ECONOMIC INTEGRATION ARRANGEMENTS AND STRUCTURE OF INTRA-AFRICAN TRADE

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ABSTRACT

African countries have pursued economic integration arrangements (EIAs) to facilitate production and expand manufactured goods trade among members. However, existing studies have only paid attention to EIAs and aggregate intra-trade despite the disproportionate volume of intra-agriculture and intra-manufacture goods trade in the various EIAs. This study, therefore, examined the effect of EIAs on the structure of intra-African trade by considering the intra-agriculture and intra-manufacture goods trade in 47 African countries classified into four EIAs – Economic Community of West African States (ECOWAS), Southern African Development Community (SADC), East African Community (EAC) and Economic Community of Central African States (ECCAS) – for the period 2001 to 2018. The study estimated a modified gravity model using the negative binomial pseudo-maximum likelihood technique. Specifically, the formation of SADC and ECOWAS significantly promoted aggregate intra-trade among their members. However, while formation on EIAs was found to significantly increase intra-agriculture goods trade in SADC and ECOWAS, there was no statistical evidence that EIAs create intra-manufacturing goods trade. The formation of ECCAS and EAC was not statistically significant in boosting aggregate intra-trade among their members, however, it enhanced intra-agriculture and intra-manufacture goods trade among its members, but the effect was statistically

insignificant. Hence, there is the need to transform the agricultural sector to deepen intra-trade and the manufacturing industry's development to increase manufacturing goods trade.

Keywords: Economic integration arrangements, Intra-African trade, Gravity model, Negative binomial pseudo-maximum likelihood

JEL classification: F14, F15, O55

1. Overview

For over fifty years, the role of economic integration arrangements (EIAs) in developing economies has remained a topical issue. On the one hand, authors such as Viner (1950), Deme (1995), Oyejide, (1997), Coulibaly (2007), Carrere (2004), Kawai and Wignaraja (2009), Caporale, Robert and Sova (2009) assert that EIAs result in the transformation of the primary sector and the subsequent increase in manufactured goods production due to economies of scale and a large market which facilitates production and expands manufactured trade among member countries. On the other hand, Schiff and Winters (2003), Venables (2003), Shams (2003), Sharma and Chua (2000), Wonnacott and Lutz (1989), and Rahul, Sadhana and Gail (2013) point out that EIAs may have a minimal or adverse impact on intra-trade. Despite these arguments, to increase intra-trade and achieve self-sufficiency among members, governments and policymakers in Africa pursued EIAs in the 1970s, and as of 2015, there were about 14 EIAs. Despite the proliferation in the number of EIAs, the average share of intra-trade (import plus export/world trade) among the EIAs in Africa was abysmally low (0.14%), much less than the average share of intra-trade of 0.56 per cent among members of various EIAs in Europe, America and Asia (WITS 2019). Besides, between 2001 and 2018, the average share of intra-manufacture goods trade stood at 39 per cent compared to the average share of intra-agriculture goods trade that was 71 per cent.

There are a plethora of studies on the impact of EIA on aggregate intra-trade (Johnson, 1995; Lyakurwa et al., 1997; Oyejide, 1997; Gunning, 2001; Yang and Gupta, 2005; Chacha, 2008; Baier and Bergstrand 2007; Caporale et al., 2009; Afesorgbor, and van Bergeijk 2011, Rahul, Sadhana and Gail 2013, Arnaud, 2014; Musah and Magai, 2019). Similarly, studies abound on the aggregate welfare effect of EIAs (Viner, 1950; Aitken 1973; Musila 2005;

Negasi, 2009; Ekanayake, Mukherjee and Veeramacheneni, 2010; Deme and Ndrianasy, 2016; Ngepah and Udeagha, 2018). However, by considering aggregate intra-trade, these studies do not account for the heterogeneous impact of EIAs on intra-agriculture goods and intra-manufacture goods trade despite the argument that EIAs transform the primary sector and increase the number and size of industries that enhance manufacture goods and boost trade among countries. Extant studies on the impact of EIAs on the structure of trade considered intra-manufacture goods trade and are for Spanish and OECD countries (Garuz, Hervitz and Moslares, 2005; Egger, Peter and Greenaway, 2008). Therefore, this study contributes to the empirical literature by examining the impact of EIAs on intra-African trade structure by considering intra-manufactured goods trade and intra-primary-product trade in Africa. This is particularly important as the question of whether there are economies of scale due to EIAs remains crucial in determining the benefit of EIAs, especially in this era of the formulation of the African Continental Free Trade Area (AfCFTA). Furthermore, unlike previous studies, this study employs the negative binomial regression as a technique of estimation. This is because of the over-dispersion (variance exceeding the mean) problem resulting from the highly skewed nature of intra-manufactured goods and intra-primary goods trade in Africa due to the pervasive missing data and/or excess zeros. Ignoring this problem would result in an unreliable result.

The rest of the paper is organized as follows: section 2 contains brief stylized facts on the trend of intra-African trade and trade structure in the region and inter-trade among the various EIAs in Africa. The empirical literature review is the focus of section 3, while section 4 provides the methodology of the study. Section 5 presents the empirical analysis, and finally, section 6 concludes the paper.

2. Economic Integration Arrangements and Intra- African Trade: Some stylized facts

This section provides the stylized facts on the trend of intra-African trade as well as the structure of trade in the region and inter-trade among the various

EIAs in Africa. The analysis is presented using tables and graphical expositions.

2.1 Trend of intra-African trade 2001 to 2019

Figure 1 presents trade statistics on the trend of trade in Africa. As shown in the figure, intra-African trade was approximately $0.23 billion in 2001. The region had the highest intra-trade of $1.23 billion in 2012; since then, however, trade among members has been declining, reaching $0.96 billion by 2019. The low trade can be attributed to many factors, including the low level of manufactured goods traded (Figure 2).

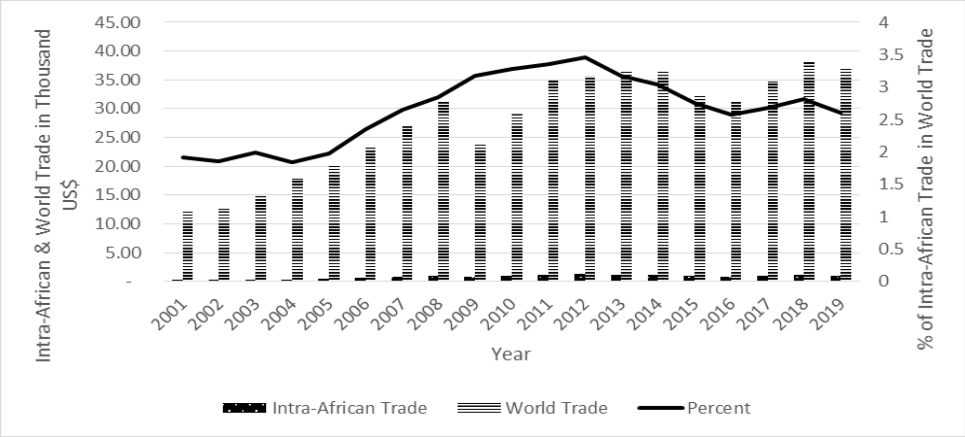

Figure 1. Trend of Intra-African Trade 2001 to 2019.

Source: Drawn using data from the WITS database online.

The share of primary product trade dominates intra-African trade. Over the study period, primary product trade accounted for over 60% of trade in Africa. This trade pattern suggests the relative comparative advantages in agriculture. The EIAs in Africa have not provided opportunities for increased manufactured goods trade.

An examination of Africa's trade structure shows that the region traded more of agriculture goods than manufactured goods throughout the study (Figure 3). Specifically, the share of primary products trade was averaged at about 66 percent while that of manufacture trade was approximately 34

percent for the period 1996-2014. This trend continued throughout the period of the study.

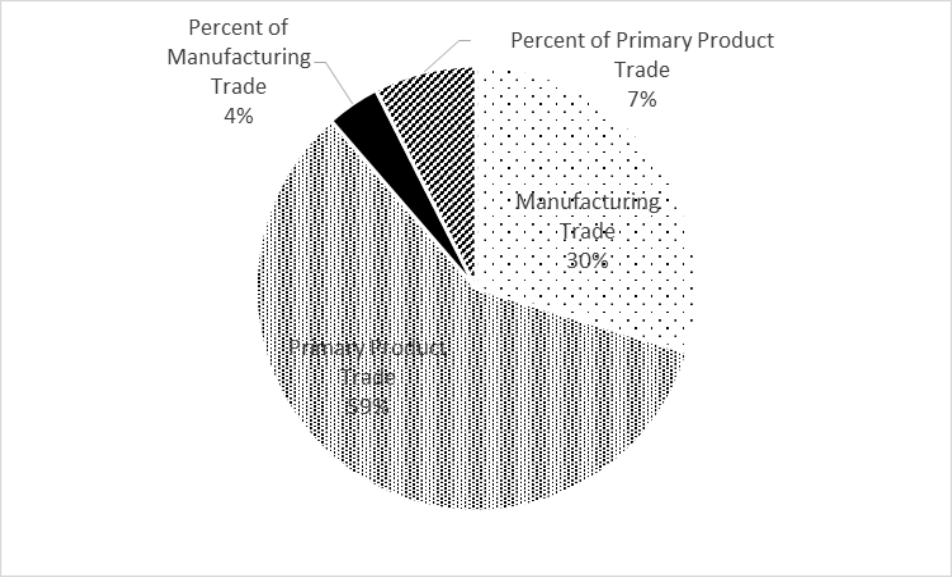

Figure 2. Average Share of the Primary Product and Manufactured Goods Trade, 2001 to 2019.
Source: Drawn using data from WITS.

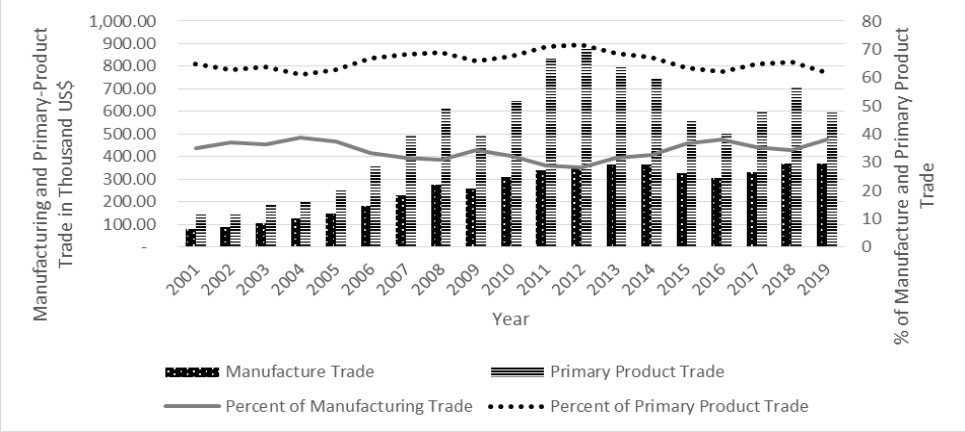

Figure 3. EIAs and Structure of Intra- African Trade.

Source: Drawn using data from WITS.

The trade among trading blocs in Africa is abysmally low and disproportionate, with the Southern African Development Community (SADC) having the highest trade share among its members (Table 1). The volume of trade is smaller in the East African Community (EAC) and the Economic Community of Central African States (ECCAS) when the countries are decomposed into their various sub-regions.

Table 1. Intra-Africa Trade and Share of Intra-sub-Regional Trade*

Regions	2001	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Africa	0.23	0.40	0.96	1.17	1.23	1.16	1.11	0.89	0.81	0.93	1.08	0.96
ECOWAS	2.20	2.09	1.39	1.87	1.72	1.88	1.57	1.54	1.81	1.84	1.66	2.11
EAC	0.41	0.58	0.41	0.40	0.45	0.43	0.50	0.55	0.51	0.48	0.47	-
ECCAS	0.11	0.10	0.25	0.17	0.15	0.22	0.14	0.13	0.13	0.24	0.08	-
SADC	5.95	6.25	6.64	6.56	6.65	7.27	7.25	8.00	7.79	7.23	6.72	6.69

*Intra-sub-regional trade / Total trade of the region

Intra-regional trade = Bilateral import and export

3. Empirical Literature Review

The work of Viner (1950) is the pioneer study that introduced the concept of trade creation and trade diversion effect to the welfare effect of regional trade agreements (RTAs). The author argued that trade agreements might not necessarily improve member countries' welfare because it may lead to trade diversion. According to Viner (1950), trade agreement only enhances members' welfare if the benefits obtained from the trade created outweigh the losses from trade diversion. Since the study by Viner, there have been a plethora of studies on the welfare impact of RTAs. Aitken (1973) investigated the effect of the European Economic Community (EEC) and the European Free Trade Association (EFTA) on European trade for the period 1959 to 1967. The author employed a sample of seven EFTA members and five EEC trading countries and adopted the least squares regression method. The author found that although gross trade creation (GTC) existed in both the EEC and the EFTA over their respective integration periods, the GTC of the EEC was substantially higher than that of the EFTA.

Considering the endogeneity problem arising from using dummy variables to represent free trade agreements (FTAs), Baier and Bergstrand (2007) examined the impact of trade agreements on members' international trade. The authors employed a panel of cross-section time-series data at five-year intervals from 1960 to 2000 for 96 countries. The authors used panel data with bilateral fixed and country-and-time effects or differenced panel data with country-and-time effects as well as instrumental variables and cross-section data. The authors found that quantitative (long-run) impact of FTAs on trade flows using the standard cross-section gravity equation biased estimates downwards and that on average, an FTA approximately doubled two members' bilateral trade after 10 years. Following up on the issue of endogeneity, treating the agreement variable as endogenous Caporale et al. (2009) examined the effect of FTAs (also called European agreements) between the 15 European Union members (EU-15) and 4 Central and Eastern European countries (CEEC-4) on trade flow. The authors adopted the fixed effect vector decomposition (FEVD) technique. And found a positive and significant impact of FTAs on trade flow. Rahul, Sadhana and Gail (2013) analysed the effects of bilateral and multilateral preferential trade agreements (PTAs) on intra Asean+6 trade for the period of 1994 to 2006. The authors utilized an augmented gravity model by estimating the effects of bilateral memberships against plurilateral PTA memberships. The authors' disaggregated country-by-country results indicate that plurilateral PTAs have had a more significant impact, relative to bilateral PTAs, in stimulating trade among the ASEAN+6 countries, in this initial period of new regionalism in Asia.

The trade effect of FTAs has also received great attention in sub-Saharan Africa (SSA) in the literature. For instance studies such as Johnson (1995), Lyakurwa et al. (1997), Oyejide (1997), Gunning (2001), and Yang and Gupta (2005) and Chacha (2008) established that RTAs in SSA had not enhanced trade among member countries. These authors attributed the low trade to lack of complementary products, high external trade barriers, inadequate trade facilitation infrastructure, less product differentiation, unwillingness to import from high-cost members, small market size, and lack

of strong and sustained political commitment. Following up on the negative impact of RTAs, Elbadawi (1997) used a sample of 28 countries in SSA and 62 trade partners in other countries for the subperiods 1980 – 1984 and 1986 - 1990. The author observed that compared to developing regions in Latin America, regional integration in SSA had been largely unsuccessful. The author also found trade integration, intra- and inter-regional trade, to be positive during the 1980 - 1984 subperiod but negative during the 1986 - 1990 subperiod, with higher impact on the Communauté économique de l'Afrique de l'ouest (CEAO). In the same vein, Ogunkola (1998) did a comparative analysis of the drivers of subregional trade in the Economic Community of West African States (ECOWAS) by considering a preintegration period (1970–1972) and a post-integration period (1978–1980). The author found intra-ECOWAS trade to be weak despite the subregion's integration efforts during the two periods. Also, the study by Avom (2005) revealed that the impact of monetary union on trade inside CEMAC was not significant.

Conversely, Deme (1995) examined the impact of ECOWAS on its members' trade flow for the period 1975 to 1991. The author found that although regional integration had a statistically significant effect on trade flow among members and succeeded in increasing trade flow among them, it has failed to increase trade flow in Africa. The study by Coulibaly (2007) proposed a variable that considers the number of years of membership to evaluate the trade effect of developing regional trade agreements in ECOWAS for the period 1960 to 1999. Using a semi-parametric approach, the author found that although ECOWAS positively impacted its members, the positive impact disappeared with time. Carrere (2004) investigated the impact of a regional agreement on intra-African trade and trade with the rest of the world from 1962 to 1996. The author employed a panel of 150 countries' trade with ECOWAS, SADC, WAEMU and COMESA within an augmented gravity model framework. The author controlled for possible endogeneity and used Hausman-Taylor (1981). The author found that RTAs have a significant impact on intra-regional trade flows in the region. For the Franc Zone, the author's results indicate that the monetary unions (UEMOA and CEMAC) have largely reinforced the positive effect of the preferential trade agreements on intra-regional trade. Arnaud (2014) evaluated the

potential effects of the ECCAS FTA on trade flows among its members. The author's gravity model estimation revealed that effective implementation of the ECCAS FTA positively but not significantly affected trade flows among members. Also, this marginal increase in intra-ECCAS trade would be the consequence of a trade diversion from the rest of the world. Agbodji (2008) evaluated the impact of preferential trade agreements and the monetary union on bilateral trade between UEMOA member countries from 1981 to 2000. The estimated dynamic gravity model using the generalized method of moments, it was possible to realize that membership in a common monetary zone and the implementation of common economic reforms had a significant effect on bilateral trade within the zone, although more in terms of diverting imports and exports than in terms of creating trade. Furthermore, economic policy distortions that foster informal transborder trade hurt trade within the region. Mohammed and Magai (2019) analysed the effects of regional economic integration on regional trade in Africa by concentrating on five regional economic communities: EAC, COMESA, ECOWAS, SADC, and AMU for the period 1995 to 2016. The author utilized panel data and a fixed effects estimator in the context of an augmented gravity model. The author found that the African Union's creation significantly affected intra-regional trade, inter-regional trade, and trade with the rest of the world. Based on this, the author concluded that regional economic integration should be considered a strategy for Africa's development and growth. Afersorgbor and Bergeijk (2011) found RTAs within SSA to have significantly increased trade flows among member countries suggesting that SSA RTAs have been trade-creating.

The welfare impact of RTAs has also received attention in the empirical literature. For instance, using the gravity model, Musila (2005) estimated the intensity of trade creation or trade diversion in COMESA, CEEAC and ECOWAS for 1991 to 1998. The author found the intensity of trade creation or trade diversion to vary across regions and periods. The author's empirical results also revealed that while the effect of trade creation was not supported empirically in CEEAC, there is evidence of a strong intensity of trade creation in the ECOWAS region. The results also revealed that the effects of

trade diversion were weak in the three regional organizations. Similarly, the study by Ekanayake, Mukherjee and Veeramacheneni (2010) analysed the trade creation and trade diversion effects of the regional trade agreements (RTAs) in Asia for the period 1980 to 2009. The authors used OLS and found the existence of a trade creation effect. Focusing on RTAs and welfare effects, Deme and Ndrianasy (2016) investigated trade creation and trade diversion among ECOWAS countries from 1992 to 2012. The authors accounted for heterogeneity in Third World countries and employed an augmented gravity model. The authors' fixed effect regression model showed that unlike previous authors, economic integration among small and relatively low-income countries has a welfare impact on the members as a group, for the majority of the individual member countries, and some Third World countries. Accounting for heterogeneity in Third World countries revealed that an RTA among low-income countries has a particularly robust trade-creation effect.

A number of studies have been done on RTAs and structure of trade. For instance, Garuz et al. (2005) analysed the determinants of intra-industry trade in Spain. The author found per capita income, the size of the economies, the existence of a common border, and EU membership to positively affect Spanish intra-industry trade, while the trade was negatively affected by distance and differences in per capita income. Egger, Peter and Greenaway (2008) investigated the effects of endogenous RTAs on both trade volume and trade structure within the OECD. They found new RTA membership to have a positive effect on intra-industry trade shares. The result of their sectoral decomposition shows that intra-industry trade share of endogenous new RTA membership tends to be lower for industries that can be classified as more or less homogeneous compared to ones associated with the production of differentiated goods. Using disaggregated data, Negasi (2009) analysed trade creation and diversion effects of the Southern African Development Community (SADC) from 2000 to 2007. Negasi (2009) adopted the augmented gravity model and random effects estimator methods. He found that RTAs had a positive and significant effect on intra-SADC trade in fuel and minerals and heavy manufacturing sectors. However, the sectors' extra-SADC coefficient indicated a negative effect implying extra-SADC trade diversion in these sectors. Similarly, RTAs revealed an adverse impact

on intra-SADC in agricultural commodities export and light manufacturing, but showed a positive sign for extra-SADC trade in the two sectors. Analysing whether joining a PTA is associated with a change in the structure of trade between members, Foster and Stehrer (2010) examined the impact of PTAs on trade between members and non-members of 168 countries for the period 1962 to 2000. They found that although joining a PTA had a positive effect on intra-industry trade, the impact of PTA membership on intra-industry trade (IIT) was larger when a PTA was formed between two developed countries.

The empirical literature indicates that a number of studies exist on the impact of EIA on aggregate intra-trade (Johnson, 1995; Lyakurwa et al., 1997; Oyejide, 1997; Gunning, 2001; Yang & Gupta, 2005; Chacha, 2008; Baier & Bergstrand, 2007; Caporale et al., 2009; Rahul, Sadhana & Gail, 2013; Arnaud, 2014; Musah & Magai, 2019). Similarly, there are many studies on the aggregate welfare effect of EIAs (Viner, 1950; Aitken, 1973; Musila, 2005; Negasi, 2009; Ekanayake, Mukherjee & Veeramacheneni, 2010; Deme & Ndrianasy, 2016; Ngepah & Udeagha, 2018). However, studies on the impact of EIAs on trade structure are scanty and pay less attention to Africa (Garuz et al., 2005; Egger, Peter and Greenaway 2008). In addition, they do not consider intra-primary-product trade and give little attention to intra-manufacturing goods trade in Africa.

4. Methodology

4.1 Model specification

The study adopts the gravity theory as the theoretical framework. The theory has been used successfully to explain bilateral flows. The traditional gravity theory postulates that bilateral trade flows between two countries *i* (exporter) and *j* (importer) depends proportionately on the product of their masses and is inversely related to the geographical distance between the countries (Tinbergen, 1962; Pöyhönen, 1963). The masses are represented with the paired countries' income and population (Egger and Pfaffermayr, 2003; Eita, 2016). Hence the traditional gravity theory as used in trade is shown as equation 1:

$$TRADE_{ij,t} = \alpha \frac{M_i^{\gamma_1} M_j^{\gamma_2} POP_i^{\gamma_3} POP_j^{\gamma_4}}{DIST_{i,j}^{\gamma_5}} \quad (1)$$

where:

$TRADE_{ij,t}$ = trade flow from country *i* to *j* at time *t*

M_i and M_j = income of countries *i* (recipient) and country *j* (source)

$DIST_{ij}$ = distance between the two countries

$\alpha\ \gamma_1 - \gamma_5$ = parameters

Authors such as Baier & Begstrand (2007), Aitken (1973), Caporale et al. (2009), Deme and Ndrianasy (2016), Sen, Srivastava and Pacheco (2013) have extended the gravity theory to include other trade enhancing and trade inhibiting factors as shown in equation 2.

$$TRADE_{ij,t} = \alpha \frac{M_i^{\gamma_1}.M_j^{\gamma_2} POP_i^{\gamma_3}, POP_j^{\gamma_4}}{DIST_{i,j}^{\gamma_5}}, X_{ij}^{\alpha_\kappa}, X_{it}^{\alpha_\iota} \quad (2)$$

X_{ij} and X_{it} represent a vector of control variables to proxy for other aspects of bilateral and country characteristics such as common official language (*CoL*) between importer and exporter countries *i* and *j*, common colony ties and culture for country *i* and *j*, as well as contiguity$_{ij}$. Other variables remain as defined earlier.

The stochastic version of the augmented gravity specification is expressed in multiplicative form as follows:

$$TRADE_{ij,t} = \alpha_0.M_{it}^{\alpha_1}.M_{jt}^{\alpha_2}.POP_i^{\alpha_3}.POP_j^{\alpha_4}.D_{ij}^{\alpha_5}.X_{ij}^{\alpha_\kappa}.X_{it}^{\alpha_\iota}.\varepsilon_{ij,t} \quad (3)$$

Traditionally, equation 3 is estimated by taking logs of both sides and then estimating the parameters of the model using OLS. However, log linearizing equation 3 alongside its error term changes the property of the error term, leading to inefficient and inconsistent estimation owing to the presence of heteroskedasticity (Egger and Pfaffermayr, 2003, Gomez-Herrera, 2012). Besides, a major feature of bilateral trade flow is the presence of excess zeros or missing data (Frankel, 1997). The traditional approach was

to ignore the excess zeroes and omitted variables and estimate the linear model. The implication of this is that the result fails to show the true situation of bilateral trade relations. Some other approaches were also introduced, such as assuming a negligible positive value or using the Heckman selection criteria. None of these approaches best captures the implication of zeroes and unreported values, and so, there is the possibility of having spurious regression (Santos Silva & Tenreyro, 2006; 2011). Owing to these problems, the gravity model is usually estimated directly from its multiplicative form (Krisztin & Fischer, 2015). This can be expressed in exponential function as:

$$exp[\ln \alpha_0 + \alpha_1 \ln M_{it} + \alpha_2 \ln M_{jt} + \alpha_3 \ln POP_{it} + \alpha_4 \ln POP_{jt} + \alpha_5 \ln D_{ij} + \alpha_6 \ln X_{ij} + \alpha_7 \ln X_{it}] \quad (4)$$

Equation 4 is interpreted as the conditional expectation of $TRADE_{ij,t}$ given M_{it}, M_{jt}, POP_{it}, POP_{jt}, D_{it}, X_{ij}, and X_{it} usually denoted as E[TRADEij,t / Mit, M_{jt}, POP_{it}, POP_{jt}, D_{it}, X_{ij}, X_{it}] shown in equation 5:

$$\mu_{ij,t}\,[TRADE_{ij,t} / M_{it}, M_{jt}, POP_{it}, POP_{jt}, D_{it}, X_{ij}, X_{it}\,] = exp[\ln \alpha_0 + \alpha_1 \ln M_{it} + \alpha_2 \ln M_{jt} + \alpha_3 \ln POP_{it} + \alpha_4 \ln POP_{jt} + \alpha_5 \ln D_{ij} + \alpha_6 \ln X_{ij} + \alpha_7 \ln X_{it}] \quad (5)$$

where: α_0 represents the intercept and $\alpha_1 - \alpha_7$ represents various slope coefficients.

Equation 5 is used to estimate aggregate intra-trade and structure of intra-trade by disaggregating aggregate intra-trade into intra-manufactured goods trade (IMT) and intra primary-product trade (IAT) and introducing intra and extra dummies following the works of Egger et al. (2008), Foster and Stehrer (2010), and Negasi (2009). The INTRA dummies take the value of 1 if a country pair belongs to the same EIA and 0 otherwise (a creation effect) and EXTRA dummies take 1 if the importer is a member of the EIA and the exporter is not and 0 otherwise (diversification effect). Apriorilly, $\gamma_1,\gamma_2,\gamma_4,\gamma_6,\gamma_7 > 0$, $\gamma_3,\gamma_5 < 0$. In the same vein, θ_1, θ_2, θ_4, θ_6, $\theta_7 > 0$, θ_3, $\theta_5 < 0$.

The coefficient of the INTRA and EXTRA is expected to be positive or negative.

4.2 Sources and measurement of data

The study employed a panel data of 47 African countries[1] classified into the ECOWAS, EAC, SADC and ECCAS sub-regions for 2001 to 2018. Specifically, total trade is the summation of export of agriculture raw materials, and agricultural materials and manufacturing goods trade. The variables are measured in US$ and computed using data from WITS (COMETRADE) SITC revision 1. Similarly, intra-primary product trade is the summation of the export of agriculture raw materials and agricultural materials. The variables are measured in US$ and computed using data from WITS (COMETRADE) SITC revision 1. Intra-manufacturing goods trade is obtained from WITS (COMETRADE) SITC revision 1 and also measured in US$. Income is captured using the GDPs of the importer and exporter countries. Similarly, the populations of the importer and exporter countries are represented with per capita income. The variables are sourced from the World Development Indicators online database. Distance is the geographical distance between major capital cities of countries *i* and *j* in kilometres. Common official language, common colony, and continuity variables enter the gravity model as dummies. These variables are obtained from the CPEII gravity dataset.

5. Analysis of Empirical Results

In Table 2, the result of the impact of EIAs on aggregate intra-African trade is displayed in column 2. This is followed by the result of the effects of EIAs on intra-manufacture trade and intra-Agriculture trade shown in columns 3 and 4 respectively. The analysis begins by interpreting the properties of the negative

[1] Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Dem. Rep., Congo Rep., Côte d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principle, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

binomial pseudo maximum likelihood (NBPML). The result indicates that the probability value of the dispersion parameter (α) is significant. Hence the null hypothesis stating that the dispersion parameter (α) is equal to zero is rejected, suggesting the presence of over-dispersion in the dependent variables and the use of the NBPML. This is further confirmed by the log of the dispersion parameter (Ln α) as the result shows that the parameter is statistically significant in all the models. As shown on the table, in all three regression models, the gross domestic product of the exporter countries had the expected positive marginal impact, showing a direct effect on intra-African trade. The implication of this is that increased GDP growth, all things being equal, spurs intra-African trade. This finding is in tandem with those of Ngepah and Udeagha (2018). Similarly, the coefficient of importing countries' GDP is found to have a positive marginal effect. Again this is consistent with the study by Ngepah and Udeagha (2018). Common border and language and the population of exporting and importing countries, conform to their apriori expectation. Distance in all three models has its traditional negative sign on intra-African trade, suggesting that distance discourages trade. Based on the paper's objective, the intra-trade dummy coefficient for aggregate intra-trade reveals a positive marginal effect in the various EIAs – EAC, ECCAS, SADC, and ECOWAS suggesting that the formation of EIAs promotes trade among members. This finding is in tandem with the studies by Afesorgbor and van Bergeijk (2011), Rahul, Sadhana and Gail (2013), Ngepah and Udeagha (2018) that the formation of EIAs creates trade among member countries. However, evidence of EIAs significantly enhancing aggregate intra-trade is found only in the SADC and ECOWAS. While the formation of EIAs is found to increase intra-agriculture trade in the SADC and ECOWAS significantly, there is no statistical evidence that EIAs create intra-manufacturing goods trade. The result points out that the various EIAs have a comparative advantage in agriculture and poor manufacturing sectors. Although the formation of the EAC and ECCAS is found to increase intra-agriculture and intra-manufacturing goods trade among its members, there is no statistical evidence that EIAs boost intra-agriculture and intra-manufacturing goods trade in the EAC and ECAS. The extra dummy coefficient is negative and significant for aggregate trade in the EAC,

ECCAS, SADC, and ECOWAS, pointing to the fact that the formation of EIAs results in increased trade among non-members. This finding supports Djemmo (2014) who concluded that EIAs bring about trade diversion in ECCAS. In terms of the components of aggregate trade, the result indicates that in ECOWAS and the SADC, the extra dummy's coefficients are negative and significant for manufacture goods trade but positive and statistically insignificant for agricultural goods trade. This implies that while the formation of both EIAs results in increased manufacturing goods trade with non-members, suggesting a trade diversion, there is no evidence of trade diversion in agricultural goods. In the EAC and ECCAS, evidence of a trade diversion is found for both EIAs as the extra dummy's coefficient is significantly negative for agriculture and manufacturing goods trade with more impact on the former.

Table 2. NBPML Results

Variables	Aggregate Trade	Intra-Mantrade	Intra-Agriculture Trade
lnDist	-0.235 (0.234)	-0.210 (0.101)	-0.106 (0.014)
lnGDPexp	0.386** (0.023)	0.355* (0.011)	0.473* (0.010)
LnGDPimp	0.442** (0.031)	0.122* (0.000)	0.245* (0.040)
lnPOPexp	0.183** (0.023)	0.353** (0.034)	0.433** (0.042)
InPOPimp	0.953** (0.021)	0.302** (0.019)	0.282** (0.042)
BOR	0.987 (0.942)	0.402 (0.207)	0.935 (0.912)
LANG	0.802 0.997	0.300 0.402	0.724 0.988
INTRA_ECOWAS	0.042** (0.046)	0.181 (0.202)	0.403** (0.044)
INTRA_EAC	0.311** (0.141)	0.243 (0.922)	0.723** (0.022)
INTRA_SADC	0.452** (0.031)	0.301 (0.421)	0.890** (0.042)

INTRA_ECCAS	0.661** (0.432)	0.064 (0.214)	0.913** (0.032)
EXTRA_ECOWAS	-0.447* 0.007	0.327 0.189	-0.589** 0.029
EXTRA_EAC	-0.448* 0.025	-0.077 0.906	-0.676** 0.026
EXTRA_SADC	-0.252** 0.024	0.112 0.222	-0.231** 0.022
EXTRA_ECCAS	-0.845 0.736	-0.011 0.442	-0.845 0.322
_cons	0.200 (0.221)	0.002 (0.582)	0.401 0.771
Alpha	0.311** (0.021)	0.540** (0.042)	0.484** (0.033)
Lnalpha	0.212** (0.041)	0.194* (0.000)	0.042** (0.029)

Source: Authors' computation.

Note: ( ) represents probability values while * and ** represent 1 and 5 per cent significant levels respectively.

6. Conclusion and Policy Implications

The study investigates the effects of economic integration arrangements on intra-African trade structure based on a panel of 53 African countries classified into four EIAs – ECOWAS, SADC, EAC and ECAS for the period 2001 to 2018. The study employs a modified gravity model specification and adopts the negative binomial regression technique due to bilateral trade data. To achieve the study's objective, the study first estimated a model for aggregate intra-African trade, after that, a model for intra-agriculture and intra-manufacturing trade was estimated. Specifically, the formation of the SADC and ECOWAS significantly promoted aggregate intra-trade among its members. However, while formation EIAs was found to increase intra-agriculture trade in the SADC and ECOWAS significantly, there was no statistical evidence that EIAs create intra-manufacturing goods trade. The formation of the ECCAS and the EAC was not statistically significant in boosting aggregate intra-trade among its members. The formation of the EAC

and the ECCAS enhanced intra-agriculture and intra-manufacture goods trade among its members, but the effect was statistically insignificant. Hence, there is need to transform the agricultural sector to deepen intra-trade in the various blocs in Africa and the overall intra-trade in the continents. There is also a need for the development of the manufacturing industry. This is essential to accelerate export in Africa, and diversify from primary products trade and increase trade in sophisticated products.

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