

Trade-Exchange Rate Nexus in Sub-Saharan African Countries: Evidence from Panel Co-integration Analysis

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Abstract

This study explores international trade-exchange rate interaction in SSA 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 results from empirical analyses show 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 export compositions. In the same vein, depreciation would not depress imports but only aggravate balance of payments. 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: Cointegration; Depreciation; Exchange rate; Exports; Imports; Panel data; Sub-Saharan Africa; Trade

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1 Introduction

In most Sub-Saharan Africa (SSA) countries 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 Programme (SAP). 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).

The relative effectiveness of exchange rate policy in terms of whether real exchange rate depreciation or appreciation improves foreign trade performance in SSA has been a subject of intense debate. 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 played significant role as a trade facilitation instrument in the Southern African Development Co-operation (SADC) regional economies. They also noted 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.

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 40 countries in SSA (1980-2008) based on data availability. This paper is in line with current trend of investigating the time series properties of variables in order to enhance policy recommendations. Thus, the central argument of this paper is that exchange rate policy without other components such as the enhancement of capital stock, technological capacity and the maintenance of comprehensive and consistent macroeconomic policy package will not deliver the desired function of foreign trade promotion.

The rest of the paper is arranged as follows: Section 2 undertakes a brief review of related literature while Section 3 presents the theoretical background and methodology used in the paper. Section 4 entails the empirical results while the summary, conclusion and policy recommendations are contained in Section 5.

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.

In general models that embark on determining export supply and import demands have taken different dimensions. Some have examined variables that engender price and elements of competitiveness. Edwards (1989) shows that real exchange rate (RER) and real effective exchange rate (REER) are measures of price competitiveness. Hence, a country may lose/gain in competitiveness following an appreciation/depreciation of its RER. In particular, Petreski and Kostoska (2009) employ REER and real unit of labour cost and industrial production to capture the competitiveness of Macedonian economy. Honthakker and Magee (1969) as contained in Aliyu (2007) found that the main determinants of exports in developing countries are the level of real income in importing countries and price competitiveness in the exporting countries. Another contribution to the study of export supply and import demand is the study by Goldstein and Khan (1985). The study presents different specifications for both imports and exports.

Evidence from the literature shows that there is no unique import and export function that serves both spatial and temporal dimensions. In this respect, Thursby and Thursby (1984) as contained in Egwaikhide (1999) examined alternative specifications based on five industrialised countries of Canada, Germany, Japan, UK and USA. They explained nine different models of aggregate imports demand from which 324 alternative specifications were derived and conclude that there is no single functional form that is universally appropriate across countries over time.

In a more recent paper on export-import demand functions in Nigeria, Aliyu (2007) shows import function as dependent on GDP, exchange rate, foreign reserves, index of openness, index of import capacity and a dummy variable to capture the possible change brought about by SAP. The study concludes, amongst others, that current income exerts little influence on both imports and exports although lag level of income affect both variables; exchange rate significantly affects imports more than exports in absolute terms and that the Marshall-Lerner condition holds in the Nigerian case.

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 (Ndlela and Ndlela, 2002; Osabuohien and Egwakhe, 2008).

Sekkat and Varoudakis (2002) found that trade and exchange rate policies are essential for manufacturing export promotion in North Africa based on fixed effects technique. In a more recent study, Qureshi and Tsangarides (2011) investigate the interaction between foreign exchange rate regimes and trade in 159 countries (1972-2006) including African sub-sample. Based on augmented gravity model the authors established that both currency unions and direct pegs promote bilateral trade in comparison with more flexible exchange rate regimes.

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. However, the finding of Reinhart and Rogoff (2004) indicate that foreign exchange rate arrangements may be quite important for growth, trade, and inflation. While Levy-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 Union 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 for the period 1973-1999 to estimate the impact of Customs Union, and de facto direct and indirect pegged exchange rate arrangements on bilateral trade flows.

Tsangarides *et al* (2009) show that membership of Customs Union tend to benefit Africa as much as the rest of the world and that Customs 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 using fixed effects 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. Theoretical Framework and Method of Analysis

3.1 Theoretical Background

There are two theoretical approaches to understanding the determinants of trade flow in a given country. These are the elasticities and the trade balance approaches. In the case of the latter, the determinants are exchange rate, real income and other macroeconomic variables. According to Aydin *et al* (2004), this method provides a more direct estimation of the effects of changes in the independent variables on the dependent variable without recourse to the Marshall-Lerner conditions.

The elasticity approach is basically Keynesian and finds justification for the effects of devaluation of the national currency. In the standard formulation, export supply and import demand are functions of real exchange rate, relative price and world real income. Price and income elasticities are expected to have negative and positive signs, respectively. In that respect, devaluation makes exportable goods cheaper *vis-a-vis* the foreign buyers and therefore it is expected to increase level of export and decrease level of imports. Consequently, for the devaluation of a country's currency to improve the current-account balance, the sum of the

absolute values of the price elasticities of domestic and foreign demand for imports must be greater than unity provided the current-account balance is zero initially. This is the Marshall-Lerner condition.

In the application of the elasticity approach, studies have strengthened the importance of perfect and imperfect substitutes in trade models. Import volumes are regressed on relative import prices and real domestic income while export volumes are regressed on relative export price and real world income. The main assumption here is the imperfect substitute framework. According to Goldstein and Khan (1985), assert that if domestic and foreign goods were perfect substitutes, then either of the goods can have unity market share, and thus each country acts as an importer or exporter of a traded good but not both. In trade analysis, the demand side is usually the focus of attention following the assumption of perfect elasticities of import and export supplies. Further, Goldstein and Khan emphasized the role of aggregate and disaggregate import demand functions in trade models. Finally, the use of static models is justified as been consistent with the formulation of Marshall-Lerner stability conditions as against dynamic formulation.

3.2 Model Specification

This study is intended to examine 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, 2001).

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) and Ndlela and Ndlela (2002). However, our models have been extended to incorporate a variety of other factors to capture foreign trade response to changes in real exchange. In the export model, we postulate that depreciation of the exchange rate (EXR) will bring about an increase in the export since exports will become cheaper for the trading partners. This has theoretical underpinnings in the Keynesian doctrine. The paper also assumes that real domestic product (RGDP) in the exporting country has direct relationship with the level of export a country can offer. The inclusion of the three variables into the model, contrary to the general approach, is to reflect specific economic conditions of the SSA countries considered in the study. In effect, explicitly specifying level of gross fixed capital formation (*KAPI*) has direct influence in developing countries where there is the dearth of this factor. The paper draws on the fact that capital is essential for production activities particularly for the domestic firms that are engaged in international trade and are faced with stiff competition. Hence, the inclusion of *KAPI* is to proxy capital stock.

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 *KAPI* 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. In this regard, technology will have effect on the trading capability as it influences cost of trading (Djankov et al, 2010). The import equation can be viewed in a similar version except that we postulate that relative prices have no direct consequences on direction of imports in LDCs. The EXR is assumed to capture price competitiveness.

The explicit models for export and import are, thus, 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 : number of units of country i's currency to one 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.

The signs below the independent variables in equations (1) and (2) are the a priori expectations.

Many studies on export supply and import demand functions assume away non-linearity and specify a double-log model. This paper assumes that imports and exports functions are typical production functions and are therefore non-linear. Therefore, there is no proportional change in the dependent variable following a change in the independent variable. Given these postulations, then we have to log-linearize the equations if we were to use Ordinary Least Squares (OLS) technique to obtain the estimates of the parameters of the models which are thus elasticities. Under these assumptions 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.

3.3 Technique of Estimation

We use panel data in this paper by 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 (2014). 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.

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 ϵ_{Mit} , are stochastic disturbance terms such that $\epsilon_{Xit} \approx i.i.d(0, \sigma_X^2)$ and $\epsilon_{Mit} \approx iid(0, \sigma_M^2)$ 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 (2011).

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. When there is no correlation between individual country 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 more 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 Tiwari and Mutascu (2011), that correlation is not relevant and therefore a panel model of random effects being the most correct way of carrying out the analysis, vice versa.

3.4 Data Sources and Measurements

The sources and measurement of the variables used in this model is presented in Table 1. All variables, in levels, are in US\$ million at 2000 prices.

Table 1: Description of Variables

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

Sources: UNSTAT and World Development Indicators-WDI (Word Bank, 2013)

The selected 40 countries used in the study include: Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central Africa Republic, Chad, Comoros, Congo (Republic), Cote d'Ivoire, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, South Africa, Swaziland, Tanzania, Togo, Uganda, and Zambia. 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.

4 Estimation Results and Discussions

4.1 Descriptive Analysis

Table 2 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.

Table 2: Summary Statistics of Variables

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

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

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; and exchange rate, EXR. 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.

4.2 Estimation Results¹

Table 3a 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 (FE) regressions and the Wald test for the random effects (RE) 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 RE regression is more efficient and consistent than the FE regression in all cases. The coefficient of determination indicates that we have a “good fit” in all cases.

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 FE. 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, 2001). 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.

Table 3a: Pooled Fixed and Random Effects Trade Regression Results

Variable	<i>Dependent Variable: Export (lexpt)</i>						<i>Dependent Variable: Import (limpt)</i>					
	Pooled		FE		RE		Pooled		FE		RE	
	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					
F-stat	2560.33	0.000	1065.3				1611.57	0.0000	1232.0	0.000		
Wald					5643	0.000					5059.7	0.000

¹We first examined the presence of multi-collinearity among the independent variables in the model using correlation test. The results (not reported) indicate that there is no issue of multi-collinearity.

Hausman			380.12	0.000			21.95	0.000
N	1157	1157	1157		1157	1157	1157	

Source: Authors' computation using STATA 11.1

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

The results in Table 3a 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).

Table 3b: Results of Sensitivity Check

Variable	<i>Result with South Africa</i>						<i>Results without Nigeria</i>					
	<i>Dependent Variable: Export (lexpt)</i>						<i>Dependent Variable: Export (lexpt)</i>					
	Pooled		FE		RE		Pooled		FE		RE	
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	0.024*	0.000	0.047*	0.000	0.047*	0.000
limpt	1.114*	0.000	0.437*	0.000	0.488*	0.000	1.122*	0.000	0.465*		0.514*	
lrgdp	0.533*	0.000	1.024*	0.000	0.955*	0.000	0.523*	0.000	1.001*	0.000	0.932*	0.000
lkapi	-0.360*	0.000	-0.131*	0.000	-0.146*	0.000	-0.362*	0.000	-0.150*	0.000	-0.162*	0.000
ltech	-0.066*	0.006	-0.074*	0.008	-0.062**	0.025	-0.067*	0.006	-0.059*	0.000	-0.049**	0.046
Constant	-2.947	0.000	-3.688	0.000	-3.465	0.000	-2.937	0.000	-3.673	0.000	-3.444	0.000
R ²	0.904		0.883		0.843		0.910		0.845		0.855	
Adj. R ²	0.903						0.910					
F-stat	2104.04	0.000	1030.74				2270.82	0.0000	1061.50	0.000		
Wald					5370.75	0.000					5559.39	0.000
Hausman					313.50	0.000					302.93	0.000
N	1128		1128		1128		1128		1128		1128	

Source: Authors' computation using STATA 11.1

Note: * and ** : significant at 1 and 5%. FE - Fixed Effects; RE - Random Effects and L-before the variables denote logarithmic transformation. Similar analysis was done using the import function, which also points to the fact that the two countries do not pose possible outlier effects. Results not reported for brevity sake.

In addition, this paper examined the sensitivity of the results with regards to possible outlier effects. This was achieved by estimating the export function without South Africa and Nigeria, and the results was compared with those of entire sample. The result of the sensitivity check is reported in Table 3b. The aim of the sensitivity check is to examine the variations of the magnitudes in the coefficients and level of significance in terms of their influence on the

dependent variable. It was also considered expedient to examine this check given the fact that some international agencies especially the African Development Bank (AfDB) usually discuss African data by classifying Africa into three: North Africa, SSA, and SSA less South Africa (Osabuohien, 2011). Another important reason is the fact that South Africa has been known to have a different growth pattern compared to other SSA countries. That of Nigeria was informed by her high population, which is about 18.31% of that of the SSA region and 15.32% of that of the entire African continent as well as the proportion of petroleum products in her export basket (Osabuohien et al, 2014).

As can be seen in Table 3b, the results reveal that there was not much difference with regard to the magnitudes of the coefficients and level of significance when the estimation was done without South Africa and Nigeria, respectively. In effect, the respective variables maintained their level of significance with very minimal variation in the size of their coefficients. Thus, it denotes that South Africa and Nigeria did not exert outlier effects in the estimated results.

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 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% in levels before attempt was made to carry out the test at first difference. The values in Table 4 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 Bandwidth.

Table 4: Panel Unit Root Test

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

Source: Source: Authors' computation using STATA 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 5. The trace and maximum Eigen-value tests, rejects the null hypothesis of no co-integration at the level of 5% 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% with probability value of 0.013 and 0.002.

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 5% 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%. However, relationship between export and exchange rate on the one hand and import and exchange rate on the other are inelastic.

Table 5: 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*			

Source: Authors' computation using STATA 11.1

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.

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. Thus, 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. The implication from the findings 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.

5 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.

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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