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REGIONAL ECONOMIC INTEGRATION AND AGRICULTURAL SECTOR EXPORT PERFORMANCE (1980-2016): CASE OF COMESA

BY

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Declaration

I declare that this Dissertation has been composed solely by myself and it has not been submitted, in whole or in part, in any previous application for a degree. Except where states otherwise by citation or acknowledgment, the work presented is entirely my own.

Signed _____ Date _____

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Dedication

I dedicate this dissertation to my *late father;* who has been my source of inspiration, my mom; who taught me to persevere and prepared me to face the challenges with faith and humility as well as my family.

Acknowledgement

Many people immensely contributed to this dissertation; however time and space are the major constraints that hinder name by name mentioning. I thank all in one way or another contributed in the completion of this dissertation. I would like to express my deep and sincere gratitude to my research supervisor, Prof A. Makochekanwa for every detail and academic precision provided to me; the necessary direction and focus for my study. I gained invaluable experience on regional economic integration and trade under his supervision. Vice Chancellor, Prof Levi Nyagura l am grateful for your financial support and opportunity to study at this tried and tested academic institution; University of Zimbabwe. I would like to extend my heartfelt gratitude to the Economics Department and AERC-CMAP 2017 staff for their support and encouragement throughout the Masters' program. My deep appreciation goes to Mr Hazvina, for the helpful discussions and valuable suggestions throughout the research.

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Abstract

The study examined the effects of regional economic integration on the agricultural sector export performance in the Common Market for Eastern and Southern Africa (COMESA) region. Panel data was used for the member countries from 1980 to 2016. Gravity model and Software for Market Analysis and Restrictions on Trade (SMART) model were used in estimating the effects of regional economic integration comparing pre and post COMESA-FTA period. As suggested by the Hausman test, the random effects model was used to examine the effects of regional economic integration on export performance due to its consistency and efficiency. The results from the study showed that the GDP of the exporting country, GDP per capita of the importing country and the regional economic integration dummy positively affect the agricultural sector export performance in the region. Using the SMART model, the results showed that the formation of the free trade area created trade worth close to US$65 million and positive trade diversion value worth US$5.6 million as well as the total trade effect of US$70.4 million. From the results, the trading bloc policy makers are encouraged to deepen the economic integration so that the policies in the agricultural sector increase the sector's production hence exports. Member countries should also adopt policies that create an investor friendly environment if they are to increase their human development and infrastructure. The study suggested that the trading bloc and its members should engage in research and development so as to advance their technologies hence innovation to increase their gross domestic product.

Table of Contents

Declaration i
Dedication ii
Acknowledgement iii
Abstract iv
Table of Contents v
List of Tables viii
List of Acronyms ix
CHAPTER ONE 1
INTRODUCTION AND BACKGROUND 1
1.0 Introduction 1
1.1 Background of the Study 4
1.1.1 COMESA trade patterns from 1980 to 2016 5
1.1.2 Agricultural sector trade patterns in COMESA from 1980 to 2016 8
1.2 Problem statement 9
1.3 Research objectives 10
1.4 Research questions 10
1.5 Research hypotheses 10
1.6 Justification of the study 10
1.7 Organisation of the rest of the study 11
CHAPTER TWO 12
LITERATURE REVIEW 12
2.0 Introduction 12
2.1 Theoretical literature review 12
2.1.1 Viner's theory of customs union 12
2.1.2 Gravity model 15
2.2 Empirical literature review 16
2.3 Conclusion 23
CHAPTER THREE 24
METHODOLOGY 24
3.0 Introduction 24
3.1 Theoretical model specification 24
3.1.1 Gravity model 24
3.1.2 SMART model 25
3.2 Empirical model specification 26

3.2.1 Gravity model 27
3.2.2 SMART model 27
3.3 Definition and justification of variables 30
3.4 Model Estimation Procedure 33
3.4.1 Fixed Effects Model 33
3.4.2 Random Effects Model 34
3.4.3 Fixed effects model versus Random effects model 34
3.4.4 Hausman test 35
3.4.5 Panel Cross-section Dependence test 36
3.4.6 Panel Unit Root test 36
3.4.7 Panel Cointegration test 37
3.4.8 Multicollinearity 37
3.5 Data Sources, Type and Period 38
CHAPTER FOUR 40
PRESENTATION, INTERPRETATION AND DISCUSSION OF RESULTS 40
4.0 Introduction 40
4.1 Summary of Descriptive statistics 40
4.2 Panel Cross-Section Dependence test 41
4.3 Panel Unit Root test 41
4.4 Panel Cointegration test 42
4.5 Multicollinearity 43
4.6 Estimated results 43
4.6.1 Gravity Model Estimation 43
4.6.2 Hausman test 44
4.6.3 SMART Model 46
4.7 Conclusion 49
CHAPTER FIVE 51
SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS 51
5.0 Introduction 51
5.1 Summary of the findings and conclusion 51
5.2 Policy implications and recommendations 52
5.3 Areas for further study 53
REFERENCES 54
APPENDICES 59

List of Figures

Figure 1: Extra and Intra trade for COMESA.....6
Figure 2: Global COMESA Exports by Sector in 2015.....7
Figure 3: COMESA Agricultural sector trend from 1980 to 2016.....8
Figure 4: Viner's model of Trade creation and Trade diversion.....13

List of Tables

Table 1: Regional Trade Agreements in Eastern and Southern Africa as well as their status...4
Table 2: Agricultural Products.....38
Table 3: Summary of Descriptive statistics 40
Table 4: Pesaran (2004)'s CD results 41
Table 5: CADF Unit Root test results in levels 41
Table 6: CADF Unit Root test results at First Difference 42
Table 7: Pedroni Panel Cointegration test results.....42
Table 8: Correlation matrix results 43
Table 9: Hausman test results 44
Table 10: Random effects model.....44
Table 11: Trade creation (TC) simulated results (US$ thousands).....46
Table 12: Simulated trade diversion (TD) results (US$ thousands).....48
Table 13: Simulated total trade effect results (US$ thousands).....49

List of Acronyms

ACBF	African Capacity Building Fund
AFTA	ASEAN Free Trade Area
ASEAN	Association of Southeast Asian Nations
CARIFTA	Caribbean Free Trade Association
CADF	Cross-section Augmented Dickey Fuller
CMA	Common Monetary Area
COMESA	Common Market for Eastern and Southern Africa
DRC	Democratic Republic of Congo
EAC	Eastern African Community
ECOWAS	Economic Community of Western African States
EU	European Union
FDI	Foreign Direct Investment
FEM	Fixed Effects Model
FTA	Free Trade Area
GDP	Gross Domestic Product
GMM	General Method of Moment
IMF	International Monetary Fund
MERCOSUR	Southern Common Market
MNF	Most Favoured Nations
NAFTA	North American Free Trade Agreement
OLS	Ordinary Least Square
OPEC	Organisation of the Petroleum Exporting Countries
PPML	Poisson-Pseudo Maximum Likelihood
PTA	Preferential Trade Area

REM	Random Effects Model
RTA	Regional Trade Agreement
SMART	Software for Market Analysis and Restriction on Trade
SADC	Southern African Development Community
SITC	Standard International Trade Classification
TFTA	Tripartite Free Trade Area
TRAINs	Trade Analysis Information systems
UNCOMTRADE	United Nations Commodity Trade
US	United States
WITS	World Integrated Trade
WTO	World Trade Organisation

CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.0 Introduction

In Africa, the significance of regional economic integration is a persistent issue, in view of the continent's economic and political backwardness. The region is confronted with a deep-rooted level of poverty, a minimal share of world trade, a low pace in human capital development of 8.8% in 2016 and also infrastructure development as well as excess challenges from external pressures (Yayo and Asefa, 2016). Ensuring that regional economic integration is a success in Africa is essential not only because of the potential and problems faced by the continent, but the policies needed to guarantee its success are not different from those needed for Africa to benefit from the process of globalisation.

African countries are facing development challenges which include small and fragmented economies with low incomes (Tumwebaze, 2015). According to World Bank (2013) Africa's average real per capita income in 2016 was US$ 784, with 26 out of 53 countries classified as low income countries, having gross domestic product per capita of US$ 995 or less. The low incomes in the continent limit the size of its domestic markets hence small domestic markets translate into low economies of scale in production and low productivity for many countries. According to the African Union (2012), Africa has been characterized by relatively low level of intra-regional trade, in terms of exports. On average over the past three decades from 1980, intra-African trade was about 10 per cent as compared to 30 per cent, 40 per cent and 60 per cent intra-regional trade[1] achieved by Asia, North America and Europe, respectively (African Union, 2012). Consequently, African countries have not been capable of capturing the complementarities of their economies fully, taking advantage of economies of scale and other benefits such as income and employment generation. In an attempt to promote intra-regional exports, Africa has witnessed renewed momentum for regional economic integration (Tumwebaze, 2015).

Economic integration refers to the policy of discriminately eliminating or reducing trade barriers only among countries joining together (Salvatore, 2004). It is an arrangement among countries which enable them to manage their fiscal and monetary policies to reduce costs for

[1] It refers to the exchanging of goods and services by countries within the same regional economic integration.

both consumers and producers, hence increasing trade flows between member countries. It consists of various levels which are Preferential Trade Agreement[2] (PTA), Free Trade Areas[3] (FTA), customs union[4], common markets[5], economic and monetary unions[6] (Pilbeam, 2013). Few trade barriers with more economic and political coordination will prevail among more integrated economies. Integration is beneficial to member countries as it helps them to have sustained development through increased exports, investment and foreign direct investment among others (Salvatore, 2004). According to Krueger (1999), preferential trade arrangements and free trade areas, have mushroomed their importance in the 1990s and this has recovered research on the effects of the trade arrangements on the welfare of both the member countries and non-member countries.

COMESA (Common Market for Eastern and Southern Africa) regional bloc has criteria for the rule of origin [7]to ensure that the goods that were produced within the region get preferential treatment when crossing borders to increase intra-regional trade. Agriculture being one of the most key sectors in many countries in the Eastern and Southern Africa region plays a crucial role in trade and regional integration (Sukari, 2016). According to the World Bank (2013), COMESA countries earn close to 43 percent of its annual growth from farming, thus agricultural commodities form an important share of COMESA trade, both regionally and internationally. However, the region still records a negative trade balance with other international markets, and this trade deficit is widening as time moves despite a clear comparative advantage that the region has in agriculture.

According to Sukari (2016) agriculture is a key sector to target for industrialisation through the establishment of agro-food industries with the COMESA industrialisation policy also placing emphasis on agro-processing as a key pillar of industrialisation. Agricultural sector in the COMESA region like most African economies occupies prime segment of the society. It is seen as the backbone and strength of the economy as it has various effects on the society with regard to employment, earnings, and food security; which can be through forward or backward linkage (Efobi and Osabuohien, 2011). Agricultural sector is considered as a significant sector that can help in the alleviation of poverty and also ensuring food security

[2] Provide lower trade barriers among member countries than on trade with non-member countries.
[3] All trade barriers are removed among countries but each country retains its own trade barrier with non-member countries.
[4] Allows no trade barriers among member and set a common tariff rates towards the rest of the world.
[5] This goes beyond customs union by allowing free movement of labour and capital among member countries
[6] This also goes further by harmonizing or even unifying the monetary and fiscal policies of member countries.
[7] Criteria needed to determine the national source of a product and the importance being that the restrictions and barriers depends on the source of imports.

for many countries in the region. However, there are some challenges that have affected the performance of the agricultural sector and agricultural export particularly in the sub-region. These include limited local market size, poor and inefficient infrastructure, over reliance on rainfall, limited technical knowhow and limited access to credit.

Chapter 18, Article 129 of the COMESA treaty states that the overall objectives of the cooperation in the agricultural sector are an achievement of food security and rational agricultural production within the common market (COMESA Treaty, 1993). To this end, member states have started to adopt a scheme for the rationalisation of agricultural production with a view to promote complementarity and specialisation in and sustainability of national agricultural programmes. These were to ensure that there is a common agricultural policy, regional food sufficiency, an increase in the productivity of crops, livestock, fisheries and forestry for domestic industries as well as the replacement of imports on a regional basis.

The effects of regional trade agreements on international trade is still an empirical issue since some researchers like Olayiwola and Ola-David (2013), Gondwe and Griffith (1989), Tumwebaze (2015) as well as Haddoud *et al*. (2015) found that regional economic integration is trade creating whilst MacPhee and Sattayanuwat (2014) and Morais and Bender (2000), found out that economic integration is trade diverting. The results differ regardless of the group, sector or product under consideration.

Many countries belong to different types of economic integration in different regions, in Africa, which includes COMESA, Southern African Development Community (SADC), Eastern African Community (EAC) and Economic Community of Western African States (ECOWAS). According to Kamau (2010) COMESA member countries have been performing dismally in trade as compared to their counterparts in other economic integrations in the Eastern and Southern Africa. In this study, the researcher will review the importance of regional economic integration on export performance specifically for the agricultural sector due to its significance in growth of many countries in the COMESA[8] region. Table 1 shows the Regional Trade Agreements (RTAs) found in the Eastern and Southern Africa[9], year of establishment, type and number of member countries in the group.

[8] COMESA consist of 19 member countries which include Burundi, Comoros, Djibouti, DRC, Egypt, Ethiopia, Eritrea, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia and Zimbabwe.

[9] Some countries in COMESA belong to more than one regional economic integration for example DRC, Malawi, Madagascar, Mauritius, Seychelles, Swaziland, Zambia and Zimbabwe are also members of SDC;

Table 1: Regional Trade Agreements in Eastern and Southern Africa as well as their status

Regional Trade Agreements	Year established	Type	No of members
COMESA	1994	Customs union	19
EAC	1967	Common market	6
SADC	1980	Free Trade Area	14

Source: Authors' illustration using information from respective websites.

1.1 Background of the Study

The history of Africa's regional economic integration dates back to the period when Common Monetary Area (CMA) was formed in 1910, which is the oldest integration in the world, following a number of rising RTAs within and outside the continent. According to Tumwebaze (2015), COMESA's origin can be traced to the mid-1960s, when countries in the Eastern and Southern Africa presented a process towards creating an Eastern and Southern African cooperation arrangement. After the colonial period, African leaders recognized that the small sizes and fragmentation of post-colonial African economies was a major constraint to economic development hence the formation of regional economic integrations. COMESA[10] was formed in December 1994 to replace the former PTA which had existed from 1980.

According to the COMESA Treaty (1993), Chapter 6, Article 62 of trade promotion, member countries should embrace measures that promote trade within the trading bloc. COMESA trading bloc was established to encourage intra-regional trade between member countries with the aim of producing more income and wealth for the people in the region (COMESA Treaty, 1993). The expectation was that by gradually removing the trade barriers among the countries that make up COMESA, trade in the region would be boosted through increased competition and bigger markets. Increased trade would eventually foster economic growth and development of the member countries.

Burundi, Kenya, Rwanda and Uganda are members of EAC whilst Libya and Egypt belong to the Arab Maghreb Union.

[10] The COMESA was formed in 1994 in succession of the Preferential trade Area (PTA) and though the tariff reduction started in 1984 the formation of COMESA resulted in further reduction in these tariffs.

In 2000 COMESA member countries signed the FTA agreement[11], to attain sustainable growth, promote joint development in all economic activities and to work together in creation of an empowering environment for foreign and domestic investment among its members in order to improve economic development within the region (COMESA Profile, 2013). From 2000, COMESA adopted many trade arrangements specific to all trading sectors. In 2009, the trading bloc had launched the custom union which was expected to be extended to economic and currency union in the coming decade. Notwithstanding the growing importance of member countries in the region, there are many challenges that have hindered the intra-regional trade. These challenges include contradicting objectives of overlapping economic integrations, absence of political obligation and insufficient information and infrastructure (Khandelwal, 2004). For example, many countries in the COMESA region are also members of the EAC as well as SADC region.

1.1.1 COMESA trade patterns from 1980 to 2016

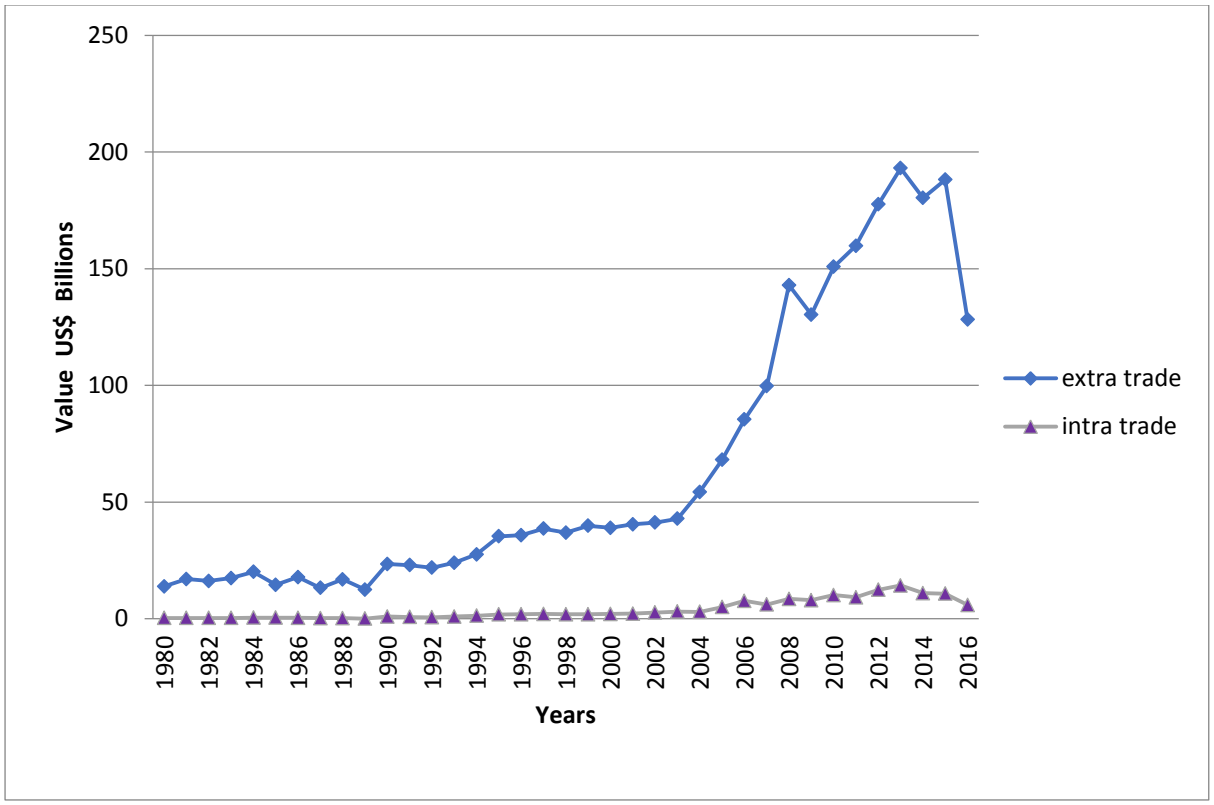
COMESA members trade within themselves and also with those countries from outside the region in different sectors including manufacturing, agricultural, mining to mention just a few.

Figure 1 shows COMESA intra and extra trade from 1980 to 2016. Countries in the COMESA region trade the most with the countries outside their trading bloc[12] than those within the bloc as shown by the difference between the extra trade and the intra trade patterns. From 1980 to 2003, COMESA members were trading with those from outside at a constant rate but the value traded increased sharply from 2004 to 2008 before going down in 2009, with a further increase in trade up to 2015 and a drop in 2016. This shows that the intra and extra trade increased more after the formation of the FTA. Extra trade increased from US$13.8 billion in 1980 to US$128.2 billion in 2016 showing that trade among COMESA members and those outside the bloc has been increasing over time. Intra trade within the bloc was increasing over time at a steady rate from US$3.6 billion in 1980 to US$15 billion in 2016.

[11] Sixteen members of COMESA have joined the free trade area so far which are Burundi, Comoros, Djibouti, Egypt, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia and Zimbabwe.

[12] Trading bloc is also the same as regional economic integration

Figure 1: Extra and Intra trade for COMESA

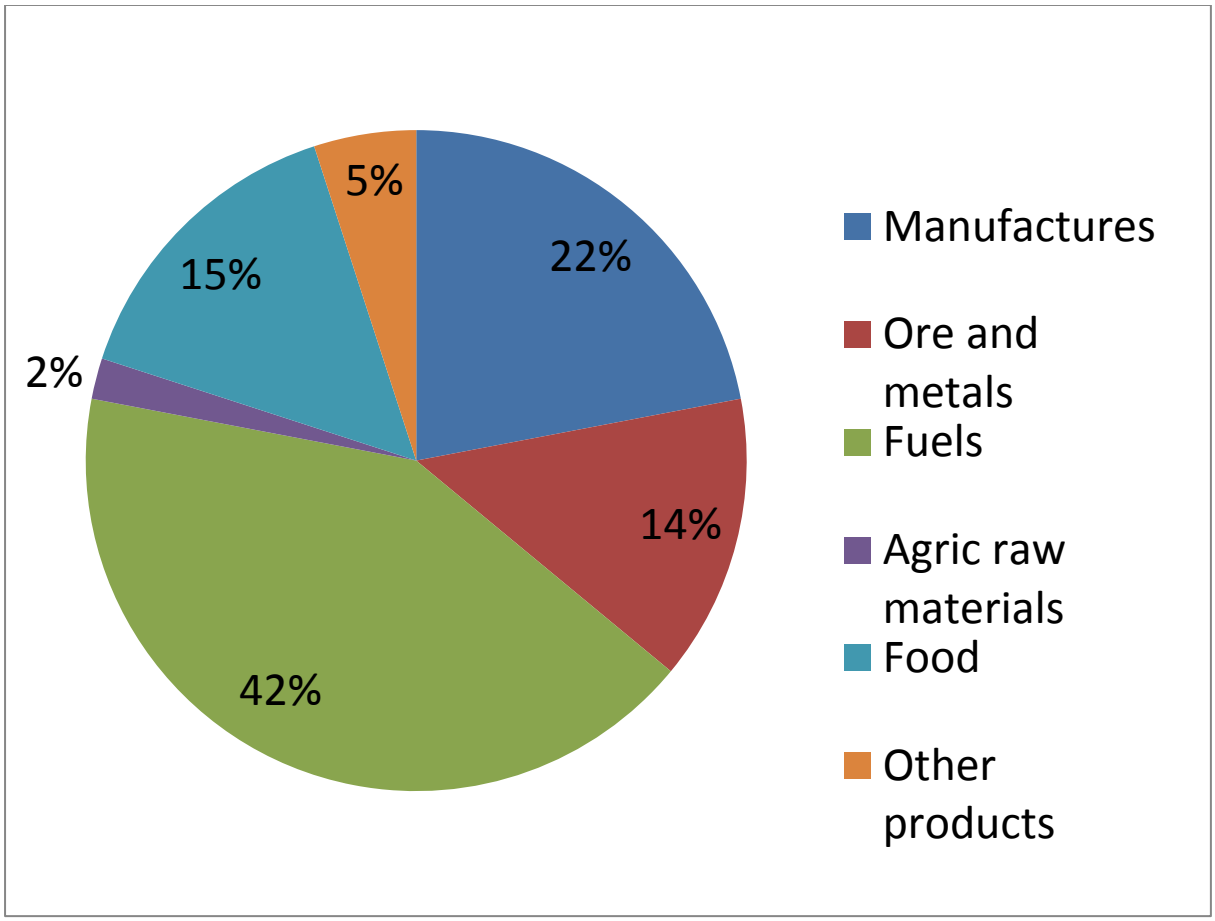


Source: Author's illustration using UNComtrade data (2017)

COMESA is part of the Tripartite Free Trade Area (TFTA), which offers member countries in the regional economic community several advantages, that is harmonising trading regimes. In 2016, intra-COMESA trade was at 12 per cent compared to 18 per cent projected for intra-TFTA trade (ACBF, 2016). Intra trade is increasing in the region but the levels are still low than what is being expected showing that trade among COMESA members is still very low and there is need for improvement.

Figure 2 depicts imbalances in terms of COMESA exports in different sectors in 2015. Though overall intra COMESA trade has been increasing over the years, not all sectors were benefiting from this increase showing that some sectors are benefitting at the expense of others. As shown in Figure 2 fuels contributed 42% to COMESA exports followed by manufactures which contributed 22% whilst agricultural raw materials, other products, ore and metals and food contributed 2%, 5%, 14% and 15%, respectively in 2015.

Figure 2: Global COMESA Exports by Sector in 2015



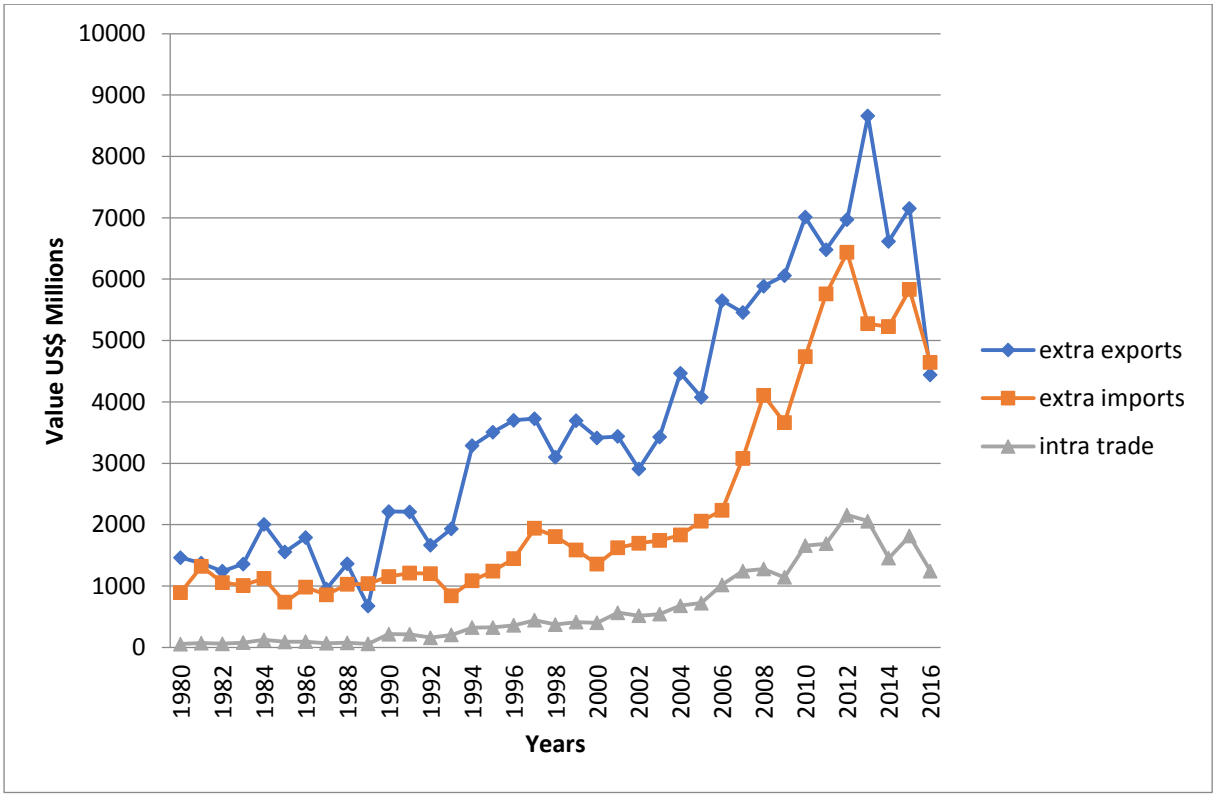
Source: Author's illustration using UNComtrade Data (2017)

According to COMESA (2016) the trading bloc's exports to the European Union (EU), its number one export market, were worth US$34 billion in 2015, up from US$31 billion exported in 2014, representing a 9% increase in value terms and a 32% market share. Exports to EU were mainly petroleum oils and oils obtained from bituminous minerals. China ranks second as a major export market for COMESA products, with exports from COMESA worth over US$14 billion in 2015, a 3% gain over the previous year. These exports mainly include petroleum oils and oils from the bituminous minerals from Libya, and refined copper and cobalt from Democratic Republic of Congo (DRC) and Zambia. According to Musengele (2014) the gain from intra-COMESA trade was uneven among countries with countries like Egypt and DRC contributing positively to the growth of intra-COMESA exports while Malawi, Uganda and Zimbabwe contributing positively to the growth of intra-COMESA imports.

1.1.2 Agricultural sector trade patterns in COMESA from 1980 to 2016

Trade in the agricultural sector has been low as compared to other sectors. Figure 3 illustrates the intra-COMESA trade as well as trade between COMESA and the rest of the world from 1980 to 2016 in the agricultural sector.

Figure 3: COMESA Agricultural sector trend from 1980 to 2016



Source: *Authors illustration using UNComtrade data (2017)*

The trend analysis in Figure 3 reveals that COMESA exports to the rest of the world were increasing at a faster rate than the imports from the rest of the world and intra-COMESA trade. Trade within COMESA region remained low over years than the trade with those outside the bloc therefore showing that intra-trade is less than the extra-trade[13]. Before the formation of COMESA, intra-trade in the agricultural sector was increasing at a constant rate from US$323 million in 1994 up to US$517 million in 2002 but after that it was increasing at an increasing rate till US$2.2 billion in 2012 and started to decrease after 2012 to 2016 with a value of US$1.3 billion. The value of extra export and import increased from 1980 with US$1.5 million as well as US$895 million respectively to 2012 with US$8.7 billion as well as US$6.4 billion respectively while they decreased from 2012 to 2016. The products

[13] Extra-trade refers to the amount of trade by members of a trading bloc with those countries outside.

considered for the agricultural sector include coffee, tea, cotton, rice, vanilla, tobacco, flowers among others.

1.2 Problem statement

The main aim for the formation of the COMESA trading bloc in the Eastern and Southern African region was to promote intra-regional trade hence increase in income and employment. Comparing the pre and post-COMESA-FTA period Figure 3 shows that intra-trade in the agricultural sector has been increasing after the formation of the free trade area from US$517 million to US$1.3 billion but the levels are still low. Though intra-trade has been increasing after the formation of the free trade area, trade in the region with the rest of the world has also been increasing which shows that member countries have not totally switched from trading with other countries outside the trading bloc. Therefore, low level of intra-trade in COMESA is a manifestation that countries are trading much with countries outside the trading bloc; between the years 2000 and 2008 member countries were relying more on the agricultural imports from Europe and China.

Though the agricultural sector is the strength of many economies in the COMESA region and can be used to revive many countries if massive production takes place due to its backward and forward linkages, less is being done in terms of exports as compared to other sectors as shown in Figure 2. Despite the region's comparative advantage in the agricultural sector, the member states are experiencing shortages in the agricultural products (staple food), with eleven countries having shortages within the period 2004 to 2005 and seven countries from 2005 to 2008. In order to increase the income, food security and employment in the region, agricultural sector should be prioritised since it is at the backbone of many economies in the region.

The low intra-regional trade in the trading bloc has not only caused imbalances in sectors but also in countries. Countries are performing differently economically with the likes of Egypt, DRC and Ethiopia performing better than other countries like Zimbabwe and Malawi. Something has to be done so that those countries performing better can help others in crisis so as to increase export performance as well as economic growth for all the countries. Since regional economic integration agreements lead to more liberalised trade among member countries through increased economic interaction, hence it should have some effects on exports hence growth. This is an important issue because agricultural sector export performance and growth in the Eastern and Southern African region is, low and highly

variable among countries (Kamau, 2010). The importance of economic integration in export performance and economic growth process has become more clear recently as many developing countries especially in the region try to determine an appropriate liberalisation strategy. Hence the need to investigate whether countries should open their markets to countries from the same region before they open to the rest of the world or just move directly towards non-discriminatory liberalisation in order to increase their trade flows and accelerate growth in the agricultural sector.

1.3 Research objectives

The broad objective of this study is to determine the effects of regional economic integration on agricultural sector export performance.

The specific objectives are:

- Determine whether economic integration enhances agricultural sector export performance in the Eastern and Southern Africa region.
- To determine whether COMESA free trade area is trade creating or trade diverting with a specific focus on the agricultural sector

1.4 Research questions

In addressing the research objectives, the following research questions were put forward:

- Does economic integration enhance agricultural sector export performance in the Eastern and Southern Africa region?
- Does COMESA free trade area create or divert trade in the agricultural sector?

1.5 Research hypotheses

The study tests the following hypotheses:

- Economic integration enhances agricultural sector export performance in the Eastern and Southern Africa region
- COMESA free trade area creates trade in the agricultural sector

1.6 Justification of the study

Empirical studies on regional economic integration and export performance such as Tumwebze (2015), Yayo and Asefa (2016), Haddoud *et al.* (2015), Veeramani and Sani (2010) as well as Olayiwola and Ola-David (2013) have mixed results. Different researchers have used different methodologies in analysing the effects of regional trade agreement with

the early empirical studies using cross-sectional data to estimate gravity models (Aitkin, 1973; Bergstrand, 1985) whilst many researchers nowadays are using panel data (Matyas, 1997; Grant and Lambert, 2008; Rojid, 2006). However, many studies failed to employ data at micro level to analyse the effects of regional trade agreement on export performance. This indicates a limitation of a model's dependence upon macro data as opposed to micro data, which can help in analysing the effects of trade agreements on specific tradable commodities or sector and helps member countries to identify whether it is advantageous to join trading bloc within a particular sector. In addition macro data masks commodity or level heterogeneity, which may also lead to biased estimates. This study is going to concentrate on the agricultural sector performance in terms of exports among COMESA countries. The research will add to the existing body of knowledge on the effects of regional economic integration and agricultural sector export performance. Respective countries and COMESA management can also this study for policy making so as to increase export performance in the agricultural sector.

1.7 Organisation of the rest of the study

Chapter Two reviews literature on the effects of regional economic integration on export performance while Chapter Three provides a detailed outline of the methods and procedures used in the study. Estimation, presentations and interpretations are done in Chapter Four and Chapter Five gives a summary, conclusion and policy recommendations based on the study as well as areas of further study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Much work has been done on the effects of regional economic integration and export performance both theoretically and empirically in Africa, Europe and Asia to mention just a few. Theoretical literature review gives an insight on the framework of the theories which have been put forward with regard to trade flows and economic integration whilst empirical literature review focuses on the application and observations, which have been made by different researchers on the similar subject under study.

2.1 Theoretical literature review

There are several theories that explain the relationship between regional economic integration and export performance. These include Viner's theory of customs union and gravity model.

2.1.1 Viner's theory of customs union

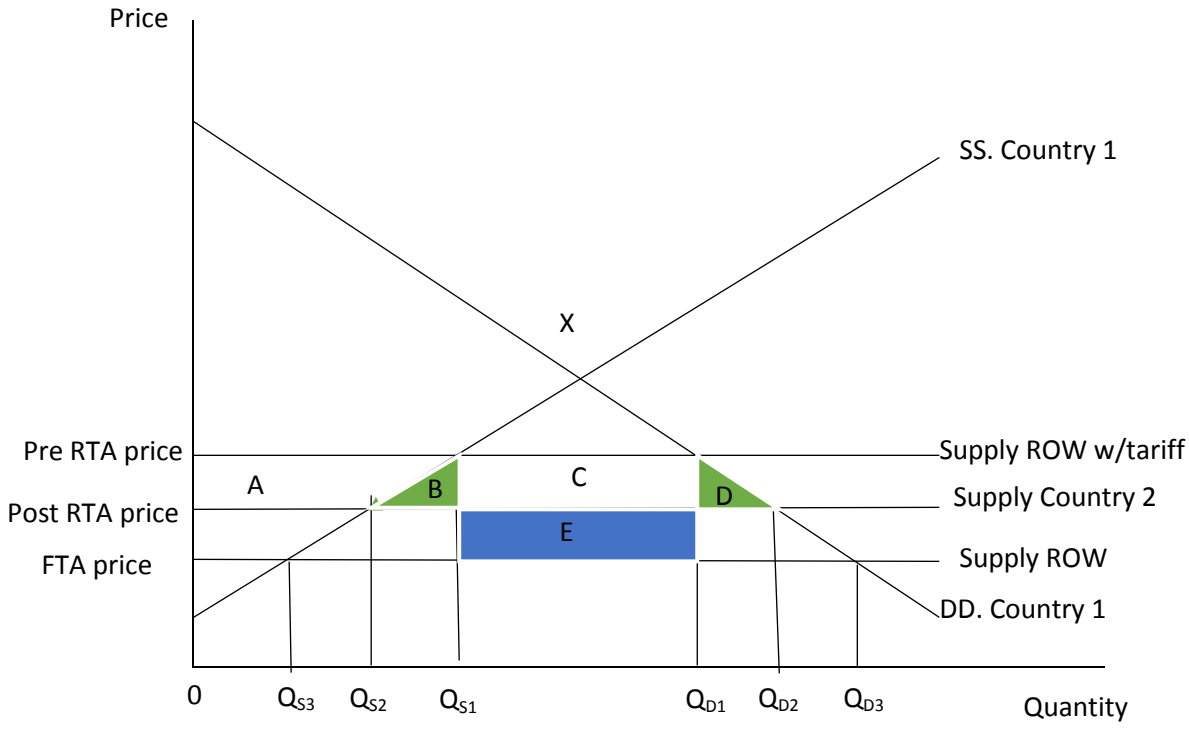
Before Viner's theory of customs union, tariff reduction was believed to be welfare improvement since tariffs are welfare reducing. Viner (1950) came with a different perspective showing that customs union is not always welfare improving, it may also be welfare reducing. This could be as a result of tariff reductions occurring as a second best option increasing trade and further leading to welfare improvement. The theory of second best focuses on what happens when the optimal conditions are not satisfied in an economic model. According to Viner (1950) tariffs are trade restrictions which can either divert trade or create trade under different scenarios.

Trade creation within regional blocs occur when tariffs are reduced allowing the member countries trading to substitute their high cost products that were produced domestically for low cost products produced by their trading partners, hence leading to an improvement in their welfare. Trade creation can be explained as a shift from trading with a high cost country to a less cost country which is efficient assuming that all economic resources are fully employed before and after integration. It also increases the benefits to the non-member countries due to the spill over effects. On the other hand, trade diversion take place as a result of reduction in trade barriers causing trade to be channelled from the third party country to the partner country, on the assumption that if the countries were treated equally the third country would have provided the low cost source of the imported goods within the region.

Trade diversion worsens the international allocation of the resources and shifts production from the countries with comparative advantage. Consequently, Viner's framework concludes that the extent to which countries gain from trade will only depend on the magnitude of trade creation and trade diversion.

Figure 4 showing the Viner's model of trade creation and trade diversion gives a deeper insight on how member countries can either benefit or lose by joining RTAs.

Figure 4: Viner's model of Trade creation and Trade diversion



Adapted from Salvatore (2004)

Figure 4 explains the trade creation and trade diversion among partner countries and the rest of the world after a tariff reduction. At point X (autarky equilibrium), countries will produce what they consume without any trade taking place. When countries open their borders to trade they will trade with the rest of the world without any tariffs being charged hence increased trade. Before economic integration under free trade, Country 1 will produce Q_{S3} whilst consuming Q_{D3}, therefore the difference between Q_{S3} and Q_{D3} will be covered by imports from the rest of the world. With tariffs being charged on the goods from the rest of the world, imports decrease from ($Q_{S3} - Q_{D3}$) to (Q_{S1} - Q_{D1}). Being in economic integration with Country 2 will increase the trade ($Q_{S2} - Q_{D2)}$ since tariffs are now less than before integration so that Country 1 will shift from trading with the high cost countries which are less efficient to trade with Country 2 a low cost country. This means that Country 2's imports

replace the imports from the rest of the world, as shown in Figure 4. The effects of being in a regional economic integration are the consumer surplus which increases by area A, B, C and D while the producer surplus decrease by area A and the tariff revenue collected falls by the area C and E. The trade creation is represented by the areas B and D and trade diversion represented by a loss of area E. Joining economic integration will reduce Country 1's government revenue by area C.

Countries are incentivised to engage in trade by the net economic gain that comes from trade creation. The economic loss of trade diversion is a result of the high prices charged by the member countries due to high costs of production, compared to non-member countries. There have been controversies on the effects of the rising number of RTAs, their impacts on trade, whether the arrangements are beneficial or costly (Jayasinghe and Sarker, 2007). According to Amponsah (2002) the main problem is whether the trade-off between trade creation and trade diversion would bring any welfare gain to the economy. Therefore, countries join regional group if and only if trade creation is greater than trade diversion though, the intensity of trade creation and trade diversion will start dropping as the economies that participate in the regional trade become highly integrated (Flynn, 2008). The static effects depend on the assumption that production efficiency can be enhanced if the member state gives considerations to the production points where they have a relative advantage. This means rationalizing on the cost of production, as well as, the pricing of goods and services. In addition, the static effects treat both tariffs and quotas as barriers to free trade. Once the effects are realized, the state always resorts to the formation of regional schemes in order to minimize trade distortions as a result of tariffs and quotas.

On overall, the static effect, can lead to trade creation or trade diversion depending on the market price and quantities in the regional bloc. However, dynamic effects are gradual and take place over a long period. It involves competition effects due to free movements of imports; the investment effect as a result of new investments that require a regional trade integration; the entire market is large and this offers an opportunity to exploit the new economies of scale created; the effects of capital formation and its influence on the terms of trade by the members. The dynamic effects therefore generate annual benefits as opposed to the static effects that may include the rising growth rate of a country that can occur even after the withdrawal of a member country.

Viner's theory of trade creation and trade diversion is crucial in understanding that trade is not always welfare enhancing but it is also welfare reducing. Trade creation and trade diversion give countries an upper hand in deciding whether or not to enter into a regional agreement depending on the magnitude of the two. However, the theory only concentrates on the short run effects of tariff reduction and also discusses nothing on the reasons why countries join regional trade agreements. The model does not include some of the variables that affect trade for example, gross domestic product per capita, economic size, and distance among others.

2.1.2 Gravity model

The model was borrowed from the law of physics, Newton's theory of gravity [14]which states that the force of attraction between two separate entities *i* and *j* is a positive function of the entities' respective masses and inversely related to the square distance between the objects (Salvatore, 2004). Application of the gravity equation in the context of international trade was first independently done by Tinbergen (1962) and Linnemann (1966) to assess and analyse international trade flows. The gravity model of trade states that trade flow between two countries is being determined by the distance between the countries and their respective economic size. It shows that the volume of trade between two countries (*i* and *j*) is proportional to their economic sizes (incomes) as being measured by GDP (Gross Domestic Product) and inversely related to geographic distance between the countries. The gravity model of trade has been used in many studies aimed at analysing the bilateral flows of trade and analysing effects of regional trading arrangements on trade. Thus, trade between two countries depends on their GDP, population size and the distance between them. The model is specified as follows:

$$E_{ij} = \frac{kY_i^{\alpha}Y_j^{\beta}}{D_{ij}^{\theta}} \ldots\ldots\ldots\ldots\ldots\ldots (2.1)$$

where E_{ij} represents the volume of trade between country *i* and country *j*, $Y_i \; and \; Y_j$ are the gross domestic products of country *i* and *j* respectively and D_{ij} is the physical distance between the two countries as well as *k* the gravitational constant whilst $\alpha, \beta \; and \; \theta$ are parameters to be estimated.

[14] Gravity model is a formulation used to analyse bilateral flows between geographical entities proposed by Newton. The overview and the equation of the gravity model are given in the study.

The gravity model is used in the study due to its significant empirical robustness and explanatory power, to evaluate the influence of regional economic integration on export performance. The model has been considered for the evaluation of trade policies and implications. Gravity model has spread widely for the past years because international trade flows are a key element in all manner of economic relationships and decision making, data for that are easily accessible and also there exist a number of papers on this issue that have established a set of standard practices. However, the gravity model only includes distance and economic size as the major determinant of trade between countries though they are other variables in empirical work (Tumwebaze (2015); Yayo and Asefa (2016)) which are significant in explaining trade for example gross domestic product per capita, infrastructure development and technology among others.

2.2 Empirical literature review

Given the theories on the effects of regional economic integration on export performance, it is important to review the relationship from an empirical point of view.

In estimating the impact of Association of Southeast Asian Nations (ASEAN)-India free trade area on India's plantation commodities, Veeramani and Sani (2010) used the partial equilibrium modelling approach that is the SMART and gravity model. These models were used to estimate the imports increase of the plantation commodities under the tariff reduction schedule of the trading bloc. Independent variables included in the model comprises of GDP, population, distance, border, language, colonial links as well as average tariff rate with all variables being significant in explaining trade in the free trade area. Coffee, tea and pepper were the plantation commodities in the study and the results showed that tariff reduction schedule increased imports significantly. The increase in imports was mainly driven by trade creation which led to an improvement in welfare due to the replacement of the high-cost products by new less-cost products. The results showed that the tariff reduction reduced government revenue and increased consumer surplus, however gain in consumer surplus outweighed the loss in government revenue leading to net welfare gain. The two models found similar results on the magnitude of the total increase in imports. The study was extensive in explaining the impact of regional economic integration by finding the impact and also the magnitude of ASEAN-India free trade area on plantation commodities trade. The use of both models; gravity and SMART gave a clear path and extent of the trade creation from the trading bloc. The study is noteworthy in explaining the effects of regional economic integration on agricultural sector export performance.

Investigating the impact of regional economic integration on export performance in the COMESA region, Tumwebaze (2015) used the Fixed Effects Model (FEM), Random Effects Model (REM) and instrumental variable General Method of Moments (GMM) regression analysis to estimate the impact. Panel data and augmented trade gravity model was used from 1980 to 2012 with GDP, GDP per capita, GDP per capita difference, infrastructure development, distance, language and the regional economic integration variables included as explanatory variables. The researcher found that the formation of COMESA promoted intra-regional exports, implying intra-COMESA export bias. Consistently, Rojid (2006) found that COMESA was a building bloc, that is, created trade more internally than it diverted from the rest of the world suggesting that COMESA's trade potential within the region was limited since most of the members were overtrading within the region using a period of 21 years (1980-2001) for 147 countries. The researchers used macro data rather than micro data neglecting the drawbacks of using macro data. Micro data is better to use because it helps in analysing the effects of trade agreements on specific tradable commodities or sectors hence helping member countries to identify sectors or products which are advantageous when joining trading bloc.

Analysing the impact of RTAs on agricultural products intra trade in three regional economic communities (COMESA, EAC and SADC) for the period 2005 to 2010, Makochekanwa (2012) used two methodologies that are the statistical analysis and the gravity model. Variables included in the model are GDP, population, distance, language, border as well as the regional economic integration with these variables being significant for different agricultural food products. Three selected agricultural food products were used which are maize, rice and wheat. The researcher found that changes in intra-regional trade across the products increased for Namibia, Rwanda, Tanzania and Zimbabwe whilst intra-regional trade of at least two of the three products declined. GDP for exporting and importing countries as well as distance had expected signs. Intra-regional trade in those regions and for the commodities was above the predicted level of the standard gravity model. The coefficients of the extra-trade dummy variable were showing a diversion across regional blocs and also across products.

Yayo and Asefa (2016) researched on the international trade effects of regional economic integration in Africa using a case study of SADC. The researchers used augmented gravity model as theoretical framework and panel data from 2000 to 2007 to estimate the trade effects. Using disaggregated data, the study focused on four different sectors which are fuel

and minerals, light manufacturing, heavy manufacturing and agricultural sector. GDP, infrastructure level, language, import to GDP ratio, GDP per capita, GDP per capita difference and border were used as control variables in the model. The results showed that intra-SADC trade was increasing in the fuel and mineral and heavy manufacturing sectors (trade creation) while decreasing in the agricultural and light manufacturing sectors (trade diversion). This showed that the existence of SADC has helped to boost trade significantly among member countries than with the rest of the world. Yayo and Asefa (2016) used disaggregated data for sectoral comparison to determine the sector with benefits in terms of increasing trade unlike Tumwebaze (2015) who used aggregated data which may produce biased estimates. The study was well articulated in explaining the effects of regional economic integration in Africa, but did not manage to measure the magnitude of the trade diversion and trade creation. Just like Tumwebaze (2015) and Makochekanwa (2012), Yayo and Asefa (2016) also adopted the use of gravity model to estimate the regional economic integration effects in the Eastern and Southern region with different periods.

Haddoud *et al*. (2015) investigated the impact of RTAs on North African countries foreign trade and economic welfare, evidence from Algeria and the European Union Association Agreement (Algeria-EU RTA). The aim of the study was to provide additional empirical evidence from the Algeria-EU RTA on the impact of regional trade agreement on North African countries' foreign trade and economic welfare using the gravity model. The study used both the ex-ante and ex-post analysis covering the period of 10 years from 2000 to 2010. The ex-ante analysis, based on trade movement observations and trade indicators calculation showed that the Algeria-EU RTA was undertaken with two natural trading, and thus expected to create trade and improve economic welfare. This was confirmed by the ex-post analysis based the quantitative method (Lloyd and McLaren model) and qualitative evaluation (Vinerian approach) which showed that the agreement has a positive effect on trade in Algeria and led to trade creation in many sectors. Driven by the same motive but using a different methodology (Balassa's method), Gondwe and Griffith (1989) examined the trade creation and trade diversion in the case of most developed countries in the Caribbean Free Trade Association (CARIFTA) from 1968 to 1974 and found that trade was created for CARIFTA as a whole though the benefits of trade creation were not evenly distributed among countries.

Using disaggregated data and the gravity model, Jayasinghe and Sarker (2007) researched on the effects of RTAs on trade of the six agricultural food products. The agricultural food

products in consideration were red meat, grains, vegetables, fruits, sugar and oilseeds. The study analysed trade creation and trade diversion effects of the North American Free Trade Agreement (NAFTA) from 1985 to 2000. Jayasinghe and Sarker (2007) estimated an extended gravity model using the pooled cross-sectional time-series regression and generalized least square methods. The researchers found that the intra-regional trade has been growing within the trade bloc and displaced trade with the rest of the world. Countries in the bloc have boosted trade significantly among themselves meaning that they have moved towards a lower degree of relative openness in agricultural food trade with the rest of the world.

Using the World Integrated Trade Solution, Software for Market Analysis and Restriction on Trade (WITS-SMART), Makochekanwa (2014) investigated the welfare implication of the COMESA-EAC-SADC Tripartite free trade area for 26 member countries. The study found creation of trade worth close to US$2 billion with DRC and Angola benefiting the most whilst a total worth of close to US$454 million trade was diverted resulting in a positive total trade effect of US$1.5 billion across 26 countries. The SMART model was used in the study to find the magnitude of trade creation and trade diversion of the regional trade agreement and not just the impact. Using the same methodology as Makochekanwa (2014), Veeramani and Sani (2010) found that regional economic integration mainly create trade than diverting it with loss in government revenue which conforms to Viner's model of trade creation and trade diversion.

In estimating the trade effects of the three RTAs which are ASEAN Free Trade Area (AFTA), COMESA and Southern Common Market (MERCOSUR) on the agricultural food products for the period 1981 to 2006, Korinek and Melatos (2009) used gravity model as well as panel dataset. The dataset comprised of annual bilateral trade data for 55 products (3-digit Standard International Trade Classification (SITC)) for all agricultural food products. Korinek and Melatos (2009) used gravity models, Ordinary Least Square (OLS) and maximum likelihood Poisson to estimate the effects of regional integration on trade, where RTAs were represented by dummy variables to correct heteroscedasticity. The results from all the estimated models showed that the three trade blocs have increased trade in agricultural food products between their members. Within the COMESA and MERCOSUR, members treaty each other duty-free for almost all the agricultural food products and AFTA members' tariffs were less than one third of the Most Favoured Nations (MFN) rates on average when the agreement was implemented; though there was no indication of trade diversion.

Confirming to the gravity model, the researcher found that the trade costs such as transport and logistics (distance) remain important factors in determine agricultural food trade flows.

Using a 35 year period from 1980 to 2014, Rasoulinezhad and Kang (2016) examined trade between South Korea and thirteen Organisations of the Petroleum Exporting Countries (OPEC) member countries using the gravity model. The study showed that there is an existence of a long run relationship between the bilateral trade flows and the main variables from the gravity model that is GDP, GDP per capita, difference between incomes, exchange rate, the openness level, distance and World Trade Organisation (WTO) membership. The study used FEM, REM and fully-modified OLS approaches and found that the trade patterns between South Korea and OPEC member countries was based on the Heckscher-Ohlin theory. Economic integration had a positive effect on trade in South Korea. Using the same method of estimation and variables as Yayo and Asefa (2016) the results were that regional trade agreement is trade, although not exhaustive the independent variables included are from literature as well as the core factors are from the gravity model.

Morais and Bender (2000) examined the trade creation and trade diversion in MERCOSUR and NAFTA. The aim of the study was to assess the effects MERCOSUR and NAFTA on welfare; trade creation and trade diversion. This was done through the estimation of gravity equations using panel data methods, with dummy variables to detect intra-trade bloc and extra-trade bloc relations. The results showed that trade creation have not occurred in both trade agreements. Using the same methodology and regional economic integrations as Korinek and Melatos (2009) as well as Jayasinghe and Sarker (2007), Morais and Bender (2000) found different results that the two trade arragements were trade diverting with the reason being maybe different time periods used and level of economic integration under consideration.

Using disaggregated data like Yayo and Asefa (2016), Alemneh (2017) compared the benefits derived from different sectors from a different economic integration. The study tried to answer the following question; which of the economic integration areas, that is, trade, security, roadways and energy might help both Ethiopia and Kenya to effectively speed up economic integration. Using the case of Ethiopia and Kenya, Alemneh (2017) investigated the economic integration in East Africa and found that trade and security accelerates integration more than roadways and energy.

Assessing the trade effects of the East African Community customs union on member countries, Buigut (2012) used a modified gravity model from 1996 to 2009. The researcher used bilateral data on import for seventy EAC trading partners. The results found show that the trading bloc has caused disproportionate effects on intra-bloc imports and exports for individual countries with Kenya, Uganda and Rwanda having a significant increase in their intra-EAC exports whilst Kenya and Tanzania having a significant increase in their intra-EAC imports. Significant changes were seen in Tanzanian imports and Kenyan exports till three years prior to the real implementation.

Taking example of Sudan, Egypt and Kenya, Karim and Ismail (2007) investigated the potential for agricultural trade in COMESA region using different indicators and indices including instability index, comparative production performance index, revealed comparative advantage index, production similarity index and export similarity index. The indices yielded different results depending on the product and country in consideration. The instability indices of roots and tubers, pulses and cereals production were relatively stable regionally than nationally. Export similarity indices results show that countries are dissimilar in their export pattern whilst the revealed comparative advantage indices, considering each country, the indices are generally higher for main export products. As dominant products differ among member countries the pattern of specialisation differs considerably among these countries, therefore, there is a potential for increasing intra-regional trade in the region. The results of the production similarity index show differences in production pattern of the three countries. The study found a promising potential for intra-regional agricultural trade. The conclusion was that government policies of COMESA countries should pay more emphasis to encourage integrating their markets regionally to benefits from potential of trade and comparative advantage exist in the region. Using a different method of estimation from Tumwebaze (2015) and Rojid (2006) but studying on the same regional economic integration, Karim and Ismail (2007) found the same results that COMESA was beneficial to member countries in terms of increasing trade between countries.

Examining the relationship between economic integration and trade facilitation in the ECOWAS region and how the trading bloc has performed in stimulating agricultural export, Olayiwola and Ola-David (2013) used statistical and econometric methods. The study investigated the effects of economic integration on trade facilitation and also the significance of trade facilitation and economic integration in promoting agricultural exports in ECOWAS for the period 2003 to 2008. The results showed that on the average, the trade facilitation in

ECOWAS is less than the world average. It was also shown that ECOWAS member countries with more bureaucratic processes have greater costs of importing/exporting. Evidence from the study also revealed continuous growth in agricultural production and a close relationship between agricultural production and agricultural exports in the region. Economic integration and trade facilitation were significant in affecting agricultural sector exports in ECOWAS region while production in the agricultural sector had a direct and significant impact on agricultural exports.

The gravity model and panel data was used to investigate whether RTAs increase member's agricultural trade for six time periods between 1982 and 2002. Grant and Lambert (2008) demonstrated that regional trade agreements effects on member countries' trade depend on whether the analysis emphasis on agricultural or non-agricultural sectors, on the particular agreement analysed as the length of phase-in period that characterises all regional trade agreements. The results confirmed the positive effects of regional trade agreements as well as significant lagged trade effects and differential effects of individual regional trade agreements with an increase in members' trade greater in the agricultural food as compared to the non-agricultural food sector.

Using twenty-seven year (1981-2008) panel data analysis, MacPhee and Sattayanuwat (2014) investigated the effects of twelve major regional trade agreements on intra and extra-regional trade flows in member developing countries, both intra-regional trade and extra-regional trade. The regression results were not favourable to regional integration as a substitute for multilateral trade liberalization, although there are exceptions. Several regional trade agreements fail to generate intra bloc trade creation. Seven of the twelve regional trade agreements generate import trade diversion while most of the extra-bloc export dummies were not statistically significant. However, three of the five African regional trade agreements in the sample increased intra-bloc trade and the differences in regional trade agreements performances are related to their implementation policies.

Huchet-Bourdon *et al*. (2013) examined the impact of RTAs on agricultural food trade flows that are agricultural against food products comparing those from developed and developing countries. The researchers considered 180 countries for four periods that is 2001, 2004, 2007 as well as 2011 and all the RTAs in force in agricultural food trade. Trade was distinguished to be trade in raw materials and trade in processed food products in order to compare the trade impacts of RTAs in both sectors. Using the gravity model, dummy variables were

introduced to control the multilateral resistance terms and also Poisson-Pseudo Maximum Likelihood (PPML) estimation method was used to deal with zero trade flows. A positive impact of RTAs on trade was found, and as expected trade impact of regional trade agreements was lower in the case of food products relative to that of agricultural products. The study also found that the positive impacts of the trade agreements on trade between involved countries was greater for the South-South trade flows than for North-South trade flows. The study found that trade was high for developing countries trading with each other than for developing countries trading with the developed countries.

2.3 Conclusion

The recent increase in regional economic integration has deepened the debate on its costs and benefits. Literature has also addressed the policy debate, focusing on the welfare and trade effects of these economic integrations as well as the effects on the multilateral trading system. The relationship between regional economic integration and export performance was reviewed both theoretically and empirically but it is not clear yet whether it is positive or negative so there is still ambiguity. Theoretically, regional economic integration affects export performance as supported by the Viner's theory of trade creation and diversion as well as the gravity model.

As reviewed by the empirical literature, many studies were done on the relationships between regional economic integration and export performance with the likes of Tumwebaze (2015), Alemneh (2017), Haddoud *et al*. (2015), Yayo and Asefa (2016) but having different results. Studies such as Morais and Bender (2000), as well as MacPhee and Sattayanuwat (2014) found that regional economic integration was trade diverting whilst Tumwebaze (2015), Huchet-Bourdon *et al*. (2013), Makochekanwa (2014) as well as Yayo and Asefa (2016) found that regional economic integration is trade creating. This shows that the effects of regional economic integration on export performance differ from region to region, country to country and also context to context. Regarding the relationship between economic integration and trade, some researchers view regional economic integration as a stepping-stone towards multilateral trade liberalisation whilst others view it as a stumbling stone against free trade. The following chapter will be looking at the methodology used in the study closely following studies done by Veeramani and Sani (2010), Makochekanwa (2014), Tumwebaze (2015) and Yayo and Asefa (2016).

CHAPTER THREE

METHODOLOGY

3.0 Introduction

Using the literature review discussed in the previous chapter, this chapter described the methodology used to test the hypotheses and answer the research questions. Presenting the methodology used in estimating regional economic integration and agricultural sector export performance from 1980 to 2016 guided by the literature review, the chapter specified the model both theoretically and empirically as well as the statistical diagnostic tests that were carried out.

The study used annual panel data for COMESA member countries and their trading partners in the trading bloc for the period 1980 to 2016 depending on the availability of data. The use of panel data has many advantages over cross sectional and time series data; that is, it helps in controlling for individual heterogeneity, better able to study the dynamics of adjustment, improves efficiency of econometric estimates, provide more informative data, less collinearity between variables and more degrees of freedom (Baltagi, 2008). This study used panel data estimation for the empirical gravity model of trade, which captures individual and time specificity. There are also problems associated with the use of panel data, which are design and data collection problems, distortions of measurement errors, though the advantages outweigh the disadvantages. The FEM and REM are used in estimating the effects when using panel data whether micro or macro.

3.1 Theoretical model specification

Two methods of estimation were used in this study to assess the impact of regional economic integration on agricultural sector export performance and also whether it is trade creating or trade diverting. These are the gravity model and the WITS-SMART simulation model. The gravity model was used to assess the impact of regional economic integration on the agricultural sector export performance for the period 1980 to 2016 whilst the WITS-SMARTS simulation model was used to assess the extent of the impact, that is, trade creation or trade diversion.

3.1.1 Gravity model

To evaluate the influence of COMESA on intra-regional agricultural sector exports, the gravity model of international trade was used because of its significant empirical robustness

and explanatory power. It has been extensively used for the evaluation of trade policy implications, particularly, for analysing the effects of regional trade agreements on trade. According to this model, trade flows is explained by factors that capture the potential of a country to produce and export goods and services, the propensity of a country to import goods and services and other factors that either attract or inhibit trade.

The gravity model of international trade by Tinbergen (1962) is represented as follows:

$$X_{ij} = \frac{kY_i^{\alpha}Y_j^{\beta}}{D_{ij}^{\theta}} \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.1)$$

where:

X_{ij} are exports from country i to country j; Y_i represents exporters' Gross Domestic Product (GDP); Y_j is importers' Gross Domestic Product (GDP);D_{ij} represents distance between country i and country j.

Equation 3.1 shows that economic size and distance are the two main factors which affect international trade; positively and negatively respectively.

According to Tumwebaze (2015) trade theories based on imperfect competition and the Heckscher-Ohlin models justify the inclusion of income, per capita income and distance. However, other variables were added to the model to make it an augmented gravity model, which include language and border. When gravity models are used to estimate the effect of regional economic integration, dummy variables are added for the RTAs under study to avoid capturing the impact of other influences on exports.

By introducing other variables like technology, language and border into the gravity model, it becomes the augmented gravity model as represented in equation 3.2.

$$X_{ij} = \beta_0 Y_i^{\beta_1} Y_j^{\beta_2} GDPC_i^{\beta_3} GDPC_j^{\beta_4} GDPCDIF_{ij}^{\beta_5} \beta_6 lang_{ij} \beta_7 Bor_{ij} Dis_{ij}^{\beta_8} \beta_9 Comesa_i \ldots\ldots \quad (3.2)$$

3.1.2 SMART model

According to Viner (1950) tariff reduction does not always have a positive effect (trade creation); it may have a negative effect (trade diversion) but whether the countries benefit from the trade policy or not depends on the extent of the two. Trade creation normally occur when countries form a free trade area that is the removal of tariffs which changes the price of imported goods such that the domestically produced goods will be expensive and replaced by those from the other members in the free trade area. This benefits the consumers since their

consumer surplus increases. Trade diversion occurs after formation of free trade area when the zero tariff arrangement results in the substitution of cheaper goods by the expensive ones which is less efficient. Welfare loss or gain depends on the existence of the two whether positive or negative effect. Revenue effect is also captured in the model, which shows the loss in government revenue that arises when the reduction or removal of tariffs. The extent of loss of government revenue from imports relies on the extent of trade between the countries involved, which affect the government's ability to provide essential public services. Due to the loss in government revenue development of the country is compromised unless alternative funds for such losses are found.

Model assumptions

Assumptions of the SMART model are as follows:

1. The elasticity of export supply is assumed to be infinite since the trading bloc countries are assumed to be small according to the world standard. That is the change in demand in the considered market (COMESA) does not have any effect on the world prices.
2. Different studies have used different values of the import substitution elasticity with Hoekman *et al.* (2001) assuming small values whilst Francois and Hall (2003) assume five as the value of the import substitution elasticity, this study assume import substitution elasticity of 1.5. The value of the import substitution elasticity shows that same products from different countries are imperfect substitutes (Armington assumption [15] holds for this model in the study).

SMART model (Partial Equilibrium) has advantages and disadvantages over the General Equilibrium models. The advantages of using Partial Equilibrium are that it is relatively easy to use, there is no data struggle when using this model and the interpretation of the results in the model is straightforward. SMART model is associated with the following disadvantages that it works under certain assumptions and is only possible when the barriers in question are not non-tariff barriers.

3.2 Empirical model specification

Explained below are the two empirical models of trade used in this study that are gravity and SMART model discussed one after the other.

[15] In this assumption the products are differentiated with respect to their country of origin and imperfect substitution between import demand and domestic supply was assumed Armington (1969).

3.2.1 Gravity model

Closely following Tumwebaze (2015) and Yayo and Asefa (2016) the control variables were selected and gravity model was used to answer the research question and meet the research objective. The study used COMESA countries and added on the variables used by Tumwebaze (2015). Accordingly, the following augmented gravity model was specified as:

$$lnX_{ijt} = \beta_0 + \beta_1 lnY_{it} + \beta_2 lnY_{jt} + \beta_3 lnGDPC_{it} + \beta_4 lnGDPC_{jt} + \beta_5 lnGDPCDIF_{ijt} + \beta_6 lang_{ij} + \beta_7 Bor_{ij} + \beta_8 lnDis_{ij} + \beta_9 Comesa_{it} + \mu_{ijt} \ldots\ldots\ldots\ldots\ldots \quad (3.3)$$

where $\mu_{ijt} = \upsilon_{ij} + \eta_{ijt}$

From equation 3.3 the notations are defined as follows:

$GDPC_{it}(GDPC_{jt})$ is the per capita income of the exporting (importing) country at time t; $GDPCDIF_{ijt}$ is per capita GDP difference between country i and j at time t; $lang_{ij}$ is language a dummy variable, which takes one if countries share a common language and zero otherwise; Bor_{ij} is variable border which takes the value one when countries i and j are sharing a land border and zero otherwise; $Comesa_{it}$ a dummy variable which takes one for the post-COMESA-FTA period for each country and zero otherwise; Dis_{ij} is distance between the two trading partners country i and j; μ_{ijt} is the overall error term, υ_{ij} is the country effect and η_{ijt} is the idiosyncratic or remainder error term; βs the parameters to be estimated.

The empirical model of this study differs in some respect from the previous augmented gravity models found in the literature with the major difference being in the variables used by researchers. Besides the core variables of the gravity model, this study adopted control variables that are believed to influence exports in the COMESA region. For example, GDP per capita was used instead of population.

3.2.2 SMART model

Following Makochekanwa (2014), WITS-SMARTS model was used to achieve the study's specific objective because of its capacity to analyse the extent of trade creation and trade diversion after a tariff reduction in COMESA. The SMARTS model is in the WITS and use data from different organisations for example UNCOMTRADE, Trade Analysis Information

systems (TRAINs). The effects to be estimated are discussed below mathematically[16]: trade creation and trade diversion.

According to Laird and Yeats (1986) the derivation of the model beginning with the simple demand and export supply functions and an equilibrating identity.

The importing country's import demand function for commodity *x* produced in country *i* is expressed as:

$$M_{xij} = F(Y_i, P_{xi}, P_{xj}) \quad (3.4)$$

The exporting country *j*'s export supply function for commodity *x* is expressed:

$$X_{xij} = F(P_{xji}) \quad (3.5)$$

The following identity is derived from the above equations

$$M_{xij} = X_{xji} \quad (3.6)$$

In a free trade, countries will be trading at an equilibrium, where the domestic price of the commodity *x* in the importing country *i* is equal to that in the exporting country *j*'s export price plus transport and insurance charges.

$$P_{xij} = P_{xji}(1 + t_{xij}) \quad (3.7)$$

The export revenues earned by *j* are:

$$R_{xji} = X_{xji}.P_{xji} \quad (3.8)$$

Trade creation effect is defined as the demand in country *i* for commodity *x* from the exporting country *j* which results from the price decrease associated price changes due to tariff reduction. Trade creation is specified as:

$$TC_{xij} = M_{xij}.E_m.dt_{xij}/((1 + t_{xij}).(1.\left(\frac{E_m}{E_x}\right)) \quad (3.9)$$

Trade diversion which shows the change in duty paid prices paid for the goods emanating from the regional bloc relative to those from the rest of the world after the formation of the regional bloc. Trade diversion is written as:

[16] The algebraic expressions are from Laird and Yeats (1986).

$$TD_{xij} = \frac{M_{xij}}{\sum M_{xij}} . \frac{\sum M_{xij} . \sum M_{xiJ} . E_S . \frac{d\left(P_{xij}/P_{xiJ}\right)}{P_{xij}/P_{xiJ}}}{\sum M_{xij} + \sum M_{xiJ} + \sum M_{xij} . E_S . \frac{d\left(P_{xij}/P_{xiJ}\right)}{P_{xij}/P_{xiJ}}} \ldots\ldots\ldots\ldots\ldots \quad (3.10)$$

In equation 3.10, there is an assumption that the substitutability between a developing country product and a similar product produced in non-beneficiary that is non-preference-receiving countries should be similar to the substitutability between a developing country product and a similar product produced in the donor importing country.

Net trade effect is calculated as the summation of trade creation and trade diversion effects as follows:

$$TE = TC + TD \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.11)$$

Net Revenue Effect is the total differential of revenue with respect to export price and volume of exports.

$$\frac{dR_{xji}}{R_{xji}} = \left(\frac{dt_{xij}}{1+t_{xij}}\right) . Em . ((1 + Ex)/(Ex - Em)) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.12)$$

The welfare effect comes from the benefits consumes in the importing country that comes from the low domestic prices after the reduction of tariffs. It is written as:

$$W_{xij} = 0.5(dt_{xij} . dM_{xij}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.13)$$

where:

M – Imports *Em – elasticity of import demand w.r.t domestic price*

X – Exports *Ex – elasticity of export supply w.r.t export price*

P – Price *TC – trade creation*

W – Welfare *TD – trade diversion*

R – Revenue *x – subscript denoting commodity*

t – Tariff rate *i – subscript denoting domestic/importing country data*

d – Change *j – subscript denoting foreign/exporting country data*

Y – National income *V – output in the importing country*

Mn – imports from the non-preference-receiving countries

Es – elasticity of substitution w.r.t relative prices of the same product from different sources of supply.

3.3 Definition and justification of variables

Exports from country *i* to country *j* in the COMESA regional integration was used as dependent variable in the model whilst the control independent variables include economic size, distance, GDP per capita, per capita income difference language and border with the dummy variable for the regional economic integration being the core variable.

Exports (X_{ijt})

Exports from country *i* to country *j* were used as the dependent variable, to assess the factors which determine the exportation of goods and services from one country to another. The study outlined how far the independent variables affect exports in the COMESA region particularly the regional economic integration dummy variable. Multilateral exports were used in the study since countries in the region trade with many countries in the same region.

Economic size (Y_{it}; Y_{jt})

As explained by the gravity model, economic size is the main variable which affects exports positively. Gross domestic product of each country was used as a proxy to economic size and included in the model to capture the factors linked to the level of economic development. More trade is expected when countries have higher GDP than those with lower GDP due to the innovation, advanced technology and more advanced infrastructures that facilitate trade by the exporting country. GDP captures the productive capacity of the exporting country and the purchasing power of the importing country. A higher GDP indicates greater potential supply of the exporting country and greater demand in the importing country. As used by Yayo and Asefa (2016) as well as Makochekanwa (2012), GDP was considered as the explanatory variable in the model. Therefore, GDP expected to have positive effect on exports.

Gross Domestic Product per capita ($GDPC_{it}$; $GDPC_{jt}$)

GDP per capita was incorporated in the model rather than population like in many previous gravity models.[17] The argument being that in trade what matters more is not the size of the population *per se*, but effective demand by individuals which can appropriately be measured by the GDP per capita. GDP per capita affect trade in two different ways, which can be large GDP per capita, indicating a large domestic market with high level of self-sufficiency and less or no need for trade. However, a large GDP per capita may promote economies of scale in production hence promoting the desire to trade in a greater variety of goods. Rasoulinezhad and Kang (2016) also included the GDP per capita as the factor which affects exports. Thus, the estimated coefficient for the GDP per capita could be either positive or negative.

Technology ($GDPCDIF_{ijt}$)

Difference in technology is another reason why countries trade. To capture technology differences between countries in explaining trade patterns, differences in per capita income were used to proxy it following closely Tumwebaze (2015). Two hypotheses exist on the effect of this variable on trade; the Linder hypothesis and the Heckscher-Ohlin. Linder hypothesis postulates that countries with similar levels of GDP per capita will have similar tastes, producing similar but differentiated products and also trading more among themselves. Whilst Heckscher–Ohlin hypothesis posits that GDP per capita differences are associated with differences in factor endowments hence smaller differences could reduce trade. In this case, the effect of this variable on exports may either be negative supporting the Linder hypothesis or a positive for the Heckscher-Ohlin hypothesis.

Language ($Lang_{ij}$)

Sharing a common language enhance export flows between countries by facilitating communication. Ease of communication facilitates foreign trade through translation as well as through the ability to communicate directly. Linguistic links, cultural and historical links are mainly important at decreasing the cost of unfamiliarity in trade, or what Linnemann (1966) called psychic costs. Therefore, the coefficient for this variable is expected to be positive.

[17] Population is necessary for aggregate exports whilst GDP per capita is preferable for specific export products Yayo and Asefa (2016). Though not exhaustive, the independent variables were from literature and there is no agreement on the variables to be included besides the core variables in the gravity model.

Border (Bor_{ij})

Border was also used as an explanatory variable in the study since it is expected that sharing a common geographical frontier promote bilateral trade. The immediate result of geographical proximity is reduced transport costs, low spoilage, less interest payments on export credits and short delivery time (Ekanayake *et al*., 2010). The near the border is, the easier the consumers will find it to cross over to buy from the other country and firms can source intermediate inputs from that country, much more readily than would be possible if the countries did not share a common border. Sharing a common border increases the exports between countries. Therefore, the coefficient of the border is expected to be positive. Tumwebaze (2015) as well as Yayo and Asefa used border variable as a measure of contiguity.

Regional Economic Integration ($Comesa_{it}$)

According to Salvatore (2004) economic integration refers to the policy of discriminately eliminating or reducing trade barriers only among countries joining together. The variable *Comesa* is a dummy variable comparing the ex-ante and ex-post periods of COMESA-FTA. The variable takes the value one for the period after the COMESA-FTA and zero otherwise, capturing the effect of COMESA-FTA on intra-regional export flows. As used by Yayo and Asefa (2016) as an explanatory variable, regional integration is the core variable in this study. Regional economic integration is expected to promote intra-regional exports; therefore, the coefficient is expected to be a positive. A positive value would imply that the formation of COMESA-FTA increase export flows among its member countries and vice versa.

Distance (Dis_{ij})

The distance variable measures the physical distance between the economic centres of the trading partners. In measuring distance, many authors locate countries at their geographical centre, capital city or most populous city (Melitz, 2007) but in this study it is the weighted distance that is the distance between economic centres in kilometres from country *i* to country *j*. Distance is a proxy for transport costs that is the greater the distance, the higher the transport costs. There are three kinds of costs associated with doing business at a distance which includes physical shipping costs, time-related costs and costs of (cultural) unfamiliarity (Rahman, 2009). Transport costs raise the price of a good in the importing country thus reducing its demand; therefore, distance is expected to have a negative effect on exports.

3.4 Model Estimation Procedure

Macro-panel data models were used in dealing with the issues of non-stationary in the time series like unit root and cointegration since T is greater than the N. According to Baltagi (2008), the fact that time is allowed to increase to infinity in macro panel data generated two aspects of ideas that is heterogeneity of regression parameters and the time series procedures to the panels. There are many methods that can be used to deal with the panel data, which includes pooled regression, fully-modified OLS, dynamic OLS, fixed effects and random effects models. Only two models were discussed in this chapter that is the fixed effects model and random effects model, with the Hausman test discussed later so as to suggest an appropriate model to use. The pre-estimation tests were discussed after the Hausman test which is panel cross-section dependence test, panel unit root test and panel cointegration test.

3.4.1 Fixed Effects Model

Panel data estimation has grown in popularity because it is used to reduce a serious challenge faced by most researchers that is the lack of an adequate list of independent variables to explain the dependent variable. According to Cameron and Trivedi (2005), fixed effects model allows for unobserved individual heterogeneity that may be correlated with the independent variables. The fixed effects model is also known as the within model. The basic assumption of this model being that the time invariant variable (ν_i) is correlated with the independent variable (X_{it}), that is, $Cov\,(X_{it}, \nu_i) \neq 0 \; \forall \; i \; and \; j$. The model at observation level is written as:

$$Y_{it} = \alpha + X'_{it}\beta + \upsilon_i + \eta_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.14)$$

Y_{it} is the dependent variable and α represents the cross-section specific intercepts which is constant over time. β is a vector of the slope coefficients of the explanatory variables whilst $X'_{it}$is a vector of independent variables. υ_i is treated as an unknown parameter to be estimated, however, consistent estimates of these additional parameters cannot be obtained in the typical panel data case. In the typical case that T is small and N is large, the fixed effects estimator will not be feasible, at least for $\upsilon_i{}'$s due to a great loss of the degrees of freedom and too many dummy variables to handle which leads to the multicollinearity problem (dummy variable trap). In this setup, however, the number of parameters is growing at the same rate as the sample. Although υ_i cannot be estimated consistently, the remaining parameters can.

3.4.2 Random Effects Model

Since fixed effects model is usually associated with multicollinearity and great loss of degrees of freedom as *N* becomes large, random effects model will be more appropriate to use. The random effects model is also known as the error component model. The model is one way to deal with the fact that T observations on N individuals are not the same as the observations on NT different individuals. The random effects model is being distinguished from the fixed effects model using its substantive assumption that the time-invariant country-specific effect υ_i is uncorrelated with the independent variable X_{it}. The model can be written as follows:

$$Y_{it} = \alpha + X'_{it}\beta + \upsilon_i + \eta_{it} \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.15)$$

According to Baltagi (2008), there are too many parameters in the fixed effects model and the loss of degrees of freedom can be avoided if the individual specific variable υ_i is assumed to be random $Cov\,(X_{it}, \upsilon_i) = 0\ \forall\ i, j\ and\ t$ to avoid endogeneity. In this case, the individual specific variable is no longer a parameter to be estimated but a random variable. This orthogonality condition[18] along with the assumptions of μ_{it} is sufficient for OLS to be asymptotically unbiased. The following are some of the assumptions which are supposed to hold when dealing with the random effects model, which includes assumptions about υ_i, about η_{it} and about the interaction of the error terms.

The following assumptions should hold for the REM:

$$\upsilon_i \sim IID(0, \sigma_\upsilon^2)\ and\ \eta_{it} \sim IID\left(0, \sigma_\eta^2\right), E(\upsilon_i|X) = E(\eta_{it}|X) = E(\upsilon_i, \eta_{it}|X) = 0\ \forall\ i, j\ and\ t$$

The overall error term is non-auto correlated and homoscedastic.

3.4.3 Fixed effects model versus Random effects model

According to Baltagi (2008), the fixed versus random effects issue has generated a strong debate in statistics literature which has spilled over into panel data econometrics literature. Having discussed the fixed effects and the random effects models as well as the assumptions underlying them, the only question left is which one to choose? The choice of the two depends on their consistency and efficiency in estimation (advantages and disadvantages).

The salient distinction between the FEM and REM depend on whether the time-invariant effects are correlated with the regressors or not. Each of the above models has its own

[18] It refers to the situation where the expected value of the errors is equal to zero.

advantages and disadvantages. The advantages of the fixed effects model are the disadvantages of the random effects model whilst the reverse is true. The advantages of using the random effects model includes it being efficient given that $Cov(X_{it}, v_i) = 0$, considers time invariant variables and also gain of degrees of freedom than the fixed effects whilst having some disadvantage of inconsistency of estimates given that $Cov(X_{it}, v_i) \neq 0$ and it is also not feasible to calculate the individual effect.

According to Cameroon and Trivedi (2005), the fixed effects model has the attraction of allowing one to produce panel data to establish causation under weaker assumptions than those needed to establish causation with panel data models without fixed effect, such as pooled models and random effects models. In the case of fixed effects models the estimation of the coefficient of any time-variant regressor, such as an indicator variables for border, is not possible as it is absorbed into the individual-specific effect.

3.4.4 Hausman test

Choice of the model to use between random effects and fixed effects model depends on the Hausman test. Depending on the assumptions of the models, if the effects are uncorrelated with the explanatory variables, the random effects estimator ($\hat{\beta}_{RE}$) will be consistent and efficient whilst the fixed effects estimator ($\hat{\beta}_{FE}$) is consistent but not efficient. In the case that the effects are not correlated with the explanatory variables, the fixed effects estimator is consistent and efficient but the random effects estimator is now inconsistent.

Hausman test follows a chi-square (χ^2) distribution and it is defined as:

$$H = \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right)' \left[Var(\hat{\beta}_{FE} - \hat{\beta}_{RE})\right]^{-1} \left(\hat{\beta}_{RE} - \hat{\beta}_{FE}\right) \sim \chi_k^{\,2}$$

where k is the rank of the matrix.

Considering the null and alternative hypothesis, the test is as follows:

$$H_0: Cov(X_{it}, v_i) = 0$$

$$H_1: Cov(X_{it}, v_i) \neq 0$$

Under this null hypothesis the random effects estimator is correct and efficient. In this case the null hypothesis is rejected if and only if the probability value is less than the significance level and concludes that random effect estimator is not efficient though fixed effect estimator

remain consistent. On the other hand, failure to reject the null hypothesis leads to a conclusion that both estimators are consistent though random effects estimator is more efficient than the fixed effects estimator.

3.4.5 Panel Cross-section Dependence test

Disturbances in panel data models are usually assumed to be cross-sectionally independent given that the number of cross sectional units is large. Many panel data models are likely to exhibit cross-sectional dependence, which exist in the errors caused by the presence of shocks and unobserved components that will become part of the error term, spacial dependence and idiosyncratic pairwise dependence in the disturbances with no particular pattern of common components (Baltagi, 2008). The other reason for this might be an ever-increasing economic and financial integration of countries and financial entities that resulted in strong interdependencies between cross-sectional units. Before unit root test, cross-section dependence should be tested to find out whether the data are cross sectional dependent or independent. Otherwise the results from the estimation would be biased and inconsistent. To test for the cross-sectional dependence, this study used the cross-section dependence Pesaran (2004) test with the null hypothesis that there is no cross-sectional dependence. The hypothesis is only rejected if and only if the probability value is less than the significance level.

3.4.6 Panel Unit Root test

Most time series data may not be stationary over time due to some changes associated when conducting researches, stationarity tests should be performed. With long time series for macro panels, issues to do with non-stationarity for example unit root, which is not the case for micro panels. Time series are said to be nonstationary when their mean, variance or auto covariance varies over time and can be stationary after the first difference. The consequences of panel data being non stationary, is the inflation of results with high chances of being inconsistent and also spurious regressions. This test is mainly done after the cross-section dependence test and the results will show the appropriate unit root test to apply. Many methods can be used to test for stationarity in the panel data for example Cross-section Augmented Dickey Fuller (CADF) test, Im, Pesaran and Shin (2003), Levin, Lin and Chu (2002) to mention just a few. For cross sectional independent series, Levin, Lin and Chu as well as the Im, Pesaran and Shin tests are most appropriate methods to use whilst the CADF is appropriate for those series which are cross-sectionally dependent. Using the null hypothesis that the series in the panel contains unit root and the alternative hypothesis allows

for some of the series to have unit roots. The cross section augmented dickey fuller was used to test the unit root where the null hypothesis is rejected when probability value of the statistic is less than the significance level.

3.4.7 Panel Cointegration test

Cointegration can be viewed as the statistical expression of the nature of long-run equilibrium relationships that is the series tend to wander. If the variables have a long-run equilibrium relationship, they can diverge in the short run but must converge to in the long run. If the variables diverge without bound, it is assumed that the equilibrium relationship does not exist. Cointegration tests are usually performed when the time series are nonstationary to determine whether they have a stable long-run relationship. If the variables are cointegrated, it means that the errors are integrated of order zero and if they are not integrated then the errors are integrated of order one. With the series stationary at the first difference, Pedroni (2001) test was applied for a group of variables where all series integrated of order one, to find whether there is any long-run equilibrium relationship between the series. The test has a null hypothesis of no cointegration in the series that allows for considerable heterogeneity and is rejected when the probability value is less than the significant level, with the intuition that enough of the individual cross-sections have statistics far away from the means. Different authors advocate for different estimation techniques after testing for panel cointegration. For example Pedroni (2001) advocates for the fully-modified OLS, Cheng and Wall (2005) suggests the use of fixed effects whilst Soren *et al*. (2014) recommends the random effects since fixed effect does not allow the estimation of the time invariant variables in the gravity model. After applying the cointegration test and finding the existence of long run equilibrium, three methods for estimation were applied to explore the estimates that are the fixed effects model, random effects model and the fully-modified ordinary least square.

3.4.8 Multicollinearity

Multicollinearity is when variables move in a systematic way, with collinear variables and it will be difficult to separate the effects of one explanatory variable from the other. The correlation matrix was used to test for multicollinearity with values ranging from zero to one. The main diagonal of the correlation matrix consist of ones indicating correlation of a variable against itself from the top left to the bottom right whilst the off-diagonals indicate some levels of correlation. If R-squared exceeds 0.8, there is serious problem of multicollinearity and the results produced are biased due to large standard errors and

covariance. This might as well lead to the acceptance of the false null hypothesis (type 1 error).

3.5 Data Sources, Type and Period

The study used annual panel data on COMESA member countries and their trading partners for the period 1980 to 2016. The dependent variable used in the analysis was exports in USA dollars from country *i* to country *j*. The data on exports were generated from the International Monetary Fund *Direction of Trade Statistics and the UN Commodity Trade Statistics* (UN Comtrade) databases. Information on GDP in USA dollars was obtained from the *World Development Indicators* databases of the World Bank, and from International Monetary Fund, *World Economic Outlook* database. Data on GDP per capita in US dollars were from the International Monetary Fund and *World Economic Outlook* database. Weighted distance in kilometres was obtained from *http://www.cepii.fr* as well as information about the partner's language and border.

Products used in the agricultural sector were classified in different categories according to their SITC codes as they are in the WITS database. Table 2 show the description of the products with respect to their SITC codes.

Table 2: Agricultural Products

Products	**SITC Codes and Description**
Livestock	0012 – Sheep, lamps and goats
Meat	0112 – Meat of sheep and goats, fresh, chilled or frozen
Fish	0312 – Fish, salted, dried or smoked
Rice	042 – Rice
Maize	044 - Maize corn
Fruits and Vegetables	05 – Fruit and vegetables
Sugar	06 – Sugar
Coffee	071 – Coffee
Tea	074 – Tea
Vanilla	07521 – Vanilla
Tobacco	121 – Tobacco
Cotton	263 – Cotton
Flowers	2927 - Cut flowers and foliage

Source: SITC classification

3.6 Conclusion

This chapter presents the methodology that was used to examine the effect of regional economic integration on the agricultural sector export performance in the COMESA region from 1980 to 2016 using with or without comparison. This includes a brief evaluation of the model specification as well as tests carried out. The chapter considered the definition and justification of variables and also shaded light on independent variables and their expected signs. The next chapter will look at the estimation, presentation and interpretation of results.

CHAPTER FOUR

PRESENTATION, INTERPRETATION AND DISCUSSION OF RESULTS

4.0 Introduction

The chapter focuses on the estimation, presentation and interpretation of the research findings. Thus, this Chapter enables the researcher to test the research hypotheses and answer the research questions put forward in Chapter one. Presented first is the summary of the descriptive statistics followed by panel cross-section dependence test, panel unit root test results and the panel cointegration test. Multicollinearity tests as well as results from the gravity model and SMART model are presented after. EViews version 10 was used to estimate the results as well as the WITS-SMART simulations.

4.1 Summary of Descriptive statistics

The study used data from 12 countries[19] due to the unavailability of data on the remainder and 37 time periods. The summary gave a better understanding of the data used in the study. Table 3 shows the summary of the descriptive statistics results from the estimations done.

Table 3: Summary of Descriptive statistics

	Exports	Y_i	Y_j	$GDPC_i$	$GDPC_j$	GDPCDIF	Dis	Lang	Bor	Comesa
Mean	4.856912	9.809117	9.798370	2.765609	2.816591	2.637478	3.073624	0.604701	0.394587	0.621083
Median	5.703235	9.811575	9.895920	2.690907	2.751845	2.601702	3.143417	1.000000	0.000000	1.000000
Maximum	9.873996	11.52244	11.52244	4.174296	4.174296	4.097336	3.695726	1.000000	1.000000	1.000000
Minimum	0.000000	8.167317	8.071882	1.996405	1.996405	-7.705792	2.210002	0.000000	0.000000	0.000000
Std. Dev.	2.525702	0.521222	0.703586	0.435766	0.420651	0.658921	0.301422	0.489089	0.488936	0.485290
Skewness	-1.005504	0.276715	-0.169862	1.064060	0.982252	-2.774275	-0.290748	-0.428299	0.431348	-0.499189
Kurtosis	2.791535	3.596789	2.563678	3.881947	3.930360	45.74729	3.211951	1.183440	1.186061	1.249189
Jarque-Bera	239.1253	38.75278	17.88868	310.4436	276.4034	108699.9	22.40902	235.9685	236.0252	237.6326
Probability	0.000000	0.000000	0.000130	0.000000	0.000000	0.000000	0.000014	0.000000	0.000000	0.000000
Sum	6819.105	13772.00	13756.91	3882.915	3954.494	3703.019	4315.368	849.0000	554.0000	872.0000
Sum Sq. Dev.	8949.977	381.1558	694.5313	266.4179	248.2574	609.1503	127.4702	335.6090	335.3989	330.4160
Observations	1404	1404	1404	1404	1404	1404	1404	1404	1404	1404
Cross section	38	38	38	38	38	38	38	38	38	38

[19] These countries include Burundi, Egypt, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Uganda, Zambia and Zimbabwe.

All the variables in the descriptive statistics have a relatively small standard deviation. Exports, GDP per capita difference, distance, language, regional economic integration and GDP of the importing countries have negative coefficients, indicating negatively skewed data whilst the GDP per capita of both countries, GDP of the exporting countries and border variables are positively skewed. GDP of the exporting countries, GDP per capita of both countries, GDP per capita difference and distance have a kurtosis of greater than three showing that the variables are normally distributed whilst the rest have a kurtosis of less than three.

4.2 Panel Cross-Section Dependence test

Table 4 shows the results of the cross section dependence in residuals using the cross-section dependence Pesaran (2004) test.

Table 4: Pesaran (2004)'s CD results

Test	Statistic	Prob
Pesaran CD	20.6225	0.0000

Based on the results of the CD Pesaran (2004) test the null hypothesis (no cross-section dependence in residuals) is rejected at 1% significance level. This implies that the series have a strong evidence of cross-sectional dependence. The results of cross-sectional dependence test show that unit root test is necessary.

4.3 Panel Unit Root test

In order to determine panel stationarity of the time series data in a cross sectional dependent panel, CADF panel unit root test was used as shown in Table 5 and 6.

Table 5: CADF Unit Root test results in levels

Variables	Probability value	Order of integration
Exp_{ij}	0.0000***	I(0)
Y_i	1.0000	Non stationary
Y_j	1.0000	Non stationary
$GDPC_i$	0.5117	Non stationary
$GDPC_j$	0.8725	Non stationary
$GDPCDIF$	0.0003***	I(0)

**** means stationary at 1% significance level and I(.) shows the order of integration.*

Exports and GDP per capita difference are stationary in levels (integrated of order zero) as indicated in Table 5. GDP and GDP per capita for the exporting and importing country are non-stationary and to be differenced in Table 6.

Table 6: CADF Unit Root test results at First Difference

Variables	Probability value	Order of integration
DY_i	0.0000***	I(1)
DY_j	0.0000***	I(1)
$DGDPC_i$	0.0000***	I(1)
$DGDPC_j$	0.0000***	I(1)

*D means first difference whilst *** means stationary at 1%.*

GDP and GDP per capita for the exporting and importing country variables are stationary after the first difference, which implies that they are integrated of order one, I(1), at 1% significance level.

4.4 Panel Cointegration test

Pedroni (2001) panel cointegration test is applied for a group of variables where all variables are I(1) to find out whether there is any long-run equilibrium relationship between variables or not, since the evidence was found that the variables were stationary at first difference. The results are presented in Table 7 and by considering the panel, group and weighted statistics which indicates that the most statistics have probability value less than 1%, the null hypothesis of no cointegration is rejected. It can be concluded from this evidence that the long run relationship between variables exist.

Table 7: Pedroni Panel Cointegration test results

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-4.142795	1.0000	-4.413422	1.0000
Panel rho-Statistic	-9.301418	0.0000**	-7.867040	0.0000**
Panel PP-Statistic	-21.39355	0.0000**	-20.57130	0.0000**
Panel ADF-Statistic	-14.86163	0.0000**	-13.20386	0.0000**
Group rho-Statistic	-5.868074	0.0000**		
Group PP-Statistic	-22.20439	0.0000**		
Group ADF-Statistic	-7.726790	0.0000**		

*Note: ** shows statistical significance at 1% level.*

4.5 Multicollinearity

From Table 8, many independent variables do not move in a systematic way since the absolute values are less than 0.8.

Table 8: Correlation matrix results

	$DGDP_i$	$DGDP_j$	$DGDPPC_i$	$DGDPPC_j$	GDPCDIF	Comesa
$DGDP_i$	1					
$DGDP_j$	0.1173	1				
$DGDPPC_i$	0.9983	0.1259	1			
DGDPPCj	0.0062	0.6427	0.0187	1		
GDPCDIF	-0.3681	-0.0395	-0.3724	-0.0565	1	
Comesa	0.6278	0.2401	0.6358	0.2620	-0.6534	1

Only GDP of the exporting country and GDP per capita are correlated since their absolute values of correlation coefficients (0.9983) are greater than 0.8 as shown in Table 8. This shows that the effects of the two cannot be separated from one another. One of the variables should be dropped because continuing with the regression will result in biased and inconsistent results. Therefore, GDP per capita is going to be dropped due to the fact that it is not a core variable in the gravity model as compared to GDP hence estimation of the model since explanatory variables are no longer correlated.

4.6 Estimated results

The results of the effects of regional economic integration on agricultural sector export performance in the region are presented below first using gravity model followed by the SMARTS model.

4.6.1 Gravity Model Estimation

After the cointegration test which show that the long run relationship exist between variables, two panel data estimation approaches were applied, that are, fixed effects model and random effects model to explore the estimates of the variables. Due to the fact that there is no similar view in the estimation of panel cointegration the models were used to find the effects of the regional economic integration. It should also be noted that the coefficients for the time-invariant variables cannot be estimated using the fixed effect estimator. The Hausman test is conducted first for the suggestion of the model which provides unbiased and consistent estimates.

4.6.2 Hausman test

The Hausman test is conducted for the suggestion of the appropriate model between the random effects and the fixed effects model. Table 9 shows the results from the Hausman test.

Table 9: Hausman test results

Variable	Fixed	Random	Var(Diff)
DY_i	3.2122	3.1879	0.0040
DY_j	-0.75769	-0.6967	0.0029
$DGDPC_j$	1.6195	1.6523	0.0068
$GDPCDIF$	-0.1210	-0.0966	0.0018
$Comesa$	1.2919	1.2766	0.0003

$\chi^2(5) = 5.1404$ *p-value = 0.3990*

Since the probability value (0.3990) is greater than significance level (0.05), there is no enough evidence to reject the null hypothesis that both the random and fixed effects estimator are consistent but the random effects estimator is efficient. The results go in favour of random effects model rather than the fixed effects model.

Table 10 shows the results for random effects model as suggested by the Hausman test.

Table 10: Random effects model

Dependent variable: Exports

Variable	Coefficient	Std. Error	t-statistic	Prob
C	4.0832	2.1724	1.8796	0.0604*
DY_i	3.1879	0.9035	3.5285	0.0004***
DY_j	-0.6967	0.7394	-0.9422	0.3462
$DGDPC_j$	1.6523	0.8460	1.9531	0.0510*
$GDPCDIF$	-0.0966	0.1296	-0.7451	0.4564
Dis	0.1144	0.6768	0.1690	0.8658
Bor	-0.0709	0.4415	-0.1605	0.8725
$lang$	0.2809	0.3946	0.7120	0.4766
$Comesa$	1.2766	0.1324	9.6449	0.0000***

** and *** means that the variables are significant at 10% and 1% significant level respectively.*

Conforming to Tumwebaze (2015), Yayo and Asefa (2016) as well as Rojid (2006), the coefficient of regional economic integration was found to be statistically significant at 1% significance level with an expected positive coefficient. This shows that the formation of COMESA free trade area has improved the agricultural sector export performance in the regional trading bloc. The coefficient of the COMESA free trade area is 2.60% [=exp (1.28)-1]. Formation of COMESA has increased the intra-regional exports by 2.60%, which reveals an increase in the willingness to trade among countries within the region than with those countries outside the trading bloc. The regional trading bloc has increased trade amongst the members showing that relatively less trade is now taking place with those outside the regional economic integration. The results reveal that the regional economic integration came as a stepping stone for many member countries rather than a stumbling one.

In the case of GDP, the findings in Table 10 shows that a 1% increase in GDP of the importing country results in 3.19% increase in exports from the agricultural sector. The effect of the GDP of the exporting country is statistically significant at 1% level of significance and positively in explaining exports in the agricultural sector which is in line with the theoretical expectation. From the results, GDP is a key determinant of a country's export capacity in the COMESA region. This indicates that a higher GDP of the exporting country shows a higher production capacity of a country which results in an ability to export more. The results are consistent to those found by Tumwebaze (2015), Makochekanewa (2012) as well as Rasoulinezhad and Kang (2016).

The coefficient of the GDP per capita of the importing country is statistically significant in the model at 10% significance level and positively influencing agricultural sector export performance in the COMESA region. This reveals that a 1% increase in the GDP per capita will result in an increase in the export performance in the agricultural sector by 1.65%. Showing that for the trading partner country, the larger the GDP per capita is, the larger the absorption capacity of the country which implies that the country is in a position to import more (high demand). The results concur to those of Tumwebaze (2015), Yayo and Asefa (2016), Buigut (2016) and Jayasinghe and Sarker (2007)

Distance, language, border, GDP of the importing country and per capita income difference coefficients are insignificant in explaining COMESA agricultural sector export performance in the model.

4.6.3 SMART Model

This section presents the results of the SMART simulation for all the COMESA countries on free trade basis.

Trade creation

Table 11: Trade creation (TC) simulated results (US$ thousands)

Country	Simulated Base year[20]	TC (US$)	% share
Burundi	2016	18.80	0.0290
Comoros	2015	0.000	0.0000
DRC	2014	55742.16	86.0284
Djibouti	2014	1082.0465	1.6700
Egypt	2016	45.588	0.0704
Eritrea	2006	492.602	0.7602
Ethiopia	2015	5553.018	8.5701
Kenya	2015	433.114	0.6684
Libya	2006	0.000	0.0000
Madagascar	2016	833.782	1.2868
Malawi	2016	0.036	0.000006
Mauritius	2016	0.000	0.0000
Rwanda	2016	73.600	0.1136
Seychelles	2016	77.583	0.1197
Sudan	2012	0.000	0.0000
Swaziland	2015	25.121	0.0388
Uganda	2016	36.25	0.0559
Zambia	2016	373.605	0.5766
Zimbabwe	2015	7.74	0.0119
Total		**64795.046**	**100**

Source: Author's estimation using SMART simulation

[20] The simulated base year applies for Table 12 and 13 also.

Table 11 shows the results for trade creation for trade bloc members. The COMESA member countries gained close to US$65 million in terms of trade creation as a result of being in a free trade area with, DRC, Ethiopia and Djibouti gaining the most. The three countries created trade by almost US$57.4, US$5.55 and US$1.08 respectively. DRC benefited the most in terms of trade creation close to 86.5% whilst the rest of the countries share the remainder 13.5%. However countries like Zimbabwe, Kenya, Swaziland, Sudan, Libya, Comoros, Mauritius and Malawi have an insignificant trade creation from the zero tariff rate arrangement. This is because these countries already belong to some free trade areas that are already liberalised. Zimbabwe and Malawi being members of SADC FTA have liberalised heavily before joining COMESA as well as Libya under the Arab Maghreb Union. Among these countries are Sudan and Comoros with an insignificant trade creation due to the fact these countries relatively trade less with those countries within the regional trading bloc.

Trade diversion

Table 12 depicts the trade diversion results obtained from the SMART model. As shown in Table 12, countries have created trade significantly more than the one diverted. Malawi is the only country with a trade diversion almost worth US$86 thousand and the rest have trade creation. Given a zero tariff arrangement in the bloc, a total worth of US$86 thousand trade will be diverted from low cost non-member countries to be replaced by less efficient bloc members. DRC, Ethiopia and Madagascar experienced largest positive values of diversion in terms of trade by close to US$3.37 million, US$0.63 million and US$0.84 million respectively. Countries like Comoros, Libya, Sudan, Swaziland and Mauritius experienced an insignificant diversion in trade from the trade bloc which shows that no trade was diverted from low cost non-member countries towards less efficient members in the trading bloc. This is possible because their major trading partners are also part of the already existing free trade area.

Table 12: Simulated trade diversion (TD) results (US$ thousands)

Country	TD (US$)	% share
Burundi	13.045	0.2346
Comoros	0.000	0.0000
DRC	3367.156	60.5673
Djibouti	153.326	2.7580
Egypt	59.455	1.0695
Eritrea	57.024	1.0257
Ethiopia	632.251	11.3727
Kenya	25.992	0.4675
Libya	0.000	0.0000
Madagascar	835.266	15.0245
Malawi	-86.385	-1.5539
Mauritius	0.000	0.0000
Rwanda	7.429	0.1336
Seychelles	49.901	0.8976
Sudan	0.000	0.0000
Swaziland	0.000	0.0000
Uganda	10.453	0.1880
Zambia	428.322	7.7045
Zimbabwe	6.131	0.1103
Total	**5559.366**	**100**

Source: Author's estimation using SMART simulation

Total trade effect

Table 13 shows the results for the simulated trade effect which is found by the summation of the trade creation and trade diversion.

Table 13: Simulated total trade effect results (US$ thousands)

Country	TE (US$)	% share
Burundi	31.845	0.0453
Comoros	0.000	0.0000
DRC	59109.31	84.016
Djibouti	1235.791	1.7565
Egypt	105.041	0.1493
Eritrea	549.626	0.7812
Ethiopia	6185.27	8.7915
Kenya	459.106	0.6526
Libya	0.000	0.0000
Madagascar	1669.048	2.3723
Malawi	-86.349	-0.1227
Mauritius	0.000	0.0000
Rwanda	81.029	0.1152
Seychelles	127.483	0.1812
Sudan	0.000	0.0000
Swaziland	25.121	0.0357
Uganda	46.703	0.0664
Zambia	801.925	1.1398
Zimbabwe	13.871	0.0197
Total	**70354.793**	**100**

Source: Author's estimation using SMART simulations

COMESA region has a total trade effect of US$70.4 million. DRC and Ethiopia have the maximum amount of total trade effect in the trade bloc whilst countries like Comoros, Libya, Malawi, Mauritius and Sudan have the least total trade effects.

In a nutshell, COMESA region is trade creating among its members' exports especially in the agricultural sector.

4.7 Conclusion

This Chapter presented the estimation, presentation and interpretation of the results. The presentation of the regression results using EViews version 10 was done after panel cross-sectional dependence; panel unit root test and also the panel cointegration were conducted.

GDP of the exporting country, GDP per capita of the importing country as well as regional economic integration were found to be statistically significant whilst GDP of the importing country, GDP per capita difference, border, language and distance were insignificant in explaining the effects of regional economic integration on the export performance in the Eastern and Southern region. The gravity model failed to reject the hypothesis that regional economic integration enhances agricultural sector export performance whereas SMART model did not find enough evidence to reject the hypothesis that COMESA is trade creating. The following Chapter provides the summary of the study, policy implications based on the results and the suggestion to areas of further studies.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.0 Introduction

This Chapter presents the summary and conclusion of the study as well as the policy recommendations based on the findings from Chapter Four. It also provides the suggested areas of further study.

5.1 Summary of the findings and conclusion

The study was done to estimate the impact of regional economic integration on COMESA agricultural export performance from 1980 to 2016. The research aimed at investigating whether the formation of COMESA was diverting or creating trade to its member countries using panel data. Random effects model was estimated in EViews 10 statistical package as suggested by the Hausman test and the SMART model was used as the second method of estimation.

In estimating the impact of regional economic integration on agricultural export performance in COMESA, GDP, GDP per capita, GDP per capita difference, border distance, language and COMESA dummy were used as the independent variables in the study. With the coefficients of GDP of the exporting country, GDP per capita of the importing country and the regional economic integration variable were found to be statistically significant whilst the coefficients of GDP of the importing country, distance, border, language and GDP per capita difference were found to be statistically insignificant. The results showed that the formation of the COMESA-FTA trade bloc increased exports in the agricultural sector.

Contrary to the gravity model, distance was found to have no impact on export performance. This showed that in the region, what is important is trade amongst member countries not considering their sizes and per capita income. GDP per capita of the importing country, GDP of the exporting country and the regional economic integration positively affect the export performance of the agricultural sector in the region.

Using the SMARTS model, the study found that the formation of COMESA trading bloc has created trade worth close to US$65 million. With the objective of determining whether the regional economic integration was trade creating or trade diverting in the Eastern and Southern region, the results proved that the trading bloc was trade creating. The countries in

the region gained differently from the economic integration with DRC, Ethiopia and Djibouti gaining more whilst Comoros, Libya, Malawi, Mauritius, Sudan and Zimbabwe gaining less. This shows that formation of the trading bloc come as a stepping stone to many member countries rather than a stumbling one especially in the agricultural sector.

5.2 Policy implications and recommendations

Policy makers are encouraged to use policies or tools that continue making regional economic integration a success in the Eastern and Southern African region since it stimulate the performance of exports agricultural sector.

Countries in the COMESA have gained from the formation of the trading bloc in terms of the export performance in the Eastern and Southern region. Regional policy makers have to deepen economic integration in the region so as to increase the benefits to its member countries. This suggests that the policy makers should not only concentrate on reducing or removing trade protectionism but also provides help to their member countries so as to increase output in the agricultural sector. This calls for the policy makers to address the challenges that have bedevilled the agricultural production such as overreliance on rainfall and lack of access to credit. If these challenges are addressed, export performance will increase resulting from agricultural production leading to the whole trading bloc benefiting. This means that regional economic integration maximisation of the benefits to the member countries will guarantee it to be a success especially in the agricultural sector.

To increase production in the region, COMESA member countries should engage in the research and development so that their technology advances. If these countries improve their methods of production by being innovative, it means that the cost of production will be reduced hence more production as well as quality products. Following the Linder hypothesis, countries with similar per capita income and technological basis countries should be in a position to produce similar but differentiated products hence trading more among themselves. This also shows that COMESA member countries will concentrate more on the exportation of processed goods than raw materials due to the fact that the latter has less value than the former one. High valued processed goods increase the value of exports.

The level of income shows the level of economic development in the country as well as the size and quality of markets. Policy makers should adopt investment friendly policies which encourage investment in human capital and infrastructure since an increase in the GDP of the importing countries has a positive effect on export performance in the region. Investment has

returns which will result in the growth of the economy hence increased income and employment.

5.3 Areas for further study

The study has not been exhaustive in the estimation of the effects of the regional economic integration on COMESA's agricultural export performance. This means that there is still room for further research in this area that other authors have to fill the gap. This study was only concentrating on the agricultural sector but future studies can explain the effect comparing different sectors for example agricultural, mining, manufacturing and tourism. Gravity model was used for the estimation; other studies can estimate the effect using PPML estimation technique, descriptive approach or computable general equilibrium.

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APPENDICES

Appendix 1: Panel Cross sectional dependence results

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation)
Pool: COINT
Periods included: 36
Cross-sections included: 38
Total panel (unbalanced) observations: 1364
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	2772.124	703	0.0000
Pesaran scaled LM	54.16812		0.0000
Pesaran CD	20.62254		0.0000

Appendix 2: Panel unit root results

Exports

Pool unit root test: Summary
Series: EXPORTS?
Date: 04/19/18 Time: 15:40
Sample: 1980 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 6
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.55244	0.0000	38	1349
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-9.93086	0.0000	38	1349
ADF - Fisher Chi-square	270.987	0.0000	38	1349
PP - Fisher Chi-square	303.092	0.0000	38	1368

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

GDP for the exporting country

Pool unit root test: Summary
Series:Y_i?
Date: 04/19/18 Time: 15:55
Sample: 1980 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Cross-

Method	Statistic	Prob.**	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-21.0362	0.0000	38	1306
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-22.6686	0.0000	38	1306
ADF - Fisher Chi-square	589.693	0.0000	38	1306
PP - Fisher Chi-square	728.188	0.0000	38	1330

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

GDP for the importing country

Pool unit root test: Summary
Series: Y_i?
Date: 04/19/18 Time: 15:57
Sample: 1980 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-23.8068	0.0000	38	1298
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-22.8148	0.0000	38	1298
ADF - Fisher Chi-square	601.249	0.0000	38	1298
PP - Fisher Chi-square	738.553	0.0000	38	1324

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

GDPPC for the exporting country

Pool unit root test: Summary
Series: $GDPPC_i$?
Date: 04/19/18 Time: 16:00
Sample: 1980 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-21.2589	0.0000	38	1306
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-22.4175	0.0000	38	1306
ADF - Fisher Chi-square	582.160	0.0000	38	1306
PP - Fisher Chi-square	706.305	0.0000	38	1330

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

GDPPC for the importing country

Pool unit root test: Summary
Series: $GDPPC_i$?
Date: 04/19/18 Time: 15:58
Sample: 1980 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 3
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-23.7047	0.0000	38	1307
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-22.4548	0.0000	38	1307
ADF - Fisher Chi-square	586.407	0.0000	38	1307
PP - Fisher Chi-square	688.162	0.0000	38	1324

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

GDPPCDIF

Pool unit root test: Summary
Series: GDPCDIF?
Date: 05/01/18 Time: 10:15
Sample: 1980 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.54649	0.0002	38	1358
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.70530	0.0034	38	1358
ADF - Fisher Chi-square	125.139	0.0003	38	1358
PP - Fisher Chi-square	123.186	0.0005	38	1368

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 3: Panel Cointegration results

Pedroni Residual Cointegration Test
Series: DY_i? DY_j? $DGDPPC_i$? $DGDPPC_j$?
Date: 04/19/18 Time: 16:03
Sample: 1980 2016
Included observations: 37
Cross-sections included: 38
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-4.142795	1.0000	-4.413422	1.0000
Panel rho-Statistic	-9.301418	0.0000	-7.867040	0.0000
Panel PP-Statistic	-21.39355	0.0000	-20.57130	0.0000
Panel ADF-Statistic	-14.86163	0.0000	-13.20386	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	-5.868074	0.0000
Group PP-Statistic	-22.20439	0.0000
Group ADF-Statistic	-7.726790	0.0000

Appendix 4: Correlation matrix

	DY_i?	DY_j?	$DGDPPC_i$?	$DGDPPC_j$?	GDPCDIF?
DY_i?	1.000000	0.117319	0.998300	0.006204	-0.368137
DY_j?	0.117319	1.000000	0.125907	0.642730	-0.039464
$DGDPPC_i$?	0.998300	0.125907	1.000000	0.018715	-0.372374
$DGDPPC_j$?	0.006204	0.642730	0.018715	1.000000	-0.056514
GDPCDIF?	-0.368137	-0.039464	-0.372374	-0.056514	1.000000

Appendix 5: Hausman test

Correlated Random Effects - Hausman Test
Pool: COINT
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	5.140442	5	0.3990

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
DY_i?	3.212180	3.187881	0.004027	0.7018
DY_j?	-0.756946	-0.696696	0.002911	0.2642
$DGDPPC_i$?	1.619497	1.652341	0.006761	0.6896
GDPCDIF?	-0.120979	-0.096584	0.001834	0.5689
Comesa?	1.291919	1.276574	0.000328	0.3965

Appendix 5: Random effects model

Dependent Variable: EXPORTS?
Method: Pooled EGLS (Cross-section random effects)
Date: 05/07/18 Time: 14:19
Sample (adjusted): 1981 2016
Included observations: 36 after adjustments
Cross-sections included: 38
Total pool (unbalanced) observations: 1364
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.083234	2.172383	1.879611	0.0604
DY_i?	3.187881	0.903477	3.528460	0.0004
DYj?	-0.696696	0.739421	-0.942219	0.3462
DGDPPCj?	1.652341	0.845971	1.953190	0.0510
GDPCDIF?	-0.096584	0.129634	-0.745053	0.4564
DIST?	0.114367	0.676803	0.168981	0.8658
BOR?	-0.070862	0.441502	-0.160501	0.8725
LANG?	0.280929	0.394561	0.712002	0.4766
Comesa?	1.276574	0.132358	9.644853	0.0000