Exchange Rate Variability and Manufacturing Sector Performance in Ghana: Evidence from Cointegration Analysis

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Abstract

This study examined the effect of exchange rate variability on manufacturing sector performance in Ghana. Using time series data from the period 1986-2013 and employing the autoregressive distributed lag (ARDL) approach, the empirical results show that there exists both a short as well as long run relationship between exchange rate and manufacturing sector performance. Thus, in Ghana as the exchange rate appreciates, the manufacturing sector performance improves and as it depreciates, the sector is adversely affected.   In view of this, it is recommended that policy should be put in place to regulate the importation of goods that could be locally produced so as to improve the performance of the manufacturing sector. In addition, the government should ensure that there is regular electricity supply, good roads, water and a reliable telecommunication system so that the manufacturing sector can perform effectively and efficiently in order to achieve a considerable rate of economic growth.

Keywords: Exchange rate, Manufacturing sector, Interest rate, Foreign direct investment, Imports, Cointegration, Vector error correction model

1. Introduction

In Ghana, the Economic Recovery Programme (ERP) started in April 1983 with the first *cedi* devaluation; thereafter, the country sought for a progressive movement towards a realistic and flexible exchange rate. The policy package under the programme among other things, sought to: realign the exchange rates and interest rates; reform and restore productive incentives and achieve economic growth. In 1986, Ghana started with a two-window system, and moved to a dual exchange rate market. Window One maintained a fixed but adjustable exchange rate and Window Two used a weekly auction system. The rate in Window One was applicable to government transactions, petroleum imports, cocoa and other traditional export receipts. The rate in Window Two applied to all other transactions. In 1992, the government of Ghana decided to unify the two-window auction systems and replaced them by an interbank wholesale system in which a weekly wholesale auction is used to determine the interbank rate. Banks were the only institutions permitted to participate in the wholesale system. The government allowed the establishment of forex bureau outlets in the 1980s by private individuals and companies. With the introduction of this system, foreign exchange rate is determined on a daily basis in an interbank system under the supervision of the Bank of Ghana. The periodic adjustment of the exchange rate is to make it possible to improve price incentives in the country and ensure growth in the productive sectors of the Ghanaian economy.

In spite of the above arrangements, the Ghana cedi continues to experience frequent fluctuations and this consequently, affects the growth and development of the manufacturing sector. This situation in Ghana has prompted some researchers to undertake various studies on the effect of the exchange rate changes on some macroeconomic variables such as the domestic prices (Adu et al., 2015), trade balance (Bhattarail & Armah, 2013), economic growth (Adu-Gyamfi, 2011) and employment growth (Mensah et al., 2013). However, to the best of my knowledge, there has not been any study on the extent to which these changes in the exchange rate specifically affect manufacturing output in Ghana. The study therefore seeks to fill this knowledge gap by empirically investigating the effects of exchange rate variability on manufacturing sector performance in Ghana. This study is important because any effect on the manufacturing subsector affects the real variables of the economy namely; output, income and employment.

The rest of the paper is structured as follows: section 2 reviews the theoretical and empirical literature. Section 3 discusses the methodology. Section 4 presents the results of the empirical analysis and section 5 contains the conclusion and policy recommendations.

2. Related Literature

The depreciation of the domestic currency may have either positive or negative effects on the performance of a country's manufacturing sector. Theoretically, there are a number of reasons for a contractionary effect of exchange rate depreciation. First, the depreciation of the exchange rate increases the price of traded goods, which feeds into the general price level rendering a negative real balance effect. This will, in turn, result in a fall in aggregate demand and output (Edwards, 1986). This leads to a reallocation of resources resulting in increased

production in import competing sectors. Second, if the demand for imported goods is inelastic due to the dominance of capital and essential intermediate and consumers' goods in a country's import basket, then exchange rate depreciation may be contractionary (Upadhaya & Upadhaya, 1999). Apart from these demand side channels, contractionary effects can also arise from the supply side (Edwards, 1986; Upadhaya & Upadhaya, 1999). The increased cost of imported inputs might adversely affect production and for that matter, manufacturing sector performance in general. Krugman and Taylor (1978), using a Keynesian framework, have also identified certain conditions under which exchange rate depreciation or devaluation is found to be contractionary. These are (1) if initially imports exceed exports, (2) consumption propensity out of profits and wages are different, and (3) if government revenues are increased as a result of currency depreciation or devaluation.

On the other hand, as a direct consequence of currency depreciation, import prices go up, which is likely to depress the demand for imports in the domestic economy. Increased exports and reduced imports are expected to improve the external trade balance. Essentially, the depreciation of the local currency is also believed to contribute to the enhancement of external competitiveness stimulating production in the export sector. This will, however, depend on whether the country in question has satisfied the Marshall-Lerner condition or not. The Marshall-Lerner condition (named after English economist Alfred Marshall (1842-1924) and the Romanian born economist Abba Lerner (1905) states that exchange rate depreciation would result in an increase in the level of output if the sum of the price elasticity of demand for imports and exports is greater than unity. According to Lotfalipour et al. (2013), exchange rate increase may increase the demand for domestic products and the cost of imported capital and other imported inputs. It will cause investment increase only if the impact on demand is more than the cost effect.

There are numerous empirical studies that have assessed the relationship between exchange rate variability and manufacturing sector performance. Azeez et al. (2012) find that oil revenue and balance of payment exert negative effects while exchange rate volatility contributes positively to GDP in the long run. Also, Ehinomen and Olodipo (2012) find that in Nigeria, exchange rate appreciation has a significant relationship with domestic output and will promote the growth of the manufacturing sector. Ubok-Udom (1999) examined the relationship between exchange rate changes and the growth of domestic output in the Nigerian economy from 1971 to 1995 and found that exchange changes have a negative sign in the estimated equations. He asserted that the rate of growth of total GDP and non-oil GDP tends to fall or rise with nominal Naira/US dollar exchange rate. This implies that the Nigerian economy apparently requires exchange rate appreciation for it to achieve high growth rate. Similarly, Ukoha (2000) carried out an empirical study of the determinants of capacity utilization in the Nigerian manufacturing industry between 1970 and 1998 and his results revealed that exchange rate had a positive effect on manufacturing capacity utilization. Again, Kandilov and Leblebicioğlu (2011) find a robust negative impact of exchange rate volatility on plant investment. Goldberg (1993) finds that a real depreciation (appreciation) of the U.S. dollar was likely to generate an expansion (reduction) in investment in the 1970s, but that the opposite pattern prevailed during the 1980s. Using an error correction methodology,

Landon and Smith (2009) estimated the aggregate and sector-level investment equations for a panel of 17 OECD countries. The authors found that real currency depreciation may reduce aggregate investment and investment of nine sectors in the short run. Furthermore, it causes reduction of aggregate investment in the long run.

However, Campa and Goldberg (1999) compare the investment sensitivity to exchange rate in the United States, United Kingdom, Japan, and Canada for the period 1970-1993, and find investment in Canada to be the least responsive to exchange rate movements.

The empirical evidence so far on the effects of currency adjustments on manufacturing sector performance is inconclusive and so country-specific studies are the best possible option to guide policy directions.

3. Methodology and Data Source

The objective of this study is to contribute to the relevant macroeconomic policy discourse more effectively by carrying out an empirical investigation of the effects of exchange rate variability on manufacturing sector performance in Ghana from 1986 to 2013. In order to achieve this research objective, the autoregressive distributed lag (ARDL) model is applied. Following Mmaduabuchi and Ifeanyi (2014), the basic model employed in this study is stated as follows:

$$\text{ManGDP}_t = \alpha_0 + \alpha_1 ExRate_t + \alpha_2 \text{IMP}_t + \alpha_3 FDI_t + \alpha_4 IR_t + \mu_t \tag{1}$$

Where ManGDP represents manufacturing as a percentage of gross domestic product (GDP), ManGDP is used here as a proxy for manufacturing sector performance. ExRate is the nominal exchange rate, IMP represents total imports and FDI is foreign direct investment, In line with existing studies on developing countries, nominal interest rate (IR) is included in the model (Mmaduabuchi & Ifeanyi, 2014; Caglayan & Torres, 2008). μ is the white noise error term.

Equation (1) is further expressed in a log-linear form and stated as follows:

$$\ln\text{ManGDP}_t = \alpha_0 + \alpha_1 lnExRate_t + \alpha_2 \ln\text{IMP}_t + \alpha_3 lnFDI_t + \alpha_4 lnIR_t + \mu_t \tag{2}$$

The log-linear model was chosen because of the following reasons: Firstly, to find the percentage change in the dependent variable resulting from percentage changes in the independent variables. Secondly, the use of log transformation is necessary because it compresses the scale in which the variables are measured, reducing a tenfold difference between two values to a twofold difference. This reduces the possibility of heteroskedasticity in the model (Gujarati, 1995).

Equation (2) is a long run equilibrium model which may form a cointegrating set if all the variables are cointegrated of order 1. Exchange rate is expected to have a positive effect on manufacturing sector performance. However, imports are expected to have a negative effect on manufacturing sector performance. FDI is expected to have a positive effect on manufacturing sector performance. Finally, interest rate is expected to have a negative effect

on manufacturing sector performance. Annual data from World development indicators of World Bank, (2014) was used for the analysis.

3.1 Variance Inflation Factor (VIF) Test

A VIF test was carried out to establish the existence of multicollinearity among all the explanatory variables in the model. According to Gujarati and Porter (2009), in cases of near or high multicollinearity, the ordinary least square (OLS) estimators have large variances and covariances, making precise estimation difficult.

3.2 Unit Root Test

To ensure that the series are stationary, a unit root test was carried out using the Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) tests. The PP test is, however, preferred to the traditional ADF test because of its use of non-parametric methods to adjust for serial correlation and endogeneity of regressors thereby preventing the loss of observations implied by the ADF test.

3.3 ARDL Model Specification

In order to investigate the long run relationship and dynamic interactions among the variables, the model is estimated using the autoregressive distributed lag (ARDL) approach to cointegration as developed by Pesaran et al. (2001). This approach allows the estimation of both short run and long run coefficients of a single equation. The coefficients of this approach are unrestricted and so the short run dynamics are not dictated by the long run equilibrium relationship. The ARDL approach has an advantage over other cointegration methods (such as the fully modifed OLS, dynamic OLS and Johansen, 1988) in that it performs better in small samples (Pesaran & Shin, 1999). Another advantage of the approach is that it works even when the underlying variables are integrated of order zero {I(0)} only, integrated of order one {I(1)} only or a mixture of I(0)/ I(1) (Pesaran & Shin, 1999). Cointegration methods such as the methods by Engle and Granger (1987), Johansen (1988) and Stock and Watson (1988) concentrate on cases in which the underlying variables are integrated of order one {I(1)} only (Pesaran, Shin & Smith, 2001).

Furthermore, the ARDL model is advantageous because it corrects for residual serial correlation and the problem of endogenous regressors by using the lags as instruments.

Following Pesaran et al. (2001), the vector autoregression (VAR) of order *p*, denoted VAR (*p*) is stated for the following manufacturing sector performance function:

$$Z_t = \beta_0 + \alpha_t + \sum_{i=1}^{p} \phi_i z_{t-i} + \varepsilon_t \qquad \text{t=1, 2, 3, 4, … T} \qquad (3)$$

Where Z_t is a vector of m_t and x_t. m_t is the dependent variable and represents manufacturing sector performance. x_t is the vector matrix and represents a set of explanatory variables while t is a time or trend variable. β_0 represents (k+1)–a vector of intercept (drift) and α_t represents (k+1)–a vector of trend coefficients.

The vector error correction model (VECM) of the series can be specified as follows:

$$\Delta z_t = \mu + \beta_0 + \rho z_{t-i} + \sum_{i=1}^{p-i} \gamma_i \Delta m_{t-i} + \sum_{i=1}^{p-i} \gamma_i \Delta x_{t-i} + \varepsilon_t \quad \text{t=1, 2, 3, 4, … T} \quad (4)$$

Where Δ is the difference operator and the long run multiplier matrix is stated as follows:

$$\rho = \begin{bmatrix} \rho mm & \rho mx \\ \rho xm & \rho xx \end{bmatrix}$$

The diagonal elements of the matrix are unrestricted. Thus, the selected series can be either I(0) or I(1). If $\rho mm = 0$, then $m = $I(1). On the other hand, if $\rho mm < 0$, then $m = I(0)$. The VECM procedures are imperative in the testing of at most one cointegrating vector between the dependent variable m_t and a set of regressors x_t. After the restrictions $\rho mm = 0$, $\mu \neq 0$, and $\alpha = 0$ are imposed, the effect of exchange rate variability on manufacturing sector performance can be stated as the following unrestricted error correction model (UECM):

$$\Delta(\text{lnManGDP})_t = \beta_0 + \beta_1(\text{lnManGDP})_{t-i} + \beta_2(\text{lnExRate})_{t-i} + \beta_3(\text{lnIMP})_{t-i} + \beta_4(\text{lnFDI})_{t-i} + \beta_5(\text{lnIR})_{t-i}$$

$$+ \sum_{i=1}^{p} \beta_{1i}\Delta(\text{lnManGDP})_{t-i} + \sum_{j=1}^{q} \beta_{2j}\Delta(\text{lnExRate})_{t-j} + \sum_{k=1}^{q} \beta_{3k}\Delta(\text{lnIMP})_{t-k} + \quad (5)$$

$$\sum_{m=1}^{q} \beta_{4m}\Delta(\text{lnFDI})_{t-m} + \sum_{n=1}^{q} \beta_{5n}\Delta(\text{lnIR})_{t-n} + \mu_t$$

Where Δ still represents the first difference operator and μ_t is the white noise disturbance term. Equation (5) shows that manufacturing sector performance is influenced and explained by its past values. In addition, the F-Wald test was done so as to differentiate the long run relationship between the concerned variables by imposing restrictions on the estimated long run coefficients of the manufacturing as a percentage of GDP, exchange rate, imports, FDI and interest rate. The null and alternative hypotheses are stated as follows: $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ against the alternative hypothesis, $H_a : \beta_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$

The test which normalizes on $ManGDP$ is denoted by

$$F_{ManGDP}(ManGDP \mid \text{ExRate, IMP, FDI, IR})$$

In the ARDL approach, two asymptotic critical values 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. When the F-statistic is greater than the upper critical value, it implies that the null hypothesis of no long-run relationship is rejected regardless of the orders of integration for the time series. This implies that there is long run relationship among the series. If the F-statistic is less than the lower critical value, we fail to reject the null hypothesis and this implies that there is no long-run relationship among the series. Lastly, if the F-statistic falls between the lower and the upper critical values, the result is inconclusive.

When cointegration is established, the conditional ARDL (*p, q1, q2, q3, q4*), the long-run

model for $ManGDP_t$ is estimated as follows:

$$\ln\text{ManGDP}_t = \beta_0 + \sum_{i=1}^{p}\beta_1\ln\text{ManGDP}_{t-1} + \sum_{i=0}^{q1}\beta_2\ln\text{ExRate}_{t-1} + \sum_{i=0}^{q2}\beta_3\ln\text{IMP}_{t-1} + \sum_{i=0}^{q3}\beta_4\ln\text{FDI}_{t-1} + $$

$$\sum_{i=0}^{q4}\beta_5\ln\text{IR}_{t-1} + \mu_t \tag{6}$$

It involves selecting the optimal lag length of the ARDL (*p, q1, q2, q3,q4*) model in the four variables using the Akaike Information Criterion (AIC).

Finally, an Error Correction Model (ECM) estimates are obtained. The ECM provides the means of reconciling the short-run behaviour of an economic variable with its long-run behavior. The ECM representation of the series is specified as follows:

$$\Delta\ln\text{ManGDP}_t = \beta_0 + \sum_{i=1}^{p}\beta_{1i}\Delta\ln\text{ManGDP}_{t-1} + \sum_{i=0}^{q1}\beta_{2j}\Delta\ln\text{ExRate}_{t-1} + $$

$$\sum_{i=0}^{q2}\beta_{3k}\Delta\ln\text{IMP}_{t-1} + \sum_{i=0}^{q3}\beta_{4m}\Delta\ln\text{FDI}_{t-1} + \sum_{i=0}^{q4}\beta_{5n}\Delta\ln\text{IR}_{t-1} + \varphi ECM_{t-1} + \mu_t \tag{7}$$

Where φ is the speed of adjustment parameter and the *ECM* is the error correction term. The coefficient φ is expected to be negative and statistically significant to further confirm that a cointegrated relationship exists.

4. Empirical Analysis

Before estimating the model, the unit root and cointegration tests were analysed. Regressions with non-stationary data have a high potential of leading to spurious relationship. The PP and ADF tests were therefore conducted in order to establish stationarity in the series. The results are presented in Table 1.

Table 1. Unit root test

Variable	PP Test		ADF Test	
	Levels	1st Difference	Levels	1st Difference
LnManGDP	0.783	-4.078***	0.771	-4.101***
LnExRate	-3.031	-4.147***	-3.215	-4.083***
LnFDI	-1.047	-4.571***	-1.044	-4.595***
LnIMP	0.829	-4.749***	0.757	-4.757***
LnIR	-1.149	-5.501***	-1.165	-5.492***

Note. Unit root tests were performed in Stata 13. ***, **, * indicate the rejection of the null hypothesis of unit root at 1%, 5% and 10% level of statistical significance respectively.

As it can be seen from table 1, at levels, none of the variables was stationary which implies

that the null hypothesis of unit root is accepted. However, after taking the first difference, all the variables became stationary.

4.1 Results of the ARDL Test for Cointegration

The conditional VECM by ordinary least square was estimated in order to test for the presence of long run relationship among the variables. Thus, an F-test was conducted for the joint significance of the coefficients of the variables. The results of the computed F-statistic when each variable is normalised (that is, considered as a dependent variable) in the ARDL–OLS regressions are presented in Table 2.

Table 2. Testing for existence of cointegration among the variables in the ARDL model

F-Statistic	99% Lower Bound	99% Upper Bound	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
5.500	3.74	5.06	2.86	4.01	2.45	3.52

Results were obtained from Stata 13.0.

Note. *Critical values based are on Narayan (2004).

The F-test for the joint significance of the lagged level variables is conducted by appealing to the Wald test. The 1% lower and upper bound critical values provided by Narayan (2004) are 3.74 and 5.06. The calculated F-statistic shows that there exists long-run relationship among the variables because the test value of 5.500 is above the upper bound critical value.

Table 3. Estimated long run coefficients using the ARDL Approach ARDL(1,0,1,1,2) selected based on Akaike information criterion

Dependent variable is lnManGDP 26 observations used for estimation from 1988 to 2013				
	Regressor Coefficient	Standard Error	T-Ratio	Prob
LnExRate	0.12082***	0.036183	3.3391	0.004
LnIMP	-.30957**	0.11653	-2.6566	0.017
lnFDI	-0.012453	0.040470	-0.30771	0.762
lnIR	0.17474	0.11383	1.5351	0.144
C	8.8143	2.2932	3.8437	0.001

Note. ***, **, and * denote the rejection of the null hypotheses at 1%, 5% and 10% levels of significance. Results were obtained from Microfit 5.0.

The results from Table 3 show that the effect of exchange rate on manufacturing sector performance is positive and statistically significant at 1%. The estimates indicate that all other factors held constant, in the long run, a 1 percent increase in exchange rate will lead to

an increase in manufacturing sector performance by 0.12 percent. This is so because as the exchange rate increases, the manufacturing sector is motivated to contribute more to the GDP. This result is consistent with Edwards (1989), Innocent et al. (2013) and Clement (2014). A coefficient of approximately -0.30957 for imports means that all other things being equal, in the long run a 1 percent increase in imports will lead to a decrease in manufacturing sector performance by about 0.31% and this is statistically significant at 5%. The implication of this result is that a greater portion of manufacturers' inputs are imported and so as imports increase, the contribution of the manufacturing sector to GDP reduces. Again, a coefficient of -0.012453 for FDI implies that *ceteris paribus*, a 1 percent increase in FDI will lead to a decrease in manufacturing sector's contribution to GDP by about 0.013 percent but this is not significant. Finally, in the long run, an increase in interest rate by 1% will lead to an increase in manufacturing sector performance by about 0.17% holding other factors constant.This result is also insignificant.

Table 4. Diagnostic tests results

Test Statistic	LM VERSION	F VERSION
A. Serial Correlation	CHSQ(1) =0.96151[0.327]	F(1, 15)= 0.57623[0.350]
B. Functional Form	CHSQ(1) =5.5301[0.112]	F(1, 15)= 1.9540[.132]
C. Normality	CHSQ(2) =0.087555[.957]	Not applicable
D:Heteroskedasticity	CHSQ(1) = 2.4839[0.115]	F(1, 24)= 2.5350[0.124]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

The results of the diagnostic tests in table 4 indicate that the model has the aspiration of econometric properties. They show that the model has no serial correlation and heteroskedasticity. The model has a correct functional form and normality assumption is also satisfied.

Table 5. VIF test

Variable	VIF	1/VIF
lnIMP	20.29	0.049296
lnFDI	11.14	0.089773
lnExRate	6.10	0.164066
lnIR	2.58	0.387360
Mean VIF	10.03	

In Table 5, it is seen clearly that even though some of the variables have a high VIF, the key variable, lnExRate shows a VIF of 6.10 which is acceptable. Multicollinearity can therefore be safely ignored. The "do nothing" school of thought expressed by Blanchard (1967) states

that "multicollinearity is essentially a data deficiency problem and sometimes we have no choice over the data we have available for empirical analysis (Gujarati & Porter, 2009).

Table 6. Error correction representation for the selected ARDL model ARDL(1,0,1,1,2) selected based on Akaike information criterion

Dependent variable is dlnMANGDP 26 observations used for estimation from 1988 to 2013				
	Regressor Coefficient	Standard Error	T-Ratio	Prob
ΔlnExRate	0.052909	0.02054	2.57581**	0.019
ΔlnIMP	-0.011463	0.074188	-0.15451	0.879
ΔlnFDI	0.054647	0.119646	2.7815**	0.012
ΔlnIR	0 .33010	0.053764	0.61399	0.547
ΔlnIR_1	-0.12037	0.548891	-2.4620**	0.024
CONSTANT	3.8599	1.5736	2.4529	0.024
Ecm(-1)	-0.43791	0.13177	-3.33234	0.004
ecm = LNMANGDP -.12082*LNEXRATE + .30957*LNIMP + .012453*LNFDI -.17474*LNIR -8.8143*C				
R-Squared	0 .67519	R-Bar-Squared	0 .49249	
S.E. of Regression	0.042973	F-stat.	F(6, 19) = 5.5434[.002]	
Mean of Dependent Variable	-0.20707	S.D. of Dependent Variable	0.660322	
Residual Sum of Squares	0.042973	Equation Log-likelihood	41.0320	
Akaike Info. Criterion	41.2457	Schwarz Bayesian Criterion	34.9552	
DW-statistic		2.3133		

Note. *** and ** denote the rejection of the null hypotheses at 1% and 5% levels of significance respectively.

The adjusted R-squared value of 0.49 indicates that about 49% of the changes in manufacturing sector performance are explained by changes in the independent variables. The regression model is said to be significant at 1% following the F-statistic of 5.54. The empirical findings from the error-correction model show that manufacturing sector performance adjusts towards long run equilibrium at the speed of about 44%. A coefficient of 0.053 for exchange rate indicates that all other factors remaining constant, in the short-run, a 1 percent increase in the exchange rate will lead to an increase in manufacturing sector performance by 0.053 percent and statistically significant at 5%. This is so because as the Ghana Cedi appreciates in value, the manufacturing sector is motivated to produce more thereby increasing its contribution to the GDP. A coefficient of approximately -0.011463 for imports means that in the short run, a 1 percent increase in imports will lead to a decrease in manufacturing sector performance by about 0.01% all other factors remaining the same. This result, however, is statistically insignificant. Again, the results show that in the short run, a 1 percent increase in FDI will lead to an increase in manufacturing sector performance by about 0.055 percent all other factors being equal and this is statistically significant at 5%. Finally, in the short run, interest rate has a negative influence on manufacturing sector performance and statistically significant at 5% level. The results show that all things being equal, in the short

run, a 1 percent increase in interest rate (one year lag) will lead to a decrease in manufacturing sector performance by about 0.12 percent.
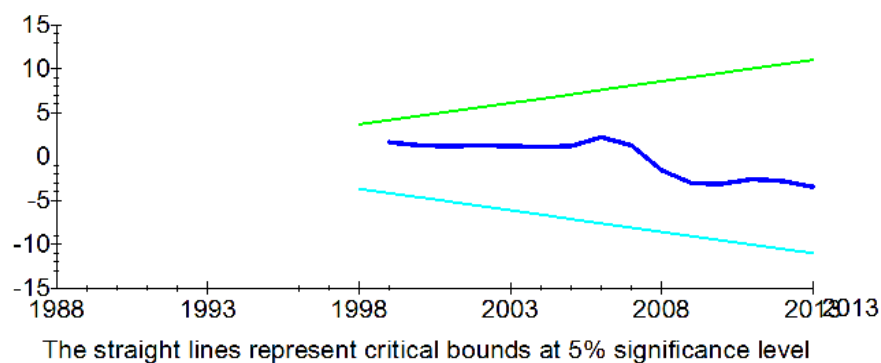

Figure 1. Plot of cumulative sum of recursive residuals (CUSUM)
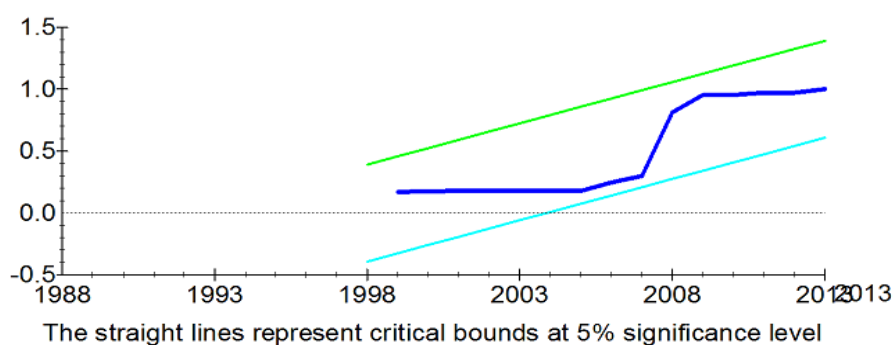
Source: Author, 2016.

Figure 2. Plot of cumulative sum of squares of recursive residuals (CUSUMSQ)

Source: Author, 2016.

Figures 1 and 2 show a graphical representation of the Cumulative Sum (CUSUM) and Cumulative Sum of Square (CUSUMSQ) plots applied to the error correction model. Both plots are within the critical bounds and so we can conclude that the model is structurally stable.

5. Conclusion

The study investigated the cointegrating relationships among manufacturing sector performance, exchange rate, imports, FDI and interest rate using the ARDL approach. With the rising importance of the manufacturing sector in the growth and development process, the study investigates whether the sector's contribution to GDP is affected by disturbances emanating from the foreign exchange market. The results from the error-correction model

show that in Ghana, manufacturing sector performance adjusts slowly to its equilibrium. However, empirical findings show that in the long- run, the growth of the manufacturing sector is positively related to exchange rate but negatively related to imports. The findings of this study are generally supportive of the contention of other researchers (Innocent et al., 2013; Opaluwa et al., 2010) that exchange rate has a significant effect on manufacturing sector performance.

6. Policy Recommendation

It is recommended that the government should put in place policy to regulate the importation of goods that could otherwise be produced locally so as that the performance of the manufacturing sector could improve. Additionally, problems such as irregular supply of electricity and water, poor roads, high interest rates should be addressed so as to boost manufacturing sector output. Finally, the government should develop and implement exchange rate policies that are aimed at minimizing currency fluctuations in the country. These policies would insulate manufacturing sector performance from the adverse effects of this exchange rate variability in Ghana.

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