EXCHANGE RATE POLICY AND AFRICA'S FOREIGN TRADE:

A PANEL COINTEGRATION ANALYSIS

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ABSTRACT

The paper investigates the effect of exchange rate on export and import across Sub-Sahara African countries. Based on partial equilibrium analysis, we develop two equations for export and import in which exchange rate, real GDP, stock of capital, and technology are the independent variables. The method of analysis is the panel co-integration with the application of Granger causality test. It is found that export and import are inelastic to changes in exchange rate. It follows that depreciation of currencies in the region may not have the expected results in view of the structure of the economies and the composition of their exports. In the same vein, depreciation would not depress imports but only aggravate balance of payments of the region. Thus, in the light of the findings, a policy of exchange rate stability which hinges on long run considerations, capital accumulation and technological capacity as well as the maintenance of comprehensive coherent macroeconomic packages remains a critical factor in ensuring that exchange rate policy performs its central role as a trade facilitation tool.

Keywords: Depreciation, Exchange rate, Export, Import, Panel co-integration
JEL Classification: C23, F14, F31, F33

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1. Introduction

Most countries in Sub-Saharan Africa (SSA) especially within the context of regional economic integration have over the years undergone some measures of real foreign exchange rate depreciation. This was particularly witnessed in mid-1980s with the incorporation of exchange rate reform as a component of Structural Adjustment Programmes (SAPs). One of the major aims of such exchange rate policy was to balance the worsening terms of trade at that time and with a view to improving foreign trade performance (Ndlela and Ndlela, 2002).

Another explanation was based on the fact that many countries experienced large premiums in the parallel foreign exchange market and as a result, devaluation of the official foreign exchange rate was seen as one of the main factors behind the observed exchange rate trends. Apart from South Africa and few other countries, most SSA countries implemented fixed exchange rate regimes prior to the SAP era. However, after SAP was implemented many SSA countries changed to floating/flexible exchange rate regimes apart from very few ones like Djibouti (Word Development Indicator, 2010).

The relative effectiveness of exchange rate policy in terms of whether real exchange rate deprecation or appreciation improves foreign trade performance in SSA has been a subject of intense debate as there is not yet consensus in extant studies. For example, Ndlela and Ndlela (2002) examined real exchange rate and output elasticities of import and exports of eight Southern African economies (Botswana, Lesotho, Malawi, Mauritius, South Africa, Swaziland, Zambia, and Zimbabwe). The authors found that exchange rate policy has not has not played significant role as a trade facilitation instrument in the SADC regional economies.

One of the reasons alluded by the authors was the distorted macroeconomic and structural macroeconomic fundamental. It was also found that the real exchange rate elasticities were generally low, which indicate that though there is considerable evidence that the real exchange rates affect trade volumes in the expected directions, the results were in most cases quite pessimistic regarding the size and effectiveness of the underlying elasticities. They concluded that trade and exchange rate policy implementation in regional economies is highly constrained by the underlying structural features of the economies which made import substitution difficult while exhibiting inelastic export response both on the demand and supply sides.

Several attempts have been made in the literature to empirically investigate this issue. This paper represents another contribution to the debate. It examines the implications of exchange rate policies on Africa's foreign trade. It employs a Panel Data analysis of forty (40) countries based on geographical convenience but for which complete data set is available between the period 1980 and 2008. These countries are grouped into four sub-regions namely; East, Central, South and West. This paper is in line with current trend of investigating the time series properties of variables in a model in order to enhance policy prescriptions. Therefore, the contribution of this paper lies in the use of Panel Co-integration and Granger causality test with a view to capturing the long run implications of policy which constitutes a departure from most other studies.

The rest of the paper is arranged as follows: Section 2 undertakes a brief review of related literature while Section 3 discusses the trend in foreign trade in the sub-regions identified. Section 4 presents the theoretical background and methodology used in the paper. Section 5 presents the empirical results while the summary, conclusion and policy recommendations are contained in Section 6.

2. Review of Related Literature

Studies on the impact of exchange rate on economic performance and in particular, export and import have enjoyed visibility in the advanced and emerging economies. There is however, a growing literature on the issue in Africa. Janine and Ayogu (1995) drawing evidence from South Africa explained that reforms aimed at removing tariffs and eliminating trade restrictions were consistent with a more depreciated real exchange rate. Thus, the extent of the exchange rate devaluation may not be sufficient to counterbalance the import rents that will have accrued from restrictive trade policies, (Ndlela and Ndlela, 2002).

Given that price incentives that were induced by currency devaluation can be distorted by the domestic cost inflationary trend that may ensue and thereby causing real exchange rate to appreciate in the process of time as result of some constraints in developing countries especially those of SSA. Some of the constraints include: external dependence, policy volatility and unpredictability, resistance to devaluation, reliance on few primary export commodities, limited scope for import substitution, among others (Bird, 1981; Cassim and Meyer, 1997; Velasco, 2000; Yagci, 2001; Ndlela and Ndlela, 2002; Osabuohien and Eguakhe, 2008).

Using changes in real effective exchange rate (REER), REER volatility and misalignment to proxy the impact of exchange rate policy in the promotion of manufacturing exports of North African countries, Sekkat and Varoudakis (2002) found that trade and exchange rate policies are essential for export promotion. In a more recent study, Qureshi and Tsangarides (2011) investigate the interaction between foreign exchange rate regimes and trade in Africa. Using an augmented gravity model that includes indicators of currency unions and pegged regimes, the authors established that both currency unions and direct pegs promote bilateral trade in Africa in comparison with more flexible exchange rate regimes. It was also noted that the effect of conventional pegs was at least as large as that of currency unions in Africa, and that the benefits of fixed exchange rate regimes flow through channels in addition to reduced exchange rate volatility.

Earlier studies like Ghosh et al. (1997) found no major differences in output growth across foreign exchange rate regimes but their results show that pegged regimes are related to higher investment, lower productivity growth, lower inflation, and higher volatility of growth and employment. Others such as Ghosh, Gulde, and Wolf (2003) noted that pegs and intermediate foreign exchange rate regimes stimulate economic growth compared to floats, but pegged regimes also increase output volatility. However, the finding of Reinhart and Rogoff (2004) indicate that foreign exchange rate arrangements may be quite important for growth, trade, and inflation. While Levi-Yeyati and Sturzenegger (2003) earlier observed that hard pegged foreign exchange rates are accompanied by lower inflation and a sluggish economic growth in developing countries, but have no effect in developed countries. Thus, as argued by Husain et al (2005) the actual implications of different exchange rate regimes will depend on the level of economic and institutional development of a country.

On the other hand, Rose (2000) used a gravity model of bilateral trade flows to empirically examine the impact of Customs Unions on trade and found that two countries sharing a currency tend to trade roughly three times as much as they would otherwise. Klein and Shambaugh (2006) used the de facto exchange rate regime classification developed by Shambaugh (2004) for the period 1973 to 1999 to estimate the impact of Custom Unions, and de facto direct and indirect pegged exchange rate arrangements on bilateral trade flows. They found significant gains from Customs Unions and direct pegs, but not a strong impact of indirect pegs on trade.

Masson and Pattillo (2004) examined the impact of Customs Unions on trade and find that Customs Unions increase trade thrice for the region. A similar finding has been made by Tsangarides et al. (2009) who show that membership of Custom Unions tend to benefit Africa as much as the rest of the world and that Custom Union lead to trade creation and increased price co-movements among members. Sekkat and Varoudakis (2000) employed a panel data on major SSA countries for the period 1970-1992 to investigate the impact of exchange rate policy on manufactured export performance using real effective exchange rate changes, real exchange rate volatility, and real exchange rate misalignment. Based on export supply equations estimated for textile, chemicals, and metals and two exchange rate regimes (a fixed rate regime represented by six CFA countries and a more flexible rate regime represented by five non-CFA countries), their results suggest that exchange rate management matters for export performance.

The major issue from the literature is that there is yet to be agreeable stance on whether exchange rate depreciation or appreciation is good for the promotion of Africa's foreign trade. This study contributes to knowledge in this regards.

3. Trend in Foreign Trade in the SSA

In appendix A, we show the total export and total import of the SSA by the major regional groupings. To a large extent, the period witnessed a series of macroeconomic policy changes aimed at making the economies of the sub-region more competitive with the external world. One of such policies is the Structural Adjustment Programme (SAP) that was implemented in Nigeria, Ghana and other African countries. From the data in the Appendix, we computed the growth rates of export and imports as reported in Table 1.

Table 1: Growth Rates of Export and Import across Sub-regions (1980-2008)

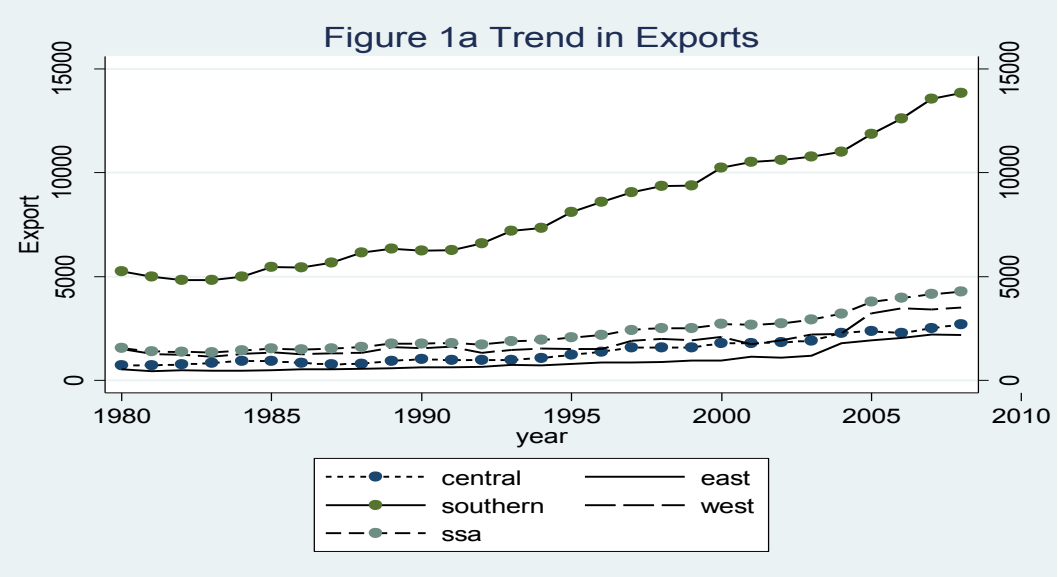
Period/Region	CENTRAL	EAST	SOUTHERN	WEST	SSA
Period	Export Growth Rate (%)				
1980-84	5.09	-1.67	0.92	-1.86	-0.09
1985-89	2.56	5.49	2.83	3.31	3.10
1990-94	3.82	4.68	5.45	-0.06	3.25
1995-99	8.60	7.21	5.62	5.53	5.96
2000-04	6.04	16.23	3.02	10.93	7.01
2005-08	4.01	5.72	3.75	3.90	3.89
1980-2008	5.07	5.64	3.60	3.77	3.83
Period	Import Growth Rate (%)				
1980-84	0.59	-1.05	-0.48	-1.71	-1.09
1985-89	-0.57	1.34	0.84	-0.68	0.16
1990-94	0.32	0.70	1.46	0.34	0.87
1995-99	2.49	0.72	0.46	1.16	0.87

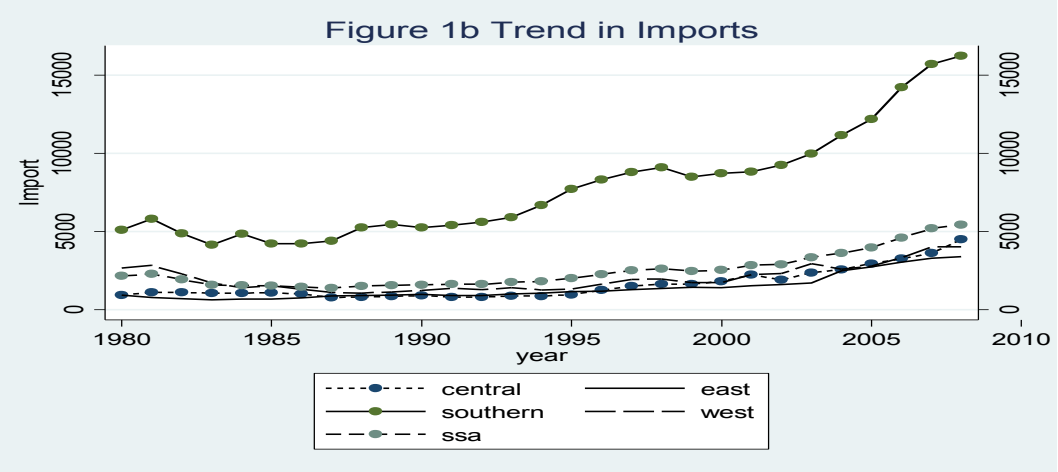
2000-04	1.99	2.68	1.25	1.98	1.72
2005-08	1.71	0.88	1.13	1.50	1.25
1980-2008	6.46	5.18	4.63	2.52	3.72

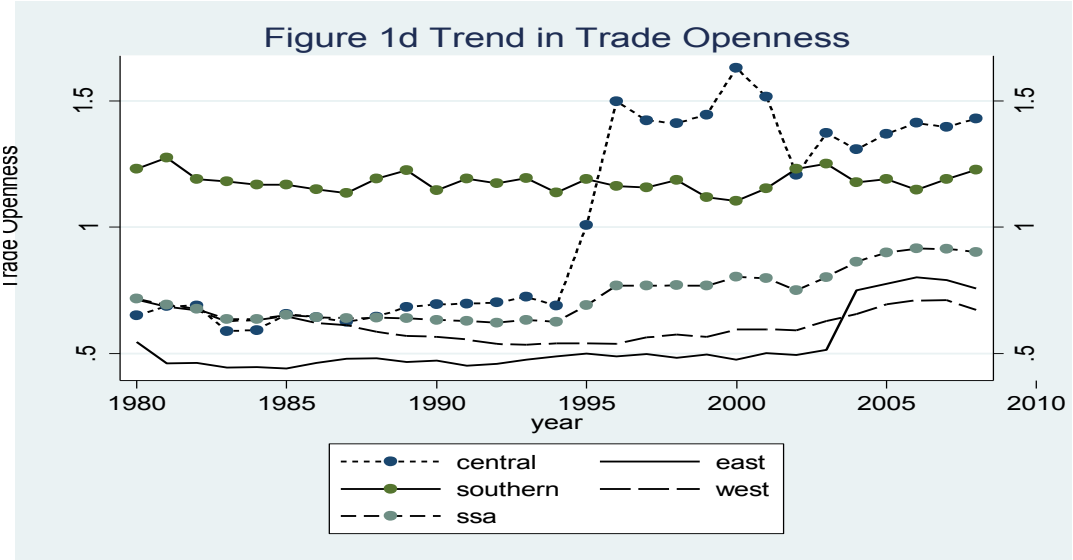
Source: Computed by the authors

The export growth rates in Table 1 show that over the period 1980-2008, SSA import grew at 3.83 percent. However, when the figure is broken down along sub-periods, sharp variations are observed with the period 1980-1984 at a negative rate of 0.09 per cent. These differences across the periods are again reflected when considered along the regions. In particular, while the growth rate of export was 5.07 per cent for the Central Africa, it was 5.64 per cent, 3.60 percent and 3.77 percent for East, Southern and West Africa, respectively. These disparities among the regions are even more pronounced when viewed across the sub-periods. These results are consequent upon the nature and composition of the region's exports which are mainly raw non-valued added agricultural and mineral products. We can also draw similar inference for the import component of external trade. While the growth rate of import of SSA stood at 3.72 per cent, it was 6.46 per cent, 5.18 per cent, 4.63 per cent and 2.52 per cent for Central, East, Southern and West Africa, respectively.

The trends in export, import and trade openness for SSA and across the sub-regions are reported in Figures 1a, 1b and 1c to show the graphical.







Source: Computed by the authors.

4. Theoretical Framework and Method of Analysis

4.1 Theoretical Background

Issues on too many competing local currencies (most of which are nonconvertible within and across regional economic communities and the multiplicity of exchange rate regimes (pegged, managed float, independent float) have been seen as factors retarding the deepening regional integration and monetary unification in Africa (UNECA, 2008). This position can be assessed using flexible and fixed exchange rate regimes.

4.1.1 Flexible exchange rates

UNECA (2008) indicate that allowing the exchange rate of an economy to float has some merits with regard to increased flexibility compared to the potential constraints of a fixed exchange rate. These include the fact that:

(a) Flexible exchange rates give a country the autonomy to adopt an exchange rate policy appropriate to its developmental objectives. It is, thus, an important advantage to be able to adjust the exchange rate appropriately;

(b) It secures the international reserves of a country since under fixed exchange rate regime the loss of reserves has often been enormously costly for the countries concerned. This problem

is eliminated under a true flexible exchange rate regime, given that the government is prepared to let the currency automatically adjust to external shocks; and

(c) Flexible exchange rates allow a country to compensate for inflation differentials and external shocks. For smaller developing countries particularly, with relatively high exposure to international trade and external shocks (as is the case of many African countries). This can be an important advantage over fixed exchange rates. Thus, flexible exchange rates help to protect countries from imported inflation (Mundel, 2002).

The above merits of flexible exchange rate notwithstanding, some of its demerits have been stated to include:

(a) Flexible exchange rates do not lead to an increased level of autonomy as it can create deflationary bias in macroeconomic policy at the global level. Thus, under flexible exchange rates, if countries wish to maintain the external balance, fiscal policy becomes relatively ineffective and countries are forced to rely more on interest rates; and

(b) Flexible exchange rate regime may not be suitable for developing countries and transition economies, as well as for smaller industrial economies. These countries tend to be far more dependent on foreign trade than the large industrial countries. Thus, flexible exchange rates can engender excessively high levels of volatility, importing uncertainty and instability from foreign partner markets.

4.1.2 Fixed Exchange Rates

Many countries faced by financial crisis in the past decade have subsequently adopted flexible rates. However, the increased volatility associated with such regimes has become an issue. As a result, there now appears to be a greater interest especially among developing countries and transition economies to use fixed exchange rate regime (hard pegs). Thus, some of the arguments in favour of fixed exchange rates include the fact that if the exchange rates are fixed in a careful way, uncertainty is reduced and international trade flourishes. Thus, fixed exchange rates can act as a powerful incentive for fiscal discipline.

On the other hand, the principal difficulty is that the wrong choice of parities may actually create more uncertainty instability. Any regime of fixed exchange rates would thus need to take into account such underlying shifts. Otherwise, a country may eventually find itself in a situation where its exchange rate is either overvalued or undervalued, with negative repercussions on economic growth. A fundamental demerit is that under fixed exchange rates, governments loose a key monetary and exchange rate instrument and fiscal policy becomes correspondingly more powerful, but at the expense of monetary policy. Without the possibility of shifts in the exchange rate that will cater for external changes, there is the possibility of greater susceptibility to asymmetric shocks.

In sum, an economy that is committed to free movement of capital cannot fix its exchange rate and at the same time pursue an independent monetary policy as such an economy would be forced to abandon one of the two objectives. This was experienced by the Asian countries affected by the currency crises of 1997-98 (UNECA, 2008).

4.2 Model Specification

This study is intended to measure the effects of real exchange rate movements on the performance of foreign trade in Sub-Saharan Africa, (SSA), we adopt the method of Ndlela and Ndlela (2002:15). The method consists in using a partial-equilibrium relative price approach to evaluate the degree of

responsiveness of exports and imports to changes in the real exchange rate. This relative price approach in which changes in import and export prices are assumed to have taken place and that the changes influence the markets for imports and exports can be contrasted with the absorption approach. This absorption approach treats current account as a component of macroeconomic identity and makes changes in saving and investment necessary to accommodate current account deficit (Hinkle and Montiel, 1990).

In the model presented in this paper, we assume that "the exporting countries are highly specialized in a small range of undifferentiated primary commodities" as it is the case in most SSA countries. The equations of the model are in the spirit of Bayoumi (1996). However, our models have been extended to incorporate a variety of other factors to capture foreign trade response to changes in real exchange. The explicit models for export and import are of the following forms:

$$X_t = f(EXR_t, IMP_t, RGDP_t, KAPI_t, TECH_t) \quad (1)$$

$$IMP_t = f(EXR_t, RGDP_t, KAPI_t, TECH_t) \quad (2)$$

where: X_t: export of goods and services

EXR_t: exchange rate of country i's currency to US dollars

IMP_t: import of goods and services

$RGDP_t$: real gross domestic product

$KAPI_t$: gross fixed capital formation

$TECH_t$: measured by aggregating value added in transport, storage and communication sectors.

For these models we postulate that depreciation of the exchange rate will bring about an increase in export since exports will become cheaper for the trading partners. The level of economic activities in the exporting country has a direct relationship with the exports while the level of gross fixed capital formation affects positively exports. Similarly, making import an explanatory variable in an export model is justifiable in the developing economies. This is because imports constitute major intermediate inputs for the industries, the extractive and agricultural sectors. Finally, in a globalised economy where level of technology is the pace-setter, including a measure of technology identifies the degree of responsiveness of export to changes in technology. The import equation can be viewed in a similar version.

Assuming that the models are nonlinear, then we have to log-linearize the equations if we were to use OLS technique to obtain the estimates of the parameters of the models. Under this assumption the log-linear form of the models are given as follow:

$$\log(X_t) = \theta_0 + \theta_1 \log(EXR_t) + \theta_2 \log(IMP_t) + \theta_3 \log(RGDP_t) + \theta_4 \log(KAPI_t) + \theta_5 \log(TECH_t) + \epsilon_X \quad (3)$$

$$\log(IMP_t) = \vartheta_0 + \vartheta_1 \log(EXR_t) + \vartheta_2 \log(RGDP_t) + \vartheta_3 \log(KAPI_t) + \vartheta_4 \log(TECH_t) + \epsilon_M \quad (4)$$

where ϵ_X, ϵ_M are the error terms in the export equation and import equation, respectively and the variables are as defined earlier.

4.3 Technique of Estimation

We use panel data in this work because of its several advantages. First, panels make it possible to capture the relevant relationships among variables over time. Second, a major advantage of using

panel data is the ability to monitor possible unobservable trading-partner-pairs individual effects. When individual effects are omitted, OLS estimates will be biased if individual effects are correlated with the regressors. Finally, combining time series and cross-sectional data increases the degree of freedom thereby reducing the incidence of biased and inefficient estimates of the regression Ojo and Alege (forthcoming). The econometric method presented in this paper is based on variants of panel model which comprises: the pooled data, the fixed effects and the random effects. According to Tiwari and Mutascu (2010), panel data analysis technique contains information necessary to deal with both the intertemporal dynamics and the individuality of the entities being investigated.
Introducing the country index and incorporating countries' unobservable individual effects in equations (3) and (4), the equations to be estimated can be rewritten as follow:

$$\log(X_{it}) = \theta_0 + \theta_1 \log(EXR_{it}) + \theta_2 \log(IMP_{it}) + \theta_3 \log(RGDP_{it}) + \theta_4 \log(KAPI_{it}) + \theta_5 \log(TECH_{it}) + \mu_{Xi} + \omega_{Xt} + \epsilon_{Xit} \quad (5)$$

$$\log(IMP_{it}) = \vartheta_0 + \vartheta_1 \log(EXR_{it}) + \vartheta_2 \log(RGDP_{it}) + \vartheta_3 \log(KAPI_{it}) + \vartheta_4 \log(TECH_{it}) + \mu_{Mi} + \omega_{Mt} + \epsilon_{Mit} \quad (6)$$

where *i* denotes country *i, t* denotes time and μ_{Xi} (μ_{Mi}) is country *i* unobservable individual effects on export (import) equation. ω_{Xt} and ω_{Mt} are unobservable time effect for export and import respectively. ϵ_{Xit} and $\varepsilon_{Mit,}$are stochastic disturbance terms such that $\varepsilon_{Xit} \approx i.i.d(0, \sigma_X^2)$ and $\varepsilon_{Xit} \approx iid(0, \sigma_M^2)$for export and import equations respectively. The specifications in equations (5) and (6) in which individual effects are incorporated are particularly justified in developing economies of SSA. In effect, those equations allow us to account for individual heterogeneity that if not taken into consideration can lead to biased estimates Tiwari and Mutascu (2010).

In addition to the pooled regression, two estimation methods are being envisaged: the fixed effects and random effects. This is to enable us choose the most efficient and consistent technique given the possibility of the presence of correlation between countries' unobservable individual effects and the determinants of foreign trade. In the absence of correlation between individual country unobservable individual effects and trade determinants, the appropriate method is the random effects. If however, there is correlation between individual country effects and trade determinants, then fixed effects method on the panel data will be the most appropriate. The choice of which one to use depends on the outcome of Hausman Test. This statistic tests the null hypothesis of non-existence of correlation between unobservable individual effects and determinants of trade against the alternative hypothesis of existence of correlation. If the null hypothesis is not rejected we can conclude as in Tiwani and Mutascu (2010), that correlation is not relevant and therefore a panel model of random effects being the most correct way of carrying out the analysis. On the contrary, if the null hypothesis is rejected we can conclude that correlation is relevant and therefore a panel model of fixed effects being the most appropriate way of carrying out our analysis of the effect of exchange rate on foreign trade of SSA countries.

4.4 Data Sources and Measurements

The sources and measurement of the variables used in this model is presented in Table 2 below. All variables, in levels, are in US$ million at 2000 prices. The countries considered in the study are arranged according to geographical dictates not necessarily on any economic or political groupings.

Table 2: Description of Variables

Names	Description and measurement
expt	Export of goods and services measured in United States dollars at 1990 constant prices
impt	Import of goods and services measured in United States dollars at 1990 constant prices
exr	International Monetary Fund (IMF) based definition of exchange rate of country *i*'s currency to US dollars
rgdp	Real Gross Domestic Product (GDP) measured in United States dollars at 1990 constant prices
kapi	Gross fixed capital formation (including Acquisitions less disposals of valuables) measured in United States dollars at 1990 constant prices.
tech	Value added by transport, storage and communication sectors measured in United States dollars at 1990 constant prices

Sources: UNSTAT and WDI Databases

Forty (40) countries that are included in the study are shown in Table 3 below. The period of analysis is 1980-2008. The choice is informed mainly by availability of data coupled with the need to take into consideration occurrence of events of economic dimensions during the time.

Table 3: List of Countries Selected for the Study

Central	East	Southern	West
Cameroon	Burundi	Botswana	Benin
Central Africa Republic	Comoros	Lesotho	Burkina Faso
Congo, Republic	Kenya	Namibia	Cape Verde
Chad	Madagascar	South Africa	Cote d'Ivoire
Equatorial Guineas	Malawi	Swaziland	Gambia
Gabon	Mauritius		Ghana
Sao Tome and Principe	Mozambique		Guinea
	Rwanda		Guinea Bissau
	Somalia		Liberia
	Tanzania		Mali
	Uganda		Mauritania
	Zambia		Niger
			Nigeria
			Senegal
			Sierra Leone
			Togo

Source: WTO (2010) International Trade Statistics

5 Estimation Results and Discussions

5.1 Introduction

In this section, we present the summary descriptive statistics both by region and then combined for all regions in SSA, the correlation coefficient matrix, the pooled, fixed and random effects regression results; the panel unit root test, the panel cointegration test as well as the panel pair-wise causality tests.

5.2 Preliminary Data analysis

Table 4 reports the summary statistics for both the dependent and the independent variables in the study. It reports the overall mean, and standard deviation values for all the variables in the model by

regions as well as for all the regions combined. The mean of the export variable, is calculated at US$2283.09 million for all regions combined. This figure contrasts very sharply with the different regional means of export. It could be seen that the mean EXPT for Southern region of SSA is US$8175.59 million which constitutes the highest in the whole of SSA, while a mean of US$942.51million is observed for the East region of SSA. The volatility in export is measured by the percent standard deviation and this shows a high disparity across the different regions in SSA. This is an indication of the divergence components of export commodities which is a reflection of the structure of the economies within the SSA. As expected, the highest average export is in the Southern region where the economies are more diversified than other regions of SSA. The dissimilarities between regions within the SSA is also shown in the other indicators such as real output, RGDP; imports, IMPT; stock of capital, KAPI; technology, TECH; exchange rate, EXR and degree of openness, OPN.

The pattern of the distribution in TECH as given by the means appear to be similar in three of the regions except in the Southern region where the mean is about five the other regions taken individually. This is not unexpected as the technological development in that region is far higher than in the other regions. There are also appreciable differences in the values of the degree of openness, OPN, across the regions of SSA. In all the regions there is the indication that trade policies adopted over the sample period, 1980-2008, has resulted into improved trade openness in the case of Central and Southern regions.

Table 4: Summary Statistics of Variables

Variables		**Central**	**East**	**Southern**	**West**	**All**
expt	Mean	1380.951	942.506	8175.591	1841.806	2283.089
	Std. Dev.	1458.225	1258.514	14931.67	4576.99	6482.174
impt	Mean	1592.727	1391.391	7781.329	2002.258	2469.714
	Std. Dev.	2226.384	1823.619	14510.46	4264.563	6275.826
Rgdp	Mean	3873.05	4005.565	26991.4	6446.51	7831.989
	Std. Dev.	4416.17	3555.959	50443.85	13374.38	21180.86
Kapi	Mean	1042.84	797.8127	5882.9	1101.02	1597.612
	Std. Dev	1310.39	857.9743	11247.75	2324.48	4586.803
Tech	Mean	304.92	316.0485	2380.11	313.7	571.1723
	Std. Dev	451.15	345.3435	4954.28	514.79	1922.112
Exr	Mean	979.81	971.2822	4.09	385.51	617.5653
	Std. Dev	2268.52	2648.975	2.54	592.69	1807.576
countries (id)		7	12	5	16	40
Period (T)		29	29	29	29	29
obs.(N)		203	348	145	464	1160

Source: Authors' computation using STATA 11.1 with data from WDI and UNSTAT Databases

Table 5: Correlation Matrix

	lexpt	limpt	lexr	lrgdp	lkapi	ltech
lexpt	1.0000					
limpt	0.9461	1.0000				
lexr	-0.1259	-0.1792	1.0000			
lrgdp	0.8829	0.8814	-0.0819	1.0000		

lkapi	0.8554	0.9105	-0.1071	0.9220	1.0000	
ltech	0.7956	0.8053	-0.0555	0.9142	0.8483	1.0000

Source: same as in Table 4

In this paper, we also examine the possibility of the presence of multi-collinearrity among the independent variables in the model by examining the pair-wise correlation matrix as contained in Table 5. The table indicates that there exists a significant positive correlation between EXPT and IMPT, RGDP, KAPI and TECH. Similarly, there is a significant positive correlation between IMPT and RGDP, KAPI and TECH. Overall, it can be established that the magnitude of the correlation coefficients indicate that multi-collinearrity is not a potential problem in the models. Thus, the data set in conjunction with the variables are appropriate for the study.

5.3 Estimation Results

Table 6 contains the results of the pooled, fixed effects and random effects panel for both export and import equations. The results show that the F-statistic for pooled and fixed effects regressions and the Wald test for the random effects regression are all significant at the level of 1 per cent. This lends support to the fact that the variables selected for the study are jointly significant in explaining the phenomenon under study. Hausman test indicates that the random effect regression is more efficient and consistent than the fixed effects regression in all cases. The coefficient of determination indicates that we have a "good fit" in all cases.

Table 6: Fixed and Random Effects Trade Regression Results

	Dependent Variable: Export (lexpt)						*Dependent Variable: Import (limpt)*					
	Pooled		FE		RE		Pooled		FE		RE	
Variable	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
lexr	0.023*	0.000	0.044*	0.000	0.044*	0.000	-0.047*	0.000	-0. 033*	0.000	-0. 037*	0.000
limpt	1.112*	0.000	0.437*	0.000	0.488*	0.000						
lrgdp	0.531*	0.000	1.025*	0.000	0.952*	0.000	0.303*	0.000	0. 802*	0.000	0. 744*	0.000
lkapi	-0.361*	0.000	-0.132*	0.000	-0.146*	0.000	0. 611*	0.000	0. 519*	0.000	0. 531*	0.000
ltech	-0.069*	0.003	-0.075*	0.007	-0.063**	0.021	-0.012	0.628	-0. 169*	0.000	-0. 158*	0.000
Constant	-2.927	0.000	-3.699	0.000	-3.449	0.000	0.897	0.000	-1.699	0.000	-1. 403*	0.000
R^2	0.918		0.857		0.866		0.848		0.816		0.815	
Adj. R^2	0.917						0.849					
Root MSE	0.506						0.557					
F-stat	2560.33	0.000	1065.3				1611.57	0.0000	1232.0	0.000		
Wald					5643	0.000					5059.7	0.000
Hausman					380.12	0.000					21.95	0.000
N	1157		1157		1157		1157		1157		1157	

Note: * and ** : significant at 1 and 5%. FE - Fixed Effects; RE - Random Effects and L-before the variables denote logarithmic transformation.

Source: Authors' computation using STATA 11.1

A close observation of the estimates of the two equations shows that there is no significant difference between FE and RE results. However, we use the RE estimated results since it is found to be more consistent than the F. We found that the exchange rate elasticity of export is very low at 0.044 and statistically significant at the level of 1 percent. This indicates that exchange rate affects

trade as expected but the size of the elasticity raises the issues of underlying factors that affect export demand/supply of SSA. This result corroborate the idea of export pessimism which maintains that world demand is inelastic with respect to both income and prices for the products in which LDC exports are concentrated (Hinkle and Montiel, 1999: 494). The positive coefficient of exchange rate means that a rising exchange rate implies a depreciation of the nominal exchange rate. This leads to a reduction in the prices of export and to a rise in demand for foreign demand for export (Akpokodje, 2009).

The results in Table 6 also show that the elasticities of all the other variables are low except that of RGDP that is close to unity (0.952). In effect, the degree of responsiveness of changes in export to import is low at 0.488 while that of KAPI and TECH stood at -0.146 and -0.063. These outcomes are not unexpected in a region where most countries that are capital trapped and level of technological development is still low.

The exchange rate has a statistically significant negative effect on imports indicating that real exchange rate depreciation leads to a rise in prices of imports and consequently a reduction in imports. The responsiveness of imports to changes in exchange rate is also inelastic. The import equation provides results which also corroborates the import demand pessimism. In effect, the imports of LDCs are made up of "production inputs whose elasticity of substitution and domestic value added is very low or essentially zero", Ndlela and Ndlela (2002: 1).

In order to examine whether or not there is co-integration, we first of all carried out panel unit root test to determine the time series properties of the variables. The result of the panel data properties shows that only Lexr is stationary at level i.e. I(0) in Levin, Lin and Chu (LLC); Im, Peseran and Shin (IPS) and Hadri Z-statistics panel unit roots tests. However, all the other variables, Lexpt, Limpt, Lrgdp, Lkapi and Ltech are stationary in first difference i.e. I(1) in both LLC, IPS and Hadri statistics. This implies that those variables that are integrated of order one i.e. I(1) in the LLC and IPS unit root tests, have first non-significant probability values at the conventional level of 5 percent in levels before attempt was made to carry out the test at first difference. The figures in table 7 are calculated using the following assumptions: individual intercept as the deterministic trend specification and the Kernel method; Bartlett has been used for the spectral estimation; and Newey-West automatic has been selected for the Bandwith.

Table 7: Panel Unit Root Test

	Levin,Lim and Chin			*Im, Persaran and Shin*			*Hadri Z-stat*		
	level	*1st diff*	*Order*	*Level*	*1st diff*	*order*	*level*	*1st diff*	*order*
Lexpt	0.874	-28.889	I(1)	4.085	-28.943	I(1)	18.870	-	I(1)
	(.809)	(.000)		(.749)	(.000)		(.000)		
Limpt	2.275	-24.636	I(1)	5.745	-23.731	I(1)	17.035	-	I(1)
	(.989)	(.000)		(.998)	(.000)		(.000)		
Lrgdp	4.839	-29.009	I(1)	10.581	-22.949	I(1)	18.849	-	I(1)
	(1.000)	(.000)		(1.000)	(.000)		(.000)		
	2.220	-26.493	I(1)	3.348	-26.553	I(1)	17.302	-	I(1)
Lkapi	(.987)	(.000)		(.999)	(.000)		(.000)		
	6.406	-21.332	I(1)	11.356	-21.316	I(1)	17.934	-	I(1)
Ltech	(1.000)	(.000)		(1.000)	(.000)		(.000)		
	-7.005	-	I(0)	-2.306	-	I(0)	19.768	-	I(0)
Lexr	(.000)			(.011)			(.000)		

Source: Authors' computation using E-view 11.1. **Note:** Figures in brackets are probability values

Having established that the variables are stationary at first difference, we then examine the long run co-integration of the variables in the model using Johansen trace and maximum eigen-value test. The cointegration test results for export model as well as the normalized co-integrating equations for both export and import are shown in Table 8. The trace and maximum eigen-value tests, rejects the null hypothesis of no co-integration at the level of 5 per cent with probability value of 0.000 and 0.001 respectively. In addition, the null hypothesis of at most one co-integrating equation is rejected at the level of 5 per cent with probability value of 0.013 and 0.002.

Table 8: Panel Cointegration Test

No. of CE(s)	Eigenvalue	Trace Stat	C. V. (5%)	Prob.	Max. Stat	C. V. (5%)	Prob.
None *	0.054	129.950	95.754	0.000	53.455	40.078	0.001
At most 1 *	0.045	76.495	69.819	0.013	44.348	33.877	0.002
At most 2	0.019	32.147	47.856	0.604	18.758	27.584	0.433
At most 3	0.009	13.389	29.797	0.873	8.820	21.131	0.847
At most 4	0.004	4.569	15.495	0.853	3.732	14.266	0.887
At most 5	0.001	0.837	3.842	0.360	0.837	3.842	0.360
Normalized Cointegrating Coefficients							
Lexpt	lexr	Limpt	lkapi	lrgdp	ltech		
Coefficient	0.496	-0.257	2.005	2.019	0.593		
T-values	5.449*	0.619	4.213*	3.687*	1.669**		
Normalized Cointegrating Coefficients							
Limpt	lexr	Lkapi	lrgdp	ltech			
Coefficient	0.532	2.039	1.768	-0.869			
T-values	5.617*	3.055*	4.365*	2.234*			

Note: The cointegration test for both export and import equations were similar showing at least one cointegrating equation; hence separate result was not presented for import equation. However, the co-integrating equation for each of them is presented because it shows the long-run relationship.
*,**: Significant at 1% and 5% respectively.

The results of the normalized co-integrating equations point to strong evidence of long-run co-integration relations between the variables of the model. The normalized export equation shows that Lexr, Lkapi, Lrgdp and Ltech are statistically significant at the at least 5 per cent while Limpt is not statistically significant. In the long-run, the response of export to capital stock and real GDP is elastic. Similarly, all the estimated parameters in the import model are statistically significant at the level of 1 per cent. However, relationship between export and exchange rate on the one hand and import and exchange rate on the other are inelastic.

It follows that the co-integrating tests indicate the stability of the relationships among the variables of the models. It also shows that the independent variables, in both models, provide information about changes in export and import. It follows then that directing efforts at influencing these policy variables will enhance export and import performance in SSA. With the exchange rate being inelastic in both export and import equations, it can be inferred that tinkering with exchange rate alone may not bring about the desired improvement in the competitiveness of SSA economies.

In order to enhance policy choices, we carried out panel granger causality test to be sure of which variable causes which one and where is the direction of causation. Table 9 shows the matrix of

bivariate Panel Granger causality tests. The equality sign, =, indicates self causation, → denotes unidirectional causation while ↔ denotes bidirectional causation. There are eleven (11) cases in which we do not reject the null hypothesis of no causality indicated by $\overline{RH_0}$. For example export does not Granger cause import and exchange rate does not Granger cause export. There are nine (9) cases of unidirectional causality. There is a unidirectional relationship between export and exchange rate i. e. Lexpt → Lexr. This means that apart from the knowledge of the linear relationship between two variables, the direction of causation is from Lexpt to Lexr.

Table 9: Matrix of Pairwise Panel Granger Causality Tests

	Lexpt	Limpt	Lexr	Lrgdp	Lkapi	Ltech
Lexpt	=	$\overline{RH_0}$	→	↔	↔	↔
Limpt	→	=	→	→	↔	→
Lexr	$\overline{RH_0}$	$\overline{RH_0}$	=	$\overline{RH_0}$	$\overline{RH_0}$	$\overline{RH_0}$
Lrgdp	↔	$\overline{RH_0}$	→	=	$\overline{RH_0}$	↔
Lkapi	↔	↔	→	→	=	→
Ltech	↔	$\overline{RH_0}$	$\overline{RH_0}$	↔	$\overline{RH_0}$	=

Note: $\overline{RH_0}$ means do not reject the null hypothesis that X does not Granger cause Y, ↔: denotes bidirectional causality; →: denotes unidirectional; = principal diagonal entries.

Source: Authors calculations using EViews 5.0

It could be seen from Table 9 that the bivariate causality between export on the one hand and real GDP, stock of capital, and technology on the other, are bidirectional i.e. Lexpt ↔ Lrgdp, Lexpt ↔ Lkapi and Lexpt ↔ Ltech. This means that real GDP, capital and technology granger cause export in the SSA economies. The implication of all of these is that liberalization policies embarked upon by African countries have preponderant effect on export in the sub region. It also means that export promotion policies can be used to guide policies in capital accumulation and technology acquisition. This means that variations in export cause changes in real GDP in SSA and at the same time, real GDP have caused the level of export observed in the SSA. This, thus, confirms that high export is a major underlying factor in the growth of real GDP in most SSA countries.

5.4 Policy Implications

There are some policy implications of this study:

1. The finding that export positively affect exchange rate and that the degree of responsiveness is inelastic implies that reduction in export of SSA countries could negatively impinge on foreign earning which can trigger inability to fund development projects as well as the danger of precipitating balance of payment disequilibrium across SSA economies.
2. The finding that the coefficient of exchange rate in the import model is statistically significant and negative means that decline in imports as a result of exchange rate fluctuations could affect domestic production and consumption. Studies have shown that production processes in these countries depend on imported intermediate and capital goods. These results are in consonance with Akpokodje (2009).
3. That there exits one way causality between Lexpt and Lexr in the Granger sense implies that policy that would increase export of SSA countries would impact exchange rate.
4. The study shows that exchange rate does not Granger cause export. However, the latter indicate bidirectional relationships with real GDP, capital stock and technology. Therefore, policy must also aim at those factors if we were to improve on external trade in the SSA.
5. The study finds evidence of the existence of stationarity and co-integration between the variables of the models. This provides information on the long run relationships between the

variables. It follows then that policy measures directed at these variables will consistence over the horizon.

6 Summary, Policy Recommendations and Conclusion

In this paper, we measure the effects of exchange rate movements on the performance of foreign trade of SSA countries. The paper assesses the trend in export and import across the sub-regions. Based on partial equilibrium analysis, we develop two equations for export and import in which exchange rate, real GDP, stock of capital, and technology are the independent variable. The method of analysis is the panel co-integration with the application of Granger causality test.

From the results, it follows that the inelasticity of export and import to exchange rate suggest the need for decisive policy intervention that would assist in stabilizing exchange rate fluctuations in the region and minimize macroeconomic shocks that may distort the preferred direction of policies. Our results also indicate that apart from monetary and fiscal policies which are often suggested in the literature to eradicate exchange rate volatility, other factors such as capital growth could help in stabilizing the currencies of countries in the sub-region and engender competitive trading relationship with the external world. This policy should be carefully implemented in view of the fact that the traditional approach of focusing on high degrees of import compression, excessive dependence on a few traditional export products while importing manufactured goods and machinery that are critical inputs in the production process has perpetuated the low responsiveness of imports and exports to changes in the real exchange rates in SSA economies.

In conclusion, this paper has investigated the effects of exchange rate on the foreign trade of some selected African countries in a panel co-integration approach. It is found that export and import are inelastic to changes in exchange rate. It follows that depreciation of currencies in the region may not have the expected results in view of the composition of our exports. In the same vein, depreciation would only aggravate imports of the region. Thus, in light of the findings, a policy of exchange rate stability which hinges on extensive institutional and technological capacity as well as the maintenance of comprehensive coherent macroeconomic packages remains a critical factor in ensuring that exchange rate policy performs its central role as a trade facilitation tool.

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Appendix

Appendix A: Evolution of Exports and Imports by Regional Groupings in SSA (US$ million)

	Exports					Imports				
Year	Central	East	Southern	West	SSA	Central	East	Southern	West	SSA
1980	726.52	530.89	5237.32	1515.50	1547.27	932.82	939.07	5103.63	2665.51	2149.12
1981	718.50	452.33	4984.21	1264.90	1390.42	1104.37	772.36	5791.79	2835.51	2283.15
1982	758.47	479.27	4835.84	1228.66	1372.46	1098.78	712.96	4866.29	2280.58	1926.69
1983	824.96	454.98	4822.55	1135.42	1337.85	1056.43	639.50	4138.74	1710.25	1578.17
1984	935.44	464.29	4986.28	1267.38	1433.23	1058.49	669.73	4838.79	1411.07	1555.43
1985	924.53	480.62	5449.25	1344.40	1524.89	1083.71	680.86	4218.99	1520.74	1529.57
1986	832.63	524.42	5424.74	1259.76	1485.03	998.97	764.74	4212.69	1295.46	1449.01
1987	768.89	544.90	5655.01	1304.33	1526.63	778.60	866.94	4388.93	1099.11	1384.60
1988	797.81	564.25	6162.82	1324.18	1608.91	809.41	913.27	5257.78	1062.15	1497.71
1989	930.71	586.67	6335.92	1591.49	1767.46	853.23	924.74	5453.30	1140.97	1564.79
1990	1023.72	627.27	6243.96	1552.92	1769.00	892.36	973.47	5238.63	1218.98	1590.62
1991	964.52	632.67	6277.55	1615.99	1789.68	816.38	891.81	5389.28	1371.90	1632.83
1992	980.51	647.40	6596.57	1326.32	1720.91	801.11	895.59	5598.65	1280.12	1620.75
1993	982.64	745.71	7191.63	1462.54	1879.65	874.27	993.76	5894.72	1404.16	1749.63
1994	1078.18	725.16	7342.23	1543.35	1941.35	866.17	1065.76	6679.29	1266.90	1812.98
1995	1221.66	781.57	8114.17	1508.56	2065.96	963.77	1166.55	7716.83	1314.23	2008.92
1996	1379.80	866.34	8587.84	1505.48	2177.04	1249.47	1192.17	8316.10	1622.31	2264.74
1997	1572.12	864.01	9054.02	1896.37	2424.62	1505.50	1278.16	8790.29	1938.56	2521.12
1998	1591.04	890.92	9369.10	1987.85	2511.99	1626.71	1366.32	9091.59	1962.69	2616.10
1999	1581.86	946.36	9377.56	1930.52	2505.14	1630.87	1443.99	8482.40	1724.27	2468.61
2000	1785.83	963.70	10245.87	2079.12	2714.01	1813.35	1418.20	8709.41	1733.93	2525.04
2001	1794.08	1132.07	10518.84	1753.33	2669.77	2233.34	1531.39	8804.81	2229.32	2842.58
2002	1826.75	1098.83	10621.59	1929.13	2748.68	1916.00	1602.68	9242.65	2307.00	2894.24
2003	1905.85	1190.00	10779.19	2214.23	2923.61	2358.72	1705.17	9959.03	2950.12	3349.26
2004	2286.90	1787.09	10996.19	2248.31	3210.18	2567.25	2476.70	11142.98	2586.02	3619.56
2005	2369.17	1932.95	11874.34	3236.67	3773.45	2945.79	2742.13	12189.20	2790.63	3978.05
2006	2272.40	2045.19	12613.79	3463.82	3973.48	3254.82	3036.54	14212.45	3320.15	4585.17
2007	2510.94	2194.41	13560.54	3406.57	4155.43	3605.04	3303.10	15705.63	4003.20	5186.30
2008	2701.17	2178.39	13833.23	3515.30	4261.49	4493.37	3382.69	16223.67	4019.67	5436.97