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The effects of exchange rate volatility on foreign trade in Ghana

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Abstract. This paper examined the effect of real exchange rate volatility on the growth of export and import in Ghana. A monthly data was used. All the variables were cointegrated and vector error-correction model was used. It was found that, in the long-run, depreciation of real exchange rate, increase in volatility and increase in output growth were significant factors that increased the growth of export. Also, decrease in real exchange rate volatility and increase in industrial output growth were significant factors that can reduced the growth of import. However, in the short run, depreciation of real exchange rate and reduction in real exchange rate volatility were significant factors that can increase the growth of export. Also, depreciation of real exchange rate and reduction in real exchange rate volatility were significant factors that can decrease the growth of import. Finally, considering the directional causality, the current values of growth of export is determined by the past values of real exchange rate volatility Therefore, it was recommended that government policies that stabilized real exchange rate and reduce its volatility are to be encouraged to facilitate the growth of export and discourage the growth of import in Ghana.
Keywords. Real exchange rate volatility, Import, Export, VECM, Cointegration.
JEL. E40, E50, E60.

1. Introduction

Since the collapse of Bretton Woods agreement, most countries all over the world had started using floating exchange rate system against other countries' currencies by early 1973. According to Frankel & Rose (1995) monetary approach was the main technique used in determining the exchange rates which assumed that continuous holding of purchasing power parity exchange rate. According to Mohsen & Hegerty (2007) economists began to have conflicting views about the effects of exchange rate volatility on the foreign trade. Among the economists, there is no consensus about the effect of exchange rate volatility on foreign trade in both theoretical and empirical perspectives. There were diverse standpoints some of these are: exchange rate has no relation with trade growth, secondly, that uncertainty of exchange rate presents a risk in case of foreign trade which enthralls some risk to exporters and so exchange rate affects trade growth adversely (Ethier, 1973). Finally, others disputed on the point that although there is a relation between exchange rate uncertainty and trade growth but the relation is nonlinear (Herwartz, 2003).

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Based on both theoretical and empirical studies this paper seeks to examine the effect of real effective exchange rate volatility on growth of import and export trade in Ghana. The government policies of 'one village one factory' will encourage production of goods which may serve as import substitute and some for export business. The investors who investing in these projects may not know how the exchange rate volatility will affect their business. Therefore, this study will help individuals, firms, investors and Government in import and export business and also established the relationship between real effective exchange rate volatility and the growth of import and export in Ghana. The findings from this study will be an eye opener for monetary policy authority to pay critical attention to the volatility in cedi and its effect on foreign trade.

Generally, the purpose of this study is to find out how real effective exchange rate and its volatility affectsforeign trade in Ghana. In specific terms, the main objectives are to determine the effect of real effective exchange rate and its volatility on the growth ofexport and import in Ghana. Also, determines Granger causality between real effective exchange rate, its volatility and growth of exportand import.

The following hypothesis will be tested:

H_0: Real effective exchange rateor its volatility has nosignificant effect on the growth of export.

H_0: Real effective exchange rate or its volatility hasno significant effect on the growth of import.

H_0: Real effective exchange rate or its volatility does not Granger caused the growth of export.

H_0: Real effective exchange rate or its volatility does not Granger caused the growth of import.

Time series properties of the variables will be checked; unit root test, Johansen's cointegration test also will be carried out to determine whether the variables are cointegrated or not. Based on the results it will be determine whether Vector Autoregressive or Vector Error Correction model will be appropriate for analyzing the effect of real effective exchange rate and its volatility on foreign trade in Ghana. The rest of the paper will be organized under the following headings; related literature, methodology, result and discussion, conclusion and policy recommendation(s).

2. Related literature

2.1. Theoretical relationship between exchange rate volatility and trade

According to economic theory, the depreciation of a country's currency will be beneficial to itsexport as the price of the exported goods become relatively lower in the international market. On the other hand, the price of the imported goods become relatively high making imported goods

expensive; these according to Yulu (2008) affect the foreign trade of a country. However, different countries have different economic conditions, so the depreciation or appreciation of currency of a specific country may have different effects on its import and export trade.

The relationship between exchange rate volatility and trade was illustrated with a simple model by Clark (1973) as follows. According to the author, a competitive firm with no market power producing only one commodity which is sold entirely to one foreign market, does not import any intermediate inputs and no hedging possibilities, such as through forward sales of the foreign currency export sales were assumed. The firm is paid in foreign currency and converts the proceeds of its exports at the current exchange rate which varies in an unpredictable fashion. Moreover, because of costs in adjusting the scale of production, the firm makes its production decision in advance of the realization of the exchange rate and as a result cannot alter its output in response to favorable or unfavorable shifts in the profitability of its exports arising from movements in the exchange rate. Then it was postulated that, the variability in the firm's profits arises solely from the exchange rate and where the managers of the firm are adversely affected by risk, greater volatility in the exchange rate, with no change in its average level, leads to a reduction in output and hence in exports in order to reduce the exposure to risk. This showed that exchange rate volatility and export are negatively related. This result was also confirmed by Hooper & Kohlhagen (1978) who reach the same conclusion of a clear negative relationship between exchange rate volatility and the level of trade.

However, this conclusion depends on some simplified assumptions such as no hedging possibilities either through the forward exchange market or through offsetting transactions. But in advanced economies where there are well developed forward markets, specific transactions can be easily hedged, thus reducing exposure to unforeseen movements in exchange rates. However, such markets do not exist for the currencies of most developing countries. Moreover, there are numerous possibilities for reducing exposure to the risk of adverse exchange rate fluctuations other than forward currency markets. The key point is that for a multinational firm engaged in a wide variety of trade and financial transactions across a large number of countries, there are manifold opportunities to exploit offsetting movements in currencies and other variables. As a result, if exports are priced in a foreign currency that is depreciating, the loss to the exporter from the declining exchange rate is at least partly offset by the higher foreign-currency export price (Cushman, 1983 and 1986). Also, if an exporter imports intermediate inputs from a country whose currency is depreciating there will be some offset to declining export revenue in the form of lower input costs. In addition, when a firm trades with a large number of countries, the tendency for some exchange rates to move in offsetting directions will provide a degree of protection to its overall exposure to currency risk. Finally, Makin (1978) analyzed from a finance

perspective suggests that there are many possibilities for a multinational corporation to hedge foreign currency risks arising from exports and imports by holding a portfolio of assets and liabilities in different currencies.

One reason why trade may be adversely affected by exchange rate volatility stems from the assumption that the firm cannot alter factor inputs in order to adjust optimally to take account of movements in exchange rates. When this assumption is relaxed and firms can adjust one or more factors of production in response to movements in exchange rates, increased variability can in fact create profit opportunities. This situation had been analyzed by (Canzoneri, *et al.*, 1984; De Grauwe, 1992; and Gros, 1987). The effect of such volatility depends on the interaction of two forces at work. On the one hand, if the firm can adjust inputs to both high and low prices, its expected profits will be larger with greater exchange rate variability, as it will sell more when the price is high, and vice versa. On the other hand, to the extent that there is risk aversion, the higher variance of profits has an adverse effect on the firm and constitutes a disincentive to produce and to export. If risk aversion is relatively low, the positive effect of greater price variability on expected profits outweighs the negative impact of the higher variability of profits, and the firm will raise the average capital stock and the level of output and exports.

Another aspect of the relationship between trade and exchange rate volatility that needs to be mentioned is the role of "sunk costs." Most of the international trade consists of differentiated manufactured products that required significant investment by the producing firms to adapt their products to foreign markets. These sunk costs would tend to make firms less responsive to short-run movements in the exchange rate because the firms would tend to adopt attitude of "wait and see" method and remain in the export market as long as their variable costs can be recovered and wait for a turnaround in the exchange rate so that their sunk costs can be recouped.

So far, the effect of volatility on trade has been within a partial equilibrium framework; that is the only variable that changes is some measure of the variability of the exchange rate and all other factors that may have an influence on the level of trade are assumed to be constant. However, those developments that are generating the exchange rate movements are likely to affect other aspects of the economic environment which will in turn have an effect on trade flows. Thus, it is important to take into account in a general equilibrium framework the interaction of all the major macroeconomic variables to get a more complete picture of the relationship between exchange rate variability and trade. Bacchetta & Van Wincoop (2000) provided this analysis of general equilibrium framework. In this model, a simple, two-country, general equilibrium model where uncertainty arises from monetary, fiscal, and technology shocks and they were compared with trade level and welfare for fixed and floating exchange rate arrangements. It was concluded that first, there is no clear

relationship between the level of trade and the type of exchange rate arrangement. Depending on the preferences of consumers regarding the tradeoff between consumption and leisure, as well as the monetary policy rules followed in each system, trade can be higher or lower under either exchange rate arrangement. As an example of the ambiguity of the relationship between volatility and trade in a general equilibrium environment, a monetary expansion in the foreign country would depreciate its exchange rate, causing it to reduce its imports, but the increased demand generated by the monetary expansion could offset part or all of the exchange rate effect. Second, the level of trade does not provide a good index of the level of welfare in a country, and thus there is no one-to-one relationship between levels of trade and welfare in comparing exchange rate systems. Koren & Szeidl (2003) develop a model which brings out clearly the interactions among macroeconomic variables. It was shown that what matters is not the unconditional volatility of the exchange rate as a proxy for risk, as used in many empirical papers in the literature, but rather that exchange rate uncertainty should influence trade volumes and prices through the covariances of the exchange rate with the other key variables in the model. In this general equilibrium context, it was stressed that it is not uncertainty per se in the exchange rate that matters, but rather whether this uncertainty magnifies or reduces the firm's other risks on the cost and demand side, and ultimately whether it exacerbates or moderates the risk faced by consumers.

2.2. Empirical results on the relationship between exchange rate volatility and trade

The empirical work on the effect of exchange rate volatility and trade surveyed showed inconsistency in results. Some of the recent works and relevant to this study are reviewed below.

Hooper & Kohlhagen (1978) examined the impact of exchange rate volatility on aggregate and bilateral trade flow data for all G-7 countries except Italy. In this study, exchange rate risk was measured by the average absolute difference between the current period spot exchange rate and the forward rate last period, as well as the variance of the nominal spot rate and the current forward rate. The result did not show any evidence of negative effect of volatility on trade.

Cushman (1983) examined the impact of exchange rate volatility on aggregate and bilateral trade flow data and used real exchange rates as opposed to nominal. Of fourteen sets of bilateral trade flows between industrial countries, it was found that in six cases there was negative and significant effect of volatility on trade.

Bailey, *et al*, (1986) examined the theoretical relationship between exchange-rate volatility and export growth and tested for the empirical impact of such volatility on real export growth of 11 OECD countries. It was argued that, theoretically, exchange rate volatility can impact on trade in either direction; positive or negative. Empirical results were provided for

the managed-rate and flexible-rate periods. Both nominal and real measures of exchange rates were used in two specifications of volatility: absolute percentage changes and standard deviations. Of 33 regressions estimated, only three support the hypothesis that exchange-rate volatility impedes export performance.

Mckenzie (1998), analyzed the impact of exchange rate volatility on trade flows in Australian. ARCH models were used to generate the measure of exchange rate volatility which is then tested in a model of Australian imports and exports. This paper gave special attention to the export and import trade data using aggregate trade data to test for the effects of volatility, also, it used disaggregate sectoral trade data. Testing sectoral trade data gave room to detect whether the direction or magnitude of the impact of volatility differs depending on the nature of the market in which the goods are traded. The results obtained suggested that the impact of exchange rate volatility does differ between traded good sectors; although it remains difficult to firmly establish the nature of the relationship.

Dell'Ariccia (1999) provided a systematic analysis of the effect exchange rate volatility on the bilateral trade of the 15 EU members and Switzerland over the 20 years from 1975 to 1994, using four different measures of exchange rate uncertainty: the standard deviation of the first difference of the logarithm of the monthly bilateral nominal and real (CPI) exchange rate, the sum of the squares of the forward errors, and the percentage difference between the maximum and the minimum of the nominal spot rate. In the basic regressions, exchange rate volatility has a small but significantly negative impact on trade. Also, the simultaneity bias that can result from central banks trying to stabilize their exchange rates with their main trading partners was taken into consideration. An instrumental variable (the sum of squares of the three-month logarithmic forward error) was used for the measures of exchange rate volatility to account for possible endogeneity in this variable. The results confirm the negative relationship between volatility and trade. In addition, both fixed effects and random effects estimation methods to account for the simultaneity bias were used. In this case, the effect is still significant, but the magnitude is much smaller.

Rose (2000) employed the gravity approach and used a very large data set involving 186 countries for the five years 1970, 1975, 1980, 1985, and 1990. The main objective was to measure the effect of currency unions on members' trade, also used the model to test for the effects of exchange rate volatility on trade. The primary measure of volatility used was the standard deviation of the first difference of the monthly logarithm of the bilateral nominal exchange rate, which is computed over the five years preceding the year of estimation. In the benchmark results using the pooled data, the result showed a small but significant negative effect. Also, random effect model was used and it showed that the magnitude of the

effect of volatility on trade is reduced to about a third of the benchmark estimate.

Arize, *et al*, (2000) investigated the impact of real exchange-rate volatility on the export flows of 13 less developed countries (LDC's) over the quarterly period 1973-1996. Estimates of the cointegrating relations using Johansen's multivariate procedure, the short-run dynamics for each country using the error-correction technique were obtained. The results showed that increases in the volatility of the real effective exchange rate exert a significant negative effect on export demand in both the short-run and the long-run in each of the 13 LDC's.

Vergil (2002) investigated the impact of real exchange rate volatility on the export flows of Turkey to the United States and its three major trading partners in the European Union for the period 1990:1-2000:12. The standard deviation of the percentage change in the real exchange rate was employed to measure the exchange rate volatility. Cointegration and error-correction models are used to obtain the estimates of the cointegrating relations and the short-run dynamics, respectively. The results obtained, provide evidence that the real exchange rate volatility has a significant negative effect on real exports.

Srinivasan & Kalaivani (2012) investigated the impact of exchange rate volatility on the real exports in India using the ARDL bounds testing procedure. Annual time series data from1970 to 2011 was used. From the test real exports, exchange rate volatility, real exchange rate, gross domestic product and foreign economic activity were cointegrated. The result showed that exchange rate volatility has significant negative impact on real exports both in the short-run and long-run, implying that higher exchange rate fluctuation tends to reduce real exports in India. Also, the real exchange rate has negative short-run and positive long-run effects on real exports.

In conclusion, from theoretical and empirical perspective the effect of exchange rate volatility on import or export is far from being conclusive. Depending on the type of the economy the effect may be negative or positive. But the question of 'the effect of exchange rate volatility on foreign trade in Ghana' has no empirical answer. So this paper empirically, examined the effect of real effective exchange rate volatility on foreign trade in Ghana. This will also contribute immensely to the developmental policies in Ghana. Also, among the method used in measuringexchange rate volatility this study adopted current on which used the ARCH models to estimate the volatility.

3. Methodology

This study used monthly data from Bank of Ghana and annual data from World Development Indicators from January 2000 to December 2016. The export, import and industrial output data were convertedfrom annual frequency to monthly data using Eviews frequency convection so that the monthly effect ofexchange rate volatility on growth of export and growth

of import can be analyzed. The stationarity of all the variables and cointegration properties will be checked.This study will use a vector autoregressive (VAR) or vector error-correction model (VECM) to analyze the effect of exchange rate volatility on growth of export and import.Let the growth of export (X_t) or growth of import (M_t), real effective exchange rate (exc_t) and its volatility ($vola_t$) and growth of industrial output (Q_t) be represented byVAR as;

$$X_t = a_0 + \sum_{i=2}^{p} a_i X_{t-i} + \sum_{j=1}^{p} a_j EXC_{t-j} + \sum_{k=1}^{p} a_k VOLA_{t-k} + \sum_{l=1}^{p} a_l Q_{t-l} + \varepsilon_{Xt} \quad (1)$$

and

$$M_t = b_0 + \sum_{i=2}^{q} b_i M_{t-i} + \sum_{j=1}^{q} b_j EXC_{t-j} + \sum_{k=1}^{q} b_k VOLA_{t-k} + \sum_{l=1}^{q} b_l Q_{t-l} + \varepsilon_{Xt} \text{ m} \quad (2)$$

where p and q are optimal lag for the growth of export and import models, respectively; a and b are parameters; a_i, a_j, a_k, and a_l are coefficients of the respective variables in export modelwhile b_i, b_j, b_k, and b_l are coefficients of the respective variables in import model.

Then, the dynamics of X_t or M_t can be represented in a VECM of the form as;

$$\Delta X_t = \nu + \Pi X_{t-1} + \sum_{i=1}^{p-1} \Phi_i \Delta X_{t-i} + \varepsilon_{Xt} \quad (3)$$

and

$$\Delta M_t = \nu + \Pi M_{t-1} + \sum_{i=1}^{p-1} \Phi_i \Delta M_{t-i} + \varepsilon_{Mt} \quad (4)$$

Where Δ is the difference operator; $\prod = \alpha\beta'$ is a long run matrix of growth of export or import, real exchange rate, volatility and growth of industrial output;$\alpha$is a vector of speed at which real exchange rate, volatilityand growth of industrial output adjust togrowth of export or importto restore a long run equilibrium in the system; β is a matrix of cointegration vectors among growth of export or import, real exchange rate, volatility andgrowth of industrial output; Φ_i are the short run response matricesamong growth of export or import, real exchange rate, volatility and growth of industrial output; ε_t is a vector of structural disturbances with nonsingular variance and p is the optimal lag length.

3.1. Variables

Nominal effective exchange rate is the rate of the Ghanaian currencies against a weighted composite basket of Ghana's trading partners' currencies. Real exchange rate is expressed as the nominal effective exchange rate adjusted for inflation. Real exchange rate depreciation is expected to have positive effect on export because depreciate of exchange rate has atendency to encourage exports and make it more competitive in

the international market. Also, it is expected to have negative effect on import as exchange rate depreciation will make import more expensive in the domestic market.

Exchange rate volatility is the short run fluctuations of the real exchange rate, thus affecting the profitability of a foreign trade. Exchange rate volatility is expected to have either negative or positive effect on both import and export. Real exchange rate volatility represented by *vola* was obtained from the GARCH(1,1) using the returns on the real exchange rate: the GARCH(1,1) with the assumption of error from mean equation having student-t distribution with fixed degree of freedom. This estimate passed the test of serial correlation, autocorrelation and it had the minimum AIC as compared to the assumptions of normal and generalized error distributions. The growth of export, growth of import, real exchange rate and growth of industrial output were computed as follows:

The growth of export, $X_t = \frac{\text{export}_t - \text{export}_{t-1}}{\text{export}_t}$, (5)

The growth of import, $M_t = \frac{\text{import}_t - \text{import}_{t-1}}{\text{import}_t}$, (6)

The growth of industrial output, $Q_t = \frac{\text{ind.output}_t - \text{ind.output}_{t-1}}{\text{ind.output}_t}$, (7)

The real exchange rate, $EXC_i = NEXC_t * \frac{CPI_{USt}}{CPI_{GHt}}$, (8)

where$NEXC_t$, CPI_{USt} and CPI_{GHt} are nominaleffective exchange rate GHC/USD, consumer price index of USA and that of Ghana, respectively.

3.2. Granger causality test

The directions of the relationships between the variables will be tested using Granger causality test, Granger (1996). This will be used to examine the linear causation between the concerned variables. The test is based on the model specified below as;

$$Y_t = \alpha_0 + \sum_{j=1}^{m} \beta_i Y_{t-j} + \sum_{i=1}^{n} \delta X_{t-i} + \mu_t, \quad (9)$$

If X_t Granger causes Y_t, then the current values of Y_t are determined by past values of X_{t-1}. The test of H_0: $\delta_i = 0$, is carried out using the F- test.

4. Result and discussion

The summary statistics of growth of export and import, real exchange rate, volatilityand growth of industrial output as proxy for output growth are shown intable 1 below. From the table, over the period under

consideration the averagegrowth of export was 0.7 percent and that of import was 0.4 percent, real exchange rate depreciated about 152.5 percent, volatility was 3.29 percentand growth of industrial output was 0.01 percent. Considering the symmetric properties, apart from the growth of import all the variables are positively skewed. From the Jarque-Bera statistics with the corresponding probabilities all the variables are not normally distributed. However, if the variables are stationary in level or first difference the multivariate time series technique will be used.

Table 1. *Summary statistics of the variables under consideration*

	GX	M	EXC	VOLA	Q
Mean	0.007809	0.004111	1.525350	0.032887	0.000131
Median	0.001863	0.007873	1.058573	0.000453	-0.00087
Maximum	0.120984	0.077815	11.37183	1.692987	0.094217
Minimum	-0.10272	-0.10083	0.114943	0.000165	-0.07691
Std. Dev.	0.047543	0.036514	1.190947	0.164891	0.031123
Skewness	0.115810	-0.99471	2.988045	7.243195	0.768849
Kurtosis	3.944989	5.247054	23.98645	62.28722	7.254344
Jarque-Bera	8.046541	76.55998	4047.231	31661.05	173.9436
Probability	0.017894	0.000000	0.000000	0.000000	0.000000
Sum	1.593137	0.838699	311.1715	6.708970	0.026726
Sum Sq. Dev.	0.458851	0.270661	287.9262	5.519385	0.196629
Observations	204	204	204	204	204

Notes: The entries in this table are calculated at the monthly level.
Source: *WDI,* Bank of Ghana, 2000:1 – 2016:12.

4.1. Unit root test

The stationarity of the variables was checked using Augmented Dicken-Fuller Unit Root Test and the result is shown in table 2 below. From the table, all the variables; growth of export and import, real exchange rate, volatilityand growth of industrial outputwerestationary in level. Therefore, all the variables are integrated of order zero, I(0).

Table 2. *The results of augmented Dicken-Fuller test for unit root*

	None			Constant			Const. and Trend		
Variables	t-stat	Prob	concl	t-stat	Prob	concl	t-stat	Prob	concl
Real exchange rate (exc)	-2.3716	0.0173	I(0)	-3.341	0.0139	I(0)	-7.919	0	I(0)
Real exchange rate Volatility (vola	-3.2704	0.0012	I(0)	-3.3892	0.0125	I(0)	-3.524	0.0395	I(0)
Export growth (X)	-3.1653	0.0016	I(0)	-3.6199	0.0059	I(0)	-3.654	0.027	I(0)
Import growth (M)	-3.8397	0.0001	I(0)	-4.5392	0.0002	I(0)	-4.819	0.0005	I(0)
Industrial output growth (Q)	-3.7267	0.0002	I(0)	-3.921	0.0021	I(0)	-4.065	0.0078	I(0)

Notes: The entries in this table are calculated at the monthly level.
Source: *WDI,* Bank of Ghana, 2000:1 – 2016:12.

4.2. Optimal lag length criteria

Since the variables are not normally distributed but stationary, cointergration test will be carried out. The Unrestricted Vector Autoregressive, VAR, is used to determine the optimal lag length for the Johansencointegration test. Tables 3a and 3b below showed the result of the unrestricted VAR lag order selection criteria forthe growth of export or import, real exchange rate, volatilityand growth of industrial output. From

the table, the optimal lag length for both models was elevenbased on Akaikeinformation criterion (AIC).

Table 3a. *VAR lag order selection criteria for export model*

Endogenous variables: X EXC VOLA Q

Lag	LogL	LR	FPE	AIC	SC	HQ
1	1036.132	NA	2.85e-10	-10.62637	-10.35491	-10.51643
2	1106.204	134.3046	1.62e-10	-11.18962	-10.64671	-10.96974
3	1156.338	94.00180	1.14e-10	-11.54519	-10.73081	-11.21536
4	1163.348	12.85144	1.25e-10	-11.45154	-10.36571	-11.01177
5	1168.363	8.985935	1.41e-10	-11.33712	-9.979828	-10.78741
6	1193.118	43.32022	1.29e-10	-11.42831	-9.799562	-10.76865
7	1270.578	132.3273	6.80e-11	-12.06852	-10.16831	-11.29892
8	1300.872	50.49009	5.88e-11	-12.21741	-10.04575	-11.33787
9	1354.522	87.18133	4.00e-11	-12.60960	-10.16648	-11.62012
10	1607.492	400.5369	3.41e-12	-15.07805	-12.36347*	-13.97862*
11	1633.650	40.32712*	3.09e-12*	-15.18386*	-12.19782	-13.97449
12	1638.937	7.929768	3.49e-12	-15.07226	-11.81476	-13.75295

Notes: The entries in this table are calculated at the monthly level. * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

Source: *WDI,* Bank of Ghana, 2000:1 – 2016:12.

Table 3b. *VAR lag order selection criteria for import model*

Endogenous variables: M EXC VOLA Q

Lag	LogL	LR	FPE	AIC	SC	HQ
1	1067.416	NA	2.06e-10	-10.95224	-10.68079	-10.84230
2	1136.113	131.6693	1.19e-10	-11.50117	-10.95826	-11.28129
3	1185.603	92.79531	8.39e-11	-11.85004	-11.03566	-11.52021
4	1192.232	12.15299	9.26e-11	-11.75242	-10.66659	-11.31265
5	1195.732	6.270896	1.06e-10	-11.62221	-10.26492	-11.07250
6	1212.883	30.01311	1.05e-10	-11.63419	-10.00545	-10.97454
7	1276.827	109.2377	6.37e-11	-12.13361	-10.23341	-11.36401
8	1291.723	24.82733	6.47e-11	-12.12212	-9.950452	-11.24258
9	1345.696	87.70625	4.38e-11	-12.51767	-10.07455	-11.52819
10	1596.023	396.3514	3.84e-12	-14.95858	-12.24400*	-13.85915
11	1634.761	59.72046*	3.06e-12*	-15.19543*	-12.20939	-13.98606*
12	1639.185	6.636561	3.48e-12	-15.07485	-11.81735	-13.75554

Notes: The entries in this table are calculated at the monthly level. * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

Source: *WDI,* Bank of Ghana, 2000:1 – 2016:12.

4.2. Cointegration test

Using the optimal lag length of eleven, the number of cointegrating vectors was obtained using the Likelihood Ratio Test which depends on the maximum Eigen values of the stochastic matrix of the Johansen (1991) procedure. The cointegration results for both models were shown in Tables 4a and 4b below. From the table, the Rank Test (Maximum Eigenvalue) statistics showed that there are three cointegrating vector at 5 percent level of significance. The null hypothesis that there is at most two

cointegratingvector in both cases were rejected against the alternative of there is at least three cointegrating vectors. Therefore, there is three cointegrating vectorin each of the models specified. These impliedthat growth of export and import, real exchange rate, volatility and growth of industrial output are cointegrated, therefore, VECM will be used for the analysis.

Table 4a. *The cointegration test for exchange rate volatility and export*

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.362015	86.29272	27.58434	0.0000
At most 1 *	0.151945	31.64344	21.13162	0.0012
At most 2 *	0.084773	17.00794	14.26460	0.0180
At most 3	0.003200	0.615363	3.841466	0.4328

Notes: The entries in this table are calculated at the monthly level. Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values
Source: *WDI,* Bank of Ghana, 2000:1 – 2016:12.

Table 4b. *The cointegration test for exchange rate volatility and import*

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.206656	44.44765	27.58434	0.0002
At most 1 *	0.151811	31.61309	21.13162	0.0012
At most 2 *	0.078258	15.64598	14.26460	0.0301
At most 3	0.003610	0.694322	3.841466	0.4047

Notes: The entries in this table are calculated at the monthly level. Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values
Source: *WDI,* Bank of Ghana, 2000:1 – 2016:12.

4.3. Long-run analysis

Tables 5a and 5b showed the results of the coefficient of β matrices in terms of normalized cointegrating coefficient of first equation. From table 5a, the coefficient of real exchange rate was 0.009153, withthe t-statistics (2.6454). By the rule of the thumb, since the absolute value of t-statistics corresponding to the coefficient is greater or approximately equal to two then the real exchange rate is significant at 5 percent level of significance in explaining the variations in growth of export. Using the elasticity, as real exchange rate increase (depreciate) by one percent the growth of exportwill increase by 1.8006 percent and it is elastic. This means that as real exchange rate depreciates the growth of export risesbut more than the percentage increase in real exchange rate and this is consistent with economic theory that depreciation of exchange rate promotes export.

Considering volatility, the coefficient of real exchange rate volatility was 0.2786, with the t-statistics (5.04) and this is significant at 5 percent level of significance in explaining the variations in the growth of export. As a result, as real exchange rate volatility increases by one percent the growth

of exportwill rise by 1.3868 percent and it is elastic. This means that as volatility increases the growth of export also rises. This result showed that volatility did not impede the growth of export in the long run. This is contrary to the view that volatility impedes the growth of export Ethier (1973) and Srinivasan (2012). Therefore, in the long run, it can be concluded that export transactions are hedged thus reducing its exposure to unforeseen movement in exchange rate.

Finally, the coefficient of industrial output growth was 0.3953, with the t-statistics (3.9445) and this is significant at 5 percent level of significance. As a result, as industrial output growth increases by one percentthe growth of export will rise by 0.0066percent and it is inelastic. This means that the growth of industrial output increases the growth of export but with less than percentage increase in the output.

H_0: Real effective exchange rate or volatility has no significant effect on the growth of export.

H_1: Real effective exchange rate or volatility has significant effect on the growth of export.

From the result, the alternative hypothesis cannot be rejected, hence conclude that real effective exchange rate or volatility has significant effect on the growth of export. Therefore, in the long run, depreciation of real exchange rate andincrease in volatility are significant in improvingthe growth of export.

From table 5b, the coefficient of real exchange rate was 0.0002 with the t-statistics (0.01934), at 5 percent level of significance real exchange rate is not significant to explain the variations in growth of import. From the table, as real exchange rate increase by one percent the growth of import will increase by 0.0744 percent and it is inelastic.

Considering volatility, the coefficient of real exchange rate volatility was 0.6938, with the t-statistics (4.32) and this is significant at 5 percent level of significance. As a result, as real exchange rate volatility increases by one percent the growth of importwill rise by 6.56 percent and it is elastic. This means that increase in real exchange rate volatility increases the growth of import more than the percentage increases in real exchange rate volatility.

Finally, the coefficient of output growth was -0.5826, with the t-statistics (-1.9) and this is significant at 5 percent level of significance. As a result, as industrial output growth increases by one percent the growth of importwill decline by 0.0186 percent. This means that as industrial output growth increases the growth of import decline but with less than percentage increase in output growth. Therefore, any action or policy that encourage domestic industrial production will be in the right direction for Ghana.

H_0: Real effective exchange rate or volatility has no significant effect on the growth of import.

H_1: Real effective exchange rate or volatility has significant effect on the growth of import.

From the result, the real effective exchange rate had no significant effect on the growth of import but volatility had significant effect on the growth of import. Therefore, in the long run, reduction in volatilitywill reducethe growth of import.

Table 5. *Long run relationship for export, import and exchange rate volatility*

Table 5A: Dependent Variable (Export)					Table 5B: Dependent Variable (Import)				
Variables	Coeff	St. Error	t-stats	Elasticity	Variables	Coeff	St. Error	t-stats	Elasticity
EXC	0.0092	0.0035	2.6454	1.8006	EXC	0.0002	0.0103	0.0193	0.0744
VOLA	0.2786	0.0553	5.0405	1.3868	VOLA	0.6938	0.1606	4.3203	6.56
Q	0.3953	0.1002	3.9445	0.0066	Q	-0.5826	0.3063	-1.9025	-0.0186

Notes: The entries in this table are calculated at the monthly level and the elasticities were computed as shown below.
Source: *WDI,* Bank of Ghana, 2000:1 – 2016:12.

Elasticity for export, $\varepsilon_{exc} = \frac{\partial X_t}{\partial EXC}.\frac{\overline{EXC}}{\overline{X_t}}$, $\varepsilon_{vola} = \frac{\partial X_t}{\partial VOLA}.\frac{\overline{VOLA}}{\overline{X_t}}$,

$$\varepsilon_q = \frac{\partial X_t}{\partial Q}.\frac{\overline{Q}}{\overline{X_t}}.$$

Elasticity for import, $\varepsilon_{exc} = \frac{\partial M_t}{\partial EXC}.\frac{\overline{EXC}}{\overline{M_t}}$, $\varepsilon_{vola} = \frac{\partial M_t}{\partial VOLA}.\frac{\overline{VOLA}}{\overline{M_t}}$,

$$\varepsilon_q = \frac{\partial M_t}{\partial Q}.\frac{\overline{Q}}{\overline{M_t}}.$$

4.4. Short run analysis

The short run dynamics between the variables are estimated using vector error correction model (VECM). This allows the introduction of previous disequilibrium as independent variables in the dynamic behaviour of existing variablesand the set of short run coefficients in the VECM. It associates the changes in the growth of export to the change in the lagged variables and the disturbance term of lagged periods. Table6a shows the result of real exchange rate, volatility, industrial output growth and the growth of export while Table6b also showsthe result of real exchange rate, volatility, industrial output growth and the growth of import.

From table 6a, the coefficient of the speed of adjustmentwas 0.3305, negative and significant at 5 percent level of significance. This shows that there is a point adjustment of 33.05 percent taking place each month of real exchange rate, volatilityand the growth of industrial output towards the long run periods of thegrowth of export.

From table, at 5 percent level of significance, the past second and third months' values of the growth of export had significant and positive effect on the current growth of export. As a result, one percent increase in past second and third months' values of the growth of export will causethe current growth of export to increase by 0.2049 and 0.2531 percent, respectively. Considering real exchange rate, the past second, third, fourth,

tenth and eleventh months' values of real exchange rate had positive and significant effect on current growth of export. From the table, as the past second, third, fourth, tenth and eleventh months' values of real exchange rate increases by one percent the current growth of export risesby 0.0229, 0.0729, 0.0447, 0.0421 and 0.0384 percent, respectively. This means that as real exchange rate depreciates the growth of export increases and this is consistent with economic theory that depreciation of exchange rate promotes export.

Also, the past first, second, fourth to eighth months' values of real exchange rate volatility had negative and significanteffect on current growth of export. From the table, as the past first, second, fourth to eighth months'values of volatility increase by one percent the current growth of export will decline by 0.4075, 0.2604, 0.1544, 0.0950, 0.1497, 0.1573 and 0.1551, respectively. This means that as volatility increases the growth of export declines. This result in the short run support the view of Ethier (1973), Clark (1973), Hooper & Kohlhagen (1978), Cushman (1983), Dell'Ariccia (1999), Rose (2000), Arize, *et al.* (2000), Vergil (2002), Srinivasan and Kalaivani (2012) that real exchange rate volatility impedes the growth of export. Therefore, real exchange rate volatility and growth of export are negatively related. This means that, in short run, export transactions are not hedged, therefore, exposed to the changes in real exchange rate. Finally, the growth of industrial output has positive and negative effect on current growth of import but these effects are not significant.

H_0: Real effective exchange rate or volatility has no significant effect on the growth of export.

H_1: Real effective exchange rate or volatility has significant effect on the growth of export.

From the result, the alternative hypothesis cannot be rejected, hence conclude that real effective exchange rate or volatility has significant effect on the growth of export. Therefore, in the short run, depreciation of real exchange rate encourage the growth of export while increase in real exchange rate volatility significantimpedes on the growth of export.

From table 6b, the coefficient of the speed of adjustment was 0.08022, negative and significant at 5 percent level of significance. This shows that there is a point adjustment of 8.02 percent taking place each month of real exchange rate, volatility and the growth of industrial output towards the long run periods of the growth of import. From table, at 5 percent level of significance, the past months' values of growth of import had no significant effect on the current growth of import.

Secondly, the past third month's value of real exchange rate had significant and positive effect on current growth of import. From the table, as the past third month's value of real exchange rate increases by one percent the current growth of import will rise by 0.0336 percent. This means that as the past third month's value real exchange rate depreciates the current growth of import increases.

Also, the past first, fourth, sixth, seventh and eighth months' values of real exchange rate volatility had negative effect on current growth of import. From the table, as the past first, fourth, sixth, seventh and eighth months, valuesof volatility increase by one percent the current growth of import will decline by 0.1816, 0.0630, 0.0696, 0.0702 and 0.0617 percent, respectively. Finally, the growth of industrial output has positive effect on current growth of import but this effect is not significant.

H_0: Real effective exchange rate or volatility has no significant effect on the growth of import.

H_1: Real effective exchange rate or volatility has significant effect on the growth of import.

From the result, the alternative hypothesis cannot be rejected, hence conclude that real effective exchange rate or volatility has significant effect on the growth of import. Therefore, in the short run, depreciation of real exchange rate and reduction in volatility had a significant effect on the growth of import.

Table 6. *VECM of export, import and exchange rate volatility*

Table 6A: Dependent Variable(Export)					Table 6B: Dependent Variable(Import)				
Variables	coefficients	St. error	t-stats	Elasticity	Variables	coefficients	St. error	t-stats	Elasticity
Cointeq1	-0.331	0.059	-5.600	-0.331	Cointeq1	-0.080	0.028	-2.857	-0.080
D(x(-1))	0.0487	0.097	0.500	0.0487	D(m(-1))	0.022	0.099	0.224	0.022
D(x(-2))	0.2048	0.105	1.959	0.2048	D(m(-2))	0.080	0.105	0.767	0.080
D(x(-3))	0.2531	0.105	2.403	0.2531	D(m(-3))	0.094	0.104	0.904	0.094
D(x(-4))	0.1426	0.099	1.437	0.1426	D(m(-4))	0.046	0.099	0.468	0.046
D(x(-5))	0.0530	0.092	0.573	0.0530	D(m(-5))	0.020	0.098	0.199	0.020
D(x(-6))	0.0460	0.092	0.502	0.0460	D(m(-6))	0.010	0.098	0.104	0.010
D(x(-7))	0.0156	0.083	0.187	0.0156	D(m(-7))	0.015	0.095	0.154	0.015
D(x(-8))	0.0057	0.081	0.071	0.0057	D(m(-8))	0.008	0.094	0.081	0.008
D(x(-9))	0.0115	0.080	0.144	0.0115	D(m(-9))	0.013	0.094	0.136	0.013
D(x(-10))	0.0326	0.080	0.408	0.0326	D(m(-10))	0.014	0.094	0.149	0.014
D(x(-11))	0.0367	0.080	0.459	0.0367	D(m(-11))	-0.020	0.098	-0.208	-0.020
D(exc(-1))	-0.001	0.002	-0.509	-99.522	D(exc(-1))	0.002	0.002	1.043	387.794
D(exc(-2))	0.0229	0.010	2.374	4.482	D(exc(-2))	0.011	0.009	1.143	424.823
D(exc(-3))	0.0729	0.015	4.753	14.268	D(exc(-3))	0.034	0.014	2.381	885.038
D(exc(-4))	0.0447	0.016	2.890	8.749	D(exc(-4))	0.022	0.015	1.474	548.139
D(exc(-5))	0.0017	0.007	0.254	0.333	D(exc(-5))	-0.003	0.006	-0.460	-170.977
D(exc(-6))	0.000	0.006	-0.059	-11.586	D(exc(-6))	-0.004	0.005	-0.703	-261.392
D(exc(-7))	-0.006	0.006	-0.944	-184.678	D(exc(-7))	-0.005	0.005	-0.903	-335.746
D(exc(-8))	0.0005	0.005	0.103	0.098	D(exc(-8))	0.001	0.005	0.135	50.152
D(exc(-9))	0.0044	0.004	1.022	0.861	D(exc(-9))	0.004	0.004	0.965	358.685
D(exc(-10))	0.0421	0.014	3.123	8.240	D(exc(-10))	0.019	0.012	1.518	564.497
D(exc(-11))	0.0384	0.014	2.808	7.516	D(exc(-11))	0.021	0.013	1.632	606.693
D(vola(-1))	-0.408	0.107	-3.828	-19.055	D(vola(-1))	-0.182	0.099	-1.840	-17.397
D(vola(-2))	-0.260	0.125	-2.091	-10.408	D(vola(-2))	-0.142	0.119	-1.190	-11.254
D(vola(-3))	-0.002	0.058	-0.037	-0.185	D(vola(-3))	0.016	0.054	0.301	2.848
D(vola(-4))	-0.154	0.036	-4.286	-21.335	D(vola(-4))	-0.063	0.030	-2.132	-20.162
D(vola(-5))	-0.095	0.037	-2.576	-12.824	D(vola(-5))	-0.036	0.029	-1.212	-11.457
D(vola(-6))	-0.150	0.029	-5.114	-25.455	D(vola(-6))	-0.070	0.025	-2.798	-26.453
D(vola(-7))	-0.157	0.029	-5.476	-27.259	D(vola(-7))	-0.070	0.024	-2.951	-27.899
D(vola(-8))	-0.155	0.031	-4.935	-24.563	D(vola(-8))	-0.062	0.025	-2.517	-23.801
D(vola(-9))	-0.042	0.035	-1.198	-5.962	D(vola(-9))	-0.017	0.032	-0.532	-5.031
D(vola(-10))	0.0230	0.024	0.972	0.114	D(vola(-10))	0.019	0.022	0.894	8.453
D(vola(-11))	-0.021	0.016	-1.275	-6.346	D(vola(-11))	-0.006	0.014	-0.421	-3.976
D(q(-1))	0.0627	0.124	0.507	0.001	D(q(-1))	0.052	0.117	0.448	0.014

D(q(-2))	-0.080	0.129	-0.618	-0.010	D(q(-2))	0.008	0.119	0.066	0.002
D(q(-3))	-0.106	0.127	-0.833	-0.014	D(q(-3))	0.001	0.118	0.007	0.000
D(q(-4))	0.0015	0.122	0.012	0.000	D(q(-4))	0.043	0.116	0.371	0.012
D(q(-5))	0.0574	0.121	0.475	0.001	D(q(-5))	0.050	0.116	0.434	0.014
D(q(-6))	0.0750	0.121	0.620	0.001	D(q(-6))	0.063	0.116	0.544	0.017
D(q(-7))	0.0994	0.118	0.845	0.002	D(q(-7))	0.063	0.115	0.549	0.017
D(q(-8))	0.1538	0.119	1.293	0.003	D(q(-8))	0.086	0.117	0.736	0.023
D(q(-9))	0.1497	0.118	1.270	0.003	D(q(-9))	0.088	0.117	0.755	0.024
D(q(-10))	0.0726	0.114	0.636	0.001	D(q(-10))	0.055	0.114	0.486	0.015
D(q(-11))	0.0983	0.122	0.809	0.002	D(q(-11))	0.120	0.131	0.918	0.029
C	-0.004	0.001	-2.773		C	-0.002	-0.001	-1.422	
R-squared	0.4017	Log likelihood	554.8		R-squared	0.1513	Log likelihood	558.7	
Adj. R-squared	0.2173	Akaike AIC	-5.3		Adj. R-squared	-0.1103	Akaike AIC	-5.341	
Sum sq. resids	0.0348	Schwarz SC	-4.52		Sum sq. resids	0.0333	Schwarz SC	-4.561	
S.E. equation	0.0154	Mean dep	-0.001		S.E. equation	0.0151	Mean dependent	0.0002	
F-statistic	2.1784	S.D. dep	0.017		F-statistic	0.5783	S.D. dep	0.014	

Notes: The entries in this table are calculated at the monthly level and the elasticities were computed as shown below.
Source: *WDI,* Bank of Ghana, 2000:1 – 2016:12.

Elasticity for export, $\varepsilon_{exc} = \frac{\partial X_t}{\partial EXC}.\frac{\overline{EXC}}{\overline{X_t}}$, $\varepsilon_{vola} = \frac{\partial X_t}{\partial VOLA}.\frac{\overline{VOLA}}{\overline{X_t}}$,

$$\varepsilon_q = \frac{\partial X_t}{\partial Q}.\frac{\overline{Q}}{\overline{X_t}}.$$

Elasticity for import, $\varepsilon_{exc} = \frac{\partial M_t}{\partial EXC}.\frac{\overline{EXC}}{\overline{M_t}}$, $\varepsilon_{vola} = \frac{\partial M_t}{\partial VOLA}.\frac{\overline{VOLA}}{\overline{M_t}}$,

$$\varepsilon_q = \frac{\partial M_t}{\partial Q}.\frac{\overline{Q}}{\overline{M_t}}.$$

4.5. Granger causality tests

Table 7 shows the pair wise Granger Causality Testsresults for growth of export or import, real exchange rate, volatilityand output growth. From the table, considering the growth of export there is unilateral directional causality between real exchange rate volatility and growth of export; real exchange rate and industrial output growth. This means that the current values of the growth of export is determined by the past values of volatility and the past values of industrial output growth. But real exchange rate does not Granger caused the growth of export. However, the past values of real exchange rate do not determine the current growth of export. Also, there is a bi-directional causality between real exchange rate and volatility, this means that the current values of the real exchange rate is determined by the past values of volatility also the current values of volatility is determined by the past values of real exchange rate. Therefore, stable real exchange rate will lead to less volatility.

H_0: Real effective exchange rate or its volatility does not Granger caused the growth of export.

H_1: Real effective exchange rate or its volatility does Granger caused the growth of export.

From the result, there is no evidence against or to reject the null hypothesis that real effective exchange rate does not Granger caused the growth of export. On the other hand, there is enough evidence against or to reject the null hypothesis that exchange rate volatility does not Granger caused the growth of export. Hence, it is concluded thatexchange rate volatility does Granger caused the growth of export.

Considering the growth of import there is unilateral directional causality between real exchange rate and industrial output growth. Also, there is a bi-directional causality between real exchange rate and its volatility. From the result, past values of real exchange rate and volatility does not Granger caused the current values of growth of import.

H_0: Real effective exchange rate or its volatility does not Granger caused the growth of import.

H_1: Real effective exchange rate or its volatility does Granger caused the growth of import.

From the result, there is no evidence against or to reject the null hypothesis. Therefore, real effective exchange rate or volatility does not Granger caused the growth of import.

Table 7. *The results of granger causality test*

Export				Import			
Null Hypothesis:	Obs	F-Statistic	Prob.	Null Hypothesis:	Obs	F-Statistic	Prob.
EXC does not Granger Cause X	313	0.91199	0.5291	EXC does not Granger Cause M	313	0.54883	0.8688
X does not Granger Cause EXC		0.11776	0.9998	M does not Granger Cause EXC		0.51657	0.8917
VOLA does not Granger Cause X	193	1.83199	0.0521	VOLA does not Granger Cause M	193	0.55486	0.8629
X does not Granger Cause VOLA		0.93227	0.5109	M does not Granger Cause VOLA		0.39588	0.9563
Q does not Granger Cause X	313	0.35192	0.9726	Q does not Granger Cause M	313	0.03280	1
X does not Granger Cause Q		0.06780	1	M does not Granger Cause Q		0.11163	0.9998
VOLA does not Granger Cause EXC	193	6.13651	0.00000002	VOLA does not Granger Cause EXC	193	6.13651	0.0000
EXC does not Granger Cause VOLA		1147.33	3E-153	EXC does not Granger Cause VOLA		1147.33	3E-153
Q does not Granger Cause EXC	313	0.16406	0.999	Q does not Granger Cause EXC	313	0.16406	0.999
EXC does not Granger Cause Q		9.15319	5E-14	EXC does not Granger Cause Q		9.15319	5E-14
Q does not Granger Cause VOLA	193	0.26466	0.9912	Q does not Granger Cause VOLA	193	0.26466	0.9912
VOLA does not Granger Cause Q		0.15280	0.9993	VOLA does not Granger Cause Q		0.15280	0.9993

Notes: The entries in this table are calculated at the monthly level.
Source: *WDI,* Bank of Ghana, 2000:1 – 2016:12.

5. Conclusions and discussions

This paper examined the effect of real exchange rate volatility on the growth of export and import in Ghana. The study aimed at whether the exchange rate volatilityimpedes on foreign trade or not. Monthly data from January 2000 to December 2016 and vector error-correction modelwere used for the analysis since the variables were cointegrated. It was found that, in the long run, depreciation of real exchange rate, increase in volatility and increase in output growth are significant factors that increased the growth of export in Ghana. Also, decrease in real exchange rate volatility and increase in industrial output growth aresignificant factors that can reduced the growth of import. Therefore, in the long run exchange rate volatility did not impede the growth of export.

However, in the short run, depreciation of real exchange rate and reduction in real exchange rate volatility are significant factors that can increase the growth of export. Also, depreciation of real exchange rate and reduction in real exchange rate volatility are significant factors that can decrease the growth of import. Finally, considering the directional causality, the current values of growth of export is determined by the past values of real exchange rate volatility but real exchange rate does not. Also, the current value of import is not determined by the past values of real exchange rate and its volatility.

Therefore, the following policy recommendations are made based on the findings: in the short run, government policies that stabilized real exchange rate and reduce its volatility are to be encouraged to facilitate the growth of export and discourage the growth of import in Ghana. Central Bank has to exert control upon the monitory policy to avoid possible high volatility in the exchange rate. Government must encourage growth of domestic industries through implementation of policies. Therefore, Government policies of 'one district one factory' is in the right direction. These industries must be encouraged to produce consumables and industrial goodswhich will serve as import substitutes to feed the local markets and industries. This will help Ghana to be less import dependent as a result, reduces pressure on the demand for foreign currency.

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