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Article

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EFFECTS OF REGIONAL ECONOMIC INTEGRATION ON REGIONAL TRADE IN AFRICA: THE CASE OF REGIONAL ECONOMIC COMMUNITIES

Musah Mohammed[1] and Petro Sauti Magai[2]

ABSTRACT

A lot of existing literature on African regional integration bloc has ignored the effects of regional economic integration by dealing with disaggregated data. This is forgetting that there is a welfare impact of trade creation versus trade diversion of regional trade in Africa. With this in mind, this article analyses the effects of regional economic integration on regional trade in Africa by concentrating on five regional economic communities. Using panel data and fixed effects estimator, the article employs an augmented Gravity Model. The results show that the creation of the African Union contributed greatly to the intra-regional trade, inter-regional trade, and trade with the rest of the world. Therefore, regional economic integration should be considered as an aspect of the strategy for Africa's development and growth, and that the benefits of such integration are essential as the central pillar of African development. Partner states should commit themselves to good governance and create a stable political environment which will lead to an increase in regional economic activities. As a result, poverty levels will be reduced leading to a high standard of life in Africa as a result of the welfare effects of this integration.
Key words: *Regional economic integration effect, regional trade, regional economic communities, Africa*

INTRODUCTION

Africa's growth and trade performance have been dwindling over the past years in terms of their share of world trade and world output. Several reasons have been attributed to Africa's poor economic performance ranging from institutional, political, geographic, demographic to infrastructural factors. With increasing consensus about the positive impact of trade on economic performance, Rodrik (1998) reminds that one of the major obstacles to economic prosperity is with the trade restrictions that are imposed on the products in and outside the African region, which makes them less competitive at the global level. For these reasons, countries have initiated regional economic integration (REI) schemes, creating sub-regional blocks like EAC (East African Community), ECOWAS (Economic Community of West African States), COMESA (Common Market for Eastern and Southern Africa) and many others to improve their trade and economic performance.

Pursuant to the continent's REI, serious efforts were initiated in the 1970s, culminating in the Lagos Plan of Action (LPA) of 1980, canvassing African countries to establish sub-regional economic blocs (Nyirabu, 2004). The Organisation of African Union (OAU) was metamorphosed into the African Union (AU) as a continental body in 2002, as a means of awakening commitment to the integration and unification of Africa politically and

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economically. This, however, has proven to be difficult as most African economies are currently dependent on the export of agricultural and non-transformed goods, inefficient and small industrial base, low level of technology, vulnerability to fluctuation in world markets and external pressure from international financial institutions (IFIs). Furthermore, the liberalisation and globalisation of world economies, greater integration of the world financial markets as well as the creation of large trading and economic blocs like North-America, Europe, South-East Asia and China after the cold war have led to further risk of marginalisation of Africa in this multi-polar world. There is hence the need to speed the process of integration.

Poor infrastructure, weak institutions, and poor economic and integrative policies contribute to the high trade costs within the Sub-Saharan countries. These high trade costs have negative effects on every economy. The challenge, therefore, is for Africa to ensure that globalisation brings about the success of the continent by ensuring that all key players understand the role expected of them in order to maximise trade potentials. The universally recognised benefits of REI which include lower transactional costs, lower risk investments, pooling of regional resources, market expansion, efficient allocation of resources and utilisation of economies of scale, must be appreciated. However, workable national economic policies need to be enacted so as to unlock these benefits. Besides the economic benefits, REI will help foster regional relations and promote regional peace and security as opined by Carbaugh (2004). Against the preceding background, a study was carried out to scrutinise the importance of regional economic integration for Africa and to see how it impacts trade within and out of the AU. The study identified and examined the benefits, challenges, and opportunities of adopting regional economic integration, followed by analysing the current approach, pace, and progress of REI in Africa. This was done to establish whether or not Africa is on the right track towards the goals of globalisation. However, considering the weak nature of most economies in Africa, the study focused on the benefits of promoting inter-African regional trade.

The article is organised in five sections: Section one provides the background against which this article has been written. Section two is the review of the literature on REI, while section three give a brief history of economic integration in Africa. Section four explains the methodology employed, while the final section covers the conclusion, policy implications, and recommendations.

LITERATURE REVIEW
International Trade Theory and Regional Integration Theory
There are two main categories of international trade: classical country-based trade and modern firm-based trade. With the traditional Ricardian Theory of Comparative Advantage, countries are expected to specialise in the production of goods based on their factor endowments. Thus, least developed countries (LDCs) endowed with primary resources are expected to concentrate on the production of primary products while developed countries (DCs) which are endowed with technology specialise in industrialised goods. While resources and trade were coined by Heckscher-Ohlin as Modern Trade Theory, Ricardian theory essentially predicts countries to export goods intensive in the use of cheap factor endowments and import goods intensive in the use of scarce factor endowments (Ray, 1998). On the other hand, specific factors and income distribution were a subject by Samuelson-Jones Theory. The theory emphasises how trade has an important influence upon income distribution. First, resources can't be transferred immediately and without costs from one industry to another; second, industries use different factors so the change in the production mix a country offers will reduce the demand for some of the production factors whereas for others it will increase

such factors. The understanding here from these models is that LDCs are more likely to trade with DCs than among themselves.
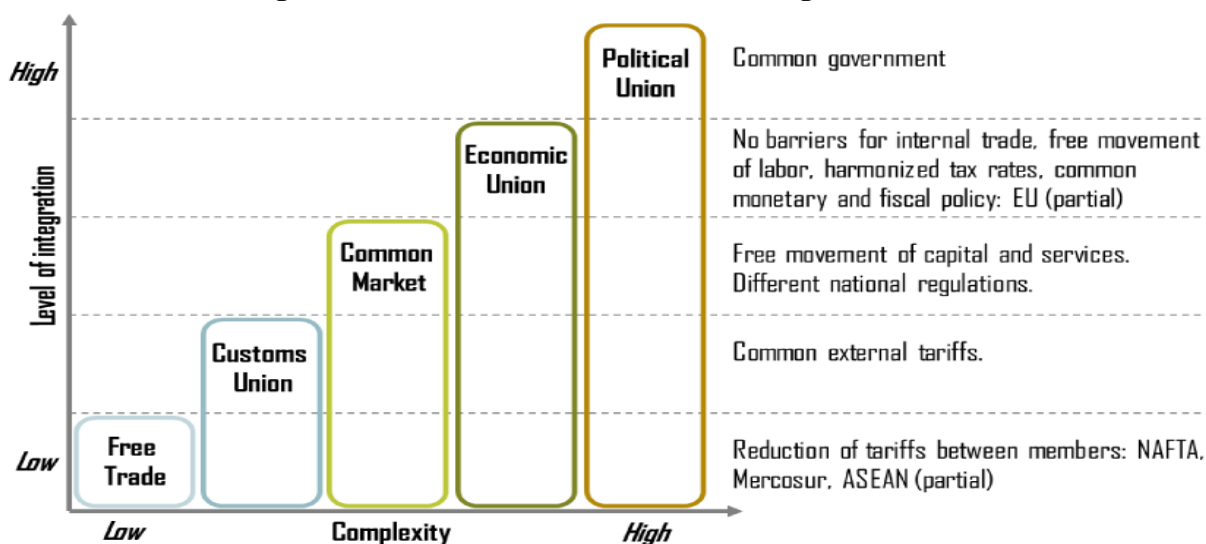
Origins of the Regional Economic Integration Theory
Some schools of thought believe that the approach of economic integration is based on Balassa (1967) but others think that this theory began with the contributions of the customs union issue by Viner (1950). The theoretical foundations of conventional approaches to regional integration date back to three essential schools of economic and political thought, which are Neo-classical, Marxist and Development Economics. The Theory of Economic Integration was developed initially from the Traditional Trade Theory, which assumes perfect competition, and whose primary concern is the allocation of production of different kinds of goods (Imbriani & Reganati, 1994). Biswaro (2003) points out that the earliest theoretical work on regional economic integration emanated from the Theory of Comparative Advantage in international trade, and the interests of liberal economists in promoting the reduction of tariff and non-tariff barriers to trade. The main ingredients of regional economic integration, as indicated by the theory include the following:

    i)   Removal of tariff and non-tariff barriers among member states.
    ii) Having a standard external trade policy which initiates common external trade restrictions against non-members.
    iii) Having free movement of goods and services, as well as free flow of factors of production across national borders.
    iv) Harmonisation of policies, unification of national monetary policies, and acceptance of a common currency.

These factors of integration happen in stages as shown in Figure 1. Nevertheless, the primary motivation for all regional integration schemes has been the prospect of enhanced economic growth and development. It should be noted that the lowest level of collaboration in regional arrangements involves at least trade, but deeper integration goes further and covers issues other than just the benefits of regional economic integration. The United States (US) is a perfect example of economic integration. Its economy is made up of fifty states in continental US plus Alaska and Hawaii, it has a common currency, and perfect labour and capital mobility – all in one country (Daniels & Daniels, 2004).

Figure 1: Characteristics of the different stages of REI

    Source: People.hofstra.edu (2018)

Effects of regional economic integration
Entry into a regional integration scheme can have static, dynamic and welfare effects. *Static effects* refer to the change in equilibrium market price and quantity before and after the creation of the regional blocks; this can either be trade creation or trade diversion. Apart from both trade creation and trade diversion effects, the static effects of regional integration can involve other impacts as complemented by Cline (1978) adding three elements of non-traditional static effects from regional trade integration: the labour opportunity effect, foreign exchange saving effect, and the economies of scale effect. Static effects of REI include labour opportunity effects, which occur when there is increased output as a result of REI and allow for extra labour employment below the minimum wage rate. There are also the economies of scale effects, where firms are able to produce at their capacity as a result of increased market size, and then, the foreign exchange savings effects where there is increased intra-regional trade and reduced trade with other commodities outside the region and saving foreign exchange in the process as discovered by (Baldwin & Venables; 1995; Lloyd & MacLaren, 2004). The *dynamic effects* are felt more gradually unlike the immediate nature of the static effects but may last longer or may never end in some cases. These effects include competition, investments, economies of scale, capital formation, and structural effects. Unlike the static effects, dynamic effects are presumed to be a continual generation of annual benefits even after withdrawal of a country from the body or union. Dynamic effects are always deemed to dominate over static effects of REI. The last of the effects are the *welfare effects*. It has been argued by some economists that REI will lead to a higher increase in welfare in countries within the integration but worsen the welfare of other countries outside. However, Clausing (2001) argues that there has never been any proof that trade creation outweighs trade diversion in an integrated region.

Empirical review on the effects of REI on regional trade
The effects of regional trade agreements on regional economic integration have been a subject to many scholars from the field of economics, international businesses, to trade from different corners of the globe. Tinbergen (1962) was the first to empirically examine the effects of economic integration on bilateral trade flow while investigating the impact of Preferential Trade Agreement (PTA) on bilateral trade flow, using the membership of the British Commonwealth and the European Economic Community (EEC) as regional blocs. He found out that there was insignificant effect of PTA on trade flow. Following Tinbergen, Linnemann (1966) using bilateral trade flow between 80 countries instead of the 42 countries used by Tinbergen, found a significant relationship between the bilateral trade flow and the PTAs for the Commonwealth countries, France and French associates and the Portuguese and Belgian associates. His results however did not prove otherwise the insignificant effects of the PTA on bilateral trade flow.

Thereafter, a number of studies emerged; for example, studies that focused on the European Economic Commission (EEC) and the European Free Trade Association (EFTA) have concluded that these blocs have contributed immensely to bilateral trade. Aitken (1973), utilising cross-sectional trade flow data from 1951 to 1967, found that EEC and EFTA after 3 to 4 years of their formation contributed significantly to intra-regional trade flow. Abrams (1980) also used the pooled cross-sectional data between 1973 and 1976 and found positive significant coefficients for EEC and EFTA. Similarly, Frankel (1997) found a significant positive impact of the EU on bilateral trade after the year 1985. Recently, while investigating the impact of the RTAs on intra-African trade with the case of SADC (Southern African Development Community), COMESA, ECOWAS, WAEMU (West Africa Economic and Monetary Zone) and CEMAC (Economic and Monetary Community of Central Africa) using

the time series data, Venables (2003) argues that RTA would lead to trade divergence among low-income countries, and thus opine that LDCs are likely to derive potential benefits from North-South RTAs. Likewise Yang and Gupta (2005) found that RTAs in Africa have been ineffective in promoting trade and recommended that Africa should increase regional trade and pay more attention to broad-based liberalisation. In the same line of thinking, Rodrik (1998) believed that Africa's intra-regional trade performance might not be that small if its economic performance was taken into consideration, pointing out that if trade restrictions were removed among member states, trade and economic performance would significantly improve. Longo and Sekkat (2001) provide a way to measure the level of contribution; they propose that the standards for measuring Africa's intra-regional trade should not be simply 'how low' but rather 'how low compared to the expected intra-regional trade flows'. Deme (1995), using trade flow from 1975 to 1991, finds significant impact for ECOWAS while employing the pooled cross-section and fixed effects. The study concluded that there is more trade to members than with non-members. Reckoned to Deme, Cernat (2001) also comes up with the same evidence of the significant impact of ECOWAS on intra-regional trade using both cross-sectional and pooled cross section for the years 1994, 1996 and 1998. Cernat finds that ECOWAS contributes to trade two times more among its members than with non-ECOWAS members.

Yayo and Asefa (2016) analysed trade creation and diversion effects of the (SADC) for the disaggregated data by employing an augmented Gravity Model using panel data and random effect estimator methods. The results show that SADC has displaced trade with the rest of the world in both fuel and minerals and the heavy manufacturing sectors; that is, SADC has increased trade considerably among its members rather than with non-members. Keck and Piermartini (2005) also applied the general equilibrium model with 15 regions and 9 sectors to check the impact of EPAs (Economic Partnership Agreements) for countries of SADC. Their results showed that EPAs with the EU enhances the welfare effects for SADC which leads to considerable increases in real GDP. Helliwell and McKitrick (1998) assessed the impact of FTA on provincial and inter-provincial trade flow in Canada and the United States using two types of approaches while arguing their case. They used the Gravity Model and the analysis of new industrial level data to estimate the degree to which tariff changes, only to explain the inter-industry variances in the growth of inter-provincial trade. The study used the Gravity Model and regional dummy variables of inter and extra, using exposit approach to capture the effects of trade creation and trade diversion. The results suggested that FTA related reduction in Canadian tariffs led to an increase in imports from the United States and a reduction in the case of inter-provincial trade.

Brief history of REI in Africa
African countries, as an economic bloc, occupy a very low position in the global economic classification. The continent is domicile to 14% of the global population, accounting for less than 3% of the global GDP (Gross Domestic Product) and receives only 3% of foreign direct investment. It should be noted that there are 55 members – a geo-political entity covering the entire of the African continent. Nevertheless, the call for REI dates back to the 1950s, then the Union of African States, an early confederation that was established by Haile Selassie of Ethiopia and Kwame Nkrumah of Ghana in 1960s following attempts to unite Africa to form the Organisation of African Unity (OAU). In Africa, trade integration plays a major role in enhancing structural transformation and inclusive growth across the continent (ECA, 2015). The continent has eight regional economic communities recognised by the African Union. However, for the purposes of this article, only five integrations of EAC, COMESA, ECOWAS, SADC, and AMU (Arab Maghreb Union) have been discussed by considering the free movement of goods and services as a priority for integrating their member countries.

Trade is also included in the African Union Minimum Integration Programme (2009) and Agenda 2063 (2015), with free movement of goods and services and greater intra-African trade among the objectives.

Pace and progress of REI in Africa

Table 1: Pace and progress of REI in Africa

Community	Specified objectives	Current economic integration status
ECOWAS	Full economic and monetary union	- Tariffs removed on unprocessed goods and traditional handicrafts - Full elimination of tariffs on industrial goods started by Benin - Second monetary zone in progress - Free movement of people - Macro-economic convergence in place
SADC	Economic and monetary union	- Free trade area launched - Power pool in place - Peace and security mechanism in place - Macro-economic convergence in place
COMESA	Free Trade Area	- Free trade agreement established and coverage is limited to goods - Launched CU 2009
EAC	CU	- The various institutions in place - Custom Union Launched 2005
AMU	Economic Union	- Due to political disagreements on Western Sahara and other differences, AMU has failed to function as a bloc.

**Source: Compiled from AU site, March 2019.**

Intra and extra African trade

Three Regional Economic Communities (RECs) have free trade areas in operation, apart from the customs unions of EAC and ECOWAS which are underway. However, the Abuja Treaty 1991 set its objective of all REC to establish the FTA and customs unions by the end of 2017. With this objective, it was hoped that COMESA would follow, but till now it is yet to be operationalized. Table 2 gives an overview of some African trade indicators for selected integration, while Figure 2 shows the total GDP of the five integrated blocs measured in constant terms.

Table 2: Selected regional indicators (2014)

|	GDP (US$ billions)	GDP/capita (US$)	Area (sq.km.) (Million)	Total pop (Million)	Total import (US$ billions)	Total export (US$ billions)
EAC	159.5	918.0	2.5	168.5	40.2	13.6
COMESA	657.4	1,335.0	12.0	492.5	183.0	95.0
ECOWAS	716.7	2130.4	5.1	339.8	113.2	138.7
SADC	678.8	2255.2	10	312.7	202.2	204.3
AMU	425.7	4518	5.8	92.2	150.9	126.8

Source: UNCTAD statistical database (2016)

Figure 2: Total GDP for selected integration (in US$ mil)
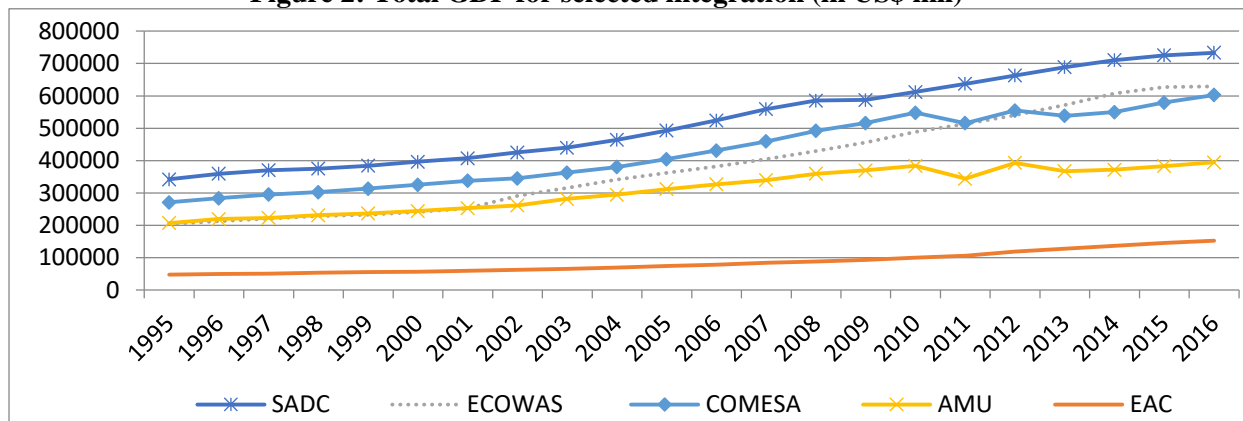
Source: UNCTAD statistical database (August, 2018)

East African Community

The East African Community (EAC) was founded in 1967, dissolved in 1977, and revived in 1999 by three countries of Tanzania, Kenya, and Uganda. Burundi and Rwanda became members in 2007 while South Sudan joined the community in April 2016. The headquarters are in Arusha, Tanzania. The ultimate goals of the community are to establish a monetary union leading to a political federation of the East African States. The EAC has already a common market that came into force in July 2010. The EAC also has a Model Investment Code that serves as a reference guide for member states to align their national investment policies in order to improve the business climate and promote trade. To improve the intra-regional trade, the EAC, COMESA, and SADC in June 2015 agreed to establish a Tripartite Free Trade Area (TFTA). The agreement has already been signed but yet to be operational due to outstanding technical work on tariff liberalisation, rules of origin, trade remedies, and harmonisation on trade-related policies. Nevertheless, this will be the largest free trade area in Africa and it could boost intra-regional trade by as much as one third[3]. Furthermore, in March 2016, EAC enacted what was called Vision 2050, which depicts a future of EAC with cohesive societies, competitive economies, and strong inter-regional cooperation that will transform the EAC region into an upper middle-income region, based on the principles of inclusiveness and accountability.[4]

Figure 3: EAC export and import to the rest of the world (US$ in millions)
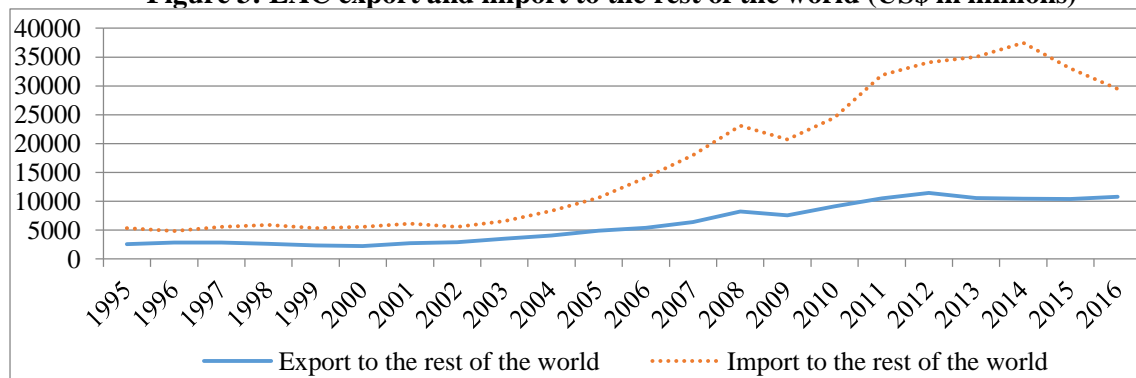
Source: UNCTAD statistical database (August, 2018)

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[3] cited Nations Economic Commission for Africa. *Tripartite Agreement could boost intra-regional trade by one third* (2016) http://www.uneca.org/stories/tripartite-agreement-could-boost-intra-regi... (accessed 6 June 2018).
[4] East African Community, *EAC Vision 2050* (Arusha, Tanzania, 2016)

Common Market for Eastern and Southern Africa

The Common Market for Eastern and Southern Africa (COMESA) came into existence[5] in December 1994 as a replacement of PTA. COMESA was formed to serve free independent sovereign states that had agreed to cooperate in developing their natural and human resources for the good of all their people. The headquarters of COMESA are in Lusaka, Zambia. Currently, fifteen out of nineteen COMESA member states[6] operate as an FTA. The Democratic Republic of Congo joined the COMESA - FTA in December 2015 and is currently finalising its tariff-cut. A customs union was subsequently launched in 2009 with a finalisation plan by 2012, but unfortunately, till now, the customs union has not been operational. As noted above, the EAC, COMESA, and SADC - TFTA is underway. In May 2007, the COMESA adopted what was called the COMESA Common Investment Area (CCIA) aimed at harmonising investment policies, regulations, and legislation, setting the standards for investor and investment protection and encouragement along with creating an institution to facilitate intra-regional economic community trade. This was to ensure a stable investment environment that promoted and protected cross-border investments within COMESA member states. At the moment, COMESA members have established the COMESA's trade facilitation instruments, including the regional customs transit guarantee scheme and yellow card; however, these instruments have been adopted by non-COMESA member states including Tanzania and South Sudan.

Economic Community of West African States

The Economic Community of West African States (ECOWAS) was established under the Lagos Treaty on May 28, 1975. The treaty was initially limited to economic cooperation but emerging political events led to its revision and expansion of its scope of cooperation in 1993. Cape Verde joined in 1976 and Mauritania decided to withdraw in 2000 to join the Arab Maghreb Union. The headquarters are in Abuja, Nigeria with fifteen-member countries.[7] The ultimate goal of the cooperation is to achieve monetary and economic union in West Africa. With the help of the ECOWAS Trade Liberalisation Scheme (ETLS)[8] adopted in 1979, which assisted in consolidating the free trade area, the community managed to establish the common external tariff since 2015. ECOWAS is also working in three areas to promote investments and competition policies: creation of the ECOWAS common investment market, promotion of the investment climate and integration of financial market. In June 2014, the negotiation of EPA with West Africa-European Union was concluded, with the exception of Gambia and Nigeria; the other ECOWAS member states have already signed the agreement[9].

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[5]Treaty Establishing COMESA. Available from https://www.tralac.org/wp-content/ blogs.dir/12/files/2011/uploads/200605....(accessed 6 June 2018).

[6] of COMESA are: Burundi, Comoros, the Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Sudan, Swaziland, Seychelles, Uganda, Zambia, and Zimbabwe

[7]The member States of ECOWAS are Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

[8]ECOWAS "*ABOUT ETLS*" Available from http://www.etls.ecowas.int/(accessed 6 June 2018).

[9]ECOWAS, "*Economic Partnership Agreement*" Available from http://www.epa.ecowas.int/(accessed 6 June 2018).

Figure 4: Export and import to the rest of the world (US$ in millions)

a) COMESA

b) ECOWAS
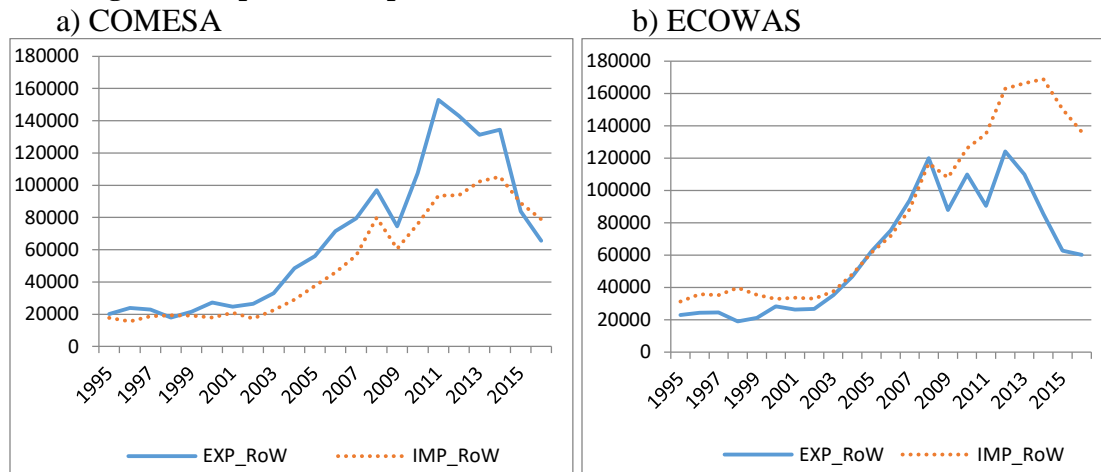
Source: UNCTAD Statistical database (August, 2018)

SADC and AMU

The Southern African Development Community (SADC), established in 1992, and which comprises 16 member states[10] is committed to regional integration and reduction of poverty within Southern Africa. The headquarters are in Gaborone, Botswana. The SADC Protocol on Trade of 2005 as amended by 2008 envisages the establishment of a Free Trade Area, of which all SADC partner states except Angola and the Democratic Republic of Congo are part of the FTA. Her objectives are to further liberalise intra-regional trade in goods and services; ensure efficient production; contribute towards the improvement of the climate for domestic, cross-border and foreign investment; and to enhance economic development, diversification, and industrialisation of the region. The Arab Maghreb Union (AMU) is a trade agreement aiming for economic and future political unity among Arab countries in North Africa. The Union was established on 17th February 1989 in Marrakech, and its members are Algeria, Libya, Mauritania, Morocco, and Tunisia. However, the Union has been unable to achieve tangible progress regarding its goals due to deep economic and political disagreements between Morocco and Algeria. With that, no high-level meetings have taken place since 3rd July 2008 and the union is largely regarded as dormant.

METHODOLOGY

The Gravity Model

This is a popular formula for analysing bilateral trade flows between different geographical entities. Initially, it was proposed by Newton in 1687 who called it the "Law of Universal Gravitation". The model quantifies the force of gravity between two objects as proportional to the product of the masses of the two objects divided by the square of the distance between them (Equation 1).

$$F_{ij} = G \frac{M_i M_j}{D^2_{ij}} \text{---} (1)$$

Where Fij is the attractive force, Mi and Mj are the masses, D^2_{ij} is the distance between the two objects and G is a gravitational constant depending on the units of measurement for mass and force.

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10 The member state of SADC is: Angola, Botswana, Comoros, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe.

Besides the application of this model in various areas of social interaction including tourism, migration and foreign direct investment, Tinbergen (1962) proposed that the same functional form could be applied to international trade flows. Consequently, a large number of empirical works applied the Gravity Model to examine the impact of the RTAs on trade creation and trade diversion. With the preceding explanation, the analysis of this article has also legitimately employed the gravity model technique. Therefore, from Equation 1, the Gravity Model predicts that the flow of people, ideas or commodities between two places is positively related to their size and negatively related to the distance (see Equation (2).

$$trade\text{ij} = \alpha \frac{(GDP\text{i}.GDP\text{j})\delta_1}{\text{Distance ij}\delta^2} \text{ ---(2)}$$

Where trade ij is the value of bilateral trade between country i and j, GDP_i and GDP_j are national incomes of country i and j, distance ij is a measure of the bilateral distance between the two countries and α is a constant of proportionality.

Applying the natural logarithm from Equation 2, we can have an admirable linear relationship between trade flows, economic sizes, and distances, both in log forms as seen in Equation 3. Therefore, Equation 3 is the core gravity model equation where bilateral trade is predicted to be a positive function of income and a negative function of distance.

$$\log(trade\text{ij}) = \alpha + \delta_1 \log(GDP\text{i} * GDP\text{j}) - \delta_2 \log(distance) + \text{Ɛij} \text{ -------(3)}$$

Where α is an intercept, δ_1 is coefficient to be estimated, while Ɛij is the error term used to capture any shocks that may affect bilateral trade between the two countries.

Theoretical justification of the Gravity Model in trade analysis
The notation developed by the physician Isaac Newton was the first justification of the Gravity Model. Another rationale is by Linnemann (1966), who while relying on gravity equation assumptions, he carried out analysis with a partial equilibrium model of export supply and import demand. Albeit, Bergstrand *et al.* (1985) were having a different opinion from that of Linnemann - that the partial equilibrium model could not explain the multiplicative nature of the equation and also left some of its parameters unidentified particularly because of exclusion of price variable. Nevertheless, Anderson (1979) came up with a strong theoretical justification of the gravity equation for the properties of expenditure systems. Since then, many authors including Bergstrand (1985), Helpman and Krugman (1985) and Deardorff (1998) have contributed to the improvement of the theoretical foundation of the model. Therefore, from these studies, the gravity model has been given weight and has been derived theoretically as a reduced form of a general equilibrium model of international trade in final goods. Finally, the theoretical justification becomes evident, well understood, and therefore widely accepted in recent times. Studies by Anderson and Wincoop (2003) and Feenstra (2002) clear the weakness emanating for the model. This explanation proves that there is a theoretical foundation in applying the Gravity Model on international trade flows. This motivates and concretises our reliance on the Gravity Model in this article for analysing the effects of regional trade on REI in Africa.

Applicability of the Gravity Model
Many empirical works have provided a number of alternative specifications for the Gravity Model. However, in the context of international trade and for the purposes of this article, we employ the basic formulation of the gravity model in Equation 3. Therefore, based on trade theories of Heckscher-Ohlin models, the inclusion of core variables of income, GDP,

population and distance is justified; however, the majority of researchers have incorporated control variables of differences in geographical factors, historical ties, exchange rate risks, and even overall trade policies because trade flows between countries can be affected by factors other than the core variables. It is, therefore, necessary to expand the Gravity Model and add other variables that will explain the impact of various issues on trade flows. In case of the gravity equation for estimation of the impact of trade RTAs, dummy variables are introduced. Therefore, we include the African Union as a dummy variable while ignoring distance since we are not dealing with individual countries.

Estimation and testing procedures
This part discusses all relevant estimations and testing procedures employed for this article. These techniques are used for panel data gravity model specification, ordinary least squares (OLS) estimation, fixed effects estimation, random effects estimation, panel estimation, and Hausman test. The article relies on panel data from UNCTAD database of 2018. Trade matrix for intra-trade (trade levels within a region), inter-trade (trade between each region and the rest of the AU), and extra-trade (trade between each region and the rest of the world) export and import flows (in millions of US dollars at current prices) and total GDP are measured in millions of US dollars at constant prices for the period of 1995 to 20016. The sample is categorised under five regional groupings: EAC, COMESA, ECOWAS, SADC, and AMU. The dataset is a balanced panel with 110 observations with symmetric data for regional, rest of the group and rest of the world among selected African regional blocs.

Panel Model
The article employs different models such as random or fixed effects estimators to allow various assumptions regarding trade flows to be investigated. Thereafter, the applicable model has to be determined by the Hausman test. The common panel data regression models take the following form:

$$Y_{it} = a + bx_{it} + \varepsilon_{it} \quad \text{--(4)}$$

Much of interest is on the error term (ε_{it}) as its assumptions assist to determine whether to use fixed effects or random effects. Under the Fixed Effects Model, ε_{it} is assumed to vary non-stochastically over *i* or *t* making the Fixed Effects Model analogous to a dummy variable in one dimension. But under random effects model, ε_{it} is assumed to vary stochastically over *i* or, *t* requiring special treatment of the error variance matrix.

Fixed Effects (Within) Model
This model doesn't allow for the estimation of the impacts of REI with a fixed membership. In as much as the model disregards the cross-sectional nature of the data, the interpretation of the dummy coefficients, therefore, remains unimportant. Nonetheless, the fixed effects estimator is a pooled OLS estimator based on time-factored variables and takes the following form:

$$\ddot{Y}_{it} = \beta_1 \ddot{X}_{it1} + \beta_2 \ddot{X}_{it2} + \cdots + \beta_k \ddot{X}_{itk} + \ddot{\varepsilon}_{it} \ldots \ldots \ldots \ldots \ldots \ldots \ldots (5)$$

Where t = 1, 2, 3......k, $\ddot{Y}_{it} = Y_{it} - \overline{Y}_i$ is time dimensioned data on Y and similar for $\ddot{X}_{it} and \ddot{\varepsilon}_{it}$. This model ignores the unobserved effect of a_i and can be removed from the model.

Random Effects Model
This model is used as a substitute for the Fixed Effects Model; its coefficients could be determined by using a random effect technique, which assumes that explanatory variables are uncorrelated with random effects. The Generalized Least Square (GLS) is used for estimation on this model. The final model for this takes the following form:

$$Y_{it} = \beta_0 X_{it} + a_i + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(6)$$

Where a_i is the random effect and should have a normal distribution of zero and constant variance. The coefficient in this model can be estimated as follows:

$$\hat{\beta} = (X'\lambda^{-1}X)^{-1}(X'\lambda^{-1}Y)$$
$$\hat{\lambda}^{-1} = I * \gamma$$

Where X and Y are the matrix versions of the regressors and independent variables respectively, I is the identity matrix, γ is the variance of unit *a,* and λ is the variance-covariance matrix.

Explanation of the models
Given the preceding models, two tests are necessary: F-test for the Fixed Effect Model and Breusch-Pagan Lagrange Multiplier (LM) test for the Random Effects Model. Nevertheless, the Hausman test is deemed to be important if both fixed and random effects are significant. After running the F-test and LM test, the null hypothesis will be rejected if the probability is less than 0.05 otherwise the null hypothesis has to be accepted. The Random Effects Model is applicable if the probability is more than 0.05, otherwise the Fixed Effect Model has to be applicable. Therefore, a Hausman test assists when choosing the best model between fixed and random effect models. The null hypothesis is that the effect, whether fixed or random, is not correlated with other regressors. If the null hypothesis is rejected, the Random Effects Model will be suffering from the violation of the Gauss-Markov Theorem leading to biased and inconsistent estimates; nevertheless, the Fixed Effects Model still remains unbiased and consistent. It should be kept in mind that the analysis used in this article differs in some aspects from many gravity models used in various literature. However, the main derivative of the model comes from the bilateral trade flows and the whole idea is dwelling within the Gravity Model, but the nature of the data variables makes it a bit difficult to include distance variable since the article deals with entire region and not individual countries. For the purposes of the article, separate gravity models are formulated (Equations 7, 8 & 9) and applied separately for estimations.

$$In(X_{ijt}) = \beta_0 + \beta_1 In(Y_{it}) + \beta_2 In(Y_{jt}) + \beta_3 Dummy_{AU} + \tau_t + v_i + \varepsilon_{it}) \dots (7)$$

$$In(X_{it}) = \beta_0 + \beta_1 In(Y_{it}) + \beta_2 Dummy_{AU} + \tau_t + v_i + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots (8)$$

$$In(X_{ikt}) = \beta_0 + \beta_1 In(Y_{it}) + \beta_2 In(Y_{kt}) + \beta_3 Dummy_{AU} + \tau_t + v_i + \varepsilon_{it} \dots\dots\dots (9)$$

Where X_{ijt} stands for inter-trade *i* and *j* in year *t,* X_{it} for intra-trade *i,* X_{ikt} for extra-trade *i* and *k* in year *t,* Y_{it} for GDP of region *i* in year *t,* Y_{jt} for GDP of region *j* in year *t,* Y_{kt} for GDP of region *k* in year *t,* $Dummy_{AU}$[11], τ_t for annually fixed effects andv_i for regional characteristic effects of *i.*

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[11]Dummy$_{\_AU}$= after the creation of African Union in 2002 (i.e. from 2003 to 2016 takes the value of 1), while, before creation of AU (i.e. from 1995 to 2002 takes the value of 0).

RESULTS, DISCUSSION, CONCLUSION AND IMPLICATION
Estimation results
The Fixed Effects Model is deemed appropriate to measure the effect of REIs on regional trade for the given regional trade blocs, for the period from 1995 and 2016 as far as its probability is not more than 0.05. The regression results for the equations (7, 8 &9) are shown in Table 4.

Table 4: Results of estimation models			
	Model1 (Intra-Trade)	Model 2 (Inter-Trade)	Model 3 (Extra-Trade)
C	-10.61563 (0.000)	-23.2386 (0.000)	-19.77822 (0.000)
Log(GDP)	1.540462 (0.000)	1.160398 (0.000)	1.176731 (0.000)
Log(GDP_RoG)	--	1.191215 (0.000)	--
Log(GDP_RoW)	--	--	0.905036 (0.0022)
Dummy_AU	0.350219 (0.000)	0.317007 (0.0025)	0.242167 (0.0017)
R-Square	0.878495	0.909356	0.914541

Note: GDP_RoG gross domestic products for the rest of the group (region)
GDP_RoW gross domestic products for the rest of the world
( ) P-Values in parenthesis

Discussion
The Fixed Effects Model was deemed the best fit for the study based on the various tests conducted. All results showed that REI has dynamic effects on all blocs used in this research. The coefficients and the P-Values for both random effects estimation are recorded in Table 4. Based further on correlation test with the Hausman test, the null hypothesis was rejected, that the random effect model is appropriate. For the estimation Model 1(intra-trade) within each individual region, was found to have positive relations with the independent variable (GDP), the estimation results showed positive coefficients and the P-Values are statistically significant at 1% significance level, the results show that holding dummy_AU constant, when there is growth in GDP, it will lead to the increases of intra-trade by 154% within each region. For estimation Model 2, results for inter-trade among the 5 African regions show almost a similar outcome with the first model, both GDP and GDP_RoG have positive coefficients and P-Values are statistically significant at 1% significance level. These two independent variables, therefore, have a positive impact on inter-trade among the five regions. That is, the regional inter-trade is estimated to increase by 116% and 119% respectively each time there is a unit increase in GDP of the individual region and GDP for the rest of the group (GDP_RoG). Estimations for Model 3, extra-trade between Africa and the rest of the world is dependent on the GDP of individual groups and GDP for the rest of the world (GDP_RoW). Observing the estimated results, the explanatory variables have positive effects on trade between Africa and the rest of the world. The coefficients are positive and the P-Values are statistically significant at 1% significance level. For Africa's extra-trade, percentage growth in GDP and GDP_RoW will lead to an estimated increase in trade between Africa and the world by 117% and 90.5% respectively. This means that trade among African countries has increased more than with the rest of the world. The regional dummy variable (Dummy_AU), also has a positive effect on all models as was expected. However, while Model 1 becomes statistically significant at 1% significance level, Models 2 and 3 become statistically significant at 5% significance level. Although the African union started in 2002, its effects were realised from 2003 and 2004 confirming the dynamic effects

of REI on the African trade and satisfying the expected positive effects. The R-square values for all the model range from a low of 0.878 to high of 0.914. Based on our random effect tests again it signifies the goodness of the model for our data.

Conclusion and implication

This article has illustrated the impact of regional economic integration of AU on regional trade which includes inter-trade within the African region, intra-trade within the individual region and Africa's external trade (extra-trade) with the rest of the world. Employing the Gravity Model, it has been observed that the formation of the AU represented by our dummy variable has impacted regional trade positively. It has been found that Africa's trade (inter-trade, intra-trade, and extra-trade) is positively affected by GDP. Therefore, trade within the individual regions (intra-trade) would increase as the GDP increases and vice versa. The coefficients of GDP have the expected signs and significance in all the models estimated. Also, coefficients of Dummy$_{AU}$ (after the formation of the AU in 2002) have the expected signs and magnitude in all estimated models to enhance regional trade, confirming the findings of Aitken's (1973) research on EEC. It is obvious that an increase of African trade can be caused by a number of factors: openness of the market, changes in the socio-economic conditions, elimination of tariff barriers and non-tariff barriers within the African continent, which are as a result of REI. However, proper institutions including policy makers are encouraged to enact and implement enabling trade-related policies to promote inter- and intra-regional trade which will facilitate regional economic integration as suggested by Rodrik (1998). Rodrik opined that Africa's intra-regional trade performance may not be that small if its economic performance is taken into consideration, pointing that if trade restrictions are removed among member states, trade and economic performance would significantly improve.

As trade involves the importation and exportation of goods and services, soft and hard infrastructure must be improved across the African continent so as to reduce the cost of doing trade in Africa; this will automatically attract foreign direct investment. Investment in human capital and technology remains to be paramount for promoting greater trade within the African continent. Also, partner states should commit themselves to good governance of regional integration and deal with unstable political environments; this will lead to an increase in regional economic activities improving the standard of life and reducing poverty in the region.

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