Article

Trade–Exchange Rate Nexus in Sub-Saharan African Countries: Evidence from Panel Cointegration Analysis

Foreign Trade Review
50(3) 1–17

SAGE Publications
sagepub.in/home.nav
DOI: 10.1177/0015732515589440
http://ftr.sagepub.com

Alege[1]
Evans S. Osabuohien[1]

Abstract

This study explores international trade–exchange rate interaction in sub-Saharan African (SSA) countries. Based on partial equilibrium analysis, we develop two equations for export and import in which exchange rate, real gross domestic product (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 that 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.

JEL: F13, F14, F31

Keywords

Cointegration, depreciation, exchange rate, exports; imports, panel data, sub-Saharan Africa, trade

[1] Department of Economics and Development Studies, Covenant University, Ota, Nigeria.

Corresponding author:
Evans S. Osabuohien, Department of Economics & Development Studies, Covenant University, P.M.B. 1023, Ota, Nigeria.
Emails: pecos4eva@gmail.com; stephen.osabuohien@covenantuniversity.edu.ng

Introduction

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 (EXR) depreciation. This was particularly witnessed in the mid-1980s with the incorporation of EXR reform as a component of structural adjustment programme (SAP). One of the major aims of such an EXR policy was to balance the worsening terms of trade at that time and with a view to improving foreign trade performance (Ndlela & Ndlela, 2002).

The relative effectiveness of EXR policy in terms of whether real exchange rate (RER) deprecation or appreciation improves foreign trade performance in SSA has been a subject of intense debate. For example, Ndlela and Ndlela (2002) examined RER 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 EXR 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 RER elasticities were generally low, which indicate that though there is considerable evidence that the RERs 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 article represents another contribution to the debate. It examines the implications of EXR policies on Africa's foreign trade. It employs a panel data analysis of 40 countries in SSA (1980–2008) based on data availability. This article is in line with the current trend of investigating the time series properties of variables in order to enhance policy recommendations. Thus, the central argument of this article is that EXR 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 article is arranged as follows: the second section undertakes a brief review of related literature while the third section presents the theoretical background and methodology used in the article. The fourth section entails the empirical results while the summary, conclusion and policy recommendations are contained in the fifth section.

Review of Related Literature

Studies on the impact of EXR 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 RER. Thus, the extent of the EXR 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 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, cited 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, cited in Egwaikhide, 1999) examined alternative specifications based on five industrialized 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 concluded 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, EXR, 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 the lag level of income affects both variables; EXR significantly affects imports more than exports in absolute terms and 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 RER to appreciate in the process of time as a 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 and limited scope for import substitution, among others (Ndlela & Ndlela, 2002; Osabuohien & Egwakhe, 2008).

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

Earlier studies like Ghosh, Gulde, Ostry and Wolf (1997) found no major differences in output growth across foreign EXR 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) indicates that foreign EXR arrangements may be quite important for growth, trade and inflation. While Levy-Yeyati and Sturzenegger (2003) earlier observed that hard-pegged foreign EXRs are accompanied by lower inflation and a sluggish economic growth in developing countries, they have no effect in developed countries. Thus, as argued by Husain, Mody and Rogoff (2005), the actual implications of different EXR 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 EXR regime classification for the period 1973–1999 to estimate the impact of Customs Union and de facto direct and indirect pegged EXR arrangements on bilateral trade flows.

Tsangarides, Ewenczyk, Hulej and Qureshi (2009) show that membership of Customs Union tend to benefit Africa as much as the rest of the world and that Customs Union leads 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 EXR policy on manufactured export performance using REER changes, RER volatility and RER misalignment. Based on export supply equations estimated using fixed effects (FEs) for textile, chemicals and metals and two EXR 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 EXR management matters for export performance.

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

Theoretical Framework and Method of Analysis

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 EXR, real income and other macroeconomic variables. According to Aydin, Ciplak and Yucel (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 RER, 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-à-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. 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.

Model Specification

As this study is intended to examine the effects of RER movements on the performance of foreign trade in SSA), we adopt the method of Ndlela and Ndlela (2002, p. 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 RER. 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 the current account as a component of macroeconomic identity and makes changes in saving and investment necessary to accommodate current account deficit (Hinkle & Montiel, 2001).

In the model presented in this article, 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 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 article also assumes that real gross 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 a direct influence on developing countries where there is the dearth of this factor. The article 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 EXR 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 and the extractive and agricultural sectors. Finally, a globalized economy, where the level of technology is the pacesetter, 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, Freund & Pham, 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 least developed countries (LDCs). The EXR is assumed to capture price competitiveness.

The explicit models for export and import are, thus, of the following forms:

$$X_t = f(\underset{-}{EXR_t}, \underset{+}{IMP_t}, \underset{+}{RGDP_t}, \underset{+}{KAPI_t}, \underset{+}{TECH_t}) \qquad (1)$$

$$IMP_t = f(\underset{-}{EXR_t}, \underset{+}{RGDP_t}, \underset{+}{KAPI_t}, \underset{+}{TECH_t}) \qquad (2),$$

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 nonlinearity and specify a double-log model. This article 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 follows:

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

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

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

Technique of Estimation

We use panel data in this article by combining time series, and cross-sectional data increase the degree of freedom thereby reducing the incidence of biased and inefficient estimates of the regression (Ojo & Alege, 2014). The econometric method presented in this article is based on variants of panel model that comprises the pooled data, the FEs and the random effects (REs).

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's unobservable individual effects on export (import) equation. ω_{Xt} and ω_{Mt} are unobservable time effects for export and import, respectively. ϵ_{Xit} and ϵ_{Mit}, are stochastic disturbance terms such that $\epsilon_{Xit} \approx iid(0, \sigma_X^2)$ *and* $\epsilon_{Xit} \approx iid(0, \sigma_M^2)$ 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 & Mutascu, 2011).

In addition to the pooled regression, two estimation methods are being envisaged: the FEs and REs. This is to enable us to 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' and consider rephrasing it for clarity. If, however, there is correlation between individual country effects and trade determinants, then FEs 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 Tiwari and Mutascu (2011), that correlation is not relevant and therefore a panel model of REs is the most correct way of carrying out the analysis and vice versa.

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.

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.

Table 1. 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

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

Table 2. 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.

Estimation Results and Discussions

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.

It could be seen that the mean EXPT for the southern region of SSA is US$8175.59 million, which constitutes the highest in the whole of SSA, while a mean of US$942.51 million is observed for the east region of SSA. The volatility in export is measured by the per cent 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 are 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 appears to be similar in three of the regions except in the southern region where the mean is about five with the other regions

taken individually. This is not unexpected as the technological development in that region is far higher than in the other regions.

Estimation Results[1]

Table 3a contains the results of the pooled, FEs and REs panel for both export and import equations. The results show that the F-statistic for pooled and FE regressions and the Wald test for the REs regression are all significant at a 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. The 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 EXR elasticity of export is very low at 0.044 and statistically significant at a level of 1 per cent. This indicates that EXR 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 corroborates 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 & Montiel, 2001). The positive coefficient of EXR means that a rising EXR implies a depreciation of the nominal EXR. This leads to a reduction in the prices of export and to a rise in demand for foreign demand for export.

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 the level of technological development is still low. The EXR has a statistically significant negative effect on imports indicating that RER depreciation leads to a rise in prices of imports and consequently a reduction in imports. The responsiveness of imports to changes in EXR is also inelastic. The import equation provides results that also corroborate 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 & Ndlela, 2002, p. 1).

In addition, this article examined the sensitivity of the results with regard to possible outlier effects. This was achieved by estimating the export function without South Africa and Nigeria, and the results were compared with those of the 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)

Table 3a. Pooled 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					
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	

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.

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 its high population, which is about 18.31 per cent of that of the SSA region and 15.32 per cent of that of the entire African continent as well as the proportion of petroleum products in her export basket (Osabuohien, Efobi & Beecroft, 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 cointegration, we first of all carried out a 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, that is, I(1) in both LLC, IPS and Hadri statistics. This implies that those variables that are integrated of order one, that is, I(1) in the LLC and IPS unit root tests, have first non-significant probability values at the conventional level of 5 per cent in levels before attempting 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.

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

The results of the normalized cointegrating equations point to strong evidence of long-run cointegration relations between the variables of the model. The normalized export equation shows that *Lexr*, *Lkapi*, *Lrgdp* and *Ltech* are statistically significant at 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 a level of 1 per cent. However, the relationships between export and EXR on the one hand and import and EXR on the other are inelastic.

It follows that the cointegrating 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,

Table 3b. Results of Sensitivity Check

	Result with South Africa Dependent Variable: Export (lexpt)						Results without Nigeria Dependent Variable: Export (lexpt)					
	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	0.024*	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. A 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.

Table 4. 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 (0.809)	–28.889 (0.000)	I(1)	4.085 (0.749)	–28.943 (0.000)	I(1)	18.870 (0.000)	–	I(1)
Limpt	2.275 (0.989)	–24.636 (0.000)	I(1)	5.745 (0.998)	–23.731 (0.000)	I(1)	17.035 (0.000)	–	I(1)
Lrgdp	4.839 (1.000)	–29.009 (0.000)	I(1)	10.581 (1.000)	–22.949 (0.000)	I(1)	18.849 (0.000)	–	I(1)
Lkapi	2.220 (.987)	–26.493 (0.000)	I(1)	3.348 (0.999)	–26.553 (0.000)	I(1)	17.302 (0.000)	–	I(1)
Ltech	6.406 (1.000)	–21.332 (0.000)	I(1)	11.356 (1.000)	–21.316 (0.000)	I(1)	17.934 (0.000)	–	I(1)
Lexr	–7.005 (0.000)	–	I(0)	–2.306 (0.011)	–	I(0)	19.768 (0.000)	–	I(0)

Source: Authors' computation using STATA 11.1.
Note: Figures in brackets are probability values.

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.
Notes: 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 cointegrating equation for each of them is presented because it shows the long-run relationship.
*,**: Significant at 1% and 5%, respectively.

directing efforts at influencing these policy variables will enhance export and import performance in SSA. With the EXR being inelastic in both export and import equations, it can be inferred that tinkering with EXR 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 a 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.

Summary, Policy Recommendations and Conclusion

In this article, we measure the effects of EXR movements on the performance of foreign trade of SSA countries. The article 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 EXR, real GDP, stock of capital and technology are the independent variables.

From the results, it follows that the inelasticity of export and import to EXR suggests the need for decisive policy intervention that would assist in stabilizing EXR 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 EXR 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 RERs in SSA economies.

In conclusion, this article has investigated the effects of EXR on the foreign trade of some selected African countries in a panel cointegration approach. It is found that export and import are inelastic to changes in EXR. 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 EXR stability that hinges on extensive institutional and technological capacity as well as the maintenance of comprehensive coherent macroeconomic packages remains a critical factor in ensuring that EXR policy performs its central role as a trade facilitation tool.

Note

1. We 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.

References

Aliyu, S.U.R. (2007). Imports-exports demand functions and balance of payments stability in Nigeria: A co-integration and error correction modeling. Retrieved 2 July 2011, from http://mpra.ub.uni-muenchen.de/10396/

Aydin, M.F., Ciplak, U., & Yucel, M.E. (2004). Export supply and import demand models for Turkish economy. Retrieved 15 July 2014, from http://unpan1.un.org/intradoc/groups/public/documents

Bayoumi, T. (1996). International trade and real exchange rates. *Exchange Rate Movements and Their Impact on Trade and Investment in the APEC Region*, IMF Occasional Papers No. 145.

Djankov, S., Freund, C., & Pham, C.S. (2010). Trading on time. *The Review of Economics and Statistics*, *92*(1), 166–172.

Edwards, S. (1989). *Real exchange rates, devaluation and adjustment: Exchange rate policies in developing countries*. Cambridge, MA: MIT Press.

Egwaikhide, F.O. (1999). Determinants of imports in Nigeria: A dynamic specification. AERC Research Paper 91. African Economic Research Consortium, Nairobi.

Ghosh, A., Gulde, A., Ostry, J., & Wolf, H. (1997). Does the nominal exchange rate regime matter? NBER Working Paper, No. 5874.

Goldstein, M., & Khan M.S. (1985). Income and price effects in foreign trade. In W.J. Jones & P.B. Kenen (Eds), *Handbook of international economics* (vol. 2, pp. 1041–1105). North-Holland: Elsevier.

Hinkle, L.E., & Montiel, P.J. (2001). *Exchange rate misalignment: Concepts and measurement for developing countries*, (vol. 1). New York: Oxford University Press.

Husain, A., Mody, A., & Rogoff, K. (2005). Exchange rate regime durability and performance in developing versus advanced economies. *Journal of Monetary Economics*, *52*(1), 35–64.

Janine, A., & Ayogu, M. (1995, December). Efficiency of foreign exchange rate markets in sub-Saharan Africa: Econometric analysis and implications for policy. *AERC Plenary Session on Foreign Exchange Markets and Exchange Rate Policies in Sub-Saharan Africa*.

Klein, M., & Shambaugh, J. (2006). Fixed exchange rates and trade. *Journal of International Economics*, *70*(2), 359–383.

Levy-Yeyati, E., & Sturzenegger, F. (2003). To float or to fix: Evidence on the impact of exchange rate regimes on growth. *American Economic Review*, *93*(4), 1173–1193.

Ndlela, D.B., & Ndlela, T. (2002). Exchange rate policy and trade facilitation in regional integration agreements: The case of Southern African economies. Trade and Industrial Policy Strategies, Annual Forum, Muldersdrift.

Ojo, J.A.T., & Alege, P.O. (2014). Exchange rate fluctuations and macroeconomic performance in sub-Saharan Africa: A dynamic panel cointegration analysis. *Asian Economic and Financial Review*, *4*(11), 1573–1591.

Osabuohien, E.S. (2011). *Analysis of international trade performance in selected SSA countries: The impact of institutional framework*. Unpublished PhD Thesis Submitted to Department of Economics and Development Studies, Covenant University, Ota.

Osabuohien, E.S., & Egwakhe, A.J. (2008). External reserve and the Nigerian economy: The dual folded debate. *African Journal of Business and Economic Research*, *3*(2&3), 28–41.

Osabuohien, E., Efobi, U.R, & Beecroft, I. (2014). Free trade, protectionism and the balance of trade: New empirical insights. In S.J. Evenett (Ed.), *Beggar-thy-poor-neighbour: Crisis-era protectionism and developing countries* (pp. 13–24). London: CEPR Press.

Petreski,G., & Kostoska, O. (2009). Modeling the determinants of exports and imports: Assessment of the Macedonian competitive performances. *Management and Marketing Journal*, *VII*(1), 36–58.

Qureshi, M.S., & Tsangarides, C.G. (2011). Exchange rate regimes and trade: Is Africa different? UNU-WIDER Working Paper, No. 2011/14.

Reinhart, C., & Rogoff, K. (2004). A modern history of exchange rate regimes: A reinterpretation. *Quarterly Journal of Economics*, *119*(1), 1–48.

Rose, A.K. (2000). One money one market: Estimating the effect of common currencies on trade. *Economic Policy*, *15*(30), 7–46.

Sekkat, K., & Varoudakis, A. (2000). Exchange rate management and manufactured exports in sub-Saharan Africa. *Journal of Development Economics*, *61*(1), 237–253.

Sekkat, K., & Varoudakis, A. (2002). The impact of trade liberalization and exchange rate policy reforms on North African manufactured exports. *Development Policy Review*, *20*(2), 177–189.

Tiwari, A., & Mutascu, M. (2011). Economic growth and FDI in Asia: A panel data approach. *Economic Analysis and Policy*, *41*(2), 173–187.

Tsangarides, C., Ewenczyk, P., Hulej, M., & Qureshi, M.S. (2009). Are Africa's currency unions good for trade. *IMF Staff Papers*, *56*(4), 876–918.

World Bank. (2013). *World development indicators*. Washington, DC: World Bank.