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Determinants of Agricultural Export and Trade Balance in Iran

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Abstract

Iran attempts to expand the non-oil exports for diminishing the dependency on oil export income. This research tries to examine the export and trade balance of Iran's agricultural sector. Accordingly, the gravity model was used for export, applying panel data from 1997 to 2017. The trade balance of Iran's total agricultural and the related sectors' commodities was also examined. It should be noted that for the trade balance, time series data from 1978 to 2018 were used. The results of the gravity model show a negative effect for the variable of distance. The coefficients of Iran's per capita GDP and also the GDP of trading partners are positive, as expected. It was found that a one percent increase in the per capita GDP of Iran causes a rise of 3.42 percent in the export of agricultural products; however, that of importing countries has low statistical significance. Based on the coefficient obtained for the population, an increase in the population of the importing countries raises the demand for Iran's agricultural products. The degree of trade openness revealed a positive and significant effect on the export of agricultural products. The coefficient for the real exchange rate was found to be around 0.9%. It was also found that the volatility of the exchange rate is related directly to the export of agricultural products. Comprehensive sanctions have a negative and significant effect, while less restricting sanctions have an insignificant effect on the export of agricultural products. The global economic crisis has also had a dampening effect on exports. For trade balance, the results show that the value added of the agriculture has a positive effect on the trade balance of entire agriculture and sectors. The real exchange rate has a negative effect on the trade balance of agricultural commodities as a whole and livestock and agronomy sectors, confirming the J-Curve theory while it was not supported for the horticultural sector. The variable of exchange rate volatility was included in the model using two measures of positive and negative series of exchange rate changes and the Autoregressive Conditional Heteroskedasticity (ARCH) effect, but their effect on the trade balance was not the same in terms of both the direction and statistical significance. The trade openness for the agricultural and horticultural sector was found with a positive coefficient, indicating that their production is based on comparative advantage. However, for the sectors of agronomy and livestock, it illustrated a negative effect. Sanctions have also harmed the trade balance.

Keywords: Agricultural Sector, Export, Gravity model, Trade balance

Introduction

The Iranian government is highly dependent on oil and energy export revenues. There have been some attempts to reduce dependency on these revenues, and non-oil export, and mainly agricultural export has received an increasing attention[3] in recent years. Iran enjoys some advantages, including fertile agricultural land, the diverse climate, and the young and educated labor force, providing more chances to meet the non-oil

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export targets (Mehrparvar Hosseini *et al.*, 2013).

Despite the necessity of agricultural export expansion, it has experienced significant fluctuation over the past two decades. For instance, agricultural and food industries have exerted 4.9 billion UDS in a 9-month period of 2019, which is 9.7% lower than the 6-year average of 2012-2018. Although the export expansion of agricultural commodities has drawn attentions, agricultural imports also account for a significant amount of Iranian imported commodities. In fact, contrary to export, Iran has experienced an increasing trend of agricultural commodities import, around 9.2 billion USD in 9-month of 2019, accounting for 51.7% of Iranian imports of commodities (Iran Chamber of Commerce, Industries, Mines & Agriculture (ICCIMA), 2019). For the most of years, imports of agricultural commodities have exceeded their exports. Strategic commodities including maize, rice, and soybean account for most of agricultural imports (Food and Agriculture Organization, 2018).

Dependence of domestic consumption on imports may mean that agricultural commodities import is not necessarily affected by important variables like exchange rate significantly, while agricultural export is expected to be affected by driving forces like relative prices, real interest rate, agriculture value added, GDP, and terms of trade (Hosseini and Homayounpour, 2013). Thus, it is crucial to examine the trade balance of agricultural commodities. Among the underlying driving factors of trade balance, exchange rate is extremely critical (Esmaili *et al.*, 2020). Currency devaluation is expected to increase the trade balance in long-run; however, it is accompanied by a reduction in the balance of trade in the short-run. This phenomenon that illustrates a "J-shaped" time path for trade balance was defined as "J-Curve" by Magee (1973). The former changes account for the increasing part of the J-curve while the latter changes will form the decreasing part of the J-curve. Changes in the exchange rate affect trade balance directly via import and export prices and indirectly via changes in import and export quantity resulting from changes in relative prices. Therefore, an increase in the exchange rate, on the one hand, raises the import costs and results in a lower trade balance; however, on the other hand, it encourages exports and induces a reduction in imports (Pedram *et al.*, 2011). There is a great body of literature using the gravity model and J-Curve as tools to examine international trade and trade balance at the economy-wide level. However, the sectoral level, especially agricultural commodities, has not received adequate attentions. This shortcoming particularly holds true for the Iranian agriculture trade. Therefore for two reasons, it is essential to examine the agricultural trade balance. First, agricultural export accounts for a significant part of non-oil exports. Second, agricultural commodities account for a significant amount of the Iranian imports of commodities, resulting in an undesirable situation of the trade balance. Accordingly, for many developing countries, fluctuations in trade balance have a significant effect due to lower access to the global capital market and lower elasticity of foreign capital supply (Najarzadeh *et al.*, 2009).

The objective of this study is to examine the factors affecting the trade balance and export of agricultural commodities in Iran. For this purpose we applied the Gravity model to examine the factors affecting Iranian agricultural exports, and for trade balance, J-Curve approach was applied.

Theoretical Background and Empirical Works

We have attempted to review the theoretical and empirical works to know the factors affecting the trade balance and export of agricultural commodities in Iran.

Export (the gravity model)

The analogy to Newton's law of gravity, the trade gravity model is presented as follows:

$$X_{ij} = G\frac{M_i^{\alpha} M_j^{\beta}}{D_{ij}^{\theta}} \quad (1)$$

Where X_{ij} is the bilateral trade between country i and j, and G is constant. M_i^{α} and M_j^{β} show the size of the countries, and D_{ij}^{θ} is the distance between the two the countries. By the size of country we mean the gross domestic product of nations. α, β and θ are also elasticities.

Soloaga and Winters, (2001)investigated the trade agreements from the 1990s.They found no significant evidence of increasing local trade blocs. However, Sandberg (2004)suggests that historical linkage is essential in the trade pattern of the Western Hemisphere. Martinez-Zarzoso *et al.* (2009), indicate that there is evidence of regionalism positive effect on intra and extra-bloc trade for the EU and NAFTA members, which is more significant than those for developing countries. This holds true for the USA-Canada as McCallum, (1995) reported a significant effect on Canada's trade with America. Agostino *et al.* (2007) for eight major OECD members have reported similar results. Shaghaghi Shahri, (2017) suggests a higher regional integration, for Islamic Conference members, who in turn, lead to enhance of the common market and foreign direct investment. Similar results were reported by Karimi Hasnijeh, (2007) for agricultural commodities in these countries. Additionally, as investigated by Zarif *et al.* (2011), Iranian agricultural exports to Islamic Conference members are affected by the exchange rate, and its fluctuations, GDP, and distance between Iran and the trading partners. These variables have been suggested as driving forces of Iranian shrimp export to the EU (Mortazavi *et al.*, 2014) and agricultural export to the ECO[1] members (ZargarTalebi *et al.*, 2016).

There is a great body of literature in which the effect of macroeconomic variables has been considered. For instance, Roy and Rayhan, (2011) found that Bangladesh's trade is positively affected by the economy size, and inversely, is related to trade barriers. For Oman's imports from Asia it was found that the imports are strongly affected by population, per capita GDP, real exchange rates, and distance (Gani and Al-Mawali, 2013). Pakistan GDP per capita showed a positive effect on trade value with the trading partners, while distance and cultural similarities showed a negative relationship (Khan *et al.*, 2013). However, language and distance showed an insignificant effect on trade of Western Hemisphere trading blocs (Croce *et al.*, 2004).

Iran has faced sanctions for many years. This barrier has been considered by some studies. For example, Arman *et al.* (2018) reported that sanctions have contracted the Iranian trade. Although Iran has tried to change its trading partners, the effect of the sanctions has been prohibitive, and export, and import have been reduced (Dizaji, 2018). The gravity model has been applied to examine the agrictural commodities export. For instance, GDP, per capita GDP, and exchange volatility indicated a significant effect on Egyptian agricultural export to its major trading partners (Abu Hatab *et al.*, 2010). For Chinese forest trade also, GDP, distance, and the global economic crisis were found to be driving factors (Nasrullah *et al.*, 2020). Cekyay *et al.* (2020), reported the significant effect of road transport quotas on Turkish export to selected EU countries. Serrano and Pinilla, (2012) suggest that the low demand elasticity for agricultural products and the protection against trade are the reason for relatively slow growth. Also, Tesfaye (2014), found that GDP, and import tariffs affect agricultural export of Sub-Suharan Africa significantly.

In general, there is a vast literature that applies the gravity model, and J-curve and different regions have been considered. The main distinguishing feature of the empirical studies is the region of the study, while there are some differences in terms of the variables applied as driving forces. However, most of the studies have used the gravity model while they cover the total trading of a country or a

1- Economic Cooperation Organization

selected region, and the agricultural commodities have not received competent attention. This gap exists for Iranian agricultural export even more significant. As far as the Iranian case is concerned, there are some facts like sanctions that make it a more interesting case for international trade literature, deserving to be investigated more deeply. Another contribution of the current study to the existing literature is that it examines the effect of exchange fluctuations by applying two proxies, i.e., positive and negative components of exchange variations and the ARCH effect.

Trade balance and J-Curve

Currency devaluation in the short run leads to higher prices for imported goods in terms of domestic prices while imports and exports volume do not experience significant changes, resulting in a temporary reduction in trade balance (moving from A to B in Fig. 1). As time passes, both consumers and producers will respond to the changes in the exchange rate. Imports will become more expensive, leading to lower demand, while exports will become cheaper, resulting in higher demand for exporting commodities (moving from point B to point C) (Dogru *et al*., 2019; Bahmani-Oskooee and Fariditavana, 2016). This phenomenon in international trade, as presented in Fig. 1, is known as J-Curve (Dogru *et al*., 2019).

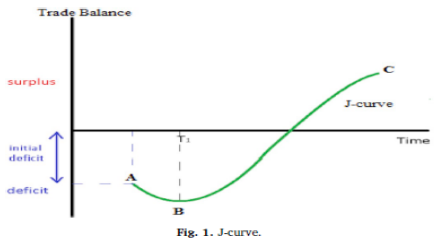

Fig. 1. J-curve.

Figure 1- J-Curve

Evidence of the J-Curve phenomenon has been reported for Iran's trade with major trading partners (Pedram *et al*., 2011). Also, for South Asia (Lal and Lowinger, 2002), and the USA (Cheng, 2020) this theory has been reported. However, it was not approved for the trade balance between Sri Lanka and its trading partners (Malith *et al*., 2021).

As far as the J-Curve phenomenon is regarded, the exchange rate is the main driving force of trade balance; however, other variables are determinant. For instance, tariff barriers have been noticed as determinants in trading between Iran and Turkey (Ghanbari and Sagheb, 2010). Trade flow between Iran and China, in addition to trade barriers, has been affected by economic growth (Ahmadian Yazdi *et al*., 2015). A similar result was observed for a group of countries from Asia, Africa, and Latin America, as trade liberalization was found to promote economic growth. However, it showed a trade balance worsening effect for Asian economies (Parikh and Stirbu, 2004).

As for the non-agricultural trade balance, in the agricultural empirical works also, exchange rate has been considered. For instance, Esmaili *et al*. (2020) suggested exchange rate as an influential factor in agricultural trade along with value added. They also reported the evidence of the J-Curve theory for trading between Iran and China as well as India. The exchange rate was also declared as the main determinant of the U.S. agricultural trade balance in both the short- and long-run (Beak and Koo, 2007). However, in addition to the exchange rate effect, the response of trade balance to exchange fluctuations is essential. The reverse effect of exchange fluctuations was reported for the trade balance of Iranian agricultural commodities (Khosravi and Mohseni, 2014).

Method

The gravity model has been able to explain the growing trend of international trade (Yu, 2009). The basic explanatory variables included, i.e., distance and the GDP explain the trade potentials between countries. Regarding the capability of this model in examining the driving forces of international trade, it may be more appropriate for the Iranian case since it faces some restrictions in international trade such as sanctions. Thus, we

used the gravity model to accomplish the goal of the study.

Gravity Model

The explanatory variables can be classified into two categories. The first group includes variables that affect the trade costs like distance, common border, and tariff. The second group is related to the trade volume including GDP and GDP per capita. The applied explanatory variables are presented as below:

Distance: geographical distance is expected to affect bilateral trade negatively (Kabir *et al*., 2017).

Common border: Theoretically common border is related to bilateral international trade costs (Kabir *et al*., 2017).

Tariff: tariff also affects trade costs indirectly. This factor may be presented in trade cost specification (Anderson and Van Wincoop, 2003).

Gross Domestic Product (GDP): in the basic specification of the gravity model, the trade between two countries is proportional to their income. A higher income in a country is expected to be associated with a higher reduction, leading to an increase in the availability of goods for trade (Jagdambe and Kannan, 2020).

GDP per capita: GDP per capita represents the level of economic development (Pass, 2002). Based on the Linder's hypothesis also, relative demand changes with per capita income (Bergstrand, 1990). Higher income is expected to raise the demand for commodities, leading to an increased consumption and production of commodities.

The variables mentioned above are those that have been applied broadly. However there are some other variables included in the standard gravity model, including population, the exchange rate volatility, trade openness, Linder's similarity index, and global economic crisis (Arman *et al*., 2018).

Population: the size of an economy may be measured through GDP and population. However its effects may be positive or negative depending on the economies of scale effect (Oguledo and MacPhee, 1994; Martinez-Zarzoso and Lehmann, 2003).

Exchange rate: the exchange rate may affect the trade volume through both price and income effect. Depreciation of exchange rate induces an increase in export; the income effect also may lead to an increase in the prices of non-tradable prices and bring about an appreciation (Dubas, 2009). The real exchange rate is defined as follows:

$$\boldsymbol{ER_t = E_t \frac{P_t^F}{P_t}} \quad (2)$$

Where ER is the real exchange rate, E is the nominal exchange rate, P^F is the foreign price index, and P stands for the domestic price index.

As declared by Chit and Judge (2011), real exchange rate volatility has a negative impact on exports, especially in developing countries. However, its effects may be dampened, depending on the level of financial development. Exchange rate volatility can be measured in different ways including the ARCH effect (Zargar Talebi *et al*., 2016). The effect of the exchange rate may be asymmetric, i.e., the appreciation effect of the real exchange rate is different from depreciation. Thus the movement of the real exchange rate should be decomposed into positive and negative components (Bahmani-Oskooee and Fariditavana, 2016).

Trade openness: economists believe that economies that are more open grow faster since it is expected to improve resource allocation. Openness may show the degree to which an economy is open having trade (Tesfaye, 2014). The ratio of trade-GDP usually is applied as an openness indicator. We used the following indicator (Nguyen, 2007):

$$OP_{ijt} = \frac{1}{2}\left(\frac{\boldsymbol{EXP_{it}+IMP_{it}}}{\boldsymbol{GDP_{it}}} + \frac{\boldsymbol{EXP_{jt}+IMP_{jt}}}{\boldsymbol{GDP_{jt}}}\right) \quad (3)$$

Where EXP_{it}, IMP_{it}, and GDP_{it} are total import, total export and GDP of the country i, respectively; EXP_{jt}, IMP_{ij}, and GDP_{jt} are those for the country j. The greater the value of this indicator, the more open the country will be.

Linder similarity index: based on the Linder's hypothesis, more intensive international trade flow is expected between

countries with similar demand structures. The Linder effect variable is calculated as follows (Kitenge, 2021):

$$LnLIN_{ijt} = Ln(YP_{it} - YP_{jt})^2 \quad (4)$$

Where YP_i and YP_j denote the per capita income in exporting and importing countries, respectively.

Sanction: sanctions effect was considered using dummy variables. Iran has experienced sanctions for many years enacted by the United States, the EU, and Canada. Sanctions were enacted from 1984 and were supplemented by comprehensive sanctions in 2010 and 2012 by the U.S., the EU, Canada, and the UN Security Council (Hufbauer *et al.*, 2012). We considered before 2010 as mild sanctions period, while the remaining period was included as period with severe and comprehensive sanctions.

Global economic crisis: the period for the global economic crisis includes 2007-2009 (Kahouli and Maktouf, 2015), which was considered using a dummy variable.

Regarding the explanatory variables discussed above, the empirical gravity regression model of this study is as follows:

$$Ln\,X_{ijt} = \boldsymbol{\alpha_0} + \boldsymbol{\alpha_1} Ln\,GDP_{it} + \boldsymbol{\alpha_2}\,Ln\,GDP_{jt} + \boldsymbol{\alpha_3} Ln\,POP_{it} + \boldsymbol{\alpha_4}\,Ln\,POP_{jt} + \boldsymbol{\alpha_5} Ln\,D_{ij} + \boldsymbol{\alpha_6}\,Ln\,LIN_{ijt} + \boldsymbol{\alpha_7}\,Ln\,ER_{ijt} + \boldsymbol{\alpha_8}\,Ln\,OP_{ijt} + \boldsymbol{\alpha_9}\,Ln\,VER^{+}_{ijt} + \boldsymbol{\alpha_{10}}\,Ln\,VER^{-}_{ijt} + \boldsymbol{\alpha_{11}} Low_t + \alpha_{12} EXT_t + \alpha_{13} Crisis_t + \boldsymbol{U_{ijt}} \quad (5)$$

where X_{ijt}, GDP_{it}, POP_{it}, $Ln\,D_{ij}$, $Ln\,LIN_{ijt}$, $Ln\,ER_{ijt}$, $Ln\,OP_{ijt}$, $Ln\,VER^{+}_{ijt}$, $Ln\,VER^{-}_{ijt}$, Low_t, EXT_t, and $Crisis_t$ represent the export of agricultural commodities from the country i (Iran) to the country j, the gross domestic of country,population, the distance between the country i and j, the Linder similarity index, the real exchange rate, the trade openness, the positive and negative components of exchange rate fluctuations, the mild and severe (comprehensive) sanctions against Iranian economy, and the global economic crisis, respectively. U is an error term. iitands for Iran, and j represents the trading partners or importing countries and t shows time. The monetary values are expressed in 1997 constant prices.

Trade balance is the difference between the monetary value of exports and imports. Due to negative values when the imports exceed the exports, the logarithmic form will not be possible to calculate. Therefore, it can be measured as the ratio of export to import. The advantage of using this ratio is that it is insensitive to the units of measurement, and the real or nominal values of measuring export and import (Bahmani-Oskooee, 1991). In J-Curve analysis, the exchange rate is the most critical variable; however, there are other driving forces that have been applied to the agricultural commodities trade balance. The trade balance equation for agricultural commodities can be written as follows (Esmaili *et al.*, 2020; Arman *et al.*, 2018; Jagdambe and Kannan, 2020):

Trade balance and J-Curve

$$Ln\,TB_t = \alpha_0 + \alpha_1 Ln\,AGRI_t + \alpha_2\,Ln\,RER_t + \alpha_3\,Ln\,OP_t + \alpha_4\,Ln\,VER^{+}_{ijt} + \boldsymbol{\alpha_5}\,Ln\,VER^{-}_{ijt} + \boldsymbol{\alpha_6} Low_t + \boldsymbol{\alpha_7} EXT_t + U_t \quad (6)$$

Where$TB$is trade balance, $AGRI$ represents the agricultural value added of Iran and t stands for time. Other variables are similar to those presented in the gravity specification. It is worth noting that exchange rate fluctuations were examined using the ARCH effect as well. This effect was obtained based on an ARMA model estimated for the exchange rate. For the gravity model, the panel data related to 1997-2017 was used. The corresponding period for trade balance is 1978-2018. The data were obtained from Food and Agriculture Organization (2018), the Central Bank of Iran (2017), the Statistical Center of Iran (2017), and TRADE MAP (2018) website. The importing countries are Afghanistan, the United Arab Emirates, Germany, Hong Kong, India, Pakistan, Russia, Turkmenistan, Turkey,

Vietnam, Azerbaijan, Kuwait, Lebanon, Oman, Qatar, and Saudi Arabia.

Results and Discussion

Export (Gravity model)

Before estimating the model, the unit root test and Chaw and Hausman test was carried out. The results of unit root test support the stationary of the applied series at usual critical levels. The results for the Chaw test also indicated the pool ability of the applied data. Housman's test statistics did not reject the random effect hypothesis. It is worth noting that due to first order serial correlation we applied the first lag of the dependent variable. However, this variable is expected to be correlated with error terms, and the instrumental variables (IV) method is used due to the endogeneity problem (Baltagi, 2008). Table 1 represents the related results.

The distance variable, in agreement with the related theory, shows a negative effect; however, the absolute value of the related coefficient is not significant. Based on the coefficient, a 10% difference in physical distance of two distinctions may lead to only around 1% export distinction. The significant values of the fixed cost compared to the costs induced by distance may be responsible for this negligible effect. Gani and Al-Mawali, (2013) also found a negative impact on Oman's import from Asian economies, while the corresponding result for export, contrary to expectations, was positive. They suggest that the distance is not for Oman's export as friction, since its export is oil-based export and energy requirements. Croce *et al*. (2004) also reported lower importance for distance for western hemisphere trading blocs. However, Zarif *et al*. (2011) suggest a significant effect of distance.

The coefficients of per capita GDP, as expected, are positive however, for importing partners is not significant statistically. Based on the coefficient estimated, an increase in Iranian per capita GDP by 1% may result in higher agricultural export by 3.4%. The higher GDP may be translated into higher investment in infrastructure in the economy and providing more chances for export expansion. There is weak evidence of similar effects on Chinese export (Nasrullah *et al*., 2020).

Table 1- Estimation results for agriculture gravity model (Export)

Variables	Coefficients	Standard errors	t-statistics
Constant	-32.367***	6.267	-5.164
Iran's per capita GDP[1]	3.429***	0.669	5.125
GDP of the Iran's trading partners	0.014	0.022	0.625
Trading partners population	0.063***	0.020	2.764
Linder similarity	0.127	0.132	0.962
Trade openness	0.128*	0.073	1.740
Real exchange rate	0.608***	0.179	3.388
Distance	-0.098*	0.051	-1.897
Severe (comprehensive) sanctions	-0.232**	0.098	-2.373
Mild sanctions	-0.034	0.084	-0.406
Positive fluctuations of exchange rate	0.383***	0.127	3.008
Negative fluctuations of exchange rate	-0.981***	0.166	-5.885
World Economy crisis	-0.248***	0.066	-3.719
Lagged export variable	0.910***	0.051	17.610
Statistics JB	J-statistic	Adjusted R-squared	R-squared
262.1(0.000)	5.80(0.325)	0.865	0.871

1- Regarding the high correlation of Iran's GDP and population with other variables, these variables were transformed and applied as per capita GDP.

The population of importing countries has a positive effect on the Iranian agricultural exports, which is in line with the findings of Nasrullah *et al*. (2020) and Gani and Almawali (2013). Contrary to the theoretical expectation, the Linder similarity index shows a positive effect, indicating that agricultural export is inclined to partners with lower similarity in terms of per capita GDP. This may cause from the identical taste in the countries with similar per capita GDP. As declared by Markusen *et al*. (1995), identical testes may result in a no-trade situation. Usually, the per capita income is interpreted as the level of development; therefore, this may show that the countries with higher divergence in per capita income are expected to have more trade with Iran. A similar result was also reported by Razini *et al*. (2015).

Trade openness affects the export of agricultural commodities positively. It is worth noting that this variable is calculated at an economy-wide level, revealing the extent of the tendency of the economy toward the global economy. A similar result was obtained for ECO members (Zargar Talebi *et al*., 2016). The real exchange rate, as expected, has a positive effect on agricultural export. The related coefficient is around 0.6, indicating that a 10% increase in the real exchange rate will increase the agricultural export by 6%. This finding is in line with the result obtained by Zargar Talebi *et al*. (2016). Exchange fluctuations that were considered in positive and negative components show that it affects the export directly, i.e., the positive changes raise the export while the negative changes result in lower export. A similar result has been reported by Abu Hatab *et al*. (2010) for Egyptian agricultural export.

Severe sanctions may affect agricultural export significantly, while the effect of mild sanctions in terms of both the magnitude of coefficient and the statistical significance sound negligible, indicating that in enacting sanctions against Iran, agricultural commodities have lower priorities. These results are in line with the findings by Dizaji, (2018) and Arman *et al*. (2018). Another variable is the global economic crisis which shows a negative effect. The recession that occurred in the worldwide economy resulted in lower demand for importing commodities. The impact of the crisis on agricultural commodities export is significant in terms of coefficient value. It is worth noting that the effect of the economic crisis is more effective than sanctions. The global economic crisis is expected to affect the countries and restrict trade between countries, while international trade is a systematic phenomenon (Dourandish *et al*., 2018).

Trade Balance of Agricultural Commodities

The results of the unit root test of the applied series support the stationary in the applied series at a 5% significance level. Table 2 presents the trade balance equation for total agricultural commodities, while the results for the agricultural sectors, including livestock, agronomy, and horticulture sectors, are reported in Table 3. Two specifications have been estimated for agricultural trade balance; the first one applies positive and negative components of changes in exchange rate, while the second one uses the ARCH effect as the proxy for real exchange rate fluctuations. In Model 1, agricultural value added has a positive effect, as expected (Table 2). An increase in agricultural production is expected to raise the export and dampen agricultural imports, resulting in an improvement in the trade balance. The related coefficient shows that a 1% increase in agricultural value added will increase the agricultural trade balance by more than 2%.

The real exchange rate also, is negatively related to the trade balance of agricultural commodities, which supports the J-Curve theory. However, it should be noted that strategic commodities, like most the cereals, are provided by the government at subsidized prices and, government plays an important role in their imports. Similar results are also

reported in the literature (Najarzadeh *et al*., 2009; Pedram *et al*., 2011; Piraee *et al*., 2015). The effect of exchange rate is not significant. It is worth noting that the impact of the exchange fluctuations on imports and exports in opposite directions may result in an insignificant impact on the trade balance. The degree of openness also shows a significant impact on the trade balance. Piraee *et al*. (2015) suggest that trade liberalization can increase non-oil exports.

Table 2- Estimation results for agriculture trade balance

	Mode1		Model 2	
Variables	**Coefficients**	**Standard errors**	**Coefficients**	**Standard errors**
Constant	***-25.613	2.778	***-27.971	2.700
Agriculture value added	***2.175	0.257	***2.321	0.231
Real exchange rate	***-0.648	0.240	*-0.385	0.234
Trade openness	0.143	0.555	-0.031	0.502
Mild sanctions	**-0.721	0.304	**-0.604	0.283
Severe (comprehensive) sanctions	**-0.891	0.372	***-0.916	0.305
Negative fluctuations of exchange rate	-0.373	0.468	-	-
Positive fluctuations of exchange rate	0.034	0.328	-	-
ARCH effect		-	2.70	4.280
Statistics				
R^2	0.802		-	0.824
JB	)0.847(0.331		-	)0.781(0.493
Q(1)	)0.016(5.850		-	)0.116 (2.468
Q(2)	)0.047(6.109		-	)0.259 (2.698

Sanctions at both severe and mild level affect the agricultural trade balance negatively. This means that exports will be under more pressure than imports, worsening the trade balance. It is worth noting that, as presented in Table 1, sanctions will affect export adversely, indicating that exports are expected to be affected more significantly compared to imports.

In Model 2, exchange rate fluctuations were examined using the ARCH effect extracted from an ARMA model estimated for the exchange rate. The impact of added value, real exchange rate, and sanctions are the same as Model 1. Contrary to the expectations, trade openness affects trade balance reversely in Model 2; however, regarding the absolute value and the statistical significance, its coefficient is not influential. Trade openness is expected to promote economic growth, accompanied by exports. The lower technology may dampen international trade, as declared in the literature (Ahmadian Yazdi *et al*., 2015). The ARCH effect failed to affect the trade balance significantly, which is in line with the findings of Khosravi and Mohseni, (2014). The Ljung–Box Q-statistics presented in Table 2 show that the residuals are not significantly correlated. Table 3 presents the trade balance estimations results for agricultural sectors. The model estimated for the livestock sector may contribute explaining more than 88% of changes in trade balance of this sector using explanatory variables. Based on the results, value added with the coefficient of more than 3 accounts for a significant part of changes in the trade balance in the livestock sector. Although the positive effect is interesting for this variable, it may indicate an unsatisfactory situation.

The real exchange rate has a remarkable impact on trade balance; however, the effect of positive and negative changes in exchange is not the same in terms of value and statistical significance. The negative changes failed to affect the trade balance significantly. This supports the existence of the J-Curve theory, meaning that the devaluation of Iranian currency leads to worsening trade balance. This mainly causes from the fact that most of the trade in this sector is faced with the government intervention and the changing nature of the policies taken by government.

Table 3- Estimation results for agricultural sub-sectors trade balance

variable	Horticultural				Agronomy				Livestock			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coefficients	Standard errors	Coefficients	Standard Errors	Coefficients	Standard Errors	Coefficients	Standard Errors	Coefficients	Standard Errors	Coefficients	Standard Errors
Constant	-5.581**	2.787	-9.467***	2.850	-33.777***	3.206	-11.358*	6.110	-37.266***	8.410	-44.614***	9.433
Value added	0.583**	0.262	0.875***	0.248	2.649***	0.283	1.224**	0.516	3.171***	0.795	3.709***	0.816
Real exchange rate	0.565**	0.220	0.553**	0.233	-0.212	0.355	-0.131	0.308	-2.988***	0.726	-1.321*	0.723
Trade openness	0.293	0.379	0.044	0.524	-2.583**	1.158	-2.363***	0.487	-5.779***	1.299	-5.784***	1.283
Mild sanctions	-0.107	0.196	-0.225	0.291	-0.813***	0.233	-0.826***	0.250	-2.317***	0.768	-1.445*	0.750
Severe(comprehensive) sanctions	-0.446*	0.243	-0.854***	0310	-2.758***	0.596	-2.225***	0.376	-4.679***	1.030	-3.941***	0.957
Negative fluctuations of exchange rate	-0.284	0.232	-	-	-0.177	0.682	-	-	-0.091	1.147	-	-
Positive fluctuations of exchange rate	-0.553**	0.237	-	-	0.150	0.378	-	-	1.883**	0.833	-	-
ARCH effect			2.679	4.268	-	-	-26.964***	3.609	-	-	4.462	11.201
Dummy variables of 1978-83)					-	-	-	-	-2.647***	0.902	-1.527*	0.873
Lagged dependent variable					0.305**	0.109	0.741***	0.088	-	-	-	-
Statistics												
R^2	0.618		0.549		0.959		0.928		0.884		0.881	
JB	0.024(0.987)		0.404(0.816)		0.859(0.650)		0.876(0.645)		0.099(0.951)		0.045(0.977)	
Q(1)	1.971(0.160)		0.888(0.346)		4.243(0.039)		0.764(0.382)		1.657(0.198)		2.312(0.128)	
Q(2)	1.998(0.368)		0.913(0.633)		4.259(0.119)		0.778(0.678)		3.857(0.145)		5.886(0.053)	

The negative effect of trade openness also will induce pressure on the trade balance of livestock commodities. This implicitly indicates the lack of comparative advantages in the production of livestock products. Parikh and Stirbu, (2004), suggest that in some developing countries, trade liberalization may lead to faster growth of imports compared to exports, resulting in worsening trade balance. Similar results also have been reported by other Iranian studies (Ahmadian Yazdi *et al*., 2015). Sanctions at any level are expected to put pressure on the trade balance, indicating that exports of livestock commodities are expected to be more affected compared to their imports. Dummy variables for 1978 and 1983 show a significant adverse effect. Production and export of Iran in the livestock sector after 1978 have experienced tremendous changes (Food and Agriculture Organization, 2018). Model 2 of livestock specification significantly is similar to Model 1; however, the effect of exchange fluctuation proxied by ARCH effect terms is not statistically significant. Regarding the results obtained for exchange rate fluctuation variables in both models, it can be concluded that the trade balance is sensitive to positive changes in the exchange rate, and the negative fluctuations are not taken into account. Another critical difference between Model 1 and 2 in livestock specification relates to the magnitude of the exchange rate coefficient, which is around two times higher in the first specification compared to the second one. However, in both models, J-Curve phenomenon is supported.

The first model for the agronomy sector does not support the existence of the J-Curve theory. A similar finding has also been reported in the literature (Najarzadeh *et al*., 2009; Piraee *et al*., 2015; Pedram *et al*., 2011). Positive and negative components of the real exchange rate also have the expected sign; however, their effect is not statistically significant. Trade openness is expected to affect the trade balance of the agronomy sector negatively. It is worth noting that, as mentioned before, Iran is considered a major importing of cereals, and becoming more exposed to the global market may result in faster growth in imports rather than exports, as declared by Parikh and Stirbu, (2004). Another closely related variable is sanctions, which will put pressure on the trade balance at both levels, and the greater the extent of sanctions, the more will be pressure on the trade balance, indicating more restrictions on export compared to imports. Added value, as expected, will improve the trade balance. The related coefficient amounts to a significant value of 2.65.

The effect of explanatory variables in Model 2 for the agronomy sector is similar to Model 1. The ARCH terms, as a proxy for real exchange rate fluctuations, are negative. As a distinguishing feature, we may point out the magnitude of variable value added that is less than half in Model 2 compared to model 1. To some extent, the effect of severe sanction has decreased in Model 2. Like specificationsfor the agronomy and livestock sectors, the trade balance of horticultural sector is also related positively to value added, and increased domestic production of horticultural output is expected to stimulate their exports, leading to improvement in the trade balance. The real exchange rate affects the horticultural trade balance positively, which doesn't support the J-Curve theory. This effect may represent the long-run effect of the exchange rate since it indicates that the increase in the exchange rate results in a higher trade balance that may be translated into lower imports and higher exports. The nature of agricultural products that is time-consuming to be produced may be responsible for this effect. The negative component of the real exchange rate failed to affect the trade balance significantly. This insignificant effect may be the result of a similar effect by the exchange rate on imports and export in which the opposite direction of changes in imports and export leads to slight changes in the trade balance.

Trade openness has no significant relation with the trade balance of horticultural commodities, which is in line with the findings

of Piraee *et al*. (2015). Sanctions influence the trade balance of horticultural products adversely; however, their effect is less restrictive compared to those seen for the agronomy and livestock sectors. The export of horticultural products experienced a remarkable reduction in 2009 due to a significant decrease in precipitation (Food and Agriculture Organization, 2018). This effect was included using a dummy variable. In Model 2, the fluctuations of the exchange rate sound insignificant.

Conclusion and Policy Implications

Expansion of non-oil exports, especially agricultural exports, has been a targeted intervention in policies. Accordingly, this study attempted to examine the determinants of agricultural export and trade balance. However, it should be noted that exports expansion in agricultural commodities will demand more environmental resources. As the findings show, there are some threats and opportunities in the agricultural commodities trade. Globalization and the progresses in international trade may promote agricultural trade as declared by some empirical works like Gani and Al-Mawali, (2013), and nowadays, trading is not limited to common-border partners. There are two implications based on the current study findings; first, the impact of the global economic crisis that occurred in 2007 has been stronger even than sanctions enacted against Iranian trade. Second, distance is not a restricting factor, indicating that there are high other fixed costs that outweigh the distance trade costs. The lower importance of distance has been reported in some empirical works in the related literature (Gani and Almawli, 2013; Croce *et al*., 2004). It might be related to globalization which has been resulted in diminished importance of distance. Therefore, distant destinations also can be considered. The targeted countries for Iranian agricultural exports are those with growing per capita income and population while providing the domestic demand also should not be forgotten. In addition, similarity in per capita GDP is not a determinant, and differences in production technology and commodities composition are expected to be more determinants in international trade (Markusen *et al*., 1995; Razini *et al*., 2015). For instance, some common-border countries like Iraq, while in terms of per capita GDP, may be close to Iran, due to limited conditions for producing agricultural products, are as central importing countries. For exports expansion, both integrations with the global economy and removing barriers like sanctions are essential. The comprehensive period of sanctions covering the period after 2011 (Hufbauer *et al*., 2012), has been restricting the exports of agriculture and the entire economy (Aghaei *et al*., 2018). The exchange rate deserves to be treated as the main driving force of agricultural exports. Regarding the potential of asymmetric effects (Bahmani-Oskooee and Fariditavana, 2016), it was examined while the changes were decomposed into positive and negative components. Positive changes in exchange may expand agricultural exports, which is in line with the empirical works like Zargar Talebi *et al*. (2016), for Iran and Abu Hatab *et al*. (2010), for Egypt. However, fluctuations may affect exports adversely.

The trade balance of agricultural commodities is positively affected by the domestic output expansion. This contribution may be realized if exports expand and imports contract. However, the contribution of exchange to the trade balance needs time, based on the J-Curve evidence, putting pressure on the trade balance in the short run while it is expected to be improved in the long run and after passing the downward part of the J-Curve. However, the evidence for the J-Curve for horticultural commodities is not significant, which may be related to the nature of their output, which is perennial plant. This also recommends the significance of time in policy implementation. As far as the agricultural sectors are concerned, agronomy and horticultural sectors have more potential for exports while livestock is more exposed to increased imports. These tendencies toward exports and imports will be reinforced with more integration with the global economy.

Sanctions also will put more pressure on exports rather than imports, resulting in worsening trade balance of agricultural commodities. Accordingly, the livestock sector will be more vulnerable to confronting the global economy, needing more caution in implementing the policies. In order to expand agricultural exports, some attempts should be made including, dampening the exchange rate fluctuations, lowering trade barriers to be more integrated with the global economy, especially accession to the World Trade Organization (WTO), and targeting the nations with growing income and populations.

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چکیده

ایران با هدف کاهش وابستگی به درآمدهای حاصل از صادرات نفت و گاز، قصد دارد صادرات غیرنفتی را گسترش دهد. در همین راستا، این پژوهش سعی دارد عوامل تعیین‌کننده صادرات و تراز تجاری بخش کشاورزی ایران را بررسی کند. برای صادرات از مدل جاذبه و داده‌های ترکیبی سال های ۱۹۹۷تا ۲۰۱۷ استفاده شد. هم‌چنین تراز تجاری بخش کشاورزی و زیربخش‌های آن با استفاده از داده‌های دوره ۱۹۷۸ تا ۲۰۱۸ مطالعه شد. نتایج مدل جاذبه نشان داد متغیر فاصله بر میزان صادرات اثر منفی دارد. در حالی که اثر متغیرهای تولید ناخالص داخلی ایران و کشورهای واردکننده مطابق انتظار، مثبت به‌دست آمد. یافته‌ها نشان داد یک درصد افزایش تولید ناخالص داخلی سرانه ایران موجب افزایش صادرات محصولات کشاورزی به میزان ۳/۴۲ درصد خواهد شد. اما ضریب به‌دست آمده برای تولید ناخالص کشورهای واردکننده از اهمیت آماری پایینی برخوردار بود. هم‌چنین مشخص گردید افزایش جمعیت کشورهای واردکننده موجب افزایش تقاضا برای صادرات محصولات کشاورزی ایران خواهد شد. درجه بازبودن اقتصاد اثر مثبت و معنی-داری بر صادرات نشان داد. ضریب متغیر نرخ ارز واقعی در حدود ۰/۹ به‌دست آمد و مشخص گردید تغییرات صادرات با تغییرات نرخ ارز هم جهت است. تحریم‌های شدید بر صادرات محصولات کشاورزی ایران اثر منفی نشان داد اما تحریم‌های کم، فاقد اثر معنی‌دار ارزیابی شد. هم‌چنین نتایج نشان داد متغیر بحران جهانی اقتصاد می‌تواند موجب کاهش صادرات محصولات کشاورزی ایران شود. در تصریح تراز تجاری مشخص گردید ارزش‌افزوده بخش کشاورزی و زیربخش‌های آن بر بهبود تراز تجاری اثر مثبت دارد. اما اثر نرخ ارز واقعی بر تراز تجاری بخش کشاورزی و زیربخش‌های زراعت و دام و طیور منفی ارزیابی شد که نشان‌دهنده تأیید تئوری منحنی J است. اما برای زیربخش باغبانی مورد تأیید قرار نگرفت. نوسانات نرخ ارز با استفاده از دو متغیر تغییرات مثبت و منفی این متغیر، و هم‌چنین اثر ARCH حاصل از تخمین مدل خودتوضیح میانگین متحرک در مدل لحاظ شد. اثر این دو متغیر ضمن تفاوت در اندازه ضریب، الزاماً هم‌جهت نبود. اثر متغیر درجه بازبودن اقتصاد بر تراز تجاری بخش کشاورزی و زیربخش باغبانی مثبت ارزیابی شد. به این معنی که تولید آنها مبتنی بر مزیت نسبی است. در حالی‌که اثر این متغیر بر تراز تجاری زیربخش‌های زراعت و دام‌وطیور منفی به‌دست آمد. هم-چنین پیامد تحریم‌ها بر تراز تجاری منفی ارزیابی شد.

واژه‌های کلیدی: بخش کشاورزی، تراز تجاری، صادرات، مدل جاذبه

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