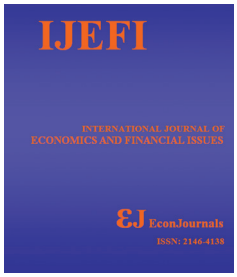

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Egyptian Intra Agriculture Trade with Common Market for Eastern and Southern Africa Trading Partners: A Gravity Model

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ABSTRACT

The regional trade provides better environment for any country to achieve the trade objective instead of a total free trade in this modern age. This study investigates the determinants of Egyptian agriculture trade with her 20 Common Market for Eastern and Southern Africa (COMESA) trading partners by using data of 1990-2015 and by applying pooled mean group estimators on gravity model. Our results are confirming the panel cointegration in our model. Egyptian gross domestic product (GDP) and population are negatively influencing to the agriculture balance of trade (BOT). COMESA trading partners' GDP and population have positive impact on the BOT. The exchange rate depreciation has unfavorable impact on agriculture BOT in the short run and has a favorable impact in long run. This is an evidence for presence of J-curve hypothesis in Egyptian trade in COMESA region and also showing an elastic behavior of exchange rate on BOT in the long run. Hence, this study recommends to Egyptian policy makers to adopt depreciation policy to correct agriculture BOT with COMESA trading partners.

Keywords: Agriculture Balance of Trade, Common Market for Eastern and Southern Africa, Gross Domestic Product, Panel Cointegration
JEL Classifications: E01, C33, F14, F53

1. INTRODUCTION

Today, the world is passing through important economic changes which requires from developing countries to review its economic policies particularly the policies of foreign trade. It has become very hard for any country to achieve its developmental objectives and sustainable self-efficiency without integration with other countries of world. The free integration is not possible with the entire world with free trade phenomena as every country has its own geographical location advantages, level of economic development and economic objectives. For example, the developed countries have taken on its shoulders the responsibility to achieve this integration as we find that the USA establishes North American Free Trade Agreement and calls for establishment of a free trade area for Americans as well as its makes the Pacific Ocean as an extension for its region in order to enter into bloc with some Asian and Australian countries. In Europe, after fulfilling the dream of big Europe which includes western and eastern countries, they started to talk about "Big Initiative" across the Atlantic between Europeans and Americans. This growing trend has not been limited to these two continents but exceeded to Asia and Africa as well.

The growing phenomenon of economic blocs and integration in some other continents like African continent and some free trade Arab countries is one of the justifications that forced to carry out this study in order to know the efficiency of performance of important economic bloc of Common Market for Eastern and Southern Africa (COMESA) in terms of agriculture trade with Egypt. Egypt is a leading trade partner in the COMESA intra-regional trade and her trade in agriculture products is rising over time with this region. Trading the agriculture commodities with COMESA is becoming a reason for agriculture exports of Egypt to grow at good pace and it also helps in improving the agriculture balance of trade (BOT) of Egypt. It is also due to a reason that Egyptian trade with COMESA provides transport cost advantages and lower tariff rates due to the trade agreements and geographical location.

On the other hands, population growth of COMESA region is rising at good pace. That can be considered as an opportunity instead of a threat for Egyptian agriculture trade due to increasing demand for agriculture products. Further, increasing incomes of this region is also supportive in increasing demand for agriculture products of Egypt. Furthermore, the agriculture value added in the gross domestic product (GDP) is about one-fourth of this region. This picture is showing a very good potential of agriculture trade among the member countries of COMESA. To capture the impact of income, population and exchange rate, the gravity model is very suitable in our case and this kind of model has not been utilized for COMESA regional trade in previous studies up to best of our knowledge. Therefore, this present research is going to contribute the COMESA regional trade literature by using a dynamic cointegration approach of pooled mean group (PMG).

2. LITERATURE REVIEW

There is a vest literature on the application of gravity model to capture the impact of income, population and exchange rate on the bilateral trade. This research selects and reviews few studies related to this topic. For example, Mahmood et al. (2013) explore the effect of exchange rate on the imports by using data of 1980-2009 for Tunisia and find that exchange rate depreciation is responsible for rising imports. Hassan et al. (2013) investigate the influence of exchange rate and GDP on the export performance of Pakistan. They find that depreciation of exchange rate and GDP have been found supportive in raising exports in Pakistan.

Zhairkov et al. (2016) investigate the determinants of bilateral trade flows between China and Russia. They find that GDP of both countries have positive effects on the imports and exports flows. Abidin et al. (2016) explore a gravity model for Malaysian and ASEAN-5 exports for a period 1990-2013. They find that GDP of Malaysia and ASEAN countries have positive influence on the exports between these countries. Further, Population of Malaysia and ASEAN countries have also positive influence on the exports between these countries. Exchange rate of ASEAN countries has been negatively influenced the exports but Exchange rate of Malaysia has been positively influenced the exports. Kuznetsova et al. (2016) explore the dependence of Russia exports and imports with Asia-pacific region. They find that GDP has been positively impact the exports and imports to this integrated association for the all years in analysis. Further distance has a negative effect on both imports and exports. Alkhateeb et al. (2016) investigate the casual relationship in exports, GDP and exchange rate in Saudi Arabia. After confirming the cointegration, they find an evidence of causality from GDP and exchange rate to the exports of Saudi Arabia.

Atif et al. (2017) investigates the determinants of agriculture trade in Pakistan by using gravity model and by using a period 1995-2014 for a panel of 63 Pakistan's trading partners. They finds that Pakistan and her partners countries' GDP have positive effect on agriculture trade and exchange rate depreciation has also been helpful in increasing agriculture exports of Pakistan. Mahmood and Alkhateeb (2017) utilize the asymmetric auto-regressive distributive lag (ARDL) cointegration technique to find the effects of positive and negative movements in exchange rate on service sector trade in Saudi Arabia. They find that trading partners' GDP have a positive effect on the most of service sector exports and exchange rate depreciation has been helpful in raising the exports of service sector in most of cases. Further, an appreciation has been depressed the exports. Mahmood et al. (2017) exploit the asymmetric ARDL cointegration technique to explore the influence exchange rate and GDP on industrial sector trade in Saudi Arabia. They find that trading partners GDP has a positive effect on the most of service sector exports and exchange rate depreciation has been helpful in raising the exports of industrial sector in most of cases. Further, an appreciation has been depressed the exports.

The empirical literature supports the argument of positive influence of income on the exports and in turn on BOT. Further, exchange rate depreciation has positive impact on the exports and BOT in the long run. But, we have not found a single study which investigates this important issue in the bilateral intra agriculture trade in the COMESA region. Therefore, this present research is going to contribute in the COMESA regional trade's literature.

3. THEORETICAL BACKGROUND, MODEL AND ESTIMATION STRATEGY

The concept of gravity model has been used in International Trade. The history of gravitation model initiated in pure sciences by Newton in his second law of motion which was later applied in social sciences by Tinbergen. Tinbergen (1962) applied Newtonian approach to explain bilateral trade flows which is positively dependent on the incomes of the trade partners or countries and negatively dependent on the air/shipping distance separating them.

Gravity model is evolved and discovered in the physics. It is describing the direct proportional relationship with the masses of objects and inversely related with a distance between the two objects. Tinbergen (1962) utilizes the same phenomena in the international trade and argued that free trade could maximize the world welfare levels. He argued that trade restriction are majorly reducing the trade between countries. Trade restrictions are placed to prevent the countries as due to income differences. Further, it is due to protection hypothesis of young industries from foreign competitions and sometimes for the protection of some vital/key industries or sector in a country. Other than above mentioned arguments, Tinbergen argued in favor of free trade in the countries that have not such problems to maximize the welfare levels. He also argued that major driving forces of trade can be claimed for income/GDP of a countries and physical distances as well. GDP shows the demand capacity in a country for foreign products and production diversity of the other country as well. A country with more diversification shows lesser tendency of imports and also showing a high capacity of exports as well. On the other hand, distance could play a negative actor in the optimum trade between countries. Based on the above arguments of Tinbergen, his gravity model can be expressed as follows:

$$T = G\frac{Y_i * Y_j}{Dis_{ij}} \quad (1)$$

T can be termed as trade, *Y* is showing income/GDP of trading countries, *G* is intercept and *Dis* is taken as distance between countries. Tinbergen also tried to incorporate the dummies for neighboring countries. It gives us liberty for incorporation of favored trade among countries like trading bloc's partners. Tinbergen model is lacking in incorporation of many variables which support the trade. Due to this theoretical and empirical short coming, many researchers proposed different conception along with simple gravity model.

3.1. Model

This study utilizes the agriculture gravity model find its determinants with Egyptian trading blocs of COMESA. We are ignoring the distance from gravity model in its simplest version of gravity model due to study on a trading bloc and further this study augments the Tinbergen (1962) model by including the population of trading partners and also by including exchange rate to capture the impact this policy variable in the analysis. The basic equation our gravity model is given below:

$$BOT_{jt} = GDPE_t.GDPP_{jt}.POPE_t.POPP_{jt}.ER_t \quad (2)$$

Here, we are assuming *j* for Egyptian trading partner located in COMESA trading bloc region, *BOT* = Agriculture balance of trade between Egypt and its trading partners. *GDPE*= Egyptian GDP, *GDPP* = Egyptian trading partners' GDP, *POPE* = Egyptian population, *POPP* = Egyptian trading parters' population and *ER* = Exchange rate of Egyptian local currency. By taking the log of equation 2, we can convert the basic non-linear gravity model into the log-log-linear specification to make it possible for estimation. The log-log-linear model can be expressed as follows:

$$\log BOT_{jt} = a + b \log GDPE_t + c \log GDPP_{jt} + d \log POPE_t + g \log POPP_{jt} + h \log ER_t + e_t \quad (3)$$

3.2. Estimation Strategy

At first, this study will check the order of integration for our gravity model. This is pre-condition for any panel-cointegration test. We are using the Im-Peasaran-Shin (IPS) panel unit root test developed by Im et al. (2003) for this purpose. The equation of IPS test is as follows:

$$\Delta W_{it} = \beta_i + \rho W_{it-1} + \sum_{k=1}^{n} \eta_{ik} \Delta W_{it-k} + \lambda_{it} + \sigma_i + u_{it} \quad (4)$$

Here, *W* assumes the each variable of our models with the null hypothesis of unit root problem in the variable and rejection of this null hypothesis will be a guaranty for a stationary series.

After testing the order of integration in our estimations, we will test the panel cointegration proposed by Pesaran et al. (1999). That is called PMG estimation technique. This methodology is dynamic and heterogeneous in nature and takes care of the features of individual cross section in the panel. This technique is of an ARDL nature and can be helpful in estimating the consistent and un-biased results. The equation of the test is as follows:

$$W_{it} = \delta_i + \sum_{i=1}^{q} \alpha_i W_{i,t-1} + \sum_{i=0}^{p} \theta_i y_{i,t-1} + \zeta_{it} \quad (5)$$

Further, by differencing the variables and by including the error correction term (ECT) in the equation 5, we can derive the error correction model to capture the term for a long run relationship and to capture the long run and short run parameters. After making such changes, the equation 5 can be converted into the following form:

$$\Delta W_{it} = \delta_i + \sum_{i=1}^{q-1} \alpha_i \Delta W_{i,t-1} + \sum_{i=0}^{p-1} \theta_i \Delta y_{i,t-1} + o_i ECT_{i,t-1} + \varepsilon_{it} \quad (6)$$

3.3. Data

This study uses the annual data on agriculture exports and agriculture imports to convert in agriculture BOT, bilateral exchange rate between trading partners i.e., Egypt and its trading partners, GDP of Egypt (GDPE), GDP of trading Egyptian trading partners located in COMESA, population of Egypt and population of Egyptian trading partners located in COMESA region from World Bank (2016) for a period 1990-2015. COMESA includes 20 member countries in analysis. The sample of time and countries are selected on the maximum availability of data. The data is collected in constant 2005 US dollars. The complete description and definitions of variables are presented in the data description section with the expected theoretical relationships.

3.4. Descriptions of Variables

3.4.1. Agriculture BOT

BOT is taken as dependent variable in the gravity model of Egyptian agriculture exports. Generally, BOT is defined as exports minus imports but it carries a problem of negative values in case of deficit in the trade. Therefore, to avoid this kind of problem, BOT is defined as the ratio of exports to imports and particular in our case as ratio of agriculture exports to agriculture imports. A more than one ratio is indicating the surplus of agriculture trade and <1 ratio will represent the deficit in agriculture trade and by this definition the net value will remain positive and we can apply comfortably the log-log linear type of gravity model in our analysis. Further, agriculture BOT variable has been converted into logarithm to use in log-log linear gravity model. A positive movement in the ratio of agriculture exports to agriculture imports will be indicating either increase in agriculture exports or decrease in agriculture imports for Egypt. The following descriptions are presented for independent variables.

3.4.2. Exchange rate

The exchange rate is defined as a price of US dollar in terms of local currency of Egypt or her trading partners. An upward movement in the exchange rate variable will represent the depreciation of local currency. A depreciation of local currency will decrease the price of local product in the international market and in turn the demand for local product may increase. Therefore, a depreciation of local currency would increase the value of agriculture exports if elasticity of demand for agriculture exports is >1. In the same manner, a depreciation of local currency will increase the price of imported good in the local market and will be responsible for decrease in demand for imported items in the local market. In that way, a depreciation of local currency will be responsible for the decrease in the value of imports if demand for imports is elastic. Therefore, in case of elastic agriculture exports

and imports, a depreciation of local currency will increase the value of exports, will decrease the value of imports and the variable of BOT of agriculture products will move in upward direction. Therefore, the relationship between exchange rate and the BOT of agriculture product is expected to be positive in the long run with an assumption of elastic agriculture exports and imports.

3.4.3. Egyptian GDP

The GDPE is used in this study as proxy for income of Egypt. Higher the income level/GDPE is expected to cater higher demand for imported agriculture products in the Egypt. Imports are located in the denominator of BOT definition. Therefore, the coefficient of GDPE is expected to carry a negative sign in the relationship of agriculture BOT.

3.4.4. GDPE trading partner

The GDPE trading partner is used in this study as proxy for income of a partner country. Higher the income level/GDP of partner is expected to cater higher demand for agriculture products' export from Egypt. Exports are located in the numerator of BOT definition. Therefore, the coefficient of GDPP is expected to carry a positive sign in the relationship of BOT.

3.4.5. Population of Egypt

The population of Egypt is used in this study as proxy for market size of Egypt for a demand for imported agriculture products in the Egypt. Higher the market size/affluence is expected to cater higher demand for imported agriculture products in Egypt. Therefore, the coefficient of POPE is expected to carry a negative sign in a relationship of BOT of agriculture products.

3.4.6. Population of Egyptian trading partner

The population of Egyptian trading partner is used in this study as proxy for market size of partner country for a demand for exports of Egyptian agriculture products. Higher the population of partner is expected to cater higher demand for agriculture products' export from Egypt. Therefore, the coefficient of POPP is expected to carry a positive sign in a relationship of BOT of agriculture products.

4. DATA ANALYSES AND DISCUSSIONS

For the estimation of gravity model for Egyptian trading partners of COMESA region, our study uses the PMG estimators developed by Pesaran et al. (1999). This is derived from an ARDL model and is uses for the estimation of dynamic types of model for a panel to find cointegration/long run and short run relationships. This is dynamic in nature and also takes care of heterogeneity in the cross sections. The pre-condition for its estimation is to test the order of integration at first. For this purpose, we use the IPS panel unit root test with an intercept in estimating the unit root equation and with the both intercept and trend as well. This is to test the problem of a unit root in a particular variable and to conclude that this variable stationary at level or first difference and resultantly to conclude the level of integration in the model. Table 1 shows the IPS Panel unit root test results. Results are showing that BOT, GDPP and POPE are stationary at their levels. The rest of variables are non-stationary at their levels and are stationary at their first differences. Therefore, we can conclude the order of integration is mixed and we can proceed for further analysis as PMG estimation remains consistent and reliable even in case of mix order of integration because of its ARDL nature of estimation procedure.

After the integration analysis, we conduct the cointegration test for the gravity model of COMESA's trading partners' trade with Egypt through PMG estimators. The results are reported in the Table 2. The results are showing that ECT is negative and highly

Table 1: Im et al. panel unit root test

Variable	Intercept	Intercept and trend
At level		
BOT	−11.3194***	−6.7874***
	(0.0000)	(0.0000)
GDPE	2.8206	−0.2221
	(0.9976)	(0.4121)
GDPP	4.6336	−5.8334***
	(0.9999)	(0.0000)
POPE	7.0897	−4.2736***
	(0.9999)	(0.0000)
POPP	2.1249	−0.0256
	(0.9832)	(0.4898)
ER	5.1153	2.3505
	(0.9999)	(0.9906)
At first difference		
BOT	−11.0636***	−8.4091***
	(0.0000)	(0.0000)
GDPE	−2.6164***	−2.7209***
	(0.0044)***	(0.0026)
GDPP	−10.9920***	−7.9242***
	(0.0000)	(0.0000)
POPE	−44.9066***	−37.2961***
	(0.0000)	(0.0000)
POPP	−5.4490***	−4.1384***
	(0.0000)	(0.0000)
ER	−4.6979***	−1.3452*
	(0.0000)	(0.0893)

*.**.*** are showing the rejection of null hypothesis at 10%, 5% and 1% respectively. BOT: Balance of trade, GDPE: Gross domestic product of Egypt

Table 2: PMG estimation (dependent variable: BOT)

Variable	Co-efficient	Standard error	t-statistics	P
Long run results				
GDPE	−0.7354***	0.1137	−6.4692	0.0000
GDPP	2.4256***	0.4273	5.6761	0.0000
POPE	−21.9225***	3.3578	−6.5289	0.0000
POPP	5.0178***	0.6241	8.0399	0.0000
ER	3.4732***	0.6504	5.3403	0.0000
Short run results				
ECT	−0.5396***	0.0468	−11.5400	0.0000
GDPE	−2.3794***	0.3058	−7.7797	0.0000
GDPP	0.3111	0.2297	1.3547	0.1764
POPE	−1.3611	10.4363	−0.1304	0.8963
POPP	12.4899	9.2583	1.3491	0.1782
ER	−0.6515*	0.3860	−1.6875	0.0924
Intercept	62.1583***	5.3879	11.5367	0.0000

*.**.*** are showing the rejection of null hypothesis at 10%, 5% and 1% respectively. BOT: Balance of trade, GDPE: Gross domestic product of Egypt, PMG: Pooled mean group

statistically significant at 1% level of significance. Therefore, it can be concluded that long run relationship is existing in our gravity model. Further, the all coefficients are carrying the expected right theoretical signs in the empirical estimation of gravity model of COMESA's trading partners' trade with Egypt.

The GDPE, GDP of Egypt, has a negative and statistically significant impact on the BOT. It is showing that an increase in Egyptian income is associated/causing increase the agriculture imports of Egypt and as import are in the denominator of BOT ratio/definition. Therefore, the BOT is falling with an increase in the GDPE. Further, GDPE elasticity of BOT is <1 and 1% increase in GDPE is come up with 0.74% decrease in the BOT. In the other words, the low elasticity is explaining that income of Egypt has no one to one relationship with BOT. On the other hand, GDPP has a positive and statistically significant impact on BOT and it is showing that an 1% increase in income of trading partners of Egypt increase the 2.43% increase in Egyptian agriculture exports and in turn increase the same amount of BOT of agriculture products. This elastic relationship is very healthy for Egyptian exports. POPE, an Egyptian population, has negative and significant impact on agriculture BOT at 1% level of significance and it is showing that rising population is coming up with a very sharp rise in agriculture imports. Being imports as denominator of BOT, it has negative impact on BOT. A very high elasticity also demonstrates that a rising size of Egyptian market size in term of population has very bad impact on agriculture BOT due to rise in demand for food and other agriculture products. On the other hand, POPP as an Egyptian partners' population has positive and statistically significant impact on agriculture BOT at 1% level of significance. It is showing that rising partners' population is coming up with a very sharp rise in agriculture exports of Egypt. Being exports as numerator of BOT, it has pleasant impact on BOT. A very high elasticity also demonstrates that a rising size of Egyptian partners' market size in term of population has very good impact on agriculture BOT due to rise in demand for food and other agriculture products in the partners' countries. In last, the exchange rate has a positive and statistically significant impact on BOT of Egyptian agriculture products. It is showing that a rising dollar price in terms of Egyptian local currency, depreciation, has a pleasant impact on BOT of agriculture goods in term of increasing agriculture exports and decreasing agriculture imports. This result is also showing an evidence for elastic behavior of exports and imports in our estimations. Depreciation is reducing the price of Egyptian agriculture exports in the international market. It is helping in increasing the demand and revenue for Egyptian exports which is an evidence for elastic exports demand. Further, elastic exports and imports demand are also showing the fulfillment of Marshal-Lerner condition in case of Egyptian agriculture trade. Resultantly, rising exports and falling imports are becoming the reason for increasing the BOT ratio with a depreciation of local Egyptian currency.

After the discussion of long run results of COMESA regional trade, the short run results are also presented in the Table 2. In the short run, only Egyptian GDP and ER are impacting the BOT and rest of variables are not impacting the BOT. The coefficient of GDPE is positive like in the long run. But, the negative coefficient of exchange rate is opposite to the long run results and carrying an important implication. A negative impact of ER on BOT trade is showing the rise in imports and fall in exports with depreciation. Rising import expenditures and falling export revenue are reducing the overall ratio of BOT and showing an opposite outcome of a depreciation policy in the short run. It is due to low elasticity of exports and imports in the short run. This short run result is also confirming the J-curve hypothesis. That is explaining a fact of worsening BOT with depreciation in the short run but this depreciation has been proved effective in improving the BOT in the long run results. In the long run, elasticity is increase and then depreciation policy works in right direction by increasing exports revenue and by decreasing imports expenditures and resultantly improve BOT in long run. Hence, these results and arguments are showing the existence of J-curve hypothesis in case of Egyptian agriculture trade with COMESA region.

5. CONCLUSION

The present study investigates the determinants of Egyptian agriculture BOT with COMESA trading partners by using bilateral trade data of a period 1990-2015. IPS unit root test has been applied to test the order of integration and PMG estimators have been used to find the long and short run determinants. IPS confirms a mix order of integration and cointegration has been verified by negative and significant coefficient of ECT in the PMG estimators. Further, signs of estimated coefficients are according to the theoretical justifications in the long run. Egyptian GDP and population are impacting negatively to the agriculture BOT.

The rising Egyptian market in terms of its size and demand has negative impact on BOT. On the other hand, COMESA trading partners' GDP and population has positive influence on the BOT. The depreciation of exchange rate is helping the BOT to be corrected in the long run. In short run, Egyptian GDP is again negatively influencing the agriculture BOT. The impact of depreciation of exchange rate is worsening the BOT in short run and it is improving the BOT in the long run results. Therefore, it is showing an evidence of H-curve hypothesis in our estimations. Therefore, this study recommends the Egyptian economy to adopt depreciation policy to improve agriculture BOT of COMESA region in the long run.

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