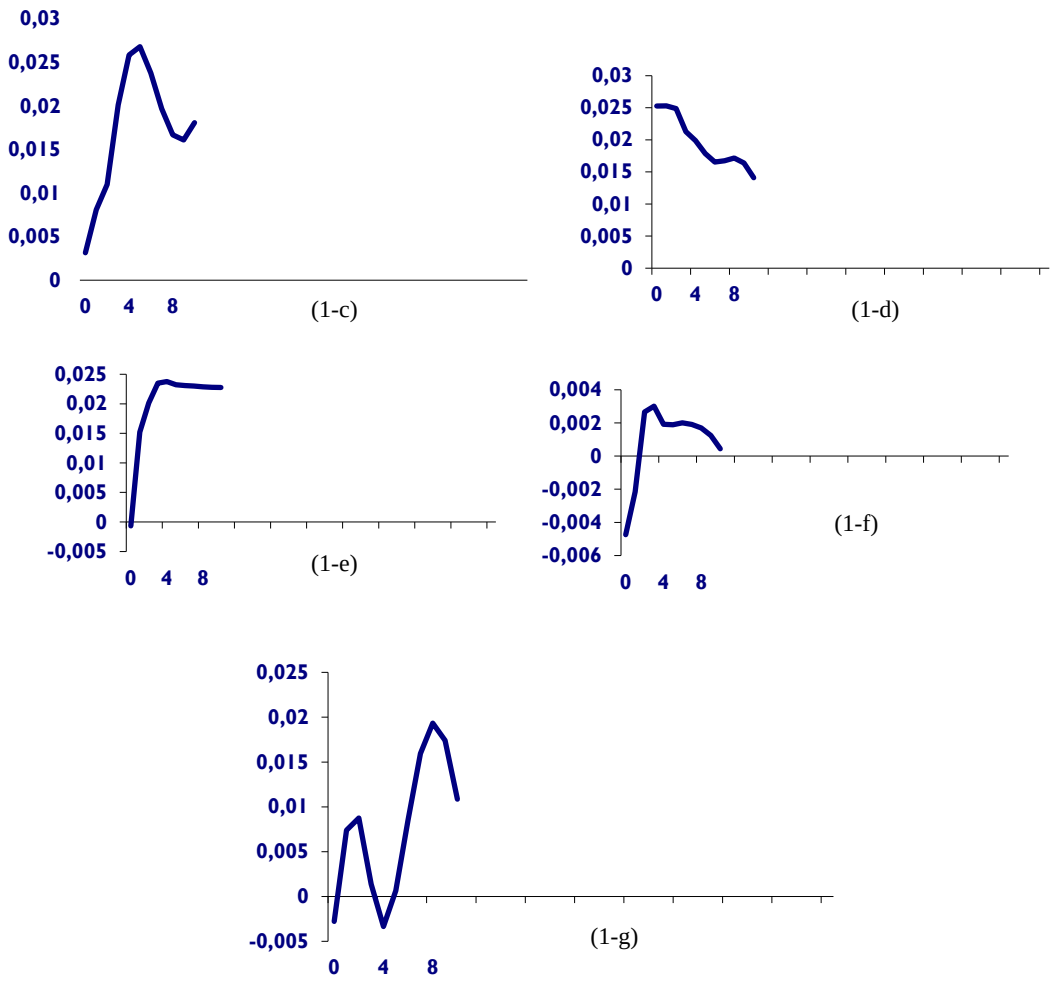


Figure 1: Estimated GIRFs based on the effect of decreased standard error shock to real exchange rate of Iran on export prices of selected countries.

In the long-run, United States export prices of pistachio show no sign of change due to Iran's exchange rate volatility. Therefore, any kind of exchange rate shock to Iran's economy would be a disadvantage to Iran in its competition against the United States. On that basis, implementation of policies to improve the quality and increase production and productivity enhances Iran's competitive advantage in the global market.

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