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The Effect Of Trade Openness On Economic Growth: The Case Of African Countries

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Biographical Sketch

Akua Sakyiabea Akuffo was born on February 8, 1985, in Kumasi, Ghana. She received her Bachelor of Science degree in Agriculture from Kwame Nkrumah University of Science and Technology in 2008. She majored in Agriculture with a concentration in Agronomy and graduated with a Second Class Upper. She worked as a Teaching and Research Assistant at the Department of Crops and Soil Sciences at the Kwame Nkrumah University of Science and Technology, from August 2008 to July 2009. She is a candidate for the Master of Science degree in Agricultural Economics.

Dedication

I dedicate this thesis to my family, Prof. Frederick Akuffo, Mrs. Patience Akuffo, Afua Ohenewa Akuffo, Michelle Akuffo, Akosua Sakyiabea Akuffo and Kwasi Ohene Akuffo, for the confidence and encouragement they provided me during my course of study. I really appreciate the support.

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List of Abbreviations

AGOA	African Growth and Opportunity Act
ASEAN	Association of South Eastern Asian Countries
BoP	Balance of Payment
CAR	Central African Republic
CPI	Consumer Price Index
ERP	Economic Recovery Program
FDI	Foreign Direct Investment
FTAs	Free Trade Agreements
GDP	Gross Domestic Product
MSE	Mean Square Error
PPP	Purchasing Power Parity
PWT	Penn World Tables
RanOne	Random One Way
RanTwo	Random Two Way
RMSE	Root Mean Square Error
RTS	Returns to Scale
TFP	Total Factor Productivity
UN	United Nations
VAR	Vector Auto Regression
WTO	World Trade Organization

Abstract

Akuffo, Akua Sakyiabea. THE EFFECT OF TRADE OPENNESS ON ECONOMIC GROWTH: THE CASE OF AFRICAN COUNTRIES. (**Major Advisor: Dr. Osei-Agyeman Yeboah**), North Carolina Agricultural and Technical State University

The main objective of this study was to measure the effects of trade liberalization on the economic growth of African countries. A modified Cobb-Douglas production function as in Miller & Upadhyay (2000) was employed to determine the impact of trade factors on Gross Domestic Product (GDP) as well as the determining Returns to Scale (RTS) of the individual economies. The factors include Foreign Direct Investment (FDI), exchange rate, capital-labor ratio, and trade openness. Trade openness was computed as the ratio of total of imports and exports to total exports. Alternative panel models including the One-Way Fixed/Random Effects models and the Two-Way Fixed/Random Effects model were developed using time series and cross-sectional data from1980 to 2008.

Based on the results from the summary statistics for all panel models, the Two-Way Random effects model was selected using the mean square error, root mean square error and the results from the Hausman test as selection criteria. The results show that trade openness has a positive effect on GDP growth. The only trade factor that was also found to significantly impact the GDP growth was Exchange rate. These results are comparable to those reported in the literature. The results of the Two-Way Random Effects model provided an average economic growth rate of 0.60 % for the continent. Ghana, South Africa and Botswana were the only countries that exhibited increasing Returns to Scale (RTS) greater than 1.0 while Guinea Bissau recorded no growth.

CHAPTER 1

Introduction

1.1 Background

Since the 1970s, African countries have been skeptical about the virtues of free trade; but all this changed in the late 1980s, when countries started developing interest in multilateral trade agreements. This interest stemmed out of three areas: the slow pace of regional integration has brought about dissatisfaction among African nations that want to liberalize trade; the belief that if trade is well managed, it will play an important role in the development challenges being faced by the continent; and finally the fact that trade can initiate and foster regional integration efforts (Taljaard, 2007). In 1994, the World Bank identified the main factors contributing to Africa's poor economic performance in the 1960s and mid 1980s as poor macroeconomic and sectoral policies respectively (Yu & Nin-Pratt, 2011). In Sub Saharan Africa, the GDP per capita fell by 5 % with the poverty level rising from 47.4 % to 49 % between 1990 and 1999 (Pinkovskiy & Sala-i-Martin, 2010; World Bank, 2004;). Between 1980 and 2004, the average per capita GDP for 21 countries in Africa was 0.7 % which was half of what the rest of the world was growing at 1.4 % (Anderson & Masters, 2008). But in recent years, African countries have shown improvement in economic growth at an average rate of 6 % per year.

According to Miller & Upadhyay (2000), the effect of trade openness on economic growth remains a highly debatable issue since theory is ambiguous regarding the effect trade openness has on economic development. Trade as a share of GDP in Africa increased from 38 to 48 % between 1988-1989 and 1999-2000. In spite of this increase, the share of the region in world trade has declined due to the slow growth of its exports as compared to the world. The composition of Africa's exports has also contributed to its marginalization in world trade, the

continent's exports have comprised of primary goods particularly agricultural produce which are not competitive on the international market due to low productivity and unfavorable exchange rates. Also the prices of such commodities continue to decline relative to manufactures and they are characterized by a high degree of price volatility on the world market (United Nations (UN), 2001). The problem of export dependency on primary goods is that it becomes even more dominant as one move from the regional level to the individual country. In order to reduce the problem of over dependency on primary commodities, some countries have been moving into exports of processed goods and manufactures. This effort however has not been that successful in improving international competitiveness in such products due to once again the inability to meet the quantity demanded on the international level and the declining exchange rates (UN, 2001).

Extensive trade openness in the 1980s along with some trade reforms have aided some of Africa's leading reformers, such as Ghana and Uganda, recover from periods of economic decline. But these countries are as yet to reach the level of per capita income they had in the 1970s. Other trade reformers including Mali and Gambia have boosted their trade volumes although they still have less to show in terms of economic growth, resulting from participation in trade openness reforms (Rodrik, 1997).

1.2 Trade Openness

Trade openness has been defined by many economists in different studies; Edwards (1993) states that trade openness has become synonymous with free trade, that is where the system of trade is free from all trade distortions like tariffs and transportation costs. Baldwin (2003) stated that trade openness can be interpreted narrowly to include only imports and export taxes or subsidies as well as non-tariff distortions of trade or broadly to include exchange rate

policies, domestic taxes and subsidies, competition and other regulatory policies, educational policies, the form of government and the general nature of institutions and culture. The definition of trade openness is subject to the variables being studied and the availability of data for the countries involved. Depending on how one defines the term openness also affects the conclusions about a particular country.

Due to the various definitions, trade openness has been measured in several ways in the various studies that have been conducted in trying to establish a relationship between growth of an economy and trade openness (Yanikkaya, 2003). One characteristic these measures have in common is that they all express trade openness as a share of the country's total income or GDP. The three most popular and traditional measures are: M/GDP; X/GDP; and (X + M)/GDP; where M and X represent imports and exports, respectively (Squalli & Wilson, 2006). Other measures of trade openness include that by Sachs & Warner (1995, 1997a, b) used population density to measure trade openness of countries. The authors constructed the ratio of total population to total area so that higher ratios imply more open economies. Densities have been used in the literature as a measure of openness due to the belief that countries with higher densities are more likely to be open would have more international contacts. Krueger (1978) in her paper she discusses how trade openness can be achieved by employing policies that lower the biases against the export sectors. According to her definition of trade openness, a country can have an open economy by employing a favorable exchange rate policy for its export sector and at the same time protecting its import sector through trade barriers. This can be expressed as (X + M)/X (Krueger, 1978). Most empirical studies have used trade policy measures but according to Rodrik (1999), this measure has limitations in terms of capturing the broad pattern of the different types of trade policies across countries and over time.

1.3 Factors of Trade Openness and Economic Growth

There is a lot of literature on the relationship between the scale and the scope of a nation's trade sector and its contribution to economic development. Positive linkages have been identified between a country's rate of economic growth and its openness to international trade, while some studies have failed to establish this relationship (Ackah, 2006). In addition, (Balassa 1985; Bhagwati, 1988 and Ram, 1985) also reported positive relations between exports and economic growth in some developing countries. Other studies also suggested a number of factors that are important when determining how much trade contributes to economic growth in developing nations. The factors include exports, imports, exchange rate, FDI, trade openness index among others; however their specific effects are not clearly known and how much they affect the growth of the economy of an African country and the region.

For several reasons, Africa until the 1990 did not fully embrace trade openness in the form of Foreign Direct Investment (FDI) as an important contribution to economic development. One of the main reasons was that the policymakers of Africa believed that the full potential of foreign investment cannot be fully realized in the region as the region is not well positioned to attract enough foreign investment into the dynamic products and sectors which have high income elasticities (UN, 2001).

Exchange rate has become an important issue for many researchers due to its effects on businesses, investments and trade policy decisions. The Plaza Agreement signed in 1985 was the first of its kind; it was drawn to keep the exchange rates in check and also force adherence to long term equilibrium rates (Cline, 1994). Some economists argue that by changing the nominal exchange rate the real exchange rate will be affected. The relationship between exchange rate and trade balance has drawn a lot of attention lately. The elasticity model of trade balance has

depicted that there is an existing theoretical relationship between exchange rate and the trade balance (Krueger, 1983). When a country devalues its nominal exchange rate, there is the assumption that the real exchange rate also changes. A devaluation causes an increase in the volume of exports whiles volumes of imports reduces as they become more expensive, this causes an improvement in the balance of trade for that country (Liew, Lim & Hussain, 2003). In a situation where the nominal exchange rate is devalued or appreciated, a short run phenomena known as the J-Curve comes into play. The J-Curve describes the movement of the trade balance. In the initial stages, a country will become worse in terms of its trade balance but eventually improves. The J-Curve hypothesis is as a result of the use of contracts in international trade; export contracts are written in the domestic currency and import contracts in the foreign currency. The price effect works faster than the volume effect following a depreciation of a country's exchange rate (Liew, et al., 2003). The exchange rate is a major determinant in determining balance of payments (BoP) position and external competitiveness of a country. The exchange rate exerts a major influence on the resource allocation and also the use of productive resources between tradable and non-tradable goods. It also affects the investment and savings decisions of a country and this influences the direction and nature of trade flows across countries (D.B. Ndlela & T. Ndlela, 2002).

1.4 Problem Statement

Not until the end of the 1970s, economic growth in Africa was relatively slow. The performance of the African continent in the late 1970s and early parts of the 1980s became progressively worse as a result of structural and institutional bottlenecks, adverse external developments and policies (UN, 2001).While other nations were trying to restore economic growth after the economic meltdown of the 1980s, Africa continued in stagnation and decline

during the first half of the 1990s. Most of the African countries adopted structural adjustment programs during the Bretton Woods Era (the period after world war II where the exchange rate was pegged to the gold standard) including "rapid and extensive liberalization, deregulation and privatization of economic activity in search of a solution to the stagnation and decline" (UN, 2001). The level of investment in many countries on the continent exceeded 25 % of their total GDPs and the savings gap between these countries and the rest of the world remained relatively moderate (UN, 2001).

Since the 1990s, trade orientation declined due to exports from Africa growing slower than the level of world exports. According to the UN report on Africa (2001), marginalization of the African continent is the outcome of the interaction of declining terms of trade with the inability of the region to expand its productive capacity and shift to dynamic products. African countries, according to the experts, should focus on growth enhancing policies including promotion of exports of dynamic products (UN, 2001).

Africa's GDP growth trend has been closely linked with its exports volumes to other parts of the world. The growth rate of exports was low compared to the global average of 6.1 %. This caused the region's export share in the global market to decline to about 3.1 %, almost half of the original growth rate. However, it has also been observed that as these countries began to open up their markets to the outside world, the share of exports in GDP has reversed its decline (Anderson et al., 2008). Bernard & Jensen (1999) also found that, mainly through reallocation of resources from less efficient to more efficient plants (Ricardian theory); the productivity of manufacturing exporters within the same industry did grow faster than non-exporters.

Africa's FDI shares have been falling since the 1970s. It plummeted from 5 % in the 1970s to about 1.8 % in the 1990s with a further 1 % drop in 1999 - 2000 (Dupasquier &

Osakwe, 2005). The destination of FDI inflows has been targeted to the few resource-rich countries. However, in recent times developing African economies like Tanzania, Tunisia, Uganda and Ghana have attracted rapidly increasing FDI inflows. In 1999, FDI accounted for 10.4 % and 5.2 % of Ghana and Zambia's GDPs respectively (Ahmed, Cheng & Messinis, 2008).

1.5 Justification

Trade is a very important contributor to economic development of any nation. The region's total contribution to world trade is just 2 % considering all the products that are exported from Africa. If Africa is able to increase its share of world trade by just about 1 %, it will increase its annual income by about $70 billion. This can be achieved through free trade agreements such as the African Growth and Opportunity Act (AGOA). AGOA was initiated by the U.S. with eligible African countries to encourage trade and investment through the reduction of tariff and non-tariff barriers on African products to the U.S. market (International Trade Administration, 2010).

From economic literature, as countries trade with each other, they open up their borders and this to improved economic development through job creation and income generation (U.S. Trade Representative, 2011). In addition, trade liberalization promotes the efficient allocation of resources, it opens the door to technological diffusion from abroad and it causes the local monopolists to lose ground in the local market (Sachs & Warner, 2011). A nation with a larger trade volume implies greater openness and this enhances the rate at which that nation's economy adopts more efficient techniques of production which leads to a faster growth of total factor productivity (TFP) and hence real per capita income (Miller & Upadhyay, 2000). Ahmed et al. (2008) observed that trade liberalization had a positive and significant effect on financial and

trade related reforms and each worked to enhance market efficiency, they reduced distortions in price and fostered Africa's competitiveness and access to the global market; thus promoting inflow of capital and expansion of exports.

Trade openness policies if adopted will have beneficial implications for both Africa and their trading partners particularly the U.S. The African Growth Opportunity Act (AGOA) since its inception has aided the increase in the two-way trade between Sub-Saharan Africa and the U.S. In 2011, U.S. exports to Sub Saharan Africa increased by 23% reaching $21 billion in exports. But in comparison, exports from the U.S. to the rest of the world increased by only 15%, showing relative increase in exports to Africa compared to the rest of the world (International Trade Administration, 2010). Trade openness will not only enhance the market access for African imports to U.S. , since one of the goals of AGOA is to eliminate barriers to U.S. Trade including qualifying African countries having tariff-free access to the U.S. market. It will also provide an expanded market access U.S. exports to African as a welfare gain for both countries. Increase in the inflow of foreign investments will also reduce the dependence of African countries on Foreign aid coming from the U.S.; and the balance of payments (BoP) for African countries will also improve with the inflow of capital.

Trade openness will also cause a currency appreciation of the local currency relative to the U.S. Dollar through the increased inflow of foreign investment. A floating exchange rate can be adopted with the appreciation of the local currency relative to the U.S. Dollar to reduce financial risks in the foreign exchange market. A floating exchange rate will provide an automatic rectification of any disequilibrium in the balance of payments as there will be no pressures to devalue or revalue. Trade openness again; will help improve the capital to labor ratio through the increase in capital investments and employment. Over six thousand jobs in the textile

industry have been created in Namibia since the inception of AGOA (International Trade Administration, 2010). The increase in employment opportunities will reduce the level of immigration from Africa to the U.S. for those in search of better jobs and living conditions. The local government will be able to pursue their own internal policies particularly pertaining to economic growth without external constraints (Markets, 2010).

1.6 Objectives

The overall goal of this study was to determine the impact that trade openness and its factors-FDI and Exchange rates have on economic growth for thirty-eight selected African countries. This goal will be achieved through the following specific objectives:

1. To econometrically determine the relationship between GDP/capita and trade openness using the following trade factors; FDI, Exchange Rate and capital-labor ratio.
2. To determining the overall returns-to-scale for the whole continent and for the individual countries.
3. To provide policy recommendations on trade openness for Africa.

The thesis is outlined as follows; Chapter Two focuses on the identification of trade variables of interest mainly exchange rate, Foreign Direct Investment (FDI), trade openness and Capital-labor ratio and their relationship on GDP. It also documents the review of studies reported in the literature.; Chapter Three describes the methodology used; also provides definitions of the variables and the data sources; Chapter Four results and discussions of the models which are: the Two-Way Random Effects model and the Parks Estimation model employed in the study including the various returns to scale of the individual economies and the average economic growth of the continent; and Chapter Five includes a summary of the

methodology, the significant findings of the study and the recommendations based on these findings.

CHAPTER 2

Literature Review

2.1 Trade Openness and Productivity

A number of studies have measured the effect of international trade on economic growth of selected African countries using a number of different models. Puente & Calvo (2009) used cross-country data, multiple regressions and the fixed effect model in studies where results suggested outward-oriented economies to have positive economic growth. Several others like Njikam, Binam & Tachi (2003) have used production function in their study. The authors specifically used the Cobb Douglas production function and estimated it econometrically using three different approaches; time-series growth accounting, cross-section growth accounting and the panel regression approach respectively. Other studies including that by Ahmed et al. (2008) have made use of time-series procedures including Granger-causality test to explore the theory of increased trade leading to higher incomes (Squalli & Wilson, 2006). This study also adopts the Cobb Douglas Production function but it has been modified to apply time series cross sectional panel data models namely the One-Way, Two-Way Fixed and Random Effects models. No causality tests will be conducted. Estimates of these models will take into account the effect of the differences in countries and also time on the impact of trade openness on economic development.

Recently an addition has been made to the existing literature by examining the effect of international trade on productivity at a micro level using a unique Indonesian data set using a growth model (Sjoholm, 1997). In line with the new theories on international trade and economic growth, the main focus was examination of the relation between the share of international trade and productivity growth. This was a follow up on a previous micro level study

which set out to examine the connection between shares of international trade and levels of productivity. The author also examined the effect on productivity of not only exports, but also imports. Results suggest that knowledge transfers through both imports and exports increase productivity, but imports as a variable have, in general, been left out of most empirical studies. One exception however is Blomström, Kokko & Zejan (1994), who examined growth in real per capita income from imports of capital equipment in seventy-eight developing countries. He found imports had no effect. Both imports and exports were used as factors of trade in this study to establish the relationship between trade openness and economic growth in thirty-eight African countries.

Levine & Renelt (1992) used both exports and imports as a share of GDP to measure the degree of openness, but they did not include both measures simultaneously in their regressions, which prevented a direct comparison of their effects. However it seemed the two measures were highly correlated in the Levine & Renelt sample of countries, since their respective coefficients were of equal size. Again, imports and exports could depend on the use of aggregated cross-country data, since countries' imports and exports are likely to be highly correlated. The results from the econometric estimations also showed establishments participating in exports or imports had relatively high levels of productivity. Moreover, there was a positive relation between exports and productivity growth. This suggested that participation in exports increased the growth of productivity. There were also indications of a positive growth effect from imports, but the result was sensitive to changes in the specification of the variables and test equation (Sjoholm, 1997). Likewise, this study explored the relationship between economic growth and countries that participate in trade. The degree of openness is measured as the ratio of the total

sum of imports and exports to total exports. The index is constructed as such to reduce the incidence of correlation between imports and exports when used simultaneously.

In a study conducted by Miller & Upadhyay (2000), a pooled cross sectional time series data was used to identify the important links between openness, trade orientation and FDI on a sample of eighty-three developed and developing countries. Two Cobb-Douglas production functions; one with stock of human capital and the other without it, with real GDP as the dependent variable, total physical capital stock, labor force and an index of total factor productivity as the independent variables were estimated. The equations were transformed to natural logs and the variables estimated. They observed that opening one's economy (that is increasing exports to GDP ratio, improving terms of trade and reducing the real value of the domestic currency to trade) generally benefitted total factor productivity (Bigsten, Collier, Dercon, Fafchamps, Gauthier, Gunning,.., Zeufack, 2000a). In another study, the authors (Njikam et al., 2006) adopted a Cobb-Douglas production function and used panel regression approach to determine the indices of total factor productivity (TFP) in a sample of twenty-seven SSA countries and to shed light on the sources of TFP in these countries. Dummy variables of countries and time were included to capture the effect of unobserved country-specific differences and time differences respectively. The researchers used labor force, human capital, sources of TFP (openness to world trade, ratio of gross investment to GDP, financial depth and population growth), an index of TFP and real GDP). Empirical results from the regression were as follows: the coefficient of openness was negative and the possible reason for this was attributed to the existence of considerable supply constraints in the African continent, which prevents the SSA countries to deal with competition following trade liberalization. A Cobb Douglas Production function with GDP/capita as the dependent variable; trade openness factors including FDI,

exchange rate, capital-labor ratio and trade openness index as the independent variables is estimated. It is modified as in the study conducted by Njikam et al. (2006) to capture time and country effects. The data will be transformed to natural logs in order to capture elasticities which will be used as a measure of overall and individual average economic growth. The trade openness coefficient in this study however is expected to be positive.

A series of cross-country econometric studies conducted in the 1970s and 1980s attempted to test the relationship between economic growth and trade. Balassa (1978) performed a regression analysis of growth rate of exports on the growth of output; he included and excluded exports as part of the measure of output. He observed the strongest positive relationship in the case when exports were included in output and that there was a significant positive effect when they were excluded for GDP. Exports and imports are not used as individual variables, but as a unit to calculate the trade openness index. This procedure is conducted to avoid autocorrelation which can affect the results, particularly the signs of the estimates.

A number of regressions were run in the Papageorgiou-Michaely-Choksi study, Ioannis Kessides (1991) using data on indices of liberalization relating growth to liberalization (Baldwin, 2003). Among the findings of this study, countries which have strong and sustained trade liberalization incidences were associated with higher increases in GDP as compared to those with weaker and failed trade liberalization episodes who experienced lower GDP. Returns to scale values will be estimated for individual countries to measure average growth of the economy for study period 1980 to 2008. It is expected that nations with increasing returns to scale values have adopted trade openness policies.

2.2 Trade Openness, Foreign Direct Investment (FDI) and Economic Development

Foreign Direct Investment (FDI) serves as a catalyst for economic development through enhancing productivity, job creation and trade growth and promotes forward and backward linkages. In light of market liberalizations which many African countries adopted in the late 1990s, are able to promote international trade at the same time attracting foreign capital investments (Ahmed et al., 2008). The success stories of the East and South East Asian countries suggest that FDI is a powerful tool in terms of export promotion, through tapping export opportunities and taking advantage of a country's comparative advantage (Sharma, 2000).

In 2008, Ahmed et al. investigated the relationship between FDI, exports and economic growth of an economy using the Granger Causality Test. They also examined the association and nature of any causal relationship between export, FDI and economic growth using the Granger Representation Theorem in a bi-variate vector auto-regression (VAR) and then used a temporal multivariate framework with an error correction term to include long-run relationships if co-integration is established between the variables. This method has been used by a number of economists for examining the causality issue using country specific case studies. Ahmed et al. (2008) used data from Ghana, Kenya, Nigeria, South Africa and Zambia. The variables used were export, FDI, real domestic income, foreign income, real imports and an index capturing openness and regime liberalization. The liberalization index was formed from two reform indictors of domestic and external liberalization which is a significant move towards a stronger liberal economic environment. Before Ahmed et al. carried out the Granger causality test, they conducted a Dickey-Fuller unit root procedure to test the level of integration among the variables concerned. The results showed FDI having an influence on growth through transfer of technology which accelerated the rate of development of new and intermediate products for

export. There was also a causal link and a long run impact of exports, imports and FDI on growth of income. Liberalization of the market was found to have a positive effect on FDI together with imports (Ahmed et al., 2008). In this study, FDI is one of the independent variables used as a factor of trade. Even though it is used alongside the trade openness index, no causality test or Dickey-Fuller test will be conducted. The research used data from thirty-three African countries in addition to Ghana, Kenya, Nigeria, South Africa and Zambia (Ahmed et al., 2008). The variables used included FDI, exchange rate, capital-labor ration and index capturing trade openness. It was expected to have a positive impact on GDP as it has become one of the major forms of trade between Africa and the rest of the world.

2.3 Exchange Rate and Trade Balance

From economic literature, various studies have been conducted in the past years to assess the influence of exchange rate on trade balance, the results obtained from these studies showed weak statistical evidence connecting exchange rates and the trade balance (Liew et al., 2003). The hypothesis for a recent study conducted by Liew et al. (2003) examined whether exchange rate had a direct effect on trade balance of five ASEAN (Association of Southeast Asian Countries) countries with one of their major trading partners, Japan. They established that exchange rate is affected by real money rather than nominal exchange rate. A depreciation or devaluation as already explained causes exports to become cheaper and imports more expensive and this improves the trade balance in the long run if both exports and imports are elastic. The trade balance in this study was calculated as "import payments – export earnings." The Consumer Price Indices (CPI) were used to estimate the equilibrium exchange rate as suggested by the purchasing power parity (PPP). A regression analysis was performed with the nominal exchange rate as the independent variable and the trade balance as the dependent variable. The

results from the analysis of the data showed that the impact of exchange rate changes in causing changes in trade balance was not very strong. Nevertheless, trade balance improved accordingly. Real exchange rates are included in the model in this study as one of the explanatory variables and GDP/capita as the dependent. It is measured as the ratio of the local currency relative to the U.S. Dollar. In this study, exchange rate effect on trade balance is not explored directly. It is included as a trade factor to explore the impact of trade openness on economic development in Africa. It is expected to have a positive relationship with GDP as depreciation of the local currency relative to the U.S. Dollar will make exports cheaper and improve the trade balance which will contribute to economic development.

CHAPTER 3

Methodology and Data

3.1 The Theoretical Model

The model employs a classical production function. The production function is a pure representation of a technical relationship between inputs and outputs of a production process. The function is represented as;

$$y = f(x),$$

where y is the output and x is the input (Chambers, 1988).

The production function has the following mathematical properties;

$x^{'} \geq x, then\ f(x^{'}) \geq f(x)$ (Monotonicity)

a) $x^{'} \geq x, then\ f(x') > f(x)$ (Strict monotonicity)

Properties a) and b) imply that additional units of any input cannot decrease the level of output. In the case of a differentiable function, it implies that all marginal productivities are positive.

b) $V(y) = \{x: f(x) \geq y\}$ Is a convex set (quasi-concavity)

Property c) below implies that the input requirement set defined as $V(y)$ is convex. This is equivalent to assuming that the law of diminishing marginal rate of technical substitution holds. $V(y)$ is strictly quasi-convex if it is a strictly convex set.

c) $f(\theta x^0 + (1-\theta)x^* \geq \theta f(x^0) + (1-\theta)f(x^*))$ for $0 \leq \theta \leq 1$ (Concavity)

Property d) imprecisely states that as the use of a particular input increases, holding all other inputs fixed, the associated marginal increment in output must never increase.

d) $f(0_n) = 0, where\ 0_n$ is the null vector (Weak essentiality).

The production process results in a strictly positive output, without the committal of scarce resources which is perfectly ruled out in this case. This does not imply that it is not a possibility to produce positive output with economically scarce resources, but that such situations are not considered here.

e) $f(x_{1,\dots},x_{i-1},0,x_{i+1},\dots,x_n)=0,$ for all x_i (strict essentiality)

Property f) states that all inputs are essential to the production process. An input is essential to the output of the production process if a positive amount of the output cannot be produced without a strictly positive utilization of the input. This implies that the process requires the use of only positive amounts of all inputs to get positive output.

f) The set $V(y)$ is closed and nonempty for all $y>0;$

Nonempty for property g) implies that it is always possible to produce a positive output. The closed portion rules out the possibility of discontinuity in the technology used in the process.

g) $f(x)$ is finite, nonnegative, real valued, and single valued for all nonnegative and finite $x.$

h) $f(x)$ is everywhere continuous and twice-continuously differentiable (Chambers, 1988).

One of the most common production functions used by most economists is the Cobb-Douglas production function. It was proposed by Knut-Wicksell between 1851-1926 and statistically tested by Cobb and Douglas in 1928. The purpose was to employ to model the growth of the American economy during the period between1899-1922. The dependent variable was output, capital invested (K) and amount of labor used (L) as the independent variables. The function they used was modeled as below;

$$P(L,K)=bL^{\alpha}K^{\beta}$$

P = total production (monetary value of all commodities produced per annum)

L= labor input (the total number of people-hours worked in a year)

K = capital input (the monetary worth of all machinery, equipment, and buildings)

b = total factor productivity

α and β are the output elasticities of labor and capital, respectively.

The elasticities measure the responsiveness of the dependent variable to a change in the levels of the independent variables used in the production process (Bao, 2008).

Another unique feature of the Cobb-Douglas function is the concept of returns to scale. There are three forms which include: constant, increasing and decreasing returns to scale. Constant returns to scale mean the proportional change in inputs and outputs is equal. It is represented as $\alpha + \beta = 1$.

Increasing returns to scale means a proportional change in input is less than the proportional change in output. It is represented as $\alpha + \beta > 1$.

Decreasing returns to scale occurs when the proportional change in inputs is more than the proportional change in the outputs. This is represented as $\alpha + \beta < 1$.

Several studies have used the Cobb-Douglas production function for estimating economic growth, productivity and the utility of commodities and inputs to individuals and firms respectively.

This study adopts a modified version of the Cobb Douglas Production Function, an expanded trade production model to measure the effects of trade openness on economic growth in Africa. This study is similar to a study conducted by Miller & Upadhyay (2000). They estimated a Cobb Douglas Production function to measure the impact of openness, human capital and trade orientation on total factor productivity. The model is derived as below:

$$G = g\left(F, E, \frac{C}{L}, T\right) \quad (1)$$

$$Y = AF^{\alpha}, E^{\beta}, \frac{C}{L}, T^{\varepsilon} \quad (2)$$

$$G = g\left(F, E, \frac{C}{L}, T\right) Y = AF^{\alpha} E^{\beta} C/L^{\delta} T^{\varepsilon} 0 < \alpha < 1,\ 0 < \beta < 1,\ 0 < \gamma < 1,\ 0 < \delta < 1 \text{ and } 0 < \varepsilon < 1$$

Where;

G =Y = output/capita

A = an index of economic growth

F = Foreign Direct Investment

E = Exchange rate

C/L = Capital-Labor ratio

T = Trade openness/capita

α, β, δ and ε = elasticities

In solving for objective two, which determined overall returns-to-scale for the average growth rate for the continent and that for the individual countries, a non-restricted production function, that is; $(\alpha + \beta + \delta + \varepsilon) \neq 1$ is used so a return to scale can be determined from the model. The returns to scale values represent the average economic growth of Africa and the other individual countries. Based on these values, policy recommendations can be provided for these countries.

All variables were transformed to natural logs to generate equation (3);

$$\ln Y = \ln A + \alpha \ln F + \beta \ln E + \delta \ln {}^{C}\!/_{L} + \varepsilon \ln T \quad (3)$$

3.2 The Empirical Econometric Model

This study applied an expanded trade production function to a panel data for estimating the impact of trade openness on thirty-eight African countries for the period 1980 to 2008. Objective one was solved through the estimation of the Trade Production function. Using the estimates, the relationship between GDP, trade openness and the factors of trade openness was determined. The use of panel data for this study was appropriate because it combined time series and cross sectional data. The model was characterized by repeated observations normally years on fixed units most frequently nations or states. Using the panel data analysis helped solve most of the problems encountered when using the traditional methods (time series analysis and cross-sectional analysis). The first problem associated with the traditional methods of data analysis was the small number of time and spatial variables. Most specifically, the small sample of conventional comparisons showed an imbalance between too many explanatory variables and too few cases. In using the panel, the cases are country-year; for example starting from the country *i* in year *t* through country *N* in the last year under investigation. This allowed the impact of a large number of predictors of the level of change and the change in the dependent variable to be tested (Podesta, 2002). Panel data contains more degrees of freedom and less multicollinearity than cross-sectional data.

Panel data models also permit the inquiry into variables that elude analysis in a simple cross-sectional or time series analysis. These variables were not noticed because their variability was negligible or not existent across either time or space.

Another advantage for using panel data was the ability of panel data models to capture not only temporal and spatial variations, but also variations due to these two dimensions separately. This is due to all countries are tested through time simultaneously instead of testing a cross-section

model for all countries at one point in time or a time series model for a particular country (Podesta, 2002).

The expanded trade production function was further modified to incorporate temporal and spatial effects on the elasticities. The extension is as follows: the production function defined in equation (3) can be econometrically estimated using alternative panel models. This includes One and/or Two-way Fixed and/or Random Effects model. The One-Way and/or Two-Way Fixed or Random Effects models are appropriate for this type of data as the number of cross-sectional units is large compared to the number of time periods over which those units are observed (Kennedy, 1997). The One-Way Fixed Effects model accounts for spatial variation using dummy variables to represent the individual countries' intercepts. The Two-Way Fixed Effects model; however, accounts for both spatial and temporal variations. The Fixed Effects models are appropriate if the purpose of the observed units are seen as a sample from the larger population and the purpose is to make inferences about the larger population (Beck, 2001). Under the Random Effects models the variation in the error terms were accounted for by introducing an additional error term. The Random Effects models assumed that the variations in the results are neither time nor country specific; the additional error term was used to capture the variation which was assumed to be random (Kennedy, 1997). The Fuller and Battese method of estimating the Random Effects model using the variance components procedure was used in the estimation of the Random Effects models in this study. This method of analysis provides generalized least squares estimates of the parameters under the assumption that the components of the variance are not zero. The panel data in this study was analyzed under the panel estimation models previously described.

The modifications to the Cobb Douglas production function made the model suitable in achieving the set objectives and also for the data set. Because the spatial and temporal effects were important in this study, the Hausman test was conducted to determine which model effect was appropriate.

In addition, the F test was used to test the significance of the temporal and spatial effects in the models. In general, the panel model was represented as:

$$y_{it} = \sum_{k=1}^{K} x_{it,k}\beta_k + u_{it}$$

where i=1,…,N cross-sectional units, t=1,…T time-series data, and k=1,..,K exogenous variables.

The One-Way fixed effects model was represented as:

$$y_{it} = \sum_{k=1}^{K} x_{it,k}\beta_k + \gamma_i + \varepsilon_{it}$$

and the Two-Way Fixed Effects model was represented as:

$$y_{it} = \sum_{k=1}^{K} x_{it,k}\beta_k + \gamma_i + \alpha_t + \varepsilon_{it}$$

Where γ_i and α_i were the non-random parameters that were estimated as cross-section and time-series specific, respectively.

Similarly, the one-way random effects model (was) represented as

$$y_{it} = \sum_{k=1}^{K} x_{it,k}\beta_k + \varepsilon_i + \varepsilon_{it}$$

and below represents the Two-Way Random Effects model:

$$y_{it} = \sum_{k=1}^{K} x_{it,k}\beta_k + \varepsilon_i + \varepsilon_t + \varepsilon_{it}$$

Where ε_i and ε_t are (were) the random errors associated with cross-sectional and time-series variation, respectively.

3.3 Data

To measure the impact of trade openness on the growth of 38 African countries, data on GDP, Foreign Direct Investment (FDI), exchange rate, capital, labor and trade openness were collected from various sources. The African countries considered in this study are listed in Appendix A. These countries were selected based on data availability.

FDI was calculated from each country's balance of payment (BoP), exports were expressed in constant 2005 US$ were obtained from the World Bank website. Exchange rate was expressed as a ratio of the local currency to the US$ and was obtained from Penn World Tables 7.0 (PWT7.0) website. Capital was measured as the gross capital formation in US Dollars. The data on capital consists of outlays on additions to fixed assets of the economy plus net changes in the level of inventories.

The total labor force which is comprised of individuals aged 15 years and older who meet the International Labor Organization's definition of the economically active population. Both capital and labor force was obtained from World Bank (2011). The data covered the period 1980 to 2008. Trade openness was calculated as the ratio of the sum of imports and exports to exports for each country. Trade openness was measured because some countries are considered only as exporters which make them not open to trade. Import and export data were obtained from World Bank (2011). All data are used in per capita basis with population data from World Bank (2011).

CHAPTER 4

Results and Discussion

Four different panel models: One-Way Fixed, Two-Way Fixed and Random Effects (One-Way Random and Two-Way Random models were employed in estimating the relationship between trade openness and GDP growth. Table 1 shows a summary of the fit statistics for all the models used in this study.

Table 1

Summary of Fit Statistics for all Panel Models

Model	SSE	MSE	R-square	DFE	RMSE	F test
One-Way Fixed	141.453	0.124	0.888	1144	0.352	33.29***
Two-Way Fixed	134.429	0.121	0.894	1116	0.347	20.96***
One-Way Random	145.240	0.123	0.406	1184	0.350	
Two-Way Random	143.371	0.121	0.364	1184	0.348	

Note. SSE = Sum of squares of error. MSE = mean square error. DFE = degrees of freedom of error. RMSE = Root mean square error.
*** = $p < 0.01$

All four panel models reported low Mean Square Error (MSE) and Root Mean Square Error (RMSE) values. The averages are: 0.12 and 0.35 for MSE and RMSE, respectively. This makes all four models good fits for the study. The F-tests for both fixed effect models were significant at 1% ($p < 0.0001$). Thus, the probabilities of the absence of temporal and spatial effects in both models are zero. The R-squared values of 0.88 and 0.89 for both the One-Way and the Two-Way Fixed effect models imply that 88 % and 89 % of the variations are explained by the explanatory

variables. In selecting the best fitting model, the R-square was not used as a selection criterion even though the values for the One-Way and the Two-way Fixed effects models were high. This is because the high R-squared values were contributed by the cross-sectional units used as explanatory variables. Instead, the selection criterion was based on the MSE and RMSE and in addition, the Hausman test was conducted to select the model of best fit.

Tables 2 and 3 show results of the Hausman test for Random effects in the One-Way and Two-Way model.

Table 2

Hausman Test for Random Effect for the One-Way Model

DF	***m* Value**	**Pr > *m***
4	6.52	0.1632

Note. DF = degrees of freedom. Pr > *m* = p value associated with the *m* statistic.

Table 3

Hausman Test for Random Effect for the Two-Way Model

DF	***m* Value**	**Pr > *m***
4	19.91***	0.0005

Note. *** = p < 0.01

The *m* statistic for the One-Way model of 6.52 was not significant at 1 % as expected (p< 0.1632). The *m* statistic for the Two-Way model of 19.91 was however significant at 1 % (p< 0.0005). The Two-Way Random Effects model was found as more efficient and consistent in estimating the parameters of the model than the One-Way Random Effects model.

Based on the MSE, RMSE and the results of the Hausman tests, the Two-Way Random Effects model was selected as the best fitting model for discussion.

Table 4 shows results for objective one using estimates from the Two-Way Random Effects model. All parameters were significant at 1 % except FDI/capita and capital-labor ratio which were both significant at only 10 %. The elasticity coefficient of 0.68 with respect to trade openness implies a 1 % rise in trade openness per capita would increase GDP per capita by 0.68 %. An expansion in trade openness implies the country is more open to trade with other countries.

Table 4

Parameter estimates for the Two-Way Random Effects Model

Variable	**DF**	**Estimate**	**Standard Error**	**T value**	**Pr > t**
Intercept	1	2.2909***	0.172	13.31	<0.0001
LnER	1	-0.0313***	0.005	-6.87	<0.0001
LnCL	1	-0.0426	0.029	-1.470	0.1425
LnTrade/capita	1	0.6866***	0.027	25.10	<0.0001
LnFDI/capita	1	-0.0092	0.006	-1.460	0.1443

Note. Pr > t = p value associated with the T statistic.
*** = p < 0.01

The elasticity coefficient of 0.03 for exchange rate means that 1 % depreciation in the local currency relative to the U.S Dollar would increase GDP per capita by 0.03 %. A depreciated local currency will make exports relatively cheaper compared to imports if the goods are elastic. The negative coefficients of elasticities for exchange rate were comparable to the results of Ndlela and Ndlela (2002). The researchers used a partial-equilibrium price approach to

determine the responsiveness of imports and exports to changes in the real exchange rate by estimating real exchange rate and output elasticities and found a negative sign for exchange rate. The estimated coefficient for the trade openness was consistent with the results of Sjoholm (1997) who conducted a study using a simple production function modified to derive a growth model. Sjoholm reported that establishments that participated in exports and imports had relatively high levels of productivity growth. He also reported a positive connection between trade openness and productivity.

Table 5 and Figure 1 show results for objective two. The values are a measure of the average economic growth of the African continent over the 28 year period.

Table 5

Overall Returns-to-scale under each Panel Model

Estimation Model	**Returns-to-scale**
Fixed One-Way	0.634
Fixed Two-Way	0.538
Fuller and Battese Variance Component (RanOne)	0.618
Fuller and Battese Variance Component (RanTwo)	0.603

All the models produced decreasing returns to scale values with the Fixed Two-Way Effects model having the least value (0.54) and the Fixed One-Way effect model with the highest (0.63). Thus, on the whole, the results suggest that the average economic growth of the African continent has been declining over the years.

Figure 1 shows the individual returns to scale by country for the study period. Using the RTS under the Two-Way Random Effect model, about 47 % of the countries exhibited RTS

above the average (0.60 %) and only 8 % showing increasing-returns-to-scale economies. Appendix B shows the RTS of all countries over the study period. Ghana, Botswana, and South Africa recorded average productivities of 1.53 %, 1.50 % and 1.43 % respectively.

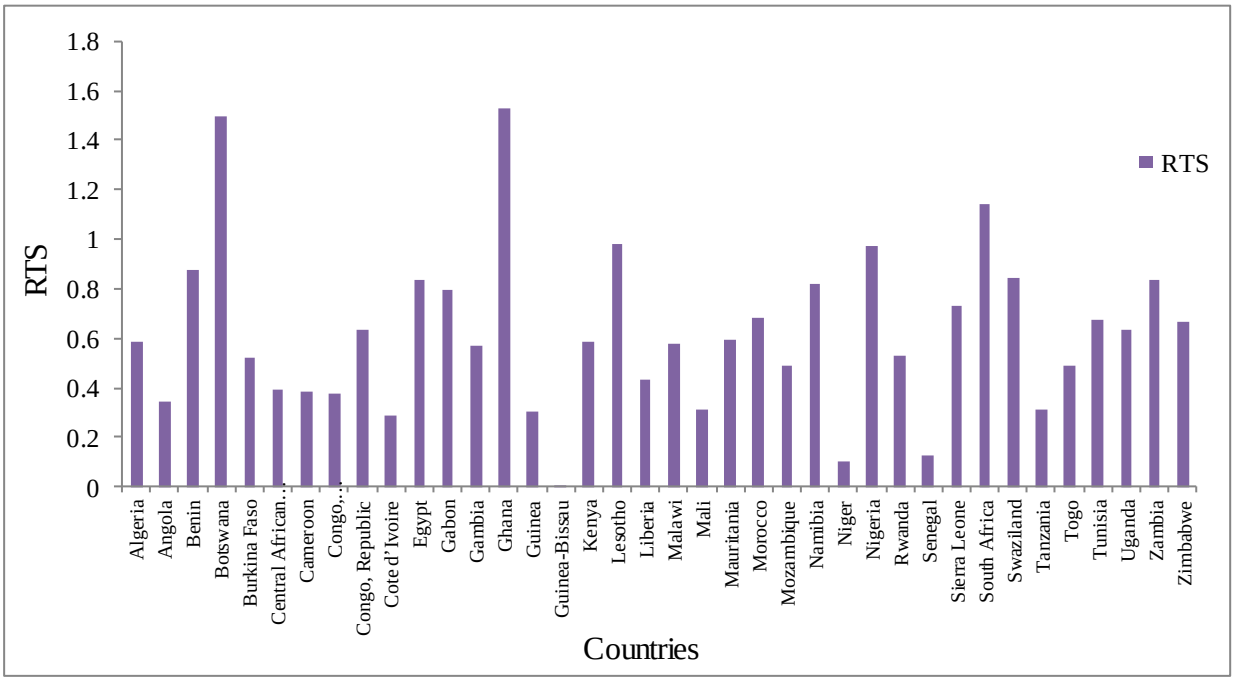

Figure 1. Returns-to-Scale (RTS) by Country

Ghana's economic decline reversed after the government adopted trade liberalization policies 1983. The growth of the country's GDP after the adoption of these policies increased from 7 % in 1972 to 9 % in 1984 (Sakyi, 2010). Agriculture has been the bedrock of the economy accounting for 48 % of the GDP since 1991. Since the start of the Economic Recovery Program (ERP) in 1983; the government has introduced several policies to adjust the pattern of the structure of trade in Ghana. These included devaluation of the currency as well as increase in producer prices for exports such as cocoa to offset the advantages of smuggling such goods across the border to Cote d'Ivoire. The government also introduced an interbank foreign exchange market to facilitate currency exchange. Exports were dominated by cocoa, which

contributed US$280 million in 1993. Other significant export commodities were gold (US$416 million) and timber (US$140 million). Non-traditional exports including furniture, pineapples and cola nuts have also increased significantly (Sakyi, 2010). Botswana's economy is one of the fastest growing economies in the world during the past 30 years. The diamond sector accounts for 35 % of the country's GDP and more than 80 % of exports (German Embassy, 2010). China has become South Africa's top export destination since mid-2009. South Africa in the last ten years has reduced tariffs and subsidies in line with the country's WTO commitments and signing of Free trade Agreements (FTAs). Gold's percentage contribution to total exports is about 40 % with manufacturing and accounting for 20 % and less than 10 % from agriculture. The opening of the agricultural sector among the world's leading exporters of agro-food products such as wine, fresh fruit and sugar. South Africa's agricultural export revenues reached almost nine % of the total value of national exports. The country is by and large dependent on natural resources with other minerals such as coal and platinum taking up increasingly important share of exports (Teweldemedhin & Schulkwky, 2010).

Most of the countries exhibited below average returns-to-scale. They include Niger, Cote d'Ivoire, Liberia, Mali, and Tanzania with RTS values between 0.10 % and 0.31 %. Guinea-Bissau had a RTS value of approximately 0.001 %. It is the third largest producer of cashew nuts in the world. The ease of growing the crop and the increase in the demand for it on the international market has caused many farmers to switch from producing other foods to cashew nut production. The country now imports rice and oil despite its ability to produce some of these goods. Imports are almost completely made up of consumer and capital goods. About 60 % of imports are made up of commodities such as rice, flour, and sugar, 30 % is represented by oil.

Guinea-Bissau's exports in 2006 were valued at US$133 million while its imports amounted to US$200 million (Economy Watch, 2011).

CHAPTER 5

Conclusions

The main objective of this study was to measure the impact of trade liberalization on the economic development of some African countries. The study employed a Cobb Douglas Production function to estimate the effect of trade openness on economic growth of thirty eight African countries over a period of 28 years (1980 to 2008). The parameters estimated were exchange rate (ER), Foreign Direct Investment (FDI), Capital-Labor ratio (C/L) and trade openness which was computed as the summation of exports and imports to exports. The data were transformed to natural logs. The Cobb Douglas Production function was modified into an expanded trade production function and estimated econometrically using alternative panel models: One way and Two-Way Fixed and Random Effects models. The Random Effects models were analyzed using the Variance Component procedure described by Fuller and Battese.

Although all four models were good fits, the MSE and RMSE values in addition to the results from Hausman test were used to select the best fitting model which was the Two-Way Random effects model. FDI/capita and capital-labor ratio coefficients showed negative signs implying no effects on GDP/capita with an increase in FDI and capital-labor ratio, while exchange rate and trade-openness/capita exhibited positive and significant impacts on GDP/capita. The depreciation of the local currency for majority of the African countries included in the study will increase growth of GDP as exports become cheaper and imports relatively expensive if the goods are elastic. This will raise export revenues. Trade openness having a significant and positive relationship with GDP growth means as exports increase incomes also increase.

Returns-to-scale values were estimated from the production function as a measure of the average economic growth of the whole continent and the individual countries. The African continent on the whole exhibited a decreasing return to scale. Using the RTS value (0.60 %) from the Two-Way Random effects model, Ghana, Botswana and South Africa were the only countries that exhibited increasing returns-to-scale. Guinea-Bissau had a RTS value of approximately zero.

This study results are comparable to those reported by Sachs & Warner (1995) who also observed positive relationships between trade openness and economic growth using a cross-country regression model. Based on the conclusions, the following recommendations are made:

- African governments should encourage policies that increase the participation of importing and exporting of goods. This will foster trade openness which is known to positively contribute to GDP growth in African countries.
- Policies that encourage floating exchange rate should be used. A floating exchange rate helps to improve the balance of payment and also aids in attracting foreign investments.
- African countries should put in place policies that will make their economies attractive to foreign investors.

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Appendix A

Table 1

List of African Countries

Algeria	Mali
Angola	Mauritania
Benin	Morocco
Botswana	Mozambique
Burkina Faso	Namibia
Central African Republic (CAR)	Niger
Cameroon	Nigeria
Congo, Democratic Republic	Rwanda
Congo, Republic	Senegal
Cote d'Ivoire	Sierra Leone
Egypt	South Africa
Gabon	Swaziland
Gambia	Tanzania
Ghana	Togo
Guinea	Tunisia
Guinea-Bissau	Uganda
Kenya	Zambia
Lesotho	Zimbabwe
Liberia	

Malawi

Appendix B

Table 2

Return to Scale Results for Individual Countries

Country	Return-to-Scale (RTS)
Algeria	0.5881
Angola	0.3423
Benin	0.8759
Botswana	1.4966
Burkina Faso	0.5250
Central African Republic (CAR)	0.3916
Cameroon	0.3826
Congo, Democratic Republic	0.3752
Congo, Republic	0.6352
Cote d'Ivoire	0.2847
Egypt	0.8397
Gabon	0.7935
Gambia	-0.2833
Ghana	1.5258
Guinea	0.3009
Guinea-Bissau	0.0001
Kenya	0.5895

Lesotho	0.9802
Liberia	0.4367
Malawi	0.5797
Mali	0.3143
Mauritania	0.5932
Morocco	0.6787
Mozambique	0.4864
Namibia	0.8198
Niger	0.1042
Nigeria	0.9726
Rwanda	0.5321
Senegal	0.1242
Sierra Leone	0.7285
South Africa	1.1430
Swaziland	0.8401
Tanzania	0.3099
Togo	0.4916
Tunisia	0.6772
Uganda	0.6328
Zambia	0.8322
Zimbabwe	0.6658