The Impact of the African Growth and Opportunity Act (AGOA): An Empirical Analysis of Sub-Saharan African Agricultural Exports

Addisalem Zenebe, University of Nebraska Lincoln,
Department of Agricultural Economics
addiszeneb@gmail.com

Dr. Wesley Peterson, Professor, University of Nebraska Lincoln,
Department of Agricultural Economics
epeterson1@unl.edu

Kassu Wamisho, Research Assistant Professor, North Dakota State University, Department of Agribusiness and Applied Economics
Kassu.Wamisho@ndsu.edu

Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2014 AAEA Annual Meeting,
Minneapolis, MN, July 27-29, 2014.

Table of Contents

List of abbreviations

AGOA	African Growth and Opportunity Act
ATPA	Andean Trade Preferences Act
CBI	Caribbean Basin Initiative
CBTPA	Caribbean Basin Trade Partnership Act
EU	European Union
FDI	Foreign Direct Investment
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GSP	Generalized System of Preferences
LDC	Least Developed Country
MDGs	Millennium Development Goals
MFN	Most Favored Nation
NB	Negative Binomial
OLS	Ordinary Least Squares
PPML	Poisson Pseudo Maximum Likelihood
ROC	Republic of Congo
SSA	Sub Saharan Africa
UNCTAD	United Nations Conference on Trade and Development
USAID	United States Agency for International Development
USITC	United States International Trade Commission
USTR	United States Trade Representative
WTO	World Trade Organisation
ZIP	Zero-inflated Poisson
ZINB	Zero-inflated Negative Binomia

Abstract

The African Growth and Opportunities Act (AGOA) which was signed into law in 2000 as part of U.S. trade legislation has the objectives of increasing trade and investment between the U.S. and eligible Sub-Saharan African (SSA) countries, by reducing or eliminating tariffs applied to African exports of different products. This Act represents a promising approach to economic growth and development in SSA through international trade.

This research paper examines the impact of AGOA on African agricultural exports. The study uses the gravity trade model framework and panel data depicting annual agricultural trade from 35 eligible SSA countries to the United States over years both before and after AGOA's implementation (1990-2011). There is wide variation in trade flows and the economic characteristics of the panel data obtained from the 35 SSA countries include numerous observations of zero trade flows. As the gravity equation is generally estimated in logarithms which are not defined for zero values, alternative statistical estimation methods, the Heckman model and the Poission family of regression modeling techniques, were used to test whether the inclusion of the zero values would change the parameter estimates significantly. The study differs from previous empirical analyses of AGOA which did not attempt to account for zero trade flows. In addition, most of these studies were based on data from the early years of AGOA while this study includes more recent data and is based on a longer time period.

The statistical results indicate that the AGOA trade preferences do not have a statistically significant impact on SSA agricultural exports, although some of the model results indicate that AGOA may have a positive effect on SSA agricultural exports to the United States. Results from some of the models indicate that an increase in per capita GDP in the SSA countries decreases agricultural exports to the United States. Likewise, currency appreciation of the SSA countries decreases the agricultural trade flows. A tariff rate quota and the exclusion of some agricultural products from the legslation still limit AGOA's broader positive economic impact. Further liberalization, reform and extension of AGOA for a longer time, investment to improve trade facilitation services, agricultural productivity and processing to meet high quality standards, and adoption of a comprehensive development assistance policy are needed if the African countries are to realize sustained economic growth and development.
Keywords: AGOA, Agriculture, SSA, United States, Gravity Model

1. Introduction

Moyo (2010) has pointed out that about $1 trillion in foreign aid has been transferred to Sub-Saharan Africa (SSA) over the past fifty years to little avail. Economic growth has been slow across the continent with average annual per capita income in 2005 international dollars for the period 2006 to 2010 only about 5 percent higher than the average for 1981 to 1985 (authors' calculations based on data from World Bank, 2013a). Moyo and others (see, for example, Okonjo-Iweala, 2007) have argued that promoting international trade represents a better strategy for growth and development than relying on foreign aid. While foreign aid is unlikely to disappear altogether, – members of the Organization for Economic Cooperation and Development (OECD) provided $126 billion in official development assistance in 2012 (OECD, 2013), about 25 percent of the aggregate GDPs of all low-income countries based on World Bank (2013a) data – there does appear to be increased interest among both donors and recipients in increasing the role of trade in economic development. Since the 1970s, high-income countries have taken advantage of GATT/WTO waivers allowing them to violate the Most Favored Nation (MFN) requirement by granting preferential access to their markets to developing countries under the Generalized System of Preferences (GSP; VanGrasstek, 2013). In 2000, the United States adopted the African Growth and Opportunity Act (AGOA) extending trade preferences to eligible countries in SSA and in 2001, the European Union launched an initiative named "Everything but Arms" granting duty-free access for exports of all goods other than arms to 49 least-developed countries including 33 in SSA (ITC, 2013; European Commission, 2013). In addition, OECD countries have recently undertaken a program referred to as "Aid for Trade" which aims to encourage trade by supporting the development of infrastructure and institutional frameworks in developing countries (OECD, 2011).

The intent of such initiatives is to encourage export growth which, in turn, is expected to lead to broader economic growth and development. The actual impacts of trade preferences have not always lived up to these expectations, however. Jones and Williams (2013) note that trade preferences may benefit traditional export industries in developing countries discouraging economic diversification. They also point to potential negative impacts in other developing countries not included in the preferential arrangements. Brenton and Ikezuki (2005) examine agricultural trade preferences finding that because of limitations in product coverage, issues surrounding rules of origin and ambiguities about the length of time the preferences will remain in effect, such preferential arrangements have had limited economic impacts in developing countries. On the other hand, there is empirical evidence that trade preferences can be of benefit to particular industries or countries. Condon and Stern (2011) review 21 studies of the effects of AGOA on SSA exports noting that four of the studies find significant impacts for apparel. Most studies of AGOA focus on the overall impact of this program with limited attention to its specific effects on agricultural trade. The purpose of this study is to evaluate the impact of AGOA on SSA agricultural exports to the United States using a gravity equation estimated with panel data for 35 AGOA-eligible SSA countries from 1990 to 2011. Most previous studies of AGOA have been based on shorter time periods and may not have captured the full effects of the program because it may take time for exporters to adjust to new terms of trade.

Gravity models are widely used in empirical studies of international trade. The use of this analytical framework raises some important technical issues that may affect the reliability of the parameter estimates. In particular, the panel data used in this and many other studies include a large number of zero values for the dependent variable which cause special problems when the gravity equation is estimated in logarithms as is usually the case. Standard statistical software often eliminates the zero values so that the estimated parameters are actually based on a truncated sample. The test for the influence of AGOA on SSA agricultural exports is based on a dummy variable for the years AGOA has been in effect and the statistical significance of the coefficient for this variable could differ between models based on the truncated sample and those that include the zero-value observations. For this study, the problem of zero values is addressed using the Heckman sample selection model and the Poisson family of models (see Martin and Pham, 2013 and Philippidis et al., 2013). The models estimated for this study include corrections for heteroscedasticity with fixed effects to account for country characteristics. The time series data are tested and found to be stationary on the basis of conventional unit-root tests. The econometric analyses are designed to insure that the results are as reliable as possible given the available data.

International trade is an important part of SSA economies with the value of exports in 2011 equal to about 34% of the region's aggregate GDP (World Bank, 2013a). Primary commodities make up the bulk of these exports and recent favorable commodity prices have contributed to significant economic growth across the region (World Bank, 2013b). Although petroleum and other minerals account for the majority of SSA exports (about 58 percent of total exports in 2012), agricultural commodities such as cocoa, coffee, tree nuts, rubber, fruits and vegetables, and cotton are of great importance particularly in countries without significant oil or mineral resources (United Nations, 2013). In many SSA countries, agriculture is still the most important economic sector in terms of employment and agricultural growth and development is frequently the most effective way to raise living standards. These factors suggest that efforts to promote agricultural exports could contribute significantly to broad-based development in the region. In addition to developing quantitative measures of the effects of AGOA on SSA agricultural exports, this study also identifies potential modifications that might improve the effectiveness of the program. In the next section, background on trade between the United States and SSA, a detailed description of AGOA provisions and a short review of the relevant literature are presented. The analytical approach, data and econometric issues are discussed in the third section which is followed by presentation and discussion of the results. The final section sets out the overall conclusions and a discussion of the policy implications of the analysis.

2.1 The African Growth and Opportunity Act

Most countries in SSA were colonies of various European powers at some point in their histories. One motivation for the colonization of Africa was to secure supplies of raw materials for European industry. Current trade patterns reflect this colonial legacy in that SSA exports are dominated by raw materials sold historically to the highly industrialized economies of Western Europe and North America and more recently to rising industrial powers in Asia. The composition of recent SSA exports is illustrated by the figures in Table 1. Over half of all exports consist of mineral fuels (coal, petroleum, natural gas and related commodities) with agricultural commodities the next largest group. On the import side, machinery and transport equipment constitute the largest category amounting to $120 billion in 2012, about 31 percent of total merchandise imports in SSA (United Nations, 2013). Data on the destination of SSA exports in 2012 are shown in Table 2. In recent years, trade with China and other Asian countries has increased dramatically. In 1990, almost 88 percent of SSA exports were destined for the European Union (EU) and the United States (IMF, 2007) but by 2012 the share of these countries

Table 1: Composition of Sub-Saharan African Trade.

Exports/Year	Food and Agriculture (% of total exports or imports)*	Mineral Fuels (% of total exports or imports)**	Manufactured Goods (% of total exports or imports)***	Other Goods (% of total exports or imports)****
2000	19.0	47.8	19.0	14.2
2009	20.0	50.3	15.3	14.4
2010	18.5	51.7	17.0	12.8
2011	18.2	54.6	13.8	13.4
2012	17.2	57.7	11.9	13.2
Imports/Year				
2000	15.2	7.8	24.3	52.7
2009	14.8	13.1	23.2	48.9
2010	14.6	13.7	22.9	48.8
2011	15.3	15.1	22.5	47.1
2012	15.1	15.5	23.7	45.7

Source: United Nations, 2013 and explanation of the Standard International Trade Classification (SITC, Rev. 3) at http://unstats.un.org/unsd/cr/registry/regcst.asp?C1=14
* SITC categories 0 (food and live animals), 1 (beverages and tobacco), 2 (crude inedible materials), and 4 (animal oils and fats)
** SITC category 3 (mineral fuels, lubricants and related materials).
*** SITC categories 6 (Manufactured goods classified by material) and 8 (Miscellaneous manufactured goods).
**** SITC categories 5 (chemical products), 7 (Machinery and transport equipment) and 9 (commodities not elsewhere classified).

was down to about 40 percent (United Nations, 2013). China's share of SSA exports increased from about 5 percent in 2000 to over 16 percent in 2012 and East Asian countries now account for about 20 percent of SSA imports up from 11 percent in 2000 (United Nations, 2013).

SSA agricultural exports are made up primarily of classic export crops such as cocoa, coffee, rubber, and a wide range of tropical products (see Table 3). The ten leading agricultural export commodities shown in Table 3 made up 78 percent of total agricultural exports in 2011.

Table 2: Sub-Saharan African (SSA) Trade Partners, 2012.

Region	Total SSA Exports (billion dollars) to:	Percent of SSA Exports to:	Total SSA Imports (billion dollars) from:	Percent of SSA Imports from:
World	491.1	100.0	390.4	100.0
SSA	70.3	14.3	70.3	18.0
Europe	131.1	26.7	104.9	26.9
East Asia*	101.5	20.7	91.8	23.5
United States	69.8	14.2	22.6	5.8
Other	118.4	24.1	100.8	25.8
High-income Economies	231.5	47.1	143.4	36.7
Developing Economies	259.6	52.9	247.0	63.3

Source: United Nations, 2013.
*Including both developing and high-income East Asia economies.

Table 3. Primary Agricultural Commodity Exports from Sub-Saharan Africa, 2011

Commodity	Export Value (millions of dollars)	Percent of Total Agricultural Exports
Cocoa beans and products	8,039.1	22.8
Fruits and vegetables	5,714.5	16.2
Coffee	2,158.7	6.1
Oilseeds and vegetable oils	2,084.3	5.9
Rubber	2,032.5	5.8
Tobacco	1,959.7	5.5
Cotton	1,935.9	5.4
Sugar	1,512.6	4.3
Tea	1,158.2	3.3
Cashew nuts	1,108.2	3.1
Total for top ten commodities	27,703.7	78.4
Total agricultural exports	35,328.1	100.0

Source: FAOSTAT, 2013

Export concentrations are even more dramatic in individual countries. In 2011, the proportions of total agricultural exports accounted for by a single commodity reached 97 percent in Guinea-Bissau (cashew nuts), 87 percent in Liberia (rubber), 80 percent in Ghana (cocoa) and 76 percent in Burundi (coffee; FAOSTAT, 2013). Export concentrations for general merchandise trade are also quite high, particularly in countries with large endowments of petroleum and other mineral resources. The World Bank (2013b) notes that petroleum exports made up 97 and 85 percent of total merchandise exports in 2011 for Angola and Nigeria respectively. In countries with limited mineral resources, a small number of agricultural commodities may account for a large share of the country's export revenues. In Côte d'Ivoire, for example, exports of cocoa, rubber and fruits and vegetables represented about 40 percent of total merchandise exports in 2011 (FAOSTAT, 2013). While the United States is generally an important trading partner for SSA, purchasing about 14 percent of total SSA merchandise exports (Table 2), U.S. imports of agricultural goods from the region have remained small representing only about 2 percent of total U.S. agricultural imports in 2012 (FAS/GATS, 2013). From the point of view of the SSA countries, the volume of agricultural exports to the United States represents about 5 percent of total SSA agricultural exports, most of which are destined for Europe (35 percent) or Asia (33 percent; United Nations, 2013).

AGOA was adopted and signed into law as Title 1 of The Trade and Development Act of the United States in May 2000 (USTR, 2013). The main objective of this act is to promote economic growth in Africa by encouraging African exports to the United States through reducing or eliminating tariffs on African goods. AGOA also includes provisions designed to facilitate investment flows between the United States and eligible SSA countries and to foster the integration of African economies with the world economy (USTR, 2013). Unlike regional trade agreements that include reciprocal reductions in trade barriers, AGOA and similar preferential arrangements do not require that the beneficiaries reduce their trade barriers on goods imported from the country granting the preferences. As noted previously, an early preferential agreement is the GSP which dates from the 1970s. Preferential treatment under the GSP is usually accorded to all developing countries. In recent years, numerous non-reciprocal programs that target specific countries or regions have been put in place. In 1984 the United States initiated the Caribbean Basin Initiative (CBI) which includes twenty-four countries in the Caribbean and

Central America (Hoekman, 2005). The United States also extends preferences to Colombia, Bolivia, Peru and Ecuador under the Andean Trade Preferences Act (ATPA). The Caribbean Basin Trade Partnership Act (CBTPA) adopted in 2000 extends preferences to textiles and apparel for the CBI countries (Hoekman, 2005). Initially, 34 SSA countries were included in the list of AGOA beneficiaries and currently 41 of the 48 SSA countries are eligible for the trade preferences.

Each year the U.S. government decides which SSA countries are eligible for AGOA preferences. The eligibility criteria include determination that beneficiary countries are working to develop market economies, to assure respect of human rights, and to promote the rule of law and good governance (AGOA, 2013). Eligibility can be withdrawn if there are adverse changes in the local political environment. For instance, in December of 2009 Guinea, Madagascar, and Niger were all suspended from the list of eligible countries because of poor governance and lack of progress towards democracy. By October of 2011, eligibility was restored for Guinea and Niger as they were able to demonstrate improvement in these areas (AGOA, 2013). For most SSA countries, eligibility is a minor issue although in some cases annual evaluations that might lead to suspension of a country's eligibility introduce substantial uncertainty in the country's trade relations with the United States.

AGOA adds about 1,800 tariff lines to the 5,000 lines already covered under GSP. (AGOA, 2013b). Schneidman and Lewis (2012) note that most of the tariff reduction under AGOA is for nonagricultural products, mostly textiles and apparel, petroleum, minerals and precious stones. 81 percent of U.S. imports from Africa consist of petroleum and minerals compared with just under 7 percent for agricultural commodities (United Nations, 2013). AGOA was first set to expire in 2008, but in 2004 it was extended to 2015 (USTR, 2013). The original AGOA legislation provided for annual conferences known as the United States-Sub-Saharan Africa Trade and Economic Cooperation Forum. The 2013 AGOA Forum, held in Addis Ababa, Ethiopia, was focused on the question of how to bring appropriate technical assistance and technologies to farmers in rural areas so they can raise productivity and become more competitive on world markets. Many African leaders at the Forum argued that there is a need to extend AGOA beyond 2015 and this sentiment has been echoed by both African and U.S. companies (AGOA, 2013c).

Many studies of the impacts of AGOA on African exports have focused on aggregate merchandise trade and most empirical evaluations have been based on data prior to 2006 (Mattoo, Roy and Subramanian, 2002). Nouve (2005) estimated a dynamic gravity model using panel data for 46 countries from 1996 to 2004 finding that AGOA has had a statistically significant impact on SSA exports to the United States. The specific economic sector that has received the most attention from analysts is textiles and apparel (Olarreaga and Özden, 2005; Lall, 2005; Collier and Venables, 2007; Tadesse and Fisseya, 2007; Mueller 2008; Condon and Stern, 2011). Collier and Venables (2007) and Tadesse and Fisseya (2007) investigate the impact of AGOA on apparel exports using gravity models and finding significant positive effects. Other authors have examined both aggregate merchandise exports and exports from the textile and apparel sector. Olarreaga and Özden (2005), Frazer and Van Biesebroeck (2007) and Condon and Stern (2011) all find that AGOA has had positive impacts on SSA merchandise exports but these effects have been particularly pronounced for apparel. Brenton and Hoppe (2006) and USTR (2010 and 2011) found evidence of significant increases in total exports under AGOA but noted that petroleum and apparel products made up the bulk of SSA exports to the United States. They argued that the impact of AGOA has been reduced by the remaining barriers to agricultural and textile exports.

In contrast to these studies, Mueller (2008), Seyoum (2007) and Zappile (2011) find that AGOA has had no significant impact on general merchandise trade between SSA and the United States. Mueller (2008) estimated two versions of a gravity model, the first focusing on all U.S. imports under AGOA except petroleum while the second evaluated the impact of AGOA on apparel exports. The models were estimated using panel data for the period 2000 to 2004 and including countries eligible for AGOA preferences during that period. The results of the first model included a negative but statistically insignificant impact on non-oil trade for the eligible countries. Likewise, the impact of AGOA on apparel exports was found to be statistically insignificant in the second model. Seyoum (2007) used an ARIMA model for a similar time period finding that AGOA has had a small positive but statistically insignificant impact on total SSA exports to the United States. Zappile (2011) used a gravity model to assess the effects of AGOA finding that it has had no statistically significant effect on either aggregate merchandise or textile exports from SSA to the United States.

A few authors have focused on specific regions or countries within SSA. Remy and Applegate (2008) use a computable general equilibrium (CGE) model to simulate the effects of AGOA on the West African Economic and Monetary Union (WAEMU). The CGE model allows the authors to estimate macroeconomic impacts in addition to the effects on particular economic sectors. They find that AGOA has had strong positive effects not only on trade but also on such macroeconomic variables as economic growth, investments, savings and government revenues. Lall (2005) analyzed the impact of AGOA on apparel exports from Lesotho. He noted that AGOA has helped Lesotho become the largest SSA apparel exporter to the United States on the basis of substantial foreign direct investment from Asia and argued that underlying structural problems may compromise the ability of Lesotho's apparel sector to maintain this record if AGOA is terminated. Other studies focusing on particular countries include those of Rolfe and Woodward (2005) on Kenya and Akanji (2007) on Nigeria.

Only a few empirical studies have examined the effects of AGOA on agricultural trade between SSA and the United States (Nouve, 2005). Asmah and Taiwo (2010) document the small role of agricultural commodities in U.S. trade with SSA. They suggest that agricultural imports under AGOA amount to only $1.2 to $1.4 billion and about 85 percent of these imports come from South Africa. Nouve and Staatz (2003) examined U.S. agricultural imports from 46 SSA countries over the period 2000 to 2003 using three gravity equations, the first for the full sample of 46 countries, the second for 27 countries that registered significant agricultural exports and the third for the eight largest agricultural exporters. All of these models were estimated both with and without South Africa on the grounds that this country might distort the overall effects of AGOA because of its economic weight. Coefficients for all of the AGOA dummy variables across the estimated equations were positive but none was significantly different from zero. The authors concluded that AGOA has had no observable impact on agricultural trade in part because the program was still relatively new when their study was conducted. Frazer and Van Biesebroeck (2007) included agriculture in their broader study of AGOA over the period 2000 to 2006. They found that AGOA has had a positive and significant impact on AGOA-eligible agricultural exports as well as on general merchandise and apparel exports.

The results of the studies of the impact of AGOA on agricultural exports from SSA to the United States are mixed making it difficult to draw reliable conclusions about the effectiveness of this program. Some of the studies relied on data from relatively short time periods and one of the purposes of the present research is to determine whether basing the analysis on a longer period will change the results reported by these authors. In addition, the studies based on gravity models generally did not explicitly address the problem of missing values for the dependent variables. The specific methods employed to address this and other statistical problems are described in the following section.

3. Method

3.1 The Traditional Gravity Model of Trade

The method used in this study to analyze the impact of AGOA is the gravity model of trade. This model has been used extensively to explain bilateral trade flows. It allows the analyst to test whether various factors such as the presence of a regional agreement or preferential trade arrangements have a statistically significant impact on trade flows. The traditional gravity model draws on an analogy with Newton's Law of Gravitation which explains the gravitational attraction between objects as a function of their mass and the distance between them**.** Tinbergen (1962) was the first to use this method using economic weight as measured by GDP and distance between two countries to account for the bilateral trade flows between the two countries. A historical review of how the gravity equation is used in international trade can be found in Anderson (1979, 2011) and Brakman and van Bergeijk (2010). Initially, the gravity equation was an ad hoc specification with little link to particular theoretical models. Anderson (1979, 2011), Anderson and van Wincoop (2003) and others have derived the gravity equation from theoretical models (see Feenstra, 2004).

The basic empirical model for trade between two countries (i and j) takes the form of equation 1. Goods supplied at origin i are attracted to destination j according to the economic weights of the two countries as measured by GDP (*Yi* and *Yj*), but the potential flow is reduced by the distance between them D_{ij}. A simple form of the gravity equation is:

$$T_{ij} = G\frac{Y_i^{\beta_1} Y_j^{\beta_2} Z_{ij}^{\beta_3}}{D_{ij}^{\beta_4}} \qquad (1)$$

Where T_{ij} is the trade flow from i to j and Y is the respective economic mass of the importing and exporting countries (as measured by GDP). An alternative for the economic mass that is often used in gravity models is per capita GDP and some analysts have included both GDP and

GDP per capita. D_{ij} is the physical distance between country i and j [1], and Z_{ij} represents other characteristics affecting bilateral trade such as common language, common border, colonial ties, regional trade agreements, or trade barriers. G is a constant intercept.

The traditional gravity equation is usually rewritten in a log-linear form to estimate the vector of β;

$$\ln T_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 Z_{ij} - \beta_4 D_{ij} + \varepsilon_{ij} \qquad (2)$$

β_0 is a constant intercept common to all trading countries and ε_{ij} is an error term. A shortcoming of this specification is that it suffers from omitted variable bias. Anderson and Van Wincoop (2003), among others, develop a more realistic gravity model in which prices in the two countries differ as a result of border effects, including transportation costs, trade barriers and other costs of doing business. With different prices, the simple gravity equation is no longer appropriate. Anderson and Van Wincoop (2003) derive a theoretically consistent gravity model that includes price indices which they refer to as "multilateral resistance variables" (p. 176). These variables depend on the level of the trade barriers between a given country and all of its trading partners. Their incorporation into the gravity equation raises some problems in the statistical estimation of the relationships. Feenstra (2004) suggests that such problems can be overcome by using panel data to estimate the equation with fixed effects. Country-specific fixed effects can be thought to capture the impact of the unobserved multilateral resistance variables.

The model can be presented in a log-linear specification:

$$\ln T_{ijt} = \beta_0 + \alpha_t + \alpha_{ij} + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 Z_{ij} - \beta_4 D_{ij} + \varepsilon_{ijt} \qquad (3)$$

Where α_{ij} represents a fixed effect for country pairs that is common to all years and which captures country heterogeneity, and α_t is a time fixed effect common to all countries, but specific to each year t. Gravity models with fixed effects have also been used by different researchers such as Millimet and Osang (2004) to estimate the effects of borders on trade; Glick and Rose (2001) and Pakko and Wall (2001) to estimate the trade effects of currency unions; by Wall (2000) and by Egger (2002) to calculate trade potentials; and by Wall (1999) to estimate the costs of protection.

[1] Note: j and u are used interchangeably to represent US

The statistical model for this study is designed to evaluate unilateral trade flows from SSA countries to the United States and to explore the impact of AGOA as a preferential trade agreement using panel data for the AGOA-eligible countries in SSA over the period 1990 to 2011. The model can be presented in a log-linear specification as follows:

$$\ln AGX_{iut} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{ut} + \beta_3 \ln VAD_{it} + \beta_4 \ln AgL_{it} + \beta_5 EX_{it} + \beta_5 AGOA_{it} + \varepsilon_{iut} \qquad (4)$$

$i = 1,2,.......N$, representing exporting SSA countries, $u = 1$ representing the importing country, the United States and $t = 1,2,.......T$, representing the pre and post AGOA years. AGX_{iut} represents the value of aggregate agricultural commodity exports of SSA countries measured in U.S. dollars at time, t. The export values included in the data are only for eligible commodities under the AGOA agreement (any SSA agricultural exports to the United States that are outside the list of eligible goods under AGOA are excluded). Y_{it} and Y_{ut} are GDP per capita for SSA and the United States at time t respectively. Since it serves as a proxy for the income level of countries, GDP per capita of countries has also been very commonly employed in place of GDP and population. Example of models with GDP per capita include Sanso, Cuairan, and Sanz (1993), Bergstrand (1989), Cheng and Wall (1999), Buch and Piazolo (2001), Fukao et al. (2003), Porojan (2001), Eichengreen and Irwin (1998) and others.

VAD_{it} is the value added of agriculture in SSA country i at time t and AgL_{it} percentage of agricultural land measured from total arable land of country i . EX_{it} represents the exchange rate of country i (i.e. real exchange rate-local currency per US dollar). These three variables are not included in most of the models estimated because they are country-specific and are expected to be accounted for by the fixed country effects. They are included in two models in an effort to ensure that the estimated coefficients are reliable. These types of variables have been used by other authors as factors that either impede or enhance bilateral trade. $AGOA$ is a dummy variable with a value of 0 for years prior to the implementation of the AGOA provisions for a given country and 1 for years following the implementation of these provisions. ε_{ijt} is assumed to be normally distributed with zero mean and constant variance for all observations. It is also assumed that the disturbances are pairwise uncorrelated.

We assumed the coefficient of the distance variable is zero since the distance is fixed over time between the exporting SSA country and the United States. The gravity Eq. (4) can be estimated by nonlinear or linear ordinary least squares (OLS) with fixed effects as suggested by

Anderson and van Wincoop (2003) and Feenstra (2004). An important drawback of estimating the gravity equation in its log-linear form with OLS estimation is that it ignores trade flows with a value of zero because the natural logarithm of zero is not defined. Actually our trade flow data shows a number of zero trade values across the studied countries. The next section explores alternative modeling approaches to handle the presence of zero values.

3.2 Modeling Zero Trade Flow

Zero or missing observations are quite common in bilateral/unilateral trade flows particularly in agricultural commodity trade. The first approach for dealing with zero trade flows is truncating the sample by dropping the observations with zero trade. The second approach is to systematically add a small positive number (usually 0.5 or 1) to all trade observations so that the log linear transformation is defined. The third is estimating the model in levels (i.e.in linear or non-log form).

Empirical estimation of trade flows with zero values with conventional OLS leads to a selection bias created by the logarithmic transformation (Burger et.al, 2009; Flowerdew and Aitkin 1982). Since zero trade flows are usually not randomly distributed, truncating the observations might lead to biased and inefficient estimates (Burger et.al, 2009; Heckman, 1979; Xiong and Beghin, 2011). Systematically adding a small positive number by itself is problematic since there is no theoretical or empirical justification for such a procedure, and it can distort the estimates (Linders and de Groot, 2006; Flowerdew and Aitkin, 1982; Xiong and Beghin, 2011). This study will address the problem of zero trade by implementing two alternative gravity model approaches using the Heckman selection model (Heckman 1979; Hoffmann and Kassouf 2005) and the Poisson Family specification of the trade gravity model (Santos Silva and Tenreyro, 2006; Burger et.al, 2009; Xiong and Beghin 2011).

3.2.1 The Heckman Selection Model

The Heckman gravity econometric model retains the log linear transformation of the model and treats zero trade values as censored observations. This approach involves estimating a Probit model in which the dependent variable is a [1,0] indicator of whether or not a given observation is non-zero. The Heckman sample gravity selection model is based on both censored variables (equation 5) and uncensored variables (equation 6):

$$\ell^*_{ij} = \theta' X_i + u_{ij} \quad (5)$$

Where ℓ^*_{ij} is a latent variable that shows if bilateral, in our case unilateral, trade between SSA countries, i and U.S, j (u) in the sample occurred. ℓ_{ij} is not observed but we do observe if countries trade or not, such that $\ell_{ij} = 1$ if $\ell^*_{ijt} > 0$; $\ell_{ij} = 0$ if $\ell^*_{ij} \leq 0$.

The outcome equation based on uncensored observations:

$$\ln T^*_{ij} = \beta' X_i + \varepsilon_{ij} \quad (6)$$

$\ln T^*_{ij}$ is the logarithm of the volume of unilateral trade as defined in equations 1 to 4. $\ln T_{ij} = \ln T^*_{ij}$ if $\ell^*_{ijt} > 0$. u_{ij} is the error term associated with the selection process. ε_{ij} is the error term of the outcome equation. X_i is a vector of variables that affect $\ln T^*_{ij}$. The errors u_{ij} and ε_{ij} have a bivariate normal distribution with zero means, standard errors of σ_u and σ_ε, (Hoffmann & Kassouf, 2005). For ease of exposition the time subscript is dropped from the equations.

The most popular way to correct for selection bias is the Heckman 2-stage least squares estimation that introduces in the specification the inverse of the “Mills ratio” (Heckman 1979). The Mills ratio is the ratio of the probability density function to the cumulative distribution function of a distribution (see Appendix B-equation 7). The two-step procedure first estimates the bivariate selection equation using a Probit model and generates the inverse of the Mills ratio, $\lambda(\alpha_u)$. Then the main model is estimated with OLS, including a measure of the probability of being in the sample, derived from the Probit estimates. Greene (2003) and Hoffmann and Kassouf (2005) show that

$$E[T^*_{ij} \mid \ell_{ij} = 1] = \beta' X_i + \rho \sigma_\varepsilon \lambda_i(\alpha_u) \quad (6')$$

Due to the correlation between X_i and $\lambda(\alpha_u)$, OLS regression on $\ln T^*_{ij}$ without the term in $\lambda(\alpha_u)$ would produce an inconsistent estimator of β (Hoffmann and Kassouf 2005). The empirical version of the gravity model of the selection model of equation (5) becomes:

$$\ell^*_{iu} = \theta_0 + \gamma_{iu} + \theta_1 \ln Y_{it} + \theta_2 \ln Y_{ut} + \theta_3 \ln VAD_{it} + \theta_4 \ln AgL_{it} + \theta_5 EX_{it} + \theta_5 AGOA_{it} + u_{iu} \quad (5')$$

And the outcome-equation 6:

$$\ln T_{iu}^{*} = \beta_0 + \alpha_{iu} + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{ut} + \beta_3 \ln VAD_{it} + \beta_4 \ln AgL_{it} + \beta_5 EX_{it} + \beta_5 AGOA_{it} + \varepsilon_{iu} \quad (6'')$$

The variable $\lambda(\alpha_u)$ is then included as an additional regressor, allowing the parameters of the outcome in equation (6'') to be consistently estimated by the OLS method (Greene 2003; Hoffmann and Kassouf 2005). ρ shows the correlation between the error terms of the selection and the outcome equation $Corr(u_{iu}, \varepsilon_{iu})$ in equation 5' and 6'.

3.2.2 Poisson Family Regressions

Since the Heckman gravity model adopts the log-linear specification as the conventional OLS estimation, it is still subject to heteroskedasticity. This implies that $E(\ln Y) \neq \ln E(Y)$, that is, the expected value of the logarithm of a random variable is different from the logarithm of its expected value (Santos Silva and Tenreyro 2006).

A recent study of Will Martin and Cong S. Pham noted that "The Heckman sample-selection estimators-whether in two-step or maximum likelihood-gave very poor results when estimated for a single equation with the same variables in the selection and estimation equations.'' (Will Martin and Cong S. Pham, 2013). So Santos-Silva and Tenreyro recommended the use of a Poisson Pseudo Maximum-Likelihood (PPML) estimator, using the dependent variable in level form and independent variables in log form instead of both logarithmic dependent and independent variables. They show that the PPML consistently estimates the gravity equation for trade and it is robust to different patterns of heteroskedasticity and measurement error.

The Poisson family of models originally derives from the analysis of count data- a non-negative integer which includes 0 values. Given the presence of zero trade flows and heteroskedastic error terms, the gravity model can be estimated consistently using the Poisson Pseudo Maximum Likelihood (PPML) estimation (Santos Silva and Tenreyro 2006). We follow the specification of Burger et al. (2009) to fit the PPML estimator.

The observed volume of trade, T_{ij} between countries i and j in a period t has a Poisson distribution with a conditional mean (μ) that is a function of the independent variables (equation 4). T_{ij} is assumed to have a non-negative integer value so that it ensures that it is zero or positive and has the probability mass function described in Apendix-B equation 8. The Poisson model requires the equi-dispersion property, i.e., the conditional variance must be equal to the conditional mean (Cameron & Trivedi, 2010). This equi-dispersion property is commonly violated because the dependent variable of unilateral/bilateral trade flows is often over-dispersed, implying that the conditional variance exceeds the conditional mean because of the presence of greater variability-statistical dispersion in the data set between countries. The presence of over-dispersion might result in inefficient estimation of the Poisson model. A negative binomial (NB) model is frequently employed to correct for over-dispersion (Burger et al., 2009).

The probability mass function of the negative binomial distribution is also explained in Appendix-B equation 10. A likelihood ratio test of Alpha (α) can be used to test whether the negative binomial distribution is preferred over the Poisson distribution (Cameron and Trivedi, 2010). If α is approximately zero, the negative binomial regression model reduces to the Poisson regression model.

Technically PPML and NB models can handle estimation of zero trade flows but neither is suitable for handling zero trade flows if the number of observed zero values exceeds the number of zeros predicted by the PPML or NB distributions (Burger et al., 2009). Under such a situation, the Zero Inflated Poisson (ZIP) and Zero Inflated Negative Binomial (ZINB) models can be used to overcome the problems (Burger et al., 2009).

The ZIP regression consists of two parts. The first part of the zero-inflated model contains a logit (or probit) regression of the probability that there is no bilateral trade at all. The second part contains a Poisson regression of the probability of each count for the group that has a non-zero probability or interaction intensity other than zero. According to Burger et al. (2009), in the presence of both over-dispersion and zero inflated problems in the study sample, a zero-inflated negative binomial (ZINB) model can be defined in a similar fashion to the ZIP model.

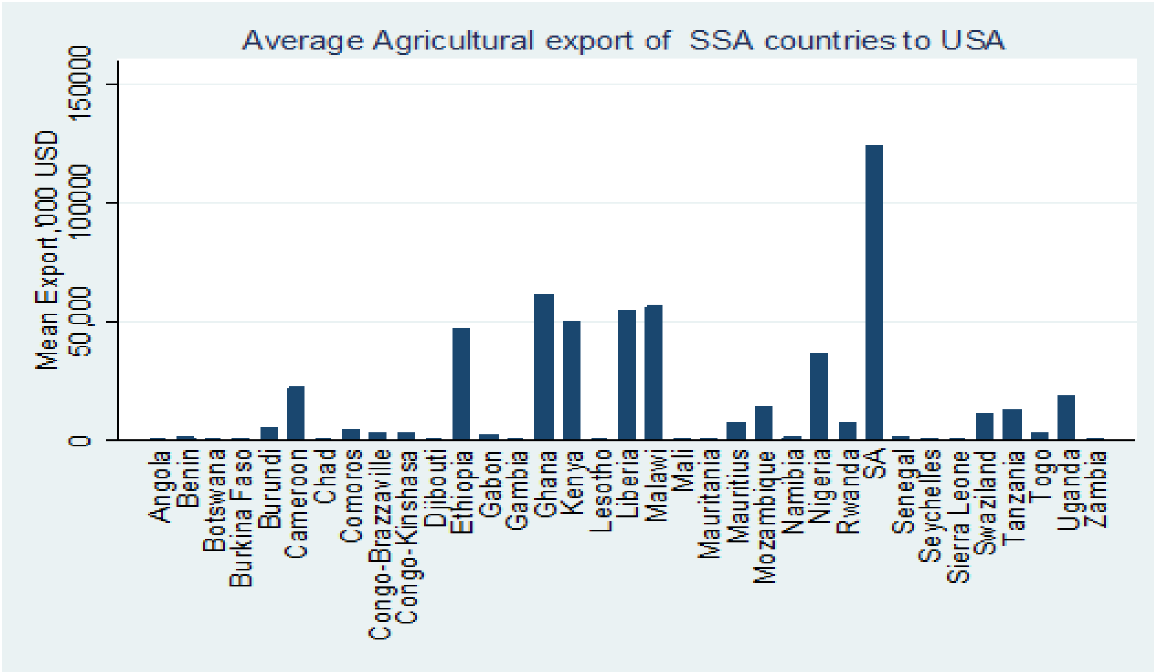
For both the zero-inflated Poisson model and the zero-inflated negative binomial regression model, the Vuong statistic (Vuong, 1989) can be employed to test whether a zero-inflated model and zero-inflated negative binomial are better than the alternatives. The likelihood ratio test of over-dispersion can also be used to test whether the negative binomial specification or the Poisson specification is more robust (Burger et.al 2009). The Vuong statistic follows a standard normal distribution with large positive values favoring the ZIP/ZINB model and large negative values favoring the PPML/NB model (Cameron & Trivedi, 2010).

4. Results and Discussions

4.1 Descriptive Statistics

According to Figure 4.1, the largest agricultural exporters to the United States are South Africa, Ghana, Malawi, Liberia, Kenya, Ethiopia, and Nigeria. In addition, based on data from USITC and USDA/GATS the share of agricultural exports in total exports from SSA countries to the United States between 2000 and 2011 varies widely from 0 percent for large oil exporting countries such as Angola, Nigeria and Gabon, to more than 95 percent in Liberia, 82 percent in Kenya, and 96 percent in Comoros. On average, agricultural exports form a very small fraction of SSA's total exports to the United States (about 2% between 1996 to 1999) and a half percentage point lower (1.5%) over the period 2000-2011. Agricultural exports in high performing economies such as South Africa, Ghana and Mauritius, form less than 5% of their total exports to the United States. Even though the share of agriculture in total exports of South Africa and Ghana is small, these two countries remain the first and second largest exporters of agricultural products from the AGOA countries to the United States (See Figure 4.1). Some countries show significant increases in the agricultural share of exports to the United States from about 63% during the period 1996-1999 to 95.8% in 2000-2011 in Liberia, 1% to 23% in Malawi, 54% to 82% in Kenya, 7% to 38% in Uganda, and 28% to 63% in Togo.

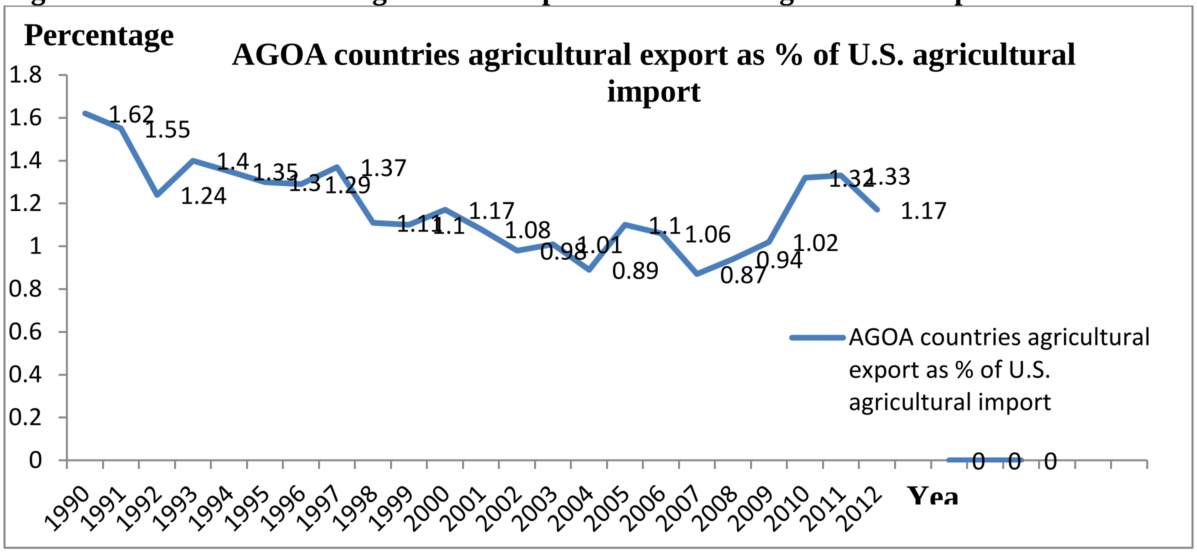
Figure 4.1 Average Agricultural exports of SSA countries to the United States



Source: Own calculation based on USITC agricultural import data

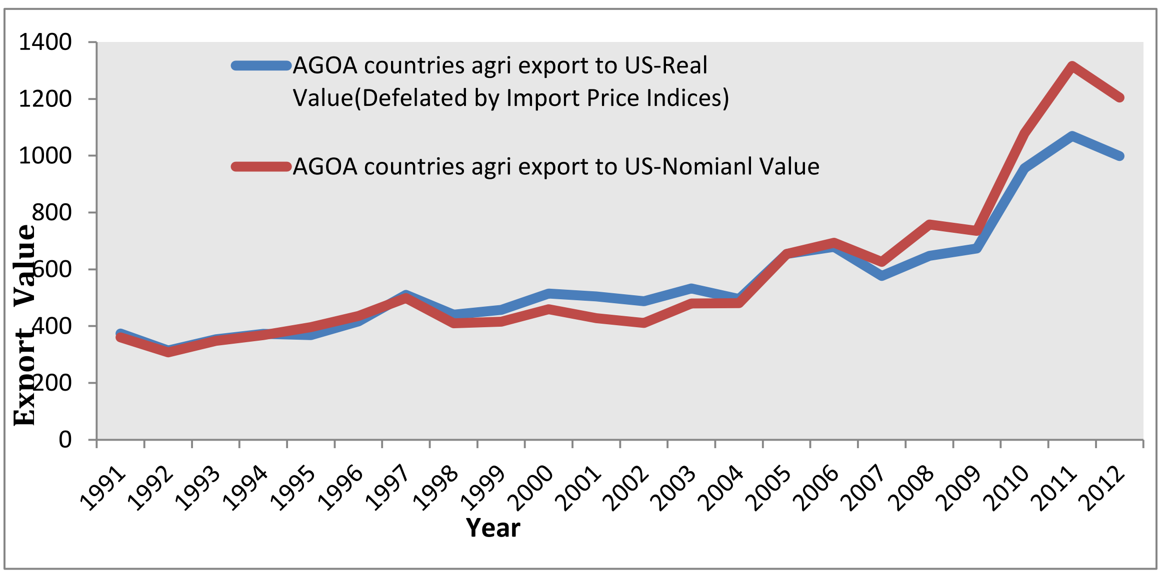
While the United States is an important market for agricultural exports from some of the AGOA countries, these countries account for a small share of total U.S. agricultural imports. According to Figure 4.2, the share of the AGOA countries in total U.S. agricultural imports was less than 2 percent over the period 1990 and 2011. On the other hand, the value of agricultural exports from the AGOA countries to the United States has grown substantially in both real and nominal terms, particularly in recent years (see Figure 4.3). The real value of AGOA agricultural exports to the U.S. since enactment of AGOA has grown by about 51 percent from $514 million in 2000 to $998 million in 2012. As Figure 4.3 shows there is also a slight decline of AGOA countries' agricultural exports from $1.1 billion in 2011 to $998 million in 2012.

Figure 4.2 AGOA countries agricultural export as % of U.S. agricultural import



Source: own analysis based on USITC data

Figure 4.3 SSA countries agricultural export values in $Millions (Real and Nominal)



Source: own analysis based on USITC data and U.S. Import Price Indexes from Bureau of Labor Statistics

4.2 Data Sources

The gravity equation was estimated using panel data on U.S. agricultural imports from 35 SSA countries. Some countries in SSA have not been eligible for AGOA throughout the period 2000 to 2011 and have been dropped from the sample. A panel of these agricultural product imports covering years prior to the adoption of AGOA (1990-1999) and years following its implementation was formed. U.S. agricultural import statistics from the individual SSA countries were obtained from United States Department of Agriculture (USDA/GATS http://www.fas.usda.gov/gats/ExpressQuery1.aspx) and U.S Department of Commerce (http://www.commerce.gov/), and also from U.S. International Trade Commission (USITC). Initially, unilateral exports from SSA country i to the United States u will be measured as the aggregate of all agricultural exports to the United States from that country under AGOA product categories. The U.S. import price indices were obtained from the United States Bureau of Labor Statistics, and used to deflate import values. In many studies, other factors such as exchange rates, land area, common border, common language, currency union, etc. that may influence trade flows have been included as additional variables in the traditional gravity model. This study also included some additional factors and re-estimated the model. Real exchange rates are from the International Monetary Fund (IMF), while countries' GDP per capita, and data for agricultural value added and agricultural land as a percentage of total land are from the World Bank's World Development indicators (WDI).

4.3 Model Results and Discussion

To obtain reliable estimates of the parameters of the gravity equation, it is necessary to examine the properties of the data set assembled for the study. To check for the stationarity of the panel data, the stationarity test proposed by Fisher for unbalanced panel data was used to determine whether the time series data have unit roots (Choi, 2001). The results are shown in Table A4.2. The null hypothesis that the panel data contain unit roots is rejected. We also considered the Harris–Tzavalis stationarity test proposed by Harris and Tzavalis (1999) for panel data stationarity and obtained the same result as with the Fisher-type unit-root test.

Second, because the initial gravity equation is estimated using ordinary least squares (OLS), we also checked for the presence of heteroscedasticity[2] using White's Test for hetroscedasticity as described by White (1980). The result of the test is shown in appendix Table A4.3.The null hypothesis of homoscedasticity is rejected suggesting that there is heteroscedasticity. The robust regression estimation as described by Andersen (2008) and Radchenko (2005) can be used to correct for heteroscedasticity and this procedure was used in the estimation of the gravity equation. These regression results are presented in Table 4.2.

Table 4.2 Robust OLS Regression Results

Dependent Variable	Full sample (35 countries)		Top 15 SSA Agricultural Exporters	
SSA Countries Agricultural Exports to US (Annual in $1000)	**(All countries)**	**(Excluding SA)**	**(All countries)**	**(Excluding SA)**
Independent Variables				
SSA GDPP	1.391** (4.63)	1.438** (4.77)	2.593** (9.05)	2.773** (9.94)
US GDPP	0.204 (0.220)	-0.199 (-0.21)	-0.04 (-0.04)	-0.94 (-0.97)
AGOA (Dummy)	0.224 (1.08)	0.198 (0.94)	0.263 (1.23)	0.220 (1.03)
Constant	-9.484 (-0.970)	-5.562 (-0.56)	-4.48 (-0.45)	4.03 (0.4)
R-Squared	0.808	0.7881	0.6281	0.6139

t statistics in parentheses *, **, and *** significant at 10%, 5% and 1% respectively
Note: All the above estimation results are without fixed effect.

Two models were estimated. The first was based on the full sample of the 35 AGOA countries with and without South Africa (SA), and the second was based on the top 15 SSA agricultural product exporters (including and excluding SA). South Africa is different from other SSA countries in terms of the size of its economy and the relatively higher incomes of its citizens. Treating South Africa differently in the two models is justified because its greater economic weight could overshadow the effects of AGOA in SSA as a whole.

The statistical results presented in Table 4.2 based on OLS show that the dummy variable reflecting the introduction of AGOA is not significantly different from zero at the 95% confidence level. Although the coefficient is not statistically significant, it is positive and suggests that AGOA may have contributed to an increase in the export of agricultural

[2] chi2(8) = 21.58, Prob > chi2 = 0.006

commodities in the range between 22 to 30 percent[3] compared to the pre- AGOA years across the models (Table 4.2). The signs of the coefficient on the per capita GDP variables considered are consistent across all models, except that the sign on the U.S GDP per capita switches to negative in the first model (Table 4.2). For most variables considered, the inclusion or exclusion of South Africa and limiting the sample to the top 15 exporters does not appear to alter the signs of the coefficients.

Per capita GDP in SSA is highly significant and positively related to SSA agricultural exports. The estimated parameters for the per capita GDP variables in a gravity equation in logarithms represent the elasticity of exports of agriculture to GDP, indicating the percentage variation in exports following a 1 per cent change in per capita GDP. For example, on average a 1% increase in the per capita GDP of SSA could result in around 1.4% increase on agricultural exports to the United States (column1 and 2, Table 4.2). The percentage increase in exports doubled in the model for the top fifteen exporting SSA countries. According to the estimates of the model, an increase in an SSA country's per capita GDP will lead to a more than proportional increase in its agricultural exports to the United States. Although, the coefficient on U.S. GDP per capita is not found to be significant the sign is consistently negative. The results suggest a 1% increase in the U.S GDP per capita would result in around 0.2 to 0.9 % percent reductions in agriculture exports to the United States, except in the first full sample result shown in column-1. This result is inconsistent with the basic expectations of gravity trade models. SSA agricultural exports make up a small portion of U.S. total agricultural trade. Even though per capita U.S. GDP is the same across all the countries in year t, observed variations from year to year in U.S. GDP per capita may not have any strong effect on the demand for those exports in the U.S. markets. Second, it is possible that per capita GDP growth in the United States may not translate into increased demand for agricultural imports, as changes in the per capita GDP are more likely to lead to increases in the consumption of non-agricultural products, which tend to be more income elastic than agricultural products. However, this result changed in the later model estimations (i.e. Poisson family of regressions).

[3] The elasticity of the AGOA dummy on the dependent variable, i.e., the % impact of AGOA policy on export is computed as $[\exp(\beta)-1]*100$ where β is a coefficient on AGOA dummy variable.

In the next section we focus on the estimation results of the models that address the problem of zero trade flows. About 13 percent of the observations of agricultural exports in the data are zeros. To deal with the possible selection bias as a result of systematically excluding these observations, we fitted different model specifications. As described in the method section, the Heckman selection model and the Poisson family of regression estimations have been suggested by several authors as ways to deal with zero observations. The estimated result in tables 4.2 is based on data that excludes zero observations.

4.3.1 Heckman and Selection Models

The Heckman solution to the gravity econometric model retains the log linear transformation of the model and treats zero trade values as censored observations in a similar way to a Probit model as described in Chapter 3. Both the selection (censored) and outcome (uncensored) equations are specified as a generalized gravity model. Table 4.3 column 2 and 4 present estimates of the selection equation (5') estimated as a Probit model while column 1 and 3 contain the estimation of outcome equation (6").

Table 4.3 Heckman Model Results

	Outcome Ln(export)	Selection (Probit)	Outcome Ln(export)	Selection (Probit)
lnGDP per capita SSA	-0.204	0.090	0.0306	0.166*
	(-1.91)	(0.037)	(0.0858)	(0.0697)
lnGDP per capita USA	2.090	0.272	0.0173	-0.964
	(2.334)	(0.827)	(1.773)	(1.217)
LnAgland%	-	-	1.139***	0.171
			(0.172)	(0.116)
LnVAD	-	-	1.043***	0.358***
			(0.0805)	(0.0518)
AGOA dummy	-0.359	0.166	-0.394	0.135
	(-0.523)	(0.187)	(-0.393)	(0.267)
_cons	-11.84	-2.436	-10.17	2.274
	(-24.069)	(-8.515)	(-18.16)	(12.48)
ρ	0.0862		0.154	
	(0.0123)		(.176)	
Ln(σ)	0.173		0.809***	
	(0.0189)		(.0296)	
λ	0.0053		0.0342	
	(1.574)		(.388)	

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: the first two columns 1 and 2 shows estimations with fixed effect. However, columns 3 and 4 takes additional variables such as Agland% and VAD to account for country specific characteristics.

The results in Table 4.3 suggest that the Heckman and selection models have not captured the effects of the gravity equation variables as none of the explanatory variables is significantly different from zero. In the right columns of Table 4.3, agricultural land as a percentage of total land area and agricultural value added have been added to the basic gravity equation. A positive and statistically significant coefficient for percent of agricultural land (Agland%) and agricultural value added (VAD) implies that an increase in agricultural land as a percentage of total land area and VAD increases agricultural export to the U.S. While these variables add to the explanatory power of the equation, their inclusion does nothing to change the results for the AGOA dummy and other variables of interest. Per capita GDP of U.S and the AGOA dummy switched signs in the outcome and selection estimation.

Since the Inverse Mill Ratio is included in the outcome equation, the coefficients in the outcome and selection equations cannot be interpreted as the elasticities as in the case of a log-linear gravity model. The estimated parameter of the variables rather shows the marginal effect on agricultural exports. We computed the marginal effects of the explanatory variable using the STATA software command. For example, the marginal effect of per capita GDP of the United States on the export of agricultural products to the United States shows a 1.1 percent increase for a 1 percent increase in the U.S GDP per capita, among those countries that have positive trade flows, ceteris paribus (Table 4.3). However there was a 0.4 percent reduction in agricultural exports to the United States for a similar increase in per capita GDP of the SSA countries. The direction and magnitude of coefficients of variables representing per capita GDP of U.S remain similar to those found in the OLS equations. The Heckman selection equation reports factors affecting the probability that positive trade occurred between SSA and the United States. For example, the marginal effect on the probability of there being zero agricultural trade observed between SSA and the United States for every 1 percent increase in SSA per capita GDP is 0.09 percent. This means that on average for every percent increase in the SSA per capita GDP there will a 0.09 percent increase in the probability that zero trade is observed.

Overall most of the coefficients were unstable and do not show consistent signs. This might be the result of the fact that the selection bias is not statistically significant and at the same time the coefficients of ρ are small, 0.086 and 0.153 for the two simulated model as shown on Table 4.3. As described in Chapter 3, Silva and Tenrevro (2006) noted that the Heckman and selection estimation methods do not address heteroscedasticity and the normality assumptions of the error terms.

4.3.2 The Poisson Family of Regressions

Results of the Poisson family regressions are reported in Tables 4.4 and 4.5. Estimates of the PPML and NB models are shown in Columns 2 and 3 respectively in each table. The ZIP and ZINB model each consist of two equations that are depicted in columns 4 through 7 in both tables. The choice of a specific Poisson model specification has been done based on formal statistical tests using Akaike's Information Criterion (AIC), and the Vuong test. Silva and Tenrevo (2006) also suggested that selecting a specific Poisson model can also be done based on the consistency of the estimated variables, the economic implications of the parameter estimates and whether the data are over dispersed (i.e. the conditional variance exceeds the conditional mean). Our first test was to choose between PPML and NB. The likelihood ratio test for PPML over NB for over-dispersion favored the NB model. Likewise the subsequent AIC test to choose between the negative binomial (NB) and zero inflated indicated that the NB should be preferred over the PPML and ZIP. Finally using the Vuong test, ZIP and ZINB gave better estimation results than PPML and NB. The test results are shown at the bottom of table 4.4 and 4.5. Furthermore, both models are robust and less sensitive to the heteroskedasticity and normality assumptions of the error terms. Overall, it can be inferred that ZINB performs the best on average, as rated by both criteria. Both table 4.4 and 4.5 show all the four results of the Poisson family regression.

Table 4.4 Poisson family of regressions

	PPML	NB	ZIP		ZINB	
	Export	Export	Export	Logit	Export	Logit
lnGDP per capita SSA	0.0226	0.00504	-0.0492***	0.164	-0.0245	0.216
	(0.27)	(0.07)	(-190.89)	(1.79)	(-0.38)	(1.72)
lnGDP per capita USA	0.036*	0.0205	1.24***	0.427	1.796	0.440
	(2.47)	(1.61)	(56.36)	(0.21)	(1.82)	(0.25)
AGOA dummy	0.0470	0.0147	0.0718***	0.275	0.0458	0.300
	(0.18)	(0.04)	(5.07)	(0.59)	(0.13)	(0.45)
_cons	-22.06	-18.83	-22.30***	-7.193	-19.56	-11.24
	(-1.74)	(-1.08)	(-355.13)	(-0.34)	(-1.23)	(-0.37)
Ln(alpha)		1.606***				1.303***
		(37.42)				(20.87)
Alpha		*4.981*				3.679
		(.2137)				(.20194)

Over dispersion (α) [4]		1.606***		1.303***
AIC	38103.7	13986	25785130	13965
[5]Vuong test				1.11*

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Note: Estimations are not fixed effect

The zero-inflated models generate two sets of parameter estimates (i.e the logit, and the Poisson (ZIP) and binomial (ZINB) labeled “export” in the table 4.4 and 4.5). The coefficient of the parameter estimates of the poison and the logit equations across all models consistently maintained similar signs and the order of the magnitude of these parameters also did not vary greatly (Table 4.4 and 4.5).

Looking at the Poisson part of the ZIP model both in table 4.4 and 4.5, it appears that in an increase in per capita GDP of the SSA countries decreases the expected volume of trade with the U.S when holding all other variables constant. For example, a 10% increase in GDP per capita of SSA decreases the volume of trade to the U.S by 1.12% (ZIP) and 2.0% (ZINB) (Table 4.5). Likewise, a similar 10 percentage increase in GDP per capita of SSA also showed 1.02% (PPML) and 2.23% (NB) falls in trade volume to the U.S. This might be possible if an increase in per capita GDP of countries in SSA leads to higher domestic demand for agricultural goods and eventually a decrease the volume of exports from the SSA countries. This is unlikely; however, as most agricultural exports from SSA countries are export crops such as coffee, cocoa and other commodities not widely consumed in SSA.

As reported in Tables 4.2 and 4.3, U.S. per capita GDP has a positive effect on the exports of agricultural products. The volume of trade increases for a one-percent increase in U.S. per capita GDP ranges between 1.5 to 4 % (Table 4.5). In addition, the parameter estimates generated by the Poisson family models deviate more from the OLS coefficients.

[4] Alpha is the variance of the multiplicative random effect and corresponds to sigma^2, it is estimated to be 1.606 and is highly significant (non-zero).Likelihood ratio test that alpha equals zero, the LR test comparing this model to a PPML model. The associated chi-squared value is 22976 with 1 df. This strongly suggests that alpha is non-zero and the negative binomial (NB) model is more appropriate than the PPML. If the alpha coefficient is zero then the model is better estimated using a PPML regression model.

[5] The Vuong test compares the zero-inflated model negative binomial ZINB with negative binomial (NB) regression model; a significant z-test indicates that the ZINB is preferred over NB.

Table 4.5 Poisson family regressions model -With additional variable

	PPML	NB	ZIP		ZINB	
	Export	Export	Export	Logit	export	Logit
lnGDP per capita SSA	-0.102	-0.223**	-0.112***	0.0598	-0.200**	0.0769
	(-1.32)	(-2.88)	(-419.62)	(0.64)	(-2.89)	(0.73)
lnGDP per capita USA	**3.949*****	**4.010***	**4.407*****	1.462	**4.266****	2.438
	(3.34)	(2.44)	(709.08)	(0.67)	(2.98)	(0.87)
LnAgland%	0.643***	0.609***	0.603***	-0.443*	0.483***	-0.496*
	(4.21)	(3.77)	(7.19)	(-2.43)	(3.46)	(-2.36)
lnExrate	-0.252***	-0.298***	-0.265***	-0.148**	-0.335***	-0.198***
	(-11.82)	(-7.07)	(-22.34)	(-3.19)	(-9.16)	(-3.37)
lnVAD	0.618***	0.735***	0.585**	-0.659***	0.646***	-0.752***
	(11.39)	(11.87)	(12.39)	(-6.95)	(11.96)	(-5.96)
AGOA dummy	0.0743	-0.00727	-0.00191	-0.234	-0.0453	-0.219
	(0.30)	(-0.02)	(-1.43)	(-0.49)	(-0.14)	(-0.37)
_cons	-32.52**	-32.06	-36.84***	-15.15	-34.11*	-25.34
	(-2.67)	(-1.89)	(-574.78)	(-0.67)	(-2.30)	(-0.88)
lnalpha		1.505***			1.110***	
		(34.57)			(19.12)	
Alpha		4.506			3.034	
		(.1962)			(.1761)	
Log seudolikelihood	-7350490	-6365.9	-6485115		-6406.6	
Over dispersion (α) [6]		4.506***			3.034***	
AIC	20734.83	13986	25785130		12639	
[7]Vuong test					1.66 **	

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The inclusion of the three variables i.e Agland%, Exrate, and VAD are taken as a substitute for the country effects.

The zero-inflated logit model identifies groups of countries in SSA that always have zero values. Hence the logit equation in the ZIP and ZINB models show factors affecting the probability of having zero trade values. With respect to the ZIP and ZINB model (Table 4.6), we find that an increase in a per capita GDP of SSA in particular affects the probability of having an agricultural trade export, which can be derived from the logit part of the model. If the per capita GDP increases by 1%, trade probability of countries belonging to the never-trading SSA country

[6] Alpha is the variance of the multiplicative random effect and corresponds to sigma^2, it is estimated to be 4.506 and is highly significant (non-zero). The Likelihood ratio test that alpha equals zero, compares this model to a PPML model. The associated chi-squared value is 22997 with 1 degree of freedom. This strongly suggests that alpha is non-zero and the negative binomial model is more appropriate than the PPML. If the alpha coefficient is zero then the model is better estimated using a Poisson regression model.

[7] The Vuong test compares the zero-inflated model negative binomial, with an ordinary negative binomial regression model. A significant z-test indicates that the zero-inflated model is preferred.

group increases by 0.06% (ZIP) and 0.08 %(ZINB). More or less similar outcomes are observed in Table 4.5. Although the per capita GDP of the SSA countries affects the probability of trading according to the ZIP and ZINB estimation results, the outcome is not statistically significant.

Overall, it can be inferred from results in Table 4.5, that a 1% increase in U.S. per capita GDP leads to a more than proportional increase in imports of eligible agricultural commodities, and this effect is statistically significant across all Poisson family models. Comparing among the Poisson family models, the regression coefficients estimated in the Poisson part of the model are similar, while some of the regression coefficients estimated by OLS, generalized fixed effect and Heckman models differ substantially from the effects under the Poisson and binomial models in Table 4.5.

Even though this study focuses on the impact of AGOA, the effects of other variables on SSA agricultural exports, such as real exchange rates (Ex-rate), agricultural land (Agland%) and value added in agriculture (AgVAD), have also been included in the Poisson family regressions.The inclusion of these variables can also be seen as a substitute for the country effects since the variables are all country-specific characteristics. Results indicate that a significant and important relationship exists between these variables and agricultural exports as shown in Table 4.5.

For instance, an important relationship exists between SSA agricultural exports and the real exchange rate. When the real exchange rate is overvalued the relative price of goods at home is higher than the relative price of goods abroad. In this case, imports increase because foreign goods are cheaper, in real terms, than domestic goods. Thus, when a country's real exchange rate appreciates, net exports decrease and imports rise. Alternatively, when the real exchange rate depreciates, net exports increase and imports fall. As shown on Table 4.5, on average a 1% currency appreciation in SSA countries decreases agricultural exports by 0.25% (PPML), 0.30% (NB), 0.265% (ZIP) and 0.335% (ZINB).

On the other hand, on average a 10 % increase in the value added of the agricultural sector in SSA induces an increase in agricultural exports of6-7%. The proportion of total land area that is used for agriculture has a significant and positive impact on trade. On average a 10 % expansion in agricultural land as a percent of total land in SSA countries increases agricultural exports to the United States by about 6.43% (PPML), 6.09% (NB), 6.03% (ZIP) and 4.83% (ZINB). Except for PPML, the coefficient for the AGOA dummy variable is negative in the

Poisson family models. The coefficient for the AGOA variable suggests that AGOA contributed to an increase in agricultural exports of about 4.81% (PPML), 1.48 % (NB), 7.4% (ZIP-here its impact also turned out to be significant), and 4.7% (ZINB) (see table 4.4). However, when other factors/variables such as exchange rate, agricultural value added and land are included in the estimation, the coefficient for the AGOA variable is insignificant across the four specifications including the ZIP model in which a statistically significant relationship was found when these variables were not included.

More generally, we compared OLS estimates (leaving the zero-valued flows out) with Heckman and Poisson models empirically. Using those models yields relatively similar results regarding the effect of AGOA. The first estimation of the robust OLS and also with fixed effects result indicates that AGOA impact was statistically insignifican. In addition, many of the alternative specifications aimed at accounting for zero values also found AGOA to be insignificant except for the ZIP estimate and that estimate also became negative and insignificant when other variables were added. We also compared the Poisson family model estimations and concluded that ZIP and ZINB perform better based on the test statistics discussed above.

CHAPTER 5: Conclusion

There appear to be very few empirical studies of the impact of AGOA on agricultural trade. For the most part, these studies covered only the early years following the adoption of AGOA when the program was not fully established. According to these studies, agriculture has not benefited greatly from the AGOA provisions, although there is a positive but statistically insignificant relationship between AGOA and SSA agricultural exports to the United States. Growth of the agricultural sector is an important issue for Sub-Saharan African countries since it is still a major source of employment and a key part of foreign exchange earnings for many of them. Agriculture provides more than 70 percent of employment in many Sub-Saharan African countries and about 40 percent of the region’s gross domestic product (World Bank, 2010).

This study developed a gravity trade model framework to explore the impact of AGOA on SSA countries’ agricultural exports using a longer time frame to determine whether AGOA has had greater effects than found in the previous studies and that are only now beginning to show up. This study is also one of the first to address the issue of zero trade flows between the AGOA countries and the United States. The economic model estimated for the study captured the development of agricultural exports to the United States from the 35 eligible countries over the period pre-AGOA (1990-99) and a post-AGOA period (2000-2011). The statistical results in both the OLS-Robust regression and from zero trade modeling (i.e. Poisson family of regressions such as PPML, NB, ZIP, ZINB) are mostly consistent with other studies in finding that the AGOA trade preferences do not have a statistically significant impact on U.S. agricultural imports. In one model the AGOA dummy was statistically significant but that relationship disappeared when additional explanatory variables were added.

Although the coefficient for the AGOA variable is not statistically significant, the sign is generally positive suggesting that AGOA is associated with increases in agricultural exports of (about 24% in the OLS model). There were also some differences in the results when only the 15 SSA largest agricultural exporters were included in the model as opposed to the full model with all 35 countries. Overall, the results in the new zero trade flow modeling did not alter the results a great deal. Another important relationship also exists between SSA agricultural exports and the real exchange rate from the implemented regressions. When there is a currency appreciation in SSA countries relative to the U.S dollar it appears to lead to reductions in the agricultural product exports.

Even though the impact on agricultural trade may have been modest, the effects of AGOA in such sectors as energy, textiles and apparel have been found to be more significant by other analysts (Condon and Stern, 2011). As wages in China and other emerging economies increase, these countries may lose their competitive advantage in textiles and apparel products and this may lead to increased development of these industries in the lower-wage countries in SSA. AGOA may contribute to this transition and, by extension, to increased economic growth and development in SSA. Condon and Stren (2011) in their analysis suggested that the textile and apparel sector transition will be facilitated if non-restrictive rules of origin for SSA products are implemented allowing African exporters the flexibility to freely source inputs and exploit their comparative advantage in labor intensive products. However, with respect to agriculture, the impact of AGOA is likely to remain limited as long as markets for commodities such as sugar, cotton tobacco, peanut oil, and are not fully opened to African exports.

The results of this study are not surprising given that the AGOA preferences were only applied to agricultural products that do not compete with goods produced in the United States. In many SSA countries there is also a general lack of processing of agricultural products and a high dependency on primary agricultural product exports such as coffee, tea, sugar, cocoa beans, cocoa, tobacco, and cotton. AGOA's agricultural benefits are also constrained by quotas that predate AGOA and by the exclusion of some agricultural products from the legslation. Product standards and quality measures, for example sanitary and phytosanitary restrictions which are very important for maintaining food quality, also put additional demands on exporters and can limit agricultural market access for AGOA-eligible agricultural products. In this regard the United States provides capacity-building support to African countries which is a critical part of a strategy to enable SSA countries to negotiate and implement market-opening trade agreements and to improve their capacity to benefit from increased trade. However, more support is needed in terms of a better implementation system and credible monitoring mechanisms to help countries to take advantage of the trade assistance and support and meet required quality standards for the export of processed agricultural products to the U.S. market.

The United States and other foreign aid donors continue to provide foreign aid (about $126 billion in 2012 according to the Organization for Economic Cooperation and Development, OECD) but AGOA and recent initiatives by OECD countries to provide support for the development of infrastructure and the legal framework related to trade ("aid for trade") may reflect a new approach to development that emphasizes capacity building rather than development projects. This shift in the development strategies of governments in high-income countries could have a significant impact on trade, economic growth and development. .

The study also found that AGOA's agricultural benefits are constrained in two major ways. First, the exclusion of certain agricultural products from duty-free access and second, quotas which predate and were not amended by AGOA both limit market access for African agricultural products. Sugar, peanut oil, tobacco, dairy, beef, and processed agricultural goods such as dried garlic or canned fruits are not included in the AGOA program. Other important African agricultural exports such as vanilla, raw chocolate, coffee, tea, cotton and birdseed, are not included in either AGOA or the U.S. GSP. Tariffs on products excluded from AGOA, particularly those applied to agricultural goods remain very high in such products as cotton, tobacco, coffee, tea, peanuts, processed fruits and others.

Therefore, some of the policy recommendations are that the economic impact of AGOA can be improved if preferences are extended to more agricultural products and tariff rate quotas (TRQ) are reformed. TRQ liberalization is generally viewed as a means of increasing market access and in this case it can make AGOA more effective for agricultural products. In addition, as AGOA is set to expire in 2015, extension of the program should be considered. If AGOA could be made more effective through the reforms mentioned and extended for a longer time period, it might help SSA to diversify its main agricultural products. SSA countries also need to use the resources and support from the developed countries effectively to improve their ability to participate in international trade. Investments in infrastructure, institutional arrangements, information services, agricultural productivity and agricultural processing that meets high quality standards are needed to improve Sub-Saharan Africa's commodity competitiveness in regional and global markets.

References

AGOA (2013a). “African Growth and Opportunity Act website,” at http://www.agoa.gov/ accessed on April 12, 2013.

AGOA (2013b). “AGOA.info website,” at http://agoa.info/ accessed on May 7, 2013.

Akanji, O. O. (2007). “Africa Growth and Opportunity Act (AGOA) and African Agriculture,” FAMAN Paper 54384, Farm Management Association of Nigeria, paper presented at conference in Ayetoro, Nigeria, September 4-6, 2007.

Anderson, J. E. (1979). ‘’A Theoretical Foundation for the Gravity Equation,’’ The American Economic Review, 69(1), 106-116.

Anderson, J. E. (2011). ‘’The Gravity Model, Paper prepared for Annual Review of Economics,’’ vol.3.

Andersen, J.E. and E. Van Wincoop (2003). ‘’Gravity with Gravitas: A Solution to the Border Puzzle,’’ The American Economic Review, Vol. 93, issue 1, pp. 170-92, Nashville.

Arieff, Alexis, Martin A. Weiss and Vivian C. Jones (2009). ”The Global Economic Crisis: Impact on Sub-Saharan Africa and Global Policy Responses,” Congressional Research Service, Washington, DC.

Arieff, A. (2010). ‘’Global Economic Crisis: Impact on Sub-Saharan Africa and Global Policy Responses,’’ DIANE Publishing

Asmah. E. and O. Taiwo. (2010). “AGOA and the African Agricultural Sector,” in *AGOA at 10:* Challenges and Prospects for U.S.-Africa Trade and Investment Relations (Brookings, 2010)

Baldwin, R. and T. Murray. (1977)."MFN Tariff Reductions and LDC Benefits under the GSP," Economic Journal, 87, 30-46.

Bayoumi, T and B., Eichengreen. (1997). “Is Regionalism Simply a Diversion? Evidence from the Evolution of the EC and EFTA,” in Takatoshi Ito and Anne O. Krueger, eds. Regionalism versus Multilateral Trade Arrangements. Chicago: University of Chicago Press.

Bergstrand, J. H (1985). ”The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence.” The Review of Economics and Statistics, 67, pp. 474-81.

Bergstrand, J. H (1989). “The Generalized Gravity Equation, Monopolistic Competition, and the Factor- Proportions Theory in International Trade,” Review of Economics and Statistics. pp. 143-53.

Brakman, S. and van Bergeijk, P.A.J. (2010).”The Gravity Model in International Trade: Advances and Applications,” Cambridge University Press

Brenton, Paul and Takako Ikezuki (2005). “The Impact of Agricultural Trade Preferences with Particular Attention to the Least Developed Countries,” in *Global Agricultural Trade and the Developing Countries*, edited by Ataman Aksoy and John C. Beghin. Washington, DC: The World Bank.

Brenton, P. and Hoppe, M. (2006). "The African Growth and Opportunity Act, exports, and development in Sub-Saharan Africa," World Bank Policy Research Working Paper, (3996).

Buch C.M, and D. Piazol(2001). "Capital and trade flows in Europe and the impact of enlargement," Econ Syst 2001; 25(3): 183-214.

Burger, M., Van Oort, F. V., & Linders, G.-J. (2009). "On the Specification of the Gravity Model of Trade: Zeros, Excess Zeros and Zero-Inflated Estimation," Spatial Economic Analysis, *4*(2), 167-190.

Cameron, A. C., and P. K.Trivedi (2010)."Microeconometrics Using Stata (Revised ed.)." College Station,Texas: Stata Press.

Charles, E. and C., Carol (2011). "U.S. Agricultural Trade: Trends, Composition, Direction, and Policy," CRS Report for Congress.

Cheng, I-Hui, and W, Howard J. (1999/2005). "Controlling for Heterogeneity in Gravity Models of Trade and Integration." Federal Reserve Bank of St. Louis Review, Vol. 87(1), January/February

Choi, I. (2001)."Unit root tests for panel data" Journal of International Money and Finance 20: 249–272.

Collier, P., and A. J. Venables, (2007). "Rethinking trade preferences: how Africa can diversify its exports." *The World Economy*, *30*(8), 1326-1345.

Condon, N and M. Stern (2010). "The Effectiveness of African Growth and Opportunity Act (AGOA) in Increasing Trade from Least Developed Countries: A Systematic Review." London: EPPI- Centre, Social Science Research Unit, Institute of Education, University of London.

Coughlin, Cletus C. and Wall, Howard J. (October 2003). "NAFTA and the Changing Pattern of State Exports." Papers in Regional Science, *82*(4), pp. 427-50.

Eichengreen, B. and, D. A. Irwin (1998). "The Role of History in Bilateral Trade Flows," in Jeffrey A.Frankel, ed., The Regionalization of the World Economy. Chicago: University of Chicago Press,1998, pp. 33-57.

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

European Commission (2013). "Everything but Arms," at: http://trade.ec.europa.eu/doclib/docs/2013/april/tradoc_150983.pdf accessed October 15, 2013.

FAOSTAT (2013). "FAOSTAT: Trade, Crops and Livestock Products." Food and Agriculture Organization accessed at: http://faostat.fao.org/site/535/DesktopDefault.aspx?PageID=535#ancor

FAS/USDA (2013). "Global Agricultural Trade Statistics (GATS)." Foreign Agricultural Service (FAS), USDA at: http://www.fas.usda.gov/gats/ExpressQuery1.aspx

Feenstra, Robert C. (2004). *Advanced International Trade: Theory and Evidence*. Princeton: Princeton University Press. Chapter 5-reviews the gravity model in light of trade theory.

Flowerdew, R. and M. Aitkin (1982). ‘’A Method of Fitting the Gravity Model Based on the Poisson distribution,’’ Journal of Regional Science, 22(2), 191-202.

Frazer, G. and Van Biesebroeck. (2007), "Trade growth under the African Growth and Opportunity *Act*." NBER Working Paper Series, National Bureau of Economic Research, July 2007.

Francois, J. B. Hoekman and M. Manchin.(2005),"Quantifying the Magnitude of Preference Erosion due to Multilateral Trade Liberalization", background paper for the DFID Global Trade Architecture project.

Froning, Denise H. (2000). "The Benefits of Free Trade: A Guide for Policymakers." *Hertigage.org*. The Heritage Foundation, acessed on December, 2012.

Glick, R and Rose, Andrew K. (July 2001). “Does a Currency Union Affect Trade? The Time Series Evidence.” NBER Working Paper No. 8396, National Bureau of Economic Research.

Greene, H. (2011). Econometric analysis, 7th ed. Upper Saddle River, NJ: Prentice Hall

Harris, D. F. and E. Tzavalis, (1999). "Inference for unit roots in dynamic panels where the time dimension is fixed," Journal of Econometrics, Elsevier, vol. 91(2), pages 201-226

Haykin, S.M.(1997). "The Challenge of African Economic Recovery & Development,"The United States Assistance Strategy for Africa.

Heckman, J.J. (1979). "Sample selection bias as a specification error," *Econometrica*, 47,153-61.

Hilaire, A., and Yang, Y. (2003). ‘’The United States and the new regionalism/bilateralism,’’ International Monetary Fund. (No.2003-2206)

Hoekman, B. (2005). "Trade Preferences and Differential Treatment of Developing Countries: A Selective Survey." World Bank Policy Research Working Paper 3566.

Hoffmann, R, & Kassouf, A. L. (2005). "Deriving Conditional and Unconditional Marginal Effects in Log Earnings Equations Estimated by Heckman's Procedure." Applied Economics, 37(11), 1303-1311

International Monetary Fund(IMF) (2010). ‘’Review of the IMF Trade Restrictiveness Index,’’ accessed at http://www.imf.org/external/np/pp/eng/2005/021405r.htm, June, 2013.

IMF (2010).’’Regional Economic Outlook: Sub-Saharan Africa,’’ http://www.imf.org/external/pubs/ft/reo/2013/afr/eng/sreo0513.pdf last accessed July 22, 2013

IMF (2007). “Regional Economic Outlook: Sub-Saharan Africa,” *World Economic and Financial Surveys*, Washington DC: International Monetary Fund at: http://www.imf.org/external/pubs/ft/reo/2007/AFR/ENG/sreo0407.pdf accessed October 21, 2013.

ITC (2013). "African Growth and Opportunity Act," Washington, DC: International Trade Administration, U.S. Department of Commerce at: http://trade.gov/agoa/ accessed June 20, 2013.

International Trade Administration (2010). U.S.- Sub-Saharan Africa Trade Profile.

International Food and Agricultural Trade Policy Council (2009). ''U.S. Tariff Rate Quotas and AGOA Market Access,'' Policy Brief Number 10

James, E. Anderson, (January 2011). "The Gravity Model," Boston College and NBER.

Jayum, A. A, Zaid A.B & A., Asnarulkhadi, (2010) "Africa's Slow Growth and Development: An Overview of Selected Countries", European Journal of Social Sciences. Volume 16, Number 4

Jones V. C. (2013). "Generalized System of Preferences: Background and Renewal Debate," Congressional Research Service, Washington, DC.

Jones, V. C., and Williams, B. R. (2012). ''U.S. Trade and Investment Relations with sub-Saharan Africa and the African Growth and Opportunity Act,'' Congressional Research Service, Washington, DC.

Jones V. C and J. F. Hornbeck (2013)."Trade Preferences: Economic Issues and Policy Options," Congressional Research Service, Washington, DC.

Kepaptsoglou, K., Karlaftis, M. G., & Tsamboulas, D. (2010). "The gravity model specification for modeling international trade flows and free trade agreement effects: A 10-year review of empirical studies," The open economics journal, 3, 1-13.

Lall, S. (2005). "FDI, AGOA and Manufactured Exports from a Land- Locked, Least-Developed African Economy: Lesotho." *Journal of Development Studies*

Linders, G.J.M. and H.F.L. de Groot (2006). "Estimation of the gravity Equation in the Presence of Zero Flows," Tinbergen Institute Discussion Paper, 2006-072/3.

Lionel, F. M. & D. Anne-C´elia (2007). "The Impact of Regulations on Agricultural Trade: Evidence from SPS and TBT Agreements," January 29, 2007.

Martin, Will and Cong S. Pham (2013). "Estimating the Gravity Model When Zero Trade Flows are Frequent," unpublished manuscript, World Bank (July 5, 2013).

Matto, A, Roy, D, & Subramanian, A. (2002). "The Africa Growth and Opportunity Act and Its Rules of Origin: Generosity Undermined?" International Monetary Fund Working Paper, September 2002.

Mátyás, L.(1997). "Proper Econometric Specification of the Gravity Model." The World Economy, 20(3), pp. 363-68.

Millimet, D. L., & Osang, T. (2004/2007). "Do state borders matter for US international trade? The role of history and internal migration," Canadian Journal of Economics/Revue canadienne d'économique, 40(1), 93-126.

Moyo, Dambisa (2012). *Dead Aid: Why Aid is Not Working and How There is a Better Way for Africa.* New York: Farrar, Strauss and Giroux.

Mueller, T. F. (2008). "The effect of the African Growth and Opportunity Act (AGOA) on African exports to the U.S." Paper presented at the annual meeting of the ISA's 49th annual convention, bridging multiple divides, San Francisco, CA, USA, Mar 26, 2008.

Nouve, K. (2005). "Estimating the effects of AGOA on African exports using a dynamic panel analysis." World Bank Policy Research Working Paper Series, July 2005.

Nouve, K. and J, Staatz (2003). "Has AGOA increased agricultural exports from Sub- Saharan Africa to the United States?"

Nouve, K. and J. Staatz (2003). "The African Growth and Opportunities Act and the Latent Agricultural Export Response in Sub-Saharan Africa." Paper presented at the 2003 Annual Meeting of the American Agricultural Economics Association in Montreal, Quebec, Canada, July 27-30.

OECD (2011). ''Aid For Trade at a Glance 2011: Showing Results," Paris: Organization for Economic Cooperation and Development.

OECD (2013). "Aid Statistics: Total DAC Flows at a Glance," Paris: Organization for Economic Cooperation and Development, at: http://www.oecd.org/dac/stats/totaldacflowsataglance.htm accessed June 15, 2013.

Okonjo-Iweala, Ngozi (2007). "Aid versus Trade," TED Talks, TedGlobal, at: http://www.ted.com/talks/ngozi_okonjo_iweala_on_aid_versus_trade.html, accessed October 14, 2013.

Office of the U.S. Trade Representative (2008). "Comprehensive report on the U.S. Trade and Investment Policy toward Sub-Saharan Africa and the implementation of the African Growth and Opportunity Act." Washington, US: Office of U.S Trade Representative.

Olarreaga, M. and C, Ozden (2005). "AGOA and Apparel: Who Captures the Tariff Rent in the Presence of Preferential Market Access?" World Economy Vol. 28, No. 1

Ombuki, C. N. (2011). "The Effect of African Growth and Opportunity Act (AGOA) on Exports of Eligible Countries: Panel Data Evidence"

Özden, C., & Sharma, G. (2004). "Price effects of preferential market access: Caribbean basin initiative and the apparel sector." World Bank Policy Research Working Paper 3244. Washington, D.C.World Bank.

Pakko, M., & Wall, H. (2001). "Reconsidering the trade-creating effects of a currency union." Available at SSRN 275248.

Porojan, A.(2001). "Trade flows and spatial effects: the gravity model revisited." Open Econ Rev; 12: 265-80.

Philippidis, G., H. Resano-Ezcaray and A. I. Sanjuán-López (2013). “Capturing Zero-Trade Values in Gravity Equations of Trade: An Analysis of Protectionism in Agro-Food Sectors,” *Agricultural Economics*, 44: 141-159.

Remy, H. and M. J. Applegate (2008). “The West African Economic and Monetary Union and the African Growth and Opportunity Act: A Computable General Equilibrium Approach,” *Journal of Economics*, 34(1): 45-75.

Rolfe, R. J. and D. P. Woodward (2005).”African Apparel Exports, AGOA, and the Trade Preference Illusion,” *Global Economy Journal*, 5(3): 1-28.

Santos Silva, J.M.C.and S, Tenreyro, (2006). "The log of gravity," The Review of Economics and Statistics 88, 641–658.

Sanso, M., Cuairan, R., & Sanz, F. (1993). "Bilateral trade flows, the gravity equation, and functional form." *The Review of economics and Statistics*, 266-275.

Schneidman, W and L. Zenia A. (2012). "The African Growth and Opportunity Act: Looking Back, Looking Forward," Brookings Africa Growth Initiative.

Seyoum, B. (2007). "Export performance of developing countries under the Africa Growth and Opportunity Act experience from US trade with Sub-Saharan Africa." Journal of Economic Studies,34(6):515 – 533.

Tadesse, B. and F. Bichaka (2008). "The impact of African growth and opportunity act (AGOA) on U.S. imports from Sub-Saharan Africa (SSA)." Journal of International Development, 20(7):920–941.

Tinbergen, J. (1962). "Shaping the World Economy," New York: The Twentieth Century Fund

United Nations (2013). “World Exports by Provenance and Destination (Table D),” *International Merchandise Trade Statistics*, New York: United Nations, at: http://comtrade.un.org/pb/WorldTables.aspx?y=2012 accessed October 18, 2013.

USDA/GATS, Data and Statistics, http://www.fas.usda.gov/gats/ExpressQuery1.aspx), last accessed July 22, 2013

U.S Department of Commerce (USDC, 2011). Foreign Trade http://www.commerce.gov/, http://www.census.gov/foreign-trade/data/ last accessed July 22, 2013

United Nations Conference on Trade and Development (2010/2011): "Generalised System of Preferences: List of Beneficiaries," United Nations, New York and Geneva.

United States International Trade Commission (USITC, 2011) website accessed at http://dataweb.usitc.gov/

United States International Trade Commission (2006). "Export Opportunities and Barriers in African Growth and Opportunity Act-Eligible Countries," April, 2006.

United States Department of Commerce.(USDC, 2011). http://www.esa.doc.gov/economic-indicators/2011/07/us-international-trade-goods-and-services last accessed June, 2013

USITC (2000): "Advice on Providing Additional GSP Benefits for Sub-Saharan Africa," USITC Publication 3359.

USITC (2007): "Sub-Saharan Africa: Factors Affecting Trade Patterns of Selected Industries, First Annual Report", USITC Publication 3914.

USTR (2011). "Trade Policy Agenda and Annual Report," http://www.ustr.gov/2011_trade_policy_agenda last accessed June 15, 2013

USTR (2012). "Trade Policy Agenda and Annual Report,'' http://www.ustr.gov/about-us/press-office/reports-and-publications/2012-0 last accessed June 15,2013

Vuong, Q. H. (1989). Likelihood Ratio Tests for Model Selection and Non-nested Hypotheses. Econometrica, 57(2), 307-333

Wall, Howard J.(2000). "Gravity Model Specification and the Effect of the Canada-U.S. Border." Working Paper No. 2000-024A, Federal Reserve Bank of St. Louis.

White, H. (1980). "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity". *Econometrica* **48** (4): 817–838.

Will, M. and S. P. Cong (2013). '' Estimating the Gravity Model When Zero Trade Flows Are Frequent,'' World Bank Working Paper

Wooldridge, J.M. (2002). "Econometric Analysis of Cross Section and Panel Data". Cambridge: The MIT Press.

World Bank (2013). *World Development Indicators*, World Bank, Washington, DC available at. http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators

World Bank,(2006). "Trade Preferences and Differential Treatment of Developing Countries," Policy Research Working Paper 3566, Bernard Hoekman.

World Bank (2010). ''An analysis of issues shaping Africa's economic future,'' http://www.worldbank.org/content/dam/Worldbank/document/Africa/Report/Africas-Pulse-brochure_Vol7.pdf, last accessed May, 2013

World Bank (2011). ''Millennium Development Goals: Gains Were Significant Before the Crisis,''http://go.worldbank.org/2E3YYC13C0, accessed April, 2013.

World Bank (2011). ''Global Economic Prospects: Sub-Saharan Africa Annex,'' http://siteresources.worldbank.org/INTGEP/Resources/335315-1307471336123/7983902-1307479336019/AFR-Annex.pdf, last accessed May 12, 2013

World Bank (2012). ''Global Economic Prospects: Sub-Saharan Africa Annex,'' http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1322593305595/8287139-1339427993716/GEP12bSSA_RegionalAnnex.pdf, last accessed May 12, 2013

WTO (2011). *World Trade Report 2011*, WTO, Geneva.
http://www.wto.org/english/res_e/publications_e/wtr11_e.htm, last accessed July 22, 2013.

WTO (2011), *International Trade Statistics 2011*.
http://www.wto.org/english/res_e/statis_e/its2011_e/its2011_e.pdf, last accessed July 22, 2013.

Xiong, B.,& Beghin, J. (2011). Does European Aflatoxin Regulation Hurt Groundnut Exporters from Africa? European Review of Agricultural Economics.