The Impact of Exchange Volatility on the Agricultural Exports of Sub Saharan African Countries

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This is to certify that the project prepared by Biruk Tekle entitled: “The Impact of Exchange Rate Volatility on the Agricultural Exports of Sub-Saharan African countries” in partial fulfillment of the requirements for the Degree of Master of Arts(in Economics) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ABSTRACT

The impact of exchange rate volatility on the agricultural export of Sub Saharan African Countries.

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The abandonment of the fixed exchange rate systems has caused exchange rate movements to become a major concern for traders, policy makers and researchers. Numerous studies have been conducted to determine whether exchange rate volatility affected international trade flows. Nevertheless, no general consensus has been reached as to the magnitude and direction of the impact of exchange rate volatility on trade flows.

This paper investigates the impact of exchange rate volatilities on the agricultural exports of Sub Saharan African countries. Twenty nine sample SSAcountries were selected for the period 1996-2008. Estimation is made using random effects model, difference generalized methods of moments (GMM) and systems GMM. Volatilities of the official exchange rate of SSA countries was generated using GARCH (1,1) and ARCH models.

The Standard gravity model augmentedby variables which affect the trade between the SSA countries and the major trading countries is estimated. Exchange rate volatilities is found to have a negative and significant impact on the agricultural exports of the SSA countries across the different estimation techniques. Trade policies that are designed to increase exports might create uncertainty in the exchange rate and ultimately end up reducing exports. The main lesson drawn from the study is, SSA countries should have a stable exchange rate policy..

Key words: Exchange rate volatilities, gravity model, system GMM,GARCH,ARCH

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Biruk Tekle

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Chapter one

Introduction

1.1 Background

African countries are waking up from the quagmires of poverty and destitution which have shackled the continent for years.Recent performance of the economies of Sub Saharan African, here after SSA, countries is one of progress which reflects the implementation of better economic policies and structural reforms. Progress in domestic and external financial imbalances, enhanced economic efficiency, greater priority to public spending on health education and other social services are some of the indicators of better economic performance of the sub region. This coupled with the growing movement towards open and participatory government and relatively better state and civil society cooperation have changed sub Saharan Africa's growth trajectory for the better. Nonetheless there still remain a lot of hurdles and uncertainties to keep this momentum continue. The economic and social situation of the sub region is vulnerable to domestic and external shocks. Limited investments to diversify economic structures and boost growth, new armed conflicts, poor weather conditions and a deterioration of the terms of trade are the prime challenges the sub region faces to uphold the gains in economic performance'(IMF report 2011).

Agriculture carries a great deal of the economic burden in African economies and many of their problems can be linked to its performance. Agriculture is the principal sector accounting for the dominant share of GDP, income, employment, food supply and export earnings. Indeed

agriculture accounts for about 70 percentage of the labor force and provides 30-60 percent of the GDP in most African countries. It also dominates external trade. Agriculture accounts for over 60 percent of export earnings, except in countries like Nigeria, Zambia and Zaire, where metals and minerals are significant sources of foreign exchange. Clearly the performance of agriculture is the most important determinant of overall economic growth in most African countries(IBID).

Exchange rate liberalization was a major component of the economic reform programs of the 1980s in Africa. The structural adjustment programme led to the adoption of the flexible exchange rate regime. This resulted in huge surge in exchange rate ranging from 0.04% in 1973 to a staggering 150% in 2006 averaging 95% for the 1973-2006 periods. The export growth for Africa after the introduction of those changes plummeted from an annual average of 13.35%in 1970-79 to 4.26% in 1990-2006 (Omojimite et al 2010). One can perceive a link between the raise in exchange rate volatility and the decline on the growth in exports.

1.2 Statement of the Problem

Exchange rate volatility is defined as the risk associated with unexpected movements in the exchange rate. Economic fundamentals such as the inflation rate, interest rate and the balance of payments, which have become more volatile in the 1980s and early 1990s, by themselves, are sources of exchange rate volatility. More recently, increase cross-border flows that have been facilitated by the trend towards liberalization of the capital account, the advancement in technology, and currency speculation have also caused exchange rate to fluctuate (Hook and Boon 2000).The high degree of volatility and uncertainty of exchange rate movements since the beginning of the generalized floating in 1973 have led policy makers

and researchers to investigate the nature and extent of the impact of such movements on the volume of trade.

The breakdown of the Bretton woods system in the 1970s led to the adoption of the floating exchange rate regime. Exchange rates started to fluctuate widely. Primarily the very wide fluctuations in exchange rate are triggered by economic fundamentals such as inflation rate, interest rate and balance of payments. However other reasons attributed to exchange rate fluctuation include increase in cross border flows witnessed by the increase in capital flows, the advancement in technology and currency speculation (IBID).

Conventionally, it was believed that exchange rate volatility dampens international trade.The uncertainty in exchange rate creates income uncertainty due to the risk aversion behavior and irreversible capital expenditure or both (Ethier 1973, Demers 1991, Sercu 1992).Contrary to this, there were evidences which showed that the relation between exchange rate volatility and trade flows were analytically indeterminate. DeGlauwe (1988)

A number of previous studies on the response of trade flows to changes in exchange rate found out varying results. There are a number of studies which assert that the volatility in exchange rate has led to reduced flow of international trade (Arize et al 2005, Tenreyeo 2004, Kenen and Rodrik 1986, Clark et al 2004). On the other hand, there are studies which found out that volatility in exchange rate has resulted in even to improved trade flows(Mackenzie 1998 , Frankel 1992, Kasman and Kasman 2005). Many researches however, have failed to establish any significant link between the exchange variability and volume of international trade flow sear (Bahmani-Oskooee 1991, Kumar 1992,Aristoloues 2001) ;(Illhan, 2006).

Africa in general and sub Saharan Africa in particular have not seen much research on how their export markets respond to changes in the exchange rate volatility. Although there were attempts to do some using sample of SSA countries (Omojimite and Akpokodje 2010, Olayungbo et al 2011) the sample countries selected, the methodology used and the time/ study period covering those studies was not enough to make any conclusive remark on how SSA agricultural exports respond to changes in Exchange rate.

This paper therefore, is an attempt to investigate the impact of exchange rate volatilities on agricultural exports of sub Saharan African countries. How did the Sub region's exports respond to the uncertainties in exchange rate? Did the region behave any differently than the rest ofthe world in general and the less developing countries in particular? What is the current policy environment of the sub-region's countries in reaction to this variability?

1.3 Objective of the Study

The main objective of the paper is to investigate how Sub SaharanAfrican agricultural exports respond to the exchange rate volatilities.The paper has the following specific objectives

- To investigate the impact of exchange rate volatility on the agricultural exports of Sub Saharan African countries.
- To estimate the magnitude of the impact of exchange rate volatility on the amount of agricultural export of Sub Saharan African countries.
- To assess the policy implication of those uncertainties to the sub Saharan countries
- To draw policy recommendation based on the findings

1.4 Data and Methodology of the Study

To address the problem of the research and accomplish the objective as well, both descriptive and empirical analysis will be undertaken. Under the descriptive section the study will attempt to see the trends in the real and the effective exchange rate, the pattern of agricultural export in the region to capture the real image of the sector in the highly competitive world market. Thus the study will use plot chart, tables will also be used to support the graphic presentation.

For the econometric analysis part,an augmented gravity model is utilized to analyze the agricultural exports of a panel of Sub Saharan to the rest of the world. That is the growth of the export sector is assumed to be affected by economic growth of the nation (GDP), the pursued policies(the real effective exchange rate), domestic production capacity (infrastructure, human capital, access to the sea) and similar other factors will affect the export sector. Accordingly the standard growth function will be augmented by those factors to see their impact on the export sector.

To accomplish the aforementioned objectives secondary data will be used for analysis. The major source of data are United NationsCommodity Trade and Statistics data base (UN Comrade), international financial statistics IMF's, –and World Bank CD ROMs of the varies trade agencies of the UN agencies like FAO,WTO etc.

1.5Significance of the Study

Sub Saharan African countries are predominantly dependent on agricultural exports as the principal source of foreign earning. However this sector is affected by macro and trade policies where exchange rate is one among the very key policy instruments. Therefore this paper shall

make the attempt to address how the sub region's exports are affected by the volatilities. Secondly even if there is a wealth of empirical literature on the impact of exchange rate volatilities on agricultural exports for the developed and emerging economies, little has been done to address this for African economies especially sub Saharan Africa. Therefore, this paper shall try to fill the research gap.

Chapter Two

2.1 Literature Review

2.1.1 Review of Theoretical Literature

Exchange rate volatility is defined as the risk associated with unexpected movements in the exchange rate. Higher exchange-rate volatility leads to higher cost for risk-averse traders and to less foreign trade. This is because the exchange *rate* is agreed on at the time of the trade contract, but payment is not made until the future delivery actually takes place. If changes in exchange rates become unpredictable, this creates uncertainty about the profits to be made and, hence, reduces the benefits of international trade (Hook and Boon 2000).

Early theoretical partial equilibrium models of risk-averse firms that are constrained to decide trade volumes before exchange rate uncertainty is resolved have suggested a negative effect of volatility on trade if hedging is not possible or is costly (Willenbockel et. al, 2008) This theoretical proposition can be applied to most of the developing and emerging countries where well developed financial markets simply do not exist.

Broll et al(1999) argue that if we consider the export market like an options market a higher stochastic volatility in exchange rate will increase the export option which ultimately leads the firm to increase production. This led the authors to assert that exchange rate volatilities are positively correlated with trade volumes. But this assertion was challenged by other authors.

Assume a firm which is operating in competitive market and produces only one product and faces an international buyer where all its produces are exported. The main source of income

uncertainty is the exchange rate variability it encounters in the local market. Since the firm could not adjust its output ahead of the sale of its product and there is no hedging opportunity for the foreign exchange, it reacts to changes in exchange rate post ante. In order to curve the reduced revenue arising out of the exchange rate risk, the firm reduces production or export. This is a simple theoretical argument to show that exchange rate volatility and exports are negatively correlated(Clark et al 2004).

The above assertion that exporters respondnegatively to changes in exchange rates is based on strong assumptions. These days there are alternative hedging opportunities which serve to counteract risks which arose from variabilities in exchange rate. On top of that, multinational firms hold their assets and liabilities in different currencies which dissolve the risks arising due to exchange rate variabilities. Secondly, it is assumed that firms couldnot adjust their production to go in tandem with the fluctuating exchange rates of countries. This assumption too could be relaxed for there are firms which could adjust one or more of their inputs according to the prevailing exchange rate risk. Hence, we see that if firms have the capacity to make adjustments the risk arising from exchange rate could be a good opportunity to make even more profits.

Dellas and zilberfarb(1993) further argued that an increase in risk has both a substitution and income effects. The substitution effect forces firms to shift away fromrisky export activities to less risky ones. However, the income effect on the contrary induces a shift into the export sector when the expected utility of export revenues declines as a result of the increase in exchange rate risk.Therefore, if the income effect is higher than the substitution effect, exchange rate volatility will have a positive impact on export.

In addition, an increase in exchange rate volatility can create profit opportunity for firms if they can protect themselves from negative effects by hedging or if they have ability to adjust trade volumes to movements in the exchange rate. Franke (1991) and Sercu and Vanhull (1992) demonstrate that an increase in exchange rate volatility can increase the value of exporting firms and thus canpromote exporting activities. Grauwe (1994) shows that increase in exchange rate volatility can increase the output and thus volume of trade if the firm can adjust its output in response to price changes.

Broll and Eckwert (1999) demonstrate that an international firm with huge domestic market base has the ability to benefit from exchange rate movements by reallocating their products between domestic and foreign market. Thus, higher volatility can increase the potential benefits from international trade. Moreover, from the political economy point of view, Brada and Méndez (1988) note that exchange rate movements facilitate the adjustment of the balance of payments in an event of external shocks, and thus, reduce the use of trade restrictions and capital controls to achieve the equilibrium, and this in turn encourages international trade.

On the other hand, Akhtar and Hilton(1984), who investigated trade flows of the United States and West Germany, classified the effects on trade flows of the exchange risk into direct and indirect effects." If the volume of goods traded internationally is adversely affected by the uncertainty about the profits and prices resulting from exchange rate uncertainty, this is the direct effect. Exchange rate uncertainty, however, could also discourage trade through less straightforward channels, but over longer periods of time and perhaps permanently. For example, when importers and exporters try to lower their exposures to risk introduced by large fluctuations

in exchange rates by relying on domestic rather than foreign market participants, these actions would constitute the indirect effects. All in all, it is expected that uncertainties in exchange rate affect trade negatively."

In brief, the theoretical results are conditional on the assumptions about attitudes towards risk, functional forms, type of trader, and presence of adjustment costs, market structure and availability of hedging opportunities. Ultimately, the relationship between exchange rate volatility and trade flows is analytically indeterminate. Thus, the direction and magnitude of the impact of exchange rate volatility on trade becomes an empirical issue.

2.1.2Review of Empirical Literature

There is dearth of research on the link between export and exchange rate volatility. Different methodologies (predominantly partial econometric analysis and few general equilibrium methods) were utilized to no conclusive empirical agreement. Bilateral and multilateral trade dealings were used to investigate how exports responded to exchange rate variabilities.

Sauer andBohara (2001) pointed out the link between exchange rate volatility and export in both developed and developing nations. Using a panel of developing and developed countries from around the world, an attempt was made to see the impact of the variability of exchange rates on exports of these countries. Pooled export equations were estimated for all the countries and a sample group of countries. The results which were checked against different volatility measures were negative for exports of African and Latin American countries but positive for least developed countries from Asia and developed countries of the first world.

Barret and Wang (2007) used Taiwan's exports to the US for the period 1989-1998; and found out that while most sectors do not significantly responded to volatilities in exchange rate, agricultural commodities were observed to have high and negatively responsive. They used multivariate GARCH-M estimator using sector and destination specific monthly data of exchange rate and export figures to get at this result.Special focus was given to the representation of the exchange risk, the way agents form expectations and the data frequency used for data analysis. The authors argue that Taiwan's agriculture's unique characteristics like the fact that it is predominantly based on small and fragmented farms with its main intermediate inputs being heavily dependent on imports that suffer from frequent liquidity constraints and the fact that there is a policy induced bias against agriculture have contributed to why agricultural exports respond negatively to exchange rate uncertainties.

Erdemetal et al (2010) investigated Turkey's agricultural trade with its twenty partner nations for the period 1980-2005 using panel cointegration analysis. They conclude among others that it is the degree of volatility in exchange rate that is more correlated with the amount of trade than is the exchange rate level.

Sheldon et.al. (2002) investigated trade flows across ten developed countries using a panel data over 1974-1995 on how exchange rate risks affect the growth of agricultural trade compared to other sectors. Making use of gravity model after controlling for differences in income, distances, membership to customs union, etc. the impact of medium to long run exchange rate volatilities were found to be negative and higher for agricultural sector relative to other sectors. The estimated coefficient was six times higher and significant at 1%.

Kandilov(2007) tried to extend Sheldon et. al.(2002) by including more developed and developing countries. The author successfully replicated the findings of Sheldon et. al.(2002) but when the sample of countries increase, the effect of exchange rate volatility almost completely disappears leading him to conclude that the results are specific to trade among the ten country pairs and that exchange rate volatility does not affect agricultural exports more than overall exports for developed country's export in general. As far as developing countries are concerned exchange rate volatility has a negative impact on their export of agricultural goods albeit with very small magnitude. Lastly, agricultural polices like domestic subsidies are one of the reasons why aggregate trade is negatively affected by volatiles since both domestic subsidies and exchange rate volatilities have similar temporal variations

Arcacia (1998) used data from the European Union member countries to see how bilateral trades among member countries respond to volatilities in the exchange rate. Using panel data and the gravity model after controlling for country specific effects, it was found that exchange rate variabilities negatively affect bilateral trade. This was one of the driving factors which made the monetary union a very important step to avoid any negative repercussions of the exchange rate volatilities.

There have been meager efforts to study the impact of exchange rate volatilities in the exports of developing countries. Bahamani-Oskooee(1991) attributes two main reasons.Firstly the industrial countries exchange rate regimes are more flexible than the developing world. Secondly lack of data on the real effective exchange rate which IMF started publishing only recently for LDCs.Despite these bottlenecks there are studies on the impact of exchange rate volatilities on

trade of the developing world. For instance Arizeet. al. (2000) used quarterly data of thirteen least developed countries to test the impact of exchange variabilities on exports. They concluded that the exports of those LDCs were negatively affected by the uncertainties arising from exchange rate volatilities and there were trends of resource reallocation as a result of this.

Using data from seven developing countries Bahamani-Oskooee(1991) investigated the impact of uncertainties introduced by floating regimes on trade volumes on the import and export volumes of Brazil, Greece, SouthKorea, Pakistan, the Philippines, Thailand, and Turkey.Using quarterly data for the 1975-85 period standard econometric technique was used.His finding revealed that while the imports of Korea, Thailand, Turkey and Pakistan was adversely affected in case of Brazil,Greece, and the Philippines, exchange rate volatility does not seem to have a significant impact on imports. As far as exports are concerned the estimates show that except Brazil and South Korea where exports reacted positively and significantly to volatilities the rest were found to be affected negatively.

Arize (1996) employed the method of the Johansen (1988) multivariate cointegration procedure as well as the Error-correction methodology to evaluate the dynamic relationship between exchange rate uncertainty and Korean exports using data from 1973-1992. An attempt was made to single out the real cause of volatility since both macroeconomic policy measures like devaluation and fiscal deficit financing lead to high exchange rate volatility in most developing countries including Korea. Both the cointegration and error correction tests showed that exchange rate volatility has a short and long run negative impact on Korean exports. In this study, the implied long run elasticity was found to be -0.128.

Chit et al. (2008) examined the impact of bilateral real exchange rate volatility on real exports of five emerging East Asian countries by employing a generalized gravity model that combines a long run demand model with gravity type variables. The study found strong evidence that exchange rate volatility has a negative impact on the exports of emerging East Asian countries.

Although there are lots of empirical studies undertaken to investigate the impact of exchange rate volatilities on trade in the developed world, the issue is least researched in developing countries and African countries have barely explored how their external trades respond to uncertainties resulting from exchange rate risk. But some attempts were made to make regional comparisons between members of CommunauteFinanciereAfricaine (CFA) countries and their non-CFA counterparts. Omojimite and Akpokodje(2010) used Twenty years data(1986-2006) using the OLS, fixed effect, first difference GMM and systems GMM equation estimation techniques. After generating the exchange rate volatility series with GARCH models. They found out for both groups of countries, exchange rate negatively affects exports.

Almost like all other studies Sub Saharan Africa have not seen much research into the impact of volatilities on trade. Nevertheless Sekkatand Varoudakis(1999) examined the impact of exchange rate policy on manufactured export performance of a panel of major Sub-Saharan African countries. Data over the period of 1970-1992 was used for three manufacturing sectors i.e. textiles,chemical and metals and export supply equations were estimated. The major findings suggest that whereas the sub Saharan manufactured exports are responsive of exchange rate induced incentives; volatility does not seem to exert a systematic negative influence on

manufactured export performance. Bleany and Greenway(2000) used data from fourteen Sub Saharan African countries over 1980-1995 to study the impact on investment and growth of the level of volatility of the terms of trade and real effective exchange rate. Volatility was estimated from a GARCH (1,1). It was found out that volatility has a significant negative effect on investment and growth.

The broad literature in the area of the impact of exchange rate volatility on trade is summarized by Illhan (2006) where he showed that the overall evidence is mixed. The main factors that determine the magnitude and kind of impact are the choices of the period of study, the specification of the model, the proxies of the exchange rate volatility and the countries considered (developed or developing)

This paper shall attempt to contribute to the meager empirical literature on how Sub Saharan African agricultural exports respond to exchange rate volatilities. It shall make use of data from the sub region's trade with the rest of the world and try to estimate how those countries respond to the risks posed by uncertain exchange rate.

2.1.3 Factors that affect Agricultural exports of Sub Saharan Africa

2.1.3.1 The impact of GDP on agricultural exports

There have been many theoretical and empirical studies discussing the impact of exports on the growth of a nation's GDP. The theoretical foundations have been avidly analyzed by different authors. Dawson et al (2010) argues that the export led growth hypothesis dominates the export-

income literature for several reasons. Firstly according to Keynesian short run arguments, export growth leads to income growth via the foreign trade multiplier. Secondly foreign exchange earned from the export sector can bolster the import of manufactured, capital and technology inputs which ultimately leads to income growth. Thirdly; following Endogenous Growth Theory popularized by Grossman and Helpman, the export sector creates positive externalities such as more efficient production methods which lead to growth.

There are numerous empirical studies of the export–income relationship. Early studies generally support the export-led growth hypothesis and include Balassa (1978) whose estimate of the export elasticity of income is 0.05, and its validity gained wide spread acceptance, notably by the World Bank (1987).Later Solow type growth equations were used to support the export lead growth hypothesis. An aggregate production function is specified with labor and capital as conventional inputs and exports as an additional 'input' were utilized. Sources-of-growth equations are then derived where income growth is determined by growth rates of both conventional inputs and exports.

But there were little efforts made to analyze the impact of agricultural exports on GDP growth or the other way round i.e. does growth in GDP leads to increase in agricultural exports. Levin and Raut (1997) who examined the impact of both manufactured and primary export on GDP growth, found that GDP growth can be increased by manufactured export growth, but not by expanding primary commodity exports. Dawson (2005), used annual data for 62 developing countries of 1965-1974 and 1975-1984 to find that the short-run agricultural export elasticity of GDP is similar to non-agricultural export elasticity and that the impact fall as income increases. Dawson

(2010) on the other hand examines the long run relationship between GDP and agricultural and non-agricultural exports by using annual data from 42 developing countries for 1970-2004. The findings prove the validity of the export lead growth hypothesis and existence of long run relationship between GDP and exports.

2.1.3.2 The Impact of Education on Agricultural Exports

Human capital development is one of the key variables which explain the growth levels of countries. Especially those sectors which require highly qualified work force definitely benefit from the investments in human capacity building. However there is no consensus on how micro and macro level data responds to empirical test of the return to education on economic growth. Levine and Renelt (1994) determined that neither secondary school enrollment nor other measures of human capital have a robust influence on GDP growth in their sub sample of developing countries.

On the other hand Levin et al(1997) Using a panel of 30 semi-industrialized developing nations over the period 1965–84 indicated a high degree of complementarity between trade policies and educational expenditure. They provide empirical evidence to support that average education has a significant relation with exports per GDP. According to this evidence, the export sector cannot be more productive than the rest of the economy without utilizing relatively educated workers; that is, the externalities and increasing returns to scale attributed to the export sector in newly industrializing countries like Hong Kong and Korea cannot be achieved without simultaneous public investment in education.

However the export of primary agricultural commodities does not respond to investment in education as much as that of the export of the manufactured indicating that increasing returns and other efficiencies are mainly concentrated within the manufacturing sector. Hence it is imperative that development policies should stimulate long run economic growth by simultaneously promoting investment in human capital as well as investment in the manufactured export sector.

2.1.3.3 The impact of Infrastructure on Agricultural Exports

There is a very wide theoretical and empirical literature on the importance of infrastructure for economic growth. But in the trade literature the role of infrastructure remains largely unexplored. Bougheas et al(1997) using data from European countries and augmented gravity model indicated that the investment on infrastructure is inversely related to transport cost. Where the reduced transport cost leads to increased export. They empirically proved that the level of infrastructure goes with the volume of trade. Limao and Venables(2001) investigated quantitively how poor infrastructure affects exports. They estimated that poor infrastructure is liable for 40% of the predicted transport costs of coastal countries while this amount even goes higher accounting for 60% of the predicted cost for landlocked countries. Hence they concluded that improvements in transport costs can lead to better export performance.

Recently Francois and Manchin (2006), using bilateral trade data between 1988-2002, investigated the role of institutions, geographical context and infrastructure on trade. They found out that are infrastructure is a lot more important factor than institutions on not only the amount of trade but also on whether countries trade or not at all.

Weak infrastructure is a major impediment to trade, competitiveness and sustainable development in most African countries. According to Mbekeani(2007) African exports face much higher transit costs than tariffs. African exports are charged 3-7 percent of tariffs in their major export destinations like Canada, the European Union, Japan and the United States. However land locked African countries on the average incur transit costs which are three times higher than the average tariffs. The major infrastructure bottle necks include exorbitant transit costs, poor communications, shortage of electricity and Inadequate access to competitive trade finance and insurance products.

2.1.4Methodological Review

2.1.4.1 Measurement of Exchange Rate Volatility

Since there is no generally accepted theoretical agreement on how exchange rate volatility affects trade, there has not been consensus aboutwhich measure of volatility is appropriate. On top of this there are different factors that affect what measure of volatility to use for the study on hand. Kandilov(2008) argues that the level of aggregation of trade flows (bilateral vs. multilateral), and the time horizons (short run vs. long run) are important factors that should be considered when choosing volatility measures.

Most of the measures of volatility used so far involve some sort of variant of standard deviations of the annual or monthly exchange rate. McKenzie (1999) conducted a thorough review of the methods of exchange rate volatility used over the years and identified a number of key variability

measuring instruments. Accordingly, the predominantly used measurement tools are the moving average of the standard deviation of the exchange rate (kenen and Rodrik,1986; Bini-Smaghi, 1991; Chowdury, 1993 and Klein 1990) and the standard deviation of the yearly percentage changes of a bilateral exchange rate around the mean observed during a sub period (De Grauwe and Belleefroid (1986).

In recent years, use of various forms of Autoregressive Conditional Heteroskedasticity (ARCH) approaches, for example, GARCH (1, 1) has become very common in the literature. For example, the GARCH (1, 1) specification has been widely used by several studies (Kandilov, 2007; Dell'Ariccia, 1999; Wang and Barrett, 2007; and Clark, Tamirisa, and Wei, 2004)

Among the other methods are the sum of squares of the forward errors, and the percentage difference between minimum and maximum of the nominal spot rate (Dell'Ariccia, 1999). Another measure, known as the Peree and Steinherr method, in which the agents' uncertainty is based upon the past experiences where agents remember the highs and lows of the previous period and utilize that information in their decision making process has also been used by some researchers (Cho, Sheldon and McCorriston, 2002).

The generalized autoregressive conditional heteroskedasticity (GARCH), as the name suggests, this approach of determining exchange rate volatility is based upon conditioning the variance by allowing changing over time based on past errors. While conventional time series and econometric models operate under an assumption of constant variance, this type of model is useful in modeling variability in the exchange rate and inflation (Hill et al., 2008). Because the ARCH model of conditional variance encountered the problem of negative variance parameter

estimates in empirical applications, extension of the ARCH model including a more flexible lag structure was immediately sought (Bollerslev, 1990).

Let ε_t denote a real valued discrete-time stochastic process and μt the information set (δ-field) of all information through t. The GARCH(p,q) process (Generalized Autoregressive Conditional Heteroskedasticity) is then given by;

$$\varepsilon_t|\psi_{t-1} \sim \mathrm{N}(0, h_t),$$

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i h_{t-i}$$

$$= \alpha_0 + A(L)\varepsilon_t^2 + B(L)h_t,$$

where

$$p \geq 0, \qquad q > 0$$

$$\alpha_0 > 0, \qquad \alpha_i \geq 0, \quad i = 1, \ldots, q,$$

$$\beta_i \geq 0, \qquad i = 1, \ldots, p.$$

For p = 0 the process reduces to the ARCH (q) process, and for p = q = 0 ε_t issimply white noise. In the ARCH (q) process the conditional variance isspecified as a linear function of past sample variances only, whereas the GARCH (p, q) process allows lagged conditional variances to enter as well.This corresponds to some sort of adaptive learning mechanism.

2.1.4.2Gravity Model

The gravity model has strong applications in the physical sciences. Gravity model was adapted to the realm of international economics by Tinbergen in the 1960s. The model has been widely used as an economic tool to examine international trade flows(Anderson, 1979).Following the studies

by Krugman 1985, Eichengreenand Irwin 1998 and Frankel 1998, the theoretical foundations of the gravity model were further developed for empirical application. The use of the gravity model in international trade is encouraged by theoretical literature that has developed the micro foundations for the gravity model (Helpman, 1987). Furthermore, this model is characterized by its widespread use under the auspices of imperfect competition and intra-industry trade theory (Krugman, 1991).

The gravity model basically states that the volume of trade between countries is directly proportional to the product of their economic masses proxied by GDP and inversely to the distance between them. It is consistent with the underlying micro foundations where the product of the countries' GDP is a positive stimulant to trade while distance representing the impact of transport costs has a negative influence (Sheldon, 2002).

In addition to trade and distance, the gravity model is augmented by relevant variables which affect the trade volume between countries. The most common variables included are existence of common language, a common border, or whether the countries are members of a common free trade area or customs union.

The gravity model is specified as:

$$\ln TRADE_{ij,t}^{k} = \gamma_{t}^{k} + \beta_{1}^{k} \ln(Y_{it}Y_{jt}) + \beta_{2}^{k}(PoP_{it}PoP_{jt}) + \beta_{3}^{k}U_{ijt} + \beta_{4}^{t}DIS_{ij} +$$

$$\beta_{5}^{k}Lang_{ij} + \beta_{6}^{k}Border_{ij} + \mathrm{E}_{ij,t}^{k}$$

where TRADE is gross bilateral trade (imports plus exports) between countries i and j, with imports by i from j proxied by exports from j to i, for trade in each sector k. $Y_{it}Y_{jt}$ is the product of i and j's GDP in period t, $PoP_{it}PoP_{jt}$ is the product of population between countries i and j in period t, U_{ijt} is a measure of exchange rate uncertainty, defined in the following section, DIS_{ij} is a measure of distance between i and j, $Lang_{ij}$ is a dummy variable which is positive if countries share a common language, $Border_{ij}$ is a dummy variable where it is 1 if countries share a common border or 0 otherwise.

Chapter Three

3.1 Data Source and Model Specification

3.1.1 Data Source

For analyzing the impact of exchange rate volatility on agricultural export, the study will rely on secondary data sources. The data type will be arranged in a panel set up for 29 Sub-Saharan African countries expanding for the period, 1996-2008. The study limit the analysis to the period and countries specified due to data paucity problem. The data sets are obtained from the United Nation Commodity Trade Statistics (UNCOMTRADE) web site, the World Bank (WB) World Development Indicator (WDI) and International Financial Statistics (IFS) as main sources. In order to fill out some missing values, countries web sites are also used. Further elaboration on data source is provided along with model specification.

3.1.2 Model Specification

It is extensively discussed in the previous chapter that the gravity model is a better tool of analysis for handling trade interactions between countries. In this paper augmented form of the gravity model is used to investigate how the sub region's agricultural exports responds to the variabilities in exchange rate. Following Willenbloke et al. (2008), the empirical model is specified as follows

$$X = f(Y, Y^*, POP, POP\_PARTNER, Dist., RFTA, VOL, CB, elc\_cons,$$
$$,Sec\_Schl, road\_net),$$

Where X stands for Agricultural exports of Sub Saharan African countries; an attempt is made to generate the data from various international databases. The prime source of which is the UN Com trade website. The international standard classification of all economic activities (ISIC) rev. 3 and rev. 2 are utilized. Additional data were acquired from the web sites of the various UN agencies including UNCTAD, International Financial statistics(IFC) and the world trade organization(WTO).

Y is the total income of an exporting Sub Saharan African country. It signifies the economic mass of the country in the standard gravity equation. Usually GDP is the most appropriate proxy used in most trade related literatures. The primary source of data is the international financial statistics which categorizes the different countries into sub categories like developed, developing, and emerging, Sub Saharan Africa etc. this coupled with the data from the world development indicator fulfill the data for GDP of Sub Saharan Countries.

*Y** represents the economic mass of trading partners which import the agricultural exports of SSA countries. For these, five major trading countries are selected based on the trade trend of agricultural exports of the SSAs. As used in many empirical literatures GDP is the most appropriate proxy for economic masses of the trade partner countries. The prime source of data is the International Financial Statistics web site.

Dist. is an abbreviation for distance between sub Saharan African countries and the major trading partners. For this study the distance between the capital cities of the trading partners is used in the model. The distance data including a set of different distance and common dummy variables used in gravity equations to identify particular links between countries such as colonial past, common languages and common borders(CB), membership to a particular Regional free trade

area (RFTA) etc is found at the website of the French Center d'EtudesProspectives et d'informationsInternationales(CEPII).

POP and POP_PARTNER refer to the total number of people living in the SSA and partner countries respectively. It is also one of the main gravity variables used in the trade literature. The prime sources for this data are the web sites of the world development indicator (WDI) and the International Financial Statistics (IFS).

Vol, a short hand for volatility in exchange rate. The prime question that this paper tries to address is to see how the agricultural exports of Sub Saharan African countries respond to the volatilities arising from exchange rate fluctuations with the main trading partners. Exchange rate volatility is a measure that intends to capture the uncertainty faced by both exporters and importers due to unpredictable fluctuations in the exchange rate. There are alternative proxies for capturing this uncertainties, however this paper uses official exchange rate to estimate volatilities of the respective countries' exchange rate by using ARCH (1, 1) and GARCH (1, 1) model. The official exchange rate is found from the website of the international financial statistics and WDI.

Infrastructure is key to the growth of trade especially export trade. The standard gravity model is augmented by infrastructure indicator captured by the length of road network, road_net, a sub Saharan African country is covered and the power generating capacity of the nation proxied by the electric consumption figures (elc_cons).

Education is also one key element in the export diversification and productive capacity of a nation. To control for the impact of education of a standard gravity equation, the paper tries to use the rate of school enrollment proxied by high school enrollment rate (*Sec_Schl)*. This data is obtained from the website of world development indicator.

Chapter Four

4.1 Descriptive and Econometric Analysis of the Data

4.1.1 Descriptive Analysis, Summary Statistics and Graphical Inspection

Before we go through the econometric study, we first need to describe the details of the data using simple graphical and statistical tools. Graphical inspections provide us the picture on how our variables of interest behave over time. Scatter diagrams showing the exchange rate volatilities of the sample Sub Saharan African countries are annexed at the appendix section. Selected major variables are discussed using chart plots.

When the volatilities of the SSA countries official exchange rate is drawn against the time period 1996 to 2008, most countries exhibit similar pattern. Except for few outliers like Nigeria, whose volatilities depict a very sharp rising and deep falling pattern. Most of the countries have volatility in logarithmic figures which oscillates between -0.5 to +1.5. This has to do with the fixed and managed floating exchange rate regime of SSA countries that anchors their currencies against a basket of major international currencies. Market forces of demand and supply play little role and therefore they tend to show similar pattern. Possibly, the Nigeria exception could be explained by the rapidly changing world price of petroleum for which Nigeria is the largest exporter of petroleum in the sub region.

The box plot of the logarithm of the volatility of the SSA countries plotted below depict a trend that is following a similar pattern for almost all countries between the upper and lower bounds.

Except Gambia, Ghana and Malawi which showed more dispersion of tail values of the volatility there is no much deviations within the countries of the sub region.

One exception that is vivid from the box plot is Rounda, Botswana and Ethiopia. Those countries have volatility in logarithm which oscillates around zero. From the nature of the agricultural exports of Ethiopia being dependent on few agricultural products and the strict control over the exchange rate market, watching a less volatile exchange does not sound much of a surprise.

Figure 3.1Volatility of SSA countries

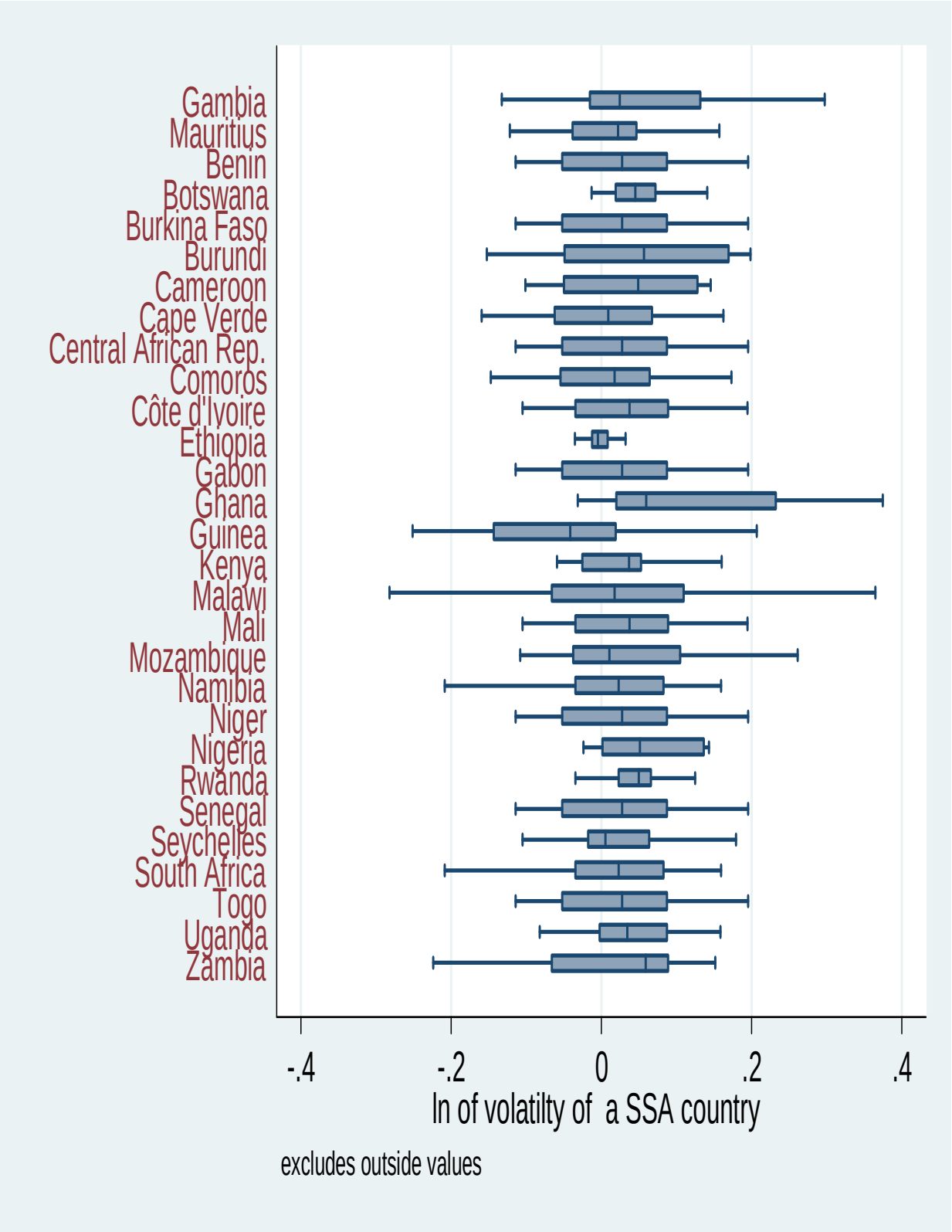
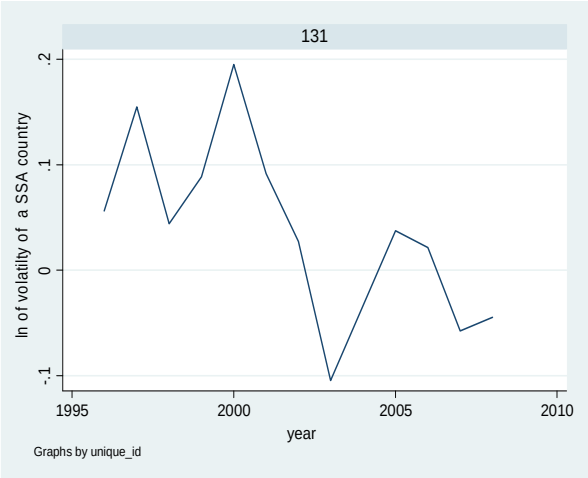
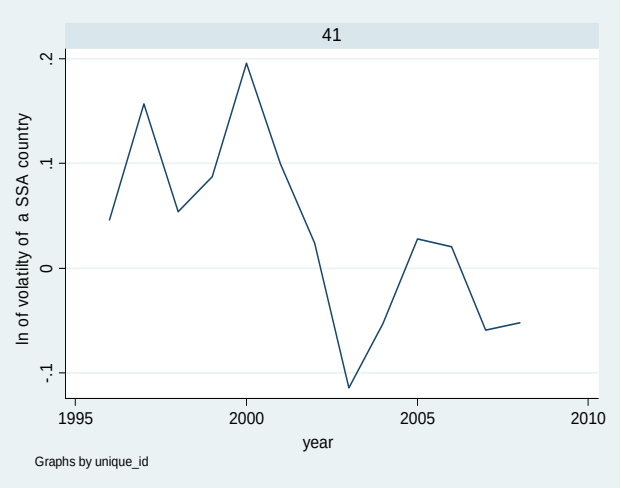


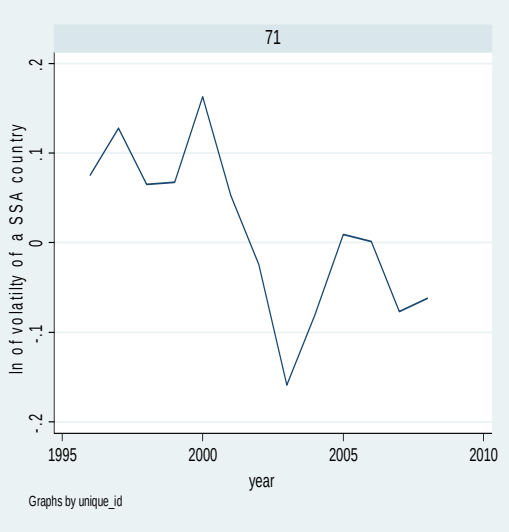
Figure 3.2 Volatilities of Western SSA countries



Cotdeivore

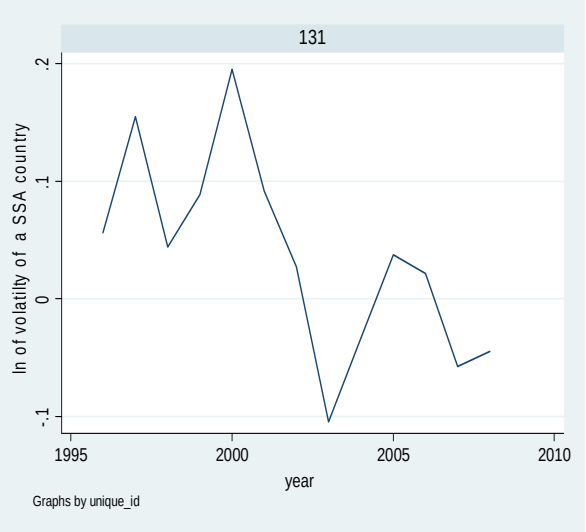


Burkinafaso



o

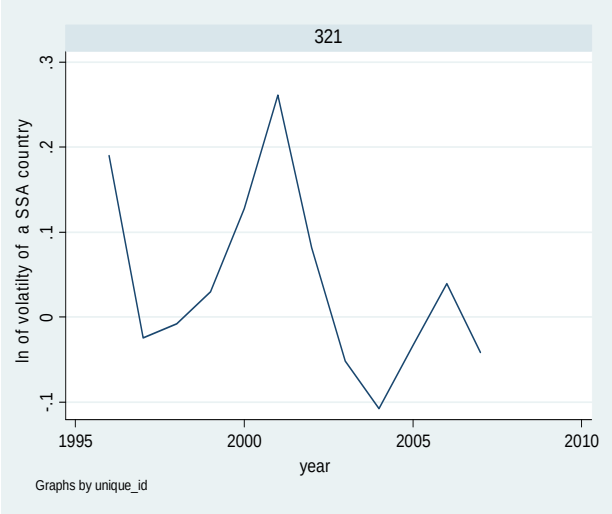
Capeverde



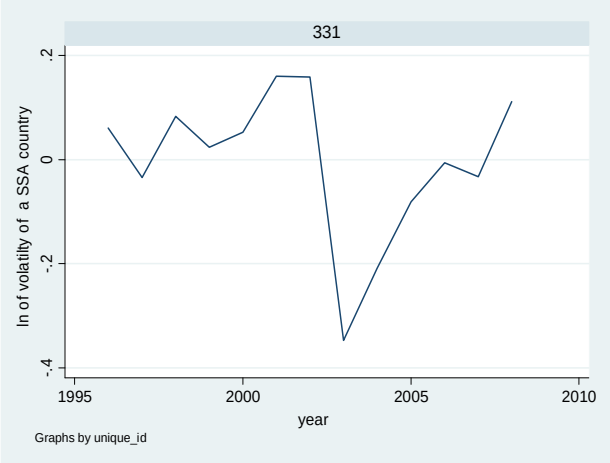
Comoros

If we follow the geographic map of the sub region and divided the SSA into three as Western, Southern, Eastern and central Africa; we observe the similarity among members of the western wing of Sub Saharan Africa. As depicted above the four countries Cotdevoire, Cape Verde, Comoros and Burkina Faso exhibited similarity for the period under investigation.

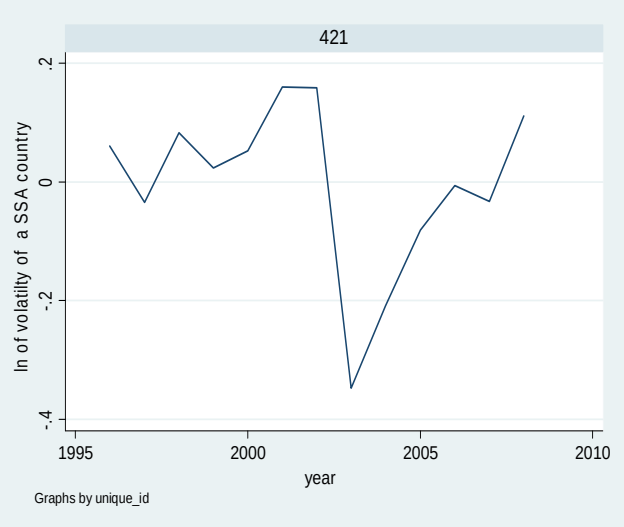
Figure 3.3 Volatilities of Southern SSA countries



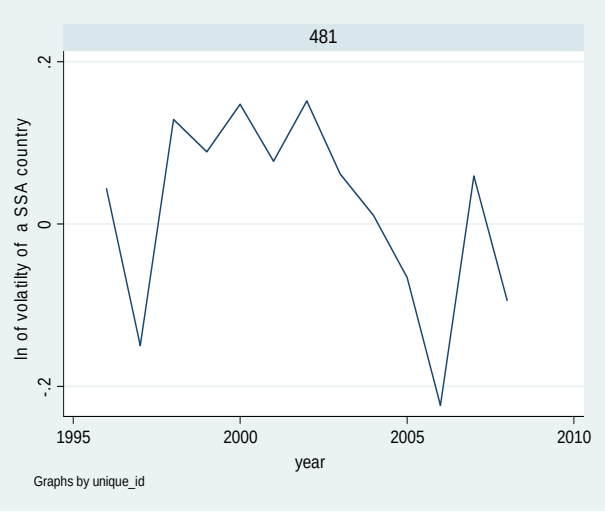
Mozambique



Namibia



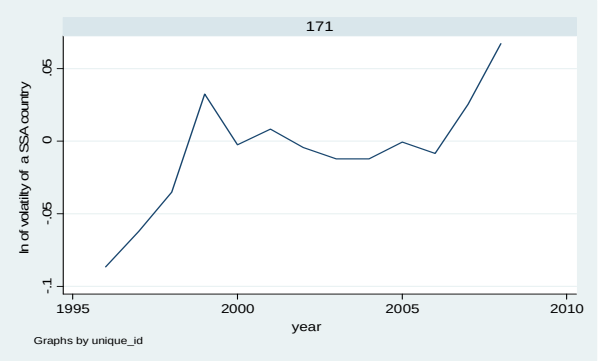
South Africa



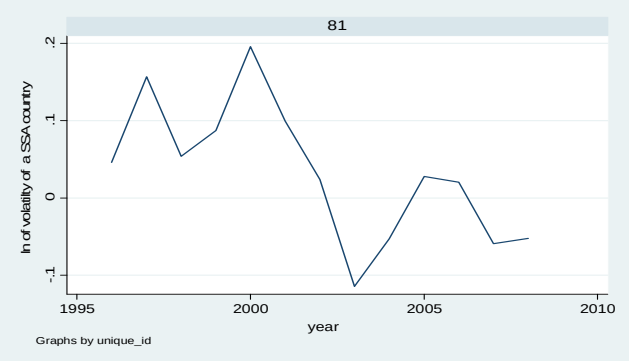
Zambia

Figure 3.3 illustrates how the southern countries of the sub region's exchange rate volatility behaved during the study period. Even though Namibia and South Africa showed almost the same pattern of change in volatility, the other two countries in the sub region behaved unpredictably. The heavy dependence of the Zambian economy on the export of copper may have contributed to this vey haphazard behavior of the exchange rate volatility.

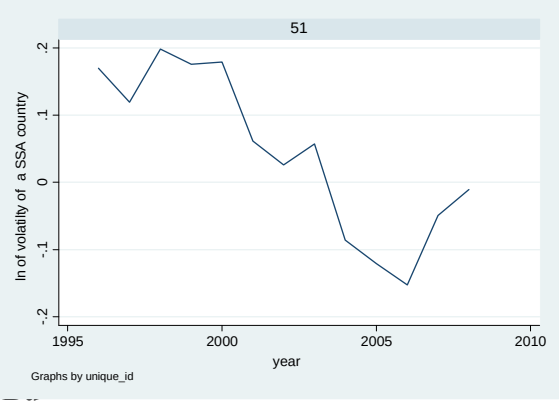
Figure 3.4 Volatilities of Central and Eastern SSA countries



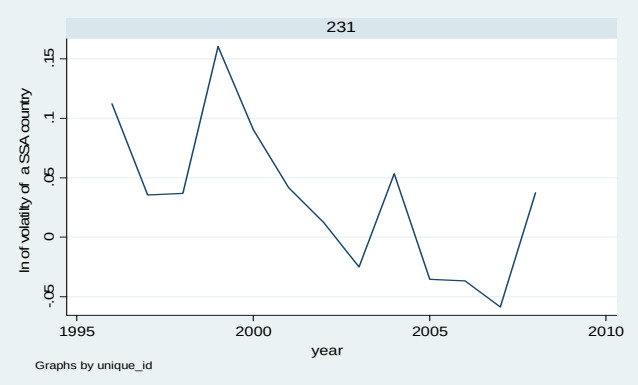
Ethiopia



Central Africa Republic



Burundi



Kenya

Lastly, when we investigate how the exchange rate volatility of different countries in the East and Central Africa behaved. Ethiopia's exchange rate was the least volatile. It doesnot share any feature of the pattern exhibited by the other countries in the central and Eastern wing of SSA. For instance compared to neighboring Kenya, Ethiopia had a slowly changing volatility hanging around zero most of the time. Central African Republic and Kenya share similar pattern albeit at different years.

In short one can conclude that Countries at the Western end of the Sahara demonstrate more homogeneity in the volatility of exchange rate under the study period than the rest of SSA countries while Eastern and central African countries showed the least homogeneity.

When we look at the box plot of the GDP of the SSA countries, we look at the fact that the scatter is uniform and mostly concentrated around zero with dispersed peaks (figure 3.5). This is in sharp contrast to the box plot for the GDP of the trading partnersv(figure 3.6). The GDP of trade partners is scattered uniformly and dispersed further from the horizontal margins. The scenario for the former is explained by the fact that most of the SSA countries are relatively homogenous economies when measured in weighted economic size while the later are from different spheres of the world. Each has a unique feature characterizing its economy. Ethiopia is a lot similar to Zambia than is china or Germany is to that of the United States of America.

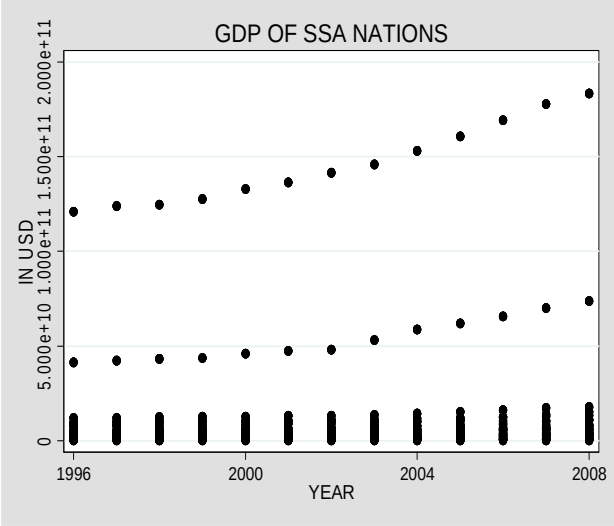


Figure 3.5 GDP of SSA countries

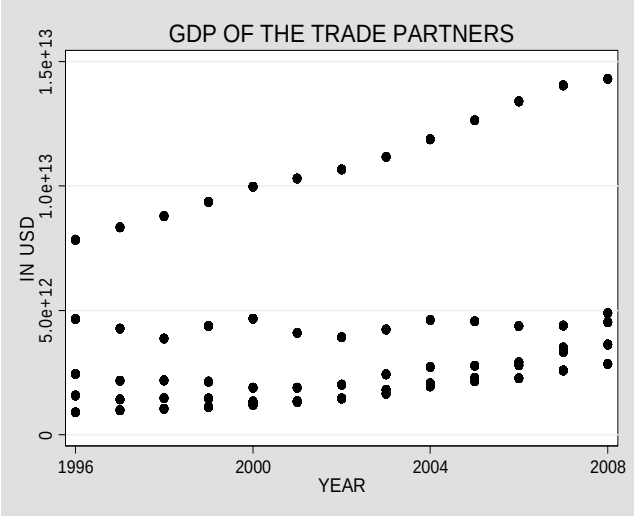


Figure 3.6 GDP of partner countries

The summary statistics provides important information about the main variables of the model we are going to estimate. In the table below we report the summary statistics of the major variables of the model. Among the variables bilateral agricultural export has the highest variability with coefficient of variability of 5.35 and mean of 265 million. Whereas distance between the capital cities of the SSA country and major trading country has the smallest variation (see annex 1).

The degree of Skewness and Kurtosis give very important information about distribution of sample point or residuals after running regression. All the variables are positively skewed except the distance between the capital cities of a country and its major trading partner. Bilateral agricultural export has more of its observation around its mean value which is why it has the highest value of Kurtosis.

The question of whether the samples of the variables specified are drawn from a population with normal distribution is addressed by investigating the statistical distribution of major gravity variables using box plot and the Jarque-Bera (JB) test for normality.

The JB test for normality is due Jarque and Bera (1980, 1981 and 1987). In statistics, the test is a goodness-of-fit measure of departure from normality. It is based on the sample kurtosis and Skewness.Jarque and Bera (1980, 1987) used the Lagrange Multiplier procedure to derive efficient joint tests for residual normality, homoscedasticity and serial independence. The test statistic is given by Jarque and Bera (1987) as:

$$LM = N\left[\frac{b_1}{6} + \frac{(b_2 - 3)^2}{24}\right]$$

Where, b1 and b2 are measures of sample skewness and kurtosis coefficient respectively, N is sample size. Jarque and Bera (1987) showed that the LM as asymptotically distributed as χ2 and a test based on the above equation is locally powerful.

The null is a joint hypothesis of both the skewness and excess kurtosis to be zero.

$H_0 : b_1 = 0$ and $b_2 = 3$

And the alternative hypothesis is

H_1: H_0 is not true

The null hypothesis is rejected if the calculated statistic is greater than the appropriate significance point of X_2.

Having conducted the JB test, all our main variables of interest like agricultural export and GDP of the SSA countries are normal (see annex 2).

4.1.2 Estimation Framework: Diagnostics and Estimation Procedure

The analysis is conducted using panel data for its explicit advantage. Panel data models have advantage over cross sectional and time series studies in the following aspects. In a cross section study the time span will be limited to one whereas in time series study the cross sectional unit of analysis will be limited to one. Panel data model make more information available allowing to

expand the time span as well as the cross sectional unit of analysis. The model, thus, provides more degree of freedom and hence more efficiency would be attained than the others. Panel set up also allows one to control for unobserved individual heterogeneity (country specific effects). Panel data enables one to study the dynamics of adjustment (see also Baltagi, 2005). More importantly panel data models provide more variation within the unit of analysis and/or between different size and characteristics of the cross sectional unit of analysis.

4.1.2.1 Testing for fixed effects:

Because our analysis focuses on a specific set of Sub Saharan African countries and their major trading partners and employs data with a relatively long time dimension, the fixed-effect estimator is considered as the most appropriate method. Hsiao (1999) notes that if the time dimension (T) of the panel is sufficiently larger than the cross-sectional dimension (N), then the fixed effects coefficients are consistent and asymptotically efficient.

In order to check which modeling structure best fits the data a regression of both fixed and random effects were run and the Hausman test was conducted. Hausman and Taylor (1981) noted that an important benefit from pooling time-series and cross-section data is the ability to control for individual-specific effects, possibly unobservable, which may be correlated with the other included variables in the specification of an economic relation.

Analysis of cross-section dataalone can neither identify nor control for such individual effect (Hausman and Taylor, 1981:1377). The authors further noted that a crucial assumption of the cross-section specification is that the conditional expectation of the disturbances given knowledge of explanatory variables is zero. An extremely useful property of panel data is that by

following the cross-section panel over time, we can test this assumption. Moreover, the fact that the within, between, and GLS estimators are affected by the failure of this assumption, suggests that we may base a test of it on functions of these statistics (Hausman and Taylor, 1981:1382)

Table 3.1 Fixed vs Random effects model

Variables	Fixed	Random
lngdp	1.623***	1.018***
	-6.82	-10.75
lnpop	-0.026	-0.082*
	(-0.78)	(-2.56)
lnroad_net	-0.154***	-0.140***
	(-5.33)	(-4.73)
lnelec_cons	0.200**	0.250***
	-2.75	-4.16
lnsec_schl~l	0.262	0.473***
	-1.93	-5.87
o.lndistcap	0	-0.523*
	(.)	(-2.29)
lnpop_part~r	1.53	0.109
	-1.1	-1.45
lngdp_part~r	0.235*	0.329***
	-2.05	-5.15
o.comcol	0	0
	(.)	(.)
volatility	-0.001***	-0.001**
	(-3.69)	(-3.03)
Constant	-54.690*	-12.786***
	(-2.28)	(-5.11)
R-squared	0.671	
Number	295	295

The above is the estimated fixed effect model and random effect models. All the variables have the expected signs. The only variable with unexpected sign is the road network which captures the impact of infrastructure on growth of agricultural exports. Except the population of SSA countries and their trading partner's population all variables are significant at 5% level of

significance. The distance and common language variables are dropped since they are fixed across the observations.

In order to compare the fixed effect model against the random effect model, the econometric model was run using the random effects estimation technique. Almost all the variables showed similar results with that of the fixed effects model. What is very interesting is that the fixed variables in the previous model are now random with significant results.

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 9.12

Prob>chi2 = 0.2444

We use random effects. Since the tabulated value at 1% 7 d.f is 15.09. Since 9.12<15.09 and also the p-value is >0.01. We fail to reject the null hypothesis and hence stick to random effects.

4.1.2.2 Test for Heteroskedasticity

Breush and Pagan (1979) noted that in some applications of the general linear model, the usual assumption of homoscedastic disturbances and fixed coefficients may be questioned. The authors further argued that when these requirements are not met, the loss in efficiency in using OLS may be substantial and more importantly, the biases in the estimated standard errors may lead to invalid inferences (Breush and Pagan, 1979:1287). Heteroskedasticity does not affect the consistency of estimators, and it is only a minor nuisance for inference (Wooldridge, 2003:125).

For the random effects model heteroskedasticity is not a problem. However in order to correct the hetroskedastic nature of the model (if any), the data is clustered and bootstrapped. Comparing the standard errors of the bootstrapped model to the previous random effect model, we witness a significant reduction in the standard errors of our major variables.

4.1.2.3 Testing For Serial Correlations

When explanatory variables are not strictly exogenous, so that one or more explanatory variables are correlated to the error terms, neither t-terms from our equation nor the overall significance of the model are valid. We formally test for presence of the first order autocorrelation.

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation

F(1, 59) = 97.662

Prob> F = 0.0000

The p-value is 0.000 which is less than 0.01. This makes us to reject the null hypothesis that says there is no first-order autocorrelation. We can conclude that there is no first order serial autocorrelation.

4.1.2.4 Hausman Test for Endogeneity

Endogeneity of the right-hand regressors is a serious problem in econometrics. By endogeneity we mean the correlation of the right-hand side regressors and the disturbances. This may be due to the omission of relevant variables, measurement error, sample selectivity, self-selection or

other reasons. Endogeneity causes inconsistency of the usual OLS estimates and requires instrumental variable (IV) methods like two-stage least squares (2SLS) to obtain consistent parameter estimates (Baum, 2006).

In our model there are two reasons which make us to doubt the results from the fixed-effect estimation. The first is the potential problem of endogeneity. A sub Saharan country from our sample may take a policy measure aimed at increasing the amount of export through devaluing its currency. This creates an endogeneity problem (Willenbockel, 2008). Secondly, the inclusion of country-pair fixed-effect dummy variables could control for the potential endogeneity if the relative size of trade partners remains the same over the period considered (Dell'Ariccia, 1999).

The standard solution to a problem of correlation between the regressor and unobserved effects is to estimate by IV using appropriate set of instruments. A crucial prerequisite for IV estimation is that all instruments must satisfy two conditions: (i) they must be correlated with the endogenous variables (instrument relevance); and (ii) they must be uncorrelated with the error term (instrument exogeneity).

For our model, since GDP is highly correlated with exports and no correlation with the error term and distance is highly correlated to exports but not correlated to error term.The instruments used are GDP and distance. Hence, distance fully satisfies instrument relevance and instrument exogeneity.

Endogeneity is formally tested using the endogeneity test of endogenous regressor. This is referred as Hausman test for endogeneity (see Hausman, 1978). The test statistic under Hausman (1978) is:

$$CHI^2(Q)=(b-B)'[V\_b-V\_B)\ ^{(-1)}]\ (b-B)$$

Where b = consistent under H_0 and H_1 ; obtained from IV regression

B = inconsistent under H_1, efficient under H_0; obtained from OLS regression

Under Hausman test for endogeneity our model the null and alternative hypotheses are:

H_0**:** difference in coefficients is not systematic

H_1: there is a systematic difference in coefficients

After running the Hausman test we find the following results Test:

Ho: difference in coefficients not systematic

chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= -1095.40

Here in all cases the calculated values are less than the tabulated value and in addition their p-value is greater than 0.01. Therefore, in all cases we can rule out the existence of endogeneity.

According to Arellano-Bond (1991), problem of endogeneity induced in the model by the Predetermined variables could be handled by transforming the data taking the first difference of the lagged variable as instruments. By doing so, one can remove the impact of all fixed effect errors in the model. On the way the problem of endogeneity created by all lagged variables

(predetermined values) will be taken care of. The second option is to instrument all the predetermined variables, as to Bond and Blundell (1998), with variables that are expected to be uncorrelated with all fixed effects. This method is referred as system generalized method of moments. At first, system GMM assumes that all the exogenous variables that are included in the model as possible explanatory variables are assumed to instrument themselves, whereas for all endogenous variables and predetermined values are instrumented with differences of the lagged values.

Roodman (2006) argues that, for random walk-like variables, past changes may indeed be more predictive of current levels than past levels are of current changes, as a result instruments generated from past changes that are utilized in system GMM. It provides system GMM instruments to be better representations for all endogenous variables, predetermined values as well. Representing lagged values, i.e. predetermined values, with best instrument gives estimates for these variables to capture all past time shocks to these variables. Therefore, system GMM is best estimator for simultaneous equation models which is endowed with an inherent problem of endogeneity of variables and the inclusion of lagged values as possible explanatory variables of a given model. In addition, the effect of all lagged variables to current shocks would also be captured.

Hence the study will use Arellano-Bond type of estimation to account for the effect of lagged values of the dependent variable and the endogeneity problem so created. The final results of the regression shall be discussed below.

Table3.2Arellano bond estimation of difference and system GMM

Dependent variable lnagri_export	Abond Difference GMM	Abond System GMM
Independent variables	**Coef./P>t**	**Coef./P>t**
L1.lnagri_expo	0.9218	0.9618
	(0.0000)	(0.0000)
volatility	-0.0002	-0.0003
	(0.7710)	(0.0060)
lngdp	0.1040	0.0559
	(0.6700)	(0.0750)
lnpop	-0.0869	-0.0561
	(0.5680)	(0.0140)
lnroad_net	0.0129	-0.0074
	(0.8760)	(0.6770)
lnelec_cons	0.0564	0.0584
	(0.7180)	(0.0610)
lnsec_schl_enrol	-0.1175	-0.0885
	(0.5840)	(0.0240)
lndistcap	-0.2653	-0.1816
	(0.8420)	(0.1410)
lnpop_partner	-0.6020	0.0692
	(0.5270)	(0.2780)
lngdp_partner	0.4793	
	(0.3640)	
ABondtestAR(1) first diff z	-0.9	-1.97
Pr > z	(0.371)	(0.049)
ABondtestAR(2) first diff z	2.33	-1.97
Pr > z	(0.02)	(0.049)
Sargan test of overid chi2(43)	376.91	376.91
Prob> chi2	(0.000)	(0.000)
Hansen test of overid chi2(43)	63.24	74.99
Prob> chi2	(0.014)	(0.002)
Hansen test excluding group chi2(24)	51.81	63
Prob> chi2	(0.000)	(0.000)

All the variables in table 3 for A bond difference GMM estimations have coefficients and p-value which are insignificant and with wrong signs. The model crushes and fails since the estimates are insignificant and contrary to the expected signs. Therefore, we resort to another estimation technique.

Since estimates from the first differencing of the lagged dependent variable cannot explain the model, we resort to estimate the model using system GMM. The model is estimated using two step system GMM method. The result is given on the right side of the Table 3.

4.1.3 Discussion on the Regression Result

According to Hayashi (2000), under the assumption of conditional homoscedasticity, Hansen's J statistic is consistent in the presence of heteroskedasticity and (for HAC-consistent estimation) autocorrelation, where a p-value result that is greater than 0.1 is typically considered passing. As shown in the Table 3, the instrument pass this test. For all the models under consideration, the Hansen J statistics is greater than 0.4. Hence it is safe to interpret the above table

The regression of the final system GMM estimates gave us coefficient estimates that are consistent with the theory and previous studies. Exchange rate volatility has a negative influence on growth of the agricultural exports of SSA countries even though the magnitude is very minimal. A 1000% increase in volatility imparts a 0.2% reduction in the export of the agricultural goods to their major trade partners. This contrasts to the finding of Olayungbo et al (2011) who estimated systems GMM from 40 SSA African countries using 10 years data. They found out that a 10% increase in exchange rate volatility led to 0.2% raise in the export of primary commodities. The estimation was made across three different categories of products namely aggregate, primary and manufactured goods where all categories of goods showed positive responses to exchange rate volatilities.

GDP is positively related with the agricultural exports and is significant at 10%. The increase in the population is the same as increase in local consumption therefore the result which is significant at 5% is negatively related to the agricultural exports. The distance between a sub Saharan country and its trading partner is a structural variable in the gravity equation. In our equation in the estimate demonstrated above has a theoretically consistent negative sign. However, it is insignificant.

From the standard gravity equation , the only variable which is not significant is population of the partner nations. The other variables are significant and have the right sign. In addition to the gravity variables, there were control variables which further are included in the estimation. The consumption of electricity which shows infrastructure availability is significant and positively correlated with the agricultural exports of the SSA. Education captured by secondary school enrollment is negatively correlated with agricultural exports and marginally significant. Probably education might reduce the labour force from the agricultural sector and hence the negative correlation.

Chapter Five

5.1 Conclusions and Recommendations

5.1.1 Conclusions

The study attempted to investigate the impact of exchange rate volatility on the agricultural exports of 29 selected Sub Saharan African countries using 13 years data (1996-2008) data. Augmented gravity model is estimated using random effect, system GMM and Arellano bond estimation techniques. The result across all the methods on the impact of exchange rate volatility on agricultural exportis found to be negative and significant. The significant negative effect on agricultural exports implies that risk averse exporters will reduce their activities, switch sources of supply and demand or change prices in order to minimize their exposure to the effect of exchange rate risk. This, in turn, can alter the distribution of output across many sectors in the concerned countries.

The main lesson learnt is that trade policy actions aimed at stabilizing the export market and earning more foreign exchange are likely to generate uncertain results. This will backfire and lead to reduction of export and hence foreign exchange earnings. Thus, exasperating the meager foreign exchange reserve especially for those countries whose economies are entirely dependent on the agricultural sector.

A second and major policy implication is that, if the problem of exchange rate volatility is not solved, trade adjustment program which are under implementation in these countries may lose their appeal to the policy makers of SSA countries ending in a serious balance of payments crisis.

Thirdly, since the data used is of shorter years(thirteen years data were used) and most SSA countries are still in the fixed to managed fixed policy regimes, the history of exchange rate volatility is still very short in SSA countries compared to developed countries. Therefore, its impact on the macro variables in these countries might not yet be substantial.

5.1.2 Recommendation

The adverse effect of exchange rate volatility on exports calls for policy actions to tackle rising exchange rate volatility. Especially monetary policy instruments should be used to curtail these shortcomings. The monetary authorities should adopt a mechanism that will lead to the stability of the exchange rate. Erratic changes in the exchange rate have a long-term negative effect on production of agricultural exports.

The design and implementation of trade and exchange-rate policies in SSA countries should benefit from knowledge of both the existence and the degree of foreign exchange-rate volatility. It is clear that policy actions aimed at stabilizing the export market are likely to generate results that are, at best, uncertain, if policy makers ignore the stability, as well as the level, of exchange rate. On the other hand, given the high rate of inflation, an exchange-rate policy by itself would not eliminate all exchange-rate volatility; therefore, policy makers should also pay attention to fiscal policy.

The primary agricultural exports under this study might respond differently to changes in the level and uncertainty of exchange rates. Therefore studies should concentrate on further disaggregating trade to include more products. Moreover, exchange rate volatility is one of the

least researched areas in the sub region hence given its significance on the trade and economic performance of countries it is a fertile topic for further studies.

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ANNEX 1 SUMMARY STASTICS OF THE LEVEL OF VARIABLES

stats	Agri_expo	gdp	gdp_par	pop	pop_partner	Dist.	volatility
mean	2.65E+08	1.09E+10	4.31E+12	3.42E+07	3.64E+08	9276.464	22.33202
Standard deviation	1.42E+09	2.76E+10	3.63E+12	1.22E+08	4.55E+08	3186.852	111.7956
skewness	14.42427	4.444601	1.418101	9.625982	1.392014	-0.06876	0.475774
kurtosis	298.023	22.84957	3.836284	110.6816	3.099786	1.674048	26.19804
coefficient of variation	5.358291	2.539995	0.841086	3.567225	1.249896	0.343542	5.006067

WHERE

Agri_expo is the agricultural export of SSA countries

gdp is the gross domestic product of SSA

gdp_par is the gross domestic product of the trade partner country

Dist. Is the distance between the SSA and its trade partner

Volatility is the exchange rate volatility of the SSA country

ANNEX 2. JB normality test

	Skewness/Kurtosis		tests for Normality
Variable	Pr(Kurtosis) adj chi2(2)		Prob>chi2
lnagri_expo	0.0193 29.40	0	
lngdp	0.0000 63.79	0	
lnoff_exr	0.0000 .	0	
lnpop	0.0000 54.26	0	
lnroad_net	0.2474 4.79	0.0914	
lnmoney_su~y	0.0004 .	0	
lnelec_cons	0.0000 .	0	
lnsec_schl~l	0.0000 41.29	0	
lndistcap	0.0000 .	0	
lnpop_part~r	0.0000 .	0	
lngdp_part~r	0.0000 .	0	
lnresid	0.0000 .	.	