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An Empirical Analysis of Exchange Rate Pass-Through to Iran's Saffron Export Price

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Abstract

Exchange rate pass-through to the price of traded goods is one of the important issues in economy of developing countries such as Iran and affects the efficiency of the exchange rate policies to improve the trade balance. The main aim of this paper is to empirically analyze exchange rate pass-through to Iran's saffron export price using panel data for twenty destination markets during 2000–2011. Utilizing the system generalized method of moments and controlling endogeneity of several explanatory variables, the estimation results showed that exchange rate pass-through was incomplete. Considering incomplete pass-through of exchange rate to Iran's saffron export price, it is concluded that Iranian exporters are able to discriminate price among destination markets and can absorb a portion of the change in the exchange rate in order to maintain or increase market share.The results also suggest that Iranian exporters partially offset the effect of tariff rate on saffron export price. Another important result is that macroeconomic environment in destination markets plays an important role in determining the Iran's saffron export price.

Introduction

The place and great importance of agriculture in Iran's economy is due to its significant share in developing and improving non-oil exports, supplying food security and increasing employment. Among agricultural products, saffron is considered as a strategic and important plant in national economy ,regarding its special role in employment and creating foreign exchange earnings; having more than four fifth of global production and three fifth of shares of global markets, Iran is the biggest producer and exporter of saffron in the world (Sadeghi et al., 2011). Concerning the importance of this plant in Iran agricultural economy, numerous studies have been carried out to examine the factors affecting the export of this product. For example, results of studies carried out by Biria and Jabal Ameli (2006) and Rezapour and Mortazavi (2010) have shown that the exchange rate has a significant effect on saffron export. However, this question arises here that how exchange rate affects the export of a product like saffron? Traditional theories of international trade state that appreciation of the exchange rate decrease export price in terms of foreign currency in destination markets. On the other hand, the effect of exchange rate on export price in terms of foreign currency is likely to be limited; it can be studied through Exchange Rate Pass-through (ERPT), and it is a new issue in international trade literature. ERPT to export price reflects the percentage change in the export price in terms of importing country's currency due to a 1% change in the exchange rate. Pricing To Market (PTM) is a concept close to ERPT and reflects the percentage change in the export price in terms of exporting country's currency due to a 1% change in the exchange rate (Ghosh & Rajan., 2007). Numerous studies have been conducted regarding evaluation of ERPT and factors affecting it in different countries. In one of the most important studies, Marston (1990) showed, using Ordinary Least Squares (OLS) method and monthly data for the period 1980(2)-1987(12), that Japanese companies followed PTM while facing changes in exchange rate. In his study, Athukorala(1991)

examined ERPT for South Korean manufactured goods for the period of 1980-89. Making use of a model with Polynomial Distributed Lag(PDL), he concluded that South Korea is price taker in exporting markets. Applying monthly data for the period of 1980(1)-1988(9), Parsley (1993) came to the conclusion that even if ERPT is constant at the industry level, changes in commodity composition of trade may change aggregate ERPT. Using OLS and seasonally data for the period 1980(1)-1992(1), Athukorala and Menon (1994) Reached to the conclusion that considering the cost effects resulted from changes in exchange rate underestimated ERPT. Yang and Hwang (1994) studied ERPT for six manufacturing sectors in South Korea over the period of 1976(12)-1990(12). Their results revealed that average ERPT to export price was 30%. Making use of sixteen Korean manufacturing export industries over the period of 1980-90, Lee (1995) concluded that applying PTM by exporters of a small country increased as their market share got smaller. Employing annual data from 1975 to 1993 and a Three Stage Least Squares (3SLS) method, Cheung et al. (1997) found out that ERPT to export price was incomplete in Taiwan. Using data related to 24 Korean imports between 1980 and 1990, Lee (1997) understood that market concentration was an important factor in determining ERPT. Webber (1997) employed Johansen Maximum Likelihood and quarterly data from 1973(3) to 1993(2) and concluded that ERPT was complete for most Australian exported goods. In another study, Webber (1999) examined response of import price to changes in exchange rate in the Asia-Pacific countries for a period of 1978-94. His results showed adjusting the effect of exchange rate by foreign exporters and domestic importers. Takagi and Yoshida (2001) concluded, using monthly data from 1988(1) to 1998(4), that ERPT was more for Japan's export price than for its import price. Otani et al (2003) employed monthly data of 1978-2002 and figured out that ERPT was complete for Japan's import price. Results of a study carried out by Parsley (2003) revealed that adjusting Hong Kong's import price to changes in exchange rate was great for the period of 1992-2000. Using panel data for the period of 1989-2001, Hoque and Razzaque (2004) concluded that ERPT was complete for primary export commodities of Bangladesh. Xie et al. (2008) concluded, using Seemingly Unrelated Regressions (SUR) and monthly data of 1998(1)-2005(12), that changes in exchange rate was an important factor in determining export price of farmed salmon. Results of a study, which was carried out by Mallick and Marques (2010) who used panel data and co-integration method, showed that ERPT to export price in India's destination markets was incomplete in a short run. In domestic studies, Haghighat and Hosseinpour (2010) concluded that exchange rate was an important factor in determining export price of raisin. Making use of Autoregressive Distributed Lag (ADL) for the period of 1971-2005, Karbasi and Ahmadi (2010) examined the effects of exchange rate fluctuations on raisin export quantity and Price. Results of the above-mentioned studies are consistent with the assumption of a competitive global market for raisins. Asgharpour et al (2011) came to the conclusion that ERPT to non-oil export price of Iran was complete. Reviewing domestic and foreign studies in this regard, it can be observed that level of ERPT varies according to market structure and type of commodities.

Since by reviewing ERPT a final result of making an exchange rate policy on the export of a product can be predicted, it can be said that it is of great importance for Iran's economy. For example, if ERPT is not complete, making the policy of domestic currency depreciation will not be efficient to increase saffron export and to improve the trade balance. Thus, empirical analysis of ERPT to Iran's saffron export price is the main objective of this study. Applying system Generalized Method of Moment (GMM), considering macroeconomic environment in destination markets and examining ERPT and Tariff Rate Pass-Through (TRPT) simultaneously are distinctive features of this study.

Materials and methods

In this section, first, the empirical model will be introduced and variables will be explained; then, statistical issues related to system GMM will be defined.

ERPT is generally estimated for import price; however, its level can also be calculated for export price (Ghosh & Rajan., 2007). In addition, in several empirical studies [e.g. (Knetter., 1989 & 1993), (Athukorala & Menon., 1994), (Yumkella et al., 1994), (Gagnon & Knetter., 1995),(Kazmierczak et al., 1997), (Goldberg & Knetter., 1997), (Carew., 2000), (Gil-Pareja., 2000 & 2003), (Hoque & Razzaque., 2004) and (Mallick & Marques., 2008 , 2010 & 2012)] panel data has been used to estimate ERPT. Considering recent studies, the following regression model is used to study ERPT to Iran's saffron export price:

$$LnP_{it}=\beta_0+\beta_1 LnE_{it}+\beta_2 LnTR_{it}+\beta_3 Inf_{it}+\beta_4 Open_{it}+\beta_5 LnP_{i,t-1}+\mu_i+v_{it} \quad \textbf{(1)}$$

Where, LnP_{it} is logarithm of Iran's saffron export price to i market in terms of domestic currency (Rials), LnE_{it} is logarithm of mutual exchange rate (the price of the destination market currency in terms

of domestic currency), $LnTR_{it}$ is logarithm of tariff rate imposed in the destination market for Iran's exported saffron, Inf_{it} is inflation in destination market, $Open_{it}$ is openness to trade (the share of international trade in gross domestic product) in destination market, μ_i is a country effect and v_{it} is error term.

In regression model (1), level of ERPT is always equal to $1-\beta_1$ from importer's point of view (Mallick & Marques., 2010). β_1, which is equal to zero, reflects that Iran's saffron export price in terms of domestic currency doesn't change as exchange rate changes and ERPT is complete. Complete ERPT shows that Iranian exporters face perfectly elastic demand, that Iran is price taker in global markets and that Law of One Price (LOP) exists (Haghighat & Hosseinpour., 2010). Similarly, β_1, equally to 1, shows that Iran's saffron export price in terms of domestic currency changes one-to-one with exchange rate and ERPT is zero. In this case, Iranian exporters have market power and fully absorb exchange rate changes. If β_1 is between zero and 1, aportion of the change in the exchange rate is absorbed by Iranian exporters and ERPT is incomplete. Incomplete ERPT is due to the existence of imperfect competition and the associated markup pricing (Mallick & Marques., 2008). TRPT is equal to $1-\beta_2$ from importer's point of view (Mallick & Marques., 2012). Therefore, β_2 equal to zero, reflects that tariff rate change in importing countries doesn't change Iran's saffron export price in terms of domestic currency and thus TRPT is complete. Similarly, β_2 equally to 1 shows that Iran's saffron export price in terms of domestic currency changes one-to-one with tariff rate and TRPT is zero. If β_2 is between zero and 1, Iranian exporters offset a portion of the change in the tariff rate and thus TRPT is incomplete. In regression model (1), some variables like "openness to trade and inflation in destination market" are used as substitute variables to consider macroeconomic environment in importing countries.

In this study, regression model (1) was evaluated using panel data. Controlling heterogeneity among countries, providing more data, more variability, less collinearity among the variables, more degree of freedom, more efficiency, more ability to examine dynamics of variables, identifying and measuring unobservable effects are some advantages of panel data (Hsiao., 2003; Baltagi., 2005). In econometric literature related to panel data, μ_i in regression model (1) reflects unobservable features of every country which don't change over time (Gujarati., 2003; Wooldridge., 2006). Most economic models such as regression model (1), are dynamic. Presence of the variable "saffron export price logarithm" with a lag ($LnP_{i,t-1}$) among regressions causes serious problems in evaluation of regression model (1) because $LnP_{i,t-1}$is a function of μ_i and thus lagged dependent variable is correlated with the error term (Baltagi., 2005). In this case, estimating lagged dependent variable is associated with bias and the created correlation is not solvable through increasing the cross-section units (countries). Anderson and Hsiao (1981) proposed first difference transformation for μ_i removal. Arellano and Bond (1991) used GMM to increase efficiency. They use lagged levels of the endogenous variables as instrumental variables which are mainly considered difference GMM. In studies carried out by Arellano and Bover (1995) and Blundell and Bond (1998), it was shown that lagged levels of the variables were poor instruments for first-differenced variables and that they used lagged level variables and lagged difference variables as instrumental variables. Arellano and Bover & Blundell and Bond estimator consists of a system of two equations (level equation and differenced equation) and it is mainly identified as system GMM. Both differenced and system GMM can be achieved in one-step and two-step formats. It's worth mentioning that making use of system GMM is valid when error term has first order autocorrelation and not second order autocorrelation. To identify autocorrelation in error term, Arellano and Bond (1991) designed a test whose null hypothesis reflected no autocorrelation in error term. Moreover, validity of instrumental variables (exogenous instruments) is examinable by Hansen test, whose null hypothesis shows no correlation between instrumental variables and regression error term. This library study is of descriptive-analytical type. Statistical universe is some exporting markets for Iran's saffron. Therefore, considering statistical limitations, Spain, Australia, UAE, England, Italy, Germany, Bahrain, Belgium, Denmark, Japan, Singapore, Switzerland, Sweden, Saudi Arabia, France, Qatar, Canada, Kuwait, Norway and Netherlands, were selected as destination markets. Information related to variables of regression model (1) was considered annually for a period of 2000-2011. Data related to the variable "Iran's saffron export price" was in terms of domestic currency

(Rials) and was gathered from customs statistical yearbooks of Iran during different years. Data related to the variable "nominal exchange rate" was collected from indicators of central bank of Iran and International Financial Statistics (IFS). Data related to variables "tariff rate, openness to trade and inflation rate" was obtained from World Development Indicator (WDI). In addition, software STATA[11] was used to evaluate regression model (1).

Results

In this section, results obtained from evaluation of regression model (1) will be assessed considering statistical criteria and economic theories.

In this study, the system GMM (two-step) was used to estimate regression model (1). In order to estimate this model, it is necessary that instrumental variables employed in this model be specified. Like the method proposed by Arellano and Bover (1995) & Blundell and Bond (1998), difference variables and lagged level variables were used as estimation tools in this study. In regression model (1), the variables of openness to trade and inflation are influenced by financial policies and they are determined endogenously (Agbeyegbe et al., 2006). Thus, lagged levels of the variables "Iran's saffron export price, openness to trade and inflation" are used as instrumental variables in the system GMM. In addition, standard instrumental variables used to evaluate regression model (1) include difference levels of the variables "exchange rate and tariff rate". Another important issue in evaluation by system GMM, is to determine lag length for descriptive variables which must be considered in regression model (1) so as to make sure that error term doesn't have second order autocorrelation. Therefore, to keep degrees of freedom and to obtain error term without second order autocorrelation, only first lag of the variable "inflation" is used in evaluating regression model (1). Considering the above issues, results obtained from the evaluation of regression model (1) along with statistical tests have been reported in table (1). According to Wald test, null hypothesis that all coefficients are simultaneously zero at 5% significance level can be rejected; thus, validity of the evaluated coefficients is confirmed. Results of Hansen tests, first order autocorrelation and second order autocorrelation, show that instrumental variables are valid (exogenous). Also, results obtained from evaluation show that all explanatory variables (at 5% significance level) have a significant effect on Iran's saffron export price; this issue reflects suitable specification of regression model (1).

Table 1. results of estimation by system GMM

Dependent variable: Iran's saffron export price in terms of domestic currency			
Variable		Evaluated coefficient	Statistics z
Intercept		0.8790614	1.51
Exchange rate		0.3420503*	6.26
Tariff rate		-0.3865076*	-4.04
Inflation in the current period		0.0609567*	8.91
Inflation with a lag		0.0372206*	4.82
Openness to trade		-0.6810973*	-8.06
Saffron export price with a lag		0.7286753*	44.13
Statistics χ^2 in Hansen test	Statistics χ^2 in Wald test	Statistics z in Arellano and Bond test for first order autocorrelation	Statistics z in Arellano and Bond test for second order autocorrelation
19.61553	25258.59*	-2.4715*	-1.7185

* Significance at the 5% level.

The listed results in table (1) show that coefficient of exchange rate is positive and is statistically significant at confidence level of 95%. At first, variable positive coefficient and significance are interpreted using economic theories. Considering demand and supply curves for Iran's exported saffron, we can analyze the way how saffron export price responds to exchange rate. Changes in exchange rate don't result in changes in supply curve of Iran's saffron exporters, because this curve is a function of saffron export price in terms of domestic currency and changes in exchange rate just lead to a movement along this curve. However, foreigners' demand curve for Iran's exported saffron changes as exchange rate changes. For example, increased exchange rate leads to decreased export price of Iran's saffron in terms of importing country's currency and thus foreigners' demand for Iran's exported saffron increases. Therefore, increased exchange rate causes an upward movement in demand curve in destination markets; since supply curve is constant, Iran's saffron export price and quantity are expected to increase in terms of domestic currency. Coefficient of exchange rate reflects elasticity of Iran's saffron export price in terms of domestic currency towards changes in exchange rate; its level shows PTM behavior. Evaluation coefficient shows that degree of PTM is about 0.34. Assuming constancy of other conditions, every 1% increase (decrease) in exchange rate increases (decreases) Iran's saffron export price in terms of domestic currency by about 0.34%. Therefore, ERPT is incomplete and only 0.66% of changes in exchange rate is pass-through to Iran's saffron export price in terms of importing country's currency. When Iran's saffron exporters face changes in exchange rate, they apply Local Currency Pricing Stability (LCPS) strategy which causes incomplete pass-through of exchange rate to saffron export price

in terms of importing country's currency. Iranian exporters employ this strategy to keep shares of export market or to increase marginal profit. For example, to keep share of export market (while facing depreciation of the exchange rate) or to increase marginal profit (while facing appreciation of the exchange rate), Iranian exporters decrease and increase the price of exported saffron respectively. Moreover, incomplete pass-through of exchange rate (or PTM) shows that Iran's saffron export markets experience imperfect competitive conditions; it also shows that Iranian exporters have significant market power and implement price discrimination policy purposefully (in markets with highly elastic demand, Iranian exporters consider lower sale prices). Price discrimination is not the only factor affecting incomplete pass-through of exchange rate; other factors which cause incomplete pass-through of exchange rate include expense adjustment, market share, market structure, ongoing structural changes in international patterns of production, transportation costs and trade restrictions (Takagi & Yoshida., 2001; Turkcan & Ates., 2009).

Coefficient of tariff rate reflects elasticity of Iran's saffron export price in terms of domestic currency towards changes in tariff rate. Listed results in table (1) show that elasticity of saffron export price towards changes in tariff rate is negative and is equal to 0.38. Assuming constancy of other conditions, each 1% increase (decrease) in tariff rate, decreases (increases) Iran's saffron export price (in terms of Rials) by about 0.38%. Therefore, TRPT is incomplete and only 0.62% of changes in tariff rate are pass-through to Iran's saffron export price in terms of importing country's currency. Incomplete tariff pass-through is associated with markup pricing and Iran's saffron exporters offset the effect of tariff rate on saffron export price in terms of importing country's currency. For example, increased tariff rate in destination markets, leads to increased Iran's saffron export price in terms of importing country's currency and thus Iranian exporters, to offset this effect, reduce their makeups; it decreases saffron export price in terms of domestic currency and causes incomplete tariff pass-through. In this case, importing countries experience terms of trade and welfare gain (Feenstra., 1989; Pompelli & Pick., 1990; Rezitis & Brown., 1999; Marchand., 2012). Generally, incomplete exchange rate and tariff pass-through in Iran's saffron export markets, shows that these markets have no competitive environment, and Iranian exporters offset a portion of the change in the tariff and exchange rate to keep or to increase market share. Findings of this study which reflected incomplete ERPT and TRPT are consistent with findings of other studies such as Pompelli and Pick (1990), Rezitis and Brown (1999) and Mallick and Marques (2008 & 2012). According to the results of table (1), the variable "inflation in the current period or inflation with a lag" has a significant positive effect on Iran's saffron export price in terms of domestic currency. Increased inflation in importing countries means decreased competitiveness of these countries in foreign and domestic markets. Thus, increased inflation results in increased demand of importing countries for Iran's exported saffron and thus increased export price of this product in terms of domestic currency. This finding reflects the importance of inflation in determining Iran's saffron export price in destination markets, and is consistent with findings of the study by Mallick and Marques (2012).

The listed results in table (1) show that the variable "openness to trade", has a negative and significant effect on Iran's saffron export price. This variable decreases trade limitations in destination markets and thus increases export of Iran's saffron to these markets and reduces export price of this product. This finding is consistent with the results of the study carried out by Mallick and Marques (2012).

Coefficient of the variable "saffron export price with a lag" is positive and significant. By assuming constancy of other conditions, every 1% increase (decrease) in saffron export price in the previous period, increases (decreases) export price of this product in the current period by 0.72%. Therefore, changes in export price in the current period are positively affected by the previous price. This finding matches the results of studies carried out by Haghighat and Hosseinpour (2010) and Karbasi and Ahmadi (2010) and is of great importance because the effects of exchange rate and tariff rate on saffron export price are not only limited to the current period, and export price of this product in future periods would be influenced by changes in exchange and tariff rates.

Discussion

The main aim of this study was to empirically analyze ERPT to Iran's saffron export price over the period of 2000-2011. Results revealed that ERPT is incomplete in Iran's saffron export markets. Therefore, Iranian exporters have market power and absorb a portion of the effect of exchange rate on saffron export price in order to maintain or increase market share. Considering relatively high degrees of exchange rate pass-through to saffron export price in terms of destination market currency, it can be concluded that implementing domestic currency depreciation policy increases Iran's saffron export value. Another finding of this research was incomplete tariff pass-through in Iran's saffron export

markets. Thus, considering incomplete tariff pass-through in Iran's saffron export markets and increased globalization which leads to reduction and unification of tariff rates, it can be concluded that Iran's saffron exporters, as marginal profit increase, follow LCPS policy which transfers interests (resulted from globalization) from foreign consumers to Iran's saffron exporters.Moreover, selecting the countries which have low tariff rates as destination markets, is suggested to the saffron exporters in Iran in order to get more profit. Results of this research showed that inflation had a significant and positive effect on Iran's saffron export price. Thus, it is suggested that Iran's saffron exporters consider changes in inflation rate in destination markets while adjusting their pricing policies. Results of this research also revealed that there was a negative and significant relationship between the variable of openness to trade and Iran's saffron export price. Considering prevailing trends in global economy, openness to trade can be expected to increase in most countries; it can increase Iran's saffron export and decrease export price of this product. Therefore, it is suggested that increase in the supply of Iran's exported saffron will be associated with increased marketing services, improved packaging, creation of a national brand and establishing process industries so as to prevent the reduction of export price of this product. Generally, with regard to the significant effect of variables "openness to trade and inflation", it can be concluded that macroeconomic environment in destination markets plays an important role in determining Iran's saffron export price.

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