

Assessing effective factors for export of Iranian dates to European Union using a gravity model

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Abstract

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Agricultural sector is the most influential sector in developing countries, such as Iran. This is on account of favorable climatic conditions and availability of natural resources, which lead to high productive capability and excess production for export of many agricultural products. Date is one of the most important agricultural export products in Iran. Recently, with the advent of exporting power of Iran, its position in the European Union (EU) market has diminished. Reasons for this are somewhat obscure and need further study. The aim of this study is to assess the role played by various factors on Iranian exports of dates to EU market. Analysis was based on an application of gravity model using data for the 2004-13 periods. Our analysis established four important results: First, Poisson Pseudo-Maximum Likelihood (PPML) estimator had more consistent results in comparison with the Least Square Dummy Variable (LSDV) estimator in assessing factors governing exports of Iranian date to EU. Second, Traditional variables such as GDP per capita, credit, openness had significantly positive impact, while distance and landlocked had a significantly negative impact on export of Iran's date. Third, economic crisis has a significantly negative impact on export of Iranian date to the EU. Fourth, EU's re-exporters also had a significantly positive impact on these exports, which perhaps could become a serious threat to Iran in global markets in the long term.

Keywords: Gravity model; PPML Estimator; LSDV Estimator; European Union; Dates

Introduction

The importance and role of international trade in the world economic development has been widely examined in the literature. Increase in trade flows is very important for all countries (Vijayasri, 2013). The pattern of international trade is determined by differences in national factor endowments, comparative advantages, technological conditions, behavioral preferences and competitiveness degree in the global trading environment (Broll & Gilory, 1986; Aswathappa, 2005; Ranjan & Lee, 2007; Keuschnigg, 2012; Gani &

Scrimgeour, 2016). Due to there is a larger of studies about factors affecting on exports between countries, economists and policymakers follow the answers of the question "why the volume of international trade is much less than predicted by economic theory?" (De Jong & Bogmans, 2011)

Agriculture is one of important sectors to access economic development especially in developing countries. Iran has appropriate potentials in agriculture sector, so strengthen of Iran's trade component play a key role in increasing agricultural exports. Date is one of the most important agricultural export products of Iran. Trade in date

is monopolized by countries in Africa and tropical regions of Asia. Because developed countries, such as Europe and America are deprived of the favorable conditions for date production. According to Food and Agriculture Organization (FAO) statistics, in 2013, Iran has produced 15 percent of world date and scored a second rank after Egypt with 21 percent of production share (Figure 1). Only 8 percent of world exports were from Iran, while Tunisia had a quarter of market share with having only 3 percent of world dates production. Tunisia exported 35 percent of date to EU countries as biggest target market, while Iran and Egypt had approximately zero and 6 percent export to of EU markets (Figure 2). According to Figure 1, majority of date producers are developing countries, so Iran has more opportunity for increasing its export share.

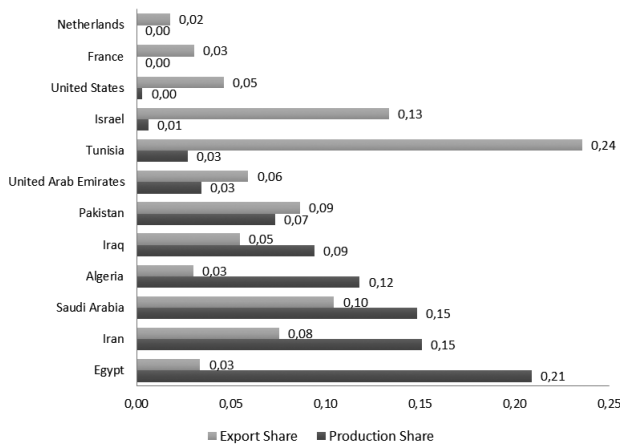


Fig. 1. The share of global production and export of major exporters (2013)

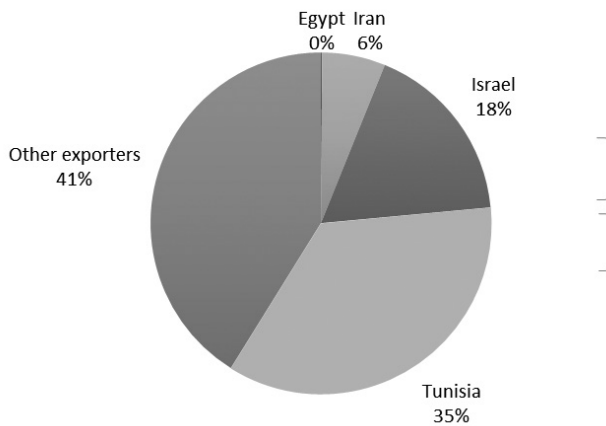


Fig. 2. Share of major manufacturing countries of dates import and export to European Union

Iranian policymakers and planners attempt to increase agricultural exports to the global markets. Due to importance of exports of date for Iran, there is no clear policy in increasing exports share. One of the important reasons is lack of research studies about factors affecting on Iranian date exports and most of studies and attentions were about factors affecting on development of exports share of Pistachio and Saffron. Therefore, this paper aims to investigate the effective factors on exports of date from Iran to EU countries.

The rest of this paper is organized as follows: Section 2 presents theoretical background and methodology; Section 3 presents our econometric results and Section 6 provides concluding remarks.

Theoretical Background and Methodology

Theoretical Background

The gravity model has been became an important and effective tool in analysis of international trade flows between countries or regions and has been widely used by a large number of studies (for example, Shepherd & Wilson, 2013; Ulengin et al., 2015; Caporale et al., 2015; Gani & Scrimgeour, 2016; Kahouli & Omri, 2017). Tinbergen (1962) was the first researcher who applied gravity model for analyzing the international trade flows. The basic form of gravity model is defined in equation (1):

$$T_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} u_{ij} \tag{1}$$

where, T_{ij} is trade between i and j countries, Y_i is GDP of the country i, Y_j is GDP of the country j, D_{ij} is the distance between two countries and u_{ij} is error term with: $E(\eta_{ij}) = 1$, assumed to be statistically independent of explanatory variables which leading to: $E(T_{ij}) = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3}$.

To estimate the gravity model with traditional method, dependent and continuous independent variables should be converted into logarithmic form as shown in Equation (2):

$$\ln T_{ij} = \ln \alpha_0 + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \alpha_3 \ln D_{ij} + \ln u_{ij} \tag{2}$$

As stated earlier, reliability of this method depends on the condition that u_{ij} is statistically independent of the explanatory variables. The $\ln u_{ij}$ has a log-normal distribution, with expected value: $E(\eta_{ij}|Y_i, Y_j, D_{ij})=1$ and variance $\sigma_{ij}^2 = f(Y_i, Y_j, D_{ij})$. If there is the dependence between the variance of u_{ij} and explanatory variables, expected value of $\ln u_{ij}$ will also depend on explanatory variables. Therefore, condition for consistency of

OLS method will violate (Silva & Tenreyro, 2006). As a result, estimation of gravity model using OLS method will lead inconsistent estimates.

In gravity model, the stochastic model is formulated as in Equation (3):

$$y_i = \exp(x_i\beta) + \varepsilon_i \quad (3)$$

With $y_i \geq 0$ and $E[\varepsilon_i|x] = 0$.

As stated earlier, estimating the coefficients of equation (3) using ordinary least squares (OLS) is inappropriate. This is due to the fact that the dependent variable can be zero which is not possible in the logarithmic form of the function. Even if all values of dependent variable are positive, estimated OLS coefficients would be inconsistent since expected value of error term generally depends on the independent variables (Silva & Tenreyro, 2006). Equation (3) is stated as equation (4) in gravity model:

$$y_i = \exp(x_i\beta)u_i \quad (4)$$

With $u_i = 1 + \varepsilon_i/\exp(x_i\beta)$ and $E[u_i|x] = 1$.

To solve the stated problems, Silva & Tenreyro (2006) presented PPML (Poisson Pseudo-Maximum Likelihood) estimation method. In this method, dependent variable is estimated without a log. The PPML estimation method is expressed in following equation (Silva & Tenreyro, 2006):

$$\sum_{i=1}^n [y_i - \exp(x_i\hat{\beta})]x_i = 0 \quad (5)$$

This method does not have the estimation flaws of OLS method and would have consistent results. By using the Poisson distribution, this method also lets the researchers use all the observations. Due to the high efficiency of PPML, this method has been widely used by researchers (Shepherd, 2012; Arroyos & Shepherd, 2012; Philippidis et al., 2013; Owen & Winchester, 2014; and Foley, 2015).

In this study, estimates of factors affecting Iranian Dates exports to EU countries were made using gravity model using both OLS and PPML methods. Equations (6) and (7) represent the model using by OLS and PPML, respectively.

$$X_{ijt} = C + \beta_1 \ln(GDP_{jt}) + \beta_2 \ln(DIS_{ij}) + \beta_3 \ln(DGDP_{ijt}) + \beta_4 \ln(OPEN_{it}) + \beta_5 \ln(CRE_{it}) + D_1 CRIS_t + D_2 OECD_j + D_3 LL_j + D_4 RE_j + u_{ij} + \varepsilon_{ijt} \quad (6)$$

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where, X_{ijt} denotes export of date from Iran (country i) to EU countries (country j) at time t . As mentioned above, in OLS method (equation 6) X_{ijt} is entered as logarithmic, while is entered without logarithm in PPML method (equation 7). GDP_{jt} is the gross domestic product per capita of country j in year t . DIS_{ij} represents geographical distance between the capitals of Iran and country j . $DGDP_{ijt}$ is the difference in GDP per capita between Iran and its partner and is a proxy for economic distance between countries. $OPEN_{it}$ is trade openness in agricultural sector in Iran in year t . CRE_{it} is assigned credit to Iran's agricultural sector in year t . $CRIS_t$ is a dummy variable for the global economic crisis equal to 1 for 2007–2009 and to 0 otherwise. $OECD_j$ is a dummy variable that equals 1 if country j belongs to Organization for Economic Cooperation and Development. LL_j is a dummy variable that is equal to 1 if country j is landlocked, and zero otherwise. RE_j is a dummy variable that is equal to 1 if country j is re-exporter of Iranian date, and zero otherwise. u_{ij} is country-pair fixed effects and ε_{ijt} is the error term. The definition, data sources and expected sign for all variables are reported in Table 1. In order to achieve the research objectives, Iranian Dates exports to 27 EU member countries over the 10-year period (2004–2013) were collected. The list of countries is given in Table 2.

Results and Discussion

Before estimating the gravity model, panel unit root is tested and presented in Table 3. Levin, Lin and Chu (2002) and Fisher-type (2001) tests were carried out to determine the unit root properties of the variables. The unit root test rejected the null hypothesis with a significance level of 0.10 for each variable, which indicate that all variables are stationary. There are two approaches in panel data regression, namely random effect model and fixed effect model. It is clear that fixed effect model should be used when identifying the characteristics of the trade flows between countries. In this paper, in order to determine which one of the modeling should be used, the Chow and Hausman tests were applied. The results presented in Table 4 that showed fixed effect model are a better choice to analyze the Iran's export performance to European Union countries.

Table 1. International studies using gravity model and estimation methods

Estimation method	Application	Year	Researchers
PPML	Land-locked developing countries export	2015	Ramesh et al.
PPML/OLS	The effect of trade liberalization on the former Soviet Central Asian states	2015	Mazhikeyev et al.
PPML/OLS/Heckman	The effect of health standards on dairy business America	2014	Owen and Winchester
PPML/OLS	Virtual water trade	2014	Fracasso
PPML	Effect agricultural institutions on bilateral trade	2014	Mendonca et al.
PPML	Agricultural exports from developing countries in Europe	2013	Shepherd and Wilson
PPML	Effect space on exports from developing countries	2010	Shepherd

Table 2. Stationery test for variables

Variables		Levin, Lin & Chu		PP-Fisher	
		Statistics	Significance level	Statistics	Significance level
Dependent	Date export to the EU	-3.524	0.0002	105.620	0.0000
	Date export to the EU (Log)	-3.059	0.0011	73.071	0.0001
Explanatory	Per capita income in EU (Log)	-10.028	0.0000	160.267	0.0000
	Economic similarity index (Log)	-8.430	0.0000	72.042	0.0731
	Degree of economic openness in agricultural sector (Log)	-5.188	0.0000	74.407	0.0505
	agricultural credit (Log)	-15.541	0.0000	609.199	0.0000

Results: The results of the study (all variables are static at 10%)

Table 3. Results panel data tests

Test	Statistics	probability level	Null hypothesis	Test result
Chow (Limer)	32.38	0.000	The same intercept	reject
Hausman	12.23	0.057	Superior random effects model	reject
Time fixed effects	1.15	0.333	Lack of time fixed effects	accept

Results: Research findings

Table 4. The results of Iranian dates exports to Europe Union countries

Estimation method	PPML			LSDV		
	coefficient	t statistic	Significance level	coefficient	t statistic	Significance level
per capita income in the EU (Log)	0.980	2.53	0.011	-0.187	-0.36	0.721
Distance (Log)	-1.609	-2.05	0.041	-1.222	-1.30	0.194
Economic similarity index (Log)	-0.023	-0.62	0.535	-0.013	-0.30	0.761
Degree of economic openness agricultural sector (Log)	0.489	2.09	0.036	0.562	2.01	0.046
Agricultural credit (Log)	0.331	1.97	0.049	1.157	3.41	0.001
Economic crisis (dummy)	-0.274	-2.79	0.005	-0.317	-2.52	0.012
High-income countries of the OECD (Dummy)	0.043	0.04	0.967	0.813	1.72	0.086
Access to the open sea (Dummy)	2.880	9.52	0.000	-0.782	-0.86	0.389
Re-exporting countries (Dummy)	4.881	5.25	0.000	0.385	0.90	0.369
constant	-9.907	-2.65	0.008	3.005	0.59	0.559
Test RESET	(0.60 (0.440))			(1.14 (0.287))		
R ²	0.880			0.848		
Number of observations	270			209		

Source: Research findings

Gravity model was fitted with PPML and LSDV methods that results are presented in Table 4. According to the general Test of model specification, both methods had good specification and R^2 index in PPML and LSDV estimation methods was 0.883 and 0.848, respectively. The results showed a higher power of explanation for the PPML model in assessing factors affecting Iranian dates export to EU countries. The results of LSDV method suffered from inconsistency in signs of two variables of EU member states (GDP per capita and landlocked) with economic theory. In other words, both variables had a positive effect on exports of Iranian dates, which were inconsistent with economic theory. Silva & Tenreyro (2006) believe that one of the main disadvantages of traditional method is that researchers do not use full information. In traditional models, zero observations exclude from the estimation of results, but zero data are also enter in the estimate in PPML method which utilizes Poisson distribution. In this study it is shown that PPML estimation method has a superior over LSDV. Since PPML estimation method has more consistent results compared to LSDV, so these results are interpreted.

According to the results of the PPML, GDP per capita of EU countries has a positive and significant effect on exports of dates. This result suggests that a one percent increase in income of EU countries would lead to \$495 thousand increase in Iranian dates exports to the EU. This variable indicates purchasing power of the importing countries leads to increase in Iranian dates exports more than other variables. Thus export of Iran's dates is vulnerable to reduction in the income of the EU countries.

Result of geographical distance also had a consistent sign with the theory, suggesting its negative impact on Iranian dates export to EU. In other words, EU importer countries which are in closer distance to Iran have higher attraction for exports of dates from Iran. Due to transportation costs, exporters and importers have a tendency to choose their business partner from the nearby countries. Thus, increased distance reduces attraction of countries for export. With one percent increase in distance between Iran and trade partners, Iran's export would reduce by \$813 thousand. According to the results, difference in GDP is negative but statistically insignificant.

The trade openness in agricultural sector has positive and significant effect on Iran's exports. Based on the results, one percent increases in openness degree, exports to EU will increase by \$247 thousand. The result is consistent with the result of Anagaw & Demissie (2013). In other words, when exporters face less trade constraints, the exports of dates would increase. According to the results, agricultural credits have a significant positive effect on Iranian dates export. Thus,

exports of agricultural products (such as dates) can be increased with increase in credits to agricultural sector. These credits create appropriate productive power in the country. If the credit increases by 1 percent, Iran's exports to EU will increase \$167 thousand.

The results show that global economic crisis had a significantly negative impact on Iranian dates export to EU countries. This sign is consistent with theoretical expectations. In other words, in a period of economic crisis in the world, Iranian dates export decreased to EU countries. Since EU is one of the target markets for dates, the economic crisis negatively effect on demand and imports of dates. Result is consistent with the results of Bao & Yang (2013), Na et al. (2013) and Caporale et al. (2015) for China's trade with EU countries that stated the economic crisis had negative impact on trade flows.

The variable of high-income OECD members has positive but insignificant effect on the export of Iranian dates. According to the results, landlocked had a negative and statistically significant impact on Iranian dates export to EU. Since most of trade is carried out through sea, countries with no sea borders have more constraints to trade. This finding is consistent with those by Silva and Tenreyro (2006) and Mazhikeyev et al. (2015). It should be noted that this variable had the inconsistent sign with the theory in LSDV estimation method.

Results show that re-exports by EU countries has positive and significant effect on Iranian dates export to EU. The numbers of EU countries are re-exporters of dates, so these countries import high quality dates from Iran with low price and then export to the other countries. For example, France and Netherland are among top 10 global exporters without domestic production of dates.

Conclusion and Recommendations

The aim of this study is assessing the factors of Iranian Dates exports to EU countries. The gravity model estimated using the new estimation model (PPML) and traditional model (LSDV) applied to data for the 2004 – 2013 periods. Based on the results, four important findings can be concluded: First, estimated coefficients results showed that PPML method is a better choice in comparison with LSDV method for estimation of gravity model. Thus, it is recommended that future studies use PPML method for achieving more reliable results.

Second, traditional variables of gravity model, such as GDP per capita of EU countries, Iran's agricultural credit and openness had a significant and positive effect on exports of Iranian dates to EU countries. While geographical dis-

tance between Iran and importing country and landlocked had a significant but negative effect on exports.

Third, results showed economic crisis of EU had a significant impact on Iranian dates exports to these countries. In other words, economic crisis not only challenged directly these economies, but also damaged indirectly their trade partners.

Fourth, the results showed that re-export variable has a positive and significant impact on Iranian dates exports. This may be considered to be a serious problem for long term Iranian exports. These countries take a major part of Iranian dates for re-exports, which leads to reduce added value for Iran in the world. Thus, this is a major challenge for planners and policy makers in Iran, and needs to implement appropriate policy. There are similar problems in exports of other agricultural products in Iran. For example, Iran's greatest pistachio importer (i.e. United States) in the past decades is now main export competitor. Similarly, Spain is second exporters in saffron by imports and re-exports. Hence, policy makers should consider two main strategies for dates export. First, exports of Iranian dates to EU countries those are not re-exporting. This policy will lead to higher exports in long term. Second strategy is improvement of packaging in line with the importers' taste. This policy would help create new customers and stabilize Iran's situation in EU markets.

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