

Original Research Article

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

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Abstract

The objective of this paper is to estimate the relationship between the volatility of exchange rate, the G-3 currencies and the economic growth in developing countries. We draw a sample of African economies namely Nigeria, Kenya, Ghana, Malawi, Zambia and Mali and utilize the Westerlund error correction based cointegration test to d Arellano-Bover/Blundel-Bond estimation technique to estimate the long run coefficients of the model. The main results are: the variables are not strongly but weakly cointegrated. The won country's real exchange rate volatility tends to depress the economic growth. The G-3 real exchange rate volatilities have mix results. While the Yen/Dollar improves economic growth, the Deutsche mark/Dollar and Yen/Deutsche tend to depress 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 occurrence of exchange rate crises.

Keywords: real exchange rate volatility, G-3 exchange rate volatility, economic growth, developing economies and causal relation

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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 market 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.

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 increasing the efficiency of price mechanisms at international level [11, 12]. Lower transaction costs and greater price transparency also affect growth performance by increasing capital markets efficiency in capital allocation [13] and by lowering risk premia and real interest rates [14]. 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.

There are channels through which developed economy exchange rate volatility may affect the performance of developing countries. Esquivel and Larrain [15] 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 [16]. 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 [17]. 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 [18]. 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 [19]. 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 [20] 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 [21] 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 [22].

The effect 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 [23].

2.1. 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 [24] 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 [25] and Arize, Osango and Slottje [26]. 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 [27] 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 [28] 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 of the probability of occurrence of currency crisis in developing countries. Aliyu [29] using error correction model examined the impact of Nigeria Naira and US Dollar exchange rate volatility on the non-oil export and imports. He found that Naira exchange rate volatility depressed exports, while that of dollar encouraged it.

Ghosh, Gulde and Wolf [30] 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.* [31] 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 [32] 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 [33] used panel estimations for more than 180 countries and find evidence that countries with more flexible exchange rates grow faster. Likewise, Eichengreen and Leblang [34] 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 [35] 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.* [36]. There are also ample evidences that confirm the negative impact of exchange rate volatility on growth is 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. Firstly, there is very little time series evidence on the effect exchange rate volatility on economic growth in developing countries where capital markets are relatively less developed. Secondly the causal relation between exchange rate volatility and growth is unknown.

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 [37] 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 and 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. fdi_{it} is the growth of financial development of country i at the time t , $Rerv_{it}$ is the real exchange rate volatility of the country i at the time t and $Rerv_{G-3it}$ 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 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

$$Rer = S_t \left(\frac{P_t^*}{P_t} \right) \quad 2$$

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. [38], Kenen and Rodrik [39], Chowdhury [40] and Esquivel and Larrain [41]. There are other measures of exchange rate variability or volatility [42] and for review of alternative measures of real exchange rate volatility [43].

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. Data on GDP per capita, real GDP, imports 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 [44] – Deutsche Mark/Dollar and Yen/Dollar. The data cover the period 1965 to 2010. 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 2000 we utilize euro/dollar.

3.4. Methods and Procedures

In trying to establish the long run relationship among the variables of equation, we use annual data from eight selected African countries over 1965 to 2010 periods. Since the model uses panel data in order to avoid spurious results obviously we must establish the integrating properties of each variable using panel unit root tests and the cointegrating properties of the relationship among all the variables using panel cointegrating tests.

Panel unit root test have been developed on the same principles that underlies the conventional Augmented Dick-Fuller (ADF) test. While a test by Levin, Lin and Shu [45] allows for heterogeneity of the intercepts across members of the panel, the one by Im, Pesaran and Shin [46] allows for heterogeneity in intercepts as well as in the slope coefficients. The Levin, Lin and Shu [47] panel unit root test model is specified as;

$$\Delta y_{it} = \alpha_i + \tau_t + \rho y_{it-1} + \zeta_{it} + v_{it} \quad 2$$

The equation (2) 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:

$$\Delta y_{it} = \alpha_i + \tau_t + \rho y_{it-1} + \sum_{j=0}^n \lambda_{ij} \Delta y_{it-j} + v_{it} \quad 3$$

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

Panel Cointegration Test

For panel cointegration test, we utilize the error correction – based panel cointegration tests of Westerlund [48]. The tests are based on structural rather than residual dynamics and do not impose any common factor restriction. The idea is to tests the null hypothesis of no cointegration by inferring whether the error – correction term in a conditional panel error correction model is equal to zero. These tests are normally distributed and are generally enough to accommodate unit specific short-run dynamics, unit specific trend and slope parameters and cross-section dependence. Two tests are deigned to test alternative hypothesis that the panel is cointegrated as a whole, while the other test the alternative that at least one unit is cointegrated. The error correction –based panel

cointegration test has been used by Persyn and Westerlund [49] to test the influence of per capita GDP on the per capita health-care expenditure for 20 countries covering the period 1970 – 2001. The error correction based panel cointegration test assumes the following data generating process.

$$\Delta y_{it} = \delta'_i d_t + \alpha_i (y_{it-1} - \beta'_i x_{it-1}) + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{it-j} + \sum_{j=q_i}^{p_i} \gamma_{ij} \Delta x_{it-j} + e_{it} \quad 4$$

Where $t = 1..T$ and $i = 1..N$ index the time series and cross-sectional units respectively while d_t contains the deterministic components for which there are three cases. In the first case, $d_t = 0$, the equation (4) has no deterministic terms, in the second case $d_t = 1$ Δy_{it} is generated with a constant and in the third case $d_t = (1, t)'$ then Δy_{it} is generated with both a constant and a trend, Like Persyn and Westerlund [50], we model the K-dimensional vector x_{it} as a pure random walk such that Δx_{it} is independent of e_{it} . Also we assume that these errors are independent across both i and t .

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 LLC test. The results of this exercise are presented in the Table 1.

Table 1: Unit root test and order of integration (LLC)

Variables	Level		First Difference	
	No trend	With trend	No trend	With trend
$\ln rgdp$	-2.040 [0.022]	-1.162 [0.123]	-9.954 [0.000]	-9.587 [0.000]
$\ln ex$	2.317 [0.990]	1.211 [0.887]	-8.103 [0.000]	-8.098 [0.000]
$\ln fd$	0.394 [0.652]	0.593 [0.724]	-13.839 [0.000]	-13.214 [0.000]
$\ln rerv$	-8.122 [0.000]	-11.863 [0.000]	-9.182 [0.000]	-7.334 [0.000]
$\ln rergpv$	-10.973 [0.000]	-10.004 [0.000]	-9.758 [0.000]	-8.423 [0.000]
$\ln regmv$	-12.253 [0.000]	-11.769 [0.000]	-14.096 [0.000]	-13.405 [0.000]
$\ln regmjp$	-9.133 [0.000]	-9.605 [0.000]	4.436 [1.000]	8.866 [1.000]

Table 1 indicates that the variables - growth of GDP per capita, exports, financial developments are integrated of order one. While the real 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.

4.3. Cointegration Test

We utilize Westerlund error correction model (ECM) Panel cointegration test. The Akaike Information criteria (AIC) are used to select optimal lag and lead lengths for each series with Bartlett Kernel window width set according to $4(T/100)^{2/9}$. The average AIC selected lag is 0.83 and lead is 0.67. The Bartlett kernel window width is 3. The null hypothesis for this test is no cointegration. The rejection of no cointegration between y_{it} and x_{it} only occurs if both statistics reject. The results are reported in Table 2.

Table 2: Panel Cointegration results

Statistics	Value	Z-value	P-value
G_t	-2.652	0.571	0.716
G_a	-7.157	2.892	0.998
P_t	-8.462	-2.027	0.021
P_a	-11.842	0.582	0.720

From the Table 2, it is observed that only P_t statistic rejects the null hypothesis of no cointegration. Thus, we conclude that the variables are not cointegrated but if they are cointegrated it weak as only P_t statistics rejects the null hypothesis.

Next, we conduct a test for cross-sectional independence using Breusch-Pagan LM test. As our time series are rather short and some periods are lost in calculation of differenced variables and lags, we assume short-run dynamics for all series with a single lag and lead ($p_i = q_i = 1$), we obtain the test for cross-sectional independence (see Appendix Table). As these results ($\chi^2_{(15)} = 47.438(0.000)$) strongly indicate that there are common factors affecting the cross-sectional units. The test is not surprising; the cross sectional units are from sub-Saharan Africa whose major exports are primary products and financial market is less developed; the growth rate is lower compared to other regions of the world. Also poverty rate is high.

Dynamic Panel Estimation

The Arellano-Bond estimation is designed for small T and large N panels. In large T panels a shock to the country's fixed effect which shows in the error term will decline with time. Similarly, the correlation of the lagged dependent variable with error term will be insignificant [54]. In this case one does not necessarily have to use the Arellano-Bond estimation. In our case we have six units and thirty two time series which may be considered large or not; we utilize the Arellano-Bover/Blundel-Bond estimation technique to estimate the long run coefficients of the model. The results are reported in Table 3.

Table 3: the Long run Coefficients

$\ln rgdp$	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
$\ln rgdp(-1)$	0.1535	0.0617	2.49	0.013	0.0326	0.2744
$\ln ex$	0.2976	0.0723	4.12	0.000	0.1559	0.4393
$\ln fd$	0.3226	0.0749	4.31	0.000	0.1758	0.4695
$\ln rerv$	-1.0602	1.0078	-1.05	0.293	-3.0354	0.9151
$\ln rerjpv$	219.765	99.115	2.22	0.027	25.5018	414.029
$\ln eregm v$	-212.136	96.958	-2.19	0.029	-402.170	-22.102
$\ln rergmjp$	-220.675	99.946	-2.21	0.027	-416.566	-24.784
α	149.017	68.028	2.19	0.028	15.6845	282.35

The results in Table 3 are quite consistent with those in the vast literature on cross-national growth empirics. Economic growth, over time horizon, tends to increase with export and financial development and tends to decrease with own country real exchange rate volatility. However the G-3 countries' real exchange rate volatility diverges in its effect on the developing countries growth. While the real exchange rate volatility of Japan (Yen/Dollar) improves economic growth of the selected Africa economies that of Germany (Deutsche Mark/dollar) and (Yen/Deutsche Mark) decrease it. We are not surprised as most African countries trade more with Europe than with Japan. 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 [55] 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, though not significant, 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 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 (see, the Nation 14th January 2009) 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 [56] 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. Accordingly, Singapore is a particularly interesting case study as it has been experiencing sustained export growth despite an appreciating currency. 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 would 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. 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 Eagle and Granger procedure. The results from the restricted cointegrating relations do suggest that G-3 real exchange rate volatility depresses

economic growth in our sample of developing countries - namely Nigeria, Mali, Malawi and Zambia. Their impact in Kenya and Ghana seems to be of growth enhancing. The own real exchange rate volatility enhances economic growth in two countries – Nigeria and Kenya and depresses growth in four – Ghana, Malawi, Zambia and Mali. In the causal relationship the findings do not indicate any causal relationship running from G-3 exchange rate volatility to GDP growth rate except in the case of Nigeria and Kenya. However we could find some feedbacks in Ghana, Malawi, Zambia and Mali. The causal relationship could not be established between own real exchange rate volatility and economic growth rate in the sample of African countries used, but only a feedback in the case of Nigeria implying that in the long run the GDP growth will stabilize the real exchange rate in the floating exchange rate regime.

We do not claim 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.

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```
. xtreg d.lnrgdp l.lnrgdp ld.lnrgdp d.lnex l.lnex d.lnrerv l.lnrerv d.lnfd l.lnf
> d d.lnrerjpv l.rerjpv d.lnrergmv l.lnrergmv d.lnrergmjp l.lnrergmjp year, fe v
> ce(bootstrap)
(running xtreg on estimation sample)
```

Bootstrap replications (50)

```
----- 1 ----- 2 ----- 3 ----- 4 ----- 5 -----
..... 50
```

```
Fixed-effects (within) regression      Number of obs   =      180
Group variable: countries              Number of groups =       6

R-sq:  within = 0.4496                  Obs per group: min =      30
      between = 0.3668                  avg           =     30.0
      overall  = 0.3283                  max           =      30

corr(u_i, Xb) = -0.5497                  Wald chi2(15)    =    1767.34
                                      Prob > chi2       =     0.0000
```

(Replications based on 6 clusters in countries)

D.lnrgdp	Observed Coef.	Bootstrap Std. Err.	z	P> z	Normal-based [95% Conf. Interval]	
lnrgdp						
l1.	-.7408127	.2180246	-3.40	0.001	-1.168133	-.3134924
ld.	-.1156818	.1876587	-0.62	0.538	-.4834861	.2521225
lnex						
d1.	.4120864	.2229653	1.85	0.065	-.0249175	.8490903
l1.	.2945388	.1078785	2.73	0.006	.0831009	.5059767
lnrerv						
d1.	-.9547736	1.431647	-0.67	0.505	-3.76075	1.851203
l1.	-1.332517	1.819915	-0.73	0.464	-4.899484	2.23445
lnfd						
d1.	.2162529	.0420484	5.14	0.000	.1338396	.2986661
l1.	.1713772	.0564776	3.03	0.002	.0606831	.2820713
lnrerjpv						
d1.	212.0721	105.8179	2.00	0.045	4.672834	419.4714
rerjpv						
l1.	179.7516	116.8792	1.54	0.124	-49.32746	408.8307
lnrergmv						
d1.	-207.5222	106.5207	-1.95	0.051	-416.2989	1.254488
l1.	-348.3685	230.988	-1.51	0.132	-801.0966	104.3596
lnrergmjp						
d1.	-214.9445	111.0706	-1.94	0.053	-432.6388	2.74987
l1.	-363.3634	241.6047	-1.50	0.133	-836.9	110.1732
year	-.0028677	.0032765	-0.88	0.381	-.0092896	.0035541
_cons	141.4455	92.24696	1.53	0.125	-39.35517	322.2463
sigma_u	.35578967					
sigma_e	.61192118					
rho	.2526502	(fraction of variance due to u_i)				

```
. xttest2
```

Correlation matrix of residuals:

```
___e1    ___e2    ___e3    ___e4    ___e5    ___e6
___e1  1.0000
___e2  0.1488  1.0000
___e3  0.4412  0.0929  1.0000
___e4 -0.1838  0.0113 -0.4114  1.0000
___e5  0.4039  0.4239  0.5910 -0.1728  1.0000
___e6  0.1065  0.1836  0.2839 -0.0346  0.5512  1.0000
```

```
Breusch-Pagan LM test of independence: chi2(15) = 47.438, Pr = 0.0000
Based on 28 complete observations over panel units
```