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THE IMPACT OF REGIONAL TRADE AGREEMENTS ON TRADE FLOWS; THE CASE OF ECOWAS AND COMESA

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Abstract

Proponents of economic integration argue that regional trade agreements can be considered as a second-best approach to free trade and welfare enhancing. Despite the great strides made towards economic integration by advanced countries, regional trade agreements in Africa have relatively few success stories. Using a panel data for the period 1970-2006 and modified gravity model that accounts for multilateral trade resistance, the effects of ECOWAS and COMESA on intra-bloc trade flows was closely scrutinised. Also, the trade creation and trade diverting effects these regional trade blocs are investigated. Both COMESA and ECOWAS are found to have increase intra-bloc trade flows moderately. However, ECOWAS is believed to have resulted in a net trade creation while COMESA was trade diverting.

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1 Chapter

1.0 Introduction

Regional trade agreements (RTAs) are major discussions in the political and international economics discourse. The number of regional trade agreements in the world has proliferated to a total of 445 since the "first wave" of regionalism in the 1990s.[1] According to Bhagwati (1991), RTAs can either serve as "building" or "stumbling" blocks to the overarching agenda of multilateralism. The relevance of RTAs to the move towards free trade and poverty reduction on a global scale cannot be underestimated. However, RTAs are considered as second best approach to liberalising trade when multilateral negotiations like the Doha Round reach an impasse. Trade integration can lead to access to larger markets and lower transaction costs, increased competition and efficiency among firms, inclusive development and growth. RTAs tend to mitigate border effects and distance that may make trade costly (Freund & Ornelas, 2010). Also, the reduction and elimination of tariffs due to RTAs enable firms to access larger markets at a relatively lower cost. Countries may pursue RTAs to expedite multilateral trade negotiations, support domestic policy reforms and to bolster their collective bargaining power in multilateral trade negotiations (Whalley, 1996). The ordinary consumer's love for variety of goods as well as lower prices for both domestic and imported goods is one proven case for free trade (Krugman, 1991). The welfare effects and distribution of gains from regional trade is also paramount in this debate.

Trade is a major component of the economic growth and development of most African countries (Allard et al., 2016). Every year, both natural-resource rich and non-commodity exporting African countries amass enormous amounts of foreign exchange through the exports of raw or semi-processed agricultural goods, manufactured goods and services. In 2015, Sub-Saharan Africa's ratio of merchandise trade to GDP was 41% compared to 34% in 1970 and 56% in 2006 (World Bank, 2016). Between 1995 to 2013, Africa's import-to-GDP ratio rose from 19% to 23% while exports-to-GDP ratio increased from by 7.5% to 27.5%. A large part of the budgets of

[1] World Trade Organization (WTO) facts and figures assessed from;
https://www.wto.org/english/tratop_e/region_e/regfac_e.htm

African countries is financed by the trade incomes with trade taxes making-up one-third of government revenues (Agbeyegbe et. al, 2006).

Regional trade blocs have become popular on the African continent in recent times. In the face of the numerous impediments to trade on the continent, the proliferation of regional trading blocs on the continent is one notable step towards promoting free trade and surmounting the persistent trade barriers. These RTAs have been of tremendous benefit to land-locked countries in Africa who contribute to the largest share of intra-African imports (Yang & Gupta, 2007). Moreover, the arguable success of the European Union (EU) in increasing trade flows and creating wealth for its citizens has served as justifications for the call for a more integrated Africa. This has been a long-standing objective of the African Union (AU) since its formation in 1963. The African Union (AU) is determined to espouse the concept of economic integration on the continent through private-sector empowerment, public-private partnerships and other pragmatic economic policies like industrialisation and financial integration. Today, there are about five main regional trading blocs on the continent, namely, the Economic Community of West African States (ECOWAS), the Common Market for Eastern and Southern Africa (COMESA), the Southern African Development Community (SADC), the East African Community (EAC). During the 25th AU summit in 2015, negotiations were commenced for the African Continental Free Trade Area (CFTA). Africa has new trading partners in emerging countries like India, China and Brazil. China in recent times has emerged as one of Africa's consistent new trade partners, surpassing the USA's trade influence in Africa (IMF, 2014). Moreover, African countries have been involved in many bilateral and multilateral agreements outside and within the continent to improve their terms of trade and market access. Two of such agreements are the Economic Partnership Agreement (EPA) with the European Union and African Growth and Opportunity Act (AGOA) with the USA, both in 2000.

Despite the growing efforts and initiatives to promote and underscore the need for economic integration in Africa, intra-regional trade on the continent remains the lowest globally. For instance, from 1995-2015, the average share of intra-African imports in total merchandise imports in Africa was only 12% compared to 69% in Europe, 43% in America and 60% in Asia. The absence of strong institutions, lack of political will, heterogeneity of countries, change in trade preferences of trade partners and inadequate infrastructure or productive capacity are attributed to the status quo (AfDB/OECD/UNDP, 2014). The boom-bust cycle of commodity prices on the world market causes acute economic shocks in many African countries that are often primary commodity exporters. Moreover, many African countries depend heavily on tariff and export revenue to finance their national budgets. Consequently, these African countries are reluctant to open their economies to free regional trade due to the fear of losing tariff revenues and national

sovereignty. In addition, some countries fear participation in free trade will hamper the growth of domestic firms that will not be able to survive intense competition from more efficient foreign firms. Low competitiveness in the global market, low technological advancement and adaptation as well as high trade costs (thick borders) are among the host of factors that pose a threat to regional trade on the continent (AfDB/OECD/UNDP, 2015).

This study attempts to isolate and evaluate the effects of two regional blocs in Africa, namely ECOWAS and COMESA on intra and extra-bloc trade of members and non-members as well as welfare. In terms of geography, the choice of these blocs will give a fair idea of how regional trade has evolved in West Africa and the Eastern and Southern regions of Africa. This study is preceded by a few studies on the impact of African economic blocs on trade using the gravity model (Afesorgbor & van Bergeijk, 2014; Carrère, 2004; Coulibaly, 2006; Deme, 1995; Musila, 2005). Only a hand full of such studies accounted for multilateral resistance terms in the gravity model with appropriate proxies. In addition, many of these studies fail to account for zero trade flows by using "less justified" estimation techniques like the tobit estimation. In this study, the multilateral resistance terms are accounted for with importer and exporter fixed effects as done in recent papers like Baldwin & Taglioni (2007) and Magee (2008). A comparison of different estimation techniques is also presented.

The study is organised in the following manner; Chapter 2 provides a review of the literature while Chapter 3 provides data analysis for both trade blocs. Chapter 4 elucidates the theoretical foundations of the gravity equation. The empirical estimation and results and analysis are provided in Chapter 5 and Chapter 6 respectively. The conclusion and discussion of the study are presented in Chapter 7 and Chapter 8 respectively.

1.1 Research questions

The formation of trade agreements is expected to increase bilateral trade hence enhance the welfare of its members through trade creation. Trade diversion may also occur but not always harmful to the welfare of members and non-members of an RTA. This study seeks to provide answers to the following questions for the period of 1970 to 2006.

1. Has the formation of ECOWAS and COMESA contributed to or caused changes in intra-regional trade besides other factors?
2. What was the extent of trade creation and trade diversion after the formation of ECOWAS and COMESA?

1.2 Methodology

The main work tool for this study is the gravity equation. It is a workhorse widely used to identify the factors that influence bilateral trade flows or to extrapolate trade costs. The gravity equation simply shows that bilateral trade is positively related to the economic sizes of both countries and inversely related to the distance between both countries. A modified gravity model modified by Soloaga & Winters (2001) and Anderson & van Wincoop (2003) is estimated for the study. Importer and exporter fixed effects are used to account for the multilateral resistance terms (MRTs) as used in several other studies. The adopted and modified gravity equation is estimated by Ordinary Least Squares (OLS), panel fixed effects and the Poisson Pseudo Maximum Likelihood (PPML) estimators. The Poisson Pseudo Maximum Likelihood estimator is best suited for the data set given the many number of zero bilateral trade flows recorded in the data. The gains from RTAs can be assessed based on their impact on trade volumes, terms of trade effects (domestic and foreign prices) and welfare effects. The study basically assesses the impact of the formation of ECOWAS and COMESA on trade volumes. The welfare effects of the RTA are also evaluated in this study based on the extent of trade creation and diversion in the aftermath of their formation.

2 Chapter

2.1 Literature Review

2.1.1 Regional trade agreements

Regional or preferential trade agreements are reached when a group of countries eliminate trade barriers[2] amongst themselves while maintaining trade barriers on imported goods from the rest of the world (Feenstra, 2002). Regional trade agreements are often considered as a step towards free trade and form part of the broader economic integration process. According to Balassa (1961), economic integration can be regarded as both a process and a state of affairs. The process involves the wiping out of all forms of discrimination between countries that impede trade while the state of affairs is the complete non-existence of any form of trade barriers. The elimination or partial reduction in trade barriers is referred to as "shallow integration" while "deep integration" is a combination of the elimination or partial reduction in trade barriers and the allowance of factor mobility and harmonisation of national policies (Burfisher et. al, 2004).

Economic integration occurs in a few dimensions as a customs union, free trade area, common market or an economic union. In a customs union, member states adopt unified external trade barriers for the rest of the world and eliminate all forms of trade barriers amongst themselves. Although all trade barriers are removed among members in a free trade area, member states maintain distinct trade barriers against trade with non-members. A common market is a customs union that allows movement of factors of production among member states. In an economic union, member states do not only remove all forms of trade barriers among themselves but adopt a unified fiscal, monetary and welfare policies. Although the most favoured nation (MFN) principle of the WTO demands equal treatment for members in the event of any trade agreement, the customs union and free trade area by their orientation violate the principle since they only result in a partial elimination of tariffs.

Do regional trade agreements ensure pareto efficiency? This question has instigated inquiries into the consequences of partial tariff reforms on the welfare of member and non-member countries of any RTA. Moreover, the gains from RTAs have inspired many researchers to probe further into the welfare impacts of regionalism and to provide policy prescriptions that will maximise the gains.

[2] These trade barriers can be either tariffs or quantitative restrictions or both

2.1.2 Welfare effects of regional trade agreements

Economic integration has ramifications on trade, income and economic growth. Old trade theories assess the welfare effects of regional trade agreements (RTAs) based on the Viner-Meade and the Heckscher Ohlin Samuelson (HOS) theoretical framework (Burfisher et. al, 2004). These theories assess the welfare impacts of RTAs based on trade creation, trade diversion and terms of trade effects. The studies based on such theories estimate the ex-post RTA effects on commodity prices and trade flows. On the other hand, new trade theories examine the welfare effects of RTAs under imperfect competition, rent seeking and "the new growth theory" and their consequences on multilateralism. New trade theories try to find the nexus between trade and productivity to ascertain the welfare impacts of regionalism. The welfare effects of RTAs fall under two headings, namely static or dynamic effects.

2.1.3 Static effects

The static welfare effects of economic integration were introduced by Viner (1950) in his book, the "Customs Union Issue". He was the first to provide the theoretical basis for the formation of customs unions and its ramifications[3]. Viner's findings only focused on the effects of forming a customs union from the perspective of the efficient allocation of factors of production. His conclusions were founded on strict assumptions of perfect competition in commodity and factor markets, balanced trade, full employment of resources and tariffs, as the only form of trade barrier. Transport costs are nonexistent in his theory. He pointed out that, forming a customs union affected not only the welfare of member states but also the rest of the world. He proved that customs unions could be both injurious and beneficial to both members and non-members.[4] He argued that trade creation and trade diversion are the static welfare effects of eliminating trade barriers between members of a customs union. Trade creation occurs when the formation of a customs union causes member states to shift from more

[3] Kemp & Wan (1976) show that custom unions may not be injurious to non-member countries if after their formation, world prices and imports from the rest of the world by member states remain fixed, and the appropriate income transfers between countries is made to compensate losers.

[4] Panagariya & Krishna (2002) show that the conclusions of the Kemp-Wan theorem can be obtained by Free Trade Areas if rules of origin (ROOs) are used to prohibit the transhipment of goods from non-member countries through lowest-tariff member countries to high tariff member countries. This ensures that FTAs lead to pareto gains.

expensive producers to less expensive producers. In other words, member states replace expensive domestic production with cheap foreign production. On the other hand, trade diversion occurs when member states shift from less expensive to more expensive producers. Specifically, trade diversion is a welfare change due to the substitution of imports from a low money cost source with a higher money cost source. Trade may be diverted from non-members as preferential trade agreements (PTAs) expand intra-bloc trade of members (Schiff, 1997). Trade creation represents a welfare gain while trade diversion is a welfare loss with respect to world allocation of resources. According to Viner, trade diversion may encourage protectionism. Trade diversion is not always detrimental to a member country of an RTA (Lipsey, 1957). The static welfare effect is analysed on the assumption that each country operates on its production possibility frontier. A customs union has the tendency of enhancing welfare provided the initial level of tariff prior to its formation is higher; the common external tariff to the rest of the world is lower; there is a higher number of member states with big economic sizes, and the pre-existing trade flows between countries before they formed the customs union was high (Cooper & Massell, 1965).

2.1.4 Dynamic effects

The dynamic welfare effects of economic integration often result in the shift of a country's production possibility frontier. The proponents of dynamic welfare effects of RTAs base their arguments mainly on increased competition and economies of scale. Increased competition lowers commodity prices, encourages innovation and stimulates efficiency gains in production (Wacziarg, 2001). Firms can lower their costs by expanding their production scale and benefit from reduced prices for intermediate inputs. Other dynamic welfare effects include technological progress, economic growth, transfer of technology and knowledge. Open global markets provide business investment opportunities for foreign direct investment by multinational firms and subsequent technology spill overs. Investment is an essential element of economic growth. It is no surprise that countries enter trade agreements to encourage both domestic and foreign investment. Economic integration can result in investment creation and/or investment diversion (Ethier, 1998). Greater access to large markets, good governance, lower trade costs and strong institutions often serve as the stimulus for increased investment activities through trade. Ethier argues that deeper integration can be a tool for growth and eradication of poverty, especially in developing countries. He suggests this is attainable when trade reforms by developing countries create investment by attracting foreign investors who will transfer technology into their economies, stimulate productivity and increase production.

2.1.5 Assessing the welfare effects of economic integration

The gravity and Computable General Equilibrium (CGE) models are two popular tools for evaluating the impact of RTAs either in terms of trade volumes or terms of trade. The impacts of RTAs can be examined in either a partial and general equilibrium set-up. The gravity model enables one to conduct ex-post studies on the impact of an RTA on bilateral trade flows by comparing actual levels of trade with the predicted trade in the absence of the RTA. Ex-ante analysis of the impact of RTAs can be conducted with a multi-country CGE model. CGE models are based on Armington's assumption of product differentiation by origin. One merit the CGE model has over the gravity model is that it enables one assess the price effects of RTAs, hence the terms of trade effects (Bacchetta et al., 2012). It can also be used to assess the redistribution of income or reallocation of economic resources within or between sectors or countries. Gravity models are suited for estimating the static welfare effects, especially with ascertaining the extent of trade creation and trade diversion from an RTA. While the gravity model can be used to forecast trade flows from RTAs, the CGE model is used a mere simulation of the impact of trade policies like RTAs.

2.1.6 Empirical evidence on the effects of trade blocs on trade flows and welfare

The literature is replete with papers that evaluate the impact of trade blocs on trade flows and welfare using the gravity model. Such papers extrapolate the welfare effects from estimating the trade creation and trade diversion ramifications of specific trade agreements. The results of such studies are often mixed. The mixed results obtained are contingent on the estimation methods applied, the specification of the gravity model, the duration of a study and the trade blocs involved in the study. Moreover, the type of data used for the study influence the results and conclusions.

One of the pioneering studies on the effect of trade blocs on trade flows was conducted by Aitken (1973). He investigated the impact of the European Economic Community (EEC), and the European Free Trade Association (EFTA) on intra-bloc trade flows from 1951-1967. The author estimated cross sectional gravity models. He introduced a dummy variable for each PTA which he called a "trade preference" variable. The respective estimates of each PTA were interpreted as the "gross trade creation effects as defined by Balassa (1967). He concluded that both PTAs resulted in significant increase in intra-Europe trade, hence gross trade creation over the period. Nevertheless, gross trade creation from EEC was found to be higher than that of EFTA. Using data for developing and industrial countries from 1965-1990, Frankel et. al (1996) also estimated cross sectional gravity equation to ascertain the impact of EEC and EFTA on trade flows. Unlike Aitken (1973), their PTA dummy variable was for all the 12 countries who were members of the EEC in the early 1990s. The authors find that the EEC was trade creating in the 1980s while there were no significant welfare

gains in the 1960s and 1970s.Also, they find the EFTA resulted in trade diversion in the period. This result contrasts the findings of by Bayoumi & Eichengreen (1997) who found trade gains from the EEC before the 1980s.

With several studies showing regionalism is likely to lead to trade diversion than foster more trade, Bayoumi & Eichengreen (1997) revisited the trade effects of regionalism in Europe. Using data for 21 industrial countries in Europe who were members of the EEC and the EFTA from 1953-1992, the authors estimated a first-difference gravity equation to ascertain the effects of these trade blocs on trade flows and welfare. Unlike the earlier studies, the authors introduced an additional PTA dummy variable that accounts for "extra bloc" imports from the rest of the world. A negative coefficient on the variable connotes trade diversion and implies PTA members imported less from other non-member countries. According to Bayoumi & Eichengreen (1997), estimating a differenced gravity model controls for omitted variable bias caused by time unobserved invariant heterogeneity. They find that both PTAs increased intra-bloc trade over time. Whereas the EEC's increase in trade among members coincided with decreased in a trade with the rest of the world, the EFTA resulted in both increases in trade among members and with the rest of the world. EFTA was trade creating in the 1960s while no evidence of trade diversion from EFTA was found as claimed by Frankel et al. (1996). Moreover, the immediate and considerable increase in intra-EEC trade flows in the 1950s dwindled after 1970.

Unlike studies that used only one or two dummy variables per trade bloc in the gravity model to assess the impact of trade blocs on trade flows, Soloaga & Winters (2001) used an augmented gravity model with three separate dummies per trade bloc and tobit estimations to ascertain the impact of regionalism in the nineties on the trade flows of nine PTAs. The authors used annual non-fuel imports data of 58 countries for the period 1980-1996 for their study. In their gravity model, they the three dummies per trade bloc separates the "intra-bloc" trade effects from "extra bloc" effects on the rest of the world in terms exports and imports. They introduced one additional PTA variable to the gravity model specified by Bayoumi & Eichengreen (1997) and Frankel (1997) which accounts for "extra-bloc" exports to the rest of the world. They conclude that the new wave of regionalism in the nineties did not expand intra-bloc trade greatly as perceived. From their results, the EU and EFTA led to trade diversion (export diversion) in the period, decreasing the welfare of non-members of both blocs in the rest of the world. The Latin American PTAs recorded increases in intra-bloc trade, but such increases were only significant for CACM and MERCOSUR. Except for MERCUSOR, the other Latin America PTAs exported more to the rest of the world while importing more from the rest of the world.

Dee & Gali (2005) in a comprehensive study used a panel data covering a period of 1970-1997 to evaluate the marginal effects of the 12 PTAs on trade flows from 1988-1997. They used a tobit fixed effects technique to estimate the gravity model. In place of the three PTA dummies specified by Soloaga & Winters (2001), they use Member Liberalization Indices (MLI) as variables to show that a specific PTA is in force or not for each year. The MLI also captures trade-restrictive effects of both tariff and non-tariff merchandise trade barriers. Also, they included dynamic PTA specific indexes as new variables to the gravity model to capture the trade and investment effects from the formation, growth or decrease in membership of each PTA. Dee & Gali (2005) find that the net trade creation effect of most PTAs in the study was negative. Their study gave credence to the trade diversion effects of PTAs as suggested in other studies. They ascribed the trade diversion to the investment creation from the PTAs. The authors also find MERCOSUR, NAFTA, EU and CER to resulted in a net trade diversion in the duration of the study. They explain their findings are dissimilar from those of other studies because they accounted for unobserved heterogeneity in the estimations of the gravity model.

Some studies have been carried out on the impact of trade blocs in Asia on trade flows and welfare using the gravity model. Clarete et. al (2003) used a panel data of 83 countries covering a period of 1980-2000 to estimate the impact of specific RTAs in and outside Asia-Pacific region on Asian trade flows in the 1980s and 1990s. The authors find that PTAs had a positive Asian trade flows in general; intra-bloc trade increased for SAPTA, APEC and SPARTECA over time while APEC diverted trade from non-members to members. APEC and CER traded less with the rest of the world as intra-bloc trade increased. Elliott & Ikemoto (2004) used trade data for the period 1982-1999 to ascertain the effect of AFTA and the Asian crisis on intra-ASEAN trade. They also estimate the anticipation effects of AFTA as well as AFTA effects on intra-ASEAN trade and ASEAN trade with the rest of the world. The authors find that Asian crisis increased intra-ASEAN trade through higher demand for imports from within the region. While Clarete et. al (2003) estimated the gravity model with cross section data for 5-year intervals starting from 1980 and panel data, Elliott & Ikemoto (2004) estimated the gravity model with OLS and tobit model. Like Clarete et. al (2003), their results confirm AFTA had no significant impact on intra-bloc trade in the years following its formation. ASEAN trade with the rest of the world continued to increase together with the intra-ASEAN trade. Elliott & Ikemoto (2004) concluded that many ASEAN countries continued to export a large share of their production to the rest of the world after the formation of AFTA.

2.1.7 Empirical evidence of trade and welfare effects of African RTAs

Many empirical and theoretical studies have found South-South trade to be less benign compared to North-North and North-South trade. South-South trade is often trade diverting than trade creating (The World Bank, 2000). Developing countries should focus more on the dynamic gains from economic integration than the static gains (Ezenwe, 1983; Jaber, 1971). There are few empirical studies on the effects of African RTAs on trade flows and welfare using the gravity model. Notwithstanding, these studies have produced mixed results.

Deme (1995) and Cernat (2001) performed pooled OLS estimations of the gravity model to ascertain the effect of specific RTAs in Africa. Deme used panel data for the period 1975-1991 to estimate the effect of the ECOWAS on the bilateral trade flow of members. Cernat estimated the gravity model using pooled data from 1994-1998 to evaluate the impact of ECOWAS, COMESA and SADC on intra-bloc and extra-bloc trade flows. Cernat captured the trade creation and trade diversion effects by including two RTA dummies in the gravity model as done by Bayoumi & Eichengreen (1997) while Deme used only one RTA dummy variable that captured only the intra-bloc effect (gross trade creation). Both authors concluded that ECOWAS had a positive and significant effect on regional trade. Deme (1995) found that bilateral trade flows between ECOWAS members increase two times the value before. Cernat concluded African RTAs were not trade diverting compared to RTAs of other developing regions. He indicated that the gradual elimination of trade barriers and improved trade facilitation procedures increased intra-regional exports of ECOWAS, COMESA and SADC. Musila (2005) employs an OLS and tobit estimation of the gravity model at levels using data for 20 African countries for the period 1991-1998. He stated that ECOWAS and COMESA were trade creating and there was no evidence of trade diversion from COMESA and ECOWAS as cited by most studies. However, ECOWAS was more trade creating than COMESA.

Carrère (2004) using panel data and a modified gravity model originally specified by Deardorff (1998) based on a transport cost examined trade among 150 countries during 1962-1996. She evaluates the impact of RTAs and currency unions in Sub-Saharan Africa on intra-regional trade and trade with the rest of the world. The RTAs considered in her study included ECOWAS, COMESA and SADC while the currency unions were CEMAC and UEMOA. Carrère estimated the gravity model in a panel with bilateral specific effects and instrumental variables. She finds that all the RTAs, except COMESA, increased intra-regional trade in the period. The author found the coefficient for the intra-COMESA to be positive but statistically insignificant. ECOWAS was found to have increased intra-regional trade by 22% and diverted export simultaneously. Carrère also found the trade creation effect of currency unions on to be higher than that of the RTAs. Coulibaly (2006) used

an unbalanced panel data for 179 countries from 1960-1996 to analyse the welfare effects of six RTAs in Sub-Saharan Africa, Asia and Latin America. He combined a gravity model with semi-parametric regressions to ascertain the non-monotonic trade effects of the RTAs. In place of the dummies for RTA membership, he employs a variable for the number of years of a country-pairs membership in a specific RTA. He performed kernel regressions of trade residuals from which he assessed the welfare impacts of RTAs based on ROW imports from the RTA and the RTAs terms of trade proposed by Winters (1997). He affirmed that ECOWAS had positive welfare effects on members (increased intra-regional trade) for only a few years after its formation while the welfare effects of ECOWAS on the ROW was negative (decrease in extra-regional trade) as the number of years of participation of a member country increased.

Using a panel data for 133 countries from 1980-1998, Magee (2008) estimated the effects of RTAs on trade flows, trade creation and trade diversion. He estimated a gravity equation with exporter and importer year fixed effects that accounted for both the natural trading partner tendencies and the country-pair specific characteristics. The author also estimated the dynamic effects of RTAs on trade flows by introducing lagged variables of the RTA variable into the gravity equation. He found that the average effect of RTAs on trade flows reduced by 3% when country-pair and year fixed effects are controlled for in the gravity estimation. In most cases, he also finds that trade creation exceeds trade diversion effects for the RTAs. Magee (2008) results show that COMESA and ECOWAS are PTAs which had a negative and negligible impact on regional trade in the period.

In a recent study, Afesorgbor & van Bergeijk (2014) used both meta-analysis and comparative gravity estimation methods to verify the robustness of the results of previous studies on the impact of African RTAs on intra-regional trade. For the meta-analysis, the authors collated 139 estimates from 14 individual studies based on African RTAs. For the comparative estimation of different gravity models, data for 47 African countries from 1980-2006 was used. The authors added one dummy variable per trade bloc to their specified gravity model that captured the membership of a pair of the trading country in the same trade bloc. The authors also accounted for MRTs in the gravity model as done by Baier & Bergstrand (2009). They find that African RTAs had a positive effect of about 27%-32% on the intra-regional trade. The authors also concluded that results of previous studies on Africa RTAs effects that failed to account for MRTs and zero trade flow correctly produced upwardly biased estimates. They find that ECOWAS and SADC were the only economic blocs that had a positive effect on intra-regional trade in the period; COMESA had a positive but insignificant impact on trade.

2.1.8 Dealing with the potential bias associated with the evaluation of the effects of RTAs on trade flows and welfare.

The use of the gravity model to ascertain the effects of RTAs on trade and welfare can produce bias and misleading results due to omitted variable bias. Many of these studies fail to account for endogenous variables, unobserved heterogeneity and the multilateral price terms proposed by Anderson & van Wincoop (2003). Moreover, OLS and tobit estimations of gravity models have considered inept in the face of an innumerable share and over-dispersion of zero trade flows in the data set. Baier & Bergstrand (2007) point out that selection bias is the main source of endogeneity bias from the cross-section estimation of the gravity model. Some authors have addressed the potential estimation bias from the use of the gravity model to examine the trade creation and trade diversion impacts of trade blocs by adopting different estimation techniques. Other authors assert that variables like the intra-bloc dummy, GDP and population are not exogenous as assumed in some studies. They argue these endogenous variables could be related to other trade policy variables in the error term of the gravity equation which also influences trade flows. Others point out that simultaneity bias could result from the estimation of the gravity model too since there is an explainable reverse causality between membership in an RTA and bilateral trade flows.

With a modified gravity model and a panel data of 130 countries from 1962-1996, Carrère (2006) examined the impact of the EU, ANDEAN, NAFTA, CACM, MERCOSUR, ASEAN and LAIA on the trade flows and welfare of both members and non-members. She estimated a static gravity model in the panel that accounts for both random country-pair specific effects and year fixed effects. Like Soloaga & Winters (2001), she introduced three dummy variables for each RTA to identify the Vinerian trade creation and trade diversion effects. She also deployed the Hausman-Taylor instrumental variable and within estimation of the gravity model to control for endogeneity bias caused by the intra-RTA, GDP, population and infrastructure variables. Baier & Bergstrand (2007) assert that the use of instrumental variables or the Heckman control function to address endogeneity in cross sectional gravity studies by Magee (2003) are is not well founded. Using a panel of cross-section times series data for 96 countries from 1990-2000, they examine the average effect of free trade agreements (FTAs) on the trade flows of members. To address the endogeneity of the FTA variable, the authors suggest a panel fixed effects or first-difference estimation of a gravity model with dyad fixed and country-and-time effects. They account for the multilateral price variables in the gravity model with time-invariant country fixed effects unlike Carrère (2006) who used remoteness variables proposed by Baier & Bergstrand (2002).

Carrère finds that for most RTAs intra-regional trade increased more than levels predicted by the gravity model, in conjunction with a reduction in imports and exports from the rest of the world. In other words, the RTAs were both trade creating and trade diverting simultaneously over time. She also found that the first enlargement of the EU resulted in pure trade creation while the second enlargement ended in both trade creation and some trade diversion. Baier & Bergstrand (2007) also estimated the gravity equation with the lagged terms of the FTA dummy variable to account for the "phasing in" of FTAs and find that FTAs double the bilateral trade between two members in 10 years.

Lastly, Martínez-Zarzoso et. al (2009) estimated both static and dynamic panel gravity models to evaluate the effect of PTAs on trade flows between 47 countries from 1980-1999. Unlike the two studies before, they accounted for hysteresis in trade by including the lagged dependent variable in the gravity equation and estimated it using a two-step GMM and system-GMM estimators. Their gravity model separate the trade creation and trade diversion effects in a similar manner like Soloaga & Winters (2001). They used the second and further lags of the endogenous variables at levels as instruments in the two-step GMM estimation and the differenced second and further lags of the endogenous variables is used in the system GMM estimation. They stated PTAs of developed nations higher positive impact on intra and extra-bloc trade than those of developing countries. Unlike Carrère (2006) who found that the EU increased intra-bloc trade by 104%, they find the EU resulted in a more intra-bloc trade by a magnitude of 90% from 1980-1990 while there was no trade diversion for the EU in the 1990s. They find NAFTA increased intra-bloc trade by 57%. They also found that MAGREB and the Euro-Mediterranean Agreements resulted in no significant changes in intra-bloc trade and were not welfare improving over time.

3 Chapter

3.1 Data Analysis

3.1.1 Data

A "square" gravity data set for all world pairs of countries, for the period 1948 to 2006 from the Centre d'Etudes Prospectives et d'Informations (CEPII) website is used for this study. This dataset was originally generated and used by Head, Mayer, & Ries (2010) in the paper, "The erosion of colonial trade linkages after independence". The data set is an unbalanced panel with 1,204,671 observations and 36 variables. The data set is made up of aggregated bilateral trade flows for 208 countries pairs. Only 7 variables out of 36 in the data set are used for the regression estimations, namely, bilateral trade flows, importer and exporter incomes/GDPs, bilateral distance, contiguity, common language and colonial history. Model estimations are done with both zero and non-zero trade flows for the period, 1970 to 2006. For estimations with only non-zero trade flows, the data set is reduced to an unbalanced panel with 532,915 observations. About 41% of the bilateral trade flows are zeros in the original data set while 52% of the trade flows are zero in the sample dataset used for the analysis.

The aggregated bilateral trade data is obtained from the International Monetary Fund's Direction of Trade Statistics (IMF DOTS). While imports are reported in Cost, Insurance and Freight (CIF) while exports are reported in Free on Board (FOB). Trade flows are recorded in millions of US dollars. The GDPs are obtained from the World Bank's Development Indicators (WDI). GDP values are recorded in nominal terms or current international dollars. A portion of the GDPs, specifically from 1948-1992, are obtained from Barbieri, Keshk, & Pollins (2009) data collection[5].

The trade cost variables for the study were collated from the CEPII GeoDist database; (http://www.cepii.fr/anglaisgraph/bdd/distances.htm).[6] These trade cost proxies are added to the gravity model as covariates. Bilateral distance is measured in two different ways; simple and weighted distances. For simple distances, only one city is needed to compute international

[5] This dataset is available on the Correlates of War Project website http://correlatesofwar.org/data-sets/bilateral-trade

[6] More information is available in notes of Mayer & Zignago (2006)

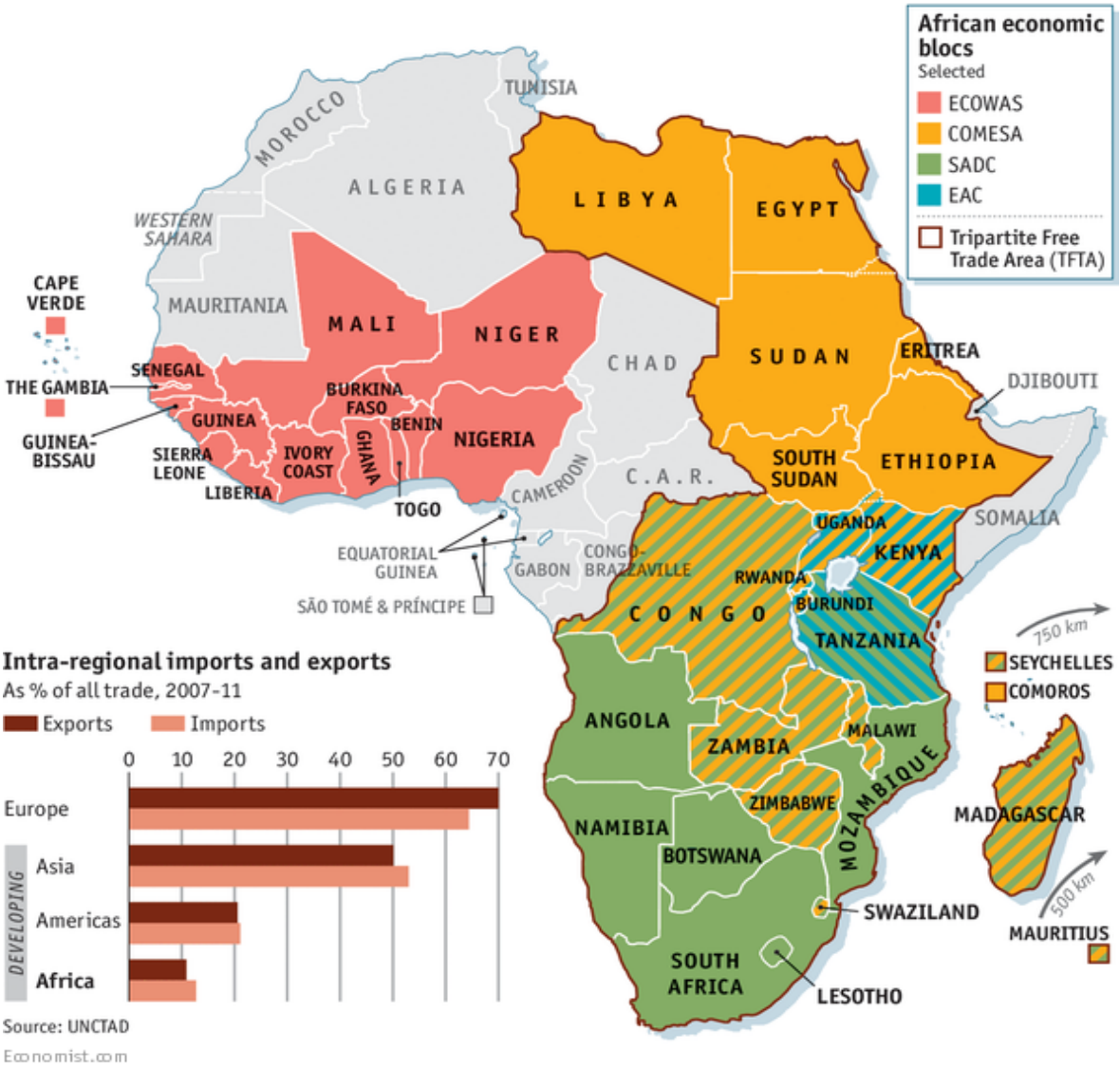
distances while weighted distances require data on principal cities in each country for computation. Simple distances are calculated following the great circle formula, which uses latitudes and longitudes of agglomerations and important cities. The population-weighted great circle distances between the principal cities of two trading countries as calculated by Head & Mayer (2002) is used in the model estimations. A common language dummy is used as a variable to determine whether two countries share a common official language. Another dummy is used to capture colonial links between any pair of countries. A border dummy is used to denote contiguity of two countries. RTA variables that accounted for membership of a pair of trading countries in an RTA are constructed based on information from the official websites of ECOWAS and COMESA.

3.2 African Economic Community (AEC)[7]

The progress made with the formation of regional trade blocs can be partly traced to concerted efforts of the AU through the African Economic Community (AEC). In June 1991, the AEC was established when the Treaty of Abuja was signed by the then AU Heads of State and Governments. The AEC Treaty has been in operation since 1994. The main objectives of the AEC include the formation of customs unions, free trade areas and common markets on the continent to foster economic integration and sustainable development (African Union, 1991). The core goals of the AEC were founded on eight Regional Economic Communities (RECs). The AEC was established based on partnerships with RECs like the Economic Community of West African States (ECOWAS), the Economic Community of Central African States (ECCAS), the Common Market for East and Southern Africa (COMESA), the East African Community (EAC) and the Southern African Development Community (SADC). In the North of Africa, the AEC interests are materialised by the Arab Maghreb Union (AMU). The Inter-Governmental Authority on Development (IGAD) is the last pillar of the AEC. The AEC has since established the African Development Bank responsible for providing the necessary funds for projects and has set sights on introducing a common currency in the region (Gathii, 2011). The AEC has also fostered relationships with economic, monetary unions like the Economic and Monetary Union of West Africa (UEMOA) and the Customs and Economic Union of Central Africa (UDEAC). Figure 3.1 shows the geographical locations of the RECs on the African continent.

[7] Information outsourced from the African Union website https://www.au.int/web/en/organs/recs unless cited otherwise

Figure 3.1 Africa's regional trading blocs



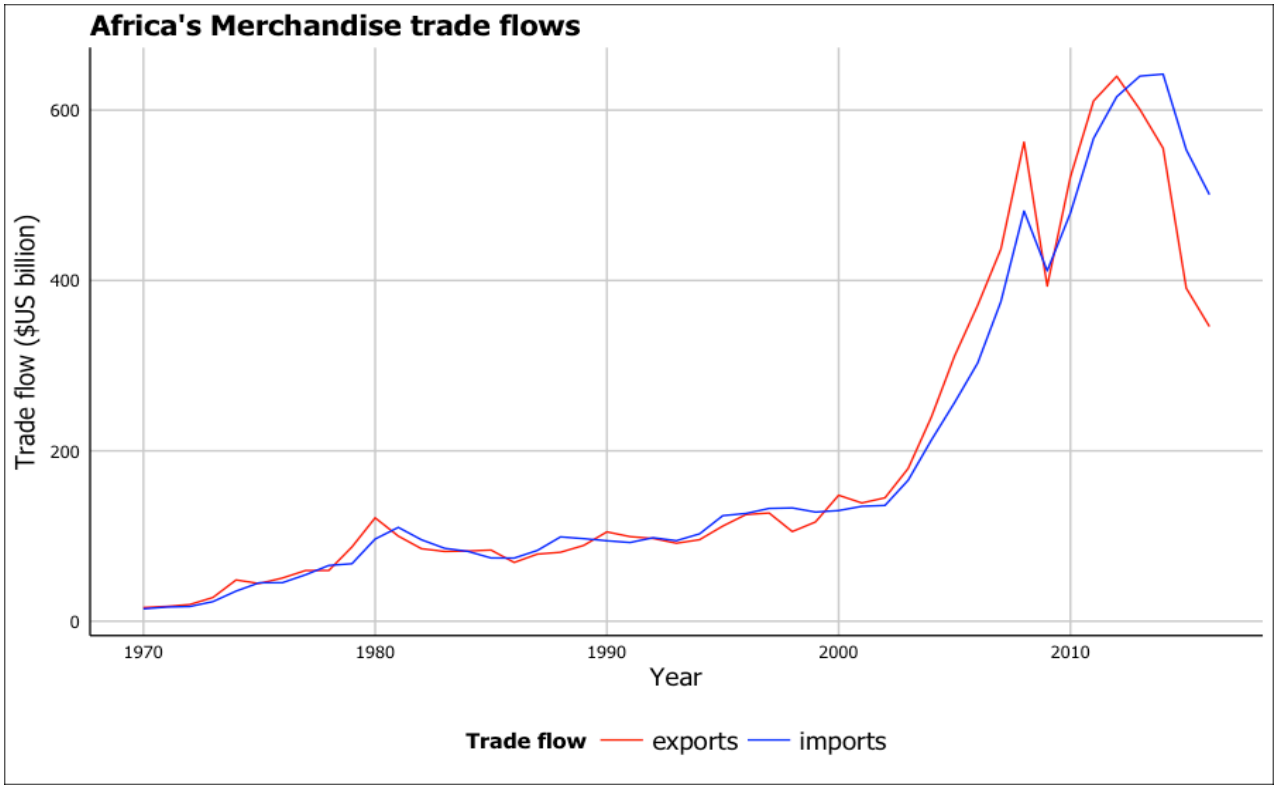
Source: The Economist magazine

3.3 Trends and patterns of merchandise trade flows of Africa

African trade has increased slightly in the last two decades. Nonetheless, compared to other regions, African trade remains the lowest. In 2006, merchandise exports expanded 23 times the amount in 1970 (US$ 12 billion) while merchandise imports expanded 20 times the amount recorded in 1970 (US$ 13 billion). The share of Africa trade in global trade has dropped from 4.72% in 1970 to 2.97% in 2016 (UNCTAD, 2017). In 2016, Africa's merchandise exports and imports amounted to US$ 345 billion and US$ 500 billion respectively. Merchandise exports

increased progressively from 2000-2008 but plunged from 2008 to 2009 due to the global financial crisis and peaked in 2012 and 2013 (See Figure 3.2).

Figure 3.2 Africa's merchandise trade flows 1970-2016



Source: Head, Mayer & Ries (2010) and UNCTAD Database

The average annual growth of African trade[8] between 2000-2008 was 16% (ADB Group, 2016). The growth in exports in the same period was explained by the increase in African exports to emerging economies among the BRICs and commodity price surge in the world market (ADB Group, 2017). The continent has been a net-importer of goods since 2013 while merchandise exports and imports have plummeted. From 2010-2015, merchandise exports declined annually by 5% while imports have increased annually by 3% (UNCTAD, 2017). From 2014 to 2016, Africa's total merchandise trade mirrored the contraction in world merchandise trade. Merchandise trade of the region decreased in that period partly because of the 45% drop in energy and oil prices, the volatility of exchange rates as well as the slowdown of the Chinese economy (WTO, 2016). Since 2000,

[8] This total African merchandise trade, in this context it is the sum of merchandise imports and exports.

Africa's merchandise has been on the rise due to the low levels of manufacturing, increasing food and manufactured goods import bills.

South Africa, Nigeria, Algeria, Egypt and Angola are Africa's major exporters while the major African importers are South Africa, Egypt, Morocco and Nigeria. These countries are some of the wealthiest and populous countries on the continent. They have the relatively high incomes and demand for goods from both the domestic and foreign markets. Except for South Africa, the other top 5 African exporters are huge exporters of oil. South Africa exports mainly mineral ores and agricultural products.

Table 3.1 African exporters and importers and the rest of the world in 2016

Top exporters			Top importers		
Rank	**Country**	**% of African exports**	**Rank**	**Country**	**% of African imports**
1	South Africa	21	1	South Africa	18
2	Nigeria	9	2	Egypt	11
3	Algeria	8	3	Algeria	9
4	Egypt	7	4	Morocco	8
5	Angola	7	5	Nigeria	7

Source: Author's calculations from UNCTAD Database

The European Union is Africa's major trading partner accounting for 30% of African trade followed by China, 15% of African trade in 2016 (ADB Group, 2017). African exports mainly comprise of unprocessed primary commodities like mining and fuel products, metals, food, beverages, tobacco; two-thirds of African exports are mostly fuel and mineral products. The major merchandise imports of the continent are manufactured goods and transport equipment.

3.3.1 Intra-African trade patterns

Intra-African trade has increased marginally since 1970. In 2017, intra-African merchandise exports were 15% of Africa's total merchandise exports compared to only 3% in 1970 and 8% in 2006 (ADB Group, 2017). Land-locked countries in Africa highly patronise intra-African trade. From table 3.1, two out of the top five intra-African importers are landlocked countries, namely Botswana and Zambia. A total of 5 out of the top ten intra-African importers are land-locked countries (UNCTAD, 2013). Also, many of the top traders within Africa are found in the Southern part of the continent. Moreover, non-fuel exporting African countries have a higher share of intra-African trade compared to fuel exporters.

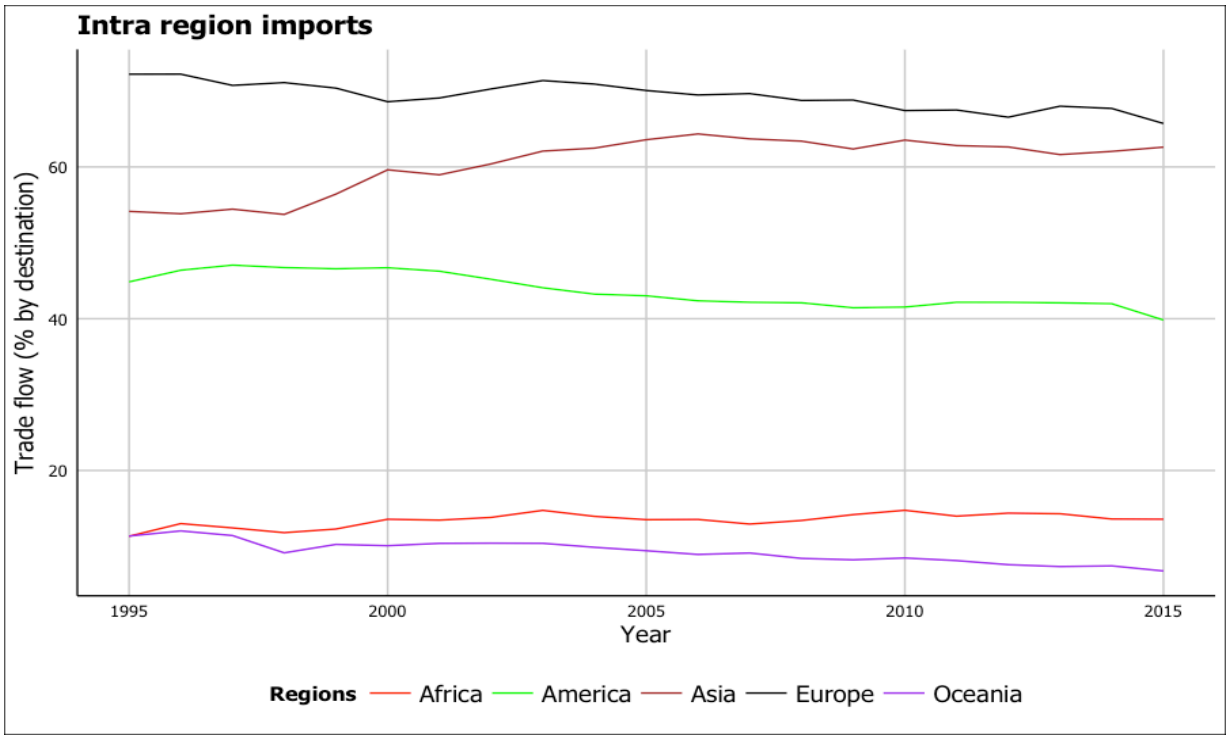
In 2016, intra African merchandise exports amounted to US$59 billion compared to only US$1 billion in 1970 while intra-African merchandise imports amounted to US$57 billion compared to US$ 949 million in 1970. The modest surge is may be misleading because the increase may only be due to the rise in commodity prices or inflation in certain periods and not necessarily a significant increase in trade volumes.

Table 3.2 Top 5 intra-African exporters and importers in 2016

Top exporters			Top importers		
Rank	**Country**	**% of intra-African exports**	**Rank**	**Country**	**% of intra-African imports**
1	South Africa	33	1	South Africa	12
2	Nigeria	7	2	Botswana	7
3	Côte d'Ivoire	6	3	Namibia	7
4	Egypt	5	4	Zambia	6
5	Kenya	3	5	Côte d'Ivoire	4

Source: Author's calculations from UNCTAD Database

Figure 3.3 Intra-region imports (in percent by destination)

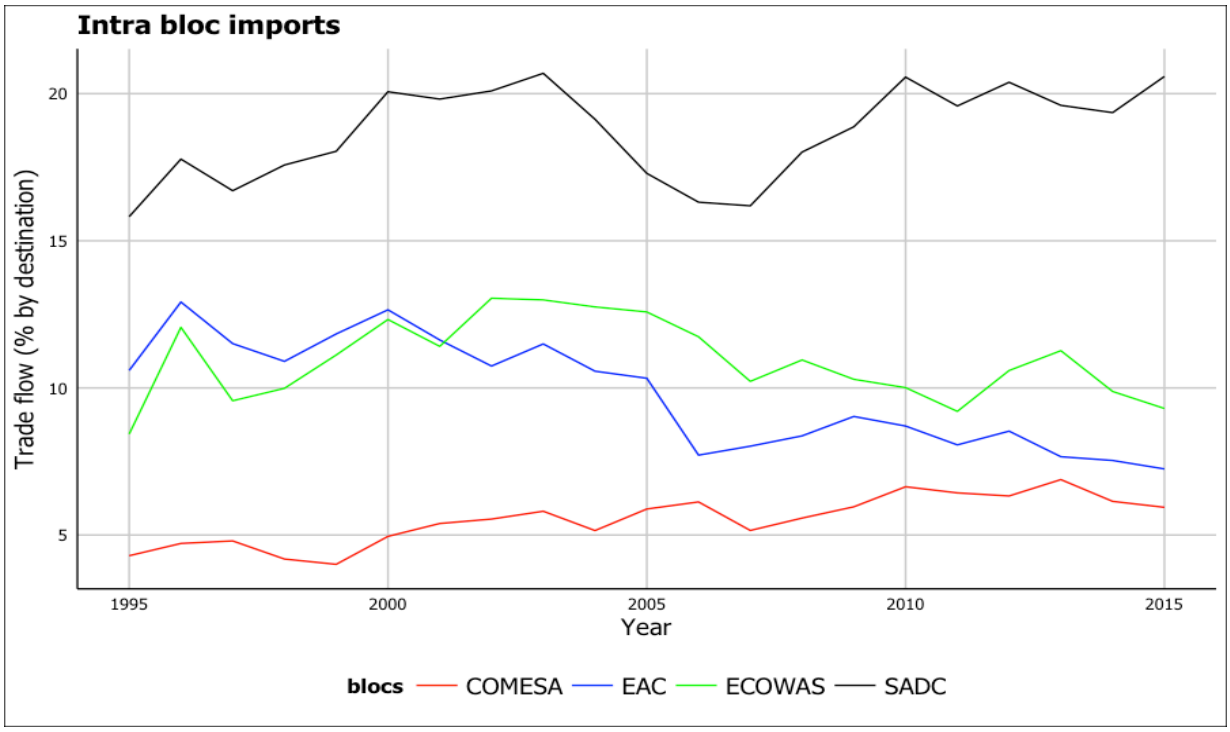


Source: Head, Mayer & Ries (2010) and UNCTAD Database

When ranked with other regions, intra-African imports was second lowest in 2015 (See Fig. 3.2). Moreover, Africa's regional blocs, compared to other regional blocs in the world, have the lowest

within-bloc trade globally. In 2015, intra-African imports were 14% of total merchandise trade compared to 66% in Europe and 63% in Asia. In 2016, manufactured goods formed 60% of intra-Africa exports compared to 40% in 2014 (AfDB/OECD/UNDP, 2015). This is because intra-African exports in agricultural goods are low due to low investment and lack of commercialization in the sector. In addition, the colonial history of African countries has made them more outward looking with trade in the extractive sectors where primary commodities are often the final output. The intra bloc imports of Africa's major regional blocs is displayed in Fig. 3.4. SADC and ECOWAS are the region's most integrated and well-performing blocs regarding intra-bloc imports. Intra-ECOWAS imports are trailed by both intra-COMESA and intra-EAC. COMESA is the least integrated regional bloc with the lowest within group import shares compared to the other regional bloc.

Figure 3.4 Intra-bloc imports in Africa (in percent by destination)



Source: Head, Mayer & Ries (2010) and UNCTAD Database

3.4 Economic Community of West Africa States

3.4.1 Background[9]

ECOWAS was established as a free trade area on the 28 May 1975 by fifteen West African states that signed the Treaty of Lagos (ECOWAS, 1975). Eighteen years later, the treaty was revised to bolster economic integration in the region due to the absence of significant progress since its implementation. The revision of the treaty was to create a common market with a single currency for the region (ECOWAS, 1994). The administrative headquarters of ECOWAS is in Abuja, Nigeria. In 2007, a proposal was made to convert ECOWAS into a customs union (ECOWAS Commission, 2007). ECOWAS has set sights of becoming an Economic Monetary Union in the future in its four-phase process of regional integration (Serón, 2014). In 2015, the common external tariff (CET) of ECOWAS was enforced. The current members of ECOWAS are Benin, Burkina Faso, Cape Verde, Cote D'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Nigeria, Senegal, Sierra Leone, Togo and Niger. All ECOWAS member states are members of the World Trade Organization (WTO). Mauritania, a founding country of ECOWAS exited the bloc in 2000.

ECOWAS comprise two sub-regional blocs, namely the West African Economic and Monetary Union (WAEMU/UEMOA) and the West African Monetary Zone (WAMZ). UEMOA is an association of eight the French-speaking countries (Benin, Burkina Faso, Cote D'Ivoire, Mali, Niger, Senegal, Guinea-Bissau and Togo) within the ECOWAS; they formed a customs union in 2000 and shared a common currency, the CFA franc. WAEMU has a common external tariff (CET) that is under-study to install the ECOWAS CET. On the one hand, WAMZ is an organisation of the five English-speaking countries within ECOWAS. Unlike UEMOA, WAMZ does not have a common currency yet. The ECOWAS Monitoring Group (ECOMOG) is another subsidiary organisation that handles peace and security related activities in the region. It has the sole responsibility of ensuring political stability in member states, respect for the rule of law and democracy. The ECOWAS Bank for Investment and Development (EBID) is the specialised bank for the regional group. Other specialised agencies of ECOWAS include the West African Monetary Agency (WAMA) and the West African Health Organization (WAHO).

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[9] Information outsourced from the official website of ECOWAS, http://www.ecowas.int/about-ecowas/basic-information/ unless cited otherwise

3.4.2 Profile of ECOWAS[10]

349 million people occupy the 15 countries in the ECOWAS region; this constitutes 35% of the population of Sub-Saharan Africa. Nigeria is the most populous nation in West Africa, inhabited by 143 million people while Cape Verde is the least populated nation. The bloc has some of the poorest countries in the world. Except for Ghana, Nigeria, Cote D'Ivoire and Cape Verde, all the other members of ECOWAS are considered as Least Developed Countries (LDCs) by United Nations. Liberia, Niger and Sierra Leone are the poorest nations in the region. ECOWAS managed a Gross Domestic Product (GDP) of US$ 1,483 billion in 2015 compared to US$ 786 billion in 2006, representing an 89% increase. However, this increase is due to the economic dominance of the three best performing economies in the region, namely Nigeria, Ghana and Cote D'Ivoire. The per capita income in the region has increased marginally from US$1,957 in 2006 to US$2,357 in 2015. In 2015, Cote D'Ivoire was Africa's fastest growing economy in 2015 with a growth rate of 6.5%. The inflation rate in the region was 8.3% in 2015.

3.4.3 Objectives of ECOWAS

ECOWAS was established to enhance regional cooperation and integration geared towards eradicating poverty, promoting sustained economic growth and development in the region. With the aim of creating a borderless region, ECOWAS was instituted to ease the factor mobility (ECOWAS, 1991). Trade liberalisation, improvement in institutional quality, infrastructural development and private sector promotion are other targets of the regional bloc. The ECOWAS Trade Liberalization Scheme (ETLS) is a trade liberalisation policy instrument in force in the region. The current working policy document of the bloc, ECOWAS Vision 2020, is centred on a bottom-top approach to regional integration (Bosuyt, 2016). To promote agriculture, food security and environmental sustainability, ECOWAS in 2005 enforced the region's common agricultural policy called the ECOWAP as part of the Comprehensive Africa Agriculture Development Programme (CAADP). Currently, plans are under way to introduce a single common currency in the region by 2020. With respect to trade policy, the regional group is guided by ECOWAS Common Trade Policy (CTP) and ECOWAS Trade Development Strategy.

[10] Facts and figures are extracted from World Bank Database, World Development Indicators

3.5 COMMON MARKET FOR EASTERN AND SOUTHERN AFRICA

3.5.1 Background[11]

COMESA existed first as Preferential Trade Area (PTA) before becoming a common market and a Free Trade Area (FTA). A ten-year transitional period was stipulated to transform COMESA into a customs union by 2008. The suggested COMESA Common External Tariff (CET) rates were 0% for raw materials and capital goods, 10% for intermediate goods and 25% on final goods imported from third countries (COMESA, 2009). The headquarters of COMESA is situated in Lusaka, Zambia. The former PTA of East and South Africa treaty was first signed in 1981. However, it only came into force on September 21st, 1982 after it was ratified by the requisite number of countries according to article 50. The resultant achievements of the PTA, together with compliance with the gaols of the of the African Union's Lagos Plan of Action (LPA) and the Final Act of Lagos (FAL), led to its evolution into a common market on 8 December 1994 in a meeting convened in Malawi. On October 2000, Djibouti, Kenya, Egypt, Zambia, Zimbabwe, Malawi, Sudan, Madagascar and Mauritius formed and inaugurated the COMESA FTA. This was proceeded by the exit of some member states of the old PTA like Lesotho and Mozambique in 1997, Tanzania in 2000, Namibia in 2004 and Angola in 2007. COMESA's membership has expanded after other agreements were reached to include member states of two other regional groups in the region, EAC and SADC. The current members of the regional group include Djibouti, Democratic Republic of Congo, Eritrea, Ethiopia, Egypt, Libya, Sudan, Comoros, Madagascar, Mauritius, Seychelles, Burundi, Kenya, Malawi, Rwanda, Uganda, Swaziland, Zambia and Zimbabwe. The subsidiary organisations of COMESA include the Commercial and Development Bank, Commercial Bank Union, Reinsuring COMESA Company, COMESA Clearing House and COMESA Institute for leather.

3.5.2 Profile of COMESA[12]

COMESA is the largest common market in Africa. It is the most populous regional bloc in Africa with 503 million inhabitants. Ethiopia is the most populous country in the region; Ethiopia, Egypt

[11] Information mainly outsourced from the official website of COMESA, http://www.comesa.int/overview-of-comesa/, unless cited otherwise

[12] Facts and figures are extracted from World Bank Database, World Development Indicators

and the Democratic Republic of Congo contribute to about 53% of the population in the region. Seychelles, Mauritius and Libya are the wealthiest countries in the region with income per capita of US$24,587, US$21,046 and US$17,200 respectively. Comoros and Djibouti are the poorest nations in the bloc. The total GDP of the region was about US$1,855 billion in 2015. Apart from Seychelles, Mauritius, Kenya, Egypt, Libya and Zimbabwe, all the other member states of COMESA are considered as LDCs. Some of the fastest growing economies in the world are in the COMESA region; the region-wide growth of COMESA was 6% in 2015. Countries like Ethiopia, DR Congo, Kenya, Djibouti, Rwanda and Uganda recorded growth levels of between 5% and 10% between 2014 and 2016.In 2005, the overall inflation of the region was 6.8%.

3.5.3 Objectives of COMESA

Like other regional blocs on the African continent, COMESA fundamentally aims at instigating sustainable growth and development in the East and South African region through trade liberalisation and implementation of market-oriented policies that promote domestic, cross-border and foreign investment (COMESA, 1995). Its mission is to;

"Endeavour to achieve sustainable economic and social progress in all Member States through increased cooperation and integration in all fields of development particularly in trade, customs and monetary affairs, transport, communication and information, technology, industry and energy, gender, agriculture, environment and natural resources."[13]

It also focuses on making firms in the member states locally and internationally competitive. This involves adding value to goods and services at every level of the value chain. Additionally, the regional body pursues some common macroeconomic policies to enhance the economic well-being of citizens of all member countries. For COMESA, trade-led growth is attainable through the existence of allocative efficient and competitive market (Bank of Mauritius, 2005). Some of the goals of COMESA yet to realised are the formation of a monetary union with a common currency and the complete consolidation of financial institution and markets in the region. Member states of the old PTA were required to reduce import tariffs from member states by 100% over time by 2000. By 2000, Zambia, Kenya, Madagascar, Zimbabwe, Egypt, Malawi, Sudan, Djibouti and

[13] COMESA missions and vision from http://www.comesa.int/comesa-vision-and-mission/

Mauritius had reduced tariffs on imports from member countries by 100%; other member states have also reduced tariffs on imports from member states by at least 60 percent.[14]

3.6 Trends and patterns of trade in ECOWAS and COMESA [15]

Total merchandise trade of ECOWAS increased from US$ 5 billion in 1970 to US$ 130 billion in 2006 and US$ 156 billion in 2016. On the other hand, COMESA's merchandise exports amounted to US$ 83 billion in 2006 from US$ 6 billion in 1970 while merchandise imports were worth US$ 4 billion in 1970 compared to US$ 75 billion in 2006 and US$ 143 billion in 2016. Intra-bloc trade is considerably higher than it was before the formation of the blocs. Intra-ECOWAS trade currently accounts for only 9% of total trade compared to 12% in 2006 while intra COMESA trade was 12% of total trade in 2015 compared to 7% in 2006. In 2015, intra ECOWAS imports US$ 9 billion amounted to compared to US$ 129 million in 1970 and US$ 6 billion in 2006; within group, imports was at its peak in 2008 and 2013. Intra COMESA imports increased from US$ 361 million in 1970 to US$ 5.3 billion in 2006 and US$ 10 billion in 2015. Intra-COMESA imports reached its peak in 2013 at a value of US$ 12.1 billion. The growth in the value of intra-regional trade for the two blocs in the last three decades is mostly due to price surges (UNCTAD, 2013). Moreover, trade within the regional groups has grown at a slow pace over the years, especially from the 1970s to 1990s (See Fig. 3.5). This is attributed to the import-substitution policies implemented by many African countries in the period with the objective of attaining self-sufficiency (United Nations, 2009). In addition, the low intra bloc trade in both regions is also attributed to recurrent incidence of conflicts or wars, prolonged and bureaucratic trade procedures and the reluctance of member states to phase out both tariff and non-tariff barriers. Lastly, low intra-regional trade is a consequence of increasing bloc trade with the rest of the world or new trade partners outside Africa (UNCTAD, 2013).

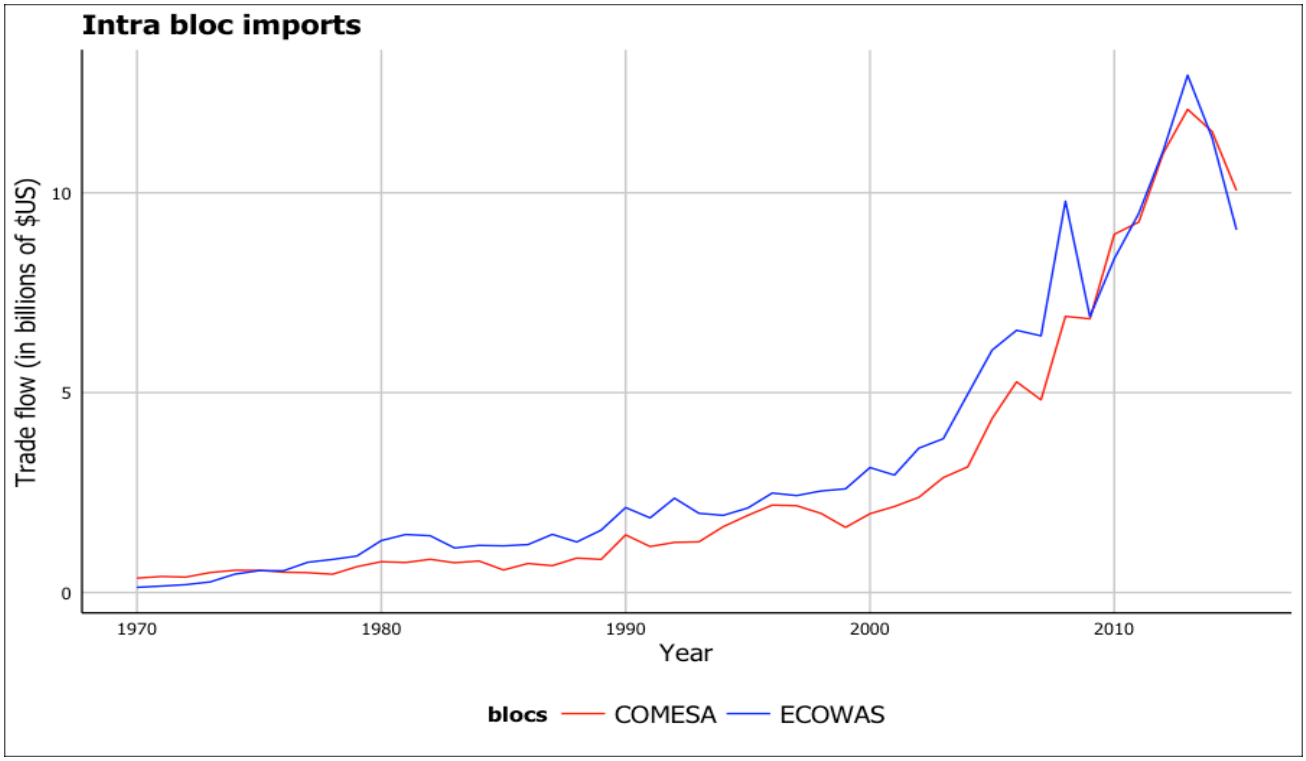
Intra COMESA imports principally comprise copper ores and concentrates, cobalt oxides, hydroxides and black tea. In 2015, Zambia recorded the highest share of intra COMESA imports of 24% while DR Congo, Sudan, Uganda and Libya registered shares of 11%, 10%, 9% and 8% respectively. Egypt, Kenya, Zambia and Congo DR are the major intra COMESA exporters

[14] Information from http://www.mfti.gov.eg/english/Agreements/Comesa.htm

[15] Facts and figures from UNCTAD Database, World Development Indicators (WDI), World Bank and IMF DOTs, and COMESA Secretariat Public Relations (2016) unless cited otherwise

accounting for 64% of intra COMESA exports in 2015. Manufactured products make up a large share of intra COMESA exports followed by other products and primary commodities. Also, copper ores and black tea remain the most exported products within the group.

Figure 3.5 Intra-bloc imports from 1970-2015



Source: Head, Mayer & Ries (2010) and UNCTAD Database

Intra ECOWAS exports of are dominated by Nigeria, Ghana and Cote D'Ivoire. These countries account for over 70% of trade within the group. ECOWAS' regional imports constitute fuel, vehicles, transport equipment, mechanical appliances and boilers, machinery and electrical appliances and pharmaceuticals. The major regional exports of the ECOWAS region include fuel and mining products, and agricultural products. Table 3.2 & table 3.3, it can be noted that intra-bloc imports of ECOWAS and COMESA have been growing faster than imports from the rest of the world; this indicates modest progress towards increasing of regional trade on the continent.

Table 3.3 Average annual growth of ECOWAS merchandise trade (in percent)

	Intra-bloc		Rest of the world	
Year	**exports**	**imports**	**exports**	**imports**
1995 - 2000	6.11	10.24	6.63	1.00
2000 - 2005	19.34	18.28	18.68	13.70
2005 - 2010	14.31	17.31	16.24	19.48
2010 - 2015	5.85	10.00	6.07	7.47

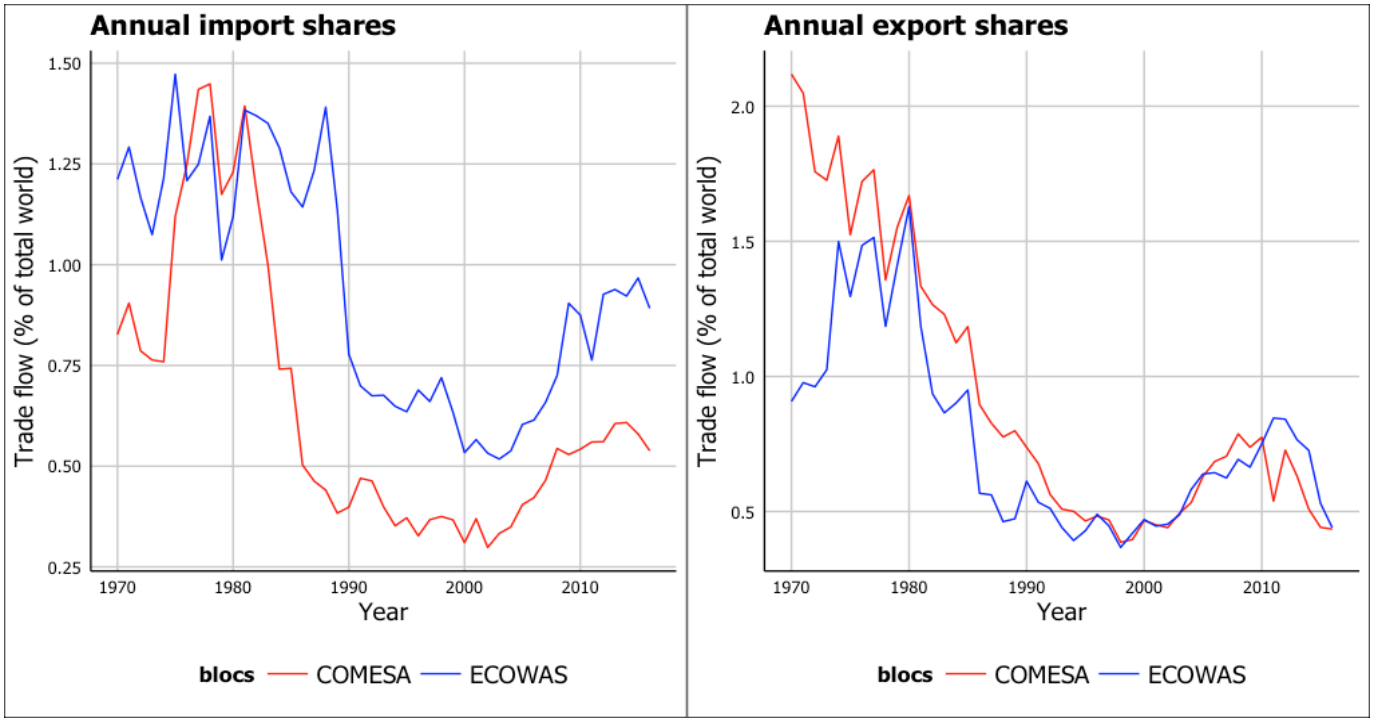
Source: Author's calculation from UNCTAD Database

Table 3.4 Average annual growth of COMESA merchandise trade (in percent)

	Intra-bloc		Rest of the world	
Year	**exports**	**imports**	**exports**	**imports**
1995 - 2000	1.11	6.05	4.75	1.18
2000 - 2005	22.5	24	21	10.51
2005 - 2010	29.40	28.40	17.52	18.16
2010 - 2015	5.91	7.45	-2.21	6.36

Source: Author's calculation from UNCTAD Database

Figure 3.6 Annual merchandise trade flow shares 1970-2016



Source: Head, Mayer & Ries (2010) and UNCTAD Database

Figure 3.6 shows the shares of exports and imports of both blocs in total world exports and imports. The exports and imports of both blocs represent a small fraction of world exports and imports. The

low export shares can be attributed to the overdependence on primary commodity export which has low and volatile prices on the world market. Moreover, the low import shares can be explained by small economic sizes of both blocs. From 1970 to 2016, the average export shares of ECOWAS and COMESA 0.8% and 1% respectively. With respect to merchandise export shares, COMESA has a higher share compared to ECOWAS. Export shares of both blocs declined from 1980 to 2000 and increased slightly thereafter. On the other hand, ECOWAS has higher imports shares compared to COMESA over the period.

3.7 Major trading partners and colonial legacy

The European Union (EU 28) is West Africa's major trading partner followed by China, India, USA and Brazil. EU 28s major imports from West Africa include mineral products, foodstuffs, beverages and tobacco. The EU 28, India, China, Brazil and USA account for 64% of West African exports. The EU 28, China, USA and India, together account for 57% of West African imports. The USA and EU 28 have been West Africa's major trade partners for many years to date. This sustained trade relations can be partly attributed to ECOWAS' participation in the AGOA and EPA trade agreements and other preferential trade agreements. However, ECOWAS trade with the USA has declined rapidly since 2000 to date. In 2009, China overtook the USA as Africa's major single trading partner (AfDB/OECD/UNDP, 2014).

African countries notably trade more with their colonial masters due to their colonial histories. Many of the member states of ECOWAS are either former English, Spanish, Dutch or French colonies. Among the EU28, France, Germany, Netherlands, Italy, Spain and the United Kingdom have been West Africa's major trading partners for years. Nonetheless, the situation is quite different now. New trading partners have emerged from Asia and South America. The explanations for this phenomenon are provided by Head et. al (2010), who show that most colonies after independence have realised a contraction in a trade with their former colonial masters. They provide three reasons for the decline in trade with colonial masters; the full exploitation of trading opportunities by the Metropole, depletion of trade enhancing capital and the cessation of existing trade agreements between colonies and metropole after independence. The authors also show that trade between independent colonies and the rest of the world declined on average contrary to expectations of higher trade between independent colonies and the rest of the world.

The top 5 trading partners of COMESA include China, EU 28, South Africa, India and Switzerland with respective shares of 15%, 14%, 9%, 6% and 5% in COMESA's total trade with the world. China is the major receiver of COMESA exports followed by EU 28, South Africa, India and Saudi Arabia.

Table 3.5 ECOWAS top trading partners in 2015 (as a share of ECOWAS trade with the world)

	Imports		Exports		Total trade	
Rank		**% world**		**% world**		**% world**
1	EU 28	26.5	EU 28	34.6	EU 28	29.5
2	China	25.9	India	18.2	China	18
3	USA	5.3	Brazil	5.9	India	9.7
4	India	4.5	Switzerland	5.2	USA	4.8
5	Singapore	2.8	China	5.1	Brazil	3.1

Source: IMF Direction of Trade Statistics (DOTS) & Eurostat Statistics

Table 3.6 COMESAs top trading partners in 2015 (as a share of ECOWAS trade with the world)

	Imports		Exports		Total trade	
Rank		**% world**		**% world**		**% world**
1	China	16.5	EU 28	18.1	China	14.9
2	EU28	11.8	Switzerland	16.5	EU28	13.5
3	South Africa	10	China	10.5	South Africa	8.9
4	India	7.2	United Arab Emirates	7	India	5.7
5	Saudi Arabia	4.8	South Africa	5.8	Switzerland	4.8

Source: IMF Direction of Trade Statistics (DOTS) & Eurostat Statistics

The major imports of the COMESA include machinery and appliances, products of the chemical or allied industries, transport equipment, food stuff, beverages, tobacco and vegetable products. On the other hand, COMESA's major exports comprise food and live animals, miscellaneous manufactured articles, manufactured goods classified chiefly by material, crude materials, inedible, except fuels, beverages and tobacco. 70% of the region's exports are primary products, specifically agricultural, fuel and mining products.[16] COMESA's trade with the India, EU 28 and China grew rapidly between 2000 and 2010. This phenomenon can be attributed to the EPA and Sino-Africa trade agreements ratified by COMESA member states in the period. While trade with the EU 28 has declined since 2012, COMESA's trade with China has been on the ascendancy.

[16] Figure outsourced from European Union website: http://ec.europa.eu/eurostat/statistics-explained/index.php/EU_trade_with_the_Common_Market_for_Eastern_and_Southern_Africa_(COMESA)

4 Chapter

4.1 Economic theory of the gravity model

4.1.1 Simple gravity model of trade

The gravity equation is a workhorse widely used to identify the determinants of bilateral trade flows and to extrapolate trade costs. Jan Tinbergen (1962) and Pöyhönen (1963) were the first to break grounds in investigating the determinants of bilateral trade flows using the gravity model.[17] The central message of the gravity model is that bilateral trade is directly related to the economic size of a country and inversely related to the bilateral distance.

The classical gravity equation[18] is as follows:

$$X_{ij} = \beta_0 Y_i^{\beta_1} Y_j^{\beta_2} t_{ij}^{\rho} \varepsilon_{ij}$$

where; X_{ij} denotes bilateral trade flows between country/origin i and country/destination j , trade flows can either be aggregated or disaggregated; β_0 is the "gravitational constant", Y_i and Y_j are the respective Gross Domestic Products (GDPs) of countries i and j; t_{ij} measures the extent of the bilateral reachability of importer j to exporter i (the bilateral distance between countries i and j , d_{ij}, is used as proxy for this variable in the basic gravity model); ε_{ij} is the assumed normally distributed error term; There is "gravity" when: β_1, $\beta_2 > 0$ and $\rho < 0$.

The logarithmic form of classical gravity equation is as follows;

$$lnX_{ij} = \alpha + \beta_1 \ln Y_i + \beta_2 lnY_j + \rho lnd_{ij} + \mu_{ij}$$

where α is the natural log of the gravitational constant and μ_{ij} is the error term.

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[17] The gravity model of trade was adopted from Newton's law of universal gravitation Newton (1687) that suggests that the force between two objects is directly related to a gravitational constant and their respective masses, and inversely related to the squared distance between the objects.

[18] The naive gravity model ignores the market clearing condition and does not incorporate the fact that consumers see tradable goods as substitutes.

4.1.2 Derivation of the gravity equation

The simple gravity model is basic and not pliable compared to theoretical gravity models. It ignores the multilateral resistance terms to trade which leads to the "golden medal mistake" (Baldwin & Taglioni, 2007). The theoretical gravity equation requires a set of assumptions to hold and can be derived from the Ricardian model, Heckscher-Ohlin model or the new trade theory models of monopolistic competition. Under the conditions of different factor intensities in the production of goods and vast differences in factor endowments among the various countries, the Heckscher-Ohlin model can be used to derive the gravity equation and perfect production specialisation across countries (Evenett & Keller, 2002). Based on the Armington assumption of goods differentiated by place of origin, balanced trade and the existence of iceberg trade costs, Anderson and van Wincoop (2003) derived the gravity model to solve the border puzzle. They emphasise the relevance of trade barriers in the gravity model and reveal the existence of a less perfect market integration. They assume prices differ across countries and use estimated border effects to account for price effects. Border effects have an asymmetric effect on countries of different sizes and in particularly large effects on small countries. They also assume every country specialises in producing one good with the existence of a 'trade separable' set-up.

4.1.3 Market clearing condition

The structural gravity equation assumes market clears in each exporting country. The total sales of exporter i, Y_i must be equal to the sum of sales (exports) to each importer j, X_{ij}. Again, the total expenditure by importer j, E_j must be equal to the sum of purchases from each exporter i, X_{ij};
$Y_i = \sum_j X_{ij}$ and $E_j = \sum_j X_{ij}$. World sales must be equal to world expenditure; $Y = \sum_i Y_i = \sum_j E_j$.
Hence country i's share of world expenditure (GDP) is given by; $s_i = Y_i/Y$

The gravity model can be derived on the assumption of a world with no frictions to trade. Under this condition, it is assumed prices of each good is equalised across countries, consumers have identical homothetic preferences, and there are no trade costs.
In the case of frictionless trade, it is assumed $t_{ij} = 1 \; \forall \; (i, j)$. In a frictionless and homogeneous world, the share of importer j's spending on goods from exporter i is equal to the share of exporter i's output in the world. In other words, the purchases of destination j from origin i is the product of the total expenditure of destination j and origin i's share in world sales.
This expression is given by;

$$X_{ij} = \frac{Y_i E_j}{Y} = \frac{Y_i Y_j}{Y} \qquad (4.0)$$

Eqn. (4.0) is the derived basic gravity model in the absence of trade cost or barriers.

$$X_{ij} = s_i s_j Y \qquad (4.1)$$

It can be inferred from Equation (4.1) that in a frictionless gravity model, large countries have higher market shares hence trade more while small countries are more open to trade with the rest of the world.

4.1.4 Accounting for trade frictions in gravity equation

Ideally, there are frictions to trade in the real world. As a result, international trade is often below the expected levels. McCallum (1995) was the first to ascertain the role borders play in intra and international trade by comparing within-Canada and US-Canada trade using the gravity model. He gave evidence to the importance of trade barriers in the gravity model. Equation (4.0) is modified by including a variable that accounts for trade related frictions such as borders and bilateral distance. The transformed equation is as follows;

$$X_{ij} = \frac{Y_i E_j}{Y t_{ij}} = \frac{Y_i Y_j}{Y t_{ij}} \qquad (4.2)$$

where $t_{ij} = d_{ij} B_{ij}$ where B_{ij} is the border effect and d_{ij} is bilateral distance. B_{ij} is the border variable, $B_{ij} = 1$, when trade in within a country, zero otherwise.

The logarithmically transformed model of equation (4.2) for estimation is as follows;

$$lnX_{ij} = \alpha + \beta_1 \ln Y_i + \beta_2 lnY_j + \rho lnd_{ij} + \gamma B_{ij} + \varepsilon_{ij}$$

By estimating the equation above, McCallum (1995) concluded that intranational trade in Canada was 22 times international trade, controlling for economic size and bilateral distance. They made the that trade barriers matter in the gravity model.

4.1.5 Expenditure share equation

Anderson (1979) provided theoretical grounds to the gravity model based on the theory of expenditure shares. He stated expenditure shares at each importer j varies with trade frictions emerging from each exporter i. Anderson derived the gravity equation on underlying assumptions of product differentiation by origin, identical homothetic preferences of consumers and the independence of preferences of output size and income. Anderson (1979) assumed a Constant Elasticity of Substitution (CES) expenditure system. The expenditure share of exporter i in importer j depends on relative prices (real price of p_{ij}) and the elasticity of substitution between traded goods. The expenditure share is expressed as follows;

$$\frac{X_{ij}}{E_j} = \beta_i \left(\frac{p_{ij}}{P_j}\right)^{1-\sigma} \qquad (4.3)$$

p_{ij} is the price of the imported good in destination j which is expressed as $p_{ij} = p_i t_{ij}$ where t_{ij} is the "iceberg trade cost"; $t_{ij} > 1$ indicating the existence of trade frictions; p_i is the price of imported good origin i. p_{ij}/P_j is the relative prices of goods from exporter i to importer j; P_j is the domestic CES price index of good at destination j; σ is the elasticity of substitution among varieties of goods traded, where $\sigma > 1$. The expenditure share of i in j's is inversely related to the relative prices. Anderson (1979) defines β_i as a "distribution" parameter; $\beta_i > 0$ and $\sum_i \beta_i = 1$. Goods from each exporter i have one distribution parameter.

The CES price index at destination j is given by;

$$\mathrm{P_j} = \left(\sum_i \beta_i \, p_{ij}^{1-\sigma}\right)^{1/1-\sigma} \qquad (4.4)$$

Based on the market clearing condition, the total sales for each exporter i can be expressed as;

$$Y_i = \sum_j X_{ij} = \sum_j \beta_i \left(p_i t_{ij}/P_j\right)^{1-\sigma} E_j \qquad (4.5)$$

Eqn. (4.5) can be expressed differently as follows;

$$\beta_i p_i^{1-\sigma} = Y_i \Big/ \sum_j \left(t_{ij}/P_j\right)^{1-\sigma} E_j$$

Eqn. (4.3) can be expressed as follows based on the preceding equation;

$$X_{ij} = \frac{Y_i E_j}{Y} \left(\frac{t_{ij}}{P_i P_j}\right)^{1-\sigma} \qquad (4.6)$$

Equation (4.7) is the derived structural gravity model specified by Anderson and van Wincoop (2003) that accounts for the multilateral price terms. This is the gravity equation used for this study. The structural gravity equation is a product of the frictionless trade flows, $Y_i E_j/Y$, and relative bilateral friction which measures relative trade barriers. They conclude that volumes of trade between countries or regions are contingent on both economic sizes and relative trade barriers.

They refer to the unobserved price indexes, P_i and P_j, as the multilateral resistance variables that depend on bilateral resistance and total sales. Whilst P_i is an index of outward trade frictions of

exporters in origin i, P_j is also an index of inward trade frictions of importer at destination j. These multilateral price terms or indexes are expressed as follows;

$$P_i^{1-\sigma} = \sum_j \left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} \frac{E_j}{Y} \quad (4.7)$$

$$P_j^{1-\sigma} = \sum_j \left(\frac{t_{ij}}{P_i}\right)^{1-\sigma} \frac{Y_i}{Y} \quad (4.8)$$

The multilateral resistance terms delineate how "remote" a country is from the rest of the world. For given trade barriers, the more isolated a country is, the higher the price index, the lower is the volume of trade.

The logarithmic transformed form of equation (4.6) is as follows;

$$lnX_{ij} = ln\, Y_i + lnY_j + (1-\sigma)Int_{ij} - (1-\sigma)lnP_i - (1-\sigma)lnP_j$$

5 Chapter

5.1 Empirical estimation of the gravity model of trade

5.1.1 Econometric specification of gravity model

Trade costs are specified differently in this study. Natural barriers to trade arise when country pairs in trade are either islands, landlocked countries or share common borders. Also, trade costs may be information costs or incentives to trade represented by dummies for common official language and colonial history, and the adjacency of trading country pairs. The bilateral trade costs, t_{ij} is a composite function defined as follows;

$$t_{ij} = dist_{ij}^{\delta_1}\left[e^{(\delta_2 contig_{ij} + \delta_3 comlang\_off_{ij} + \delta_4 col\_hist_{ij})}\right]$$

where "$dist_{ij}$" is the weighted distance between the principal cities of country i and country j; "$contig_{ij}$" is a dummy variable that assumes a value of 1 if countries i and j share a common border and otherwise 0; " $comlang\_off_{ij}$" is a dummy variable that assumes a value of 1 if i and j share a common official language and otherwise 0; "col_hist_{ij}" is a dummy variable that assumes a value of 1 if i and j have a common colonial history and otherwise 0.

The theoretical log-linear gravity is estimated as;

$$lnX_{ijt} = \beta_0 + \beta_1 lnY_{it} + \beta_2 lnY_{jt} + \beta_3 lndist_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} + \beta_6 col\_hist_{ij} - P_i^{1-\sigma} - P_j^{1-\sigma} + \varepsilon_{ij} \quad (5.0)$$

Where β_0 is a constant, ε_{ij} is the assumed log-normally distributed error terms; P_i and P_j are the multilateral resistance variables for country i and j respectively. The expected signs of the estimates are as follows; $\beta_1, \beta_2 > 0$, high levels of income of either exporting or importing countries results in higher bilateral trade; $\beta_3 < 0$, this means the further apart countries are in terms of distance, the lower the levels of trade between them; $\beta_4 > 0$, $\beta_5 > 0$ and $\beta_6 > 0$ when two countries in trade share a common border, official language and colonial history respectively.

5.1.2 Accounting for multilateral resistance terms

In this study, the multilateral price resistance terms in the gravity model were captured by importer and exporter fixed effects, also known as country specific fixed effects[19]. Importer and exporter fixed effects were earlier used in studies by Harrigan (1996) and Rose & Van Wincoop (2001). However, this has recently become a common tool used other trade economists like Feenstra (2004) and Redding & Venables (2004). They control for country-pair heterogeneity and peculiar country characteristics that affect trade flows. Country fixed effects are also able to capture observables related to over-statement, under-statement or erroneous recording of trade flows (Head & Mayer, 2014). They are represented by dummies and can be either be time varying or time invariant. One drawback of using country fixed effects is that it results in the creation and use of many dummies that may retard the computation process, estimation and delivery of the results of the gravity equation (Head & Mayer, 2014).

5.2 Estimation of gravity model with importer and exporter effects and time effects

5.2.1 Cross section econometric specification of gravity equation

The equation below is the baseline form of the gravity model using country fixed effects as proxies for the MRTs. It can be estimated by Ordinary Least Squares.

$$lnX_{ijt} = \beta_0 + \beta_1 lnY_{it} + \beta_2 lnY_{jt} + \beta_3 lndist_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} + \beta_6 col\_hist_{ij} + \beta_7 I_i + \beta_8 I_j + \beta_9 I_t + \varepsilon_{ij} \quad (5.1)$$

where I_i and I_j are the time invariant exporter and importer effects respectively. For a given country pair (i, j), I_i assumes a value of 1 if the exporting country is i and zero otherwise. I_j will also assume a value of 1 if the importing country is country j, and zero otherwise. I_t is the time dummy variable for each year; it assumes a value of 1 for a specific year and zero otherwise. When the main variables of interest are the bilateral variables that influence trade flows, the equation above is appropriate for OLS estimation.

[19] Other variables have been used as proxies for the multilateral resistance to trade terms. Remoteness variable has been used by Wei (1996), Helliwell (1996) and Baier & Bergstrand (2002). Baier & Bergstrand (2009) also use a first order Taylor series approximation of price indices as a proxy for the MRT terms.

$$lnX_{ijt} = \beta_0 + \beta_3 lndist_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} + \beta_6 col\_hist_{ij} + \beta_7 I_{it} + \beta_8 I_{jt} + \beta_9 I_t + \varepsilon_{ijt} \quad (5.2)$$

Equation (5.2) is different from the former because it accounts for time varying country fixed effects. I_{it} and I_{jt} are the time varying exporter and importer effects respectively. This gravity equation is appropriate for OLS estimation when the multilateral resistance to trade terms are assumed to vary with time. The estimation of Eqn.(5.2) with eliminates the partial effects of time varying country-specific explanatory variables like GDP. These time varying country-specific variables are likely to be correlated with the country effects dummies.

5.2.2 Panel econometric specification of gravity equation

The within estimator is widely used and preferred in the gravity literature because there is little need for theoretical explanation about the distribution of multilateral resistance to trade. This estimation technique of the gravity model is also founded on the assumption of the presence of time-invariant heterogeneity unique to each country pair in the panel data. Unobserved heterogeneity is easily controlled for in panel analysis. The fixed effects model is a suitable model in the presence of unobserved time invariant bilateral variables the may be in the error term and correlated with the RTA variable (Baier & Bergstrand, 2007). On the other hand, random effects models can be used to estimate the gravity model when the multilateral resistance to trade are presumed to be independent and identically distributed. Egger (2002) and Carrere (2006) have estimated the gravity model using the random effects model. When estimating the effects of RTAs on trade flows, the random effects model is more suitable if the RTAs have fixed membership (Carrère, 2006). There is strong evidence that with a Hausman test, the fixed effects gravity model is often preferred to the random effects gravity model when country-specific fixed effects are added to the model (Egger, 2000).
The gravity equation specified for the within estimation is as follows;

$$lnX_{ijt} = \beta_o + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_7 I_i + \beta_8 I_j + \beta_9 I_t + \alpha_{ij} + \nu_{ijt} \quad (5.3)$$

$$lnX_{ijt} = \beta_o + \beta_7 I_{it} + \beta_8 I_{jt} + \beta_9 I_t + \alpha_{ij} + \nu_{ijt} \quad (5.4)$$

where α_{ij} represents the fixed effects specific to each country pair and are the same for all years, this variable includes the common language, colonial history, bilateral distance among others.; ν_{ijt} is the

assumed log-normally distributed error term. Equation (5.3) can be estimated using a within estimator if the coefficients of interest are those of the country-pair or bilateral variables. Time invariant MRTs are often suitable and applicable when the periods under consideration is short, especially for the panel fixed effects estimation of gravity model (Bachetta et al., 2012). When the bilateral variables of interest are time-invariant, the within estimator of the gravity model cannot be used to extrapolate their respective estimates. This is because these time-invariant bilateral variables disappear from the model through the demeaning of regressors. Hence no estimates are obtained for trade related economic inferences. In order to fully deal with biased results from unobserved trade costs and model misspecification, the MRTs in a panel data must be time varying (Baldwin & Taglioni, 2006).

5.2.3 Poisson Pseudo-Maximum-Likelihood (PPML) Estimator

In the presence of a high percentage of zeros or the highest possible values for a continuous dependent variable, corner solutions become imminent. The Tobit model becomes the appropriate method of estimation that is often utilised in such cases. However, the tobit (censored) gravity regression as used by Soloaga & Winters (2001) and other authors have been criticised for having no theoretical basis. Nonetheless, the commonly used alternate gravity model estimators instead of the tobit model are the PPML. In their ground breaking work, Santos Silva & Tenreyro (2006) posit the PPML estimator outperforms the OLS estimator because in the presence of heteroscedasticity and innumerable zero trade flows it is consistent. The estimation of the logarithmically transformed multiplicative gravity model with many zero trade flows by OLS results in the dropping of observations with zero trade flows. The omission of these observations results in sample selection bias and biased parameter estimates (Westerlund & Wilhelmsson, 2011). Under such circumstances, the OLS estimates of the gravity model are biased and inconsistent.

The gravity equation specified for the PPML estimation is as follows;

$$\mathrm{E}(\mathrm{X}_{ijt}|Z_{ijt}) = \exp(\beta_0 + \beta_1 lnY_{it} + \beta_2 lnY_{jt} + \beta_3 lndist_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} + \beta_6 col\_hist_{ij} + \beta_7 I_i + \beta_8 I_j + \beta_9 I_t + \varepsilon_{ij}) \quad (5.5)$$

$$\mathrm{E}(\mathrm{X}_{ijt}|Z_{ijt}) = \exp(\beta_0 + \beta_3 lndist_{ij} + \beta_4 contig_{ij} + \beta_5 comlang_{off_{ij}} + \beta_6 col\_hist_{ij} + \beta_7 I_{it} + \beta_8 I_{jt} + \beta_9 I_t + \varepsilon_{ij}) \quad (5.6)$$

where Z_{ijt} represents the covariates of the gravity model

5.3 Estimating gravity model to assess the effect of regional trade agreements on trade flows

To ascertain the extent of change in trade flows resulting from the formation of a regional trade agreement, a binary and bilateral variable is added to the gravity equation. This variable assumes a value of one if both countries i and j in each trading country pair are in a specific regional trade agreement, and zero otherwise. This integration binary variable is created based on the year of ratification of the regional trade agreement and the year other countries officially joined the bloc. In the equation below, this variable is denoted by "RTA" and the coefficient of interest is β_7 ; it is the average treatment effect (ATE) of forming the regional trade bloc. The coefficient enables us to determine the magnitude of change in bilateral trade flows since the formation of the RTA in question. The specified gravity equation to be estimated is as follows;

$$lnX_{ijt} = \beta_0 + \beta_1 lnY_{it} + \beta_2 lnY_{jt} + \beta_3 lndist_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} + \beta_6 col\_hist_{ij} + \beta_7 RTA_{ij} + \beta_8 I_t + \beta_9 I_i + \beta_{10} I_j + \varepsilon_{ijt} \quad (5.7)$$

5.3.1 Measuring trade diversion and trade creation in the gravity equation

Trade creation and trade diversion effects can be isolated and shown in the gravity model by introducing three dummies per any RTA as deployed by Soloaga & Winters (2001), Clarete et. al (2003), Carrere (2006) and Martínez-Zarzoso et. al (2009) in the gravity literature. This approach enables us to observe the welfare effects of economic integration on the formation of a trade bloc. Unlike the single RTA dummy variable in (5.8), these three dummies enable one to isolate the trade creation and trade diversion effects for an RTA. This allows one assess the resultant effect of the RTA on the trade flows of both members and non-members. The gravity model can be used to obtain and compare the predicted level of bilateral trade to the "normal/counterfactual" in the absence of the RTA for a given set of countries. That is the three dummies introduced can be used to determine to what extent bilateral trade from the RTA is above or below the trade levels predicted by the gravity model.

The augmented gravity model specification is given by;

$$lnX_{ijt} = Ex_{ij} + \sum_m \gamma_m B_m + \sum_m \delta_m B_{mi} + \sum_m \rho_m B_{mj} + \varepsilon_{ijt} \quad (5.8)$$

where B_m is a binary variable that assumes a value of one if both countries i and j belong to the same regional trade agreement, and zero otherwise; Ex_{ij} is all the other regressors in (5.0)**;** B_{mi} takes the

value of one if country i is a member of bloc m and country j belongs to the rest of the world, zero otherwise; B_{mj} is a dummy that assumes a value of one if j is a member of bloc m and i belongs to the rest of the world, zero otherwise; δ_m measures the magnitude of export diversion while ρ_m measures of extent of import diversion. While δ_m captures bloc exports to the rest of the world, ρ_m captures bloc imports from the rest of the world; δ_m shows how much export is higher to non-member countries than the normal levels whilst ρ_m shows how much imports from non-member countries is higher than the normal levels.

From this equation, the impact of regional trade agreement membership on export diversion, import diversion and openness can be analysed. The γ_m and δ_m coefficients can be interpreted as measures of openness and trade diversion outcomes of RTAs; γ_m is the measure of trade creation, it measures the degree to which trade is higher than normal levels if both countries i and j belong to the same trade bloc.

When $\gamma_m > 0$ and $\delta_m \geq 0$, there is pure trade creation in terms of exports (imports). There is trade diversion in terms of exports when $\gamma_m > 0$ and $\delta_m < 0$. If $\gamma_m > 0$ and $\delta_m < 0$, and $\gamma_m > \rho_m$, then there is both trade creation and export diversion. If $\gamma_m > 0$ and $\delta_m < 0$ and $\gamma_m < \rho_m$, then there is only export diversion. On the other hand, when $\gamma_m < 0$ and $\delta_m > 0$, there is extra-bloc export expansion. When $\gamma_m < 0$ and $\delta_m < 0$, there is both export diversion and intra-bloc export contraction.

The following equations are the augmented log-linear gravity equations to be estimated;

For cross sectional estimations;

With no year and country fixed effects;

$$lnX_{ijt} = \beta_0 + \beta_1 lnY_{it} + \beta_2 lnY_{jt} + \beta_3 lndist_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} + \beta_6 col\_hist_{ij} + \sum_m \gamma_m B_m + \sum_m \delta_m B_{mi} + \sum_m \rho_m B_{mj} + \varepsilon_{ijt}$$

Eqn. (1)

With year and country fixed effects;

$$lnX_{ijt} = \beta_0 + \beta_1 lnY_{it} + \beta_2 lnY_{jt} + \beta_3 lndist_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} + \beta_6 col\_hist_{ij} + \beta_7 I_t + \beta_8 I_i + \beta_9 I_j + \sum_m \gamma_m B_m + \sum_m \delta_m B_{mi} + \sum_m \rho_m B_{mj} + \varepsilon_{ijt}$$

Eqn. (2)

For panel estimations;

With year and country fixed effects;

$$lnX_{ijt} = \beta_0 + \beta_1 lnY_{it} + \beta_2 lnY_{jt} + \beta_3 lndist_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} + \beta_6 col\_hist_{ij} + \beta_7 I_t + \beta_8 I_i + \beta_9 I_j + \sum_m \sum_m \gamma_m B_m + \sum_m \delta_m B_{mi} + \sum_m \rho_m B_{mj} + \alpha_{ij} + \varepsilon_{ij}$$

Eqn. (3)

For PPML estimations;

$$E(X_{ijt}|Z_{ijt}) = \exp(\beta_0 + \beta_1 lnY_{it} + \beta_2 lnY_{jt} + \beta_3 lndist_{ij} + \beta_4 contig_{ij} + \beta_5 comlang\_off_{ij} + \beta_6 col\_hist_{ij} + \beta_7 I_t + \beta_8 I_i + \beta_9 I_j + \sum_m \gamma_m B_m + \sum_m \delta_m B_{mi} + \sum_m \rho_m B_{mj} + \varepsilon_{ijt})$$

Eqn. (4)

6 Chapter

6.1 Results and Analysis

6.1.1 Cross section gravity model using various specifications

In table 6.1, the results from an OLS estimation of the log-linear gravity model for a for a time span of 34 years (1970 to 2006) are displayed. This enables one to observe the effects of the explanatory variables on bilateral trade flows over time. Different specifications of the gravity model are estimated for strictly non-zero nominal bilateral trade flows.

Column (1) shows the results from estimating the gravity equation without year fixed effects and the multilateral price resistance terms (**Eqn. (1)**). The R-squared is quite high; 59 % of the variation in bilateral trade flows from 1970 to 2006 is explained by the explanatory variables. The exporter and importer GDPs are close to one, positive and significant at 1%. A 1% increase in exporter GDP increased bilateral trade flows by 1% while a 1% increase in importer GDP increased bilateral trade flows by 0.8%. The signs of the estimates of the trade cost and incentive dummies are as expected. Bilateral distance has a negative and significant coefficient while the coefficients of the border, common language and colonial history variables are positive and significant at 1% each. A 1% increase in bilateral distance decreased bilateral trade flow by 1.2% over the period. Over the duration, countries that share the same a common border traded 87% more than countries that do not. Moreover, countries that use the same official language traded 114% more than countries that do not. Countries with colonial links also traded 318% more than countries without the same colonial history.

The remaining variables in table 6.0 are the variables that explain the magnitude of trade creation and trade diversion from the formation of the two regional trade agreements under consideration in this study. Their estimates can be used to deduce the integration effects. These are the "key variables" of interest in this study. "ECOWAS" and "COMESA" capture the trade creation effects from the formation of the two regional blocs. Their estimates show the magnitude of change in intra-ECOWAS and intra-COMESA trade flows compared to "normal" levels of trade. "ECOWASX" and "COMESAX" estimates are export diversion effects. "ECOWASX" is the variable for extra-ECOWAS exports, that is exports from an ECOWAS member state to a non-member while "COMESAX" is extra-COMESA exports, that is exports from a COMESA member state to a non-member.

Table 6.1 OLS estimation of differently specified gravity models of trade

	Dependent variable:		
	trade flow		
	(1)	(2)	(3)
Exporter income	0.983***	1.061***	0.657***
	(0.001)	(0.002)	(0.009)
Importer income	0.809***	0.888***	0.577***
	(0.001)	(0.001)	(0.009)
Distance	-1.162***	-1.195***	-1.431***
	(0.004)	(0.004)	(0.005)
Border	0.625***	0.521***	0.623***
	(0.018)	(0.018)	(0.019)
Common language	0.760***	0.769***	0.639***
	(0.009)	(0.009)	(0.010)
Colonial history	1.431***	1.184***	1.208***
	(0.016)	(0.015)	(0.017)
ECOWAS	0.048	0.517***	0.459***
	(0.037)	(0.037)	(0.060)
ECOWASX	-0.769***	-0.458***	-0.376***
	(0.019)	(0.019)	(0.044)
ECOWASM	-0.443***	-0.141***	-0.012
	(0.015)	(0.015)	(0.035)
COMESA	-1.112***	-0.262***	-0.034
	(0.055)	(0.055)	(0.061)
COMESAX	-1.386***	-0.731***	-0.483***
	(0.019)	(0.019)	(0.024)
COMESAM	-1.010***	-0.358***	-0.133***
	(0.016)	(0.017)	(0.021)
Fixed effects	None	Year	TI, Year
Observations	532,915	532,915	532,915
R^2	0.591	0.620	0.693

Note: *p<0.1; **p<0.05; ***p<0.01

The White's heteroskedastic-consistent standard errors are in the parentheses. The dependent variable is the natural log of nominal bilateral trade flow from country i to country j. ECOWAS and COMESA denote trade creation effects whilst ECOWASX and COMESAX denote export diversion effects and ECOWASM and COMESAM denote import diversion effects. Estimates for year and country fixed effects are not presented in the table for brevity in the presentation of results.

The import diversion effects can be inferred from the estimates of "ECOWASM" and "COMESAM". These estimates indicate the degree of change in imports of the member states of the two respective trading blocs from non-members.

The estimate of the intra-ECOWAS dummy is positive as expected but statistically insignificant. Notwithstanding, the estimates of the extra-ECOWAS exports and extra-ECOWAS imports variables are both negative and significant at 1%. The extra-ECOWAS exports were 54% lower than the bilateral trade of countries that are non-members of ECOWAS while extra-ECOWAS imports were 36% lower than the bilateral trade of countries that are non-members of ECOWAS. These results imply both import and export diversion from ECOWAS; a welfare loss to both non-members and members of ECOWAS. All the estimates for the COMESA trade creation and diversion effects variables are negative and significant at 1%. Intra-COMESA trade was 67% lower than the bilateral trade of countries that are both non-members of COMESA while extra-COMESA exports and extra-COMESA imports by 75% and 64% lower respectively, than the bilateral trade of countries that are non-members of COMESA. There is no proof of welfare gains for the COMESA bloc.

In Column (2), the results for the OLS estimation with the only year fixed effects are shown. Year fixed effects dummies are included because bilateral trade flows are likely to vary with time. A test for the significance of the year fixed effects with the null hypothesis as "no time-fixed effects needed" results in the rejection of the null. The year fixed effects matter in the gravity model. The inclusion of the year fixed effects increases the R-squared from 0.59 to 0.62. In this model, 62 % of the variation in trade flows are explained by the explanatory variables. Here, the exporter and importer GDPs are both positive and significant at 1% and increase in value. Over the duration, countries that share the same border traded 68% more than countries that do not. Also, countries that use the same official language traded 116% more than countries that do not. Countries with colonial links also traded 227% more than countries without the same colonial history. In this model, the intra-ECOWAS trade dummy estimate remains positive but becomes significant at 1%. It can be deduced that intra-ECOWAS trade was 68% higher than "normal" levels or bilateral trade of any non-ECOWAS member states. Extra-ECOWAS exports and extra-ECOWAS imports were 37% and 13% lower respectively than the bilateral trade of any non-members of ECOWAS. There were welfare gains for the ECOWAS bloc through trade creation as well as welfare loss to ECOWAS from a reduction in imports from the rest of the world. Also, there was welfare loss to non-member countries due to the reduction in ECOWAS exports to the rest of the world. On the one hand, the intra-COMESA trade coefficient remained negative and significant at 1%. Intra-COMESA trade was 23% lower while extra-COMESA exports and extra-COMESA imports were 52% and 30% lower respectively than the bilateral trade of nonmembers of COMESA.

The omission of the multilateral resistance terms in column (1) and column (2) inevitably causes "the gold medal mistake" as pointed out by Anderson & van Wincoop (2003) and Baldwin & Taglioni (2007). Both models are misspecified, and there is the need to account for MRTs. Even though some may agree with economic theory, the failure of account for the MRTs invalidates the reliability results.

Column (3) shows the results of the log-linear gravity model with both year and time invariant country fixed effects (**Eqn. (2)**) estimated by OLS. In this model, the multilateral resistance to trade terms were accounted for. The R-squared increases to 0.69. The estimates of both the exporter and importer GDPs are relatively smaller than those in column (1) and column (2). However, they remain positive and significant at 1%; their economic interpretation is theoretically valid and consistent as well. A 1% increase in exporter GDP increased bilateral trade flows by 0.7% while a 1% increase in importer GDP increased bilateral trade flows by 0.6%. The bilateral distance variable has a bigger, negative and statistically significant coefficient. A 1.4 % reduction in trade was associated with a 1% increase in bilateral distance. The remaining geographical and historical variables have the expected positive and statistically significant coefficients. The coefficient of the intra-ECOWAS trade is positive and significant at 1%. The absolute value of this estimate is smaller compared to the result obtained in the first column (2). Intra-ECOWAS trade was 58% higher than "normal" levels /than the bilateral trade of any non-ECOWAS members over the duration. The indication of welfare gains (trade creation) from the ECOWAS bloc as revealed in column (2) remains unchanged but lower (10% less). Extra-ECOWAS exports were 31% lower than the bilateral trade of any non-members of ECOWAS. The coefficient of extra-ECOWAS imports is negative and statistically insignificant. There was no indication of import diversion between 1970 and 2006 from ECOWAS. The intra-COMESA trade dummy remains negative but statistically insignificant in this model estimation. It simply means COMESA had no trade creation effect in the period. This is a surprising conclusion. Nevertheless, the estimates of both extra-COMESA exports and extra-COMESA imports are negative and significant at 1 percent. Over the duration, extra-COMESA exports and extra-COMESA imports were lower by 38% and 12% respectively, than bilateral trade between non-members of COMESA. This implies a welfare loss (trade diversion) to both member states and non-member states of COMESA.

6.1.2 Panel gravity equations using various specifications

Panel fixed effects regression results are presented in table 6.2 for the time-period of 1970 to 2006. There are no estimates for time invariant trade-related variables like bilateral distance, contiguity, common language and colonial history. These variables disappear from the equation after the within

transformation. The estimates shown in the columns of the table are only for variables in the gravity model of time dimensions. The estimates for the panel regression accounting for time varying importer and exporter fixed effects are not displayed in the table. The enormous number of dummies using time variant country fixed effects makes it impossible to obtain panel regression results for 1970-2006.

Table 6.2 Static Panel gravity regressions

	Dependent variable:		
	trade flow		
	(1)	(2)	(3)
Exporter income			0.679***
			(0.018)
Importer income			0.631***
			(0.016)
ECOWAS	1.260***	-0.424***	0.111
	(0.139)	(0.140)	(0.141)
ECOWASX	0.976***	-0.664***	-0.387***
	(0.073)	(0.074)	(0.073)
ECOWASM	1.359***	-0.282***	0.008
	(0.055)	(0.056)	(0.053)
COMESA	1.008***	-0.163	0.221**
	(0.112)	(0.111)	(0.107)
COMESAX	0.559***	-0.557***	-0.388***
	(0.046)	(0.048)	(0.047)
COMESAM	0.902***	-0.231***	-0.124***
	(0.038)	(0.040)	(0.039)
Fixed effects	TI	TI, Year	TI, Year
Observations	587,646	587,646	532,915
R^2	0.013	0.158	0.204
Note:			*p<0.1; **p<0.05; ***p<0.01

The White's heteroskedastic-consistent standard errors are in the parentheses. The dependent variable is the natural log of nominal bilateral trade flow from country i to country j. ECOWAS and COMESA denote trade creation effects whilst ECOWASX and COMESAX denote export diversion effects and ECOWASM and COMESAM denote import diversion effects. Estimates for year and country fixed effects are not presented in the table for brevity in the presentation of results.

Instead, inference will be made from the regression results where time-invariant country fixed effects are considered. One noticeable result with the panel regressions is the sharp decrease in the R-squared for all the differently specified models. The values of the R-squared now ranges from 1.3% to 20%. The results of the three distinct gravity models are estimated with the within estimator and presented.

In Column (1), the results of a panel fixed effects regression of the gravity model without year fixed effects but time invariant country fixed effects are displayed. The intra-ECOWAS trade dummy variable is positive and statistically significant at 1%. Intra-ECOWAS trade was 253% higher than "normal levels" or bilateral trade between non-members of ECOWAS. This represents a big trade creation effects from ECOWAS. For COMESA, intra-bloc trade was 174% higher than "normal levels" or bilateral trade between non-members of COMESA. Unlike the results in the table before, the trade diversion dummies are positive and significant at 1% for both ECOWAS and COMESA. Extra-ECOWAS and extra-COMESA exports were 165% and 79% higher than the bilateral trade of non-members of ECOWAS and COMESA respectively. On the other hand, extra-ECOWAS and extra-COMESA imports were 289% and 146% higher than the bilateral trade of any non-members of ECOWAS and COMESA respectively. There is an indication of welfare gains from these agreements both for member and non-member states from these estimates. ECOWAS exports and imports from more the rest of the world than COMESA. The estimates of the integration variables from this model estimation are biased upwards or over-estimated.

In Column (2), the panel regression is estimated with year and time invariant country fixed effects. A statistical test of the significance of the year fixed effects shows that they are different from zero and relevant in the gravity equation. Although, the R-squared increases from 0.013 to 0.158, all the estimates of the integration dummies become negative and statistically significant at 1 %. Intra-ECOWAS trade was 35% lower than the norm. The intra-COMESA trade variable estimate is positive but statistically insignificant at 1%. There is no credible evidence of trade creation or welfare gains from COMESA. These results are contrary to those obtained in column (1). Also, extra-ECOWAS and extra-COMESA exports were 48% and 43% respectively lower than the bilateral trade of non-members of ECOWAS and COMESA. While extra-ECOWAS imports were 25% less than the norm, extra-COMESA imports were 21 percent less. There is no evidence of welfare gains the member states of ECOWAS and COMESA in this model. Import and export diversion is dominant consequence from COMESA in the period.

In Column (3), the results of a panel regression with exporter and importer GDPs, year and time invariant country fixed effects are shown. The importer and exporter GDPs coefficients have the expected positive signs and are statistically significant at 1%. Adding these two variables increases the R-squared from 0.158 to 0.204. Both the intra-ECOWAS and intra-COMESA dummy estimates

become positive, but the intra-ECOWAS coefficient loses its statistical significance. Intra-COMESA trade in the period is 25% more than bilateral trade flows between any non-members of COMESA. Unlike COMESA, there is no sign of trade creation from ECOWAS in this model. The extra-ECOWAS import dummy coefficient is approximately zero and statistically insignificant while the extra-ECOWAS export dummy is negative and significant at 1%. Extra-ECOWAS exports and extra-COMESA exports were both 32% lower than bilateral trade between non-members. Lastly, extra-COMESA imports were 12% lower than bilateral trade predicted by the gravity model.

The results in the last two columns signify no welfare gains for ECOWAS. This contradicts what trade theories predict about the impact of RTAs on trade. The results obtained could be due to misspecification of the gravity model or failure to account for endogeneity bias (Carrère, 2006; Egger, 2004).

6.1.3 Poisson pseudo-maximum likelihood estimation of gravity equation using various specifications

In table 6.3, the results of the PPML estimation of differently specified gravity models are displayed for the time-period of 1970-2006 for the first three columns and 2002-2006 for the last column. The results in table 6.0 (OLS estimation) can be juxtaposed to the results in this table. Similar models are estimated in the corresponding columns of both tables. All the estimates of the variables are significant at 1%. From the results, the coefficients of colonial history dummies have an unexpected negative sign and are statistically significant in the first two columns. Intra-COMESA trade dummy estimates are unexpectedly negative and significant in the first two columns. There is an increase in the number of observations for all the models due to the inclusion of all zero bilateral trade flows. Column (1) shows the results of the poisson estimation without any fixed effects. Column (2) shows estimates for poisson with only time fixed effects while in Column (3), the results of the poisson estimation with year and time-invariant country fixed effects (**Eqn. (4))** are displayed. Column (4) presents the results of a poisson estimation of the gravity equation with year and time varying country fixed effects. The trade diversion effects disappear in the estimation process in the last column.

The results in the first and second column like in the OLS are biased and inconsistent since the multilateral price terms are not accounted for. The absolute value of the estimates of the exporter income, distance and common language variables are smaller compared to the OLS results in table 6.1. Except for column (2), the border effect is smaller under poisson than the OLS. For the integration effects, the estimates of the intra-ECOWAS dummy are bigger than those of the OLS. They remain positive in all the columns.

Table 6.3 Poisson Pseudo-maximum likelihood estimator (PPML) of gravity model

	Dependent variable:			
	trade flow			
	(1)	(2)	(3)	(4)
Exporter income	0.765***	0.784***	0.574***	
	(0.004)	(0.004)	(0.021)	
Importer income	0.784***	0.804***	0.626***	
	(0.005)	(0.005)	(0.017)	
Distance	-0.604***	-0.616***	-0.832***	-0.893***
	(0.007)	(0.007)	(0.006)	(0.012)
Border	0.605***	0.573***	0.566***	0.478***
	(0.027)	(0.027)	(0.018)	(0.030)
Common language	0.586***	0.592***	0.207***	0.202***
	(0.023)	(0.023)	(0.016)	(0.030)
Colonial history	-0.112***	-0.129***	0.014	0.029
	(0.025)	(0.025)	(0.023)	(0.046)
ECOWAS	0.837***	0.954***	0.513***	1.272***
	(0.060)	(0.060)	(0.118)	(0.148)
ECOWASX	-0.144***	-0.085*	-0.360***	
	(0.052)	(0.052)	(0.098)	
ECOWASM	-0.229***	-0.170***	0.002	
	(0.030)	(0.030)	(0.070)	
COMESA	-0.348***	-0.177**	0.075	0.772***
	(0.080)	(0.083)	(0.108)	(0.158)
COMESAX	-0.754***	-0.658***	-0.405***	
	(0.059)	(0.060)	(0.063)	
COMESAM	-0.602***	-0.505***	-0.411***	
	(0.024)	(0.025)	(0.029)	
Fixed effects	None	Year	Year, TI	Year, TV
Observations	778,252	778,252	778,252	152,816
Note:				*p<0.1; **p<0.05; ***p<0.01

The White's heteroskedastic-consistent standard errors are in the parentheses. The dependent variable is the nominal bilateral trade flow at levels from country i to country j. ECOWAS and COMESA denote trade creation effects whilst ECOWASX and COMESAX denote export diversion effects and ECOWASM and COMESAM denote import diversion effects. Estimates for year and country fixed effects are not presented in the table for brevity in the presentation of results.

The trade diversion effects of ECOWAS are negative and statistically significant. In column (3), intra-ECOWAS trade was 67% higher than the "normal" level or bilateral trade between any non-ECOWAS members. For the first three models, the absolute values of the intra-COMESA estimates are lower than those of the OLS estimation in table 3. The coefficient of the intra-COMESA trade variable is negative and statistically significant for the first two columns. There is no indication of trade creation for COMESA in column (3); the coefficient of intra-COMESA trade dummy is positive but statistically insignificant. When the poisson estimation of the gravity model with time-varying country fixed effects was run for a 4-year period in column (4), the estimate of the intra-COMESA dummy becomes positive and statistically significant at 1%. This suggests intra-COMESA trade increased from 2002-2006.

6.1.4 RTAs impact on trade flows from different estimation methods

In table 6.4, the summary of estimates of the integration effect variables for the correctly specified models are displayed. These are all the gravity equations that accounted for the year fixed effects as well as the importer and exporter fixed effects. The coefficients of the integration variables from three different estimations are highlighted and elaborated in the short paragraphs below.

Firstly, there is evidence of trade creation (welfare gains) for member countries of the ECOWAS. ECOWAS resulted in an increase in intra-bloc trade over the period; by 58% (column 1), 12% (column 2) and 67% (column 3). The intra-ECOWAS trade variable has positive and statistically significant estimates in all the models except for the panel fixed effects model. The coefficient of the intra-ECOWAS trade variable is higher in the OLS model than the panel but highest in the PPML model. ECOWAS exports to the rest of the world were lower than what is predicted by the gravity model in the duration under consideration. Since the extra-ECOWAS export dummy has negative and statistically significant coefficients in all the models, there is evidence of export diversion and consequently, a decrease in the welfare of non-members of ECOWAS. ECOWAS imports to the rest of the world were below the norm by 31% (column 1), by 32 (column 2) and 30% (column 3). This result is logical as similar studies predict a reduction in exports to and imports from the rest of the world when intra-bloc exports increase because of an RTA. All the estimates for the extra-ECOWAS import dummy are statistically insignificant. There is no evidence of import diversion for ECOWAS in all the models. The results also show that there is no pure trade creation concerning ECOWAS. While the net trade creation effect for ECOWAS in the OLS model is 27% above what is predicted by the static gravity model, it is magnified to 37% in the poisson.

Table 6.4 Summary of estimates for integration dummies

	Dependent Variable:		
		ln (trade flow)	*trade flow*
	OLS	*panel linear*	*Poisson*
	(1)	(2)	(3)
ECOWAS	0.459***	0.111	0.513***
	(0.060)	(0.141)	(0.118)
ECOWASX	-0.376***	-0.387***	-0.360***
	(0.044)	(0.073)	(0.098)
ECOWASM	-0.012	0.008	0.002
	(0.035)	(0.053)	(0.070)
COMESA	-0.034	0.221**	0.075
	(0.061)	(0.107)	(0.108)
COMESAX	-0.483***	-0.388***	-0.405***
	(0.024)	(0.047)	(0.063)
COMESAM	-0.133***	-0.124***	-0.411***
	(0.021)	(0.039)	(0.029)
Constant	-2.199***		-3.246***
	(0.174)		(0.219)
Fixed effects	TI, Year	TI, Year	TI, Year
Observations	532,915	532,915	778,252
R^2	0.693	0.204	

Note: *p<0.1; **p<0.05; ***p<0.01

The White's heteroskedastic-consistent standard errors are in the parentheses. The dependent variable is either the nominal bilateral trade flow from country i to country j at levels or in natural logarithms. ECOWAS and COMESA denote trade creation effects whilst ECOWASX and COMESAX denote export diversion effects and ECOWASM and COMESAM denote import diversion effects. Estimates for year and country fixed effects are not presented in the table for brevity in the presentation of results.

Secondly, the only evidence of trade creation effects from COMESA is in the panel model. The estimate for an intra-COMESA variable is positive and statistically insignificant only in column (2). The estimates of the extra-COMESA export and extra-COMESA import variables are negative and statistically significant in all the models. Again, one can conclude that trade diversion was a consequence of the COMESA bloc as exports to and imports from the rest of the world plummeted.

This indicates a welfare loss to both members and non-members of COMESA. There is no evidence of trade creation from COMESA from the poisson and OLS estimations. For COMESA, the trade diversion effects outweighed trade creation effects in all the models. COMESA is found to be trade diverting or resulted in a negative net trade creation. The net trade creation effect for COMESA in the poisson model is 67% lower than what is predicted by the static gravity model, and 50% and 37% lower in the OLS and panel estimations respectively.

The impact of these two RTAs on trade flows mirrors the low levels of intra-regional trade within both blocs as expounded in Chapter 3. For a period of 34 years, one can conclude the impact of these RTAs on trade flows is moderately low compared to changes of greater magnitude obtained by other trade blocs in the world within a shorter duration of time. Only ECOWAS is found to create more trade within the region.

Table 6.5 Summary table of magnitude of RTA-related trade effects (in percent)

Trade bloc		**ECOWAS**			**COMESA**	
Estimator	**OLS**	**Panel**	**PPML**	**OLS**	**Panel**	**PPML**
Intra-bloc exports	58		67		25	
Extra-bloc exports	-31	-32	-30	-38	-47	-33
Extra-bloc imports				-12	-12	-34
Net trade creation	27	-32	37	-50	-34	-67

Note: Figures in the table represent percentage changes in trade flows

6.1.5 Re-estimation of the RTA-related effects on trade flows

The statistically insignificant coefficients of the intra-COMESA trade variable from the OLS and PPML estimations in table 6.4 contradicts theoretical expectations and calls for a re-specification and re-estimation of the gravity models. The results in this table 6.6 can be used as a test for the robustness of the results obtained in table 6.4. Within the period of study, ECOWAS and COMESA assessed onto two other preferential trade agreements, namely AGOA and the EPA in 2000. Dummies for these trade agreements are created and added to the correctly specified gravity models for re-estimation. The following are conclusions are inferred from the results in table 6.4.

Firstly, the intra-ECOWAS trade coefficients remain positive and statistically significant for all the models except for the panel fixed effects model (column 2). These coefficients increase marginally for the OLS and poisson estimations. However, it remains the case that ECOWAS is net welfare improving and creates more trade within the region. Like before, there is no trace of import diversion for ECOWAS despite the changes to the model. The ECOWAS export diversion variable estimates are still negative and statistically significant at 1 %. We can still infer from the

table 6.4 that ECOWAS exports to the rest of the world plummet over time. Again, for the OLS model, the net trade creation effects with regards to ECOWAS is now 50% higher than what is predicted by the static gravity model.

Table 6.6 Robust check on estimates for integration dummies

	Dependent Variable		
	ln (trade flow)		*Trade flow*
	OLS	*panel linear*	*Poisson*
	(1)	(2)	(3)
ECOWAS	0.518***	0.095	0.606***
	(0.060)	(0.141)	(0.119)
ECOWASX	-0.289***	-0.350***	-0.329***
	(0.044)	(0.073)	(0.100)
ECOWASM	-0.038	-0.028	0.015
	(0.035)	(0.053)	(0.071)
COMESA	0.102	0.076	0.263**
	(0.063)	(0.122)	(0.123)
COMESAX	-0.331***	-0.290***	-0.349***
	(0.025)	(0.050)	(0.066)
COMESAM	-0.180***	-0.157***	-0.292***
	(0.022)	(0.041)	(0.031)
Constant	-2.136***		-3.238***
	(0.174)		(0.219)
Fixed effects	TI, Year	TI, Year	TI, Year
Observations	532,915	532,915	778,252
R^2	0.693	0.205	

Note: *p<0.1; **p<0.05; ***p<0.01

The White's heteroskedastic-consistent standard errors are in the parentheses. The dependent variable the nominal bilateral trade flow from country i to country j at levels or in natural logarithms. ECOWAS and COMESA denote trade creation effects whilst ECOWASX and COMESAX denote export diversion effects and ECOWASM and COMESAM denote import diversion effects. Estimates for year and country fixed effects are not presented in the table for brevity in the presentation of results.

In the poisson model, it is much higher, specifically 55% higher than what is predicted by the gravity model. The net trade creation increases for both the OLS and PPML estimations compared to results in table 6.3.1. The is a net welfare gain from ECOWAS.

Secondly, except for column (3), the estimates of the intra-COMESA trade variable are positive and statistically insignificant. The estimate of the intra-COMESA trade variable is statistically significant at 5% in the poisson model. Unlike in table 6.4, there is now evidence that COMESA resulted in trade creation (welfare gains) although it remains less compared to trade creation from ECOWAS.

Intra-COMESA trade was 30% above "normal" bilateral trade levels predicted by the gravity model in column (3). This indicates a resultant increase in intra-regional trade from COMESA from 1994-2006. Moreover, COMESA resulted in trade diversion in terms of exports and imports. Extra-COMESA exports and imports are both lower than what the static gravity model has predicted. All the estimates of the extra-COMESA exports variable are negative and significant at 1%. In all models, the magnitude of export diversion effects exceeds the import diversion effects of COMESA. In the poisson model, the trade creation effects did not offset the trade diversion effects as in the other models where no trade creation is reported (See table 6.7). The net trade creation effect for COMESA in the poisson model is 24% lower than what is predicted by the static gravity model, and still 46% and 40% lower in the OLS and panel models respectively.

Table 6.7 Summary table of magnitude of RTA-related trade effects (in percent)

Trade bloc		**ECOWAS**			**COMESA**	
Estimator	**OLS**	**Panel**	**PPML**	**OLS**	**Panel**	**PPML**
Intra-bloc exports	68		83			30
Extra-bloc exports	-28	-30	-28	-32	-25	-29
Extra-bloc imports				-14	-15	-25
Net trade creation	40	-30	55	-46	-40	-24

Note: Figures in the table represent percentage changes in trade flows

6.2 Evaluation of estimators

According to Santos Silva & Tenreyro (2006), the estimation of log-linear gravity equation of trade with OLS is likely to produce biased and spurious estimates in the presence of numerous zero trade flows in the data and heteroscedasticity. They recommend the estimation of the gravity equation in its multiplicative form in levels with the poisson pseudo-maximum likelihood (PPML) estimation technique. They add that the dropping observations with zero trade flows from the data before any OLS or panel fixed effects estimations as done in this study often lead to biased and inconsistent estimates depending on the sample and model in use. For that matter, the results from the PPML

estimator are reliable in the presence of heteroscedasticity in the models when controlling for fixed effects.

The goodness of fit is one of the evaluation parameters used in validating the suitability of a functional form in relation to the data set. The goodness of fit of the log-linear gravity model estimated by OLS and the within estimator can be compared directly but not with the pseudo R-squared of PPML estimated gravity equation. This is because the gravity equations of former two estimators have the same dependent variable which differs from the latter (($ln(X_{ij})$ vs X_{ij}).The goodness of fit may not be the appropriate basis to select the model that fits the data best in this case. Nonetheless, the OLS has a higher adjusted R-squared compared to the within-estimator (69% vs 21%). This implies the gravity model estimated by OLS has a higher explanatory power compared to the gravity model estimated with the within-estimator. The pseudo R-squared can be calculated for the poisson estimation by subtracting the ratio of the residual deviance to the null deviance from one. The pseudo R-squared of the poisson is 94% and higher than the R-squared of the two other models. However, the choice of the model that fits the data best requires further checks.

In terms of the theoretical consistency of the results, only a few the models produced unexpected estimates for the integration variables. For instance, for the panel and OLS estimations, the intra-COMESA trade variable has a positive but statistically insignificant coefficient. The estimate of the intra-ECOWAS trade variable is not statistically significant in the panel (See table 6.6).

Also, I plotted the fitted bilateral trade flows against the observed bilateral trade flows for the three estimators. The deviations from the 45° line depict the absolute deviations in each plot. Although there are instances where the predicted bilateral trade flow is not close to the observed bilateral trade flow, the fit of the model looks quite good in the plot for the PPML estimator compared to the OLS and panel fixed effects estimators (See Appendix A, B and C). It is the case that the predicted bilateral trade flows are over-estimated when the observed bilateral trade flow is small for the PPML. This is an indication that the PPML estimator performs relatively better at predicting trade flows compared to the others.

Based on the reasons explained in the preceding paragraphs, the results from the PPML estimation of the gravity model is used for the conclusions of the study.

6.3 Reasons for low intra-regional trade in both blocs

One of the reasons attributed to low intra-regional trade on the African continent is the increasing informal cross border trade (UNCTAD, 2013). Some trade economists claim intra-regional trade on the continent should be higher than what is recorded presently provided informal and unrecorded

trade activities are captured by official trade data. For instance, it was realised from surveys conducted in the SADC region that informal trade could contribute up to 40 percent of intra-SADC trade (UNCTAD, 2013). These informal cross border activities that are not accounted for by official trade data are termed "missing trade". On the contrary, some authors like Pritchett & Foroutan (1993) assert that the low intra-African trade does not fall short of expectations. Findings like this one are objected on the grounds of the unrepresentative sample and inappropriate methodology for the study.

Based on the estimates from the PPML estimation of the gravity equation in table 6.6, the annual observed and predicted intra-bloc imports are compared for both COMESA and ECOWAS from 1970-2006 to find out whether there is evidence of missing trade. From Figure 6.1, the gravity model over predicts total imports within ECOWAS from 1970-1989. This may indicate that West African countries in the period traded below some expected levels; some trade may have gone "missing" or unrecorded. Although the gravity model predicted trade flows lower than the actual from 1990-2006, the predicted trade flows increases closely to the observed trade flow. The evidence for missing trade for ECOWAS is not too strong.

Figure 6.1 Observed and predicted annual intra ECOWAS imports (in US$ billions) 1970-2006

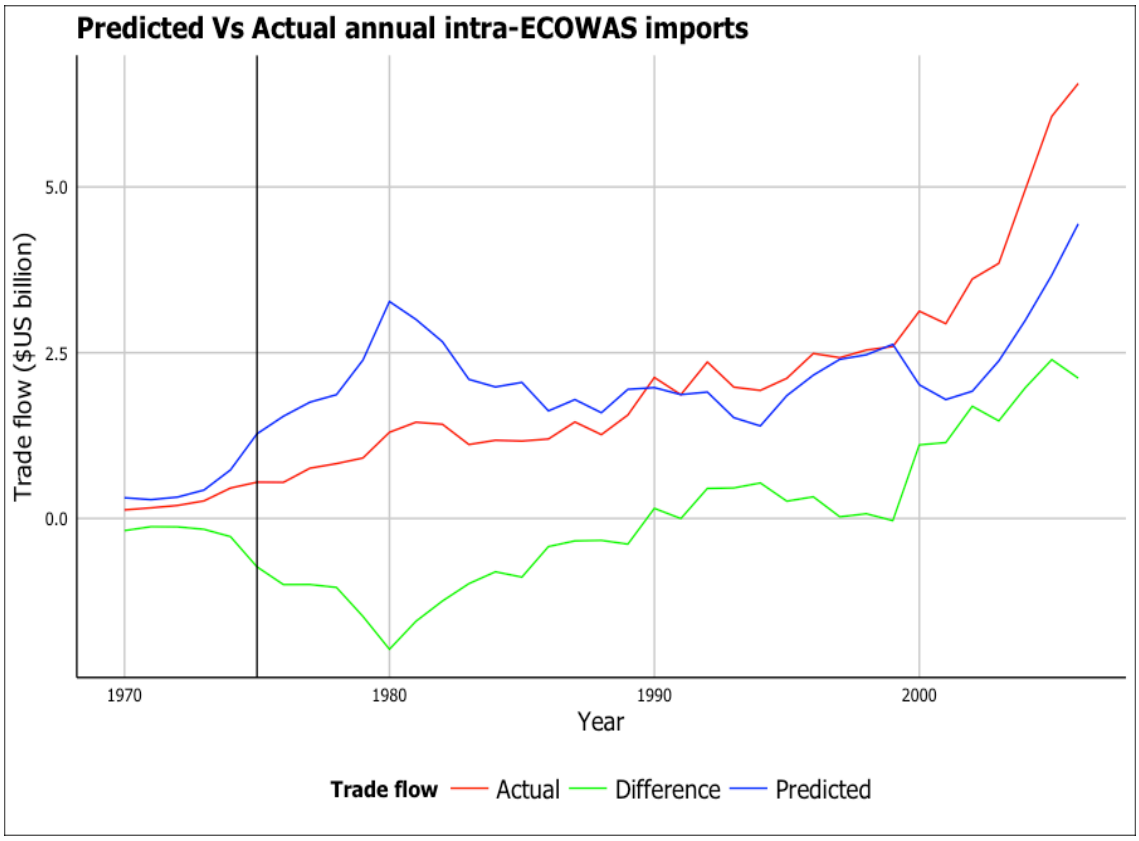
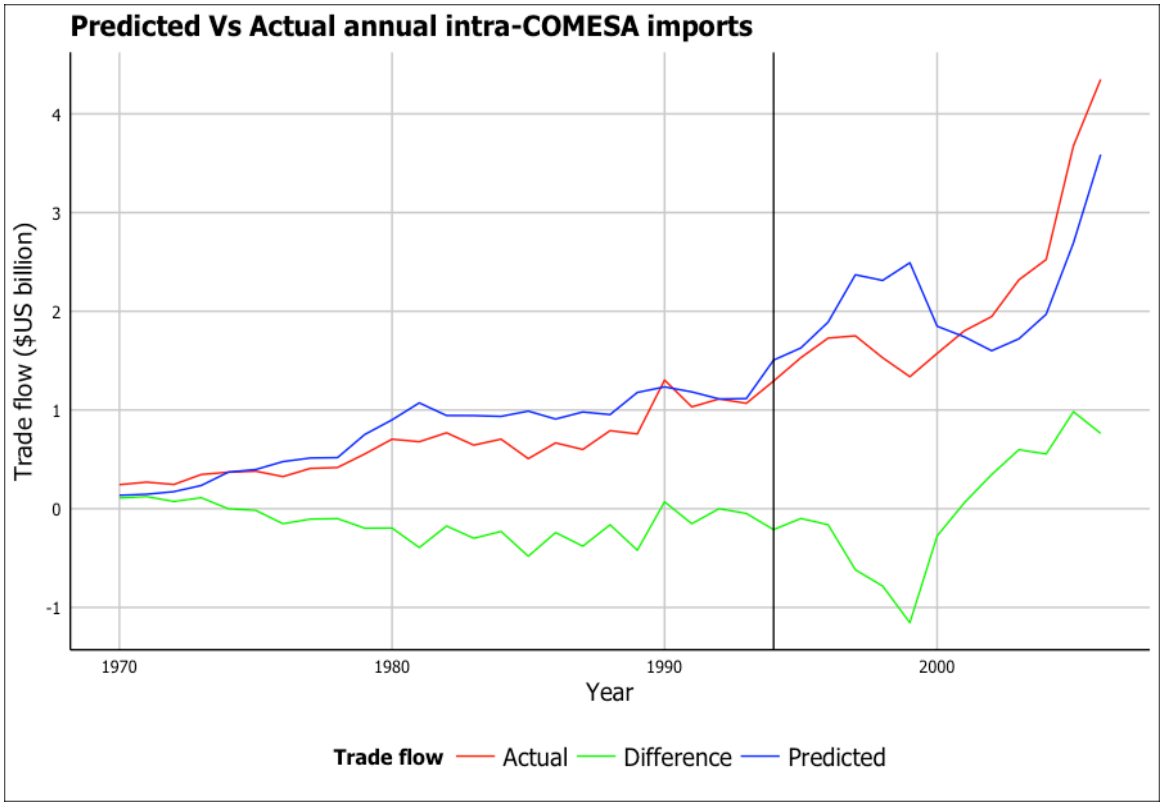


Figure 6.2 Observed and predicted annual intra COMESA imports (in US$ billions) 1970-2006



There is a more consistent trend for COMESA's actual and predicted annual bloc imports. For most of the period, predicted intra-bloc imports exceeds the observed intra-bloc imports. In some years, the observed annual imports exceeded the predicted and vice versa (See Figure 6.2). Compared to ECOWAS, there may more convincing signs of "missing trade" for some years for COMESA.

Apart from the "missing trade" phenomenon, several other reasons have been outlined to explain the low regional trade in Africa as confirmed from the results in this chapter and chapter 3. The lack of political will to implement regional trade policies, overlapping membership in different trade blocs, neglect of the need to reduce non-tariff barriers (NTBs) in consonance with tariff reductions and the relatively high external barriers are reasons why RTAs in Africa are less likely to enhance welfare or often end in trade diversion (Yang & Gupta, 2007). Also, regional integration schemes in Africa often focus on non-economic objectives compared non-economic ones (Gunning, 2001). The failure of countries to integrate regional trade policies with national policies is a major impediment to realising the full benefits of economic integration in Africa. This has often resulted in delayed reductions in both tariffs and non-tariff barriers which may lead to trade diversion. For example, after agreeing to reduce tariffs by 80% in 1996, only five of the 20 member states of

COMESA had reached the target in 2001 (Bourenane, 2002). Even though African countries to some degree have reduced or eliminated their tariffs through trade agreements, their external tariffs remain high for third member countries.

Besides, many African countries are known to have assessed onto RTAs and implemented import substitution policies at the same time. These import substitution policies have often conflicted with the goals of RTAs to liberalise trade and led to trade diversion. Multi-membership in economic integration is often cited as one of the limitations to the success of RTAs in Africa. Many African countries are members of more than one RTAs and find it difficult to make the necessary commitments to enforce the different policies required of them by their respective trade blocs. For example, member states of ECOWAS double as members of either WAEMU or WAMZ. The delay in tariff reductions and conflicting national and regional trade interests are found to be some of the notable consequences of such multi-RTA memberships. Afesorgbor & van Bergeijk (2014) claim multi-RTA membership could boost intra-regional trade if membership in other subsidiary RTAs provides the required drive to achieve the objectives of the main RTA.

Again, the low intra-regional trade is attributed to the small economic sizes of many African countries. From the gravity model, GDP, used as a proxy for economic size is directly related to bilateral trade. Consequently, the relatively low GDPs of African RTAs explains the low production of and demand for tradable goods and services not only within the region. African RTAs are likely to divert trade or create little trade since many African countries have similar production compositions or factor endowments (Yeats, 1998). High trade costs remain the prime cause of low intra-regional trade in Africa. The high costs of trading on the continent often result from high tariffs and non-tariff trade costs such as high transport costs, border and behind-border costs and the inadequacy of the requisite infrastructure for trade within the continent. According to Limão & Venables (2001), the poverty of infrastructure in Africa accounts for half of Africa's transport-related trade costs; the cost is relatively higher for landlocked countries on the continent. African trade will increase by 2% for every 1% investment or upgrade of infrastructure by either an African importer or exporter (Longo & Sekkat, 2004). Concerning infrastructure, Africa trails other regions in the world in telecommunications, roads, railways, aviation and financial integration among others. It is believed that efforts to lower Africa's high transport-related trade costs can tremendously increase intra-regional trade. Inefficient border procedures are noted as a cause of high trade costs and low regional trade in Africa. The delays caused at borders due to unreliable electronic systems for documentation of trading activities, corruption as well as the poor operations and coordination increase the cost of doing business and trade in Africa (UNCTAD, 2013).

7 Chapter

7.1 Discussion

A few limitations of this study are worth noting and mentioning. The final results obtained in this study could have been different if a couple of them were addressed within the duration of the study. Some degree of care is required in making economic inferences from the results.

7.1.1 Estimation techniques

There are a few concerns from the estimation of the gravity model in this study. Other advanced estimation techniques could not be used in this study. The failure to carry out such estimations in the study may mean the results of the integration effects could have been exaggerated or under-rated.

Advanced studies on the trade effects of RTAs using the gravity model point out that the endogeneity of the RTA variable among other variables like GDP in the gravity model biases the estimates of the trade effects of RTAs. They argue the RTA variable is affected by other factors in the error term of the gravity equation that also influence trade flows (Baier & Bergstrand, 2002; Carrere, 2006; Magee, 2003). For the lack of time and requisite knowledge, this is not addressed in this study. It will be interesting to know the extent of change in the results obtained in this study when the endogeneity of each intra-RTA variable and other endogenous variables are accounted for. The instrumental variable within estimation of the gravity model as proposed by Hausman & Taylor (2010) could have been used in the panel estimation to control for endogeneity. Also, the gravity model estimated in this study only allows us to ascertain the static effects of the RTAs on trade flows. An estimation of a dynamic gravity model as done by Martínez-Zarzoso et al. (2009) would have added a different perspective to the already obtained results. This would have also allowed the examination of the anticipation effects of RTAs on trade flows and possible consideration of hysteresis in trade.

Secondly, the different estimations methods used in this study could not be done with time varying importer and exporter fixed effects for the entire period of the dataset. Some authors assert that time varying country fixed effects are more suited for panel data with many years and time variation (Baier & Bergstrand, 2009; Head & Mayer, 2014). It would have been interesting to juxtapose the results from using time-invariant country fixed effects to those from using time-varying country fixed effects. I was unable to estimate the gravity model for the full duration of my data with the OLS and within estimator when time varying importer and exporter fixed effects are used as proxies for the multilateral resistance terms. In the only instance in the study where the gravity model

was estimated with time varying country fixed effects for a short period, the integration effects on trade are found to be bigger. Resources at my disposal concerning my computer's ability did not permit such estimations for longer durations. It was also impossible to estimate the panel gravity model with time varying country fixed effects for the same reason. Also, the within estimator happens to be the weakest model in the study. The performance of the model is contrasting to expectations given it is highly recommended by a host of authors like Egger (2004, 2005), Carrère (2006) and Martínez-Zarzoso et al.(2009). The failure to address endogeneity in this study while using the within estimator may be answerable. Again, it would have been interesting to do a within-estimation of the gravity model with time-varying country fixed effects for comparative reasons.

Although the PPML estimation of the gravity equation is suited for data sets with many zero trade flows and in the presence of heteroscedasticity as proposed by Santos Silva & Tenreyro (2006), some weaknesses of this estimation technique have been identified by some authors. According to Burger et. al (2009), the PPML estimation technique is susceptible in the face of immoderate zeros trade flows and over-dispersion of trade flows. They suggest zero-inflated models as a replacement to the PPML estimator. Some recommended alternative models include the Heckman two-step model, Zero-inflated Binomial Pseudo Maximum Likelihood (NIBPML) and the Zero-inflated Pseudo Maximum Likelihood (ZIPML) estimations. In future research, estimating the gravity model with any of these alternative techniques will be a sound basis for further comparative gravity equation estimation techniques. It is difficult to confidently declare the PPML estimation technique is the best fit for the data when these other techniques were not considered in the study.

7.1.2 Data

The study was confined to the use of aggregated trade data. The process, availability and time needed to gather such data especially for African countries precluded such initiative. It would have been interesting to examine the impact of the RTAs on the trade flows at product levels, for example, food or manufactures. The composition of trade can serve as a guide for trade policies as some trade theories suggest. In the case of African countries where regional trade is said to be concentrated in manufactured goods, it would have been interesting to confirm such claims. This can credence to or doubts about the call for industrialisation and private sector investment to boost intra-regional trade on the continent. Besides, there are few studies on the impacts of African RTAs on trade in specific product categories. This could be explained by challenges in collating trade data of this kind for developing countries which most African countries form part of. Moreover, such trade databases are replete with many zero trade flows, and gravity models must be estimated with the necessary precautions.

Secondly, many changes may have occurred to trade in Africa since 2006. It would have been interesting to extend the duration of the study to recent times. Although several studies point out that intra-African trade has not changed much, current trade data may have told a different story. The data used for this study can only be used to explain the trade trends and patterns of COMESA and ECOWAS from 1948-2006. The acquisition of current processes and that requires more time to the verify or differentiate "true zero" trade flows from "missing values" or measurement errors. Hence care should be taken in the use of the results of the study for any generalisation. In any future research, the current data can be used for the same study.

7.1.3 Gravity model and welfare effects of RTAs

Lastly, the use of the gravity model is not without constraints. It has been found inappropriate for welfare analysis. Hence, inferences on welfare must be made carefully. It would have been interesting to probe into the price changes (terms of trade), income distribution and poverty, and sectoral reallocation of resources because of the formation of these RTAs. The gravity is not suited for such studies. Multi-country computable general equilibrium models could have served such purposes well but require some depths of knowledge, time and skills. However, this can be considered for future studies. With the gravity model, one can only make economic inferences from changes in trade volumes (quantities) and not prices.

8 CHAPTER

8.1 Conclusion

In this study, a modified gravity model with the year, importer and exporter fixed effects was estimated to isolate the after-effects of the formation of ECOWAS and COMESA on intra-bloc trade as well as trade creation and trade diversion. In the augmented gravity model, three dummy variables per RTA are included to capture the trade creation and trade diversion effects. The Poisson pseudo maximum likelihood estimator compared to the within-estimator and Ordinary Least Squared estimator is found to be the appropriate method of estimation of the gravity model and for making economic inferences from the results.

ECOWAS and COMESA are found to increase intra-bloc trade moderately. From, 1975 to 2006, intra-ECOWAS trade was 83% above the norm. In other words, ECOWAS members traded only 0.83 times more than the predicted levels among themselves. As intra-ECOWAS trade increased marginally in the period, extra-ECOWAS exports were 30% below the norm. On the other hand, intra-COMESA trade was only 30% above the norm since its formation in 1994. Intra-COMESA trade increased barely by a factor of 0.30. COMESA imports from the rest of the world and exports to the rest of world were 29% and 25% respectively below the norm. Considering the years of existence of these RTAs, the resultant increases intra-bloc trade for the respective blocs is low. Besides, ECOWAS is found to have resulted in positive net trade creation while COMESA was trade diverting in general. In effect, ECOWAS enhanced the welfare of members while non-ECOWAS members experienced welfare loss from export diversion. ECOWAS resulted in export diversion and no import diversion. On the other hand, COMESA resulted in both export and import diversion. The welfare gains for members regarding trade creation was also marginal. Trade creation from COMESA did not exceed trade diversion and consequently resulted in total welfare loss. The results from this study are not far from results obtained in similar studies as encapsulated in Chapter 2 and Chapter 3. The general outcome of the study points to the fact that regional trade is very little and calls for critical trade policy plans and actions. Many studies also conclude that ECOWAS has had a bigger impact on regional trade than COMESA as highlighted in the results of this study.

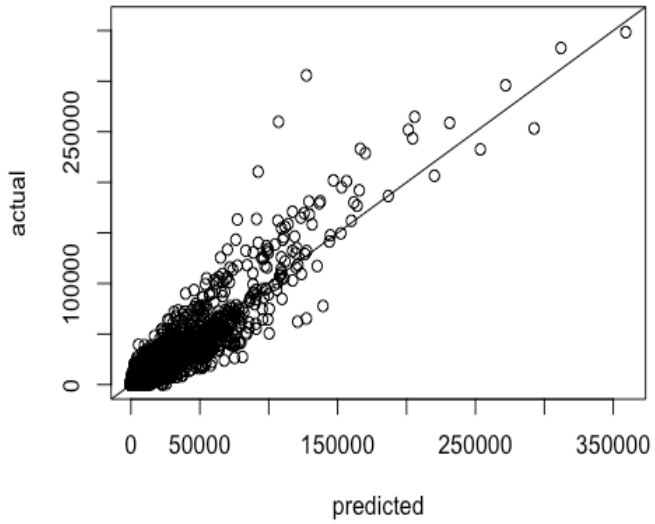
Efforts geared towards reducing the high transport-related trade costs in Africa must be at the epicentre of policy making as well as unilateral or multilateral commitments towards the elimination of both tariff and non-tariff trade barriers. There is the need to improve infrastructure and integrate technological advancement with the regional trade. There is the need to provide cheap, reliable and efficient energy and telecommunication systems required to drive higher domestic production,

exports and industrialisation. The inefficient, bureaucratic, corrupt and costly port and border procedures must be addressed to allow the easy movement of goods and services across borders. Lastly, since the intra-African trade in manufactured goods is relatively higher than primary goods, policies towards industrialisation and private sector growth may provide the lacking impetus to regional trade. Governments should endeavour to provide an enabling environment to attract both domestic and foreign investors. Industrialization will also enable African countries to add value to their primary good exports which are vulnerable to volatile price shocks on the world market.

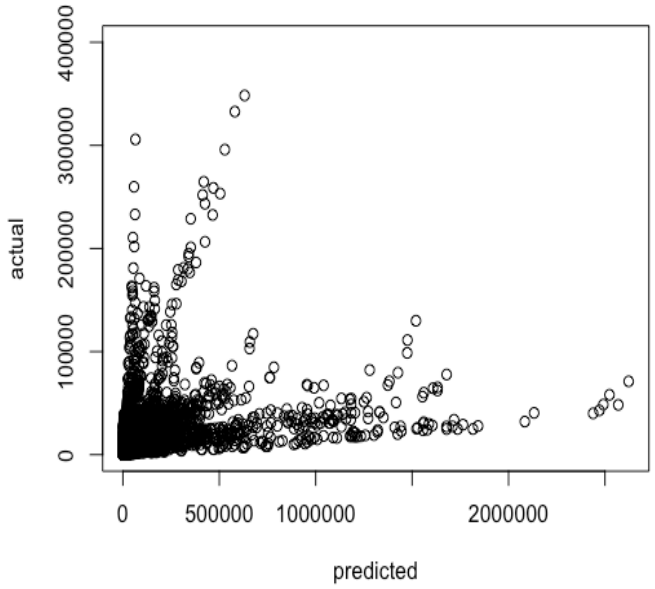
9 Appendix

Plots of the Actual trade flows against predicted trade flows for all models

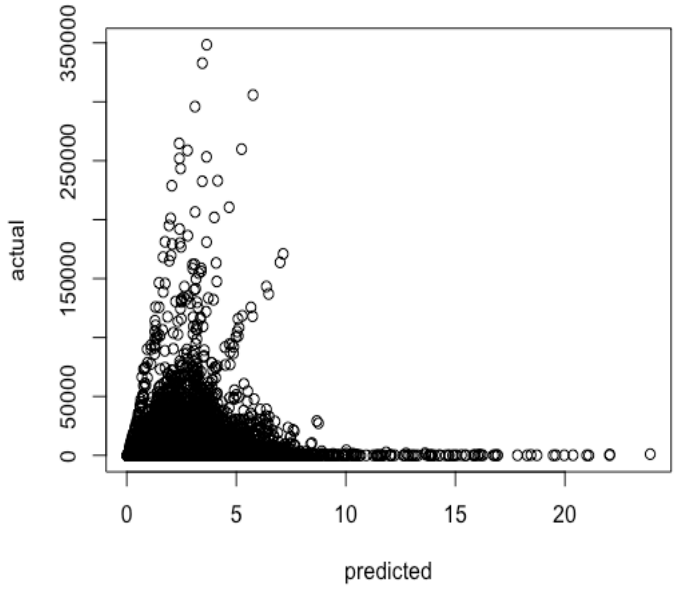
Appendix A: The Poisson Pseudo-Maximum Likelihood (PPML) estimator



Appendix B: Ordinary Least Squares (OLS) estimator



Appendix C: Panel fixed effects estimator



Appendix D: R codes

```
# specify the path of the folder containing the dataset
path <- "/Users/albertosei-owusu/Desktop/Data/Gravity/"
setwd(path)

## 1.a Load dataset and create dummies
dat = read.dta(paste0(path,"col_regfile09.dta"))

## 2.a Run regression
## Creating RTAs
ecowasset = c("BEN", "BFA", "CPV","CIV", "GMB", "GHA", "GIN", "GNB",
              "LBR","MLI","NGA", "SEN", "SLE", "TGO","NER")

## countries that were part of COMESA from 1993-2006 ###
comesa = c("AGO","BDI","COM","COD","DJI","EGY","ERI","ETH","KEN","LBY",
           "MDG","MWI","MUS","RWA","SYC","SDN","SWZ","UGA","ZMB","ZWE")
```

```
##Change working directory
results="/Users/albertosei-owusu/Desktop/Data/Gravity/Tables"
path=setwd(results)

#####################################################################
### Average trade creation and diversion ###
#####################################################################
## Intra-bloc trade dummies
dat$bothinE = ifelse(dat$iso_o %in% ecowasset &
                     dat$iso_d %in% ecowasset &
                     dat$year >= 1975, 1, 0)

dat$bothinC = ifelse(dat$iso_o %in% comesa &
                     dat$iso_d %in% comesa &
                     dat$year >= 1994, 1, 0)

## Extra-bloc export dummies
dat$oneinE = ifelse(dat$iso_o %in% ecowasset &
                    !(dat$iso_d %in% ecowasset) &
                    dat$year >= 1975, 1, 0)

dat$oneinC = ifelse(dat$iso_o %in% comesa &
                    !(dat$iso_d %in% comesa) &
                    dat$year >= 1994, 1, 0)

## Extra-bloc import dummies
dat$oneinE1 = ifelse(!(dat$iso_o %in% ecowasset) &
                     dat$iso_d %in% ecowasset &
                     dat$year >= 1975, 1, 0)

dat$oneinC1 = ifelse(!(dat$iso_o %in% comesa) &
                     dat$iso_d %in% comesa &
                     dat$year >= 1994, 1, 0)
```

```
## OLS and FE estimation
# OLS, time and time-invariant country effects
m1 = lm(log(flow)~log(gdp_o)+log(gdp_d)+factor(year)+
         factor(iso_o)+factor(iso_d)+
         log(distw)+contig+comlang_off+col_hist+
         bothinE+oneinE+oneinE1+
         bothinC+oneinC+oneinC1,
       data = subset(dat, flow>0 & year %in% 1970:2006))
summary(m1)
cov1 <- vcovHC(m1, type = "HC0", method="arellano")
robust.se1 <- sqrt(diag(cov1))



# Panel FE, time and time invariant country effects
dat$pairid = paste0(dat$iso_o, dat$iso_d)
m4 = plm(log(flow) ~ log(gdp_o)+log(gdp_d)+factor(year)+
          bothinE+oneinE+oneinE1+
          bothinC+oneinC+oneinC1,
          model = "within",
          index=c("pairid", "year"),
        data = subset(dat, flow>0 & year %in% 1970:2006))
summary(m4)
cov4 <- vcovHC(m4, type = "HC0", method="arellano")
robust.se4 <- sqrt(diag(cov4))

## Poisson (PPML) estimator
# time invariant country effects included (takes a long time to run)
m5 = glm(flow ~ factor(year)+ factor(iso_o)+factor(iso_d)+
          log(gdp_o)+log(gdp_d) +
          log(distw)+contig+comlang_off+col_hist+
          bothinE+oneinE+oneinE1+
          bothinC+oneinC+oneinC1,
        family="poisson",
```

```
        data = subset(dat, year %in% 1970:2006))
summary(m5)
cov5 <- vcovHC(m5, type = "HC0", method="arellano")
robust.se5 <- sqrt(diag(cov5))

## Robust regressions ###
#### Multilateral trade agreements from 1970-2006 ####

epa = c("AGO","BDI","COM","COD","DJI","EGY","ERI","ETH","KEN","LBY",
        "MDG","MWI","MUS","RWA","SYC","SDN","SWZ","UGA","ZMB","ZWE",
        "BEN", "BFA", "CPV","CIV", "GMB", "GHA", "GIN", "GNB",
        "LBR","MLI","NGA", "SEN", "SLE", "TGO","NER","MRT",
        "BWA","LSO","MOZ","NAM","ZAF","TZA",
        "CMR","CAF","TCD","COG","GNQ","GAB","STP")

eulist= c("AUT", "BEL","BGR","FIN", "FRA", "DEU", "GRC",
          "IRL", "ITA", "NLD", "PRT", "ESP", "SWE","GBR",
          "CYP", "CZE", "EST", "HUN","HRV", "LVA", "ESP",
          "LTU","LUX", "MLT", "POL","ROU", "SVK", "SVN")

agoa = c("AGO","BEN","BWA","BFA","BDI","CIV","CMR","CPV","TCD","DJI",
        "ETH","GAB","GMB","GHA","GNB","KEN","LSO","LBR","MWI","MRT",
        "MUS","MOZ","NAM","NGA","RWA","STP","SEN","SYC","SLE","SWZ",
        "TZA","UGA","ZAF","ZMB")

# EPA extra-bloc export dummy
dat$oneinEPAX = ifelse(dat$iso_o %in% epa  &
                       !(dat$iso_d %in% eulist) &
                       dat$year >= 2000, 1, 0)

# EPA extra-bloc import dummy
dat$oneinEPAM= ifelse(!(dat$iso_o %in% eulist)  &
                      dat$iso_d %in% epa &
                      dat$year >= 2000, 1, 0)
```

```
# AGOA Extra-bloc export dummy
dat$oneinAGX = ifelse(dat$iso_o %in% agoa &
                      !(dat$iso_d %in% "USA") &
                      dat$year >= 2000, 1, 0)

# AGOA Extra-bloc import from USA
dat$oneinAGM = ifelse(!(dat$iso_o %in% "USA")  &
                      dat$iso_d %in% agoa &
                      dat$year >= 2000, 1, 0)

## OLS estimation
# OLS, time and time-invariant country effects
m1 = lm(log(flow)~log(gdp_o)+log(gdp_d)+factor(year)+
          factor(iso_o)+factor(iso_d)+
          log(distw)+contig+comlang_off+col_hist+
          bothinE+oneinE+oneinE1+
          bothinC+oneinC+oneinC1+
          oneinAGX+oneinAGM +
          oneinEPAX+oneinEPAM,
        data = subset(dat, flow>0 & year %in% 1970:2006))
summary(m1)

cov1 <- vcovHC(m1, type = "HC0", method="arellano")
robust.se1 <- sqrt(diag(cov1))




# FE, time and time invariant country effects
dat$pairid = paste0(dat$iso_o, dat$iso_d)

m4 = plm(log(flow) ~ log(gdp_o)+log(gdp_d)+factor(year)+
           bothinE+oneinE+oneinE1+
```

```
          bothinC+oneinC+oneinC1+
          oneinAGX+oneinAGM +
          oneinEPAX+oneinEPAM,
        model = "within",
        index=c("pairid", "year"),
        data = subset(dat, flow>0 & year %in% 1970:2006))
summary(m4)

cov4 <- vcovHC(m4, type = "HC0", method="arellano")
robust.se4 <- sqrt(diag(cov4))

## 5. Poisson (PPML) estimator
# time invariant country effects included (takes a long time to run)
m5 = glm(flow ~ factor(year)+ factor(iso_o)+factor(iso_d)+
          log(gdp_o)+log(gdp_d) +
          log(distw)+contig+comlang_off+col_hist+
          bothinE+oneinE+oneinE1+
          bothinC+oneinC+oneinC1+
          oneinAGX+oneinAGM+
          oneinEPAX+oneinEPAM,
        family="poisson",
        data = subset(dat, year %in% 1970:2006))
summary(m5)

cov5 <- vcovHC(m5, type = "HC0", method="arellano")
robust.se5 <- sqrt(diag(cov5))

## producing a regression table
stargazer(m1,m4,m5,
          type = "html", no.space = TRUE,
          title = "Table : Summary of robust gravity regressions",
          se=list(robust.se1,robust.se4,robust.se5),
          dep.var.labels=c("Trade flow"),
          covariate.labels=c("ECOWAS","ECOWASX",
```

```
                "ECOWASM","COMESA","COMESAX","COMESAM",
                "AGOAX","AGOAM","EPAX","EPAM"),
omit = c("year", "iso","gdp_o","gdp_d","distw","col_hist","contig","comlang_off"),
omit.stat = c("f", "aic", "ll","adj.rsq"),
out="model100.html",
add.lines = list(c("Fixed effects", "TI", "TI", "TI")))
```

10 Bibliography

ADB Group. (2017). *African Economic Outlook 2017*.

ADB Group. (2016). *African Economic Outlook 2016*.

AfDB/OECD/UNDP. (2015). *African Economic Outlook 2015*.

AfDB/OECD/UNDP. (2014). *African Economic Outlook 2014*.

Afesorgbor, S., & van Bergeijk, P. A. G. (2014). Multi-membership and the effectiveness of regional trade agreements in western and southern Africa: A comparative study of ECOWAS and SADC. *South African Journal of Economics*, *82*(4), 518–530.

African Union. (1991). *Treaty Establishing the African Economic Community*.

Agbeyegbe, T. D., Stotsky, J., & WoldeMariam, A. (2006). Trade liberalization, exchange rate

Aitken, N. D. (1973). The Effect of the EEC and EFTA on European Trade: A Temporal Cross-Section Analysis. *The American Economic Review*, *63*(5), 881–892.

Allard, C., Canales Kriljenko, J. I., Chen, W., Gonzalez-Garcia, J., Kitsios, E., & Treviño, J. (2016). Trade Integration and Global Value Chains in Sub-Saharan Africa In Pursuit of the Missing Link. *International Monetary Fund. The African Department*.

Anderson, J. E. (1979). A theoretical foundation for the gravity equation. *The American Economic Review*, *69*(1), 106-116.

Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: a solution to the border puzzle. *the american economic review*, *93*(1), 170-192.

Bacchetta, M., Beverelli, C., Cadot, O., Fugazza, M., Grether, J.-M., Helble, M., … Piermartini, R. (2012). *A Practical Guide to Trade Policy Analysis*. World trade organization.

Baier, S. L., & Bergstrand, J. H. (2002). On the Endogeneity of International Trade Flows and Free Trade Agreements.

Baier, S. L., & Bergstrand, J. H. (2007). Do free trade agreements actually increase members' international trade? *Journal of International Economics*, *71*(1), 72–95.

Baier, S. L., & Bergstrand, J. H. (2009). Bonus vetus OLS: A simple method for approximating international trade-cost effects using the gravity equation. *Journal of International Economics*, *77*(1), 77–85.

Balassa, B. (1961). *The Theory of Economic Integration*. *The Theory of Economic Integration*.

Balassa, B. (1967). Trade creation and trade diversion in the European Common Market. *The Economic Journal*, *77*(305), 1–21.

COMESA Secretariat Public Relations. (2016). *Summit bulletin*.

Cooper, C. A., & Massell, B. F. (1965). Toward a general theory of customs unions for

developing countries. *The Journal of Political Economy*, 461–476.

Coulibaly, S. (2006). Evaluating the Trade and Welfare Effects of Developing RTAs. Ecole des HEC/DEEP.

Deardorff, A. (1998). Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World? *The Regionalization of the World Economy*, 7–32.

Dee, P., & Gali, J. (2005). The Trade and Investment Effects of Preferential Trading Agreements. In *International Trade in East Asia, NBER-East Asia Seminar on Economics, Volume 14* (pp. 133-176). University of Chicago Press.

Deme, M. (1995). The Impact of Ecowas on Intraregional Trade-Flows - an Empirical-Investigation. *Review of Black Political Economy*, *23*(3), 113–129.

ECOWAS. (1975). ECOWAS Treaty.

ECOWAS. (1991). Treaty of ECOWAS, 45.

ECOWAS. (1994). Economic Community of West African States Revised Treaty.

ECOWAS Commission. (2007). Final Communique: 31st Session of the Authority of Heads of State and Government.

Egger, P. (2000). A note on the proper econometric specification of the gravity equation. *Economics Letters*, *66*(1), 25–31.

Egger, P. (2002). An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials. *The World Economy*, *25*(2), 297–312.

Egger, P. (2004). Estimating regional trading bloc effects with panel data. *Review of World Economics*, *140*(1997), 151–166.

Egger, P. (2005). Alternative techniques for estimation of cross-section gravity models. *Review of International Economics*, *13*(5), 881–891.

Elliott, R. J. R., & Ikemoto, K. (2004). AFTA and the Asian crisis: Help or hindrance to ASEAN intra-regional trade? *Asian Economic Journal*, *18*(1), 1–23.

Ethier, W. J. (1998). The new regionalism. *Economic Journal*, *108*(449), 1149–1161.

Evenett, S. J., & Keller, W. (2002). On theories explaining the success of the gravity equation. *Journal of Political Economy*, *110*(2), 281–316.

Ezenwe, U. (1983). *ECOWAS and the economic integration of West Africa*.

Feenstra, R. C. (2002). *Advanced International Trade*. *Journal of Development Economics*.

Feenstra, R. C. (2004). Border effects and the gravity equation: consistent methods for estimation. *Scottish Journal of Political Economy*, *49*(5), 491–506.

Frankel, J. A. (1997). *Regional Trading Blocs in the World Economic System*.

Frankel, J. A., Stein, E., & Shang-Jin, W. (1996). Regional trading arrangements: natural or

super-natural? *The American Economic Review*, *86*(2), 52–56.

Freund, C., & Ornelas, E. (2010). Regional trade agreements. *Annu. Rev. Econ.*, *2*(1), 139-166.

Gathii, J. T. (2011). African regional trade agreements as legal regimes.(Vol. 6, pp. 361–389). Cambridge University Press.

Harrigan, J. (1996). Openness to trade in manufactures in the OECD. *Journal of International Economics*, *40*(1–2), 23–39.

Hausman, J. A., & Taylor, W. E. (2010). Panel Data and Unobservable Individual Effects. *Econometrica*, *49*(6), 1377–1398.

Head, K., & Mayer, T. (2002). Illusory Border Effects : Distance Mismeasurement Inflates Estimates of Home Bias in Trade, *1*(604), 106–112.

Head, K., & Mayer, T. (2014). *Gravity Equations: Workhorse,Toolkit, and Cookbook*. *Handbook of International Economics* (Vol. 4). Elsevier B.V.

Head, K., Mayer, T., & Ries, J. (2010). The erosion of colonial trade linkages after independence. *Journal of International Economics*, *81*(1), 1–14.

Helliwell, J. F. (1996). Do National Borders Matter for Quebec's Trade? *Canadian Journal Of Economics*, *29*(3), 517–522.

IMF. (2014). *Regional Economic Outlook: Sub-Saharan Africa, Staying the Course*. *International Monetary Fund* (Vol. Oct).

Jaber, T. (1971). The Relevance of Traditional Integration Theory to Less Developed Countries. *Journal of Common Market Studies*, *9*(3), 254.

Kemp, M. C., & Wan, H. Y. (1976). An elementary proposition concerning the formation of customs unions. *Journal of International Economics*, *6*(1), 95–97.

Krueger, A. O. (1999). Are Preferential Trading Arrangements Trade-Liberalizing or Protectionist? *Journal of Economic Perspectives*, *13*(4), 105–124.

Krugman, P. (1991). Increasing Returns and Economic Geography. *Journal of Political Economy*, *99*(3), 483–499.

Limão, N., & Venables, A. J. (2001). Infrastructure, geographical disadvantage, transport costs, and trade. *The World Bank Economic Review*, *15*(3), 451-479.

Lipsey, R. G. (1957). The Theory of Customs Unions: Trade Diversion and Welfare'. *Source: Economica, New Series*, *24101*(93), 40–46.

Longo, R., & Sekkat, K. (2004). Economic Obstacles to Expanding Intra-African Trade. *World Development*, *32*(8), 1309–1321.

Magee, C. S. (2003). Endogenous Preferential Trade Agreements: An Empirical Analysis. *Contributions in Economic Analysis & Policy*, *2*(1).

Magee, C. S. P. (2008). New measures of trade creation and trade diversion. *Journal of International Economics*, *75*(2), 349–362.

McCallum, J. (1995). National borders matter: Canada-US regional trade patterns. *The American Economic Review*, *85*(3), 615-623.

Martínez-Zarzoso, I., Felicitas, N. L. D., & Horsewood, N. (2009). Are regional trading agreements beneficial?. Static and dynamic panel gravity models. *North American Journal of Economics and Finance*, *20*(1), 46–65.

Mayer, T., & Zignago, S. (2006). Notes on CEPII ' s distances measures.

Musila, J. W. (2005). The intensity of trade creation and trade diversion in COMESA, ECCAS and ECOWAS: A comparative analysis. *Journal of African Economies*, *14*(1), 117–141.

Panagariya, A., & Krishna, P. (2002). On necessarily welfare-enhancing free trade areas. *Journal of International Economics*, *57*(2), 353–367.

Pöyhönen, P. (1963). A Tentative Model for the Volume of Trade between Countries, *90*, 93–100.

Pritchett, L., & Foroutan, F. (1993). Intra - Sub - Saharan African trade: is it too little? *Journal of African Economies*, *2*(1), 74–105.

Redding, S., & Venables, A. J. (2004). Economic geography and international inequality. *Journal of International Economics*, *62*(1), 53–82.

Rose, A. K., & Van Wincoop, E. (2001). National money as a barrier to international trade: The real case for currency union. *American Economic Review*, *91*(2), 386–390.

Santos Silva, J. M., & Tenreyro, S. (2006). The Log of Gravity. *The Review of Economics and Statistics*, *88*(4), 641–658.

Schiff, M. (1997). Small is beautiful: preferential trade agreements and the impact of country size, market share, and smuggling. *Journal of Economic Integration*, *12*(3), 359–387.

Serón, J. G. (2014). Ecowas Regional Integration Processes and International Cooperation, 1–58.

Soloaga, I., & Winters, L. A. (2001). Regionalism in the nineties: What effect on trade? *North American Journal of Economics and Finance*, *12*(1), 1–29.

The World Bank. (2000). *Trade blocs. World Bank Policy Research Report*.

UNCTAD. (2013). *Economic Development in Africa; intra-African trade,unlocking private sector dynamism*.

UNCTAD. (2017). *Key statistics and trends in International Trade 2016*. Geneva: United Nations.

United Nations. (2009). *Economic Development in Africa Report 2009*. *New York*.

Sub-Regional Office for West Africa, (February), 32.

Viner, J. (1950). *The customs union issue*.

Wacziarg, R. (2001). Measuring the Dynamic Gains from Trade. *The World Bank Economic Review*, *15*(3), 393–429.

Wei, S. (1996). *Intra-National Versus International Trade: How Stubborn Are Nations In Global Integration?* (No. No. w5531). *NBER Working Paper Series*.

Westerlund, J., & Wilhelmsson, F. (2011). Estimating the gravity model without gravity using panel data. *Applied Economics*, *43*(6), 641–649.

Whalley, J. (1998). Why do countries seek regional trade agreements?. In *The regionalization of the world economy* (pp. 63-90). University of Chicago Press.

Winters, L. (1997). Regionalism and the Rest of the World: the Irrelevance of the Kemp - Wan Theorem. *Oxford Economic Papers*, *49*(2), 228.

World Bank. (2016). *World Development Indicators 2016*.

WTO. (2016). World Trade Statistical Review. *World Trade Organization*, 165.

Yang, Y., & Gupta, S. (2007). Regional Trade Arrangements in Africa: Past Performance and the Way Forward. *African Development Review*, *19*(3), 399–431.

Yeats. (1998). *What can be expected from African regional trade arrangements? World Bank Policy Research Working Paper*.