



THE TRANSITIONAL RELATIONSHIP BETWEEN ECONOMIC GROWTH AND EXCHANGE RATE IN GHANA: AN EMPIRICAL APPROACH

 Ignatius Abasimi¹⁺
Xuan Li²
Seidu Mohammed³

^{1,2}School of Economics, Northeast Normal University, Changchun, Jilin, China, School of Economics, Shandong University, Jinan, Shandong, China.

¹Email: abasimiignatus@gmail.com

³Email: seidumohammed138@gmail.com

²School of Economics, Northeast Normal University, Changchun, Jilin, China

³Email: lix199@nenu.edu.cn



(+Corresponding author)

ABSTRACT

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The motivation behind this study was to investigate empirically the transitional relationship between economic growth and the exchange rate in Ghana, *viz.*, to what extent and magnitude does the exchange rate affect economic growth? The variables incorporated in the study were interest rate, inflation and direct foreign investment. The statistical results using the Phillips-Perron (PP) test of stationarity disclosed that the variables were integrated in order of I(1) and I(0). Johansen cointegration (maximum eigenvalues) established the existence of at least two cointegration vectors and long-run relationships between the variables in the model. The output from the long and short-run estimates revealed the exchange rate to have a robust significant relationship with economic growth. It was recommended that government should embark on rigorous domestic economic transformation (monetary policies, infrastructure repositioning, adequate security etc.) as well as external export promotions to strengthen the economic fundamentals so as to attract foreign investment into the economy. It was also recommended that the Bank of Ghana should pay particular attention to inflation and interest rate volatilities to ensure and embed consumer and producer confidence.

Contribution/Originality: This study contributes in the existing literature by illuminating the dynamism and robustness of exchange rate volatilities, and their interlinking causality with economic growth in Ghana. The study employed a new estimation methodology to establish both short and long-run connections between these economic fundamentals and internal economic development.

1. INTRODUCTION

Economic growth is a relative concept compromised of various indicators and factors. Some of these indicators are measured by natural and geographical locations such as discoveries of oil, minerals and geographical positioning. Some are influenced by domestic policies and effective management strategies from the micro to the macro level. Economic growth is mostly realized through an optimum amalgamation of microeconomic and macroeconomic variables. Macroeconomic variables such as exports, imports, the exchange rate, interest rates, inflation and human capital exhibit a profound influence on economic growth, especially in developing economies.

The evolution of exchange rate regimes in Sub-Saharan African economies including Ghana dates back to 1980. According to the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), exchange rate regimes can be classified in three ways: pegged, intermediate, and floating. Pegged exchange rate regimes comprise hard pegs (countries with a currency board or countries without a separate legal tender, including

monetary unions) and conventional single-currency pegs. The intermediate category comprises basket pegs, pegs within bands, crawling pegs, and floats with rule-based or discretionary intervention (managed floats). A floating exchange rate regime comprises independent floats. According to [Regional Economic Outlook \(IMF, 2016\)](#) a majority of Sub-Saharan African economies use the pegged exchange rate system (nearly 60 per cent of countries in sub-Saharan Africa had a peg in 2014 compared with 47 per cent in other emerging market and developing economies). The same report suggested that there is no single prescription, and that the appropriate regime for a country depends on its circumstances, particularly prevailing macroeconomic challenges. For instance, in the year 2000, there was not much of a per capita growth differential among countries using different exchange rate regimes. But since around 2000, countries with more flexible exchange rate arrangements in sub-Saharan Africa have enjoyed higher annual output per capita growth of one-to-two per centage points than countries with pegged rates. Such a growth differential is not evident in other developing economies. The mean differences are the relative competitiveness among those individual economies that employ pegged and floating systems ([IMF, 2016](#)).

Based on IMF recommendations, and taking into consideration the institutional structure of the Ghanaian economy, and the robustness of the floating exchange rate for both trade and internal economic stability, Ghana shifted from a pegged to a floating exchange rate regime. This was one of the major transformations and initiatives implemented during the Financial Sector Adjustment Programme (FINSAP). FINSAP was an element of the Economic Recovery Programme (ERP) employed in the 1980s to address the poorly performing Ghanaian economy. The change from a fixed to flexible exchange rate was, among other things, done as a result of the belief that a floating exchange rate remedies the boom and bust cycle, and also kindles economic growth through the exchange rate's pass-through effect to consumer prices, volume and terms of trade, and investment.

The exchange rate is a significant economic growth indicator. It reflects the strong points of both real and goods sectors, as well as established relative competitiveness between world economies. The foreign exchange marketplace according to the Central Bank of Ghana is, in effect, the standard dealings between sellers and buyers of foreign exchanges. The supplier of foreign exchange institutes the sales, while the purchasers of foreign exchange account for demand. In consequence, the supply of foreign exchange is driven by such factors as oil exports, non-oil exports, expenditure by foreign tourists within Ghana, and remittances by Ghanaian residents abroad.

According to [Goldberg and Knetter \(1997\)](#) exchange rate pass-through is the per centage change in local currency import prices resulting from a one per cent change in the exchange rate between the exporting and importing countries. Exchange rate pass-through is, therefore, the effect (positive or negative) of exchange rates on import and export prices, consumer prices or inflation, investments and trade volumes. [Engel and Rogers \(1996\)](#) established that crossing the US-Canada border can considerably raise relative price volatility, and that exchange rate fluctuations explain about one-third of the volatility increase. Put another way, US-Canada border is an important determinant of relative price volatility even after making due allowance for the role of distance. [Parsley and Wei \(2001\)](#) confirmed previous findings that crossing national borders adds significantly to price dispersion. The demand for and supply of money are key contributing factors to exchange rates volatility. Interest Rate Parity is another important concept that explains the equilibrium state of the relationship between the interest rates and exchange rates of two countries. The foreign exchange market is in equilibrium when deposits of all currencies offer the same expected rate of return. An interest rate parity condition exists where the expected returns on deposits of any two currencies are equal when measured in the same currency. This implies that potential holders of foreign currency deposits view them all as equally desirable assets, provided their expected rates of return are the same. Given that the expected return on, say, US dollar deposits is four per cent greater than that on Ghanaian cedi deposits, all things being equal, no one will be willing to continue holding Ghanaian cedi deposits, and holders of Ghanaian cedi deposits will try to exchange them for US dollar deposits. [Krugman et al. \(2012\)](#) explained that there will therefore be an excess supply of Ghanaian cedi deposits and an excess demand for US dollar deposits in the

foreign exchange market. This phenomenon will cause the Ghanaian cedi to depreciate considerably and also retard economic growth if the depreciation is persistent over time.

Exchange rate fluctuations affect economic growth and have a perverse effect on domestic prices through their impact on aggregate demand and supply. Holistically, when a currency depreciates it will result in higher import prices if the country is an international price taker, while lower import prices will result from an appreciation. The potentially higher cost of imported inputs accompanying with an exchange rate depreciation increases marginal costs and leads to higher price of locally manufactured products (Kandil, 2004). Nevertheless, the scope of such price modification rests on a diversity of determinants such as the relative number of domestic and foreign firms in the market, market structure, product substitutability and the nature of the government's exchange rate policy (Fouquin *et al.*, 2001). Ghana's approval and establishment of the Structural Adjustment Programme (SAP) in 1983 was intended to restructure the economy and facilitate unfettered productivity in both the private and public sectors. It was considered to be a substantially undertaking with only a few minor setbacks. Under the SAP, a mixture of exchange rate regimes caused an overvaluation of the cedi which was supported by exchange control regulations that in turn stimulated significant changes to the economy including a robust improvement in economic growth.

The available literature suggests that depreciation of a country's currency is largely a monetary phenomenon that can have a significant negative impact on economic growth. However, monetary experts have also associated this with short and long-run inflationary shocks. In many scenarios, monetary policy authorities have over-reacted to failures to meet short-term targets in an attempt to prevent a rapid loss of public confidence. This has often been damaging to the economy. Attempting to meet inflation targets every year is not necessarily desirable, and may not even be feasible in a developing economy like Ghana.

Inflation is one macroeconomic variable that remains elusive to policy makers in the Ghanaian economy. Although the much-desired single digit level was attained in 2010, 2011 and 2012, it could not be sustained and has, as expected, returned to double digits, standing at 10.3 per cent at the end of the 2013 fiscal year. This trend is predicted to prevail for some time as policy makers struggle to discover the most effective policy mix that will control both inflation and its effects on economic growth (Nchor *et al.*, 2015). Nevertheless, inflation targeting is a flexible concept. Since the implementation of the structural adjustment program in 1983, the Bank of Ghana (BoG) has formulated various monetary policies to ameliorate the impacts of inflation on the economy. These measures caused inflation to drop to single digits (10.7 per cent in 2010 and 9.2 per cent in 2012). From 1999 and 2018, inflation growth in Ghana has been relatively high. For instance, consumer prices increased 10.4 per cent year-on-year in March of 2018, easing from a 10.6 per cent rise in the previous month. This was mainly due to a reduction in clothing, footwear and transport prices. Ghana's inflation rate averaged 16.81 per cent from 1998 until 2018, reaching an all-time high of 63 per cent in March of 2001, and a record low of 0.40 per cent in May of 1999.

These factors notwithstanding, it is apparent that there is a strong connection between economic growth and the exchange rate transmission mechanism, which may have positive or negative effects on the Ghanaian economy. A depreciation of the cedi could result in higher demand for imports which boost GDP growth, may weaken domestic businesses, or even discourage foreign investment. Appreciation of the currency may have other effects as well. Exchange rate volatility can impact on economic indicators such as inflation (Bobai *et al.*, 2013) exports (Wang and Barrett, 2007) economic activity (Adewuyi and Akpokodje, 2013) trade (Doyle, 2001); (Clark *et al.*, 2004) and employment growth (Tenreiro, 2007).

However, the scope and direction of the exchange rate on economic growth has not been thoroughly and empirically investigated in Ghana. Exchange rate variability has been observable for at least two decades, and its apparently broad-ranging economic impact makes rigorous discourse on the subject imperative. This study seeks therefore to analyze the significant pervasive effect of the exchange rate on growth in the Ghanaian economy. In addition, it will explore and analyze the most significant impacts of interest rates and inflation on economic growth.

The work's contribution to existing literature includes an improved understanding of exchange rate dynamism and its inherent connection to economic growth in Ghana. It reveals also the significance of exchange rate volatilities, and inflation and interest rate dynamism on domestic growth while establishing both short and long-run causality of these economic fundamentals on internal monetary policy and economic growth.

2. LITERATURE REVIEW

This section lays out the essence of empirical literature on the subject, with special attention to studies that have been carried out in an attempt to explain and understand the causal relationship between economic growth and the exchange rate pass-through mechanism. It also outlines their parameters and empirical methodologies.

David *et al.* (2010) checked the impact of exchange rate fluctuations on Nigeria's manufacturing sector, employing a multiple regression econometric technique. The results showed a negative correlation between manufacturing sector performance and exchange rate fluctuations. In a similar study by Khosa *et al.* (2015) survey results showed a clear and significant negative relationship between exchange rate fluctuations and export performance.

In the study Bahmani-Oskooee and Gelan (2018) a sample of twelve African countries was used to investigate the impact of real exchange rate fluctuations on trade flows. Bounds-testing methods were used to distinguish between the apparent impact of real exchange rate fluctuations on the exports and imports of these countries, both in the short and long-term. The research found that while exchange rate fluctuations affect trade flows in many countries, short and long-term effects were limited to exports from five countries, and imports from only one. The level of global and domestic economic activity was identified as the main determinant of exports and imports.

Barguelligil *et al.* (2018) studied the impact of exchange rate fluctuations on economic growth. Empirical studies using samples of 45 developing and emerging countries during the period 1985-2015 were conducted using differential and systematic generalized methods of moment estimation. The results showed that nominal and real exchange rate volatility measures based on generalized autoregressive conditions heteroscedasticity have a negative impact on economic growth. In addition, the impact of exchange rate fluctuations depends on the exchange rate system and financial openness. In essence, when countries adopt a flexible exchange rate system and financial openness, volatility is more harmful.

Umaru *et al.* (2018) investigated the effects of Exchange Rate Volatility on economic growth in West African English-Speaking countries between 1980 and 2017. The study employed macroeconomic data from the World Bank's development indicators and analyzed the data with the help of the Stata 14 statistical package. The paper used only two variables for the empirical econometric analysis: GDP per capita as the dependent variable; and the real exchange rate as the independent variable. The Configuration Wald Test results showed that heteroskedasticity did not exist in the data, although the result of the Hausman Test (prob > 5 percent) supported the alternative Fixed Effect (FE) hypothesis by having a p-value of more than 0.05 on the Hausman Test. The statistical output from the ordinary least squares, fixed effect, and random effect models showed that real exchange rates have a significant but negative coefficient (-5.981, -626, and -5.981 respectively) with economic growth. The research therefore concludes that the independent variable (real exchange rate) is statistically significant and negatively related to the dependent variable (GDP) in West African English-speaking countries, excluding time-invariant variables.

Peter and Isaac (2017) investigated the causality between the real exchange rate and economic growth in Ghana using annual data from 1984 to 2014. Their study incorporated explanatory variables such as real effective exchange rate, government expenditure, real Gross Domestic Product Growth, gross fixed capital formation, labor force, trade openness, and direct foreign investment. The descriptive results showed all variables to have a positive means with the exception of direct foreign investment. The unit root test revealed some of the variables to be stationary and non-stationary at levels, trend and first difference. By employing the ARDL cointegration estimation

method, the study found out that the real exchange rate has a robust cointegration with economic growth. The long-run ARDL estimates further revealed that gross fixed capital formation and the labor force have significant positive effects on economic growth, while real effective exchange rates, government expenditure, real Gross Domestic Product growth, trade openness, and direct foreign investment accounted for a significant negative influence on economic growth in Ghana. The short-run output also revealed direct foreign investment, trade openness, real effective exchange rates and gross fixed capital formation to possess significant positive influences, while the rest of the variables had negative impacts.

Katusiime *et al.* (2016) noted both short and long-run pass-through effects on the exchange rate volatility-economic growth nexus in Uganda. They used annual time series data from 1960 to 2011. They further incorporated variables such as real GDP per capita, gross capital formation, index of human capital per person, exchange rate, trade openness, financial sector development, inflation rate, trade balance and an interaction term for exchange rate volatility and political instability. Their descriptive statistics showed all the variables to have both positive mean and standard deviations. A statistical test comprising the Augmented Dickey-Fuller Test (ADF) (Dickey and Fuller, 1979) and Phillip-Perron (PP) (Phillips and Perron, 1988) unit roots test showed that all variables employed in the empirical investigation had a mixture of I(1) and I(0) properties. The ARDL, and both the short and long-run dynamics results also revealed that real GDP per capita, gross capital formation, exchange rates, trade openness, financial sector development, inflation rate, trade balance and an interaction term for exchange rate volatility and political instability were statistically significant at one percent and five percent, while only the trade balance was relatively insignificant at a level of ten percent. These empirical results exemplified the need for further structural and institutional reform in light of growth capacity, and should further promote the development of the financial sector. The Ugandan government should act with caution when dealing with the negative impact of inflation on economic growth, taking into consideration both micro and macro-economic policies designed to curb and anchor inflation expectations.

Oriavwote and Oyovwi (2012) used annual data from 1970 to 2010 to test the elements of the real exchange rate in Nigeria. Their research outlined a dynamic model of real exchange rate determination and effectively tested the consequences of the change. The orthodox error correction model results showed that the ratio of government expenditure to GDP, terms of trade and technological progress was not an important determinant of the real effective exchange rate. The results further showed that price levels, capital flows and nominal effective exchange rates are important determinants of the real effective exchange rate in Nigeria, and recognizes that the Dutch Syndrome is held in Nigeria and suggests that policies must be in place to address inflation.

In addition, by employing the Vector Error Correction Model (VECM), Akinlo and Lawal (2015) revised the impact of exchange rates on industrial production in Nigeria between 1986 and 2010. The survey results confirm the long-term relationship between the Industries Production Index and the exchange rate, money supply and inflation rate. Depreciation has no obvious impact on industrial production in the short-term, but it has a positive impact in the long-run. Nigeria's output, inflation and exchange rate were the focus of Odusola and Akinlo (2001). By using structural VAR models, evidence from these estimates indicates mixed effects of exchange rate depreciation effects on output. It was found that inflation will have a serious destabilizing effect on people output, suggesting that monetary authorities should play a key role in providing an environment conducive to growth. It was concluded that the price, parallel exchange rate and loan interest rates are a major cause of official exchange rate fluctuations. The real exchange rate depreciation rate is related to the decrease in output and a rise in inflation.

Ogun (2006) studied the impact of real exchange rates on Nigeria's non-oil export growth, highlighting the impact of real exchange rate misalignment and volatility on non-oil export growth. He adopted a standard trade theory model of export growth determinants, and two different real exchange rate out-of-schedules, one of which is the bias of purchasing power parity (PPP) and the other model-based equilibrium real exchange rate estimation

(ERER). He pointed out that regardless of the alternative measures, the actual exchange rate misalignment and fluctuations will have an adverse impact on the growth of Nigeria's non-oil exports.

Ehinomen and Oladipo (2012) studied the impact of exchange rate management on manufacturing growth in Nigeria and arrived at a seemingly perverse finding. By using ordinary least squares (OLS) multiple regression analysis and time series data over the period 1986 to 2010, the empirical results of the study indicated that exchange rate depreciation was part of the 1986 Structural Adjustment Policy (SAP), in which there was no significant relationship with the manufacturing industry's productivity during that period. It was found that in Nigeria, exchange rate appreciation was of great significance, and had a robust relationship with domestic output. Based on the empirical evidence, Ehinomen and Oladipo (2012) suggested that the government should guide its exchange rate management policy in order to boost exchange rate appreciation and further condense the cost of production in the manufacturing sector that depends heavily on foreign inputs, while there should be simultaneously a total ban on the importation of consumer and intermediate goods that can be or are manufactured locally.

Gyimah-Brempon and Gyapong (1993) notably investigated the effects of exchange rate distortions and economic growth in Ghana. Their study used five equation simultaneous models to analyze the time series data for Ghana. Kwabena and Anthony's empirical output revealed that exchange rate distortion, as determined and measured by the black-market premium, had a parsimonious effect on economic growth rate. This negative effect is demonstrated by a reduction in investment and a diminution of international trade. The results imply that liberalized exchange rate policies will enhance the growth possibilities of less developed countries (LDCs) specifically those in Sub-Saharan Africa.

3. METHODOLOGY AND DATA SOURCE

The study employed annual time series data from the World Bank development indicators and international monetary fund databases for the period 1980 to 2013. The variables considered in the study include gross domestic product (GDP) which is the sum of gross value added by all resident producers in the Ghanaian economy, plus any product taxes, and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current local currency. Inflation (GDP deflator) is measured by the annual growth rate of the GDP implicit deflator and shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. It is adopted as a proxy for the yearly percentage inflation rate in Ghana. The official exchange rate refers to the exchange rate determined by national authorities, or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar). Nominal interest rates are proxied in this study as deposit interest rates. The deposit interest rate is the rate paid by commercial banks for demand, time, or savings deposits. The terms and conditions attached to these rates differ by country, so limiting their comparability. Lastly direct foreign investment represents the net inflows of investment intended to acquire a lasting management interest (ten per cent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors and is divided by GDP.

3.1. Analytical Econometric Method

This study employed Johansen's Co-integration, the ARDL method, and an error correction model (ECM) for empirical analysis. The appeal of the ARDL model is that it is related to a single cointegration equation and takes into account that all variables to be integrated in the model are $I(0)$ or $I(1)$, or even $I(0)$ and $I(1)$ synthesis (Pesaran

and Shin, 1999). According to Pesaran and Shin (1999) the model has a “spurious free” approach to co-integration of non-stationary and stationary variables, and can be unified for cointegration through the ARDL approach and error-correction (EC) processes. The model is expressed empirically as;

$$GDP_t = \beta_0 + \beta_1 GDP_{t-1} + \dots + \beta_Z GDP_{t-Z} + l_0 EXH_t + l_1 EXH_{t-1} + \dots + l_k EXH_{t-k} + \omega_0 INT_t + \omega_1 INT_{t-1} + \dots + \omega_j INT_{t-j} + z_0 INF_t + z_1 INF_{t-1} + \dots + z_h INF_{t-h} + \varphi_0 FDI_t + \varphi_1 FDI_{t-1} + \dots + \varphi_U FDI_{t-U} + \varepsilon_t \quad (1)$$

Where GDP, EXH, INT, INF, FDI are gross domestic product, exchange rate, interest rate, inflation rate, and direct foreign investment respectively.

Equation 1 is adopted by attaching elasticities and first order differences to attain the ARDL model of short and long-run dynamics as follows:

$$\begin{aligned} \Delta \ln GDP_t = & b_0 + \sum_{i=1}^q b_{1i} \Delta \ln GDP_{t-i} + \sum_{i=1}^q b_{2i} \Delta \ln(EXH_{t-i}) + \sum_{i=1}^q b_{3i} \Delta \ln(INT_{t-i}) \\ & + \sum_{i=1}^q b_{4i} \Delta \ln(INF_{t-i}) + \sum_{i=1}^q b_{5i} \Delta \ln(FDI_{t-i}) + b_6 \Delta \ln GDP_{t-1} + b_7 \ln EXH_{t-1} \\ & + b_8 INT_{t-1} + b_9 \ln INF_{t-1} + b_{10} \ln FDI_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

Where b_1, b_2, b_3, b_4, b_5 , are the short-run coefficients or dynamics of the model, while $b_5, b_6, b_7, b_8, b_9, b_{10}$, represents the long-run characteristics and elasticities of the model, q is the optimal lag length, Δ represents the first difference operator. Before estimating Equation 2, a Johansen cointegration test is performed on the null hypothesis $H_0: b_6 = b_7 = b_8 = b_9 = b_{10} = 0$ for no cointegration or no long-run relationship between the variables against the alternative hypothesis $H_1: b_6 \neq b_7 \neq b_8 \neq b_9 = b_{10} \neq 0$ of long-run cointegration or long-run relationship between the variables. When the regressors considered are statistically significant and co-integrated, an unrestricted error correction model (ECM) is used to estimate the given long-run relationships among them. The unrestricted error correction model (ECM) is given as:

$$\begin{aligned} \Delta \ln GDP_t = & b_0 + \sum_{i=1}^{w_1} b_{1i} \Delta \ln GDP_{t-i} + \sum_{i=1}^{w_2} b_{2i} \Delta \ln(EXH_{t-i}) + \sum_{i=1}^{w_3} b_{3i} \Delta \ln(INT_{t-i}) \\ & + \sum_{i=1}^{w_4} b_{4i} \Delta \ln(INF_{t-i}) + \sum_{i=1}^{w_5} b_{5i} \Delta \ln(FDI_{t-i}) + \phi EC_{t-1} + \varepsilon_t \end{aligned} \quad (3)$$

Where w_1, w_2, w_3, w_4 and w_5 denote the optimal lags of the ECM model, and ϕ represents the speed of adjustment from disequilibrium to equilibrium based on previous shocks, EC is the error term originated from the long-run analysis.

4. RESULTS AND DISCUSSION

The study used the Phillips-Perron test (PP) to ascertain the stationarity and non-stationarity of the study variables. The Phillips-Perron unit root test was employed instead of the traditional Augmented Dickey-Fuller (ADF) test, largely because it provides a robust assessment of the time series data and is effective even in the existence of heteroscedastic errors and serial correlations. The results from Table 4.1 showed that GDP was non-stationary and integrated at order I(1) at both level and first difference; the exchange rate was stationary and integrated at I(0) at both level and first difference, again; and interest rate, inflation rate and direct foreign investment were non-stationary and integrated at order I(1) at level, but were also found to be stationary and integrated at I(0) at first difference.

Table-4.1. Phillips-Perron Test (PP) for the transitional relationship between economic growth and exchange rate in Ghana from 1983 to 2013.

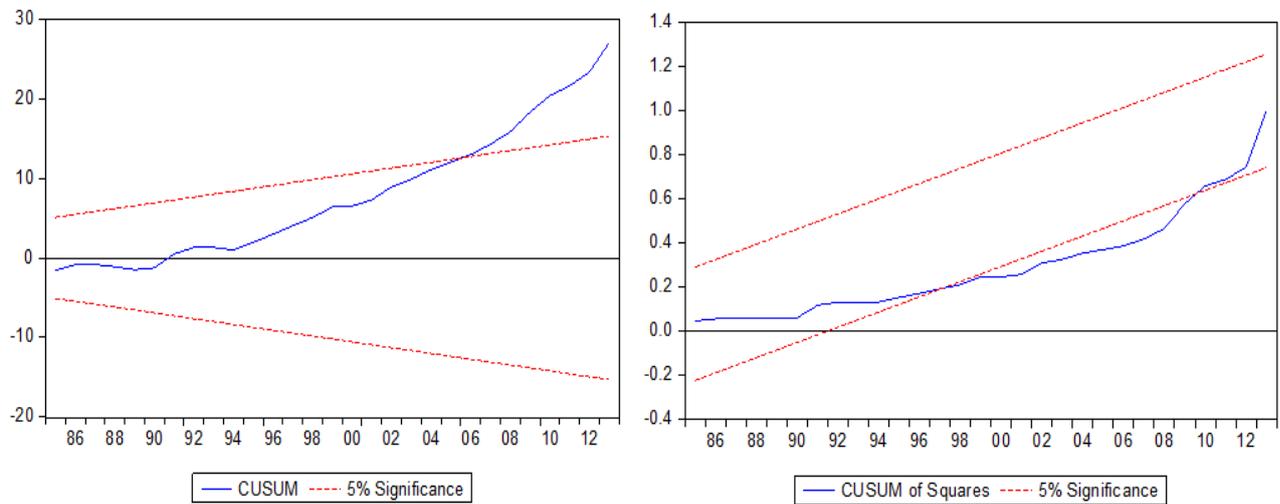
Variables	Z(t)	Phillips-Perron Adj t-statistics	1% critical	5% critical	10% critical	MacKinnon (1996) one-sided p-values approx. for Z(t)	Decisions
LNGDP _t	Z(t)	9.295	-2.637	-1.951	-1.611	1.0000	Unit roots
ΔLNGDP _t	Z(t)	-1.399	-2.639	-1.952	-1.611	0.1472	Unit roots
LNEXH _t	Z(t)	-5.699	-2.637	-1.951	-1.617	0.0000	No Unit roots
ΔLNEXH _t	Z(t)	-2.364	-2.639	-1.952	-1.615	0.0196	No Unit roots
LNINT _t	Z(t)	-0.162	-2.63	-1.951	-1.611	0.6201	Unit roots
ΔLNINT _t	Z(t)	-5.445	-2.639	-1.952	-1.611	0.0000	No Unit roots
LNINF _t	Z(t)	-0.269	-2.636	-1.951	-1.611	0.5813	Unit roots
ΔLNINF _t	Z(t)	-12.797	-2.639	-1.951	-1.611	0.0000	No Unit roots
LNFDI _t	Z(t)	-1.087	-2.639	-1.951	-1.611	0.2452	Unit roots
ΔLNFDI _t	Z(t)	-5.193	-2.639	-1.952	-1.610	0.0000	No Unit roots

Note: The absolute values of Z(t) of the PP test statistics is compared with the critical values (absolute values) at 5% significance level and the null hypothesis (unit roots) is rejected if Z(t)>5% critical value.

Δ= first difference, LN =natural log.

4.1. Stability Diagnostic Test

In other to ensure parameter stability, the study adopted a parameter diagnostic test. The variables incorporated are relatively volatile economic indicators and related to structural breaks within the period investigated. From the CUSUM test displayed in Figure 4.1 there are considerable, sharp breaks from 2006 to 2013. This is because the parameters line (blue line) did cross the five percent significance line (red line). Similarly, in the CUSUMQ, the breaks started from 1998 to 2009 and became stable afterwards. These irregular breaks may be due to inflation and exchange rate volatilities. This is strongly indicated by the short-run dynamic coefficients of the model.



Figures-4.1. CUSUM Tests and CUSUM of Squares Test.

The results of the cointegration analysis are presented in Table 4.2. From the results, we fail to reject the hypothesis that no cointegrating vector exists in support of “at least two” cointegration vectors present at five percent significance levels. Nonetheless, the existence of no cointegration is rejected at the same significance levels. Consequently, the normalized cointegrating coefficients in Table 4.3 are implemented to derive the long-run dynamic equation for the transitional relationship between economic growth and the exchange rate in Ghana.

Table-4.2. Unrestricted Johnson cointegration test (maximum Eigenvalue) for the transitional relationship between economic growth and exchange rate in Ghana from 1983 to 2013.

Hypothesized No. of CE(S)	Max-Eigenvalue Statistic	Eigenvalue	5% Critical Value	**MacKinnon <i>et al.</i> (1999) P-Values
None*	0.716048	40.28638	33.87687	0.0075
At Most 1*	0.407329	16.73972	27.58434	0.0024
At Most 2*	0.358964	14.22943	21.13162	0.0265
At Most 3	0.229182	8.329713	14.26460	0.3462
At Most 4	0.007143	0.229399	3.841466	0.6320

Max-eigenvalue test indicates 2 cointegrating egn(s) at the 0.05 level.

*Denotes rejection of the hypothesis at the 0.05 level.

**MacKinnon *et al.* (1999) p-values.

Table-4.3. Normalized Cointegrating Coefficients (1cointegrating equation).

Variables	Coefficients	Standard Error
LnRMD	1.000	-
LnEXH	4.16E+09	2.1E+09
LnINT	3.30E+08	7.3E+07
LnINF	-0.8902671	3.0E+07
LnFDI	2.60E+09	3.5E+08
Log likelihood	-972.9124	-

Source: Authors analysis, 2019.

4.2. Long-run Cointegrating Equation

$$\text{LogGDP}_t = 0.716 + 4.16\text{E}09 \log(\text{EXH}_t) + 3.30\text{E}08 \log(\text{INT}_t) - 0.89 \log(\text{INF}_t) + 2.60\text{E}09 \log(\text{FDI}_t) + \varepsilon_t \quad (4)$$

The logs attached to the variables are interpreted as elasticities. The official real exchange rate of the Ghanaian cedi to the US dollar possesses a positive sign, which indicates a depreciation of the Ghanaian cedi to the USD. When the cedi depreciates against the USD, it is expected that investors will respond slowly to investment opportunities in the long-run. However, investors in the domestic export trade sector will find benefit, largely because depreciation in the cedi’s value will make their exports cheaper in global markets, so increasing the demand for such products and possibly higher profits for domestic producers that will boost the long-term economic growth. Interest rate also has a robust positive coefficient. This implies that an increase in the depositor’s interest rate will rise economic growth by the corresponding coefficient value (in per centage terms). The coefficient value of inflation is negative implying that a decrease in inflation rate will promote economic growth in the long-run. The positive value of foreign direct investment suggests that FDI invariably increase economic growth in Ghana in the long-run.

Due to the presence of long-run association emanating from the Johansen cointegration analysis, it was vital to investigate the short-run causality between economic growth and its determinants by employing the error correction model (ECM). Table 4.4 displays the empirical output of the short-run estimates.

Table-4.4. Short-run error correction model (ECM) estimates for the transitional relationship between economic growth and exchange rate in Ghana from 1983 to 2013.

Variables	Coefficients	Standard Errors	t-Statistic	Probability Value
c	0.344470	0.071411	4.823787	0.0001***
ΔlnGDP(-1)	0.272815	0.272675	-1.000513	0.3275
ΔlogEXH(-1)	-0.437318	0.078512	-5.570070	0.0040***
ΔlogINT(-1)	-0.097725	0.092887	-1.052077	0.3037
ΔINF(-1)	0.001311	0.000980	1.337097	0.1943
ΔFDI(-1)	-0.011778	0.016219	-0.726189	0.4750
ECM(-1)	-25.79140	0.733742	-35.15050	0.0000***

Note: asterisk ***, donates significance levels at 1%. Source: Authors analysis, 2019.

R-square = 0.689190 Adj-R-Square=-0.422326 F-Statistic = 5.894449 prob (F-Statistic) = 0.005358 Δ= first difference.

The study initially estimated the ADRL model and extracted the residuals from the model for the short-run analysis the results of the ADRL estimates are in Table 4.5 below. From the results showed in Table 4.4 (Short-run error correction model (ECM) estimates), only exchange rate is significant and quite robust in explaining economic growth in Ghana. The negative coefficient sign of exchange rate implies an appreciation of the Ghanaian cedi against the US dollar will promote economic growth by 9.7% in the short-run.

Table-4.5. Autoregressive Distributed Lags Estimates.

Dependent Variable: LNGDP				
Method: ARDL				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNGDP(-1)	0.912609	0.042334	21.55739	0.0000
LNGDP(-2)	0.092345	0.040044	2.306105	0.0332
LNEXR	-0.045761	0.030680	-1.491551	0.1531
LNEXR(-1)	0.007586	0.037814	0.200614	0.8432
LNEXR(-2)	-0.002790	0.033108	-0.084266	0.9338
LNEXR(-3)	0.016803	0.018586	0.904066	0.3779
LNINT	-0.055039	0.020657	-2.664449	0.0158
LNINF	0.227247	0.009404	24.16400	0.0000
LNFDI	-0.000587	0.008526	-0.068798	0.9459
LNFDI(-1)	-0.004249	0.009552	-0.444786	0.6618
LNFDI(-2)	0.015073	0.010542	1.429777	0.1699
LNFDI(-3)	0.010599	0.007153	1.481848	0.1557
C	-0.379715	0.390588	-0.972162	0.3439
R-squared	0.999955	Mean dependent var	21.21022	
Adjusted R-squared	0.999926	S.D. dependent var	2.587463	
S.E. of regression	0.022310	Akaike info criterion	-4.472468	
Sum squared resid	0.008959	Schwarz criterion	-3.871119	
Log likelihood	82.32326	Hannan-Quinn criter.	-4.276443	
F-statistic	33625.56	Durbin-Watson stat	2.532621	
Prob(F-statistic)	0.000000			

4.3. Summary and Conclusion Remarks of the Study

The study carried out a pragmatic investigation of the transitional relationship between Economic growth and exchange rate in Ghana. The statistical test conformation resulting from PP test of stationary showed that the variables were integrated in order of I(1) and I(0), this provoked and supported the study to perform Johansen cointegration of long-run causality. Johansen cointegration (maximum eigenvalues) established the existence of at least two cointegration vectors and long-run relationship among the variables in the model. Based on the existence of long-run causality, the ECM model was adopted for the short-run dynamism of the studied parameters.

The positive coefficient of exchange rate in the long-run indicates that a depreciation of the Ghanaian cedi will affect economic growth by 4.16E+09, dissimilar to the short-run negative coefficient of -0.437318 implies in the short-run an appreciation of the cedi will have a positive effect the Ghanaian economy progress by the stated value or by 44% approximately. Interest rate, inflation, and foreign direct investment were again discovered in both the long and short-run to have the required and robust statistical coefficients which support economic theory. However, exchange rate was only the significant variable in the short-run output. The study therefore concludes that an appreciation of the Ghanaian cedi has a positive significant relationship with economic growth in the short-run. The study therefore recommends that, government should embark on rigorous domestic economic transformation (monetary policies, infrastructure repositioning, adequate security etc.) as well as external export promotions to strengthen the economic fundamentals, and so attract foreign investment. The Bank of Ghana should also pay special interest to inflation and interest rate volatilities to ensure and embed consumer and producer confidence.

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