International Journal of Agricultural Management and Development (IJAMAD)
Available online on: www.ijamad.com
ISSN: 2159-5852 (Print)
ISSN:2159-5860 (Online)

Sustainability Test of Iran's Agricultural Balance Trade

Mohsen Salehi Komroudi [1], Esmaeil Pishbahar [2] and Hossein Raheli [3]*

Received: 7 May 2014,
Accepted: 17 August 2014

Abstract

From the perspective of new growth models and new international trade theories, both exports and imports play an important role in a dynamic economy. Economically, we cannot merely emphasize on a positive trade balance and we ignore the benefits of imports, and also we cannot advise negative trade balance. But the main concern of policy makers about international trade should be making stability and equilibrium of trade balance in the long run. Especially, deficit agricultural trade balance can be a great danger for food security. Hence, the main objective of this study was to test the sustainability of Iran's agricultural trade balance during the period 1961-2011 (1340-1390). For this purpose, After confirming the existence of cointegration by Gregory-Hansen Test, Hasted and Arize models was estimated with OLS, FMOLS and DOLS methods and it released we can verify sustainability of agricultural trade balance during the period of the study. Also, the estimation of error correction model showed that there is a bidirectional causality relationship between import and export in long-run while in short-run export only cause import in agriculture sector.

Keywords:
Agricultural Sector, Arize Model, Balance Trade, Husted Model, Sustainability

[1] *PhD Student in Agriculture Economics, Agriculture Faculty, Tabriz University, Tabriz, Iran.*
[2] *Assistance Professor in Agriculture Economics, Agriculture Economics Department, Tabriz University, Tabriz, Iran.*
[3] *Associate Professor in Agriculture Economics, Agriculture Economics Department, Tabriz University, Tabriz, Iran.*
* *Corresponding author's email: Salehi89@ms.tabrizu.ac.ir*

INTRODUCTION

Both export and import play an important role in a dynamic economy. In new growth theory, export promotion is key factor for economic growth. Because export improves productivity and provides needed exchange revenues for importing intermediate and capital goods. Also export speeds optimum resource allocation and enhances technology with generating competition (Levin and Raut, 1997). However, the importance of export doesn't mean that like mercantilists we must only stress on positive trade balance and ignore the import advantages. Because according to comparative advantage theory, the goods which produce more expensive in country can be imported. Therefore, import is important the same as export. Export and import must be considered as complementary to each other instead of substitution (Gorji and Alipourian, 2005). Surely, the importance of import doesn't justify negative balance trade. Because this can be harmful for national authority. Therefore, the main concern of policy makers must be the establishment of long run equilibrium and sustainability of balance trade. This is more important for agricultural trade balance. Because if it be negative, food security may be threatened (Bakhtiari and Haghghi, 2003).

Given to large and inevitably wave of globalization, understanding the relationship between export and import can help to create efficient trade policies in order to sustain (agricultural) trade balance. Since foreign trade volume reflects macroeconomic policies, with the recognition of export and import relationship can be examined the effect of these policies on international trade. If there is a cointegration between export and import, it can mean the macroeconomic policies could create the long run equilibrium in international trade sector. Cointegration between export and import is a key element to regularize trade policies in order to achieve balance trade (Uddin, 2009).

From theoretical perspective, can exist bilateral causality relationship between export and import. Import compel internal producer to produce high-quality goods with enhancing technology, to produce cheaper product with decreasing production cost and to rise the quantity and diversity of the products by making use of more diverse inputs. Thus Import can provide condition to participate in the Global market (Tayebi *et al.*, 2008). On other hand, export revenues provide condition to import greater (Lee and Huang, 2002). Additionally, export increases economic wants through the increase of economic growth and so it rises import potential (Karahasan, 2009).

In Iran, have rarely studied the relation between export and import. The study of Kharazmi and Samadi (2004) for OPEC countries during period 1960-1998 using Johansen cointegration test showed that there is not the export and import relationship in Iran, Saudi Arabia, Kuwait and Gabon but such a relation exists in Indonesia, UAE, Algeria and Nigeria. There are few studies about export and import cointegration abroad. Hossain *et al.,* (2009) examined the relationship among export, import and GDP of Bangladesh using Johansen method during period 1973-2008. The results revealed that there is a causality relation from export to production. Also export impacts on import in short run and long run. Ullah *et al.,* (2009) examined the presence of cointegration and causality among export, import and economic growth using Engle – Granger test during period 1970-2008 and realized that there is a one-way causality relationship from growth to both export and import. Emmy *et al.,* (2009) with Johansen method showed that there is cointegration between forest products import and forest products export (including wood pulp, wood fuel, paper and paper board, sawn wood, …) and bilateral causality relationship between export and import in short run and long run.

According to the above discussions, the aim of this research is to examine of the existence of long run equilibrium and sustainability of agricultural trade balance. Also this study tries to identify the causality relationship between agricultural export and agricultural import.

MATERIALS AND METHODS

Husted (1992) provided a theoretical framework to show the relationship between export and import. Husted model obtains from current budget constraint as follow:

$$C_t = Y_t + B_t - I_t(1+r)B_{t-1} \quad (1)$$

Where C_t, Y_t, B_t, and I_t are respectively con-

sumption, production, foreign borrowing, investment and international interest rate. He with imposing some assumption and solving math operation represented follow model for sustainability test:

$$X_t=\alpha_1+\beta M_t+e \quad (2)$$

Arize (2002) introduced as alternative below regression:

$$M_t=\alpha_2+bM_t+\varepsilon \quad (3)$$

In (2) and (3), X_t and M_t are, respectively, export and import, both β and b represent slope coefficient, α shows intercept, e and ε are error term. If cointegration between export and import (prerequisite) is verified and $\beta=1$ or $b=1$ statistically, it can conclude for a long run period that the country has not violated international budget constraint, balance trade has been sustainable, there has not been trade deficit and thus the country is able to redeem external debt. On the opposite, if there are not cointegration, it mean that balance trade has been unsustainable and international budget constraint has been violated.

According to above, to achieve the aims of research must examine cointegration between export and import. Because first, the two series are often non-stationary and so cointegration is prerequisite for long run equilibrium and sustainability of balance trade. On other hand, the selection of appropriate method for the examination of causality relationship relate to the presence/ absence of cointegration. The popular cointegration tests are Engle-Granger, Johansen and auto regressive distributed lag method. But unfortunately these tests don't allow for structural failure. Given to the events such as the war, the revolution and the jump in oil revenues during study period, the results of these methods may be misleading. Therefore, in this research is used Gregory and Hansen tests (1996a and 1996b) which allow to test cointegration with accounting structural break. Also, to examine unit root with accommodating structural change is applied Zivot and Andrews test (1992). Both tests will be introduced as follow.

Zivot and Andrews test: If in augmented dickey–fuller test structural change is not considered, the results of the test will have a bias towards the failure to reject the null hypothesis and thus the test power will reduce. Therefore, Zivot and Andrews (1992) introduced a method to determine a most possible endogenous structural change in data.

Let be Y_t the studied time series, α intercept and e error term. The null hypothesis represents as follow:

$$H_0: Y_t=\alpha+Y_{t-1}+e_t \quad (4)$$

Which doesn't allow for structural change and represents unit root. The alternative hypothesis depending on the assumption about whether the break occurred in intercept or trend represents as follow:

$$H_1^A: Y_t=\alpha+\theta DU_t(T_b)+\omega t+\rho Y_{t-1}+\sum_{j=1}^{L}\delta_j\Delta Y_{t-j}+e_t \quad (5)$$

$$H_1^B: Y_t=\alpha+\gamma DT_t(T_b)+\omega t+\rho Y_{t-1}+\sum_{j=1}^{L}\delta_j\Delta Y_{t-j}+e_t \quad (6)$$

$$H_1^C: Y_t=\alpha+\theta DU_t(T_b)+\gamma DT_t(T_b)+\omega t+\rho Y_{t-1}+\sum_{j=1}^{L}\delta_j\Delta Y_{t-j}+e_t \quad (7)$$

Where Θ, ω, ρ, δ, γ are slope coefficients, t is trend variable, T_b shows structural change date (year) and L represents lag length. The DUt and DTt are dummy variables which shows break in intercept and break in trend respectively. The regressions (5), (6) and (7) are ADF regressions in which allows for break in intercept, break in slope and break in both intercept and slope respectively. The values of DUt are 1 for $t > T_b$ and zero for other years. Also the values of DTt are t-T_b for $t > T_b$ and zero for other years. The three regressions is estimated with various values of T_b by OLS method. The break date is related to the value T_b which gives minimum t-statistic of the coefficient ρ. If t-statistic is greater than critical value test, null hypothesis will be rejected and the series will be stationary (Malakian and Khatami, 2011).

Gregory and Hansen test: This test allow for an endogenous structural break in the cointegrating vector. The cointegration regression represents as follow:

$$y_{1t}=\alpha+\delta_{y2t}+e_t \quad (8)$$

Where $_{y2t}$ is an m-dimensional vector including I (1) variables and e_t is I (0) error term. The structural change modeling is as follow:

$$y_{1t}=\alpha+\Theta D_{tb}+\delta_{y2t}+e_t \quad (9)$$

$$y_{1t}=\alpha+\Theta D_{tb}+\delta_{y2t}+\omega t+e_t \quad (10)$$

$$y_{1t}=\alpha+\Theta D_{tb}+\delta_{y2t}+\gamma (y_{2t}\times D_{tb})+e_t \quad (11)$$

Where D_{tb} is dummy variable which receives 1 for the values after the possible break and zero

for other years. The regressions (9), (10) and (11) are known as the level shift model, the level shift with trend model and regime shift model. In first, second and third structural change take places in intercept, both intercept and trend, and slope respectively. Gregory and Hansen (1996 a) for determining the structural break points and the examination of cointegration represented new statistic with modifying the statistics of Philips (1987) and ADF. The minimum value of this statistic for various years represents the possible structure break point. If the statistic is significant, the null hypothesis of non cointegration rejects (Samadi *et al.*, 2006). Also Gregory and Hansen (1996 b) introduced a forth model namely the regime and trend shift which in is assumed that structural change take places in both intercept and slope.

DISCUSSION

In this study the data of import and export during period 1961-2011 in dollar terms were obtained from the food and agriculture organization of the United Nations website (FAO, 2014). Figure 1 displays that agricultural trade value can classified into four period. In the first period, before 1973, Iranian foreign trade increased with slow rate. With increasing food demand after jumping oil prices in 1973, agricultural import raised considerably and shifted from 3688 billion $ in 1973 to 12766 $ in 1976. With the emergence of Iranian revolution and according to the limitation capacity of the ports and transportation system this trend was stopped after 1977. During 1973-77 export has increased significantly as a result of remarkable increase in intermediate and capital goods import. In third period (1976-1998) as results of revolution, war and reconstruction, foreign trade growth decreased and agricultural trade fluctuation increased. Since 1998 agricultural trade value have raised continuously and sharply, shifted from 34463 billion $ in 1999 to 193760 billion $ in year 2011.

Figure 1 shows that firstly, export and import in agricultural sector following each other in a good way during the time and thus there is most likely cointegration between them.

Secondly, the data may have structural failure and it is better to perform data analyzing with the methods which consider this fact. Thirdly, mean and variance of the series was not constant over time and probably they are not stationary and thus it is essential to avoid from spurious regression, firs the integration degree of the variable must be determined. For this reason, stationary of agricultural export variables examined by using Zivot – Andrews unit root test (Table1).

As shown in table 1, the unit root statistics, for the both variables, are not significant in level and thus null hypothesis of the existence of unit root cannot be rejected but after differencing the two variables, the t-statistic of the test will be significant at 1% and the null hypothesis can be rejected. In other word, both the variables are stationary after first differencing. Therefore Gregory – Hansen test which was designed for I (1) variables can be applied. The results of this test reported in table 2 and shows both the statistics of Z_t^* and Z_α^* are significant at 95% confidence level but ADF^* statistic is not

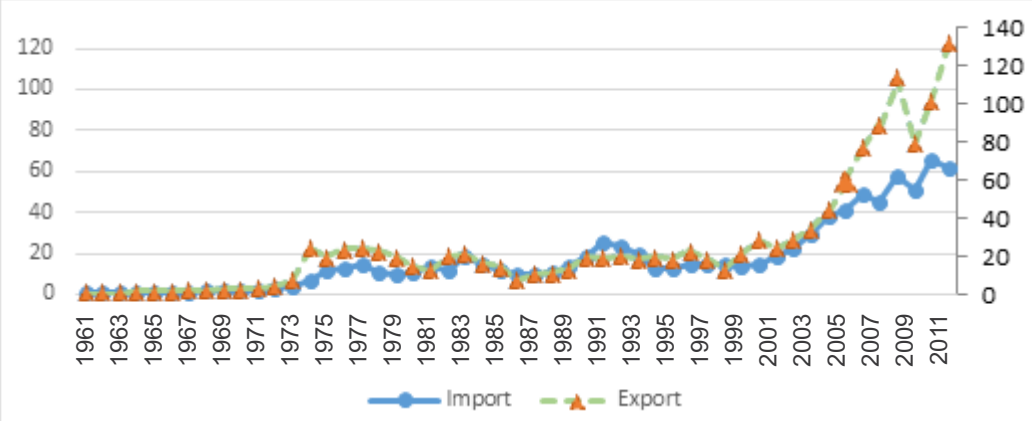

Figure 1: Iranian Agricultural export and import value during 1961-2011(billon dollar) (Export value and import value have displayed in right and left vertical axis respectively).

Table 1: The results of Zivot–Andrews test

Variables		First Model: Structural break in intercept		Second Model: Structural break in trend		Third Model: Structural break in both intercept and trend	
		Possible structural break year (Tb)	Minimum t-statistic	Possible structural break year (Tb)	Minimum t-statistic	Possible structural break year (Tb)	Minimum t-statistic
lnM	Logarithm of agricultural import	1973	-3.47	1975	-3.61	1973	-3.86
lnX	Logarithm of agricultural export	1984	-2.93	1974	-2.45	1979	-2.84
ΔlnM	First difference of agricultural import	1978	-5.44**	1995	-4.75***	1976	-5.59***
ΔlnX	First difference of agricultural export	1977	-7.25***	1986	-6.56***	1975	-7.93***

*** Statistically significant at 1 % - Optimum lag was selected using Schwarz Information Criterion
Source: Research findings

significant. As a result, the cointegration between agricultural export and agricultural import is verified altogether. Therefore it can be said that agricultural balance trade placed in long run equilibrium.

According to some economists, the existence of cointegration is the prerequisite for establishing sustainability of trade balance and a sufficient condition, the slope coefficient equals to one in the Hosted or Arize models, must be satisfied. To investigate this issue, the two mentioned models are estimated by Ordinary Least Square (OLS), Dynamic Ordinary Least Square (DOLS) and Fully Modified Ordinary Least Square (FMOLS) methods and the results are presented in Table 3. The estimated slope coefficients with their standard errors are reported in the second and fourth columns of this table. It is observed that all the coefficients are significant and close to one. Also can be seen that in columns three and five, the null hypothesis that the slope coefficient of models equals to one could not be rejected in all cases because the Wald test statistics are not significant. Thus, a sufficient condition for the stability of the agricultural trade balance in the period under study is established.

After confirming cointegration, error correction model (ECM) can be estimated (Table 4). With considering Table 2, for estimating ECM two dummy variable was used to capture structural beak: the variable *D8211* which takes 1 for

Table 2: The results of Gregory - Hansen Test

Statistics	Level Shift Model		Level Shift with Trend Model		Regime Shift Model		Regime & Trend Shift Model	
	Possible structural break year	Statistic value	Possible structural break year	Statistic value	Possible structural break year	Statistic value	Possible structural break year	Statistic value
Z_t^*	1979	-4.95**	1981	-5.77**	1981	-5.41**	1984	-7.13***
Z_α^*	1979	-5.00**	1981	-5.83**	1981	-5.47**	1984	-7.21**
ADF^*	1979	-35.39	1981	-42.00***	1981	-38.75***	1984	-51.64

*** Statistically significant at 1 % - Optimum lag was selected using Schwarz Information Criterion
Source: Research findings

Table 3: The estimation of Husted and Arize models

Estimation Method	Husted Model		Arize Model	
	Coefficient	Wald statistic (X^2) for testing *H0: β=1*	Coefficient	Wald statistic (X^2) for testing *H0: β=1*
OLS	0.88*	0.05	0.98**	0.03
	(0.05)	(0.81)	(0.31)	(0.85)
DOLS	1.07***	0.05	1.00	0.00
	(0.09)	(0.45)	(0.07)	(0.96)
FMOLS	1.00***	0.00	1.04***	0.40
	(0.06)	(0.99)	(0.06)	(0.52)

***, ** and * Statistically significant at 1, 5 and 10 percent respectively- Optimum lag or lead was selected using Schwarz Information Criterion –The Numbers in the parentheses in columns 2 and 4 are Standard deviation while in columns 3 and 5 are prob.
Source: Research findings

years - 1982-2011 and zero for other years and shows the existence of structural break in intercept, 2- the variable $D8211 \times ln\ M$ which captures structural break in slope. For Arize model the coefficients of both dummy variable were not significant and thus were omitted. As shown in table (4), error correction coefficient is negative, absolutely less than one and significant, either the difference in logarithm of export is dependent variable or the difference in logarithm of import is dependent variable. Therefore it can be concluded export cause import in agriculture sector and vice versa. The reason is probably that increasing exchange revenues from export, provides condition for rising import and on the other side with increasing import, production and export will increase through the rise in import of intermediate goods and raw materials, especially in food industries. Also, the coefficient of the $\Delta\ ln\ M_{t-1}$ variable is not significant in Husted model while the coefficient of the variable $\Delta\ ln\ X_{t-1}$ in Arize model is

Table 4: The estimation of error correction model

Variables	ECM for Husted Model $\Delta\ ln\ X_t$ is Dependent Variable	ECM for Arize Model $\Delta\ ln\ M_t$ is Dependent Variable
ecm_{t-1}	-0.60**	-0.17*
	(0.23)	(0.10)
$\Delta\ ln\ X_{t-1}$	0.27	0.21*
	(0.20)	(0.12)
$\Delta\ ln\ M_{t-1}$	-0.01	0.15
	(0.24)	(0.14)
D8211	-3.43**	--
	(1.78)	
D8211 × ln M	0.19*	
	(0.10)	--
Intercept	0.21***	0.06***
	(0.08)	(0.03)
R^2	0.18	0.30

***, ** and * Statistically significant at 1, 5 and 10 percent respectively- Optimum lag was selected using Schwarz Information Criterion –The Numbers in the parentheses are Standard deviation - For Arize model the coefficients of both dummy variable were not significant and thus were omitted
Source: Research findings

significant. Thus it can be concluded that there is a one-side causality relationship from export to import in short run. The error correction coefficient of Husted model shows that about 60% of export deviation from its long run equilibrium adjusts in every period. In addition, the error correction coefficient of Arize model suggests that five periods after a shock, import will return to its long run equilibrium.

RESULTS

In this paper we followed three aims. First, we want to investigate whether foreign trade in Iran's agriculture sector is in long run equilibrium. In other word, we tried to answer whether Iranian agricultural export and Iranian agricultural export in long run are Diverging toward one another or converging. To achieve this aim, after understanding the variables are I (1) by Zivot – Andrews test, we examined cointegration with Gregory – Hansen test. According to confirm cointegration, we concluded long run equilibrium between export and import exists. This is opposite to the result of the study of Kharazmi and Samadi (2004) on Iranian total balance trade. Second, we tried to test agricultural trade sustainability. According to Husted (1992) after confirming cointegration to examine sustainability must regress export on import and test whether the slope coefficient statistically equals to one. According to Arize (2002) an alternative is to regress import on export and then to test whether the slope of export statistically equals to one. We estimated Husted and Arize models by three method of cointegration vector estimation namely OLS, DOLS and FMOLS and then performed Wald test on the estimated coefficients. The results showed the slope coefficients statistically equals to one in both models and the hypothesis of agricultural trade sustainability cannot be rejected. Therefore it can be said totally during study period food security was not threatened through agricultural import. Third, we tries to study the causality relationship between export and import in agriculture sector. Using error correction model it was revealed export causes import. Given to the positive coefficient of the import variable in estimated Husted model, it can be said that import have likely positive effect on export. Therefore it can be concluded that as long as there is dependence on import of intermediate goods and raw material, to promotion export inevitably must import. Additionally, the rise in exports through the increase in exchange revenues cause to encourage import in long run and short run. In this regard, we recommend to spend export revenues to import intermediate and capital goods more than before.

REFERENCES

1- Andrews, D., & Zivot, E. (1992). Further evidence on the Great Crash, the oil price shock, and the unit-root hypothesis. Journal of Business and Economic Statistics, 10, 251-70.

2- Arize, C.A. (2002). Imports and exports in 50 countries: test of cointegration and structural breaks. International Review of Economics and Finance, (11), 101-115.

3- Bakhtiari, S., & Haghghi, Z. (2003). The study of food security and human development in Islamic countries. Agricultural Economics and development, 11(43 & 44), 21-51. (In Farsi)

4- Emmy, F.A., Baharom, A.H., Radam, A., & Illisriyani, I. (2009). Export and Import Cointegration in Forestry Domain: The Case of Malaysia. Munich Personal Repec Archive, 4.

5- FAO. (2012). Website FAO, Available at: http://faostat.fao.org.

6- Gorji, E., & Alipourian, M. (2006). The study of trade liberalization on Iranian economic growth (and other OPEC countries). Iranian Journal of trade studies, (40), 187-204. (In Farsi)

7- Gregory, A.W., & Hansen, B.E. (1996 a). Residual-Based Tests for Cointegration in Models with Regime Shifts. Journal of Econometrics, 70(1), 99-126.

8- Gregory, A.W., & Hansen, B.E. (1996 b). Tests for Cointegration in Models with Regime and Trend Shifts. Oxford Bulletin of Economics and Statistics, 58 (3), 555-60.

9- Hansen, B.E. (1992). Efficient estimation and testing of cointegrating vectors in the presence of deterministic trends, Journal of Econometrics, 53(1), 87-121.

10- Hossain, M.A., Haseen, L., & Jabin, N. (2009), Dynamics and Causality among Exports and Income in Bangladesh. The Bangladesh Development Studies, (2).

11- Husted, S. (1992). The emerging U. S. Current

Account deficit in 1980: cointegration analysis. The Review of Economics and Statistics, (74), 159-166.
12- Karahasan, B.k. (2009). Causal Links between Trade and Economic Growth Evidence from Turkey and European Union Countries. Munich Personal RePEc Archive. 29809.
13- Lee, C.H., & Huang, B-N. (2002). The Relationship between Exports and Economic Growth in East Asian Countries: a Multivariate Threshold Autoregressive Approach. Journal of Economic Development, 27(2).
14- Levin, A., & Raut, L.K. (1997). Complementarities between Exports and Human Capital in Economic Growth: Evidence from the Semi-industrialized Countries. Economic Development and Cultural Change, (44), 155-174.
15- Malakian, N., & Khatami, S. (2011). The examination of economic convergence of MENA countries (1980-2008). Journal of Economic Research, 11(3), 135-157. (In Farsi)
16- Memon, M., Hussain. B., Waqar, S., & Ali, M. (2008). Causal Relationship between Exports and Agricultural GDP in Pakistan. Munich Personal RePEc Archive, 11845.
17- Phillips, P.C. (1987). Time series regression with a unit root. Econometrica: Journal of the Econometric Society, 277-301
18- Samadi, A.H., Haghighat, A., & Aminzadeh, K. (2006). Inflation and structural failure; the experimental evidences from Iran's economy. Journal of Economic Research, 8(27), 65-87. (In Farsi)
19- Stock, J.H., & Watson, M.W. (1993). A simple estimator of cointegrating vectors in higher order integrated systems. Econometrica: Journal of the Econometric Society, 783-820.
20- Tayebi, K., Emadzadeh, M., & Sheykhbahaei, A. (2008). The effects of manufacture export and human capital on total factor productivity and economic growth in OIC countries. Journal of Quantitative Economics, 5(2), 85-106. (In Farsi)
21- Uddin, J. (2009). Time Series Behavior of Imports and Exports of Bangladesh: Evidence from Cointegration Analysis and Error Correction Model, International Journal of Economics and Finance, 1(2).
22- Ullah, S., Zaman, E., Farooq, M., & Javid, A. (2009). Cointegration and Causality between Exports and Economic Growth in Pakistan. European Journal of Social Sciences, 10(2).