Regional Trade Agreement and Agricultural Trade in East African Community.

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Abstract

According to World Bank statistics, agricultural activities contribute about 33 per cent of the East African Community's Gross Domestic Product, and up to 80 per cent of the populace depends on agriculture directly and indirectly for food, employment and income, while about 40 million people in EAC suffer from hunger. Intra-EAC trade is very low, that is, at 9 per cent of the total regional trade, but it is on upward trend. Agricultural trade accounts for over 40 per cent of the intra-EAC trade. This study investigated the effect of EAC regional trade agreement on the regions agricultural trade by analyzing the degree of trade creation and diversion effects. Several Augmented gravity models were estimated using the Pseudo Poisson Maximum Likelihood (PPML) Approach. Panel data from UNCOMTRADE, International Financial Statistics and World Development Indicators for the period 2000 – 2012 on the five EAC members and other 77 trade partners were used. The empirical findings showed mixed results for the different EAC member states. EAC regionalism had no significant effect on agricultural exports of Burundi, Rwanda and Uganda, while Kenya and Tanzania had reported significant effect of regionalism on their agricultural exports. This study concluded that EAC regional trade agreement has a potential of promoting EAC regional agricultural trade.

Keywords: Regional Trade Agreement, Agricultural Trade, East African Community, Gravity Model, Pseudo Poisson Maximum Likelihood, Kenya, Uganda, Tanzania, Rwanda, Burundi

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1. Introduction

Regional integration has always been viewed as a major policy tool that a country can use to climb the ladder of industrialization and economic growth, and attain better social welfare for its citizens. This belief, beside other factors, has led to the rise of regional trade arrangements (RTAs) all over the world over the past few decades. According to World Trade Organization (2013), there are over 350 RTAs in force, some fully operational while others under ongoing negotiations. There are another over 200 notifications to form RTAs received by World Trade Organization (WTO).

Economic integration in the form of RTAs are known to advance the cause of trade liberalization and lead to freer markets by reducing or eliminating tariffs and some non-tariff trade barriers among member states, even though at the risk of diverting trade away from non-member states (Vollrath, 1998). Economic integrations also provide an alternative platform for agreement on contentious issues that hinder the multilateral trade negotiations of the WTO. RTAs, therefore, do have both positive and negative effects on trade depending on how they are designed and implemented. Furthermore, whether any individual RTA improves net welfare of society is an empirical issue. This is because any RTA may have trade creation and trade diversion effects, whichever dominates determines the net welfare effects.

However, agricultural products are rarely subjected to such rules of trade liberalization, especially in predominantly agricultural economies. This is because it is believed that full liberalization of trade in agricultural products may aggravate poverty and even lead to food insecurity. Full liberalization of agricultural products may lead to influx of such commodities in the domestic market, leading to low returns to local producers and discouraging local production. This may lead to overdependence on imported products, poor food security, increase poverty levels and adversely affect the economic growth of agricultural based economies. These factors have made liberalization of agricultural trade to move at a slower pace compared to liberalization in other commodities, Sawkut and Boopen (2009). EAC partner states agreed on commodities that require extra protection over imports from outside the region (EAC, 2010). These commodities include among others sugar, milk, wheat flour, maize, rice, palm oil and textile.

Formation of regional trade agreements has resulted in the rise of intra-regional trade volumes within the RTAs in general. The formation of NAFTA, for instance, led to increase in the intra-regional trade from less than 35 per cent in the late 1980s, to almost 50 per cent in 1999. Over the same period, trade among the MERCOSUR members doubled from 10 to 20 per cent. In Africa, the picture is mixed. The extent of regional integration among COMESA members has been relatively static over the past two decades. In contrast, the share of intra-regional trade has increased substantially for ECOWAS since the early 1980s, and for SADC since the late 1980s. Vinaye (2009).

The three East African Countries (Kenya, Uganda and Tanzania) have enjoyed a long history of economic integration: custom union between Kenya and Uganda in 1917, which was joined by the main land Tanzania in 1927; the East African High Commission (1948 – 1961); the East African Common Services Organization (1961 – 1964); and the East African Community (1967 – 1977). The three countries also had a common monetary system known as the East African Currency Board (EACB) that was established in 1919 to provide for and control currency supply.

However, the EACB ceased functioning in 1966 following the creation of the independent central banks by the three countries.

The demise of the earlier East African Community in 1977 was owing to perceived trade and industrial benefits imbalances created by the colonial era against Uganda and Tanzania, and in favour of Kenya. This led to the lesser developed members (Uganda and Tanzania) imposing tariffs on imports from a country with which they had trade deficit to protect their infant industries (Goldstein and Ndung'u, 2001). Other factors that contributed to the collapse of East African Community formed in 1967 included: divergent and conflicting political and economic ideology by the partner states; increasing animosity among the leaders of the EAC countries, especially following Idi Amin's forceful takeover of power in Uganda in 1971; worsening relationship between Uganda and Tanzania that resulted in to war between the two countries; and failure of the three Heads of State to meet anymore. Eventually the East African Community (EAC) was officially dissolved in 1983.

The EAC was, however, re-established in 1999 following successful negotiations and the signing of the treaty by the Heads of State of the three countries. Under the EAC treaty implemented officially in 2001, the first entry point to the community was the establishment of a customs union, then a common market, subsequently a monetary union and ultimately a political federation of the East African States. Rwanda and Burundi were officially admitted into EAC in July 2007.

Progress has been made in liberalizing trade among the member states by establishing a custom union. The East Africa Custom Union (EACU) commenced operations in 2005 following the signing of the protocol establishing it in 2004. As a way of addressing former trade imbalances that lead to the collapse of the old EAC, member countries resolved to apply the principle of asymmetry in the elimination of internal tariff, whereas the goods from Uganda and Tanzania were to enter Kenya duty-free, whereas the two countries were to impose a tariff at reducing rates on selected imports from Kenya for five years. The protocol establishing the East African Common Market was signed in 2009 and came into force on July 1, 2010. The establishment of the customs union and the common market has continued to pave way for free movement of goods and services, and labor within the region.

The intra-EAC trade remains low despite the fact that EAC member countries have over the years, since the revival of the custom union in 1999, put more efforts in coming up with policies and strategies to increase transaction and exchange among the member states. Intra-EAC trade averaged at about 9 per cent of the total trade of the region, compared to other RTAs such as EU (66 per cent), East Asia (55 per cent), NAFTA (44 per cent), ASEAN (27 per cent) and SADC (13 per cent). (See World Bank, 2009; Keane, Cali and Kenan, 2010 and Sally, 2010). As documented in EAC trade report 2008, the five EAC countries are forming both economic and political integration with the main objective of attaining sustainable and equitable growth and development, with the aim of improving the standards of living of the populace through increased competitiveness, value-added production, trade and investment (EAC, 2010).

The EAC partner countries ratified the Common Market Protocol, with the aim of increasing trade among member states. Other steps taken by EAC countries to promote trade among the members include: immediate elimination and gradual reduction of tariffs (asymmetrical

reduction of tariffs, which was to reach 0 per cent in January 2010); removal of tariff equivalent charges on internal trade; exemption of selected products; establishing and maintaining a Common External Tariff (CET); and elimination of all non-tariff barriers (NTBs), which was successfully implemented through establishment and operationalization of the National Monitoring Committees (NMCs) on NTBs in all partner states. The NTBs to be eliminated or reduced were categorized into the following eight clusters: custom documentation procedures; immigration procedures; cumbersome inspection requirements; police road blocks; varying trade regulations among the EAC countries; varying cumbersome and costly transiting procedures in the EAC countries, duplication of functions within agencies involved in custom activities; and business registration and licensing (EAC, 2010).

One of the main objectives of countries joining common RTAs is to promote trade amongst themselves. In Africa, leaders adopted regionalism during the post-colonial meetings in 1958 and 1960 as a strategy to navigate economic constraints imposed by smallness and fragmented national markets, (Vinaye, 2009). However, these RTAs have been found to have different effects on regional trade. Previous studies have shown that such movements do lead to trade creation, trade diversion, or both, (see Vollrath, 1998; Yang and Gupta, 2005; Grant and Lambert, 2005 and Moghaddasi, 2012).

It has been assumed that a RTA would be welfare improving since tariffs, which are in general welfare reducing, would fall. However, it has been empirically shown that RTAs would not necessarily improve welfare, since the tariff reductions occur in a world of the "second best", Viner (1950). Thus, a RTA would be beneficial if on balance it is "trade creating" and harmful if it is "trade diverting". In general, trade creation means that a regional trade agreement generates trade that would not have existed otherwise. As a result, supply occurs from a more efficient producer of the product. In all cases, trade creation would raise a country's national welfare, while trade diversion would reduce national welfare. This study therefore investigates the effects of EAC-TRA on the region's agricultural trade.

In the face of the above background, the objective of this study is to investigate the effect of regional trade agreement, that is, the EAC, on the region's agricultural exports. The study investigated if membership to EAC create or divert the members' agricultural exports. The study specified and estimated gravity equations involving agricultural exports of each member state to other selected 77 trading partners across the globe, the GDP of the exporter and importers, population of the exporter and importers, exchange rates, distance between capital cities, common language dummy, adjacency dummy and a dummy for EAC membership. The empirical findings showed mixed results for the different EAC member states. EAC regionalism had no significant effect on agricultural exports of Burundi, Rwanda and Uganda, while Kenya and Tanzania had reported significant effect of regionalism on their agricultural exports.

The remainder of this study is organized as follows. Section 2 reviews the empirical literature on regional trade agreement and trade, section 3 provides the methodology adopted in the study, while the study findings and policy implications are presented and discussed in section 4.

2. Empirical Literature

Vollrath (1998) assessed agricultural trade in six RTAs, including AFTA, APEC, ANZCER, CUSTA, MERCOSUR and the EU, using data for 1953-1959 and 1959-1970. The study showed that both APEC and AFTA had neither positive nor negative effect on agricultural trade flows. On the other hand, ANZCER, CUSTA and MERCOSUR were found to be more trade creating than diverting, welfare improving and helped in opening up the member-countries to the world agricultural economy. And EU was found to be more agricultural trade diverting than creating, hence, welfare reducing. However, Vollrath's work fell short of describing the estimation technique employed in the study to arrive at the econometric results discussed.

Grant and Lambert (2005) adopted the augmented gravity framework to analyze the effect of regionalism on the volume of agricultural trade. Using a sample of nine (9) agricultural goods in eight (8) RTAs across the world involving 87 countries, they estimated pooled, cross section and time series regressions on the augmented gravity equation for the period between 1985 and 2002. A total of 11 regressions were run, 9 for each individual agricultural product, 1 for all agricultural products and 1 for all non-agricultural products. Out of the 8 RTAs, 3 were in sub-Saharan Africa (that is, SACU, SADC and COMESA) and referred to as 'Africa' in the study. They found that in 'Africa', 4 of the 9 commodities experienced trade diversion from non-member sources. However, the effects were found to be generally small and in all cases trade diversion did not outweigh trade creation. On the other hand, NAFTA and EU showed significant trade creation effects in 8 and 6 individual agricultural products, respectively.

Grant and Lambert's work, despite its intellectual appeal, is fraught with several methodological problems, which significantly reduce its value (Vinaye, 2009). First, the choice of RTAs was rather limited, and the idea of grouping the three African RTAs was objectionable, since they were at different levels of integration. Second, the estimation method used was not clear. Although the gravity equations were estimated using panel data, no panel data techniques were employed. The use of the Ordinary Least Squares method could lead to biased estimates to the extent that zero trade values are ignored from the effective sample. However, as recent developments in the estimation of gravity equations suggest, even the use of Tobit is subject to the criticism that they result in inconsistent estimates.

Vinaye (2009) examined the intra-SADC's agricultural trade using panel data set of 68 exporting and 222 importing countries (both SADC members and non-member trading partners) for the period 2000 – 2007. Vinaye computed several trade indices and estimated the gravity equation using Pseudo Poisson Maximum Likelihood (PPML) technique. The study revealed limited trade complementarity among SADC economies, which implied low potential for intra-regional agricultural trade. This methodology was a significant deviation from the norm where researchers would transform the gravity equation into logarithm form and apply the usual estimation techniques such as OLS or Tobit. Silva and Tenreyro (2006) argued that the use of OLS or Tobit in estimating gravity model would constitute a misuse of Jensen's inequality, that is, log-linearizing economic relationships in the presence of heteroskedasticity in the data could lead to biased and inconsistent estimates. They suggested the use of PPML technique as an alternative estimation procedure, which would maintain the gravity equation in its multiplicative form and still yield consistent estimates.

Moghaddasi (2012) studied the relationship between regionalism and Iran's export of processed agricultural products. Iran is a member of Economic Cooperation Organization (ECO) together with nine (9) other countries. Using generalized gravity model, the study employed panel and pooled data techniques, that is, OLS estimator, one-way Fixed Effects Model (FEM) and one-way Random Effects Model (REM). The results revealed a positive and significant impact of the regionalism on the Iran's agricultural exports. However, the methodology adopted in this study has been criticized in its ability to give consistent and efficient results in cases where zero trade is reported between the trading partners. The study also does not evaluate the causes of agricultural trade among the ECO member states.

3. Methodology

Based on the theory of the consumer behaviour, the study used the gravity model developed by Tinbergen (1962) and later augmented by Anderson (1979), and Anderson and Wincoop (2003). Anderson (1979) presented a theoretical foundation for the gravity model based on the constant elasticity of substitution (CES) preferences and goods differentiated by place (country or region) of origin. Two key assumptions in the theoretical derivation of the gravity model include: goods are differentiated by place of origin, and identical and homothetic preferences approximated by a CES utility function.

If c_{ij} denotes the consumptions of residents of country j (importer) of goods from country i (exporter), then the consumers in country j maximize utility given as

$$U_j = \left[\beta_i^{(1-\sigma)/\sigma} c_{ij}^{(\sigma-1)/\sigma}\right]^{\sigma/(\sigma-1)} \quad \text{.....(1)}$$

Subject to the budget constraint

$$\sum_j p_{ij} c_{ij} = y_j \quad \text{.....(2)}$$

where σ is elasticity of substitution between all goods, β_i is a positive distribution parameter, y_j is the nominal income of country j's residents and p_{ij} is the price of country i's goods to country j's consumers.

Due to trade costs, which are not observable, prices differ in the countries. If p_i is the exporter's supply price and t_{ij} is trade cost factor between i and j, then $p_{ij} = p_i t_{ij}$. The assumption is that the exporter bears the trade costs. For each good shipped from i to j, the exporter incurs export cost equal to $(t_{ij} - 1)$ of country i goods. These trade costs are passed on to the importer in form of higher prices. The nominal value of i's exports is $x_{ij} = p_{ij} c_{ij}$

The total income of country i now become $y_i = \sum_i x_{ij}$, and $x_{ij} = p_{ij} c_{ij}$

Demand for country i's exports by country j's consumers that satisfy the optimization problem in equations (1) and (2) above is

$$x_{ij} = \left[\frac{\beta_i p_i t_{ij}}{P_j}\right]^{(1-\sigma)} y_j \quad \text{.....(3)}$$

Equation (3) is a Marshallian demand function. Demand for imported goods is directly proportional to consumers' income and inversely proportional to price. where P_j is the consumer price index of country j given by

$$P_j = \left[\sum_i (\beta_i p_i t_{ij})^{1-\sigma} \right]^{1/(1-\sigma)} \quad \text{.....(4)}$$

The general equilibrium structure of the model imposes market clearing condition, which implies that

$$y_i = \sum_j x_{ij}$$

That is;

$$y_i = \sum_j x_{ij} = \sum_j (\beta_i t_{ij} p_i / P_j)^{1-\sigma} y_j = (\beta_i p_i)^{1-\sigma} \sum_j (t_{ij} / P_j)^{1-\sigma} y_j \text{.....(5)}$$

To derive the gravity equation, the study follows Anderson (1979) and Deardorff (1998), by using the market clearing condition in equation (5) above to solve for the coefficients β_i while imposing the choice of units such that all supply prices p_i were equal to one (the equilibrium scaled prices, $\beta_i p_i$), and then substituting into the import demand equation (3).

Let the world nominal income be y^w, such that

$$y^w \equiv \sum_j y_j$$

And the income shares be θ_j, such that;

$$\theta_j \equiv y_j / y^w$$

Then the technique gives;

$$x_{ij} = \frac{y_i y_j}{y^w} \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \quad \text{.....(6)}$$

where $\Pi \equiv \left(\sum_i (t_{ij} / P_j)^{1-\sigma} \theta_j \right)^{1/(1-\sigma)}$ .....(7)

Substituting the equilibrium scaled prices into equation (4), gives

$$P_j = \left(\sum_i (t_{ij} / \Pi_i)^{1-\sigma} \theta_j \right)^{1/(1-\sigma)} \quad \text{.....(8)}$$

Solving equations (7) and (8) together for all π_i's and P_i's in terms of income shares, bilateral trade barriers and σ, and assuming that trade barriers (trade costs factor) are symmetric (that is, $t_{ij}=t_{ji}$), then a solution to (7) and (3.8) is $\pi_i=P_i$, with

$$P_j^{1-\sigma} = \sum_i P_i^{\sigma-1} \theta_i t_{ij}^{1-\sigma} \text{.....(9)}$$

This gives an implicit solution to the price indices as a function of all bilateral trade barriers and income shares. The gravity equation, therefore, becomes

$$x_{ij} = \frac{y_i y_j}{y^w}\left(\frac{t_{ij}}{P_i P_j}\right)^{1-\sigma} \quad \text{.....(10)}$$

The price indices are referred to as 'multilateral resistance' variables, since they depend on all the bilateral resistances t_{ij}. Increase in trade barriers raises the index. The gravity equation above, therefore, tells us that bilateral trade depends on the economic sizes of the trading partners (measured by the proportion of their income to world's income) as attracting forces and the resistance factors (bilateral trade barriers) in form of trade costs that can be measured by various trade obstacles such as the distance between trading partners and lack of common currency. Equation (10) can therefore be expressed as;

$$EXP_{ij} = f(GDP_i, GDP_j, TC_{ij}) \text{.....(11)}$$

Where EXP_{ij} is the exports from country i to country j; or total trade, GDP is the measure of economic size and TC is trade costs (which captures various resistance factors; distance, language barrier, among others).

The standard gravity equation given in equation (11) tends to ignore many other variables that could have either positive or negative impact on trade volumes between the trading partners, which results to misspecification bias (Vinaye, 2009). To address this problem, the standard approach has been to specify an augmented gravity model by addition of relevant variables to the traditional model, most of which are inspired by theory and motivated by various testable hypotheses (Vinaye 2009). Most estimates of GM add a certain number of dummy variables to the original gravity equation that test for specific effects. These refer sharing of a common land border and commonality of language, among others. With inclusion of dummy variables of trade agreements, GM has broader implications in terms of the trade creation and trade diversion, which may have influence on the extent of IIT within the region. However, necessary caution must be taken since too many dummies may cause the problem of dummy trap in the data analysis. Equation (11) can therefore be re-written as

$$EXP_{ij} = f(GDP_i, GDP_j, POP_i, POP_j, EXRT_{ij}, DIS_{ij}, CL_{ij}, AD_{ij}) \text{.....(12)}$$

Where:

EXP - is the real value of the total annual exports of agricultural products of the exporting country to the trade partner.

GDP - is the annual real GPD of a country measured in constant 2000 US dollars. GDP_i is the real GDP of the exporting country while GDP_j is the real GDP of the importing country.

POP - is the population of the country. POP_i is the population of the exporting country while POP_j is the population of the importing country.

EXRT - is the real exchange rate between the currency of the exporting country and that of the importing country

DIS - is the geographical distance between the economic centres (in most cases the capital cities) of two trading partners

CL - is a dummy representing common national language between trading partners

AD - is a dummy representing common border between trading partners.

This study specified GM with several variables based on theory and literature reviewed, as in equation (13)

$$EXP_{ijt} = \alpha_0 GDP_i^{\alpha_1} GDP_j^{\alpha_2} POP_i^{\alpha_3} POP_j^{\alpha_4} EXRT_{ij}^{\alpha_5} DIS_{ij}^{\alpha_6} CL_{ij}^{\alpha_7} AD_{ij}^{\alpha_8} \varepsilon_{ij} \text{.....(13)}$$

Transforming equation (13) into log-linearized form and taking into account the time series, then

$$LogEXP_{ijt} = \alpha_0 + \alpha_1 LogGDP_{it} + \alpha_2 LogGDP_{jt} + \alpha_3 LogPOP_{it} + \alpha_4 LogPOP_{jt}$$

$$+ \alpha_5 LogEXRT_{ijt} + \alpha_6 LogDIS_{ij} + \alpha_7 CL_{ij} + \alpha_8 AD_{ij} + \varepsilon_{ijt} \text{.....(14)}$$

where: *i* represents the exporter country; *j* represents the importer country; *t* represents the year*;* EXP_{ijt} represents the value of bilateral agricultural export from country *i* to country *j* in year t; GDP_{it} is the GDP level of the exporter country in year *t*; GDP_{jt} is the GDP level of the importer country in year *t*; POP_i is the population level of the exporter country in year *t*; POP_j is the population level of the importer country in year *t*; DIS_{ij} is the distance between the exporter and importer; CL_{ij} is the dummy for common language (taking value of 1 for common language, and 0 otherwise); AD_{ij} is a dummy representing adjacency between any pair of trading partners (taking value of 1 for common border, and 0 otherwise); and ε_{ijt} is an error term.

Pseudo Poisson Maximum Likelihood (PPML) methodology involves writing the conditional expectations of exports in the stochastic equation (14), hence giving equation (15) as follows;

$$E\left[EXP_{ijt} \mid \Omega_{ijt} \right] = \exp\left[Log\alpha_0 + \alpha_1 LogGDP_{it} + \alpha_2 LogGDP_{jt} + \alpha_3 LogPOP_{it} + \right.$$

$$\left. \alpha_4 LogPOP_{jt} + \alpha_5 LogEXRT_{ijt} + \alpha_6 LogDIS_{ij} + \alpha_7 CL_{ij} + \alpha_8 AD_{ij} \right] \text{.....(15)}$$

Where it is assumed that $E[\varepsilon_{ij} \mid \Omega_{ij}] = 1$ and Ω_{ij} is the vector of explanatory variables. Assuming that each observation in equation (15) is associated with an error term $\eta_{ijt} = EXP_{ijt} - E[EXP_{ijt} \mid \Omega_{ijt}]$, the augmented gravity equation becomes;

$$EXP_{ijt} = \exp\left[Log\alpha_0 + \alpha_1 LogGDP_{it} + \alpha_2 LogGDP_{jt} + \alpha_3 LogPOP_{it} + \alpha_4 LogPOP_{jt} \right.$$

$$\left. + \alpha_5 LogEXRT_{ijt} + \alpha_6 LogDIS_{ij} + \alpha_7 CL_{ij} + \alpha_8 AD_{ij} \right] + \eta_{ijt} \text{.....(16)}$$

where $EXP_{ijt} > 0$ and $E[\eta_{ijt} \mid EXP_{ijt}] = 0$.

Equation (16) was estimated using the PPML technique to analyze the causes of intra-EAC exports, after carrying out all the necessary diagnosis tests.

To evaluate trade creation and/or trade diversion effects of the EAC regional trade agreement, a variable for membership to the EAC was added to equation (16) to get equation (17).

$$EXP_{ijt} = \exp\left[Log\alpha_0 + \alpha_1 LogGDP_{it} + \alpha_2 LogGDP_{jt} + \alpha_3 LogPOP_{it} + \right.$$

$$\alpha_4 LogPOP_{jt} + \alpha_5 LogEXRT_{ijt} + \alpha_6 LogDIS_{ij} + \alpha_7 CL_{ij} + \alpha_8 AD_{ij} +$$

$$\left. \alpha_9 EAC_{ijt} \right] + \eta_{ijt} \text{.....(17)}$$

Where EAC_{ijt} is a dummy variable indicating the existence of EAC-RTA between countries i and j. Following Sawkut and Boopen (2009), equation (17) can be modified to capture more precisely the impact of the EAC-RTA on trade. To capture the degree of trade creation and trade diversion effects of EAC-RTA, the study employed two EAC dummies rather than one, that is, $EAC1_{ijt}$ and $EAC2_{ijt}$ to capture trade creation effects and trade diversion effects, respectively. Equation (17) can now be re-written as;

$$EXP_{ijt} = \exp\left[Log\alpha_0 + \alpha_1 LogGDP_{it} + \alpha_2 LogGDP_{jt} + \alpha_3 LogPOP_{it} + \right.$$

$$\alpha_4 LogPOP_{jt} + \alpha_5 LogEXRT_{ijt} + \alpha_6 LogDIS_{ij} + \alpha_7 CL_{ij} + \alpha_8 AD_{ij} +$$

$$\left. \alpha_9 EAC1_{ijt} + \alpha_{10} EAC2_{ijt} \right] + \eta_{ijt} \text{.....(18)}$$

Where: $EAC1_{ijt}$ is a binary variable which is unitary if both i and j belong to the EAC regional trade agreement and zero otherwise, (degree of trade creation effects). $EAC2_{ijt}$ is a binary variable which is unitary if i belongs to EAC regional trade agreement and j does not or vice versa, and zero otherwise (degree of trade diversion effects). Using data from the five (5) EAC members and the other 77 trading partners, equation (18) was estimated using the PPML technique. Whether to employ PPML technique under fixed effects or random effects, the Hausman test was performed and random effects model (REM) was estimated. The 77 trading partners were selected on the basis of data availability. Only countries that recorded consistent agricultural trade with the EAC members over the period of the study were selected. The list of all the 82 countries under the study is provided in the appendices. The study employed secondary data retrieved from publications on EAC countries and their trading partners for the period 2000-

2012. Specific data sources included UNCOMTRADE online database, International Financial Statistics (IFS) CD-ROM, World Development Indicators (WDI).

The gravity equation can be estimated through various econometric estimation techniques such as; OLS, GMM, MLE, and the latest approach, the PPML. The main challenges of applying OLS and GMM in estimation of the gravity model is how to deal with zero trade values reported, and how to isolate the effects of regionalism from the effects of other factors on the intra-regional trade. This is due to the fact that estimation using these techniques requires transformation of the gravity equation into a log–linearized form, yet the logarithm of zero is undefined, leading to biased and inconsistent results. PPML approach is superior due to its ability to maintain the gravity equation in its multiplicative form hence resulting in unbiased and consistent results. Additionally, PPML estimation technique is superior in estimation of gravity model of trade and give reliable and robust results, despite the common characteristic of bilateral trade where some data may be zero in some periods.

4. Results, Discussion and Policy Implications

The study used a panel data involving the five EAC countries and other 77 trading partners, and estimated panel Poisson gravity equations under random effects using the Pseudo Poisson Maximum Likelihood (PPML) technique. The panel root test was performed to investigate if there was any variable that was non-stationary. The presence of unit root in any variable may lead to spurious regression where the regression results may be misleading. The Im-Peseran-Shin panel unit-root test developed by Im, Pesaran and Shin (1997) was adopted in this study.

The Im-Pesaran-Shim (IPS) test is based on the famous Dickey-Fuller test and it involves testing for the presence of unit roots in panels that combines information from the time series dimension with that from the cross section dimension, such that fewer time observations are required for the test to have power. IPS test is therefore superior to Augmented Dickey Fuller (ADF) test and other unit root test techniques in analyzing long-run relationships in panel data with fewer time observations (Im, Pesaran and Shin - IPS 1997). The test allows for individual effects, common time effects and time trends. The Im-Pesaran-Shin panel unit root test hypotheses are as follows:Ho: All panels contain unit root; Ha: Some panels are stationary. The results of the unit-root test for all the panels are presented in Table 1.

The results of unit root tests showed the rejection of null hypothesis at one per cent level of significance for exports (which was the dependent variable in the study) at levels for all the five exporters. On the contrary, all other variables were non-stationary at levels, implying the presence of unit root. However, all variables, except the population of the importer, became stationary at 1% level of significance upon first differencing. This implies that the dependent variable is integrated of order zero, I(0), while the independent variables are integrated of order one, I(1). Based on these findings, augmented gravity equations were specified with the dependent variable (Agricultural Exports), the dummies and distance at levels, while the other independent variables (GDP, Population, Exchange rate) at first difference using the PPML technique. However, population of the importers was dropped from all the equations because of failing to be stationary even after first differencing and de-trending, and also being highly collinear with the GDP of the importer.

Table 1: Results for unit-root test (Im-Pesaran-Shin panel unit-root test)

Exporter	Variable	t-bar statistic		
		Levels	**First Difference**	**Levels with time trend**
Kenya	Log Exports	-1.9052***	-4.2410***	-3.2065***
	Log GDP Exporter	0.4977	-1.9695***	-1.8627***
	Log GDP Importer	-0.4387	-2.4146***	-1.6340
	Log Population Exporter	-0.1985	-2.2990***	-1.1934
	Log Population Importer	-1.8430	-3.0190	-3.5130
	Log Exchange Rate	-3.2725	-4.3879***	-3.5050
Uganda	Log Exports	-2.4292***	-4.8217***	-3.1965***
	Log GDP Exporter	-0.8223	-2.2867***	-0.9318
	Log GDP Importer	-0.7194	-2.7091***	-1.7288
	Log Population Exporter	0.2301	-3.9864***	-2.0202***
	Log Population Importer	-0.8071	-2.1557**	-1.9534
	Log Exchange Rate	-1.1276	-3.1595***	-1.9663
Tanzania	Log Exports	-1.8820***	-4.0893***	-2.6512***
	Log GDP Exporter	-0.3377	-4.0648***	-1.5427**
	Log GDP Importer	-0.6841	-2.7112***	-1.7507
	Log Population Exporter	13.5235	-2.4425***	-4.0569
	Log Population Importer	-2.2635	-2.0045	-2.0797
	Log Exchange Rate	-1.4324	-3.0027***	-2.0978***
Rwanda	Log Exports	-2.3150***	-4.0252***	-2.7248***
	Log GDP Exporter	-0.2019	-5.0295***	-2.9567***
	Log GDP Importer	-0.8590	-2.7095***	-1.5656
	Log Population Exporter	2.7140	-1.0619**	-0.7786
	Log Population Importer	1.5326	-1.8489	-1.6386
	Log Exchange Rate	-1.7720	-2.2603***	-1.6466
Burundi	Log Exports	-2.5195***	-3.3583***	-2.1447
	Log GDP Exporter	0.9861	-4.5261***	-1.9115***
	Log GDP Importer	-0.5918	-3.0774***	-2.0289
	Log Population Exporter	2.1113	-6.2177***	-7.1182***
	Log Population Importer	0.8516	-2.4563**	-2.1147
	Log Exchange Rate	-2.1769	-3.1000***	-2.8437**

***,** and * denotes rejection of the null hypothesis at 1%, 5% and 10% levels of significant.
Source: Study Data (2015)

Hausman test helps in determining which between random effect moydel (REM) and fixed effects model (FEM) is the most appropriate for the study data. Hausman (1978) suggested a test for correlation between the unobserved effect (the country-specific effect) and the explanatory variables as comparison between the fixed effect and random effect estimates, assuming that the idiosyncratic errors and explanatory variables are uncorrelated across all time periods. REM assumes that there are random/probabilistic variations across the panel, while FEM assumes individual heterogeneity.

The results of Hausman test presented in Table 2 in the appendices reject the null hypothesis of "no systematic difference in random and fixed effects coefficients" for all the data sets. The test

results show that Chi-square statistics and the corresponding p-values for the difference between FEM and REM were 2.20 (0.9005), 2.92 (0.6110), 2.65 (0.8310), 2.86 (0.7216) and 8.66 (0.1235) for Kenya, Tanzania, Uganda, Rwanda and Burundi, respectively. All the p-values were larger than the critical values of 0.01 (at one per cent), 0.05 (at five per cent) and 0.1 (at 10 per cent) implying that the REM is most suitable for the study data.

The regression results (see Table 3) show that membership to EAC regional trade agreement has different effects on the region's agricultural exports across the member states. The integration trade diversion effects were evident in case of Rwanda exports. However, the effects were found to be statistically insignificant at all levels. Results from all the other countries show effects of trade creation, with that of Uganda and Burundi being statistically insignificant, while the coefficients of EAC1 (trade creation dummy) was found to be highly significant at one per cent level of significance and with the right positive sign for both Kenya and Tanzania.

This implies that Kenya and Tanzania, on average, tend to export more agricultural products to the EAC region as a result of the regional trade agreement. More specifically, the results show that there is a 14.3 percentage effect on Kenyan agricultural exports to EAC as a result of being a member of the RTA, while Tanzania realized 20.5 percentage effect on its agricultural exports to EAC as a result of being a member of the RTA. This implies that the most open countries tend to benefit more from regionalization compared to less open economies. According to World Bank's trade tariff restrictiveness index (TTRI) that gauges openness, Tanzania is the most open country in EAC at 7.8, followed by Kenya at 8.2, while Rwanda is the least open country in EAC at 16.2 (Society for International Development, 2011). Additionally, the failure of Rwanda and Burundi to realize any significant effect of regionalism on their agricultural exports may be due to the fact that the two countries joined the block late (that is, in July 2007) and could have taken time to implement EAC policies that could have had significant effect.

The results further indicate that EAC integration has not been effective in promoting agricultural exports from Uganda, Rwanda and Burundi to the region, as the coefficients are all insignificant statistically. This implies that EAC as a regional agreement has very limited potential to increase or expand intra-EAC agricultural trade. This probably may be due to the fact that most countries in the region can only meet a small share of the region's import demands. Based on similar results, Yung and Gupta (2005) suggested that policies aimed at boosting African trade on short to medium term must focus on promoting trade with the rest of the world, rather than within African RTAs.

These findings are in agreement with the findings of other studies on effects of regionalism on trade. As much as it may be expected that regionalism promotes trade, this may not necessarily be the case. Elbadawi (1997) found that African RTAs increased intra-regional trade by 31% on average without causing trade diversion for the period 1980-1984, but thereafter, substantial trade diversion and decrease in both intra-regional and overall trade was reported. Vollrath (1998) found that APEC and AFTA had no effect at all on the regional agricultural trade flows. ANZCER, CUSTA and MERCOSOR were more trade creating than diverting, while EU was more trade diverting than creating. Additionally, Moghaddasi (2012) found ECO to have a positive and significant effect on Iran's agricultural exports to the other nine ECO members.

This study therefore recommends that EAC secretariat and the respective governments in EAC member countries should implement strategies that enhance regional integration among the member states. This is because the results show that membership to EAC has significant effect on agricultural trade volumes in Kenya and Tanzania. Kenyan and Tanzanian governments should come up with incentives that would encourage the other three state members to remain in the integration and promote regionalism. Such policies may include but not limited to adhering to EAC's liberalization and harmonization schedules, reduction or elimination of import duties on commodities, lowering or liberalizing import requirements and procedures.

On the other hand, Uganda, Rwanda and Burundi, which are yet to benefit from the integration in terms of agricultural exports, should also implement strategies that would enhance regional integration. This is because empirical results show that integration is likely to promote agricultural exports of member states, as in the case of Kenya and Tanzania. These policies should include reduction and/or elimination of non-tariff barriers (NTBs).

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APPENDICES

Table 1A

1	Afghanistan	22	Eritrea	43	Madagascar	64	Singapore
2	Algeria	23	Finland	44	Malawi	65	South Africa
3	Angola	24	Fomer Sudan	45	Malaysia	66	Spain
4	Australia	25	France	46	Malta	67	Sri Lanka
5	Austria	26	Germany	47	Mauritius	68	Swaziland
6	Bahrain	27	Ghana	48	Morocco	69	Sweden
7	Belgium	28	Greece	49	Mozambique	70	Switzerland
8	Benin	29	Hong Kong SAR	50	Netherlands	71	Tanzania
9	Botswana	30	Hungary	51	New Zealand	72	Thailand
10	Brazil	31	India	52	Nigeria	73	Turkey
11	Bulgaria	32	Indonesia	53	Norway	74	UAE
12	Burundi	33	Iran	54	Oman	75	Uganda
13	Canada	34	Ireland	55	Pakistan	76	UK
14	Chile	35	Israel	56	Poland	77	Ukraine
15	China	36	Italy	57	Portugal	78	USA
16	Comoros	37	Japan	58	Republic Korea	79	Vietnam
17	Cyprus	38	Jordan	59	Russian Federation	80	Yemen
18	Denmark	39	Kenya	60	Rwanda	81	Zambia
19	Djibouti	40	Korea	61	Saudi Arabia	82	Zimbabwe
20	DRC	41	Kuwait	62	Senegal		
21	Egypt	42	Kyrgyzstan	63	Seychelles		

Table 2: Hausman test results for FEM and REM (Dependent Variable: Log of Exports)

	KENYA			TANZANIA			UGANDA			RWANDA			BURUNDI		
	FEM	**REM**	**DIFF.**	**FEM**	**REM**	**DIFF.**	**FEM**	**REM**	**DIFF.**	**FEM**	**REM**	**DIFF.**	**FEM**	**REM**	**DIFF.**
Log GDP Exporter	4.22***	4.20***	0.02	2.74	2.54	0.20	1.10	3.13	-2.03	4.00	5.92	-1.92	-24.37***	-21.27***	-3.11
Log GDP importer	0.56	0.61***	-0.05	0.51	0.94***	-0.44	2.91**	1.17***	1.74	1.13	-0.37	1.49	-3.72	0.29	-4.01
Log POP Exporter	-2.72	-2.51	-0.21	-3.61	-2.58	-1.034	-2.42	-3.59	1.16	-8.97	-7.62	-1.35	27.22***	21.39***	5.84
Log POP Importer	0.40	0.09	0.31	1.66	-0.03	1.69	-1.75*	-0.64**	-1.11	13.12	0.40	12.72	2.97	-0.59	3.55
Log Exchange Rate	-0.07	-0.03	-0.04	0.32	0.10	0.22	-0.25	-0.11	-0.14	0.80	-0.08	0.87	-1.04**	-0.38	-0.67
Log Distance	-0.34**	-1.49***	1.15	Omitted	-1.60**	-	Omitted	-1.70*	-	Omitted	-0.76	-	Omitted	0.18	-
Common Language	Omitted	-0.69**	-	Omitted	2.09***	-	Omitted	Omitted	-	Omitted	Omitted	-	Omitted	0.30	-
Adjacency	Omitted	-0.64	-	-0.94***	1.37	-2.31	Omitted	2.90*	-	Omitted	-3.08**	-	Omitted	-0.91	-
EAC1	0.53***	0.50***	0.02	0.06***	0.16	-0.10	Omitted	-0.45	-	-2.27**	-0.68	-1.58	Omitted	0.57	-
EAC 2	Omitted	Omitted	-	Omitted	Omitted	-	Omitted	Omitted	-	Omitted	Omitted	-	-1.16***	Omitted	-
Constant	15.54	25.36		13.61	30.45		22.39	42.95		-49.37	58.67		-170.57***	-129.23***	
No. of Observation	770	770		793	793		481	481		156	156		182	182	
R-Squared: Within	0.262	0.260		0.183	0.170		0.287	0.267		0.200	0.152		0.116	0.087	
Between	0.219	0.385		0.158	0.517		0.000	0.276		0.071	0.432		0.000	0.011	
Overall	0.218	0.362		0.133	0.419		0.001	0.266		0.018	0.245		0.000	0.001	
F-statistics	-			-			7.76			28.71			8.68		
Prob>F	-			-			0.000			0.000			0.001		
Chi-square statistics		895.18	2.20		146.29	2.92		53.96	2.65		100.500	2.86		71.95	8.66
Prob>Chi-square		0.0000	0.9005		0.0000	0.611		0.0000	0.8310		0.0009	0.7216		0.0000	0.1235

***, ** and * denote statistical significance at 1, 5 and 10 percent levels, respectively. Source: Study Data (2015)

Table 3: Regression Results by Countries (Dependent Variable: Log of Exports)

	KENYA		TANZANIA		UGANDA		RWANDA		BURUNDI	
	Coefficient	P-values	Coefficient	P-values	Coefficient	P-values	Coefficient	P-values	Coefficient	P-values
Log GDP Exporter	1.543***	0.002	3.107	0.176	0.004	0.996	-4.413***	0.002	-0.626	0.649
Log GDP importer	-0.085	0.393	-1.119***	0.003	-1.812***	0.000	3.827***	0.002	-0.174	0.898
Log POP Exporter	-57.891	0.347	31.706***	0.000	47.203	0.274	20.753***	0.007	12.813	0.244
Log Exchange Rate	0.025*	0.074	0.021	0.720	0.059	0.273	-0.055	0.877	-0.043	0.714
Log Distance	0.018	0.229	0.169***	0.000	-0.001	0.988	-0.160***	0.000	-0.048	0.114
Common Language	-0.063*	0.055	0.108***	0.000	Dropped		Dropped		0.014	0.801
Adjacency	0.221***	0.000	0.347***	0.000	0.263***	0.000	-0.376***	0.000	-0.119*	0.089
EAC1	0.143***	0.000	0.205***	0.000	0.050	0.346	-0.119	0.237	0.024	0.728
Constant	3.423**	0.040	-0.547*	0.063	0.537	0.710	2.990***	0.000	1.873***	0.000
No. of Observations	700		732		444		143		168	
Pseudo R^2	0.082		0.181		0.166		0.211		0.031	
Pseudo log-likelihood	-1564.938		-1665.405		-988.745		-329.288		-385.343	

***, ** and * denote statistical significance at one, five and 10 per cent levels, respectively.