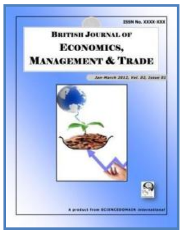

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Exchange Rate Volatility and Growth Dynamics: Evidence from Selected Sub-Saharan African Countries

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Authors' contributions

This work was carried out in collaboration between authors Kevin Odulukwe Onwuka and Kenneth Obi. Author Kevin Odulukwe Onwuka designed the study, and wrote the first draft of the manuscript. Also author Kevin Odulukwe Onwuka managed the literature searches, analyses the data of the study, while author Kenneth Obi read first manuscript and adds vital information that are necessary to improve the work.

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ABSTRACT

The objective of this paper is to examine the relationship between the volatility of real exchange rate of own country and the G-3 countries (United States of America, Japan, and Germany/ or Euro zone) and the economic growth in developing countries. We draw a sample of African economies namely Nigeria, Kenya, Ghana, Malawi, Zambia and Mali and utilize quarterly data from the period 1980 -2013 which is divided into two periods - 1980- 2001 and 2002 – 2013. We apply the residual based cointegration test of Kao and Johansen –Fisher combined cointegration test to detect the long run relationships among the variables. Finally, we employ the Fully Modified Ordinary Least Squares of Philips and Hansen to estimate the long run coefficients of the model. The main results are: the long run relationships among the variables are strongly stable in the period 1980 – 2001

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but ambiguous in the period 2002 –2013. The financial system is underdeveloped and it negatively affects the economic growth in the selected African Countries. The own country's real exchange rate volatility tends to depress the economic growth in both periods. The G-3 countries' real exchange rate volatilities have mix results. While the Yen/Dollar and the Deutsche mark/Dollar improve economic growth, the Yen/Deutsche does not have any appreciable effect on economic growth in the developing African countries in the period 1980 - 2001. However, the period 2002 – 2013, the G-3 countries' real exchange rate volatility tends to depress the economic growth in the developing African countries. These findings suggest that greater stability in international exchange rate system and lower G-3 currency volatility are desirable to promote higher growth in developing countries and which might reduce the possibility of occurrence of exchange rate crises.

Keywords: Real exchange rate volatility; G-3 exchange rate volatility; economic growth; developing economies; Panel data.

***JEL Classification**: F 31; O16*

1. INTRODUCTION

Following the collapse of the Bretton Woods exchange rate system in 1970s, most economies adopted floating exchange rate system. Continued exchange rate adjustments eliminate discrete parity adjustments and therefore instability which is potentially associated with fixed exchange rate systems and might reflect the failure of monetary authorities to predict exchange rates more accurately than market operators. Efficient floating exchange rate system is expected to adjust automatically to ensure balance of payment equilibrium. Since it reflects the market-determined prices of currencies it will contribute to the efficient resource allocation internally and internationally. Flexible exchange rate regime is criticized for increasing the level of uncertainty and thus reducing incentives to trade, leading to depressed growth. Nominal and real exchange rate volatility under flexible exchange rates is much larger than volatility in fundamentals. Such volatility may translate into reduced trade and economic growth. This criticism generated a larger literature that focuses on the impact of exchange rate volatility on trade. The conclusion from these literatures is that causality runs from exchange volatility to trade. However, Mundel's [1] optimal currency area hypothesis suggests an opposite direction of causality, where trade flows stabilises real exchange rate fluctuations, thus reducing real exchange rate volatility. This has been the central idea behind the floating exchange rate regime that increased trade will determine the true value of country's currency, allow exchange rate to move within a limited band and reduce the volatility of exchange rate and eventually leads to growth.

The poor performance of some of the macro variables in most developing countries is often blamed on exchange rate volatility. This often gives rise to proposal for government intervention in exchange rate market with policies to limit the volatility and thus deviating from domestic monetary policy goals. Many developing countries have targeted real effective exchange rate, implying that if trade does not act as a stabilizer, the policy interventions will reduce the bilateral exchange rate volatility with the major trading partners.

It is becoming clear to economists that the instability in most developing countries or newly emerging markets is not only as a result of volatility on the own exchange rates of these economies but also on the volatility of exchange rate of the trading partners. This assertion has support from intuition or standard argument. The impact comes from the fact that most of the international transactions take place in Dollars, Yens and Deutsche Marks or euro, exchange rate instability or exchange rate uncertainty if combined with risk-averse agents, may lead to increased instability in international economic transactions. This in turn may provoke distortions, uncertainty and economic fluctuations worldwide which may negatively affect the developing countries or emerging markets. The second argument is that most emerging markets depend on the Dollar, Deutsche Mark or euro or Yen zones for their exports, thus tying their GDP growth to these economies. The swings in Japanese or US economy, for example, are likely to affect the economies that depend on them for their exports, for example Nigeria. Thirdly with many emerging market currencies tied to the US Dollar either implicitly or explicitly, movements in the exchange rate values of the currencies of major countries in particular – the prolonged appreciation of the US Dollar vis-à-vis the Yen and Deutsche Mark will tend to worsen the competitive position of the emerging market economies [2]. It is argued that reducing the variability in the G-3 currencies by establishing a target bands, will reduce the destabilizing shocks on the emerging market economies. Under this system the relative prices for emerging markets may become more stable in an environment of predictable exchange rate but interest volatility may make debt servicing costs less predictable and greater G-3 income volatility may make demand for the products of emerging market economies more uncertain.

The objectives of this paper are of two folds. First is to estimate the causal relation between exchange rate volatility and economic growth. Few theoretical and empirical papers have attempted to estimate the causal relationship between exchange rate volatility and trade. These studies focussed on the effects of exchange rate regimes or volatility on trade by assuming that the exchange rate process is driven by exogenous chocks and is unaffected by endogenous factors. By definition this implies that the effect of growth on exchange rate volatility is assumed nonexistent rather than jointly estimated with the effect of exchange rate volatility on growth. What we lack in the economic literature is the knowledge on causal relation between the exchange rate volatility and growth. That is whether the swings in the growth rate can as well lead to exchange rate volatility and vice-versa. The second objective is to determine the effect of exchange volatility in the G-3 currencies on the growth of developing countries or emerging markets. By incorporating this in the model we will be able to know which exchange rate volatility – G-3 or own exchange rate swing that depresses growth. To the best of our knowledge no work has focussed on these issues. The paper by Esquivel and Larrain [3] focussed on the impact of exchange rate volatility of G-3 on real effective exchange and foreign direct investments in developing countries. Knowledge of the causal relation between the exchange rate volatility and growth is very important in understanding the effectiveness of exchange rate and monetary policies used to stabilise the economy. The changes in current account may stem from the changes in exchange rate. Understanding the movements of both exchange rate volatilities (G-3 and own exchange rate movements) is equally important as it affects the competitiveness of the developing countries in the international markets. The effect will depend on whether the anchor currency is appreciating or depreciating vis-à-vis the rest of the world. An economy, for example, that exports to Japan or US, a depreciation of Yen or dollar will mean less export earnings and less growth, which may in the long run, depresses exports and consequently growth.

2. LITERATURE REVIEW

There are two strands of macroeconomic theory that relate to the question of how exchange rate volatility affects macroeconomic performance. The first strand examines how the domestic economy responds to foreign and domestic real and monetary shocks under different exchange rate regimes. The second strand focuses on the issue of how exchange rate volatility under flexible exchange rate regimes affects international trade.

2.1 Monetary Shock under Different Exchange Rate Regimes

Macroeconomic theory suggests that the appropriate exchange rate regime depends on the types of shocks that an economy typically faces, and on the extent to which capital is internationally mobile. In the case of free mobility of capital, an economy that is affected mainly by shocks to the LM curve, due to changes in money demand for example, will experience large fluctuations in output, inflation, and the exchange rate if the exchange rate is flexible. If the exchange rate is fixed and capital is internationally mobile then the money supply is endogenous – changes in money demand determine changes in the money supply so that LM shocks will have no effect on output or inflation.

A foreign real shock will have larger effects on the domestic economy if the exchange rate is fixed. Under fixed exchange regime, real exchange rate adjustment must be carried out through relative price and productivity changes which in the world of price and wage rigidities are slow and costly [4]. The outcome is lower growth performance. If, for example, foreign income falls, the demand for domestic exports will fall, leading to a fall in domestic income. As Nandwa and Andoh [5] noted, a reliable forecasting of exchange rate volatility is important in risk-taking assessment and investment decision-making which are critical to long-term growth. Exchange rate volatility is variable and is less volatile under fixed exchange rate regime and higher under flexible regime. Under flexible exchange rates this effect will be mitigated by a depreciation of the exchange rate. A foreign financial shock will have opposite effects under fixed and flexible exchange rates. A rise in foreign interest rates will lead to depreciation and a rise in income under flexible exchange rates, but will lead to a monetary contraction and a fall in income under fixed exchange rates. It is worthy to note why the flexible exchange rates have been regarded as an important tool to cope with asymmetric shocks [6,7].

Overall, the impact of the exchange rate volatility will depend on the type of shocks hitting the domestic economy, with the general principle being that flexible exchange rates provide better insulation against foreign real shocks, and fixed exchange rates insulating against domestic sourced LM type shocks. In relation to this final point, it is also true that fixed exchange rates are thought to deliver more credible monetary policy and lower inflation. To the extent that lower inflation reduces inflation variability then a fixed exchange rate regime will be preferable. Mckinnon [8] emphasized the benefits of fixed exchange rate regimes for small open economies in the face of nominal shocks. Assuming that for small open economies the international price level is given and traded goods make up a high share of the domestically consumed goods, exchange rate stability ensures domestic price stability. The welfare effect of stable exchange rates originates in macroeconomic stability which provides a favourable environment for investment and consumption. From this perspective, as acknowledged by Mundel [9,10] in later works, monetary and exchange rate policies are regarded as a source of uncertainty and volatility in small open economies. Growth is enhanced when exchange rate fluctuations are smoothed. A decline in exchange rate uncertainty also enhances price transparency and increases the efficiency of price mechanisms at international level [11,4]. Lower transaction costs and greater price transparency also affect growth performance by increasing capital markets efficiency in capital allocation [12] and by lowering risk premia and real interest rates [13]. In addition, if there are credit constraints, or if investment is irreversible, lower aggregate nominal exchange rate volatility is likely to translate into higher growth.

2.2 Exchange Rate Volatility under Flexible Exchange Rate Regimes

There are channels through which developed economy exchange rate volatility may affect the performance of developing countries. Esquivel and Larrain [3] identified trade flows, foreign direct investment, currency crises, and debt servicing costs, portfolio composition and commodity prices.

The relation between the exchange rate volatility and international trade is established in the literature. The general argument is that if commodity traders are risk averse or even risk neutral, higher exchange rate uncertainty may lead to reduction in the volume of trade [14]. The more risk averse are firms, the fewer are the opportunities to hedge against exchange rate fluctuations, and the greater is the fraction of revenues and expenditures denominated in foreign currency. As long as there is uncertainty the economic agents will demand a higher price to cover their exposure to currency risk and this in turn reduces the trade volume and thus growth as revenues are reduced for development projects. Also, from microeconomic perspective exchange rate volatility, for instance measured as day-to-day or week-to-week exchange rate fluctuations, is associated with higher transactions costs because uncertainty is high and hedging foreign exchange risk is costly [4]. Indirectly, fixed exchange rates enhance international price transparency as consumers can compare prices in different countries more easily. If exchange rate volatility is eliminated, international arbitrage enhances efficiency, productivity and welfare. These microeconomic benefits of exchange rate stabilization have been a detrimental motivation of the European (monetary) integration process [15]. From the macroeconomic dimension, the long-term exchange rate fluctuations, for instance, measured as monthly or yearly changes of the exchange rate level, affect the competitiveness of domestic export and import competing industries [4]. In specific, the growth performance in small open economies is strongly influenced by long-term fluctuations of the exchange rate level. Even large, comparatively closed economies such as the euro area and Japan are sensitive to large exchange rate swings, in particular in the case of appreciation. McKinnon and Ohno [16] show that for Japan since the early 1970s when the Yen became flexible against the Dollar growth has been strongly influenced by the appreciation of the Japanese currency.

Most international transactions take place in some developed countries currency; exchange rate uncertainty among them may have an effect that is even equivalent to a higher uncertainty on the bilateral exchange rate. Therefore, increased currency volatility among the developed countries may lead to a lower volume of trade. However if a developing country chooses to peg exchange rate of its currency to one of the main world currencies, changes or rapid movements among developed countries' currencies may have an indirect effect on the competitiveness of all the countries that are pegged to one of the main currencies. The effect will depend on whether the anchor currency is depreciating or appreciating relative to rest of the world. For example, McKinnon and Schnabl [17] argue that for the small open East Asian economies, the fluctuations of the Japanese yen against the US dollar strongly affected the growth performance of the whole region. They identify trade with Japan and competition in third markets (US) as crucial transmission channels. Before 1995 the appreciation of the Japanese yen against the dollar enhanced the competitiveness of the smaller East Asian economies who kept their exchange rate pegged to the dollar and thus economic growth in the region accelerated. The strong deprecation of the yen against the dollar from 1995 into 1997 slowed down growth, contributing to the 1997/98 Asian crisis.

An interesting strand of this literature focuses on the impact of exchange rate variability on firms' location decisions. When deciding whether or not to invest in a foreign country, the variability of the exchange rate will affect the option value of delaying investment. Greater exchange rate variability will lead to 'hysteresis', whereby firms are locked out of foreign countries by exchange rate variability, or locked into countries in which firms are already located. It is hard to gauge the overall effect of hysteresis on trade volumes, though it would appear that hysteresis would reduce the level of capital flows between countries. The greater exchange rate volatility will increase uncertainty over the return of a given investment. Potential investors will invest in locations only as long as the expected returns are high enough to cover for the currency risk. Foreign direct investment and thus growth will be low under higher exchange rate volatility.

Changes in the bilateral real exchange rates of the major currencies will have an immediate effect on the real wealth of developed countries. The developed countries as the major sources of FDI to developing nations, changes in their real wealth as a result of changes in their bilateral real exchange rate may have a direct effect on the amount and direction of the FDI. It may decrease or increase FDI depending on which currencies are appreciating or depreciating. Thus to carry out FDI will depend the relevance of FDI to source country. For more understanding of the impact of developed countries exchange instability on the currency crisis and debt servicing see [3]. The effect of exchange rate volatility on growth might critically depend on a country's level of financial development. For countries with relatively low levels of financial development, exchange rate volatility generally reduces growth, whereas for financially advanced countries, there is no significant effect [18].

2.3 Empirical Evidence

A very large literature has arisen documenting the fact that flexible exchange rates lead to medium to high frequency movements in real and nominal exchange rates that are too great to be explained by macroeconomic fundamentals. However, a number of papers focus more directly on the implications of this volatility for the real economy such as trade, foreign direct investment and economic growth. Much is on the trade implications of exchange rate uncertainty.

The predominant finding among the literatures is that exchange rate volatility either has no effect, or has a very small effect on trade. Gagnon [19] seeks to explain this result using a calibrated model designed to exaggerate the effects of exchange rate variability on trade. He finds that exchange rate volatility of the magnitudes observed until the early 1990s would not significantly affect trade. The papers that do find significant effects of exchange rate volatility on trade are Rose [20] and Arize, Osango and Slottje [21]. Rose finds a very large positive effect of a currency union on international trade, and a small negative effect of exchange rate volatility on trade. Rose uses a large panel data set to estimate an augmented gravity model of trade. Standard gravity models include only income and distance variables to explain trade between two countries – the model Rose estimates is augmented with a number of other variables including common language, common currency, and exchange rate volatility.

Arize, Osango and Slottje [21] estimate an export demand equation for thirteen LDCs with world demand conditions, the terms of trade, and the moving sample standard deviation of the exchange rate as explanatory variables. In all countries the impact of exchange rate volatility on trade is found to be negative and significant. Overall the empirical literature does not seem to come to any firm conclusion about the implications of greater exchange rate volatility on trade. In a more recent paper, Esquivel and Larrain [3] examine both the impact of the own country's exchange rate volatility and G-3 exchange rate uncertainty on developing countries, trade and investment. This paper concludes that G-3 exchange rate volatility has significantly negative effect on developing countries, exports, foreign direct investment in certain regions and increases the probability of occurrence of currency crisis in developing countries. Aliyu [22] using error correction model examined the impact of Nigeria Naira and US Dollar exchange rate volatility on the non-oil exports and imports. He found that Naira exchange rate volatility depressed exports, while that of dollar encouraged it.

Ghosh, Gulde and Wolf [23] investigated the relationship between exchange rate volatility and growth and found weak evidence that exchange rate stability affects growth in a positive or negative way. Aghion et al. [24] using 83-country data set spanning the years 1960-2000 found that the exchange rate volatility can have a significant impact on the productivity growth but it depends on the level of country's financial development. For countries with relatively low levels of financial development, exchange rate volatility generally reduces growth, whereas for financially advanced countries, there is no significant effect. The coefficient of exchange rate volatility is -0.637. A recent study by Schnabl [4] using panel estimation reveals a robust negative relationship between exchange rate volatility and growth for countries in the economic catch-up process with open capital accounts. Similarly, Edwards and levy-Yeyati [25] used panel estimations for more than 180 countries and find evidence that countries with more flexible exchange rates grow faster. Likewise, Eichengreen and Leblang [26] reveal a strong negative relationship between exchange rate stability and growth for 12 countries over a period of 120 years. They concluded that the results of such estimations strongly depend on the time period and the size of the sample. Schnaling [4] showed that the volatility of South Africa output growth (via the trade balance) is largely driven by international business cycles rather than by real exchange rate variability. In fact, he did show that the international business cycle is more than 12 times as important for South Africa as the real exchange rate. Moreover, the implied coefficient on exchange rate volatility at 0.02 is larger than the effects found by Aghion et al. [27]. There are also ample evidences that confirm the negative impact of exchange rate volatility on growth and are particularly strong for emerging and low income economies. For the industrialized countries where capital markets are more developed the negative impact of exchange rate volatility on growth is less crucial. On the basis of literature, there appears to be some important gaps in our understanding of the possible effects of exchange rate volatility on economic growth. Firstly, there is very little time series evidence on the effect exchange rate volatility on economic growth in developing countries (especially African countries) where capital markets are relatively less developed. Secondly, we employ the modern estimation techniques – panel cointegration and Fully Modified Ordinary Least Squares to estimate the parameters of the model.

3. MODEL, DATA AND METHODOLOGY

3.1 Model

The question of whether a country's own exchange rate volatility has an effect on growth has not been given attention in economic literature. Also the impact of volatility of third country's exchange rates on growth of developing countries is not known, as there are no previous attempts in this direction. As changes in the multilateral exchange rate of a given country can be partially explained by changes in both the bilateral real exchange rate vis-à-vis the dollar and in the bilateral G-3 real exchange rate against dollar. In this paper we specify a simple growth model similar to the one used by Esquivel and Larrain [3] that includes exports, own country's bilateral exchange rate volatility and G-3 exchange rate volatility. As the level of country's financial development may influence the effect of exchange rate movements, we introduce it in the model. A strong financial system offers risk diversification and effective capital allocation. It is observed that the higher the degree of financial development in a country, the wider will be the availability of financial services. A developed financial system offers higher returns with less risk. Also the degree of asymmetric information reduces with a well developed financial system and offers efficient operations that help to reduce information asymmetry in the market. This yields the following estimating equation that is specified in panel form as follows.

$$\ln y_{it} = \alpha + \beta \ln ex_{it} + \delta \ln rerv_{it} + \theta \ln rerv_{G-3it} + \phi \ln fdi_{it} + e_{it} \quad (1)$$

where y_{it} is the growth of real GDP per capita of country i at the time t, ex_{it} is the growth of real exports of country i at the time t. We include exports in the model with assumption that more trade (export) will tend to stabilize exchange rate. fd_{it} is the growth of financial development of country i at the time t, $\mathrm{Re}\,rv_{it}$ is the real exchange rate volatility of the country i at the time t and $\mathrm{Re}\,rv_{G-3it}$ is the real exchange rate volatility of the G-3 countries for country i at the time t or the major trading partners and e_{it} is the error term that is normally distributed with mean zero and constant variance.

3.2 Definitions of Variables

Real exchange rate: The real exchange rate included in the model is calculated from the following formula

$$\mathrm{Re}\,r = S_t\left(\frac{P_t^*}{P_t}\right) \quad (2)$$

where S_t is the nominal exchange rate of the country under investigation, P_t is the domestic consumer price index and P_t^* is the trading partner consumer price index (USA). The data on exchange rate and consumer price index are from International Monetary Fund Database.

Real exchange rate Volatility: One of the most common measures of exchange rate volatility is the standard deviation of the growth rates of real exchange rates (V). This measure is approximated by a time-varying measure defined as follows:

$$V_{t+m} = \left[\frac{1}{m}\sum_{i=1}^{m}(R_{t+i-1} - R_{t+i-2})\right]^{1/2} \quad (3)$$

where R is natural log of the bilateral real exchange rate (ε) and m is the order of the moving average. The measure has been used among others by Arize et al. [21], Kenen and Rodrik [28], Chowdhury [29] and Esquivel and Larrain [3]. There are other measures of exchange rate variability or volatility [30] and for review of alternative measures of real exchange rate volatility see [31].

An alternative measure of exchange rate volatility is defined as the time-varying 5-year coefficient of variation (CV) of the real exchange rate (this is in fact a measure of dispersion of the real exchange rate).

$$CV_{t+m} = \frac{\left[\frac{1}{m}\sum_{i=1}^{m}(\varepsilon_{t+i-1} - \bar{\varepsilon})^2\right]^{1/2}}{\bar{\varepsilon}} \quad (4)$$

where $\bar{\varepsilon}$ is the mean of the bilateral real exchange rate between years t and $t+m-1$. In the estimation we utilize only one measure, the standard deviation of the growth of the real exchange rate (V). Financial development is proxied by real money plus quasi money (M2/GDP).

3.3 Data

The model is estimated using panel data drawn from the sample of Sub-Saharan African countries; Namely Nigeria, Ghana, Malawi, Kenya, Tanzania and Zambia. Quarterly data on GDP per capita, real GDP and exports are taken from World Development Indicator database, and exchange rates (end period averages) and consumer price indices are taken from International Financial Statistics of International Monetary Fund online database. For the financial development indicator we use the ratio of M2 to GDP and the data are taken from the International Financial Statistics online database. The country exposure index is measured by export growth. This is because where export growth is low exports are often the engine of growth and has the ability to stabilize the real exchange rate in the long run than the imports. For G-3 countries we choose two major currencies used by Esquivel and Larrain [3] – Deutsche Mark/Dollar and Yen/Dollar. The data cover the period 1980 to 2013. We do recognize that Euro currency is dominant currency in most the Europe however the individual country's currencies still exist. Before the existence of euro currency Deutsche Mark was the dominant currency in EU and thus from 2002 we utilize euro/dollar. That is in the period of 2002 – 2013 we use the euro/dollar.

3.4 Methods and Procedures

3.4.1 Panel unit root test

In trying to establish the long run relationship among the variables of equation (1), we use quarterly data from six selected African countries over the period 1980 to 2013 periods. Since the model uses panel data, in order to avoid spurious results obviously we must establish the stationary properties of the variables using panel unit root tests and the long run relationship among all the variables using panel cointegrating tests. Four different types of panel unit root tests are used. Levin, Lin and Chu's [32] (LLC) test assume a common unit root process, $\rho_i = \rho \forall_i$. Im, Pesaran, and Shin's [33] test (IPS), Fisher type ADF and PP tests, presented by Maddala and Wu [34], and Pesaran's [35] test allow for an individual unit root processes.

The Levin, Lin and Shu [32] panel unit root test model is specified as;

$$\Delta y_{it} = \alpha_i + \tau_t + \rho y_{it-1} + \varsigma_{it} + v_{it} \qquad (5)$$

The equation (5) can be augmented to account for serial correlation assuming that all series have the same ρ under the alternative hypothesis. The augmented equation is as:

$$\Delta y_{it} = \alpha_i + \tau_t + \rho y_{it-1} + \sum_{i=0}^{n} \lambda_{ij} \Delta y_{it-j} + \varsigma_{it} + v_{it} \qquad (6)$$

The null hypothesis is $H0: \rho = 0$ and alternative hypothesis is $H1: \rho < 0$

Pesaran's (2007) test is based on a regression

$$\Delta y_{it} = \rho y_{i,t-1} + \eta_i t + \alpha_i + \delta_i \theta_t + \varepsilon_{it} \qquad (7)$$

Where $\alpha_i s$ are individual constants, $\eta_i t$ are the individual time trends, θ_t is common time effect, whose coefficients (δ_i) are assumed to be stochastic and they measure the impact of the common time effect on the series i . $\varepsilon_{it} \sim i.i.d.N(0,\sigma^2)$ over time and ε_{it} is independent of ε_{js} and θ_s for all $i \neq j$ and s,t .

Cross-sectional dependence is allowed through the common time effects which are proxied by the cross-section mean of $y_{it} (\bar{y}_t = N^{-1} \sum_{j=1}^{n} y_{it})$ and its lagged values, $\bar{y}_{t-1}$, $\bar{y}_{t-2}$ etc. The null hypothesis is that $Ho: \rho_i = 0 \forall_i$ and alternative hypothesis allows for some of the tested series to be non-stationary.

3.4.2 Panel cointegration test

The panel unit root tests aim to assess the order of integration of the variables. If the main variables are found to be integrated of order one, then we should use panel cointegration tests to address the non-stationarity of the series. Some of these tests were developed as extensions of earlier tests for time series data.

Pedroni [36,37] provides cointegration tests for heterogeneous panels based on the two-step cointegration approach of Engle and Granger [38]. Pedroni uses the residuals from the static (long-run) regression and constructs seven panel cointegration test statistics: Four of them are based on pooling (within-dimension or 'panel statistics test'), which assumes homogeneity of the AR term, whilst the remaining are less restrictive (between-dimension or 'group statistics test') as they allow for heterogeneity of the AR term. The assumption has implications on the computation of the second step and the specification of the alternative hypothesis. The *v*-statistic is analogous to the long-run variance ratio statistic for time series, while the *rho*-statistic is equivalent to the semi-parametric 'rho' statistic of Phillips and Perron [39]. The other two are panel extensions of the (non-parametric) Phillips-Perron and (parametric) ADF *t*-statistics, respectively. These tests allow for heterogeneous slope coefficients, fixed effects and individual specific deterministic trends, but are only valid if the variables are I (1). Pedroni [36] derived critical values for the null hypothesis of no cointegration.

Kao [40] proposes residual-based DF and ADF tests similar to Pedroni's, but specifies the initial regression with individual intercepts ('fixed effects'), no deterministic trend and homogeneous regression coefficients. Kao's tests converge to a standard normal distribution by sequential limit theory [41]. Both Kao and Pedroni tests assume the presence of a single cointegrating vector, although Pedroni's test allows it to be heterogeneous across individuals.

Maddala and Wu [42] propose a Fisher cointegration test based on the multivariate framework of Johansen [43]. They suggest combining the *p*-values of individual (system-based) cointegration tests in order to obtain a panel test statistic. Moreover, Larsson et al. [44] suggest a likelihood ratio statistic (LR-bar) that averages individual rank trace statistics. However, the authors find that the test requires a large number of temporal observations. Both of these tests allow for multiple cointegrating vectors in each cross-section. The Johansen – Fisher combined cointegration allows using a mixture of I(1) and I(0) variables in the test [45]. Hence, this may indicate that conducting the panel cointegration test, using a set of panel data variables which have different orders of integration, would not create biased results. Fisher-type test can be defined as

$$-2\sum_{i=1}^{N}\log(\theta_i) \rightarrow \chi^2 2N \quad (8)$$

Where θ_i is the p-value from an individual Johansen cointegration test for cross-section i.

Westerlund [46] suggests four cointegration tests that are an extension of Banerjee et al. [47]. These tests are based on structural rather than residual dynamics and allow for a large degree of heterogeneity (e.g. individual specific short-run dynamics, intercepts, linear trends and slope parameters). All variables are assumed to be I(1). Moreover, bootstrapping provides robust critical values in cases of cross-section dependence. The tests assess the null hypothesis that the error correction term in a conditional ECM is zero – i.e. no cointegration [41]. Although, these tests allow for cross-sectional dependence via the effects of short-run dynamics, they do not consider long-run dependence, induced by cross-sectional cointegration [48]. In that case, panel cointegration tests may be significantly oversized [43]. Moreover, most cointegration tests may be misleading in the presence of stationary data, as they require all data to be I (1).

In estimation of Cointegrated Panel data, several estimators have been proposed. Probably the most commonly used estimators have been the fully-modified OLS (FMOLS) proposed by Phillips and Moon [49] and Pedroni [50], and the dynamic OLS (DOLS) proposed by Kao and Chiang [51]. The major problem for estimators in cointegrated panel data has been the modeling of simultaneous cross- sectional and time series dependence [49].

4. ANALYSIS AND RESULTS

4.1 Unit Root Test

We begin our analysis by examining the time properties of the panel data. First, we examine the order of integration using four panel unit root tests – LLC, IPS, and Fisher type ADF and PP tests. The period of analysis is divided into two – 1980.1- 2001.4 and 2002.1 – 2013.4.the first period 1980.1 – 2001.4 includes the Deutsch Mark exchange rate and the period 2002.1 – 2013.4 incorporates euro exchange rate. The unit root results of these two periods are presented in the Tables 1a and 1b.

Table 1a indicates that all the variables are integrated of order one under LLC test. While under IPS, Fisher-ADF and Fisher-PP, the GDP per capita, exports and financial development are integrated of order one (I(1)) and the real own country exchange rate volatility and G-3 economies exchange rate volatility are integrated of order zero (I (0)). We are not surprised at this result because the growth rate of any series is similar to taking the first difference of the series.

In Table 1b, the variables GDP per capita, exports, financial development, real exchange rate volatility for Japanese Yen, are integrated of order one (I(1)). The real own country exchange rate volatilities are integrated of order zero (I (0)) in all the tests. From Tables 1a and 1b we can see that the order of integration is mix.

Table 1a. Unit root test and order of integration (1980.1 – 2001.4)

	Level		First difference		
Variables	**No trend**	**With trend**	**No trend**	**With trend**	**Order of integration**
LLC					
$\ln rgdp$	-1.119[0.132]	-1.591[0.056]	-22.109[0.000]	-24.002[0.000]	I(1)
$\ln ex$	1.088[0.862]	-0.736[0.231]	-24.272[0.000]	-26.053[0.000]	I(1)
$\ln fd$	0.426[0.381]	0.689[0.755]	-22.434[0.000]	-23.988[0.000]	I(1)
$\ln rerv$	-0.302[0.381]	0.636[0.738]	-20.105[0.000]	-21.036[0.000]	I(1)
$\ln rergpv$	0.325[0.628]	1.147[0.874]	-16.855[0.000]	-17.210[0.000]	I(1)
$\ln regmv$	-0.630[0.264]	1.240[0.893]	-19.423[0.000]	-20.257[0.000]	I(1)
$\ln regmjp$	-1.146[0.126]	0.319[0.625]	-19.461[0.000]	-20.258[0.000]	I(1)
IPS					
$\ln rgdp$	-1.035[0.150]	-1.110[0.133]	-22.138[0.000]	-22.848[0.000]	I(1)
$\ln ex$	0.442[0.671]	-0.725[0.234]	-22.641[0.000]	-22.903[0.000]	I(1)
$\ln fd$	0.357[0.640]	-0.076[0.470]	-21.903[0.000]	-22.152[0.000]	I(1)
$\ln rerv$	-4.431[0.000]	-2.913[0.002]	-21.820[0.000]	21.912[0.000]	I(0)
$\ln rergpv$	-3.686[0.000]	-2.192[0.014]	-21.182[0.000]	-22.024[0.000]	I(0)
$\ln regmv$	-5.320[0.000]	-4.290[0.000]	-21.818[0.000]	-21.961[0.000]	I(0)
$\ln regmjp$	-6.124[0.000]	-6.017[0.000]	-21.859[0.000]	21.962[0.000]	I(0)
Fisher-ADF					
$\ln rgdp$	19.200[0.084]	16.117[0.186]	190.362[0.000]	270.080[0.000]	I(1)
$\ln ex$	11.520[0.485]	12.702[0.391]	180.349[0.000]	290.681[0.000]	I(1)
$\ln fd$	8.378[0.755]	10.160[0.602]	193.434[0.000]	282.060[0.000]	I(1)
$\ln rerv$	42.785[0.000]	28.013[0.006]	194.395[0.000]	278.938[0.000]	I(0)
$\ln rergpv$	33.814[0.001]	20.765[0.054]	194.433[0.000]	280.420[0.000]	I(0)
$\ln regmv$	51.311[0.000]	38.079[0.000]	194.408[0.000]	279.586[0.000]	I(0)
$\ln regmjp$	61.072[0.000]	55.812[0.000]	193.949[0.000]	279.607[0.000]	I(0)
Fisher-PP					
$\ln rgdp$	21.396[0.045]	22.274[0.035]	190.233[0.000]	291.487[0.000]	I(0)
$\ln ex$	12.428[0.412]	13.579[0.328]	178.873[0.000]	299.024[0.000]	I(1)
$\ln fd$	8.905[0.711]	11.229[0.509]	193.434[0.000]	282.133[0.000]	I(1)
$\ln rerv$	50.127[0.000]	34.244[0.001]	194.395[0.000]	278.938[0.000]	I(0)
$\ln rergpv$	41.449[0.000]	26.384[0.010]	194.433[0.000]	280.420[0.000]	I(0)
$\ln regmv$	58.094[0.000]	49.081[0.000]	194.408[0.000]	279.586[0.000]	I(0)
$\ln regmjp$	67.749[0.000]	65.291[0.000]	193.949[0.000]	279.607[0.000]	I(0)

Note: LLC is Levin, Lin and Chu, test, IPS's W-statistics is Im, Pesaran and Shin, test, ADF-Fisher Chi-square and PP-Fisher Chisquare. Figures in brackets are the p-values

4.3 Cointegration Test

For panel cointegration test we rely on Kao residual-based Panel cointegration and Johansen-Fisher combined panel cointegration tests to test for long-run relationship among the variables. The Johansen–Fisher combined contegration test allows for mix order of integration which tests the null hypothesis of r-cointegration relationships against the alternative of (r+1) relationships [52]. This allows us to study more carefully the likely number of cointegrated variables in the system compared to residual based single equation approaches as in Kao [40]. Depending on the results, we are then able to move on and specify different regression models which are capable of estimating non-stationary panel data models including information in levels and first differences. The lag selection is determined by AIC. The maximum lag is two for the data series of 1980 – 2001 and six for the data series of 2002 - 2013. The results are reported in Tables 2 and 3.

Table 1b. Panel unit root test (2002.1 – 2013.4)

	Level		**First difference**		
LLC					
Variables	**No Trend**	**With Trend**	**No trend**	**With trend**	**Order of Integration**
$\ln rgdp$	-0323[0.378]	-1.638[0.051]	-25.931[0.000]	-32.420[0.000]	I(1)
$\ln ex$	0.285[0.612]	0.953[0.830]	-6.149[0.000]	-4.763[0.000]	I(1)
$\ln fd$	-0538[0.295]	0.752[0.774]	-7.972[0.000]	-7.059[0.000]	I(1)
$\ln rerv$	-0.997[0.159]	0.087[0.535]	-4.449[0.000]	-2.858[0.002]	I(1)
$\ln rergpv$	2.865[0.998]	3.045[0.999]	-8947[0.000]	-8.907[0.000]	I(1)
$\ln regmv$	-3.823[0.000]	-1.619[0.054]	-4.695[0.000]	-3.361[0.000]	I(0)
$\ln regmjp$	-1.242[0.107]	0.059[0.524]	-4.922[0.000]	-2.901[0.002]	I(1)
IPS					
$\ln rgdp$	1.947[0.974]	-0.966[0.167]	-28.401[0.000]	-35.599[0.000]	I(1)
$\ln ex$	-0.069[0.473]	-0,537[0.296]	-9.143[0.000]	-7.960[0.000]	I(1)
$\ln fd$	0.763[0.777]	0.917[0.820]	-9.802[0.000]	-8.936[0.000]	I(1)
$\ln rerv$	-3.964[0.000]	-3.759[0.000]	-8.495[0.000]	-7.197[0.000]	I(0)
$\ln rergpv$	1.128[0.870]	3.073[0.999]	-8.526[0.000]	-8.371[0.000]	I(1)
$\ln regmv$	-7.114[0.000]	-5.221[0.000]	-8.537[0.000]	-7.655[0.000]	I(0)
$\ln regmjp$	-3.684[0.000]	-1.276[0.101]	-14.329[0.000]	-14.288[0.000]	I(0)
Fisher-ADF					
$\ln rgdp$	7.507[0.974]	16.063[0.188]	117.201[0.000]	606.911[0.000]	I(1)
$\ln ex$	11.365[0.498]	12.2994[0.370]	99.149[0.000]	77.246[0.000]	I(1)
$\ln fd$	7.788[0.802]	8.212[0.768]	108.188[0.000]	89.076[0.000]	I(1)
$\ln rerv$	37.718[0.000]	33.577[0.001]	90.376[0.000]	68.510[0.000]	I(0)
$\ln rergpv$	4.231[0.979]	1.158[1.000]	90.794[0.000]	81.861[0.000]	I(1)
$\ln regmv$	72.640[0.000]	47.567[0.000]	90.939[0.000]	73.646[0.000]	I(0)
$\ln regmjp$	33.660[0.001]	15.030[0.240]	167.747[0.000]	152.531[0.000]	I(0)
Fisher-PP					
$\ln rgdp$	17.350[0.137]	45.203[0.000]*	215.520[0.000]*	806.038[0.000]*	I(1)
$\ln ex$	10.683[0.556]	11.357[0.499]	172.736[0.000]*	149.067[0.000]*	I(1)
$\ln fd$	11.551[0.482]	8.450[0.749]	180.160[0.000]*	237.975[0.000]*	I(1)
$\ln rerv$	29.163[0.004]*	21.001[0.050]**	168.442[0.000]*	142.944[0.000]*	I(0)
$\ln rergpv$	4.771[0.965]	1.253[1.000]	168.852[0.000]*	157.533[0.000]*	I(1)
$\ln regmv$	50.908[0.000]*	27.579[0.006]*	168.991[0.000]*	148.143[0.000]*	I(0)
$\ln regmjp$	33.660[0.001]*	15.776[0.202]	167.747[0.000]*	152.662[0.000]*	I(0)

Note: LLC is Levin, Lin and Chu, test, IPS's W-statistics is Im, Pesaran and Shin, test, ADF-Fisher Chi-square and PP-Fisher Chisquare. Figures in brackets are the p-values

Table 2. Panel co integration test results (1980Q1 – 200Q4)

Johansen-Fisher Combined Test (Maximum lag = 3)				
Hypothesized No. of CEs	**Fisher Stat.* (from trace test)**	**p-value**	**Fisher stat (from max-eigen test)**	**p-value**
$r \leq 0$	262.7*	0.0000	544.5*	0.0000
$r \leq 1$	318.7*	0.0000	172.5*	0.0000
$r \leq 2$	165.6*	0.0000	110.1*	0.0000
$r \leq 3$	78.62*	0.0000	49.68*	0.0000
$r \leq 4$	38.30*	0.0001	27.84*	0.0058
$r \leq 5$	22.34**	0.0339	16.35	0.1757
$r \leq 6$	26.75*	0.0084	26.75*	0.0084
	Kao residual based cointegration test			
	$t-statistics$	$p-value$		
ADF	-4.124886*	0.0000		

*Note: r = rank, * and, ** denote significance level at 1% and 5%*

Table 3. Panel co integration test results (2002Q1 – 2013Q4)

Johansen-Fisher combined test (Maximum lag = 2)				
Hypothesized No. of CEs	**Fisher stat.* (from trace test)**	**p-value**	**Fisher stat (from max-eigen test)**	**p-value**
$r \leq 0$	47.73*	0.0000	4.126	0.9811
$r \leq 1$	46.66*	0.0000	12.63	0.3967
$r \leq 2$	36.80*	0.0002	19.05	0.0874
$r \leq 3$	22.45**	0.0328	17.06	0.1472
$r \leq 4$	11.90	0.4540	9.465	0.6628
$r \leq 5$	8.782	0.7214	8.912	0.7105
$r \leq 6$	9.501	0.6596	9.501	0.6596
Kao residual based cointegration test (lag=6)				
	$t-statistics$	$p-value$		
ADF	2.01504	0.0220**		

*Note: r = rank, * and, ** denote significance level at 1% and 5%*

From the Table 2 we can see that Kao test clearly rejects the null hypothesis of no cointegration. Also the Johansen-Fisher combined (trace test) test rejects the null hypothesis and shows that there is evidence of stable cointegration relationship for the variables. However, looking at the p-value of based Fisher statistics for Johansen maximum eigenvalue test the results are ambiguous. But there is statistical support for the existence of cointegration relationship between five of the six variables at 1% significance level.

From the Table 3, the two cointegration tests - Johansen-Fisher combined and Kao residual based tests - the evidence of stable cointegration relationship for the variables becomes less evident. Looking at the p-value of based Fisher statistics for Johansen trace test, the test gives ambiguous results. While the test in first place indicates statistical support for the existence of only three cointegration relationships between three of the six variables there is also further evidence of stable cointegration vector including all variables at the 5% significance level for Koa residual based test.

4.4 Estimated Coefficients of Cointegrated Panel Data

In this section we utilize panel FMOLS estimation technique. The FMOLS adjusts for the temporal dependencies of the data by directly estimating the various nuisance parameters semiparametrically. The presence of autocorrelation is tested and it is found that there is no presence of first order autocorrelation and the residual is normally distributed for the data period between 1980Q1 – 2001Q4. For the data period between 2002Q1 – 2013Q4 we could not detect the presence of autocorrelation and but the residual is not normally distributed. In the estimation we used weighted estimation, Bartlett kernel and integer Newey-West fixed bandwitdth. The variables ($rergmv$) and $(rergmjp)$ represent Deutsch mark/dollar and yen/deutsch marke exchange rate volatility respectively in the period 1980Q1 – 2001Q4 and euro/dollar and yen/euro exchange rate volatility respectively in the period 2002Q1 -2013Q4. The results are reported in Table 4.

Table 4. Long-run estimates

Variables	FMOLS	
	1980Q1- 2001Q4	2002Q1-2013Q4
$\ln ex$	-0.0050 [0.408] 0.683	1.7337* [79.318] 0.000
$\ln fd$	-0.0835* [-6.937] 0.000	-0.3798 * [-21.905] 0.000
$\ln rerv$	-0.7711* [-31.617] 0.000	-0.5798* [-14.757] 0.000
$\ln rergpv$	2.1800* [87.180] 0.000	-2.1761* [-79.417] 0.000
$\ln rergmv$	0.1821* [6.989] 0.000	-6.4952* [-193.42] 0.000
$\ln regmjp$	0.0107 [0.4229] 0.673	0.9504* [25.726] 0.000
R	0488	0.34

*Note: Figures in bracket are the t-values, *, **, and *** denote 1%, 5% and 10% significance levels respectively*

From the Table 4, the financial development affects the economic growth of the selected African countries negatively in both periods. The coefficients of this variable are negatively significant at 1% level in both periods. The reason may be due to underdevelopment of the financial system in most African countries. For this reason, some African countries still depend on foreign financial markets for their capital. Secondly, as financial markets are linked, any crisis in financial system in one region will spill over to other regions. We observe a negative and a positive effect from exports on real GDP per capita in both periods respectively but only significant in the period 2002Q1 – 2013Q4 and its magnitude in this period is high. The period 2002Q1 – 2013Q4 experiences increased export activity in the selected African countries or there are policies in place that favour exports sector of the countries under investigation.

Next the own country real exchange rate volatility is negatively signed in both periods and is highly significant at 1% level. This agrees with the economic theory and most empirical evidence in the economic literature. Appreciated real own exchange rate leads to reduced earnings through reduction in exports as goods and services from a particular country become less competitive in the world market.

The G-3 countries' real exchange rate volatility diverges in its effect on the developing countries growth over the two period horizons. While the real exchange rate volatility of Japan (Yen/Dollar) and Germany (Deutsche Mark/dollar) improve economic growth of the selected Africa economies (Yen/Deutsche Mark) does not have any appreciable effect in the period 1980Q1 – 2001Q4. However, the G-3 countries real exchange rate volatility in the period 2002Q1 - 2013Q4 depresses economic growth in these African countries except yen/euro that tends to improve the economic growth. We are not surprised because the world financial system seems to be stable in the period 1980s and 1990s than in the 2000s especially late 2000s. The financial market crisis in US that spills over to many countries and the most recent debt problem in euro zone spell doom to most developing countries that rely on these markets for their exports trade. The only thing, we are worried about is the magnitude of the coefficients of G-3 real exchange rate volatilities. The effect of G-3 real exchange rate volatility is not direct but via exports and foreign direct investments. As Esquivel and Larrain [3] noted that G-3 exchange rate volatility has significantly negative effect on developing countries, exports, foreign direct investment in certain regions and increases the probability of occurrence of currency crisis in developing countries.

Are there any policy implications from these results? The volatility of own real exchange rate, has also its own policy implications. A maintained hypothesis is that exchange rate is a policy variable. Strictly speaking, this is not true as the real exchange rate is a relative price and is determined in general equilibrium along with all other relative prices. But governments have a variety of instruments at their disposal to influence the level of the real exchange rate. Appreciation would tend to reduce exports and increase imports. This suggests that goods and services from a developing country whose currency appreciates relative to others in the region will be uncompetitive in the world markets. The imported goods and services will appear to be relatively cheaper in the home country compared to locally produced goods and services. Moreover, this compounds the problems of balance of payments disequilibrium and current account deficit and consequently leads to decline in the country's foreign reserves. For example, the recent deliberate devaluation of Nigeria currency (naira) by Central Bank of Nigeria (CBN) is to curtail the long run effects of the global economic crises could have on Nigeria economy through appreciation of naira or decline in demand of its mono export product – crude petroleum and possibly to prevent balance of payment disequilibrium and make Nigerian goods and services more competitive in the international markets, theoretically. As experience has shown the impact is excruciating and is felt in every sphere of the economy. Thus, this further suggests that developing countries with mono exports sector are likely to suffer most if their trading partners experience economic crises or recession than those with diversified export base.

Depreciation of own currency may translate into higher demand of goods and services from the trading partners as the goods and services become more competitive in the world market. That is when the exchange rate rises, the prices of foreign products rise relative to the prices of domestic products. The volume of exports that are bought by foreigners rise and the volume of imports bought by domestic residents falls. In the short run, the current account would immediately decrease after exchange rate depreciation, then increase gradually as the volume effect begins to dominate the value effect. As export volume increases, more export earnings would accrue to the country and hence increase in foreign reserves, according to economic theory.

Nevertheless, it is not always true in all cases. For instance, Abeysinghe and Yeok [53] empirically investigated the impact of currency appreciation on exports in the case of Singapore and found that in the presence of high import content, exports are not adversely affected by currency appreciation because the lower import prices due to appreciation reduce the cost of export production. This implies that the cushioning effect outweighs that of the effect of productivity gains on export competitiveness. Moreover, low income economies such as Kenya, Nigeria, Ghana, Mali, etc., are also characterized by heavy dependency on export of few primary commodities which may not respond as expected, mainly due to a decline in terms of trade for primary commodities, lack of trade finance caused by the inefficient domestic banking system, inadequate marketing information systems and excessive dependence on imported inputs which may be more expensive in local currency terms. When trade volumes do not respond to exchange-rate changes, the trade balance moves in the wrong direction; depreciation makes the country's trade deficits increase at least in the short run. Furthermore, the effect of currency depreciation/appreciation is not uniform across countries. If a country is export dependent like China and Japan, a strong currency may not be in their better interest. On the other hand, if a country imports more than it exports, an appreciated currency does give consumers more purchasing power and ultimately increases consumers' spending and this in turn not only raise economic growth but also reduces inflation.

One possible policy implication of the swings in the G-3 exchange rate volatility with reference to deutsche mark/dollar, is that in appreciation period the export earnings of the developing exporting countries will tend to increase while during the period of depreciation, it will tend to decline and consequently leading to current account disequilibrium and thus the capital projects and the most needed infrastructures that could generate employment and put the developing country on the growth path could not be achieved. This is clearly evident in the recent global economic meltdown that hit US and Europe witnessed in the period 2002Q1 – 2013Q4. The effect is still being felt today. The export earnings of most developing countries declined substantially due to volatility in the exchange rate of the trading partners.

However, the situation might be problematic where the country depends on one product for its foreign earnings, as is the case with Nigeria. Economic crises and recession experienced in the economies of its trading partners spell doom for Nigerian economy. The present balance of payments disequilibrium being experienced is due to low demand for crude petroleum and price fluctuations resulting from the slowdown of economic activities in the economies of trading partners. Had it been that Nigeria has a good export portfolio, the risks would have been diversified and the overall effect would be less.

This calls for export diversification away from the oil and gas sector. This would restore balance of payment equilibrium. The situation may be worst if the non-oil manufacturing sector depends mostly on importation for its raw materials. Evidence shows that over 50% of the inputs of manufacturing sectors are imported. This will translate into higher prices in domestic economy and thus leading to a rise in general price level and higher inflation rate.

With many emerging market currencies tied to the US Dollar either implicitly or explicitly, movements in the exchange values of the currencies of major trading partners have the potential to influence the competitive position of many developing countries. This being the case, the developing countries need to establish exchange rate target bands to reduce the variability of the G-3 currencies. This would limit the destabilizing shocks emanating from trading partners. Under a system of target bands the relative prices for developing countries may become more stable but greater interest rate volatility may make the debt servicing costs less predictable and greater G-3 income volatility may make demands for the products of emerging market economies more uncertain. For countries in the economic catch-up process where capital markets remain underdeveloped and macroeconomic instability tends to be high, target bands are important anchor for macroeconomic policies and private expectations. In particular they provide an important anchor for the adjustment of asset and labour markets. As analysts have apportioned some of the blame for financial crises in the emerging markets on the shoulders of the volatile exchange rate of industrialised nations, the target bands might be a useful instrument to mitigate or avoid the financial crises and reduce its crucial effects. Besides, the target bands might reduce the developing countries' trade deficits and prevent them from going into recession. Finally, the welfare consequences to an emerging market economy are ambiguous. It depends on the initial conditions, the specification of behaviour, and the dynamic nature of the trade-off between lower G-3 exchange rate volatility and higher G-3 interest rate variability.

5. CONCLUSION

The major focus of this paper is to trace the effect of the own real exchange rate and G-3 real exchange rate volatilities on economic growth of developing economies. To do this, we use a sample of African economies namely Nigeria, Kenya, Ghana, Malawi, Zambia and Mali and employ Fully Modified Ordinary Least Squares (FMOLS) procedure. The results do suggest that G-3 real exchange rate volatility improves economic growth in the period 1980Q! – 2001Q4 and depresses it in the period 2002Q1 -2013Q4. The own real exchange rate volatility depresses economic growth in two periods. The financial system in the selected needs to be strengthened as it has a negative impact on the economic growth in both periods but more especially in the late 2000s as a result of turbulence in world financial market and debt crisis in Europe. Strong financial system in Africa will minimize or reduce over dependency on the foreign financial markets for capital or loans.

We do not claim that the results presented here are robust as it might be affected by data constructions, sources and technique of estimation. However, these findings suggest that greater stability in the international exchange rate system may be desirable in order to promote higher growth in developing countries. The results also suggest that an added benefit of lower G-3 currency volatility would be to reduce the occurrence of exchange rate crises in the developing economies and thus enhance economic growth.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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