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Abstract

We assess Ghana's trade competitiveness against its major trading partners. In doing so, we compute the real effective exchange rate (REER) index using total trade weighted for the period 2006-2012. The paper further evaluates the volatility of REER and the extent to which variations are ascribed to either the relative price or nominal exchange rate. The findings indicate annual appreciation of the REER in 2001, 2003-2006, 2008, 2010-2011 and 2015-2016. In contrast, real depreciation was recorded for the periods 2002, 2007, 2009 and 2012-2014. These developments in the REER largely mirrored trends in Ghana's trade balance and supports the notion that real depreciation (appreciation) improves (worsens) trade balance (trade competitiveness). We further observed a strong positive pass-through of nominal exchange rate to real exchange rate, while the impact from price differentials was relatively small. This finding suggests that despite the perceived moderate pass-through of nominal depreciation to domestic prices, dynamics in the nominal exchange rate remain critical for Ghana's trade competitiveness. Consequently, this paper assigns higher priority to nominal exchange rate stability to attain the desired level of real exchange rate alongside moderating volatilities in other macroeconomic variables.

Key Words: Effective Exchange Rate, Price Differentials, Trade Competitiveness, Ghana.

JEL Codes: E52, F13, F14, F31

1. Introduction

The exchange rate is an important determinant of the economic health of particularly developing economies. For instance, effective exchange rate serves as a metric of trade competitiveness for domestic producers in relation to their most significant trading partners. But to attain an objective and informed view, effective exchange rate has to manifest the contemporary adjustments in the structure of foreign trade as a result of the globalisation process. In view of this, exchange rate policies are among the most observed, analysed and deployed economic measures. However, analysis of the impact of policy variables on the real exchange rate is sensitive to the type of real exchange rate index chosen. This is because there are several ways of measuring real exchange rate and the choice of index depends on the objective of study. Edwards (1989) further argued that the choice of price index is equally crucial for the computation of real exchange rates. It is therefore necessary to apply the price index which is more suitable for a particular policy objective.

Over the years, volatility in foreign exchange market has remained topical in academic, political and policy discourses in Ghana. This is largely hinges on the fact that the Ghanaian cedi has been among the weakest currencies in the world in recent years. Major recurrent policy question has been whether the continuous nominal depreciation has correspondingly resulted in real depreciation? A related question is whether the incessant depreciation really benefits Ghana's external trade in the midst of the narrow and predominantly primary export base? More importantly, whether the perennial depreciation has also considerably enhanced Ghana's trade competitiveness?

Like many developing economies, studies on the measurements of real exchange rate for Ghana had relied extensively on bilateral trade and nominal exchange rate (mostly between the Ghana and the USA) and in some cases, on the three core countries of the USA, European Union (EU) and United Kingdom (UK). Notable studies include International Monetary Fund (IMF) (2000-2016), Opoku-Afari (2004) and Sackey (2001). For instance, in analysis the effect of foreign aid on REER, Sackey (2001) used bilateral nominal exchange rate in the measurement of real exchange rate for the period 1962-1996. However, Opoku-Afari (2004) computed annual multilateral real exchange rate (MRER), also known as real effective exchange rate (henceforth REER), for Ghana using nine (9) trading partners over the period 1961-2001. As aforesaid, international trade pattern has changed dramatically amid the rapid pace of globalization as well as gradual transformation of global economies. We emphasised therefore that the previous studies have aged and hence, do not to encapsulate the recent dynamics of Ghana's international trade. In particular, the direction of Ghana's external trade

has altered significantly over the years with China, South Africa, United Arab Emirates and Nigeria emerging as prominent trade partners.

Against this background, this paper constructs a more contemporary and comprehensive REER index that captures the recent dynamics of Ghana's major trading partners, as a gauge for trade competitiveness. In addition, we investigate the extent to which volatilities in REER are influenced by either the relative price or nominal exchange rate. We further examine the evolution of our computed REER and trade balance in the quest to ascertaining the impact of exchange rate developments on Ghana's external trade. In terms of contribution, this paper constructs a more encompassing monthly and CPI-based REER index for Ghana using 18 major trading partners. Consequently, our computed index would reflect the contemporary developments in Ghana's external trade and hence, the findings will remit key implications for policy decisions in Ghana and other economies with similar macro-dynamics.

The rest of this paper is organized as follows: Section II presents the proposed measure of REER index and data. Section III presents the empirical results and reference, while Section IV provides the conclusion and policy suggestions.

2. Methodology and Data Sources

2.1 Proposed methodology for Ghana's REER index

The choice of the method and weighting system employed depends on the choice of the home country's policy objective. Some of these domestic policy objectives could range from the impact of exchange rate changes on the balance of payments, international competitiveness, and to domestic price stability. In this paper, we are primarily concerned with the relative trade competitiveness of Ghana and price stability objective.

In compiling the REER, we first identified the relevant trading partners[1] for Ghana using bilateral weighting system. The choice of bilateral weighting system was based on the fact that it incorporates total foreign trade and also draws on information about price responses. The weights of the relevant trading partners are thus obtained as followed:

$$\Psi_j = \frac{X_j + M_j}{\sum_{j=1}^{n}(X_j + M_j)} \qquad (1)$$

where X and M denote export and import respectively of the home country. The inclusion of imports provides a way of evaluating the potential impact of exchange rate on domestic price

[1] In this case, a certain balance between sufficient coverage of foreign trade and efficiency has to be found.

stability objective. In line with Opoku-Afari (2004), we also applied geometric method of weighting for our computation of REER as it overcomes shortcomings often associated with arithmetic approach. This contrasts with the work of Sackey (2001) which used the arithmetic mean method of weighting.

Similarly, the choice of base year is relevant in the REER computation. This paper chose 2006 as the base year (2006=100)[2], mainly to capture recent developments such as the rebasing of the national accounts.

Against this background, this paper computes REER for Ghana using equation 2:

$$REER = \prod_{i,j=1}^{n} \left(\frac{S_{NEER_{ij}} P_i}{P_{ij}^*} \right)^{\Psi_{ij}} \qquad (2)$$

where, S_{NEER} denotes the Nominal Effective Exchange Rate (NEER), define as the average change of a home country's exchange rate against all the trading currencies at time i. Thus, in this paper, nominal exchange rate is measured as units of foreign currency of country j per unit of domestic currency; P_i measures the domestic price level at time i; P_{ij}^* is the price level in country j at time i; and Ψ_{ij} is the trade weight assigned to each exchange rate of domestic currency against foreign currency (j) at time i. The use of consumer price index is purely based of easily availability of data.

Although our approach is similar to that of IMF's annual compilations of REER index for member countries and that of Opoku-Afari (2004), we provide a high frequency (monthly) MRER index for Ghana which is germane for timely monetary policy decision. In addition, our index is more comprehensive as it involves larger number of trading partners.

2.2 Dataset

We apply several estimation techniques to investigate the relative weight of nominal exchange rate and price differentials on the evolution of real exchange rate. This is to ensure a more robust estimation outcome. The main techniques applied in this paper included the Exponential General Auto-Regressive Conditional Heteroskedastic (EGARCH)[3] model, Simple and Markow Regime Switching methods, Threshold OLS regression and OLS with breakpoints.

[2] We have used monthly data spanning 2000 to 2016 for our computation, hence the base year index of the REER are averages of the values for the twelve months of that year (Base Year=2006 =100).

[3] For detail on GARCH family models refer to Bollerslev (1986), Nelson (1991) and Akosah (2014). Also refer to Eviews 9 manual for the details on the other methods.

The choice of different techniques is to ascertain the possible evidence of non-linearity or threshold effects in the link between real exchange rate and its components.

Dataset for this study was sourced from several areas. For instance, the trade weights were computed from historical Balance of Payments Database within the Statistics Department of the Bank of Ghana for the period 2006-2012. Nominal exchange rates in the respective national currency per US dollar (US$) were obtained from the International Financial Statistics (IFS) of the International Monetary Fund (IMF). Monthly average of the nominal exchange rates was used. Similarly, the consumer price indices for the 18-trading partner countries were obtained from IFS of the IMF. Overall, this study computes a monthly REER index for Ghana over the period 2000M01 to 2016M12. In contrast, annual datasets were used by Opoku-Afari (2004) and Sackey (2001).

3. Empirical Results and Inferences

3.1 Ghana's Major Trading Partners and Their Respective Weights

Table 1 displays the relative weights of relevant trading partners for the construction of the REER index for Ghana. In all, we identified 18 major trading partners, representing 94 per cent of total trade for Ghana over the period 2006-2012.

Table 1: Computed Weights for Major Trading Partners

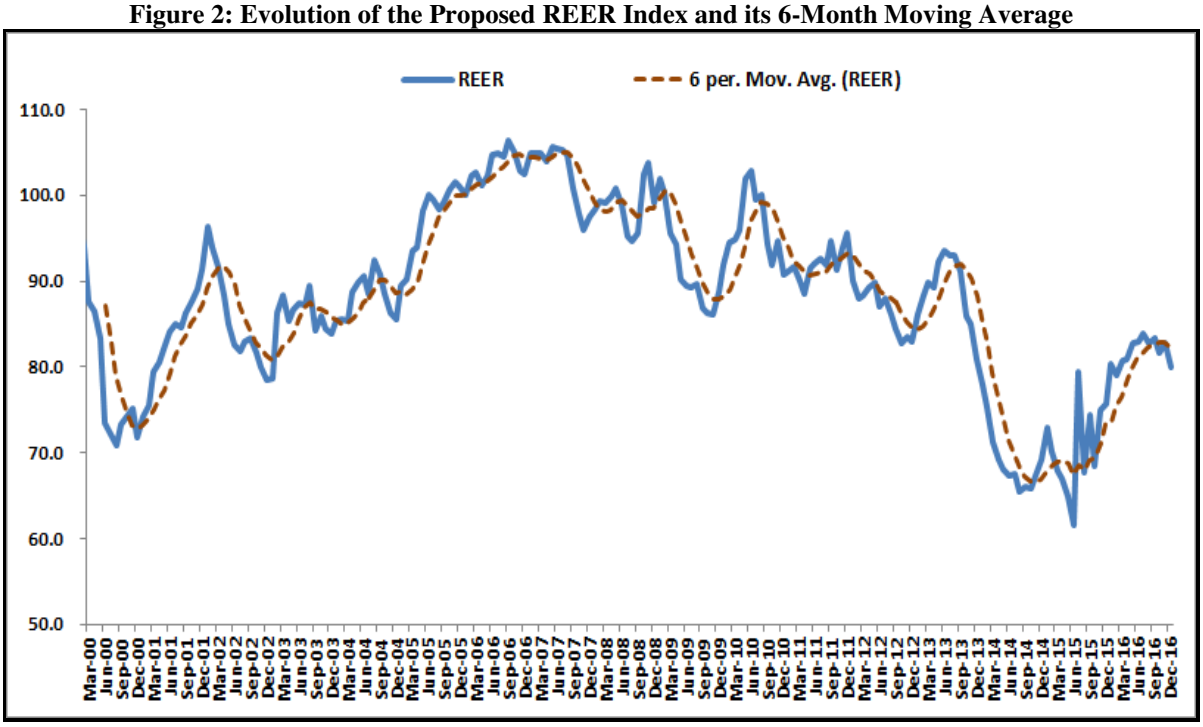
Country	Share of Trade Covered by the Countries Selected in Total Trade
1. EU	0.3461
2. South Africa	0.1578
3. China	0.0812
4. US	0.0596
5. Nigeria	0.0565
6. UAE	0.0406
7. UK	0.0387
8. India	0.0264
9. Canada	0.0162
10. Malaysia	0.0146
11. Turkey	0.0141
12. Korea Republic	0.0135
13. Brazil	0.0134
14. Japan	0.0134
15. Togo	0.0132
16. Cote D'Ivoire	0.0128
17. Thailand	0.0126
18. Australia	0.0089
19. Total	0.9400

The EU which comprised 9 countries[4] had the highest trade weight, followed sequentially by South Africa, China, USA, Nigeria, United Arab Emirates (UAE) and UK, while Australia had the least trade weight. This suggests that the estimation of REER index based on either the three core currencies (namely, the US dollar, the pound and the Euro) or the bilateral (only US dollar) may not be representative enough as it omits the significant roles of some countries especially China, South Africa and Nigeria in Ghana's trade dynamics.

3.2 Derived REER Index for Ghana

Having identified the major trading partners and their respective weights, we proceed to compute the REER index using 2006 as the base year. Figure 2 displays the evolution of our computed REER for Ghana for the period 2000M01 to 2016M12.

Figure 2: Evolution of the Proposed REER Index and its 6-Month Moving Average



It is apparent that the REER has experienced significant volatility over the sample period. In particular, the index reveals considerable real depreciation below its 6-month moving averages over the period 2000, 2002, 2009, 2012, 2013Q3-2014Q2 and 2015Q2, suggesting an undervaluation and hence an improvement in Ghana's trade competitiveness. It is also evident that the real depreciations are often followed or preceded by real appreciation, implying that the currency tends to correct itself towards an equilibrium level.

[4] The EU area economies comprised the Netherlands, France, Switzerland, Belgium, Italy, Germany, Spain, Sweden and Estonia. This implies that we used a total of 26 trading partners in the computation of REER for Ghana.

We examine the degree of volatilities in the REER by computing annual percentage changes using equation (2);

$$\Delta REER_t = \frac{(REER_t - REER_{t-12})}{REER_{t-12}} * 100, \quad (2)$$

where $\Delta REER_t$ denotes change in REER index, with positive values connoting appreciation, while negative values imply depreciation of the cedi. To identify extreme volatility periods, we further computed a threshold band based on 95% confidence level, as shown in equation (3) below:

$$TL_{reer} = \mu_{reer} \pm 2 * \sigma_{reer} \quad (3)$$

where TL_{reer} denotes a threshold level of REER; μ_{reer} is the mean REER; and σ_{reer} is standard deviation of the REER. The paper thus associates depreciation below the critical lower bound as over-depreciation, and also associates an appreciation exceeding the critical upper bound as over-appreciation. However, equation (3) makes sense only when the distribution of the REER index is approximately normally distributed. Figure 3 clearly demonstrates that the changes in REER index are non-normally distributed and this is corroborated by the quantile-quantile (Q-Q) plot in Figure 4. Besides, the boxplot in Figure 5 also clearly shows evidence of positive and negative outliers, epitomising excessive volatilities in the REER index.

Figure 3: Histogram of Changes in REER

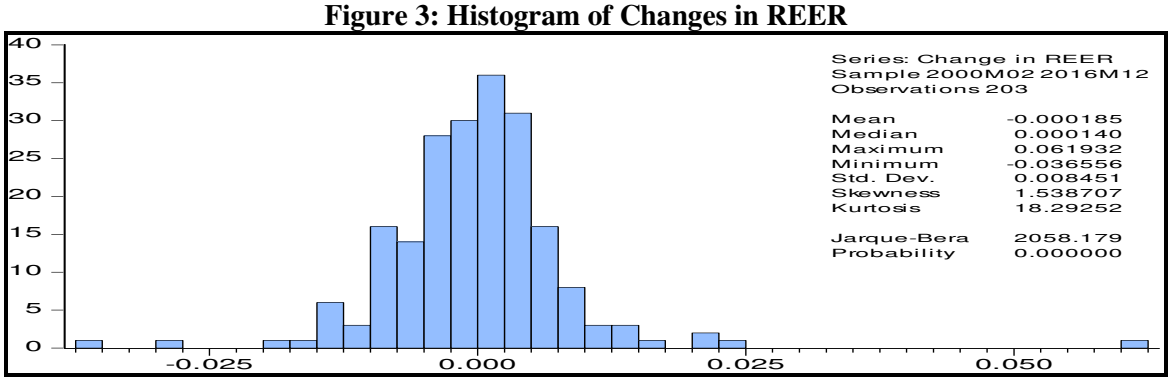


Figure 4: Q-Q Plot of Changes in REER

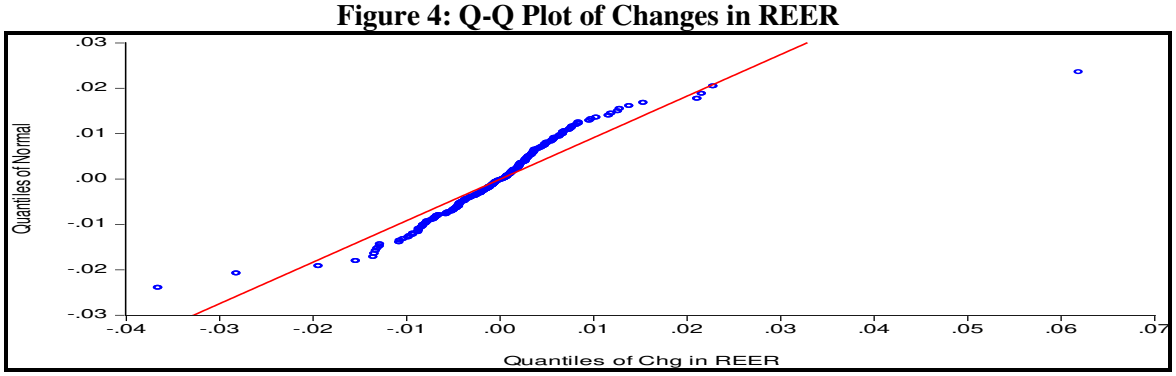
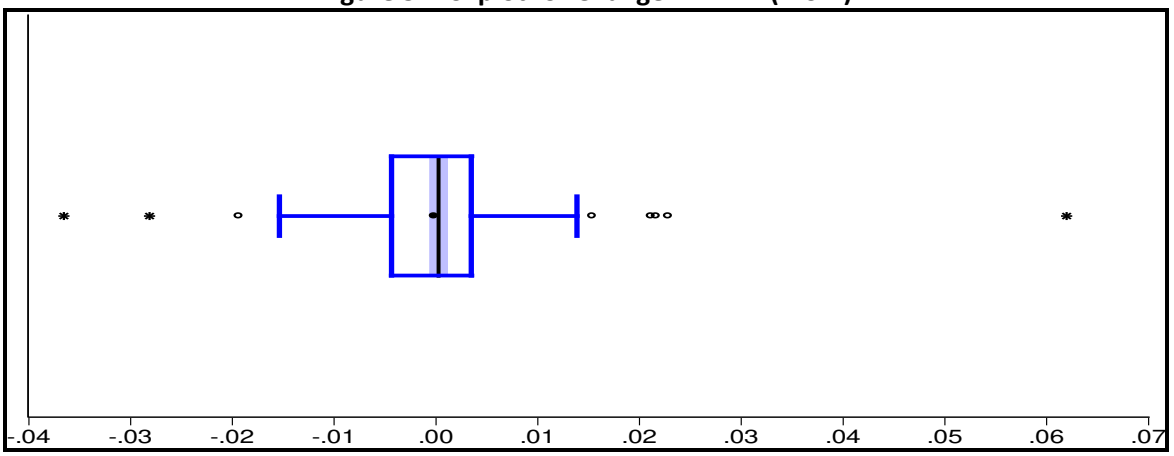
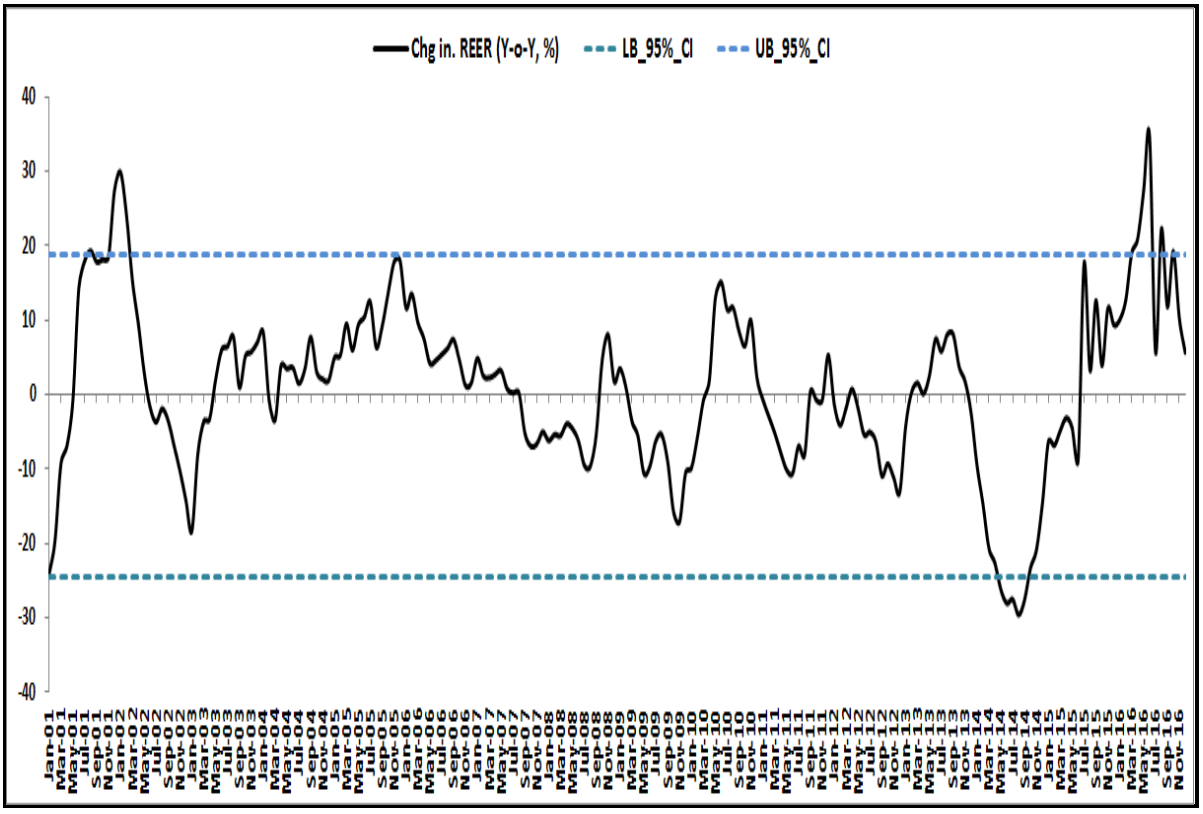


Figure 5: Boxplot for Change in REER (Y-o-Y)



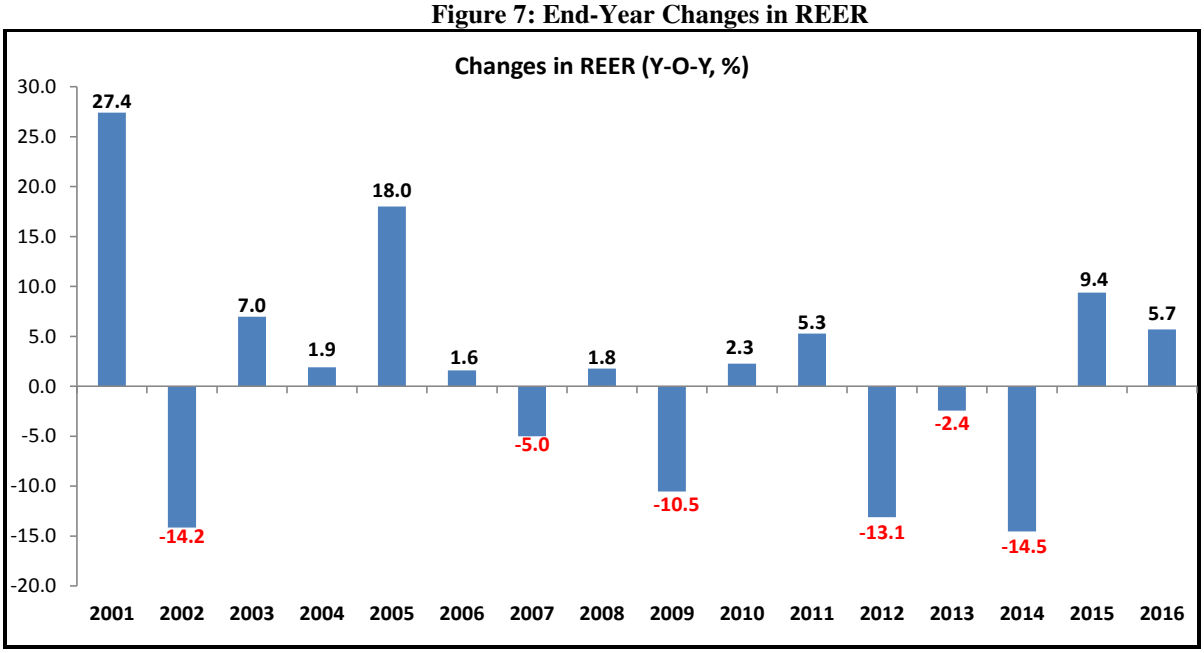
In this paper, therefore, an excessive change in the REER index is defined as any percentage change in REER lying outside the lower or upper band of the threshold level based on empirical bootstrap with 100000 replicates over the period January 2001 to December 2016. Figure 6 displays the movements of changes in the REER index and critical threshold bands since 2001 (also Figure 7 presents annual changes in REER). Clearly, the result reflects periods of excessive real depreciation and appreciation of the cedi, consistent with the result from the Boxplot.

Figure 6: Year-on-Year Changes in REER and 95% Confidence Bounds



Note: + = appreciation; - = depreciation

Figure 7: End-Year Changes in REER



Specifically, the event analysis revealed that the REER recorded significant depreciation (25%) during the early 2001 (over-depreciation), but recovered sharply to record over 27.4% appreciation by the end of the year, exceeding the critical upper bound. This however triggered a sharp depreciation of about 14.2% by the end of 2002. Thereafter, the REER index generally appreciated between the period 2003 and 2006, largely attributable to the inflows related to the adoption of Heavily Indebted Poor Countries' (HIPC) initiative accompanied by the multilateral debt relief.

Real correction ensued during the second half of 2006. This continued throughout 2007 and worsened during the first three quarters of 2008 but subsequently followed by a sharp recovery in the last quarter of 2008. The general real depreciation in 2007 and 2008 could be attributable to the excessive fiscal expenditure related to the Golden Jubilee celebration (2007), hosting of African Cup of nation and election cycle (2008). The recovery was short-lived as the cedi sharply depreciated in real terms in 2009 amid loss of confidence on the back of subdued economic growth.

Sharp recovery subsequently followed with the cedi appreciating at the end of 2010 and 2011, on the back of large foreign exchange inflows following the commencement of crude oil production and exports in 2011.

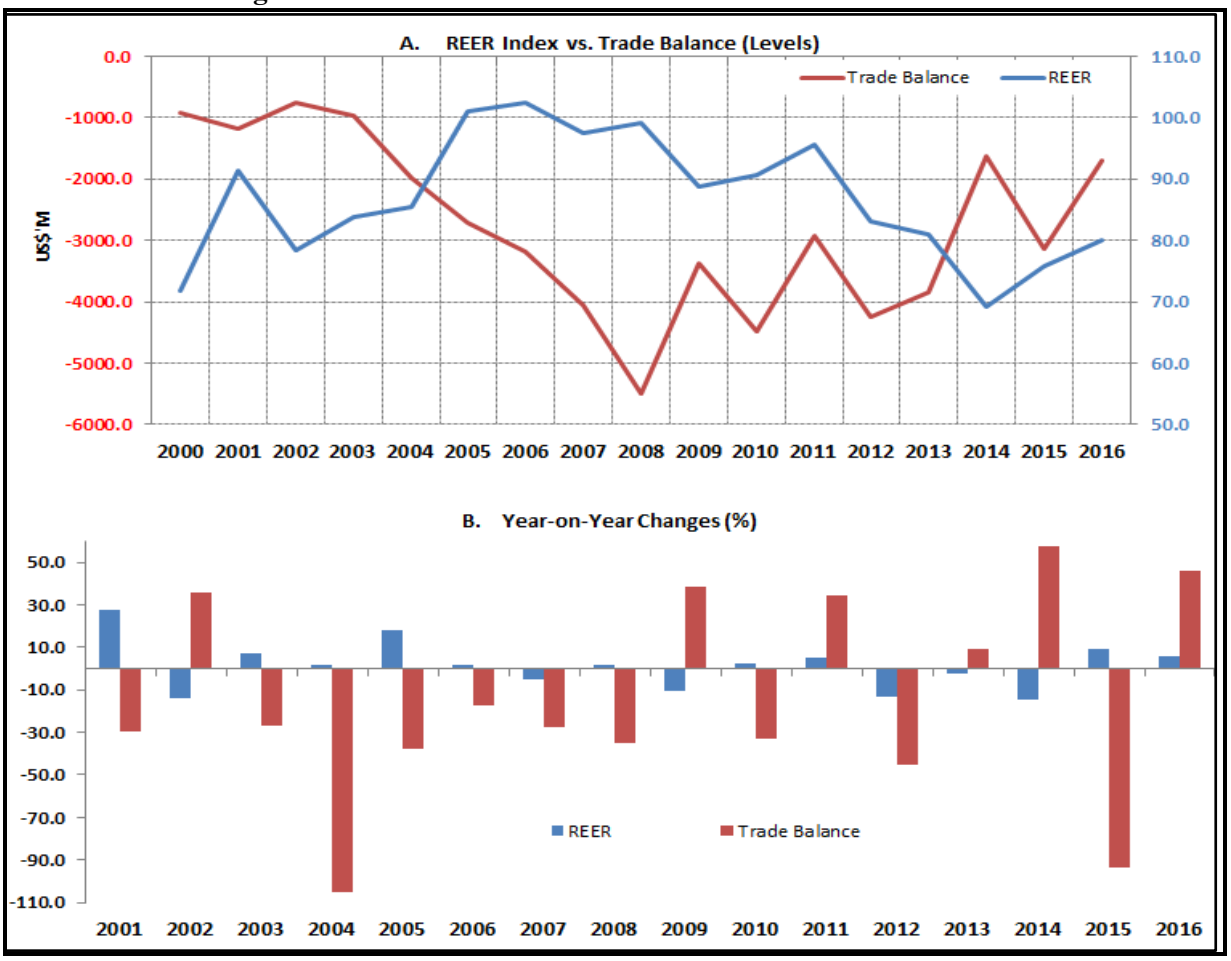
Large real depreciation ensued between 2012 and 2014 with some respite in 2013, largely attributable to the lingering macroeconomic vulnerabilities resulting from the fiscal excesses during the 2012 elections. This reflected in double-digits twin (current and fiscal) deficits in

2012. In particular, the over-depreciation observed during the third quarter of 2014 was underpinned by poor macroeconomic fundamentals and speculative activities on the foreign exchange market.

The cedi thereafter strengthened substantially in real terms in 2015 and 2016. This relative was largely attributable to the tighter fiscal and monetary policies that ensued following the IMF's support and conditionality since the last quarter of 2014 as well as the expected large inflows from cocoa syndicated loans and the floatation of Eurobond in the second half of 2015. As exhibited in figure 6, the cedi was over-appreciated during the second quarter of 2016 but thereafter experienced a general downward correction.

In addition, an examination of Figure 8 clearly demonstrates that the developments in REER index are somewhat mirrored in the dynamics of Ghana's trade balance. With the exception of 2007 and 2011, we observe that periods of real depreciation (appreciation) are largely associated with improvement (worsening) in the trade balance. The divergence from this observation especially in 2011 may be attributed to additional export earnings from the commencement of crude oil production during the year.

Figure 8: Evolution of REER Index and Trade Balance in Ghana



Further empirical analysis based on bivariate Philips-Ouliaris cointegration and Engel-Granger two-step cointegration methods (in Table 1) shows evidence of a long run relationship between real exchange rate and Ghana's trade balance. Particularly, we observe a significant negative link between real exchange rate and Ghana's trade balance in the long run, while the short run link is also negative but statistically insignificant. The result clearly reinforces that real appreciation (depreciation) tends to deteriorate (augment) Ghana's trade balance (or competitiveness) in the long run.

Table 1: Bivariate Analysis of Trade Balance and REER

A: Philips-Ouliaris Cointegration Test				
Null hypothesis: Series are not cointegrated				
Dependent	**tau-statistic**	**Prob.***	**z-statistic**	**Prob.***
LTBAL	-5.311	0.000	-37.977	0.000
LREER	-3.249	0.075	-17.179	0.074
B: Engel-Granger Two-Step Methods				
I: Long Run Estimates				
Dependent Variable: $LTBAL_t$				
Variable	**Coefficient**	**t-Statistic**	**Prob.**	
C	2.001	2.885	0.0053	
LREER $_{t-1}$	**-0.495**	-3.149	0.003	
LTBAL $_{t-1}$	0.432	5.769	0.000	
Diagnostics				
R-squared	0.405	Prob(F-statistic)	[0.000]*	
S.E. of regression	0.172	Durbin-Watson stat	2.073	
Normality	[0.071]	Heteroskedasticity	[0.586]	
Serial Correlation	[0.731]	Stability Test	[0.438]	
Residual Unit Root Test (ADF-Test)			[0.023]**	
II: Short Run Estimates				
Dependent Variable: $\Delta LTBAL_t$				
Variable	**Coefficient**	**t-Statistic**	**Prob.**	
C	0.004	0.185	0.854	
ΔLREER $_t$	-0.327	-0.845	0.402	
ECM $_{t-1}$	-0.618	-4.782	0.000	

Note: [ ] denotes p-values; * & ** represent 1% and 5% significance levels respectively. Regression covered the period 2000Q1-2016Q4

3.3. Relative Impact of Nominal Exchange Rate and Price Differentials on REER

Real exchange rate is derived as the nominal exchange rate adjusted by the relative prices. However, the extent of contribution from each component to the variations in REER remains ambiguous in the extant literature. Consequently, we bridge the knowledge gap by examining

the relative impact of nominal exchange rate and price differentials on REER in the Ghanaian context, using several approaches. This analysis is deemed essential for policy decision especially within the inflation targeting framework pursued by the central bank.

First, we qualitatively scrutinise the evolution of relative conditional volatilities based on exponential GARCH (1, 1) estimation as displayed in Figure 9. We observed that, since 2008, the volatility in REER has largely been driven by volatility in the nominal effective exchange rate (NEER). In contrast, relative price contribution to changes in REER seems to be strongly evident during the pre-2008 period. Besides, the relative contribution to the variations in our computed REER index is consistent with analysis based on the bilateral REER (see Figure 10).

Figure 9: Relative Volatilities of REER, NEER and Price Differentials

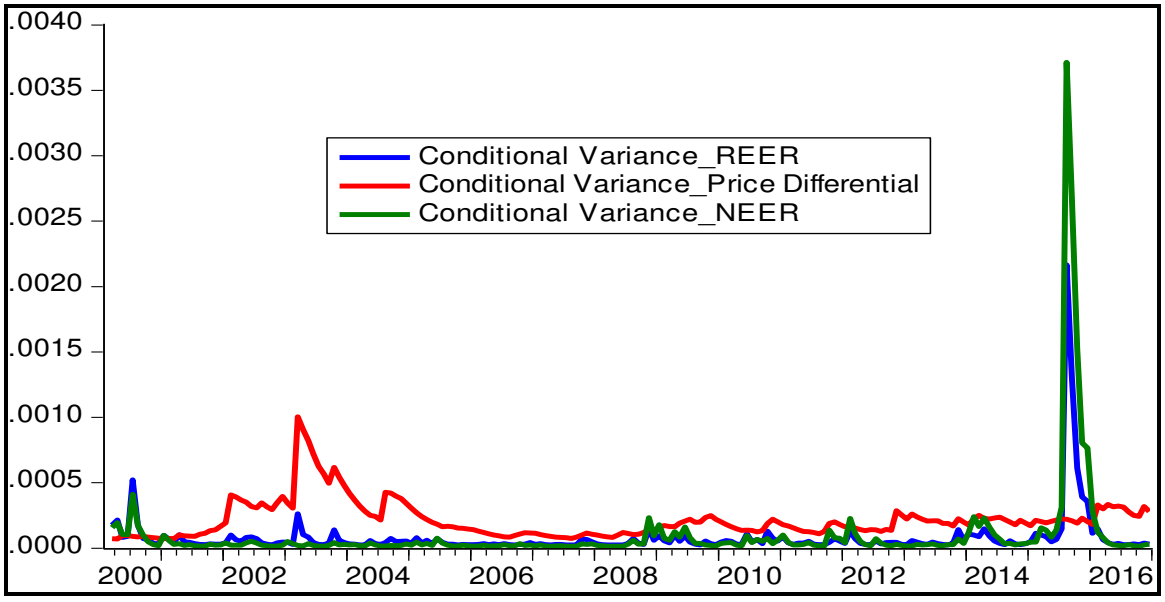
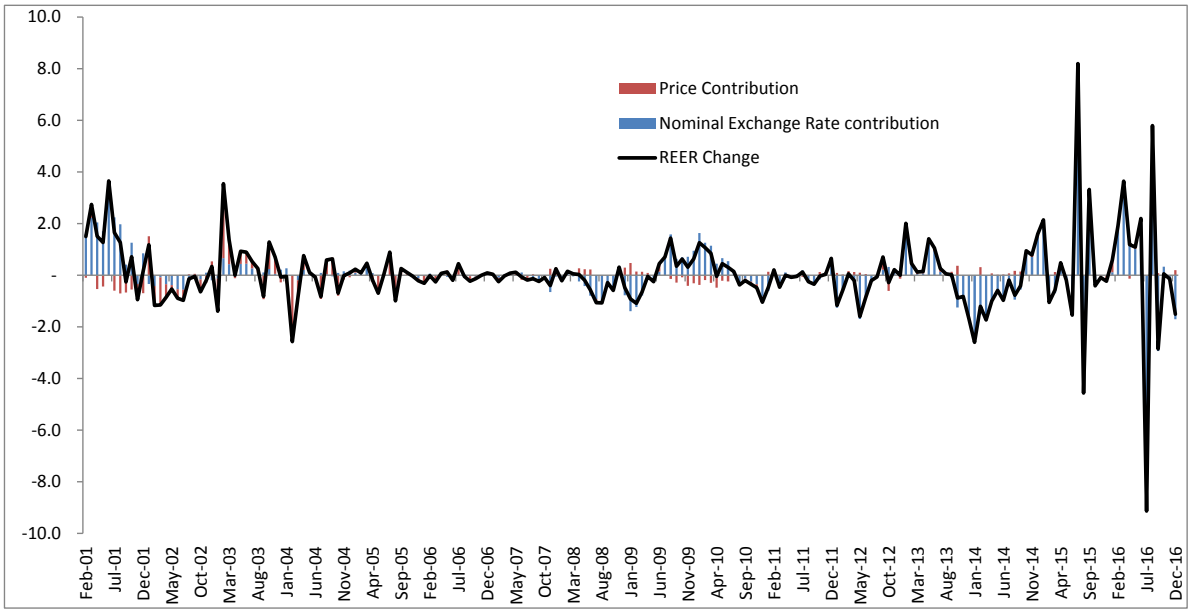


Figure 10: Bilateral REER Change & its components



Secondly, we empirically establish the extent to which the evolution of the REER in Ghana has been propelled by relative adjustments in the nominal exchange rate (NEER) and price differentials (gaps) using both linear and non-linear estimation techniques. Table 3 presents the estimation results from Exponential GARCH (1, 1), Simple Regime Switching (SRSM), Markow Regime Switching (MRSM), Threshold regression and OLS regression with breakpoint techniques. Our empirical results in Table 3 clearly illustrate that real exchange rate changes in Ghana are predominantly influenced by changes in the nominal exchange rate. Consistently, the direction of impact of nominal exchange rate developments on real exchange rate remains positive and highly significant in all the models. In terms of magnitude, 1% nominal depreciation (or appreciation) leads to an average real depreciation (or appreciation) ranging between 0.75% and 0.87%. This suggests a very high pass-through of nominal exchange rate change to real exchange rate.

In contrast, the results show that the effect of price differentials on real exchange rate variation is generally minimal irrespective of the estimation techniques applied for the sample period. In addition, direction of impact of price differential on real exchange rate is less obvious as it changes sign depending on the regime or period (see Table 1).

For instance, the empirical results (see SRSM, MRSM, Threshold regression and OLS with breaks estimation in Table 1) suggest that 1% increase (decrease) in price differential leads to a real depreciation (or appreciation) of about 0.004% in regime 1. On the other hand, we identified that a 1% increase (decrease) in price differential leads to a real appreciation (or depreciation) of about 0.001% in regime 2. Our empirical results therefore point to the need to maintain stability in nominal exchange rate in order to achieve the desired level of real exchange rate alongside moderating other macroeconomic volatilities.

Table 3: Relative Impacts of NEER and Price differentials on REER

	Dependent Variable: RETURN_REER$_t$						
	Exponential GARCH (1, 1)			SRSM	MRSM	THRESHOLD_Regression	OLS with Breaks
	Full Sample	*Sub Sample*	*Sub Sample*	*Full Sample*	*Full Sample*	*Full Sample*	*Full Sample*
	2000M2 - 2016M12	*2000M2 - 2006M12*	*2007M2 - 2016M12*	*2000M2 - 2016M12*	*2000M2 - 2016M12*	*2000M2 - 2016M12*	*2000M2 - 2016M12*
	Coeff[T-Value]	*Coeff[T-Value]*	*Coeff[T-Value]*	*Coeff[T-Value]*	*Coeff[T-Value]*	*Coeff[T-Value]*	*Coeff[T-Value]*
	Mean Equation			*Regime 1*	*Regime 1*	*Regime 1: RETURN_NEER ≥ K (129 obs)*	*Regime 1: 2000M03 - 2007M10 (92 obs)*
Constant	0.002[10.16]*	-0.001[-2.43]**	0.002[11.99]*	0.001[2.57]*	0.001[2.57]**	0.002[5.65]*	0.001[1.92]***
RETURN_REER$_{t-1}$	0.026[1.15]	-0.003[-0.06]	-0.012[-1.45]	0.104[1.85]***	0.104[1.85]***	0.061[1.69]***	0.005[0.11]
RETURN_NEER$_t$	0.856[47.76]*	1.245[24.42]*	0.803[55.36]*	1.041[13.50]*	1.041[13.50]*	0.845[38.74]*	1.176[20.15]*
Price_Differentials$_t$	0.0003[0.95]	-0.007[-9.65]*	0.001[1.73]***	-0.003[-2.82]*	-0.003[-2.82]*	-0.002[-2.33]**	-0.005[-4.63]*
LOG(δ)				-5.508[-58.05]*	-5.508[-58.05]*		
	Variance Equation			*Regime 2*	*Regime 2*	*Regime 2: RETURN_NEER < K (73 obs)*	*Regime 2: 2007M11 - 2016M12 (110 obs)*
Constant	-22.161[-53.91]*	-0.094[-0.39]	-11.192[-4.88]*	0.002[7.61]*	0.002[7.61]*	0.001[0.50]	0.001[3.05]*
ARCH$_{t-1}$	0.413[7.43]*	-0.179[-1.42]	-0.949[-3.24]*				
Leverage Effect	0.103[9.43]*	-0.259[4.11]*	-1.196[-6.05]*				
GARCH$_{t-1}$	-0.868[-22.77]*	0.977[46.22]*	0.030[0.15]				
RETURN_REER$_{t-1}$				-0.049[-1.81]***	-0.049[-1.81]***	-0.113[-4.99]*	-0.032[-1.25]
RETURN_NEER$_t$				0.798[48.62]*	0.798[48.62]*	0.755[12.13]*	0.795[38.42]*
Price_Differentials$_t$				0.001[1.31]	0.001[1.31]	0.002[3.84]*	0.001[0.72]
LOG(δ)				-6.503[-44.21]*	-6.503[-44.21]*		
R-squared	*0.84*	*0.71*	*0.90*			*0.87*	*0.86*
Log likelihood	*886.89*	*371.95*	*550.30*	*892.07*	*892.07*	*881.01*	*878.38*
Sum squared resid	*0.0023*	*0.0011*	*0.0011*	*0.0021*	*0.0021*	*0.0019*	*0.0020*
Observations Included	*202*	*82*	*120*	*202*	*202*	*202*	*202*

*Note: K = -0.00337; *, ** & *** denote 1%, 5% & 10% significance levels respectively*

4. Conclusion

We assessed Ghana's trade competitiveness against its major trading partners by computing multilateral real exchange rate index for the period 2000-2016, based on total trade weights and CPI index. The paper further appraised the volatility of real exchange rate and analysed the extent to which the latter is ascribed to variations in either relative price or nominal exchange rate between Ghana and the trading partners. Our results have significant policy implications.

We observed a general annual appreciation of the REER during 2001, 2003-2006, 2008, 2010-2011 and 2015-2016, while real depreciations were recorded for 2002, 2007, 2009 and 2012-2014. It was also noted that developments in REER were largely mirrored by trends in Ghana's trade balance; reinforcing the notion that real depreciation (appreciation) generally improves (worsens) trade balance. In addition, the empirical results clearly illustrate that real exchange rate changes in Ghana are predominantly influenced by changes in the nominal exchange rate. This finding presupposes that despite the perceived modest pass through of exchange rate depreciation to domestic prices, the dynamics in nominal exchange rate remains very critical for Ghana's trade competitiveness.

Consequently, this paper assigns higher priority to nominal exchange rate stability to help inure the desired level of real exchange rate while simultaneously moderating volatilities in other macroeconomic indicators.

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