

Senior Project
Department of Economics



“The Trade Creation and Diversion
Effects of African RTA Membership”

David Dietrich
May, 2016

Advisors: *Dr. Francesco Renna*
Dr. Sucharita Ghosh

Abstract

This study utilizes Jacobs Viner's (1950) theory on customs unions and examines if an African nations membership to a RTA (Regional Trade Agreement) will impact its trade flows in a trade creation or trade diversion way. Due to the numerous amounts of RTAs in Africa this study examines only three RTAs, that being the CEMAC, COMESA and ECOWAS. Using the gravity model to analyze bilateral trade two dummy variables are used to show evidence of trade creating or trade diversion effects. Due to this study using cross-panel data the random effects model is used to control for unobserved heterogeneity that may take place over time. The results show RTAs are not the best trade policy for African nations, as significant evidence for trade diversion is shown.

Contents

I.	Introduction.....	1
II.	RTAs in Africa.....	2
III.	Literature Review.....	4
IV.	Theoretical Model	8
V.	Methodology and Data.....	10
VI.	Empirical Results.....	14
VII.	Conclusion	16
VIII.	Appendix	18
IX.	Bibliography.....	23
X.	SAS Work.....	25

1. Introduction

Over the past few decades the world has been experiencing a huge boom in globalization and the distance between countries seems to be getting smaller as the transportation of goods and people are becoming faster and more efficient. Since the end of WWII international trade has become not only more common amongst countries, it has become, for some, the reason for huge economic growth (Irwan, 2008). Trade liberalization policies have been implemented to promote open, unilateral trade. Countries such as Germany and China have seen huge growth in trade, as their 2014 trade to GDP ratios are 85 and 42 percent, respectively. This being drastically different when compared to their ratios 30 years ago which was 44 and 14 percent, respectively. As international trade growth has surged so has the integration of regional areas through what's known as Regional Trade Agreements (RTAs). Some economists believe that international trade amongst neighboring countries should be sought out, and the creation of these agreements will lead to welfare enhancing scenarios for its member nations (Krugman, 1991). However, there is the debate amongst economic scholars in which is the best trade policy for a country to pursue, the policy of overall trade liberalization amongst all nations, or the exclusive trade rights of RTAs.

Several studies have examined major regional trade agreements. For example Baldwins (1997) study examined European and North American trade agreements and found that these agreements have proven to be beneficial to their member countries. However, the study on RTAs involving developing countries in regions such as Sub-Saharan Africa is a bit more limited when compared to studies on the major RTAs the world. Africa should be an important place of interest for trade for multiple reasons. One being that according to the World Bank, Africa will contain an estimated 2.6 billion people by the year 2060. In 2004 Africa already contained 11% of the world's population. However, the IMF reported the continent as a whole only contributed

to 3% of the world's trade. With such huge population growth in African nations it's pivotal that their economies be growing with as well, trade can help to accomplish this, however, it must be done right. Also, according to the IMF all but one country in Africa falls under the developing country category. The African continent as a whole is lagging being when compared to the rest of the world; active steps must be taken to ensure their policies are efficient in helping them catch up. Due to these problems African nations should be asking themselves if RTAs are the best route for them to take as an international trade policy. This motivation has led me to my research question. That question being, does an RTA membership for African nations impact its trade flows in a trade creating or trade diverting way? To answer this question I will examine three different African RTAs, the Economic Community of West African States, Economic and Monetary Community of Central Africa and Common Market for Eastern and Southern Africa in order to see if a country's membership in these RTAs leads to trade creation or trade diversion

2. RTAs in Africa

Over the past few decades RTAs have become a widely popular and growing form of trade policy amongst nations; however, Africa has been a long time pioneer in regional integration. Throughout the past century there has been a great deal of trade agreements that have emerged from the African continent. From the Pan African Congress to the Southern African Costumes Union which was established in 1910 African nations have been pushing to promote trade and growth through regional cooperation. (Yang and Gupta, 2005) The rest of this section will briefly discuss the three African RTAs that will be tested for trade diverting or trade creation effects.

ECOWAS:

On May 28 1975 the Economic Community of West African States (ECOWAS) was established, including 15 different West African nations. The ECOWAS states their motive behind this unification of different countries is to promote interstate economic and political cooperation. They claim that due to the increased population boom amongst its nations and cultural diversity this union will be necessary to establish peace and security amongst the region. As this RTA begins to enter its 41st year of existence they plan to continue their economic integration and continue to grow as a trading block.

CEMAC:

The Economic and Monetary Community of Central Africa (CEMAC) was created in 1994, however, did not become operational until the treaty's ratification in 1999. The CEMAC was put into place to revive the member countries regional economic cooperation and replace an older inefficient RTA, known as the UDEAC. It's stated that their main goal is "cooperation and exchange amongst its members." There are six members in the CEMAC and they have been loosely tied economically since their independence in the 1960's. The total of CEMAC member nation's population is about 37 million and covers about 3 million square kilometers, making it one of the largest Central African regional communities.

COMESA:

The largest in terms of member nations this paper will investigate is the Common Market for Eastern and Southern Africa (COMESA), which has 19 members. Beginning in December 1994, just like the CEMAC the COMESA came to be through the replacement of an older trade agreement which was created in 1981. Under their older trade agreement member nations were

experiencing falling investment rates and exports to the world and developing countries falling by 1.5% and 8.3%, respectively. The reformation of the RTA brings with the hope of revive trade amongst its member nations. COMESA's mission vision states, "To be a fully integrated, internationally competitive regional economic community with high standards of living and for its entire people to merge into an African Economic Community".

3. Literature Review

There is no shortage on previous literature reviews involving not only trade, but how RTAs and other trade agreements can cause either trade creating or trade diverting effects. Throughout all the articles the authors utilize a gravity model to try and explain the impact certain trade agreement have on nation's trade flow. Much of the literature also concludes that trade agreements may seem promising at first, however, they usually end in diverting trade from other parts of the world.

Trade creation and trade diversion is taken into consideration in Jugurnath, Stewart and Brooks (2007) study on Asian/Pacific regional trade agreements. They take Viner's (1950) hypothesis which challenged the idea that RTAs are always welfare enhancing, claiming that through trade diversion a country can actually be worse off by being forced to trade with member countries which may have higher production cost compared to cheaper outside sources. To test for trade diversion this study focused on 5 Asian/Pacific RTAs and use a gravity model to regress trade (imports) on a series of variables. The variables of interests for this model are 3 dummy variables. The first one represents if an importing country is a member of the observed RTA. A second dummy variable represents if the exporting country belongs to the observed RTA. A positive coefficient on both variables indicates the RTA could be trade creating. The

third dummy variable represents if both the exporting and importing country belong to the same RTA. A positive coefficient on the last dummy variable and a negative coefficient of the previous two indicates that the RTA is trade diverting. The conclusions to this study was fairly split. Both ASEAN and CER were found to be trade creating, meaning trade was created both inter-regionally and globally. APEC, Mercosur and NAFTA showed different results, with trade showing to be significantly positive amongst RTA member nations. However, that trade created amongst the member nations was taking from non-member nations. This implying that trade diversion had occurred.

Trade agreements between Tunisia and EU and its possible benefits for the developing country are analyzed in Zidi & Dhifallah's (2013). The author's claim the topic of North / South trade is important to investigate, because so many developing countries are starting to use RTAs to promote their development. To investigate if this RTA is beneficial to Tunisia this paper refers to Viner's work on trade creation and trade diversion and the welfare gains or losses that can be achieved through regional trade. To test and see if Tunisia is experiencing trade creation or diversion this study utilizes a gravity model. Just like Stewart and Brooks (2007) three dummy variables are included in this study. One representing if the Tunisia is the importer and the paired exporter is an EU member. Another representing if Tunisia is the exporter and the paired importer country is not an EU member. With the final dummy variable representing if Tunisia is the importer and the paired exporting country is not an EU member. Using data from 1995-2004 (The RTA occurred in 1995) this study found that the 3 dummy variables were significant at the 1% level and positive. Indicating that Tunisia's trade flow amongst the rest of the world and imports from the EU has risen when compared to its controlled value. Even through all these coefficients are significant and positive for the time frame of 1995-2004, when the time period is

restricted to only 2005-2010 the three variables are negative, however, they are statistically insignificant. Leaving the authors to conclude that this trade agreement may have initially brought trade creation amongst Tunisia and the EU members, however, its positive impact to its trade flows eventually ended.

Sampath Jayasinghe and Rakhal claim that despite the growing amount of literature on RTAs the empirical literature is not enough to provide conclusive evidence results to determine if RTAs are beneficial in their in trade creation or causes trade diversion. To try to answer this question empirically a gravity model is used to assess if NAFTA has created better intra-regional trade or trade diversion in the 6 agricultural goods amongst its members. The two variables of interest in their gravity model are dummy variables representing NAFTA membership between two countries and openness to non-member countries. It is also important to take note that they ran a gravity model regression for each of the 6 agricultural goods individually. Their study concluded that the creation of NAFTA has increased regional trade significantly. Their results show trade diversions has occurred amongst NAFTA members on all but one good.

Ullah and Inaba (2012) investigate the Impact of RTAs and PTA's (preferred trade agreements) on the export flows of Bangladesh. They begin their paper by recognizing that the creation of RTAs amongst developed nations such as NAFTA has proven beneficial to their welfare. However, this leads them to question if RTAs are also beneficial amongst developing nations such as Bangladesh. To answer this question they will see if Bangladesh's multiple RTAs have had an impact on their trade flows. The authors chose to use a gravity model to investigate what variables affect trade flows (exports and imports). Their model includes 6 different variables that are typical to gravity models, such as export percent of GDP and geographical indicators such as common land borders. However, the variables of interest are the dummy

variables representing the 3 RTAs which Bangladesh are involved in. Their first regression shows that all 3 variables are significant at least at the 2% level, also that each coefficient is negative. The RTA with the lowest coefficient explaining there to be a 2.21% decrease in Bangladeshis trade flow when compared to not belonging in an RTA. With such an impact on Bangladeshis trade the negative effects of an RTA should not be over looked. This study finds that there are no benefits from Bangladesh being involved in RTAs, in fact its involvement hurts their trade. These findings lead the authors to conclude that Bangladesh should avoid RTAs with its neighbors in Southeast-Asia.

4. Theory behind Trade Creation and Trade Deviation

The purpose of this paper is to investigate if African nation's involvement in an RTA impacts its trade in a trade creating or trade diverting way. A customs union is one of many ways for two or more nations to lower their tariffs with one another while still keeping high tariff barriers amongst nations outside the union. Viner (1950) gives the requirements that a perfect customs union must accomplish, with one criteria being the elimination of tariffs amongst the unions members and an established uniform tariff on outside nations. However, Viner states through his writings that a customs union may not only take away trade from nations outside the union, but also may be non-beneficial to the member nations. To understand the concept on how customs unions can be non-beneficial Paul Oslington (2012) provides a simple example, that being the Methuen treaty between England and Portugal. This treaty required that there be no tariffs between the two nations on either Portuguese wine or English textiles. This outraged Scottish economist J.R. McCulloch, arguing that because of this treaty he was forced to purchase the inferior and more expensive Portuguese wine rather than superior French wine.

To better understand how regionalized economics may impact nation's trade I will be utilizing Viner's (1950) theory on the static effects of economic integration. Viner states that when a nation chooses to move toward a freer trade amongst a customs union one of two things can occur, either trade creation or trade diversion. According to Carbaugh's (2013), trade creation occurs when a member country of an RTA produces a good at a lower-cost. This causing increased welfare to member countries due to their increased production specialization. Carbaugh also states, "Trade diversion occurs when imports from a low-cost supplier outside of a union are replaced by purchases from a higher-cost supplier within the union." Thus creating a welfare loss for the member countries, and decreasing efficiency amongst world production.

To show the welfare implications graphically refer to Graph 1 located in the appendix. This graph represents a scenario where there are three countries in the world, Ghana, Nigeria and the United States. If Ghana and Nigeria were to form an RTA and adhere to Viner's (1950) assumption of a perfect customs union then tariffs between the two nations would be abolished while keeping a common tariff restriction on the United States. Ghana's supply and demand functions are represented in Graph 1, also assume Ghana is a small country compared to Nigeria, this meaning Ghana cannot influence foreign prices and supply schedule of corn is perfectly elastic. Nigeria can supply corn to Ghana at a price of \$3.25 a ton and the United States can supply corn at \$3 a ton. In free trade equilibrium Ghana will purchase all of its imports of corn from the United States due to its lower price relative to Nigeria, producing 1 ton of corn itself while importing 22 tons from the United States. If a \$.50 tariff is imposed on all imports to Ghana then the most efficient importer would still be the United States. However, when the RTA is enacted and tariffs between members are dropped Ghana will now switch to Nigeria as supplier of corn, importing 20 tons of corn and producing 4 tons. The triangle represented by A

and B shows trade creation and the welfare gains associated with it. However, trade deviation and the loss in welfare can be seen in the area labeled C. Though static analysis one can see if an RTA will bring a trade creating or trade deviation effect. If area $A+B$ is greater than C trade creation has occurred, however, if area C is greater than $A+B$ then trade deviation has occurred. Using this theory as the essential economic backbone to my investigation I can better understand the effect of an RTA on the trade flows of its member nations.

5. Methodology and Data

The methodology used for this project follows Ghosh and Yamarik's (2004) econometric model which was used to analyze if RTA membership is either trade creating or trade diverting. They used a gravity model which ran a regression on bilateral trade. Using variables which are typical in gravity models, such as distance between two countries, combined GDP of two countries and a set of control variables. Distance is used as a proxy to capture transportation costs and combined GDP is used to capture the combined market size of the two trading nations. Their variable of interest was two dummy variables which are used to represent evidence of trade diversion and trade creation. Gravity models are typically used to analyze bilateral trade between two nations (Head, 2003) and their model does just that. To accomplish this, their gravity model compares two countries to each other, for their study the subscript i and subscript j represents the observed paired importing and exporting nation respectively. The purpose behind their model is to determine if a nation's membership in an RTA was trade creating or diverting, this being similar to what this paper aims to accomplish.

Also, it's important to take note that the model used in this paper will analyze bilateral trade flows from the years 2000, 2005, 2010 and 2013. The reason for these four years is that

two of the three RTAs this paper will examine were not created until the mid-1990. Examining these four years will allow the model to better represent the effects of RTAs because of the few years it may take for RTA policies to be fully implemented.

Due to my model using data which contains observations over time, I needed to take into consideration the problems of using a pane-data set. My estimations may be biased due to unobserved heterogeneity issues, so an OLS regression is not sufficient. The best way to counter this problem would be to use the fixed effect method, this would overcome any omitted variable biases that may occur. However, due to my model using distance, which is fixed over time, I cannot use the fixed effect method and will need to use the random effects method to ensure my estimations will be unbiased.

The gravity model that I will be using to analyze bilateral trade flows and to show evidence for trade creation and diverting effects will be as followed.

$$\log(\text{TRADE}_{ijt}) = \alpha_{ij} + \beta_1 \log(\text{GDP}_{ijt}) + \beta_2 \log(\text{DIST}_{ij}) + \beta_3 \text{Language} + \beta_4 \text{SharedBorder} + \beta_5 \text{SharedColonialPast} + \beta_6 \text{RTA}_{ij} + \beta_7 \text{RTA}_t + \epsilon$$

The dependent variable will be the logged bilateral trade (imports + exports) between two nations. This data is collected from the UN Comtrade database, which includes the US dollar value of annual trade between countries. The first two independent variables are important to any gravity model, this being GDP and distance. Head (2003) states that the gravity model is a sort of representation of supply and demand forces, that GDP of the paired countries represents their willingness to supply one another's demands. The intuition behind this is as the paired nations GDP increases so will their combined market sizes, this increasing their attractiveness to trade

with one another. Because of this I expect the GDP coefficient to be positive. The distance variable is used as proxy to represent the transportation cost. The intuition behind this variable is the farther the distance between the paired nations the higher the transportation costs. With higher costs in trading the paired nations will be less attracted to trade with one another. Because of that I expect the distance coefficient to be negative.

The single GDP variable will be the two trading nations GDP multiplied by each other, this variable will represent the GDP for the model and will be logged. This data was fairly easy to acquire and was gathered from the World Bank database. Distance will be a single variable which represents the distance between the two trading countries; this variable will also be logged. To acquire this data there is a website called CEPII database. The data is given in kilometers and is measured “as the crow flies”, meaning in a straight line.

The other three variables are ones that usually have an impact on a nation’s bilateral trade and will be used as control variables. The first control variable will represent if the two nations share a boarder, the second will be if they share a colonial past and the third will be if the two nations share the same common language. Common language will be defined as spoken by at least 20% of the population. The controlled intercept for this study will be trade between two countries which share no border, no common language, no common colonial past and both belong outside the 3 RTAs. If the two trading nations share a border, share a common language or share a similar colonial past they are represented in these control variables. All three of these lead to a positive impact on trade, thus are expected to have a positive coefficient.

The next two variables will be the variables of interest for my model. The first represents if both the reporter and partner nation have a shared membership in CEMAC, COMESA or ECOWAS, the second represents if either the reporter or partner nation belong to any of these 3

RTAs. These will be exactly like the dummy variables used in Ghosh and Yamarik's (2004) model. The first dummy variable of interest represents if there is an increase in bilateral trade between the members of the three RTAs. A positive sign will indicate that the member countries trade will be increased when compared to the control, this representing evidence of trade creation. The second dummy variables coefficient will represent trade between the members of the three RTAs and their trade with nations who are non-members. This will allow for evidence in trade diversion. The reason being that a positive sign will represent that trade between a member of the three RTAs and a non-member is greater when compared to two countries who do not belong in the 3 RTAs, this representing trade openness between the members and the outside world. However, a negative sign will represent possible trade restrictions between members and the outside world, showing evidence for trade diversion.

My variables of interest, β_{5RTAij} and β_{6RTAi} should be easy to predict. I expect the first variable to be positive, the reason being that an RTA allows for member nations to have lower tariffs amongst one another. Because of this the member nations of the 3 RTAs will increase their trade with one another, when compared to the control. For my second variable I predict it to be negative, the reason being that the cons of being a member of an RTA will be evident through this variable. Due to lower tariffs and other incentives to trading with member nations, trade will take away from outside of the RTA block, even if a non-member is the low cost producer of a good.

6. Empirical Results

The results for an Ordinary Least Square regression is displayed in the first column of table three. For this regression there was a total of 76,128 observations and the adjusted R-square

of .69 represents this model explaining 69% of the variation in the data. Not only are the variables which are typical in a Gravity Model significant at the 1% level, but so are the two variables that are so show evidence for trade creation and trade deviation. The coefficients for the control variables, GDP, and Distance also have their expected signs. For example, the coefficient for distance, which is a proxy for transportation costs is -1.26. This coefficient estimate showing that a 1% increase in distance will decrease bilateral trade between countries by 1.26%. With these coefficients showing their expected signs we can be confident that the gravity model regression is working as expected. Looking at the RTA_{IJ} coefficient one can see that its positive sign indicates evidence for trade creation between the three African RTA member nations. However, the negative coefficient for RTA_I is evidence for trade deviation. Due to the previously stated problems with OLS and using a panel data set this regression may be biased and a random effects model will be needed.

Below in the second and third columns of table 3 the results are shown for the random effects model. The reason why there are two separate regressions is because due to the amount of data the computer memory needed for the regression to be ran in one model was too much, thus reading an error in the statistical program. To separate the data in an unbiased and truly random way each country pair group was randomly assigned a value between 0-1, those with a value of less than .50 was assigned to group one and those greater than or equal to .50 was assigned to group 2. Each regression gave similar results. However, for the remainder of the paper Group 1's results will be used.

After the random effects model was ran the predictive power of the model was significantly reduced. Now accounting for the county pair and time the random effects model had an R-squared of .34, representing the model to now explaining 34% of the variation in the

data. Even though the R-squared significantly dropped all but one variable is significant at the 1% level, only the variable representing shared partnership in one of the three RTAs having a 5% significance level. The variables capturing if the trading partners share a common language, boarder or colonial past are all positive, showing a positive impact these conditions can have on bilateral trade between nations. The coefficient for sharing a common boarder is 1, this coefficient estimate showing that if the two trading nations are to share a border trade will increase by 1%, when compared to the controlled intercept. As previously stated with the OLS model the significance and signs of the coefficients for GDP and distance represents the Gravity Model is running as expected.

The biggest change once the Random Effects model is utilized to correct for any unobserved heterogeneity is the decrease coefficient RTA_{IJ} . With a coefficient estimate of .42 showing that if two nations are have shared membership in one of the three RTAs their trade will be increased by .42%, when compared to the control intercept. The most important part of the coefficients estimate has to be its positive sign, this showing evidence that trade creation has occurred between the three RTAs. The RTA_I coefficient estimate shows that if one of trading partners is to belong to one of the three RTAs their trade will be lowered by .57%, when compared to the controlled intercept. Again the most importing part of this coefficients estimate is its negative sign, this showing evidence for trade diversion. With the RTA_{IJ} coefficient now being smaller than the RTA_I coefficient this shows evidence that the trade creation effect is larger than the trade diversion effect.

7. Conclusion

Using OLS regression this study initially found that the three African RTAs of the ECOWAS, CEMAC, and COMESA showed both evidence for trade creation and trade diversion effects. However, once a Random Effects Model was ran the evidence for trade creation then became smaller, leaving there to be greater evidence for trade diversion. This may seem startling, that an agreement that is meant to increase trade is empirically showing little trade creation at all. The RTAs only increasing trade by .42% raises some suspicion. However, looking closely into the problems African RTAs face the almost non-existent impact RTAs bring on trade begins to make more sense.

Pervious work on African RTAs has found that a primary focus for these agreements is intra-regional tariff reduction; this being what would cause trade creation from an RTA. However, it's found amongst RTAs such as COMESA restrictions for intra-regional trade are still in effect. Import bans, administrative charges as well as non-trade barriers such as unofficial boarder fees and roadblocks are shown to be evident, thus restricting and decreasing trade amongst member nations. (Yang and Gupta, 2005). External trade barriers also have remained excessively high amongst African nations. It's reported that African nations Most Favored Nations (MFN) tariffs are higher than any other world region. With one of the three examined RTAs in this study, CEMAS, being reported as making little progress in reducing its tariffs to the rest of the world. (Yang and Gupta, 2005). These high extra-regional tariffs leading to huge trade diversion effects.

If African nations are wanting to better their trade potential and create a trade regime which will help to support its future growth in the world market, an RTA may not be the best option. Due to evidence for trade diversions, these three examined African RTAs are shown do

be doing more harm than good. A breaking up of these agreements and a policy of overall trade liberalization amongst all nations may prove to help them in the long run. However, with 1/3 of all government revenues being generated through trade taxes this may be difficult for African countries.

Some limitations to this study is it only examined four years of trade, and only investigation three separate African RTAs. Even though the examined RTAs are considered one of the largest and most important in Africa, there is the possibility they do not represent Africa as a whole. Future studies examining all or even different RTAs would be greatly beneficial to the investigation of African RTA' and their trade creation and diversion effects.

Appendix

Graph 1. (Carbaugh, 2013)

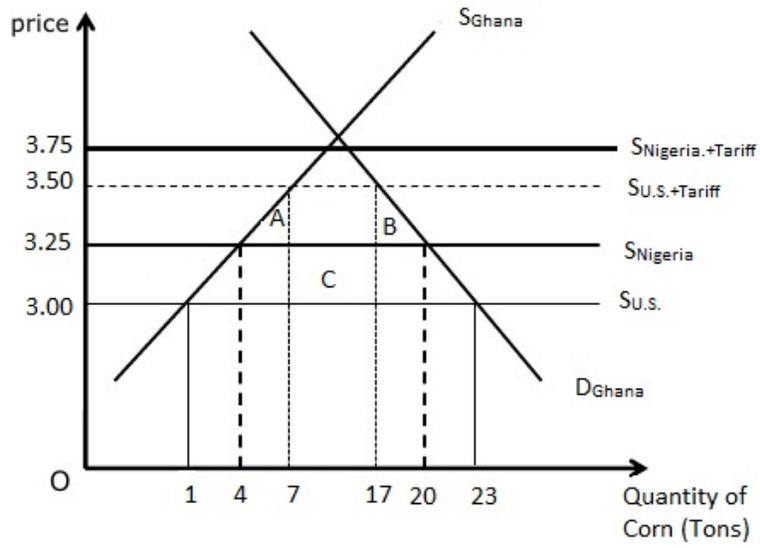


Table 1. Variable descriptions

Variable	Definition	Source
InTrade	Both imports plus exports between a reporter and the partner nation logged.	UN Comtrade
InGDP _{ij}	Logged GDP of Ghana and partner nation multiplied, measured in real US currency.	World Bank, <i>Economy and Growth</i> http://data.worldbank.org/indicator/NY.GDP.MKTP.CD
InDistance _{ij}	Logged distance between Ghana and partner nation in miles.	CEPII, <i>Research and Expertise on the World Economy</i> http://www.cepii.fr/cepii/en/bdd_model/bdd.asp
Contig	Dummy variable for trade reporter and partner sharing a common boarder. If reporting nation and partner nation have a shared boarder, then the variable is given a value of one; otherwise zero	CEPII, <i>Research and Expertise on the World Economy</i> http://www.cepii.fr/cepii/en/bdd_model/bdd.asp
Colony	Dummy variable for trade reporter and partner sharing a common colonial past. If reporting nation and partner nation have a shared colonial past, then the variable is given a value of one; otherwise zero	CEPII, <i>Research and Expertise on the World Economy</i> http://www.cepii.fr/cepii/en/bdd_model/bdd.asp
Comlang_off	Dummy variable for trade reporter and partner sharing a common colonial past. If reporting nation and partner nation have a shared colonial past, then the variable is given a value of one; otherwise zero	CEPII, <i>Research and Expertise on the World Economy</i> http://www.cepii.fr/cepii/en/bdd_model/bdd.asp

RTAIJ	Dummy variable for trade reporter and partner both being a member of either ECOWAS, COMESA or ECOWAS. If reporting nation and partner nation both are a member, then the variable is given a value of one; otherwise zero	The World Trade Organization http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx
RTAI	Dummy variable for either trade reporter or partner being a member of either ECOWAS, COMESA or ECOWAS. If reporting nation and partner nation either are a member, then the variable is given a value of one; otherwise zero	The World trade Organization http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx

Table 2. Expected Values

Variable	Unit	Expected Signs
Trade Flows between countries (exports plus imports)	USD	Dependent Variable
$GDP_i * GDP_j$	USD	+
Distance _{ij}	Kilometers	-
Contig	Dummy Variable	+
Colony	Dummy Variable	+
Comlang_off (Both countries share a common language)	Dummy Variable	+
RTA _{ij} (Both nations are members to one of the 3 RTAs)	Dummy Variable	+
RTA _i (One of the nations is a member to one of the 3 RTAs)	Dummy Variable	-

Table 3. Regression Results

Gravity Model for Bilateral Trade Analysis			
Depended Variable: lnTrade(exports + imports)			
Variables	OLS	Random Effects 1	Random Effects 2
	Column 1	Column 2	Column 2
Intercept	-23.66 ***(-151.52)	-21.3 ***(-45.04)	-21.45 ***(-45.7)
lnGDP	1.02 ***(382.58)	.97 ***(126.23)	.98 ***(126.85)
lnDistance	-1.26 ***(-124.39)	-1.28 ***(-40.42)	-1.29 ***(-39.86)
Common Boarder	0.95 ***(16.37)	1.00 ***(5.4)	1.06 ***(5.76)
Colonial Past	.79 ***(12.91)	1.02 ***(5.16)	.97 ***(4.72)
Common Language	.96 ***(43.66)	.97 ***(13.83)	.94 ***(13.42)
RTAIJ	.63 ***(9.26)	.42 **(1.96)	.38 *(1.87)
RTAI	-.50 ***(-21.40)	-.57 ***(-8.14)	-.51 ***(-7.18)
R ²	.70	.34	.34
Adj. R ²	.70		
Observations	76,128		
Cross Sections		11,198	11,191

t-value is in parentheses. * represents significance at the 10% level, ** represents significance at the 5% level and *** represents significance at the 1% level.

Table 4. Descriptive Statistics

Descriptive Statistics					
Variable	N	Mean	Std. Dev.	Max	Min
Trade	77,186	1,196,511,892	10,931,196,669	638,000,000,000	567.24
GDP	77,186	400,636,411,128	1,429,256,000,000	16,680,000,000,000	13,741,844.59
Distance	76,128	7312.99	4384.94	19,812.04	51.6
Common Boarder	76,128	0.0219367	0.1464780	1	0
Colonial Past	76,128	0.0169977	0.1292632	1	0
Common Language	76,128	0.1524406	0.3594498	1	0
RTAIJ	77,186	0.0140570	0.1177265	1	0
RTAI	77,186	0.1270049	0.3329806	1	0

Bibliography

Zidi, A., & Dhifallah, S. M. (2013). Trade creation and trade diversion between Tunisia and EU: Analysis by gravity model. *International Journal of Economics and Finance*, 5(5), 131-147.

Rose, Andrew (2004) "Do we really Know that the WTO Increases Trade? *The American Economic Review*, Vol. 94 No.2, 98- 114.

Jayasinghe, S., & Sarker, R. (2008). Effects of regional trade agreements on trade in agrifood products: Evidence from gravity modeling using disaggregated data. *Review of Agricultural Economics*, 30(1), 61-81.

Jugurnath, B., Stewart, M., & Brooks, R. (2007). Asia/Pacific regional trade agreements: An empirical study. *Journal of Asian Economics*, 18(6), 974-987.

Ullah, Muhammad and Inaba, Kazuo (2012) "Impact of RTA and PTA on Bangladesh's Export: Application of a Gravity Model" *Journal of Industry, Competition and Trade*, Vol. 12, no.4: 445-460.

Krugman, Paul. (1991) "Increasing Returns and Economic Geography" *Massachusetts Institute of Technology*, 24(99), 483-499.

Diao, Xinshen; Roe, Terry; Somwaru, Agapi. (2001) "What is the Cause of Growth in Regional Trade: Trade Liberalization or RTAs?" *The World Economy*, Vol. 24, no.1: 51-79.

Keith, Head. (2003). "Gravity for Beginners" *University of British Columbia*.

Yongzhen, B., & Gupta, S. (2005) "Regional Trade Arrangements in Africa: Past Performance and the Way Forward" *IMF Working Paper*, 5(36), 3-36.

Viner, Jacob. *The Customs Union Issue*. New York: Carnegie Endowment for International Peace. 1950.

Robert, Carbaugh. *International Economics*. Mason, Ohio: South-Western Publishing, 2013.

Irwin, D. A. (2008, December). *International Trade Agreements*. Retrieved from <http://www.econlib.org/library/Enc/InternationalTradeAgreements.html>

International Democracy Watch. (n.d.). Retrieved April 11, 2016, from <http://www.internationaldemocracywatch.org/index.php/central-african-economic-and-monetary-community>

Economic Community of West African States(ECOWAS). (n.d.). Retrieved April 11, 2016, from <http://www.ecowas.int/about-ecowas/basic-information/>

ABOUT COMESA. (n.d.). Retrieved April 11, 2016, from http://about.comesa.int/index.php?option=com_content

SAS Code:

```
data Ex;
set Exports;

data Im;
set Imports;

data Dis;
set Distance;
run;

proc sort data=Ex;
by partner_reporter;
run;

proc sort data=Im;
by partner_reporter;
run;

proc sort data=Dis;
by partner_reporter;
run;

data one;
merge Ex Im Dis;
by partner_reporter;
run;

data pgdp;
set Partnergdp;
run;

data rgdp;
set Reporterghdp;
run;

proc sort data=One;
by ISOJ_Year;
run;

proc sort data=pgdp;
by ISOJ_Year;
run;

data two;
merge One pgdp;
by ISOJ_Year;
run;

proc sort data=Two;
by ISOI_Year;
run;

proc sort data=rgdp;
by ISOI_Year;
run;
```

```

data Final;
merge Two rgdp;
by ISOI_Year;
run;

data five;
set final;
if GDPJ = "." then delete;
if Export = "." then Export = "0";
if Import = "." then Import = "0";
if GDPI = "." then delete;
GDP = (GDPI*GDPJ);
Trade = (Export + Import);
lnTrade = log(Trade);
lnGDP = log(GDP);
Distance = (distkm);
lnDistance = log(Distance);

CEMACI=0;
if ISOI = "GAB" then CEMACI = 1;
if ISOI = "CMR" then CEMACI = 1;
if ISOI = "CAF" then CEMACI = 1;
if ISOI = "TCD" then CEMACI = 1;
if ISOI = "COG" then CEMACI = 1;
if ISOI = "GNQ" then CEMACI = 1;

CEMACJ = 0;
if ISOJ = "GAB" then CEMACJ = 1;
if ISOJ = "CMR" then CEMACJ = 1;
if ISOJ = "CAF" then CEMACJ = 1;
if ISOJ = "TCD" then CEMACJ = 1;
if ISOJ = "COG" then CEMACJ = 1;
if ISOJ = "GNQ" then CEMACJ = 1;

COMESAI = 0;
if ISOI = "BDI" then COMESAI =1;
if ISOI = "COM" then COMESAI =1;
if ISOI = "COD" then COMESAI =1;
if ISOI = "DJI" then COMESAI =1;
if ISOI = "EGY" then COMESAI =1;
if ISOI = "ERI" then COMESAI =1;
if ISOI = "ETH" then COMESAI =1;
if ISOI = "KEN" then COMESAI =1;
if ISOI = "LBY" then COMESAI =1;
if ISOI = "MDG" then COMESAI =1;
if ISOI = "MWI" then COMESAI =1;
if ISOI = "MUS" then COMESAI =1;
if ISOI = "RWA" then COMESAI =1;
if ISOI = "SYC" then COMESAI =1;
if ISOI = "SDN" then COMESAI =1;
if ISOI = "SWZ" then COMESAI =1;
if ISOI = "UGA" then COMESAI =1;
if ISOI = "ZMB" then COMESAI =1;
if ISOI = "ZWE" then COMESAI =1;

COMESAJ = 0;

```

```

if ISOJ = "BDI" then COMESAJ =1;
if ISOJ = "COM" then COMESAJ =1;
if ISOJ = "COD" then COMESAJ =1;
if ISOJ = "DJI" then COMESAJ =1;
if ISOJ = "EGY" then COMESAJ =1;
if ISOJ = "ERI" then COMESAJ =1;
if ISOJ = "ETH" then COMESAJ =1;
if ISOJ = "KEN" then COMESAJ =1;
if ISOJ = "LBY" then COMESAJ =1;
if ISOJ = "MDG" then COMESAJ =1;
if ISOJ = "MWI" then COMESAJ =1;
if ISOJ = "MUS" then COMESAJ =1;
if ISOJ = "RWA" then COMESAJ =1;
if ISOJ = "SYC" then COMESAJ =1;
if ISOJ = "SDN" then COMESAJ =1;
if ISOJ = "SWZ" then COMESAJ =1;
if ISOJ = "UGA" then COMESAJ =1;
if ISOJ = "ZMB" then COMESAJ =1;
if ISOJ = "ZWE" then COMESAJ =1;

ECOWASI = 0;
if ISOI = "BEN" then ECOWASI =1;
if ISOI = "BFA" then ECOWASI =1;
if ISOI = "CPV" then ECOWASI =1;
if ISOI = "GMB" then ECOWASI =1;
if ISOI = "GHA" then ECOWASI =1;
if ISOI = "GUF" then ECOWASI =1;
if ISOI = "GNB" then ECOWASI =1;
if ISOI = "LBR" then ECOWASI =1;
if ISOI = "MLI" then ECOWASI =1;
if ISOI = "NER" then ECOWASI =1;
if ISOI = "NGA" then ECOWASI =1;
if ISOI = "SEN" then ECOWASI =1;
if ISOI = "SLE" then ECOWASI =1;
if ISOI = "TGO" then ECOWASI =1;

ECOWASJ = 0;
if ISOJ = "BEN" then ECOWASJ =1;
if ISOJ = "BFA" then ECOWASJ =1;
if ISOJ = "CPV" then ECOWASJ =1;
if ISOJ = "GMB" then ECOWASJ =1;
if ISOJ = "GHA" then ECOWASJ =1;
if ISOJ = "GUF" then ECOWASJ =1;
if ISOJ = "GNB" then ECOWASJ =1;
if ISOJ = "LBR" then ECOWASJ =1;
if ISOJ = "MLI" then ECOWASJ =1;
if ISOJ = "NER" then ECOWASJ =1;
if ISOJ = "NGA" then ECOWASJ =1;
if ISOJ = "SEN" then ECOWASJ =1;
if ISOJ = "SLE" then ECOWASJ =1;
if ISOJ = "TGO" then ECOWASJ =1;

RTAIJ = 0;
if CEMACI = 1 and CEMACJ = 1 then RTAIJ = 1;
if COMESAI = 1 and COMESAJ = 1 then RTAIJ =1;
if ECOWASI = 1 and ECOWASJ = 1 then RTAIJ =1;

```

```

RTAI = 0;
if CEMACI = 1 and CEMACJ = 0 then RTAI = 1;
if COMESAI = 1 and COMESAJ = 0 then RTAI = 1;
if ECOWASI = 1 and ECOWASJ = 0 then RTAI = 1;

proc reg data=five;
model lnTrade = lnGDP LnDistance contig colony comlang_off RTAIJ RTAI;
run;

proc sort data = five; by Combo_Year;

data six; set five; by Combo_Year;
if first.Combo_Year;
run;
proc sort data = six;
by Partner_Reporter Year;
run;

proc freq data = six;
tables Partner_Reporter/ out = Freq;
run;

proc sort data= Freq;
by Partner_Reporter Year;
run;

data mg;
merge Freq six;
by partner_reporter;
run;

data random;
set mg;
if COUNT = "1" then delete;
if ISOJ = "ABW" then delete;
if ISOI= "ALB" then delete;
run;

proc sort data = random; by Partner_Reporter;

Proc freq data=work.Random;
table Partner_Reporter / out = out1;
run;

data work.AssignedGroups;
set work.Out1;
call streaminit(4);
r = rand("Uniform");
drop COUNT PERCENT;
GROUP = 0;
if r < 0.50 then GROUP = 1;
if 0.50 <= r then GROUP = 2;
run;

Proc Sort data=assignedgroups;
by Partner_Reporter;

```

```
run;

data Random2;
  merge Random AssignedGroups;
  by Partner_Reporter;
run;

data Group1;
  set Random2;
  if GROUP NE 1 then delete;
  if distkm = "." then delete;
run;

data Group2;
  set Random2;
  if GROUP NE 2 then delete;
  if distkm = "." then delete;
run;

proc means data = random2;
run;

proc reg data = Random2;
model lnTrade = lnGDP LnDistance contig colony comlang_off RTAIJ RTAI;
run;

proc panel data = Group1;

id Partner_Reporter Year;
model lnTrade = lnGDP LnDistance contig colony comlang_off RTAIJ RTAI
/RANTWO;

run;

proc panel data = Group2;

id Partner_Reporter Year;
model lnTrade = lnGDP LnDistance contig colony comlang_off RTAIJ RTAI
/RANTWO;

run;
```