Real exchange rate and economic growth in Ghana

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ABSTRACT

The study sought to determine effect of real effective exchange rate on economic growth in Ghana using annual data from 1984 to 2014. Data was sourced from the databases of World Bank, Bank of Ghana annual bulletins, and Ghana Ministry of Finance and Economic Planning. Using the ARDL cointegration estimation technique, the study found that real exchange rate and economic growth are cointegrated. The result suggests that real exchange rate exerts a positive and statistically significant effect on economic growth in both the long-run and short-run. Thus, there is the need to ensure exchange rate stability in the Ghanaian economy to help boost economic growth.

KEY WORDS: Real effective exchange rate, economic growth, autoregressive distributed lag model

BACKGROUND TO THE STUDY

The World Bank and IMF in the era of World War II aftermath witnessed a period of fixed exchange rate regime. This system was however, not fit to survive even from the infantile state due to its inflexibility. The Bretton Woods system by 1973, adopted the floating exchange rates. The collapse of the Bretton Woods institutions was preceded by the imbalances in the U.S economy.

The imbalances include huge balance of payments deficits, significant outflows of gold, and the refusal of major trading partners to realign currency values. The major U.S policy that brought the World Bank and IMF to their knees is the sole termination of the U.S dollar conversion to gold by the Nixon administration. This new regime subsequently led to market forces freely influencing some many currencies. The relative desirability regarding the fixed vis-a-vis the floating exchange rate has long been a debatable issue in international money and finance, and this remains unresolved for decades after the Bretton Woods epoch. Those in favor of fixed exchange rate argued that floating exchange rate has the tendency to increase uncertainty in trade and expose importers to high risk due to fluctuation in the domestic currency, and this may lower trade volumes. This argument is indeed valid because, some empirical evidence exists to attest to fixed exchange rate promoting trade openness and economic integration (Frankel & Rose, 2002).

Hanke and Schuler (1994) also argued that fiscal institutions could be strengthened or improved in a fixed exchange rate regime by enabling sound management of budget because this crippled Government in its ability to print money to expend.

Proponents of floating exchange rate however, argued that risks that could result from exchange rate fluctuation are mild through sufficient and systematic hedge, therefore does not

affect trade flows. It was also argued that, floating exchange rate ensure discipline in fiscal policy because unbalanced fiscal policies can be easily corrected through adjustment in exchange rate and price level (Tornell & Velasco, 2000).

Exchange rate instability is the persistent fall and rise in value of domestic currency relative to other currencies (exchange rate). This has gained much attention in recent international finance literature due to its influence on developed and developing countries. Exchange rate fluctuations has an effect on most macroeconomic indicators like exports (Wang & Barrett, 2007); trade (Doyle, 2001); (Clark, Dollar, & Micco, 2004); inflation (Danjuma et al., 2013); employment growth (Tenreyro, 2007) and economic activity (Adewuyi & Akpokodje, 2013).

Ghana, shifted from the pegged exchange rates to floating exchange rate regime as part of the major reforms adopted during the Financial Sector Adjustment Programme (FINSAP). FINSAP was a component of the Economic Recovery Programme (ERP) implemented in the 1980s to address the ailing Ghanaian Economy. This change from the fixed to flexible exchange rate regime was among other things done due to the understanding that floating exchange rate cures the boom and bust syndrome and will also stimulate economic growth through exchange rate pass-through on consumer prices, terms of trade, volume of trade and investments.

The Ghana Cedi under the floating exchange rate regime in Ghana depreciated against the major currencies especially the US Dollar (US$), although, not monotonic, the Ghana Cedi however was somewhat stable between 2002 and 2007. The country undertook a redenomination exercise on July 1st, 2007 which led to a dollar (US$1) exchanged for 93 pesewas. This exercise saw the Ghana cedi depreciating and by the end of July 2009, a Ghana Cedi was worth US$ 0.67. (Bank of Ghana Annual report, 2009).

While the above statistics may partly espouse some connection between exchange rate and economic growth in Ghana through the pass-through mechanism, more research is needed to examine the true correlation because the pass-through mechanism can be positive- that is depreciation leading to higher growth through a rise in demand for domestic goods by internationals or negative- that is depreciation declining growth due to undying taste for foreign goods by nationals and low productive capacity to take advantage of the currency depreciation (Devereux & Engel, 2003). Exchange rate variability and its effect on Economic growth can also be positive- when the shock is immediately corrected through sound monetary policies and adjustment in prices or negative- when there is poor adjustment in prices and policies leading to a fall in trade volumes. The extent or magnitude of the exchange rate effect on economic growth also needs to be examined. Exchange rate instability has been a topical issue in the country for some time now and all these makes ascertaining the effect of unstable exchange rate on the Ghanaian economy an important discourse (Gagnon & Ihrig, 2004)

This study seeks to examine the effect of real exchange rate on GDP growth in Ghana- the short run and long run relationship, correlation between these variables together with the magnitude of the effect was examined. The study relied on time series data spanning from 1984 to 2014. Foreign direct investment, trade openness, government expenditure, labour force and capital stock were used as control variables.

The fluctuation in the value of the currency can be detrimental to the economy by creating uncertainty in businesses (trade) and altering consumer prices which lowers trade volume (Obstfeld & Rogoff, 1998). However, with appropriate monetary policies, hedging against exchange rate risk and quick adjustment in prices, flexibility in exchange rate may be beneficial to the economy (Devereux & Engel, 2003).

From a historical perspective to even more recently, the exchange rate of Ghana has on the average depreciated over time. Contemporary trade argument would mean that the economy must experience a favourable trade balance but this is not the case. This paint the picture that the economy is in a way not competitive. Recent marginal falls in the GDP growth of Ghana from 14% in 2011 to a 4% currently has been attributed to the exchange rate unsteadiness.

From the Ballassa-Samuelson proposition, the real effective exchange rate has implication for international trade from the tradable and non-tradable sectors. Nonetheless, differences in the nature of economies among countries and some peculiar factors make the real effective exchange rate somehow unpredictable in terms of its impact on economic growth. From the early 1980s, Ghana has barely run a flexible exchange rate. It is therefore, appropriate for more research to be conducted to ascertain how real effective exchange rate influence economic growth. Therefore, this work intends to further study the link between real exchange rate and Gross Domestic Product growth using a data, spanning from 1984-2014 in Ghana.

The study intends to analyze the effect of real exchange rate on economic growth in Ghana. Specifically, the study examined: (1) the short run relationship between real exchange rate and economic growth in Ghana and (2) the long run relationship between real exchange rate and economic growth in Ghana.

METHODOLOGY

The methodology used for this study is discussed in this section. It provides a comprehensive description of the research design, theoretical and empirical models and a detailed explanation of variables and estimation techniques used in the study.

Theoretical Model Specification

The theoretical model specification for this study relied on the growth model by Solow (1956). The neoclassical growth model is based on a large number of contemporary theoretical

and empirical studies conducted on economic growth. The model was extensively used because it hinges on the essential role it plays in bringing together and incorporating a number of studies in public finance macro and international economics. This model as a result, enjoys a comprehensive usage in aggregate economic analysis.

The fundamental argument of Solow (1956) was that there will be no hostility between natural and unwarranted growth rates, when production takes place normally under conditions of variable proportions and constant returns to scale. The system can adjust itself to any given growth rate of labour force and ultimately move towards a steady state proportional expansion. The Solow growth model, portray that the only drivers of economic growth in the long run are the accumulation of labour and capital, with no role for tax or any other policies.

However, changes in tax structures can have a bearing on the long run levels of GDP growth, with the effects occurring over a transitional period towards a new equilibrium. The length of such transitions is in principle uncertain, but given considerable adjustment costs of capital or education, it is imaginable that it can take decades to reach a new equilibrium. Nonetheless diverse roles for public policies arise, in more recent models of endogenous growth. For instance, Lucas (1988), explains that policies and institutions can have a direct effect on the long run economic growth rate.

The Harrod-Domar model which has fixed capital-output ratio are differentiated from the Solow model because it defines a production function that permits continuous substitutability of factors for each other. This constant substitution implies that the marginal product of each factor varies, with respect to how much of the factor is already used in production and how many other factors it is being combined with.

The Solow's model looks neoclassical in nature because of continuous substitutability of the factors of production (Van den Berg, 2001). Another assumption by Solow was that each

of the factors of production is subject to diminishing returns. Thus, as equal amount of one factor is combined with a fixed quantity of the other factor of production, output initially increases at a faster rate, but later it increases by ever-smaller amounts.

The aim of Solow was to demonstrate how wrong the Harrod-Domar model was in their conclusion that a constant rate of saving and investment could foster permanent economic growth. Solow indicated that, with the existence of diminishing returns, continuous investment could not, by itself, generate permanent economic growth because it would eventually cause the benefit in output from investment to approach zero. However Solow's model clashed with the recommendations of many development economists which advised policy makers to increase savings and investment in any way possible in order to increase economic growth (Van den Berg, 2001).

According to the postulates of the neo-classical Solow model a combination of two elements, namely labour and capital resulted in economic growth. The question then arises as to what percentage of the output growth can be attributed to other factors of production with exception of capital and labour. In order to answer this question, Solow break down the growth in output into three components, each identified as contribution of one factor of production, labour, capital and total factor productivity. This type of measurement of total factor productivity is still often referred to as the Solow residual. The term residual is appropriate because the estimate present the part of measured GDP growth that is not accounted for by the weighted-average measured growth of the factors of production (capital and labour). To account for this, Solow used the Cobb-Douglas production function and started from his simple growth equation. For simplicity, the equation can be written as:

$$Y=f(A, L, K) \qquad (1.)$$

Where A = total factor productivity which allows for augmentation and for the purpose of this work, it comprises real exchange rate, inflation, GDP per capita, foreign direct investment, and industry.

L = Labour force

K = Capital stock

Using Cobb-Douglas production function, Solow stated the following equation

$$Y_t = A_t K_t^{\propto} L_t^{\delta} \quad (2)$$

From this, Solow defined his TFP to be technology. According to Solow (1956) it is convenient to use the Cobb-Douglas productions function because it exhibits constant returns to scale. The key point to note here is that the variable is not constant but varies with different production functions based on the factors being studied. This production function is widely used in literature including Feder (1983), Fosu (1990), Mansouri (2005), Fosu and Magnus (2006). Aside the traditional input of production-labour and capital, the model assumes other conventional inputs.

Empirical Model Specification

Our empirical model closely follows the analytical framework depicting the relationship between aggregate output and the real effective exchange rate, controlling for other variables. However, a large number of empirical studies e.g. Atkins (2000), Edwards (1986), Rhodd (1993), and Upadhyaya and Upadhyay (1999) also include respective countries' external terms of trade (TT). For a small open economy, TT is truly exogenous and when not controlled for explicitly in the experiment, some of its impact could be transmitted through the indicator of external competitiveness. The real exchange rate is often considered to be the terms of trade of the country. However, for many countries, the movements in their terms of trade

and real effective exchange rate are quite different. The link between economic growth and the explanatory variables can be expressed as follows:

GDPG=f (EXHH, GOV, LLF, OPN, GFCF, FDI).

The empirical model specification based on a logarithmic transformation of the variables above can be written as:

$$\ln GDPG = \beta_0 + \beta_1 \ln EXHH + \beta_2 \ln GOV + \beta_3 \ln OPN + \beta_4 \ln GFCF + \beta_5 FDI + \beta_6 \ln LLF + \upsilon \quad (3)$$

where, *ln* denotes natural logarithm, time is represented by subscript *t*, GDPG, EXHH, GOV, GFCF, OPN, LLF and FDI represent real Gross Domestic Product Growth, real effective exchange rate, government expenditure, trade openness, labour force, gross fixed capital formation, foreign direct investment respectively while υ stands for the error term. The signs of $\beta_1, \beta_3, \beta_4, \beta_5$ and β_6 are expected to be positive while β_2 is expected to have a negative sign. The coefficient of β_1 which captures the effect of real exchange rate devaluation on real output growth is the primary interest of this study and its sign cannot also be predetermined.

Data Source and Data Analysis

The data for this work was sourced from the databases of World Bank (World Development Indicators), Bank of Ghana annual bulletins, and the Ministry of Finance and Economic Planning.

Estimation Technique

Autoregressive Distributed Lag (ARDL) Model

As already stated, equation (3) shows the assumed long-run equilibrium relationship. In order to establish and analyse the long-run relationships as well as the dynamic interactions

among the various variables of interest empirically, the autoregressive distributed lag cointegration procedure developed by Pesaran *et al* (2001) was used.

The basis for using the ARDL to estimate the model centred on the following reasons:

The ARDL cointegration procedure is comparatively more effective even in small sample data sizes as is the case in this study. This study covers the period 1984–2014 inclusive. Hence, the total observations for the study is 31 which is relatively small.

The ARDL enables the cointegration to be estimated by the Ordinary Least Square (OLS) technique once the lag of the model is known. This is however, not the case of other multivariate cointegration procedures such as the Johansen Cointegration Test developed by Johansen (1990). This makes the ARDL procedure relatively simple.

The ARDL procedure does not demand pretesting of the variables included in the model for unit roots compared with other methods such as the Johansen approach. It is applicable regardless of whether the regressors in the model are purely I(0), purely I(1) or mutually cointegrated.

Unit Root Test

It is very important to test for the statistical properties of variables when dealing with time series data. Time series data are rarely stationary in level forms. Regression involving non-stationary time series often lead to the problem of spurious regression. This occurs when the regression results reveal a high and significant relationship among variables when in fact, no relationship exist. Moreover, Stock and Watson (1988) have also shown that the usual test statistics (t, F, DW, and R2) will not possess standard distributions if some of the variables in the model have unit roots. A time series is stationary if its mean, variance and auto-covariance are independent of time.

The study employed a variety of unit root tests. This was done to ensure reliable results of the test for stationarity due to the inherent individual weaknesses of the various techniques. The study used both the PP and the ADF tests. These tests are similar except that they differ with respect to the way they correct for autocorrelation in the residuals. The PP nonparametric test generalizes the ADF procedure, allowing for less restrictive assumptions for the time series in question. The null hypothesis to be tested is that the variable under investigation has a unit root against the stationarity alternative. In each case, the lag-length is chosen using the Akaike Information Criteria (AIC) and Schwarz Information Criterion (SIC) for both the ADF and PP test. The sensitivity of ADF tests to lag selection renders the PP test an important additional tool for making inferences about unit roots. The basic formulation of the ADF is specified as follows:

$$X_t = \mu + \alpha X_{t-1} + \gamma t + \varepsilon_t \quad (4)$$

Subtracting X_{t-1} from both sides gives:

$$\Delta X_t = \mu + (1 - \alpha) X_{t-1} + \gamma t + \varepsilon_t \quad (5)$$

The t-test on the estimated coefficient of X_{t-1} provides the Dickey Fuller test for the presence of a unit-root. The Augmented Dickey Fuller (ADF) test is a modification of the Dickey Fuller test and involves augmenting the above equation by lagged values of the dependent variables. It is made to ensure that the error process in the estimating equation is residually uncorrelated, and also captures the possibility that X_t is characterized by a higher order autoregressive process. Although the DF methodology is often used for unit root tests, it suffers from a restrictive assumption that the errors are *i.i.d*. Therefore, representing $(1 - \alpha)$ by ρ and controlling for serial correlation by adding lagged first differenced to equation (5) gives the ADF test of the form:

$$\Delta X_t = \mu + \rho X_{t-1} + \gamma\tau + \sum_{i=1}^{\rho} \emptyset_i \Delta X_{t-i} + \varepsilon_t \quad (6)$$

Where X_t denotes the series at time t, Δ is the first difference operator, $\mu, \gamma, \emptyset$ are the parameters to be estimated and ε_t is the stochastic random disturbance term.

The ADF and the PP test the null hypothesis that a series contains unit root (non-stationary) against the alternative hypothesis of no unit root (stationary).

That is:

$H_0: \rho = 0$ (X_t is non-stationary)

$H_0: \rho \neq 0$ (X_t is stationary)

ARDL Technique and Bounds Testing Procedure

The Autoregressive Distributed Lag (ARDL) Cointegration Test, otherwise called the Bounds Test developed by Pesaran *et al* (2001) was used to test for the cointegration relationships among the series in the model. Two or more series are said to be cointegrated if each of the series taken individually is non-stationary with I (1), while their linear combination are stationary with I(0). In a multiple non-stationary time series, it is possible that there is more than one linear relationship to form a cointegration. This is called the cointegration rank. The study therefore applies the ARDL cointegration technique developed by Pesaran *et al* (2001) to the system of the six variables in the growth equation to investigate the existence or otherwise of long-run equilibrium relationships among the variables.

The ARDL Bounds testing procedure essentially involves three steps. The first step in the ARDL bounds testing approach is to estimate equation (9) by OLS in order to test for the existence or otherwise of a long-run relationship among the variables. This is done by conducting an F-test for the joint significance of the coefficients of lagged levels of the variables.

The hypothesis would be:

$H_0: \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = \theta_6 = \theta_7 = 0$

$H_1: \theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq \theta_5 \neq \theta_6 \neq \theta_7 \neq 0$

The test which normalizes on Economic Growth (GDPG) is denoted by

$F_{GDPG}\,(EXHH, GOV, OPN, FDI, GFCF, LLF)$

Two asymptotic critical values bounds provide a test for cointegration when the independent variables are I (d) (where $0 \leq d \leq 1$): a lower value assuming the regressors are I(0) and an upper value assuming purely I(1) regressors.

Given or established that the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship is rejected regardless of the orders of integration for the time series. On the flip side, if the F-statistic falls below the lower critical values, the null hypothesis is accepted, implying that there is no long-run relationship among the series. However, if the F-statistic falls between the lower and the upper critical values, the result becomes inconclusive.

In the second stage of the ARDL bounds approach, once cointegration is established the conditional ARDL ($p, q_1, q_2, q_3, q_4, q_5$), the long-run model for $GDPG_t$ can be estimated as:

$$\Delta lnGDPG = \beta_0 + \sum_{i=l}^{\rho} \beta_{li}\, \Delta lnGDPG_{t-i} + \sum_{f-1}^{n1} \beta_{2f} lnEXHH_{t-f} + \sum_{g-1}^{n2} \beta_{3g} lnGOV_{t-g} + \sum_{k-1}^{n3} \beta_{4k} lnIND_{t-k} + \sum_{j-1}^{n4} \beta_{5j} FDI_{t-1} + \sum_{t-r}^{n5} \beta_{6r} lnGFCF_{t-r} + \sum_{k-1}^{n} \beta_{7m} \Delta lnLLF_{t-m} + \mu_t \quad (10)$$

This involves selecting the orders of the ARDL ($p, q_1, q_2, q_3, q_4, q_5$) model in the six variables using Akaike Information Criterion ((Akaike, 1973)

The third and the last step in the ARDL bound approach is to estimate an Error Correction Model (ECM) to capture the short-run dynamics of the system. The ECM generally provides the means of reconciling the short-run behaviour of an economic variable with its long-run behaviour.

The ECM is specified as follows:

$$\Delta lnGDPG_t = \gamma + \sum_{i=l}^{\rho} \beta_{li}\, \Delta lnGDPG_{t-i} + \sum_{f-1}^{n} \beta_{2f} \Delta lnEXHH_{t-f} + \sum_{g-1}^{n} \beta_{3g} \Delta lnOPN_{t-g} + \sum_{k-1}^{n} \beta_{4k} \Delta lnGOV_{t-k} + \sum_{j-1}^{n} \beta_{5j} \Delta lnGFCF_{t-J} + \sum_{t-r}^{n} \beta_{6r} \Delta FDI_{t-r} + \sum_{k-1}^{n} \beta_{7m} \Delta lnLLF_{t-m} + \rho ECM_{t-1} + \mu_t \qquad (11)$$

From equation (3.25), β_i represent the short-run dynamics coefficients of the model's convergence to equilibrium. ECM_{t-1} is the Error Correction Model. The coefficient of the Error Correction Model, ρ measures the speed of adjustment to obtain equilibrium in the event of shocks to the system.

RESULTS AND DISCUSSION

Descriptive statistics

The study computed the descriptive statistics of the relevant variables involved in the study. From Table 1, the variables have positive average values (means) with the exception of foreign direct investment. It can also be seen from Table 1 that, log of real exchange rate (LEXHH), log of capital stock (LGFCF), trade openness (LOPN) and foreign direct investment (FDI) are negatively skewed implying that majority of the values are greater than their means. On the other hand, log of Gross Domestic Product Growth(LGDPG), log of government expenditure (LGOV) and log of labour force (LLF) are positively skewed implying that the majority of the values are less than their means. The minimal deviations of the variables from

their means as indicated by the standard deviations which demonstrate that taking the logs of variables minimizes their variances.

Table 1: Summary Statistics of the Variables

	LGDPG	LGFCF	LLF	LOPN	LGOV	LEXHH	FDI
Mean	23.353	19.817	4.2647	2.2729	2.9579	2.31E-0	-0.1980
Median	23.307	19.858	4.2654	2.2985	2.8921	0.2586	0.0000
Maximum	24.235	24.115	4.3134	2.7850	4.0853	1.5538	2.1154
Minimum	22.638	14.432	4.2282	1.6094	2.1664	2.7225	-4.2795
Std. Dev.	0.4625	2.8690	0.0255	0.3215	0.5337	1.2100	0.9494
Skewness	0.3287	0.2200	0.1362	0.4716	0.2769	0.9126	-2.4543
Kurtosis	2.0982	1.9352	2.0154	2.4302	1.9836	2.8458	13.533
Jarque-Bera	1.6086	1.7144	1.3478	1.5684	1.7303	4.3345	174.45
Probability	0.4473	0.4243	0.5096	0.4564	0.4209	0.1144	0.0000
Sum	723.96	614.34	132.20	70.462	91.697	7.17E-0	-6.1385
SumSq. Dev.	6.4182	246.93	0.0196	3.1019	8.5467	43.929	27.043
Obsevation	31	31	31	31	31	31	31

Note: Std. Dev. represents Standard Deviation while Sum Sq. Dev. represents Sum of Squared Deviation.

Source: Computed by Author using Eviews 9.0 Package

The structure of the data informed the researcher about the status of the variables under examination. Also, the Jarque-Bera statistic which shows the null hypothesis that all the series are drawn from a normally distributed random process cannot be rejected for LEXHH, LINF, LIND and LGPC implying that they are normally distributed. But the null hypothesis can be rejected at 5 percent and 1 percent levels of significance in the case of LGDPG and FDI respectively, and therefore the series are not normally distributed.

Trend Analysis of Real Exchange Rate (1984 – 2014)

The figure below shows the trend of real effective exchange rate over the study period. It is clear that from 2000, the local cedi shows some recurrent appreciation and depreciation.

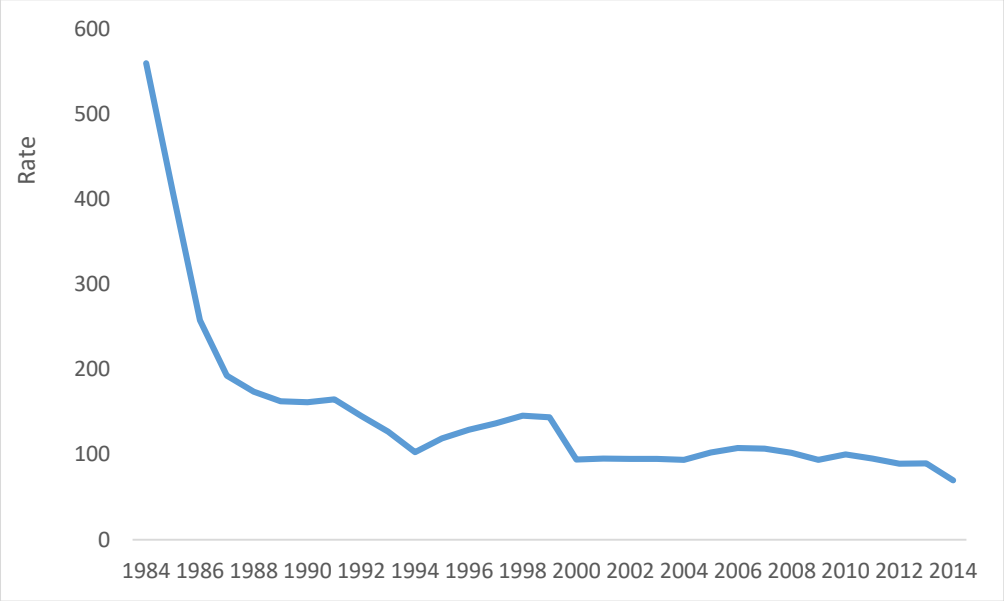

Figure 1: Plot of the trend of real effective exchange rate.
Source: Computed by Author with data from WDI, 2017.

The local currency appreciated by 3% between August 2009 to March 2010, and as a consequence was worth US$ 0.67 in April 2010. The Cedi has for now been very unstable. The beginning of January 2014 for instance saw the Ghana cedi worth US$ 0.45 and by the close of September 2014, it was worth US$ 0.31 representing about 44.65 percent depreciation. This fall in the value of the Ghanaian Cedi arguably led to a rise in consumer prices (inflation)

from 13.8% in January 2014 to peg at 17% in December 2014. Economic growth dwindled as GDP growth fell to 8.8% in 2012 from 15.0% in 2011, and further fell in 2013 to 7.6% in 2013. In 2014, GDP growth rate fell much below the initial target of 7.1% to 4.2%. (Bank of Ghana Annual Report, 2009, 2010, 2011,2013 &2014).

Unit Root Test Results

Although the bounds test (ARDL) approach to cointegration does not require the pretesting of the variables for unit roots, it imperative to conduct this test to confirm that the variables are not integrated of an order higher than one. The purpose is to verify the absence or otherwise of *I* (2) variables to free the results from spurious regression. There is the need to complement the estimated process with unit root test in order to ensure that some of the variables are not integrated of a higher order.

For this reason, a unit root test was conducted to ascertain the stationarity of the data before applying Autoregressive Distributed Lags approach to cointegration. As a result, the ADF and PP tests were applied to all the variables in levels and in first difference in order to formally establish their order of integration. To be certain of the order of integration of the variables, the test was conducted with intercept and time trend in the model. The optimal number of lags included in the test was based on automatic selection by Schawrtz-Bayesian Criteria (SBC) and Akaike Information Criteria (AIC) criteria. The study used the P-values in the parenthesis to make the unit root decision, (that is, rejection or acceptance of the null hypothesis that the series contain unit root) which arrived at similar conclusion with the critical values.

The results of ADF and PP test for unit root with intercept and trend in the model for all the variables are presented in Table 2 and Table 3 respectively. The null hypothesis is that the series is non-stationary, or contains a unit root. The rejection of the null hypothesis is based on the MacKinnon (1996) critical values as well as the probability values.

Table 2: Results of Unit Root Test with constant and trend: ADF Test

Levels			First Difference			
Variables	ADF-Statistics	Lag	Variables	ADF-Statistics	Lag	
LRDPG	-3.4710[0.0161]**	0	ΔLRDPG	-8.1773[0.0000]***	0	I(0)
LEXHH	1.9262[0.9997]	3	ΔLEXHH	-4.9840[0.0004]***	1	I(1)
LGFCF	-2.8139[0.2035]	1	ΔGFCF	-5.5673[0.0005]***	1	I(1)
LOPN	-1.4676[0.8176]	1	ΔLOPN	-3.4480[0.0645]*	0	I(1)
LLF	-2.9787[0.1549]	0	ΔLLF	-1.6791[0.0875]*	1	I(1)
LGOV	-4.1927[0.0127]**	0	ΔLGOV	-4.4453[0.0082]***	3	I(0)
FDI	-3.3618[0.0207]**	0	ΔFDI	-6.4517[0.0000]***	0	I(0)

Table 3: Results of Unit Root Test with constant and trend: PP Test

Levels			First Difference			
Variables	PP-Statistics	BW	Variables	PP-Statistics	BW	
LRDPG	-3.5216[0.0143]**	2	ΔLRDPG	-9.5220[0.0000]***	6	I(0)
LEXHH	1.5994[0.9992]	18	ΔLEXHH	-4.7648[0.0007]***	27	I(1)
LOPN	-1.3894[0.8434]	3	ΔLOPN	-3.5787[0.0495]**	3	I(1)
LGOV	-4.0251[0.0186]**	11	ΔLGOV	-4.4453[0.0082]***	28	I(0)
LGFCF	-2.7136[0.2385]	3	ΔGFCF	-10.9834[0.0000]***	8	I(1)
Table 3 Continues						
LLF	-1.6236[0.7593]	0	ΔLLF	-1.6791[0.0965]*	2	I(1)
LFDI	-3.3973[0.0191]**	1	ΔFDI	-9.8097[0.0000]***	10	I(1)

Note: ***, **, * indicates the rejection of the null hypothesis of non- stationary at 1%, 5%, 10% level of significance respectively, Δ denotes the first difference, BW is the Band Width and I(0) is the lag order of integration. The values in parenthesis are the P-values.
Source: Computed by author using Eviews 9.0 package

From the unit root test results in Table 2, the null hypothesis of the presence of unit root for some of the variables (LEXHH, LGCFC, LOPN, LLF) in their levels cannot be rejected since the P-values of the ADF statistics are not statistically significant at any of the three conventional levels of significance with the exception of log of Government expenditure, log GDP growth, and foreign direct investment of which were stationary at 5 percent significant levels. However, at first difference, the variables become stationary. This is because the null hypothesis of the presence of unit root (non-stationary) is rejected at 1 percent significant levels for all the estimates except log of labour force (LLF) and trade openness (LOPN) which are stationary at 10 percent.

The PP test results for the presence of unit root with intercept and time trend in the model for all the variables are presented in Table 3. From the unit root test results in Table 3, the null hypothesis of the presence of unit root for the variables in their levels cannot be rejected since the P-values of the PP statistics are not statistically significant at any of the three conventional levels of significance with the exception of log of Gross Domestic Product Growth, log of government expenditure, and foreign direct investment which were stationary at 5 percent significant levels. However, at first difference, the variables become stationary. This is because the null hypothesis of the presence of unit root (non-stationary) is rejected at 1 percent significant levels for all the estimates but log of trade openness and log of labour force which were significant at 5 percent and 10 percent respectively. The PP unit root test results in Table 3 are in line with the ADF test in Table 2, suggesting that most of the variables are integrated of order one, I(1), when intercept and time trend are in the model.

It is therefore clear from the unit root results discussed above that all the variables are integrated of order zero, I(0), or order one, I(1). Since the test results have confirmed the absence of I(2) variables, the ARDL methodology is used for estimation.

Cointegration analysis

Since the main objective of this study is to establish how real effective exchange rate is related to economic growth, it is essential to test for the existence of long-run equilibrium relationship between these two variables within the framework of the bounds testing approach to cointegration. The study employs an annual data, and hence uses a lag length of 2 for annual data in the bounds test. According to Pesaran, Shin and Smith (1999) a maximum of two lags can be used for annual data in the bounds testing to cointegration. An F-test for the joint significance of the coefficients of lagged levels of the variables was conducted, after the lag length was ascertained. In this regard, each variable in the model is considered as a dependent variable and a regression is run on the other variables. For instance, LGDPG is taken as the dependent variable and it is regressed on the other variables. After that another variable like inflation is taken as a dependent variable and regressed on all the other variables. This exercise is conducted for all the variables in the model. After this action is taken the number of regressions estimated would equate to the variables in the model.

According to Pesaran & Pesaran (1997) "this OLS regression in the first difference are of no direct interest" to the bounds cointegration test. What is important is the F-statistics values of all the regressions when each of the variables is normalized on the other. The joint null hypothesis that the coefficients of the lagged levels are zero is tested by the F-statistics. In order words, they are not related in the long run. The essence of the F-test is to determine whether there exist a long run relationship of cointegration among the variables or not. The results of the computed F-statistics when LGDPG is normalized (that is, considered as dependent variable) in the ARDL-OLS regression are presented in Table 5.

From Table 4, the F-statistics that the joint null hypothesis of lagged level variables (i.e. variable addition test) of the coefficients is zero is rejected at 5 percent significance level. Further, since the calculated F-statistics for

$F_{GDPG}(.) = 13.6492$ exceeds the upper bound of the critical value of band (4.150), the null hypothesis of no cointegration (i.e. long run relationship) between economic growth and its determinant is rejected.

Table 4: Bounds test results for cointegration

Critical Value Bound of the F-statistic: intercept and no trend (case II)						
K	90% Level		95% Level		99% Level	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
6	2.080	3.000	2.390	3.730	3.060	4.150
Calculated F-Statistics: 13.6492***						
F_{LGDPG} (LGDPG**,** LEXHH, LGFCF, LGOV, LGFCF, LFDI, LOPN)						

This result shows a unique cointegration relationship among the variables in Ghana's economic growth model and that all the determinants of economic growth can be treated as the "long-run forcing" variables for the explanation of economic growth in Ghana. Since this study is based on growth theory, $LGDPG_t$ is used as the dependent variable. Therefore, there is existence of cointegration among the variables in the growth equation and hence we therefore proceed with the growth equation.

Long-run results (LGDPG is dependent variable)

Table 5 presents results of the long run estimates based on the Schwartz Bayesian criteria (SBC). The selected ARDL (1, 2, 1, 2, 2, 2, 2) passes the standard diagnostic test (serial

correlation, functional form, normality and heteroscedasticity) as can be seen beneath Table 5. The coefficients indicate the long run elasticities.

Table 5: Estimated Long Run Coefficients using the ARDL Approach

ARDL (1, 1, 0, 2, 1, 0, 2) selected based on SBC Dependent Variable: LGDPG

Variable	Coefficient	Std. Error	T-Ratio	Prob.
LGFCF	0.1764***	0.0120	14.672	0.0000
LLF	3.6540***	0.6042	6.0469	0.0001
LOPN	-0.4889***	0.0639	7.6426	0.0000
LGOV	-0.0353**	0.0140	2.5207	0.0303
LEXHH	-0.0871***	0.0166	5.2485	0.0004
LFDI	-0.0204**	0.0067	3.0156	0.0130
CONS	5.5240*	2.6269	2.1028	0.0618

Note: ***, **, * imply significance at the 1, 5, and 10 percent levels respectively.
Source: Computed by Author using Eviews 9 Package.

From the results, the coefficient of trade openness is statistically significant at 1 percent significance level, indicating that if the country were to increase her trade openness by 1 percent, economic growth measured as real gross domestic product will decrease by approximately 0.49 percent in the long run. According to economic theory, trade induces should rather economic growth by enhancing capital formation and efficiency, and by increasing the supply of scarce resources. For Ghana, the results obtained suggests that the trade openness policy adopted as part of the structural reforms in the 1986 in Ghana has on the average been detrimental to growth. This seem not to support the notion that emphasizes the fact that trade openness enhances competition and efficiency as well as transfer of technology and knowledge and hence enhancing growth. The results is in line with the findings of (Ali & Abdullah, 2015) in their study 'Impact of Trade Openness on the Economic Growth of Pakistan: 1980-2010' and Githanga (2015) for Kenya. The findings by Ali and Abdullah (2015)

showed a negative and statistically significant long-run relationship between trade openness and economic growth for Pakistan. Githanga (2015) on the other hand also found a negative and statistically significant long-run relationship between trade openness and economic growth for Kenya implying that trade openness is growth hampering in the long-run in Kenya. The results obtained in this study in the long run does not absolutely resolve the conflicting results in the extent literature but contribute to the controversy in the literature by aligning itself with those studies such as Edwards (1993); Nduka, Chukwu, Ugbor and Nwakaire (2013); and Ayibor (2012) which believe that trade openness positively affects GDP growth. Moreover, Edwards (1993), Sachs and Warner (1995), Nduka et al. (2013); and Hamad, Mtengwa and Babiker (2014) who found a positive impact of trade openness on economic growth.

From the results, the coefficient of real effective exchange rate is statistically significant at 1 percent significance level, indicating that if the country were to experience real effective exchange rate depreciation by 1 percent, economic growth measured as Gross Domestic Product Growth will decrease by approximately 0.09 percent in the long run. The estimate of real effective exchange rate in Table 5 is in line with the first objective of the study which is to investigate the long run relationship between real effective exchange rate and economic growth. The null hypothesis is rejected at 1 percent significance level which implies that there is a long run relationship between real effective exchange rate and economic growth and that the relationship is negative according to the results in Table 5. That is a real depreciation of the local currency makes the economy competitive. Theoretically, a depreciation of the domestic currency should Ghanaian exports relatively cheaper and as such leads to increase in demand for exports and by extension economic performance where as an appreciation of the domestic currency makes exports more expensive and as such reduces economic performance in the long run. This is not the case and the possible explanation is that international competitiveness holds in relation to the Marshall-Lerner condition. Empirically, however, the demand and supply of

exports and imports have proved fairly inelastic and therefore, a rela depreciation in effect hinders growth. This result is in line with most studies by Apkan (2008) and Asher (2012) in relation to exchange rate –economic growth nexus in the short run. However, this finding is deviates from Adebiyi (2009) who identified an insignificant relationship between exchange rate and GDP in both short and long run.

The long run results reveal yet another petrifying outcome which is in contravention with expectation as economic theory suggests. We found that the coefficient of foreign direct investment (FDI) has a negative impact on growth. It is statistically significant at 1 percent significance level. A one percent increase in FDI will lead to a fall in GDP growth by 0.02 percent approximately, all other things remaining the same. This negative relationship between FDI and GDP growth in Ghana is consistent with a previous study by Frimpong and Oteng-Abayie (2006) but inconsistent with theory and other empirical findings by Balasubramanyam, et al. (1999), Asheghian (2004) and Vu, et al. (2006). This interesting result obtained from the empirical study confirms the mining sector FDI dominance which does not generate direct growth impacts on the wider economy (Frimpong, J.M and E.F Abayie, 2006). Some conditions that are often associated with official FDI to developing countries, Ghana inclusive, might not be directly favourable to initiating higher levels of industrial performance as well as economic growth. For instance, substantial FDI go to non-manufacturing sectors of the economy, particularly services sector for which reason FDI will not make any significant impact on industrial performance and also on economic growth (Adenutsi, 2008).

The coefficient of capital stock of 0.1764 shows that a 1 percent increase in capital input would result in a 0.18 percent increase in real GDP, holding all other factors constant and is statistically significant at 5 percent significance level. The sign of the capital variable supports the theoretical conclusion that capital contributes positively to growth of output since the coefficient of capital in this long-run growth equation is positive and significant. This

positive relationship between capital stock and output is consistent with the expectation of the classical economic theory. The finding is line with the findings of Shaheen, Ali, Kauser and Bashir (2013); Falki (2009); and Khan and Qayyum (2007). It is also consistent with conclusions reached by Ibrahim (2011) and Asiedu (2013) in the case of Ghana. Ibrahim (2011) and Asiedu (2013)found positive and statistically significant effect of capital on economic growth for Ghana. It is consistent with conclusions reached by Aryeetey and Fosu (2003); and Fosu and Magnus (2006) in the case of Ghana.

Moreover, the results show that the coefficient of labour force is positive and statistically significant signalling a positive influence on economic growth. Labour force is positive and significant at 1 percent with a coefficient of 3.6540 indicating an increase in economic growth by approximately 3.7 percent if there is a 1 percent increase in the labour force. This is consistent with the argument of Jayaraman and Singh (2007) and Ayibor (2012) who asserted that there can be no growth achievement without the involvement of labour as a factor input hence, the positive and significant coefficient. This result however contradicts the works of Frimpong and Oteng-Abayie (2006) and Sakyi (2011) who found a negative effect of labour on economic growth.

The effectiveness of government expenditure in explaining GDP growth in the country is negative and is statistically significant at 5 percent significance level. A one percent increase in government expenditure will cause real GDP per capita to decrease by 0.0354 percent, ceteris paribus. This result obtained means that government has not been spending more on productive sectors (provision of safe water, primary health care, education etc) of the economy. This result obtained is not in line with finding by Ram (1986) and Aschauer (1989) but consistent with other findings obtained by Landau (1986) and Barro (1990).

The long-run results indicate that any disequilibrium in the system as a result of a shock can be corrected in the long run by the error correction term. Hence, the error correction term that estimated the short-run adjustments to equilibrium is generated as follows.

ECM = LGDPG - (0.1765*LGFCF + 3.6541*LLF -0.4889*LOPN - 0.0354*LGOV -0.0872*LEXHH -0.0204*FDI + 5.5240)

Short Run Estimates (DLRDPG is the dependent variable)

The presence of a long run relationship between economic growth and its exogenous variables allows for the estimation of long run estimates. This is reported in Table 5. The short run estimates also based on the Schwartz Bayesian Criteria (SBC) employed for the estimation of the ARDL model are reported in Table 6.

Some descriptive statistics can be obtained from Table 6. From the Table, it can be observed that the adjusted R^2 is approximately 0.60. It can therefore be explained that approximately 60 percent of the variations in economic growth is explained by the independent variables. Also, a DW-statistics of approximately 2.641 reveals that there is no autocorrelation in the residuals.

The results also showed that the coefficient of the lagged error correction term ECT (-1) exhibits the expected negative sign (-0.8125) and is statistically significant at 1 percent. This indicates that approximately 81 percent of the disequilibrium caused by previous years' shocks converges back to the long run equilibrium in the current year. According to Kremers, Ericsson, and Dolado (1992) and Bahmani-Oskooee (2001), a relatively more efficient way of establishing cointegration is through the error correction term. Thus, the study detects that the variables in the model reveal evidence of reasonable response to equilibrium when there is a shock in the short-run.

Theoretically, it is argued that whenever there is a cointegrating relationship among two or more variables there exist an error correction mechanism. The error correction term is thus derived from the negative and significant lagged residual of the cointegration regression. The ECM stands for the rate of adjustment to restore equilibrium in the dynamic model following a disturbance. The negative coefficient indicates that any shock that whenever there is a disturbance in the short-run, it will be corrected in the long-run. The rule of thumb is that, the greater the error correction coefficient (in absolute terms), the faster the variables adjust back to the long-run equilibrium when shocked (Acheampong, 2007) and therefore shows that the adjustment in the study in restoring equilibrium following a shock is quite swift.

Table 6: Estimated Short-Run Error Correction Model using the ARDL Approach ARDL (2, 2, 0, 0, 1, 0, 2) selected based on SBC Dependent Variable: LGDPG

Variable	Coefficient	Std. Error	T-Ratio	Probability.
D(LGFCF)	0.0854***	0.0059	14.3096	0.0000
D(LGFCF(-1))	-0.0279**	0.0101	-2.7420	0.0208
D(LLF)	-0.8697*	0.3930	-2.2129	0.0513
D(LOPN)	-0.0682**	0.0261	-2.6060	0.0262
D(LOPN(-1))	0.1902***	0.0392	4.8461	0.0007
D(LGOV)	-0.0270***	0.0044	-6.0215	0.0001
D(LGOV(-1))	-0.0071**	0.0028	-2.5083	0.0310
D(LEXHH)	-0.0180***	0.0046	-3.8418	0.0033
D(LEXHH(-1))	0.0316***	0.0053	5.8659	0.0002
D(FDI)	-0.0053**	0.0017	-3.0447	0.0124
D(FDI(-1))	0.0118***	0.0015	7.5219	0.0000
ECT(-1)	-0.8125***	0.0596	-13.6245	0.0000
R-squared	0.7826	Mean dependent variable		1.6463
Adjusted R-squared	0.5942	S.D. dependent variable		0.3260
S.E. of regression	0.2076	Akaike info criterion		0.0006

Sum squared residual	0.6469	Schwarz criterion	0.6607
Log likelihood	13.990	Hannan-Quinn criterion	0.2073
F-statistic	4.1548	Durbin-Watson stat	2.6413
Prob(F-statistic)	0.005157		

Note: ***, **, * imply significance at the 1, 5, and 10 percent levels respectively. Source: Computed by Author using Eviews 9 Package.

Table 6 reports the short run dynamic coefficients of the estimated ARDL model. Interestingly, all the variables are significant with some having counter intuitive signs.

Consistent with the long run results, the contemporaneous effect of real effective exchange rate on economic growth in negative. With a coefficient of -0.0181, it implies that a 1 percent depreciation of the exchange rate leads to reduction in economic growth by approximately 0.02 percent in the short run. The result is statistically significant at 1 percent level of significance. Possible explanation for this results is that exchange rate variations might impact negatively on exporters and trend economic growth by discouraging firms from undertaking investment, innovation and trade. It may also discourage firms from entering into export markets (OECD, 2007). Large fluctuations in the exchange rate over shorter periods prevalent in developing countries can also impose adjustment costs on the economy as resources keep shifting between the tradable and non-tradable sectors. This could permanently shift resources to the non-tradable sector if firms are put off entering, or staying in, export markets due to high exchange rate variability. This result is in line with most studies by Apkan (2008) and Asher (2012) in relation to exchange rate –economic growth nexus in the short run. However, this finding is deviates from Adebiyi (2009) who identified an insignificant relationship between exchange rate and GDP in both short and long run. Also Bosworth (1995), Aghion et al (2009), Eichengreen and Lebtang (2003), and Eme and Johson (2012) all attested to the fact that no short or long run relationship exist between exchange rate and economic growth.

Nonetheless, the lag effect of exchange rate on economic growth proved growth inducing. The coefficient is positive and statistically significant at 1 percent level of significance. The results show that a 1 percent depreciation of the local currency leads to a 0.03 improvement in economic growth. The possible explanation could be that real depreciation enhances a country's international competitiveness, leading to increases in exports and foreign exchange supplies and, hence, increasing official capacity of a country to import the needed inputs for production. This finding is inconsistent with the findings of Prasad (2000) who found that short run changes in real effective exchange rate leads to increased exports and economic growth for Fiji.

From the results, the coefficient of trade openness is statistically significant at 1 percent significance level, indicating that if the country were to increase her trade openness by 1 percent, economic growth measured as real gross domestic product will decrease by approximately 0.1 percent in the short run. The results is in line with the findings of Ali and Abdullah (2015) in their study 'Impact of Trade Openness on the Economic Growth of Pakistan: 1980-2010' and Githanga (2015) for Kenya. The findings by Ali and Abdullah (2015) showed a negative and statistically significant long-run relationship between trade openness and economic growth for Pakistan.

However, the lag of trade openness openness has the theorized positive impact on economic growth in short run. The coefficient of trade openness is statistically significant at 1 percent. From the results, the coefficient of trade openness is statistically significant at 1 percent significance level, indicating that if the country were to increase her trade openness by 1 percent in the short run, economic growth measured as real gross domestic product will increase by approximately 0.55 percent. This result aligns itself with studies such as Dollar and Kraay (2003), Sarkar (2008), Ali and Abdullah (2015), and Falki (2009) which believe that trade openness positively affects real GDP in the short run.

Furthermore, it can be observed that foreign direct investment (FDI) exerts a negative influence on economic growth. Its coefficient of (-0.0053) suggests that, one percent increase in FDI leads to approximately 0.01 decrease in economic growth at five percent level of significance. Some conditions that are often associated with official FDI to developing countries, Ghana inclusive, might not be directly favourable to initiating higher levels of industrial performance as well as economic growth. For instance, substantial FDI go to non-manufacturing sectors of the economy, particularly services sector for which reason FDI will not make any significant impact on industrial performance and also on economic growth (Adenutsi, 2008). This negative relationship between FDI and GDP growth in Ghana is consistent with a previous study by Frimpong and Oteng-Abayie (2006) but inconsistent with theory and other empirical findings by Balasubramanyam, et al. (1999), Asheghian (2004) and Vu, et al. (2006). The findings also contradicts the findings of Asiedu (2013) and Frimpong and Oteng-Abayie (2006) for Ghana and Falki (2009) in the case of Pakistan. These studies found a negative and statistically significant effect of FDI on economic growth in the short run. This interesting result obtained from the empirical study confirms the mining sector FDI dominance which does not generate direct growth impacts on the wider economy (Frimpong & Abayie, 2006). The study is however inconsistent with the work of De Mello Jr (1997). De Mello Jr (1997) argued that FDI influences economic growth by serving as an important source of capital, which complements domestic private investment in developing productive capacity. To add, Lall (1985) argued that foreign investments come to host country with a package, including capital, technology, and management and marketing skills. They can, thus, improve competition, efficiency; provide additional jobs and financial resources in an economy and hence leading to robust economic performance.

Interestingly, however, it can be observed that the lag of foreign direct investment (dFDI) exerts a positive influence on economic growth. Its coefficient of (0.0118) suggests

that, a 1 percent increase in FDI leads to approximately 0.01 percent increase in economic growth at 1 percent level of significance. The positive effect of FDI reemphasizes the fact that Ghana has benefited positively from the spillover effect of foreign investors in the country mostly in the short run. The study is consistent with the work of De Mello Jr (1997). De Mello Jr (1997) argued that FDI influences economic growth by serving as an important source of capital, which complements domestic private investment in developing productive capacity. He further observed that FDI has the potential to generate employment and raise factor productivity via knowledge and skill transfers, adoption of new technology which helps local firms to improve their productive capacity thereby enhancing economic performance. The finding, however, contradicts the findings of Asiedu (2013); Frimpong and Oteng-Abayie, (2006) for Ghana and Falki (2009) in the case of Pakistan. These studies found a negative and statistically significant effect of FDI on economic growth in the short run.

From the short run results, the effect of lag government expenditure in explaining GDP growth in Ghana is negative and is statistically significant. The effect lag of government expenditure in (-1) and (-2) are -0.0682 and -0.0071 respectively meaning that one percent increase in government expenditure will cause GDP growth to decrease by approximately 0.07 percent, and 0.01 percent, ceteris paribus. This result obtained means that most government has not directed towards productive sectors (provision of safe water, primary health care, education etc) of the economy. The result found is not mimic the findings obtained by Landau (1986) and Barro (1990).

The coefficient of Gross fixed capital formation proxying capital stock is positive and statistically significant at 1 percent. With a coefficient of 0.0854, it means that a 1 percent increase in capital input would result in a 0.09 percent increase in real GDP, holding all other factors constant. The sign of the capital variable supports the theoretical conclusion that capital contributes positively to growth of output since the coefficient of capital in this long-run growth

equation is positive and significant. This positive relationship between capital stock and economic growth is consistent with the expectation of the classical economic theory. The finding supports the findings of Shaheen et al. (2013); Falki (2009); Khan and Qayyum (2007). It is also consistent with conclusions reached by Ibrahim (2011) and Asiedu (2013) in the case of Ghana. Ibrahim (2011) and Asiedu (2013) found positive and statistically significant effect of capital on economic growth for Ghana.

Nonetheless, coefficient of lag of gross fixed capital formation proxying capital stock is negative and statistically significant at 5 percent significance level. With a coefficient of (-0.0279), it means that the lag effect of a 1 percent increase in the labour force will cause economic growth in Ghana to fall by approximately 0.03 percent in the short run.

Finally, the results show that the coefficient of labour force is negative and statistically significant signalling a negative influence on economic growth. This result is counter intuitive. Labour force is significant at 10 percent with a coefficient of -0.8697 indicating a decrease in economic growth by approximately 0.87 percent if there is a 1 percent increase in the labour force. This result supports the works of Frimpong and Oteng-Abayie (2006), and Sakyi (2011) who found a negative effect of labour on economic growth. This is however, inconsistent with the findings of Jayaraman et al. (2007) and Ayibor (2012) who asserted that there can be no growth achievement without the involvement of labour as a factor input hence, the positive and significant coefficient.

Diagnostic and Stability Tests

Table 7 reports the results of the diagnostic test for the estimated ARDL model. From the table, the results show that the estimated model passes the Langrangean multiplier test of residual serial correlation, Normality based on the skewness and Kurtosis of the residuals and heteroscedasticity test based on the regression of squared residuals on fitted values.

Table 7: Diagnostic Tests

Test Statistics	Version	F-statistic and Probability
Serial Correlation	F	F (2, 8) =1.2211 [0.3445]
Normality	Chi-Square	CHSQ = 0.1682 [0.9193]
Heteroscedasticity	F	F (18, 10) = 0.6237 [0.8153]
Ramsey RESET	F	F(2, 8) = 0.5365 [0.7158]

Diagnostics test were conducted for the ARDL model. The tests as reported in table 6 indicate that the estimated model passes the Langrangean multiplier test of residual serial correlation among variables. Also, the estimated model passes the tests for Functional Form Misspecification using square of the fitted values. The model also passed the Normality test based on the Skewness and Kurtosis of the residuals. Thus, the residuals are normally distributed across observations. Finally, the estimated model passes the test for heteroscedasticity test based on the regression of squared residuals on squared fitted values.

Specifically, The Table 7 shows the Breusch-Goddfrey Serial Correlation LM test for the presence of autocorrelation. The result of the test shows that the p-value of 0.3445 which is about 34 percent is greater than the critical value of 0.05 (5%). This shows the non-existence of autocorrelation. The White Heteroscedasticity test above shows that the p-value of about 0.8153 which is approximately 82 percent is more than the critical value of 0.05 or 5 percent. That is, we accept that there is no heteroscedasticity. This shows that there is no evidence of heteroscedasticity since the p-value are considerably in excess of 0.05 and conclude the errors are not changing over time. Table X also shows that the normality test shows that the p-value of approximately 92 percent (0.9193) and this is greater than the critical value of 0.05 or 5 percent. This shows that there is no apparent non-linearity in the regression equation and it would be concluded that the linear model is appropriate. From the table, the estimated ARDL

model passes the specification test (RESET test) since the f-statistics has a probability of 72 percent (0.7158) which is greater than the traditional 0.05 (5%). Therefore, the model is correctly specified.

Stability Tests

Pesaran and Pesaran (1997) suggests that the test for the stability for parameters using cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) plots be conducted after the model is estimated. This is done to eliminate any bias in the results of the estimated model due to unstable parameters. Also, the stability test is appropriate in time series data, especially when one is uncertain about when structural changes might have taken place.

The results for CUSUM and CUSUMSQ are depicted in Appendix A and Appendix B respectively. The null hypothesis is that coefficient vector is the same in every period and the alternative is that it is not (Bahmani-Oskooee & Nasir, 2004). The CUSUM and CUSUMSQ statistics are plotted against the critical bound of 5 percent significance level. According to (Bahmani-Oskooee & Nasir, 2004), if the plot of these statistics remains within the critical bound of the 5 percent significance level, the null hypothesis that all coefficients are stable cannot be rejected.

Appendix A depicts the plot of CUSUM for the estimated ARDL model. The plot suggests the absences of instability of the coefficients since the plots of all coefficients fall within the critical bounds at 5 percent significance level. Thus, all the coefficients of the estimated model are stable over the period of the study.

Appendix B depicts the plot of CUSUMSQ for the estimated ARDL model. The plot also suggests the absences of instability of the coefficients since the plots of all coefficients fall within the critical bounds at 5 percent significance level. Thus, all the coefficients of the

estimated model are stable over the period of the study. It is therefore clear that the parameters will neither be changing systematically or erratically. There is convergence.

CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings

The focus of this study was to find out the relationship between real effective exchange rate and economic growth. In sum, the study examined real effective exchange rate together with some control variables and economic growth using an Auto Regressive Distributed Lag Model that was developed by Pesaran and Shin (1999).

In the empirical literature analysis reviewed, the study explored the relationship between real effective exchange rate and economic growth for this study on Ghana over the period 1984 to 2014 and it was clear that the bulk of the literature produced mixed interactions between real effective exchange rate and economic growth.

In order to estimate the long and short-run dynamic parameters of the model, the Autoregressive Distributed Lagged Model (bounds testing) approach to cointegration was employed. We then started the estimation process by testing for the stationarity properties of the variable using the Augmented-Dickey Fuller (ADF) and Phillips-Peron test statistics. The unit roots results suggest that all the variables were stationary after taking first difference while gross domestic product per capita growth stationary at levels with a constant and trend under the Philip Peron test statistics. The study then proceeded to examining the long-run and short-run relationship between real effective exchange rate and economic growth.

The bounds tests results revealed that in the long-run, only exchange rate and gross domestic product per capita exerted a statistically significant positive impact on economic growth. The result supports Aksoy and Salinas (2006) findings that the overvaluation of the real effective exchange rate was a key factor limiting the supply reaction of trade reforms. They further argued that real depreciation/devaluation enhances a country's international

competitiveness, leading to increase exports and foreign exchange supplies and, thereby, increasing official capacity to import needed inputs for industrial production and therefore economic performance.

The short-run results revealed that the variables trade openness, exchange rate and capital stock have a positive and significant influence on economic growth. However, labour force and foreign direct investment proved harmful to economic growth.

The long-term relationship that exist between real exchange rate and GDP growth is further confirmed by a negative coefficient which is statistically significant on the lagged error correction term and the size of this coefficient suggest that, the disequilibrium forced by previous years' disturbance converges back to the long-run equilibrium in the current year. The relationship shows that depreciation of the currency is detrimental to growth in the long run.

The diagnostic tests result show that the model passes the test of serial correlation, normality and heteroscedasticity. The graphs of the cumulative sum of recursive residual (CUSUM) and the cumulative sum of squares of recursive residual (CUSUMSQ) exhibit that there exists a stable relationship between real effective exchange rate and the selected macroeconomic variables used for the study.

Conclusions

The study has empirically examined the real effective exchange rate and economic growth in Ghana using Ghanaian data set for the period 1984 to 2014. The empirical evidence revealed the following findings: First, both the long-run and short-run results found statistically significant positive effects of foreign direct investment, government expenditure, and real effective exchange rate on Ghana's economic growth. This means that, continuous degree of depreciation of the exchange rate (local currency), FDI which largely goes into mining sector and unproductive government spending will hamper the growth of the economy.

However, the long run dynamics also showed a positive impact of capital stock and labour force improvements also induces growth. on economic growth. The impact of real effective exchange rate on economic growth is however more pronounced in the long run than in the short run.

Recommendations

Based on the findings from the study, the following recommendations are proposed.

First, as a way of improving exports, creating employment, curbing imported inflation, the government should pay critical attention to the exchange rate. The exchange is often thought of to enhance international competitiveness but largely it been revealed in this study that it is rather growth hindering. This is true in that the elasticity of demand of demand for imports and experts for Ghana is still inelastic. Therefore, Ghana is better off ensuring a strong or appreciating currency.

Government expenditure yielded a negative relationship with real GDP per capita over the study years for Ghana. This implies that government expenditure was not directed into pro-growth and pro-poor activities of the economy. The government should therefore take it upon itself to keep on directing it's spending into productive sectors of the economy such as education, health, water, sanitation, rural development and infrastructural development. There is the need for projects to increase the number of public educational institutions as well as ensuring quality education.

Moreover, of all the explanatory variables, the labour force proved very potent in explaining growth of Ghana. The labour force variable was found to have a positive relationship with GDP growth. From the results, a policy suggestion is that the government should continue to devote more resources to expanding technical and vocational education. The reform of the pre-university educational system is in the right direction. Also, the government needs to devote more resources to enhance non-formal education with strong emphasis on basic

literacy and skills training. Government of the day should also map out strategies or policies to ensure that most of the labour force are employed. The agricultural sectors need to be revamped since it is one of the key sources of employment in the country. New small or medium scale productive enterprises should be established to absorb the increasing labour force.

Also, regarding foreign direct investment, the government of the day should review contracts and policies since it does not improve growth. These investments have been resource sapping and therefore the country would be better off if FDI are encouraged or channelled into productive ventures like the establishment of new small or medium scale enterprises.

Physical capital had a positive impact on growth in this study. This suggests that government should continue to invest tremendously in plants, machinery, raw materials, industrial buildings, engineering, technology and other capital stock that are central to production and at the same time develop the human resource capacity by increasing investment in the educational sector to ensure an efficient use of the equipment and technology that may be available.

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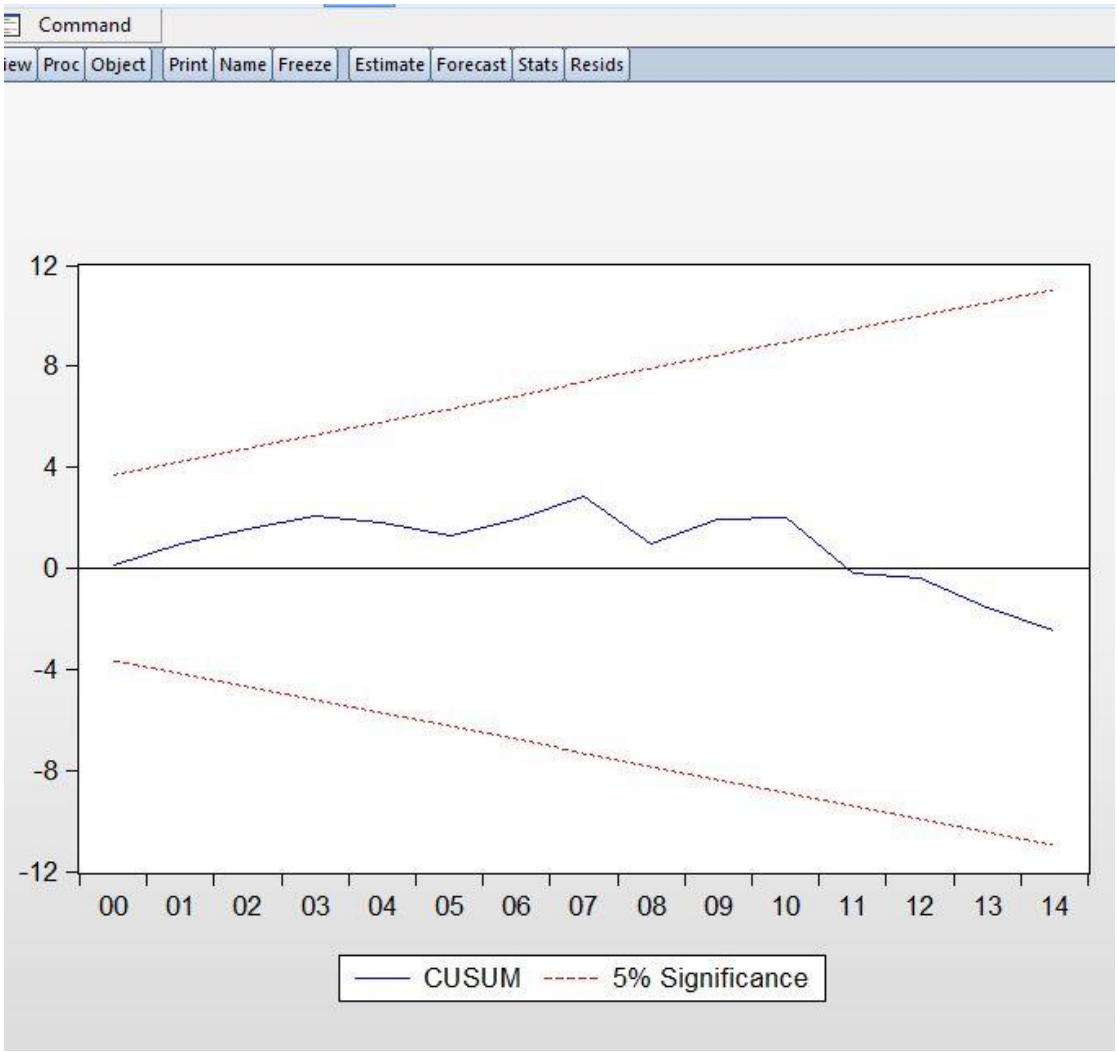
APPENDIX A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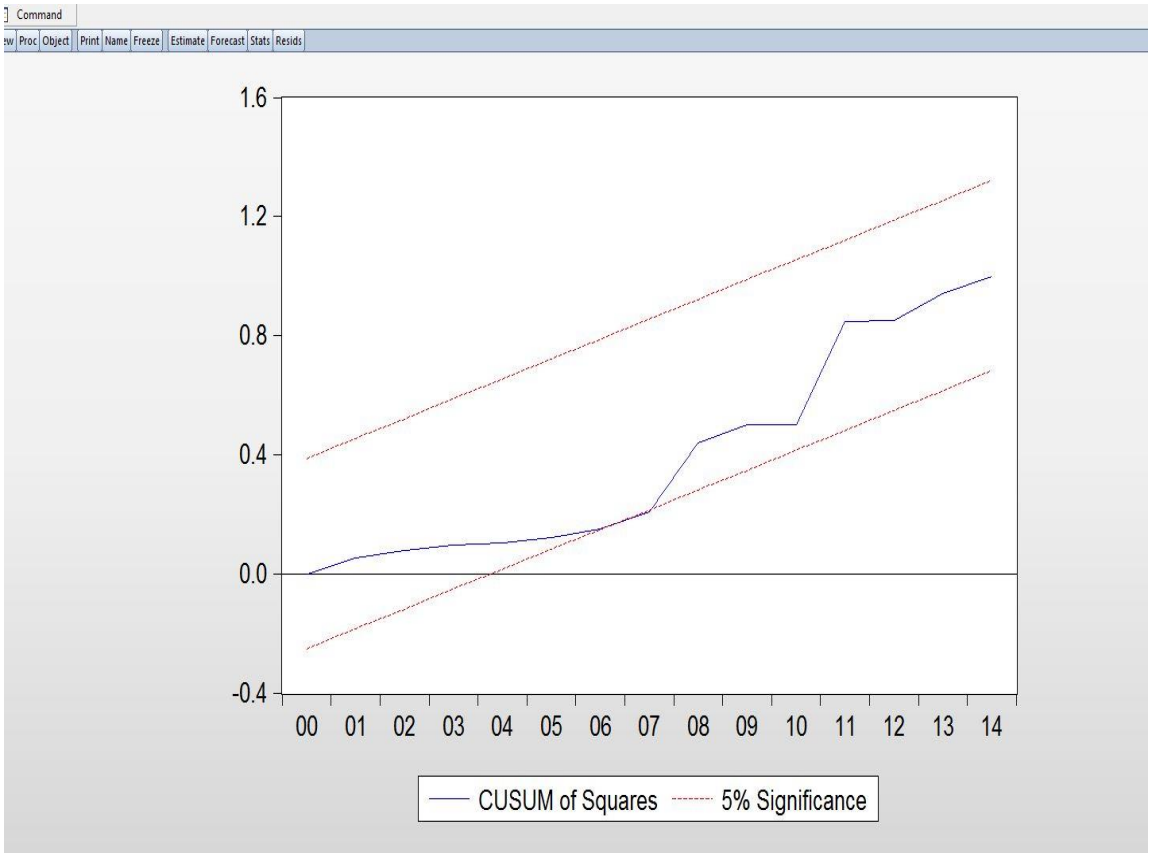
APPENDIX B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