Is Ghana achieving sustainable trade balance in the participation of international trade? time series assessment for Ghana

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Abstract

This paper examines the long run relationship between exports and imports for Ghana during the period 1961 and 2013. Using the Johansen cointegration test, it is found that export and imports are cointegrated irrespective of the variable that is dependent. The results indicate a stable long run link between export and import. The results indicate Ghana's macroeconomic policies have been effective in the long run and suggest that Ghana is not in violation of its international budget constraint. Future studies should examine the direction of causality and the issue of structural breaks.

Key words: Export, Import, Johansen cointegration, long run
Jel Codes: C22, F14, F43

1.1 Introduction

Since Husted (1992) seminal article, a large literature has evolved that examines the potential trade balance sustainability. The question of whether trade balance is sustainable has been an issue of particular interest (Babatunde, 2014; Hussein, 2014; Jiranyakul, 2012; Mohamed et al., 2014; Pillay, 2014; Mukhtar & Rasheed, 2010; Dumitriu et al., 2009). Husted (1992) reported of significant long run link between export and import for the U.S. economy, when export was the dependent variable and import was the regressor. It suggests that U.S. trade balance is sustainable. As also stressed by other researchers (Babatunde, 2014; Mukhtar & Rasheed, 2010), long run link has important implications for the effectiveness of macroeconomics policies. If there is no significant long run link, the logical implication is that there is unsustainable trade deficit, which indicates a violation of international budget constraints over time. According to Babatunde (2014), persistent trade deficit might harm the welfare of the citizens.

The empirical literature does not reach the conclusion that export and import have long run relationship, using different estimation methods. That is, the findings have been mixed which calls for further empirical evidence to add to the debate. Various reasons account for the mixed findings (Babatunde, 2014). Among the reasons are the nature of the estimation methodology, the model specification, and selectivity bias.

The findings of statistical significant link between export and import are found in the works of researchers such as Babatunde (2014) for Nigeria; Mukhtar and Rasheed (2010) for Pakistan; Ali (2013) for Pakistan; Al-Khulaifi (2013) for Qatar; Herzer and Nowak-Lehman (2006) for Chile; Tang and Mohammad (2005) for some countries (Bangladesh, Cameroon, Chad, Guyana, Indonesia, Mali, Morocco, Niger, and Senegal).

The findings of studies that report of insignificant long run link between export and import are found in the works of researchers such as Hussein (2014) for MENA countries; Hye and Siddiqui (2010) for Pakistan; Dumitriu et al. (2009) Romanian; Konya and Singh (2008) for Indian; Cheong (2005) for Malaysia; Irandoust and Ericsson (2004) for UK; Keong et al. (2004) for Malaysia.

The review shows that there is no agreement in literature on the significant relationship between export and import in both developed and developing economies. This calls for further empirical works to add to the ongoing debate.

Ghana has being experiencing persistent high negative trade balance over time (2015 Budget Statement). For example, the overall balance of payments showed significant deterioration in 2011 by about 63% from 2010. In 2011, the country recorded a relatively higher balance of trade deficit of US$3,183.0 million against the trade deficit of US$2,806.7 million recorded in 2010 (ISSER, 2011). According to the 2015 budget report in Ghana, trade balance for the period January to September 2014, showed a deficit of US$681.3 million, compared with a deficit of US$3,848.3 million at the end of 2013. The budget indicated that, the trade balance is estimated to improve further to a deficit of US$1,312.87 million.

The current study is motivated by the mixed findings of prior empirical research efforts and the fact that limited work exists on the topic in the study area. The objective of the study is to examine the long run relationship between exports and imports in order to determine whether there is sustainable trade balance over the years. The research question underlying the study is what is the nature of Ghana's international budget constraints over time? The study is based on an assumption that Ghana's trade balance is sustainable over time. The rest of the paper looks at the methodology, results, discussions, and conclusions.

2 Research Methodology

2.1 Unit Root and Cointegration Test

The paper is based on quantitative design and time series analysis. The long run link between export and import are explained quantitatively, in three major steps. The unit root properties of the variables are examined using the Augmented Dickey-Fuller (1981) (ADF) unit root test method and the Kwiatkowski et al. (1992, KPSS) in the first step. The unit root properties are examined to avoid spurious results and to determine the nature of shock to export and import.

In the second step, the Ordinary Least Square (OLS) is used to examine the linear association among the variables in a log-linear form. The Johansen cointegration test is used in the third step to examine the long run relationship. Series are said to be cointegrated if they are integrated of order one, 1(1) in the presence of nonzero vector which is integrated of order zero, 1(0). The equation is as specified in equation (3.19).

$$\Delta X_t = \mu + \beta X_{t-1} + \sum_{i=1}^{q} \gamma_i \Delta X_{t-1} + \varepsilon_t \text{.....................................(1)}$$

Where X_t = (3x1) vector of the series, β and γ are (3x3) matrices of coefficients. μ is (3x1) vector of the constant terms in the model. In the Johansen cointegration test analysis the critical values are provided by the 'trace' statistics, "maximum eigen value" statistics, and the information criterion statistics (SBIC, HQIC, AIC). The Johansen preforms better in the presence of more variables and provides feedback effect of the link between the variables. In addition, it is appropriate for larger sample size. In the use of the trace statistics, the following hypotheses hold. H_0: r=0 (There is no cointegration among the variables). H_1: r >0 (There is one or more cointegration vector). In the cases of the use of the maximum Eigen value statistics, the assumptions are H_0: r=0: H_1: r=1 Or H_0: r= 1: H_1: r=2 Or H_0: r=2 H_1: r=3

Once cointegration link is established among the series in the model the error- correction model formulated in equation (2) is estimated. The error correction term (EC_{t-1}) measures the speed of adjustment from short run disequilibrium to long run equilibrium

$$\Delta Y_t = \rho_0 + \rho_1 \Delta Y_{t-i} + \rho_2 \Delta X_{t-i} - \gamma Z_{t-1} + \varepsilon_t \text{.............}(2)$$

Where Z_{t-1} is the residual error term from the static regression of Y_t on X_t. The selection of the lag length is based on information criteria such as SBIC, HQIC, AIC.

2.2 The Model

The study is based on a bivariate model as specified in equation (1) and (2). The dependent variable in equation (1) is export whereas the explanatory variable is import. In equation (2) the dependent variable is import whereas the explanatory variable is export. The models are based on Husted (1992) theoretical framework for small and open economy. According to Husted (1992), in a simplified economy without Government, goods produced are exported. Participants in the international market can borrow and lend at the world interest rate with the aim of maximizing lifetime utility given a budget constraint. The empirical model is as specified in equation (4) with import as the dependent variable, and export as the independent variable. The two equations (3), and (4) are used since they are used in the cited empirical works with different empirical findings.

$$EX_t = c + \alpha IM_t + e_t \text{..}(3)$$

$$IM_t = d + \beta EX_t + e_t \text{..}(4)$$

Where EX_t= export; IM_t= import; 'c' and 'd'= constant; 'e_t'= error term

Data for the estimation of the model are taken from World Development Indicators (WDI-2012). The study period is from 1961-2013.

3 Discussions and Analysis

3.1 Time Series Plot

The time series plot results are shown in figure 1 to figure 4. The figures indicate that the series are unit root in levels (figure 1 and figure 2) but attained stationarity after first differenced (figure 3 and figure 4). The ADF and the KPSS tests are further used to examine the nature of the unit root.

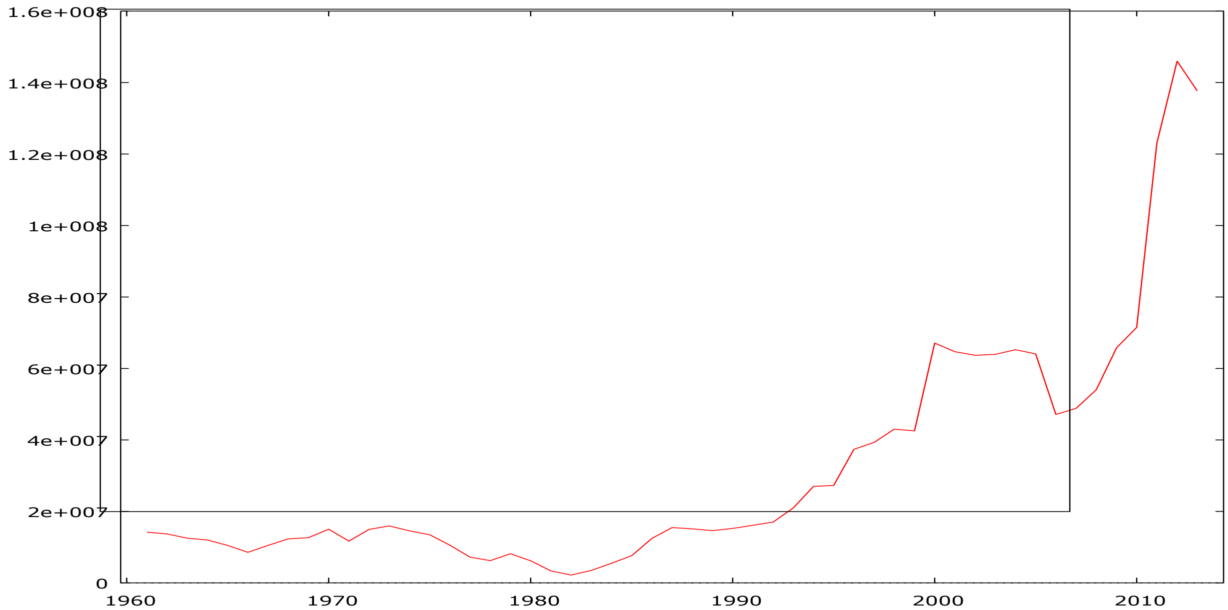

Figure 1 Time series Plot of Export in levels

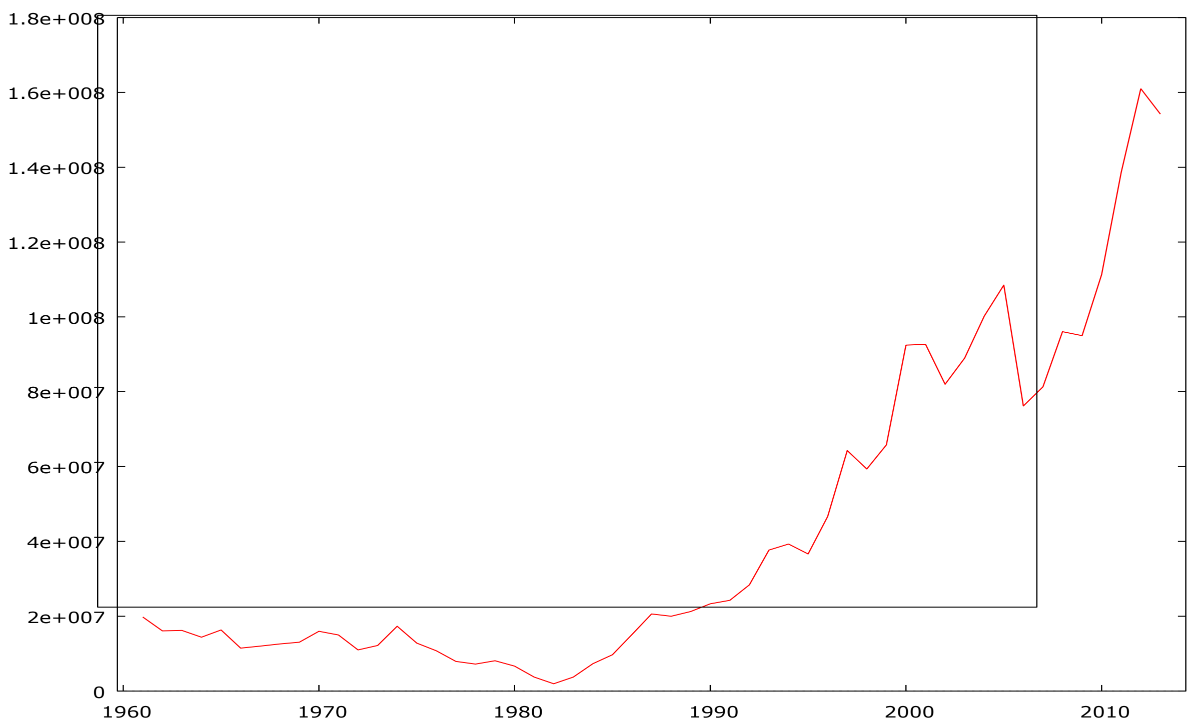

Figure 2 Time series Plot of Import in levels

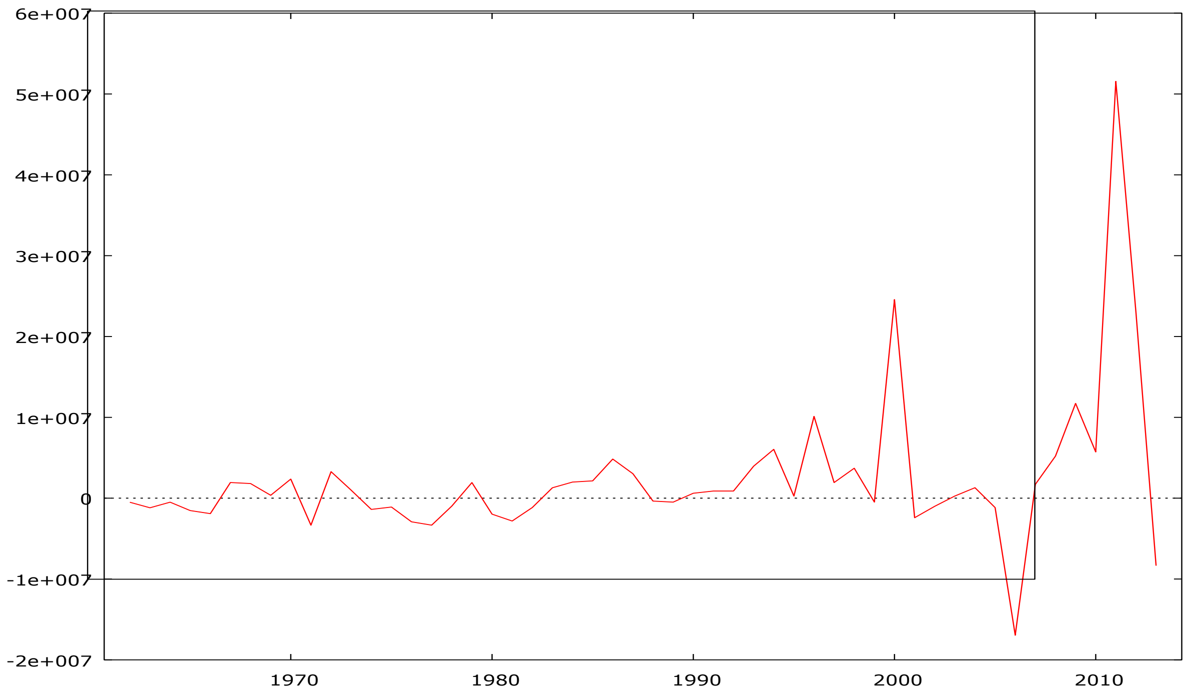

Figure 3. Time series Plot of Export in first difference

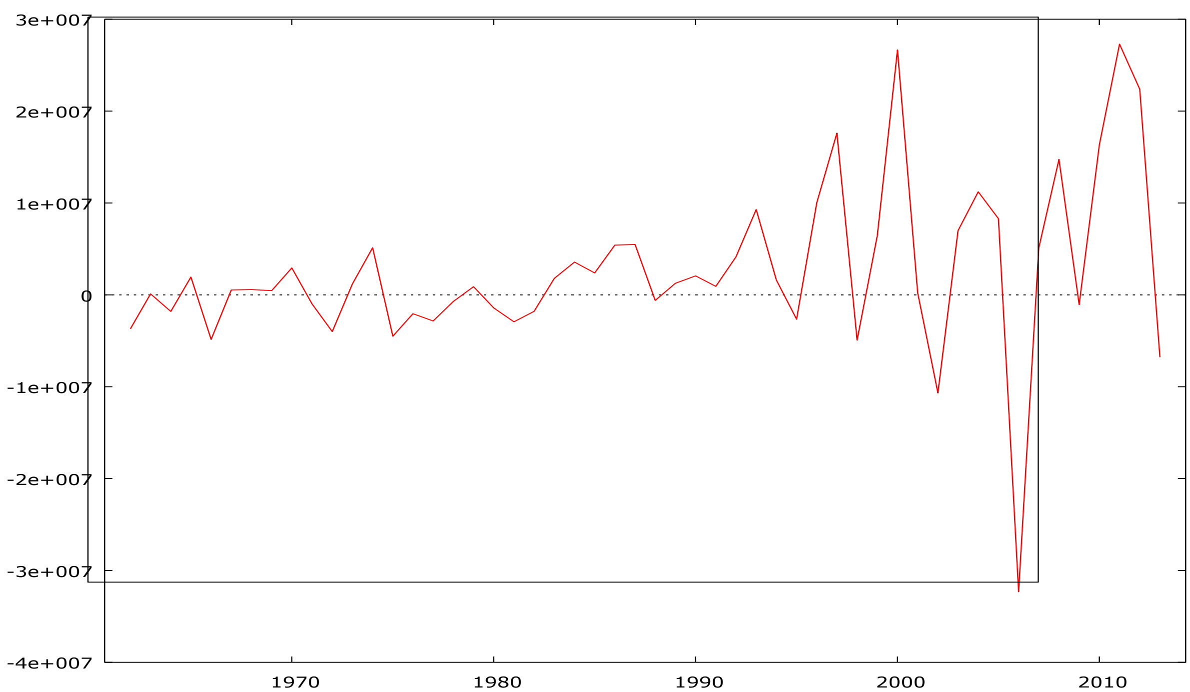

Figure 4. Time series Plot of import in first difference

3.2 The ADF/KPSS Test Results

The ADF test results are reported in Table 1 and Table 2. The ADF test is based on the null hypothesis (Ho) that a unit root exists in the time series. The unit root test is performed on levels with a constant and a trend. The results indicate that the series are unit root in levels (Table 1) but attained stationarity after first differencing (Table 2). The KPSS test is used as a confirmatory test to the ADF test. The KPSS test results are shown in Table 3 and Table 4. The results indicate that the series are unit root in levels (Table 3) but attained stationarity after first difference (Table 4). The results show that shocks to export and imports have permanent effect and not temporary effect.

Table 1 ADF stationarity test results with a constant and trend

Variables	coefficients	t-statistics	ADF/P-Value	Results	Lag length
EX	0.0705	0.5419	0.9994	Accept the Ho	10
LNEX	-0.1092	-2.1343	0.5260	Accept the Ho	10
IM	-0.0054	-0.0661	0.9954	Accept the Ho	10
LNIM	-0.1136	-2.1424	0.5214	Accept the Ho	10

Source: Author's computation, 2015

Table 2 ADF stationarity test results with a constant and a time trend

Variables(1st dif.)	Coefficients	t-statistics	ADF/P-Value	Results	Lag length
ΔEX	-2.5930	-1.9994	0.6011	Accept Ho	10
LNΔEX	-0.6909	-4.9919	0.0009***	Reject Ho	10
ΔIM	-3.3219	-4.2711	0.0034***	Reject Ho	10
LNΔIM	-0.9533	-5.4986	0.0000***	Reject Ho	10

Source: Author's computation, 2015: Note: *** denotes significance at 1% level

Table 3 KPSS stationarity test results with a constant and a time trend

Variables (levels)	t-statistics	Results	Lag length
EX	0.285055	Reject Ho	3
LNEX	0.25794	Reject Ho	3
IM	0.336669	Reject Ho	3
LNIM	0.255441	Reject Ho	3

(Author's computation, 2015): Critical values at 10% (0.122), 5% (0.149) and 1% (0.212) significant levels

Table 4 KPSS stationarity test results with a constant and a time trend

Variable (first diff.)	t-statistics	Results	Lag Length
ΔEX	0.0645585	Fail to reject the null hypothesis	3
LNΔEX	0.055482	Fail to reject the null hypothesis	3
ΔIM	0.045334	Fail to reject the null hypothesis	3
LNΔIM	0.0806803	Fail to reject the null hypothesis	3

Author's computation, 2015: Critical values at 10% (0.122), 5% (0.149) and 1% (0.212) significant levels

3.3 Regression Results

3.3.1 OLS Regression Results of Import on Export

The OLS test results were initially used to examine the correlation between export and import with export as the dependent variable and import as the explanatory variable. The results as reported in Table 5 show import is positively related to export at 1% significant level. The results indicate that 1% increase in import leads to about 72.7% increase in export. The R^2 value shows that the estimated model do perform well. The value indicates that import explains about 86.0% changes in export.

Table 5. OLS Regression Results

Dependent var.= Export				
Variables	**Coefficient**	**Std. error**	**t-ratio**	**p-value**
const	1.2951	1.7165	0.7545	0.4542
LIM_{-2}	0.7269	0.2517	2.8890	0.0058 ***
$LNEX_{-2}$	0.1903	0.2843	0.6694	0.5064
Mean dependent var	16.82024	S.D. dependent var	0.996544	
Sum squared resid	6.934588	S.E. of regression	0.380093	
R-squared	0.860345	Adjusted R-squared	0.854526	
F(2, 48)	49.83690	P-value(F)	1.93e-12	
Log-likelihood	-21.48561	Akaike criterion	48.97123	
Schwarz criterion	54.76670	Hannan-Quinn	51.18585	
rho	0.606147	Durbin-Watson	0.776805	

Author's computation, 2015: Note *** denotes significance at 1% levels

The results of the diagnostic test are reported in Table 6. The model passed only the normality test. The null assumptions of adequate specification, absence of heteroskedasticity, and no autocorrelation could not be accepted.

Table 6 Diagnostic Tests

Test statistics		Results
Functional Form Ho: specification is adequate Ha: specification is not adequate	Test statistic: F = 5.001603, with p-value = P(F(2,46) > 5.0016) = 0.0108***	Reject Ho
Heteroskedasticity Ho: heteroskedasticity not present Ha: heteroskedasticity is present	Test statistic: LM = 11.342260, with p-value = P(Chi-square(2) > 11.342260) = 0.003444***	Reject Ho
Normality Ho: error is normally distributed Ha: error is not normally distributed	Test statistic: Chi-square(2) = 4.74141 with p-value = 0.0934148	Reject Ho
Serial Correlation Ho: no autocorrelation Ha: autocorrelation is present	Test statistic: LMF = 23.605048, with p-value = P(F(2,46) > 23.605) = 8.83e-008***	Reject Ho

Author's computation, 2015: Note *** denotes significance at 1% level

The results of the stability tests using the CUSUM and CUSUMSQ are shown in figure 5 and figure 6 respectively. Both stability tests (CUSUM and CUSUMSQ) as shown in Figure 5 and 6 revealed that the estimates are stable since the residuals fall within the various 5% critical boundaries. The null assumptions are rejected in figure 5 and figure 6.

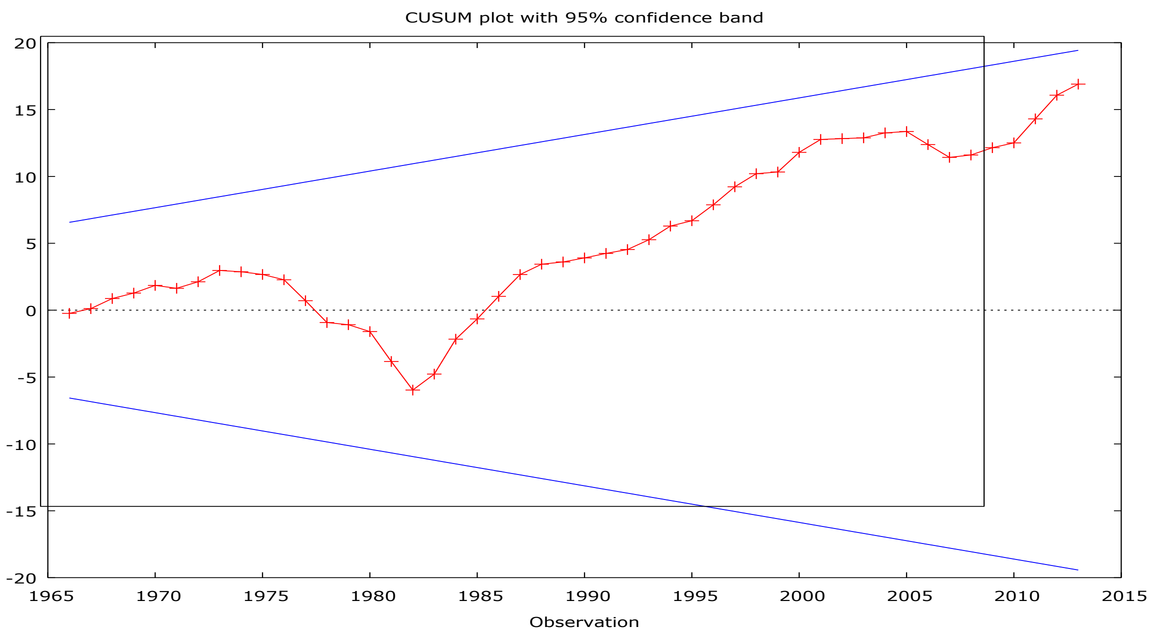

Figure 5. Plot of CUSUM

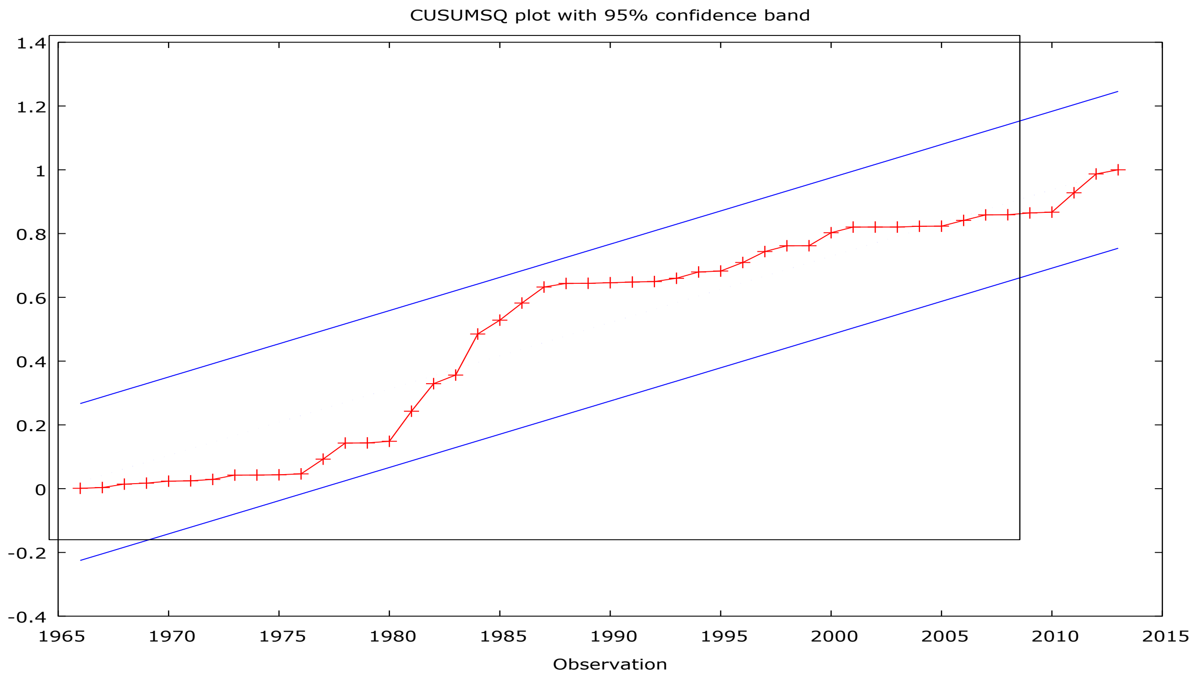

Figure 6. Plot of CUSUMSQ

3.3.2 OLS Regression Results of Export on Import

The OLS test was also performed using import as the dependent variable and export as the explanatory variable. The results as reported in Table 7 show export is negatively related to import but insignificant. The results indicate that 1% increase in export leads to about 25.3% decrease in import. The R^2 value shows that the estimated model do perform well. The value indicates that export explains about 85.9% changes in import. The lag values of import significantly influence the current values of import at 1%. The results show that, 1% increase in import lag 2 leads to about 102% increase in current import.

Table 7. OLS Regression Results

Dependent var. = Import				
Variables	**Coefficient**	**Std. error**	**t-ratio**	**p-value**
const	0.8792	1.2302	0.7147	0.4782
$LNEX_{-2}$	-0.2532	0.3879	-0.6526	0.5171
$LNIM_{-2}$	1.2027	0.3433	3.503	0.0010 ***
Mean dependent var	17.06166		S.D. dependent var	1.097122
Sum squared resid	8.511907		S.E. of regression	0.421107
R-squared	0.858568		Adjusted R-squared	0.852675
F(2, 48)	145.6931		P-value(F)	4.10e-21
Log-likelihood	-26.71170		Akaike criterion	59.42339
Schwarz criterion	65.21887		Hannan-Quinn	61.63802
rho	0.524372		Durbin-Watson	0.939605

Author's computation, 2015: Note *** denotes significance at 1% level

The results of the diagnostic test are reported in Table 8. The model passed did not pass any of the diagnostic tests. The null assumptions of adequate specification, absence of heteroskedasticity, normally distribute error, and no autocorrelation could not be accepted.

Table 8 Diagnostic Tests

Test statistics		Results
Functional Form H0: specification is adequate Ha: specification is not adequate	Test statistic: F = 8.513278, with p-value = P(F(2,46) > 8.51328) = 0.000715***	Reject Ho
Heteroskedasticity H0: heteroskedasticity not present Ha: heteroskedasticity is present	Test statistic: LM = 23.785051, with p-value = P(Chi-square(2) > 23.785051) = 0.000007***	Reject Ho
Normality H0: error is normally distributed Ha: error is not normally distributed	Test for null hypothesis of normal distribution: Chi-square(2) = 12.404 with p-value 0.00203***	Reject Ho
Serial Correlation H0: no autocorrelation Ha: autocorrelation is present	Test statistic: LMF = 16.439223, with p-value = P(F(2,46) > 16.4392) = 4.11e-006***	Reject Ho

Author's computation, 2015: Note *** denote significance at 1% level

The results of the stability tests using the CUSUM and CUSUMSQ are shown in figure 7 and figure 8 respectively. Both stability tests (CUSUM and CUSUMSQ) as shown in Figure 7 and 8 revealed that the estimates are stable since the residuals fall within the various 5% critical boundaries. The null assumptions are rejected in figure 7 and figure 8.

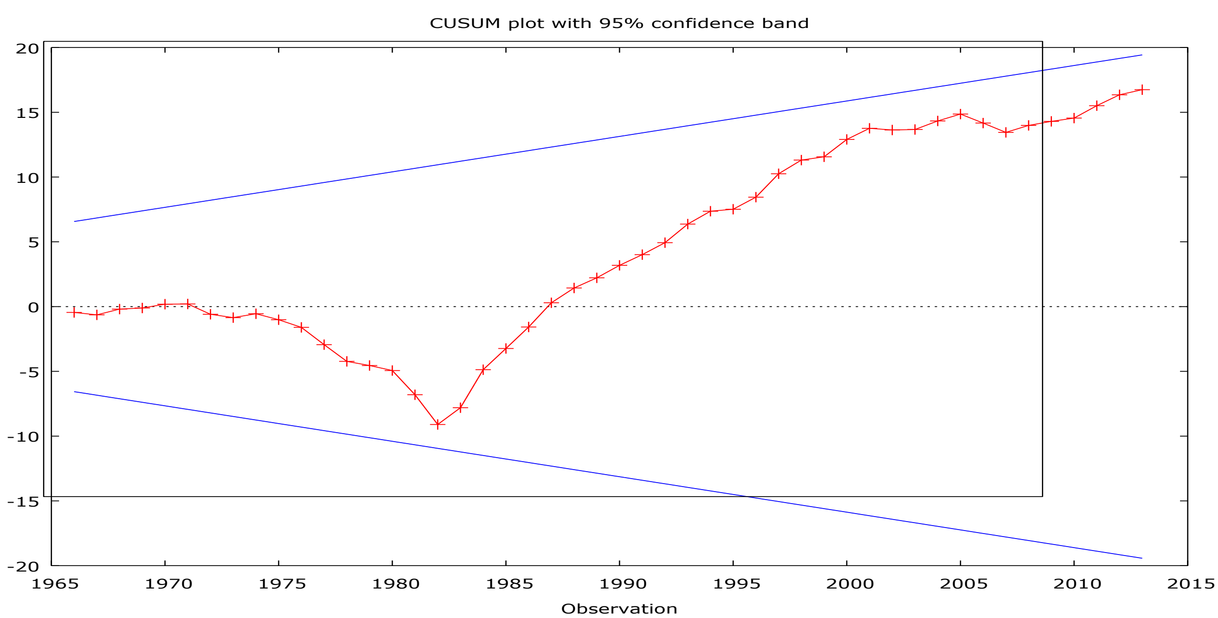

Figure 7. Plot of CUSUM

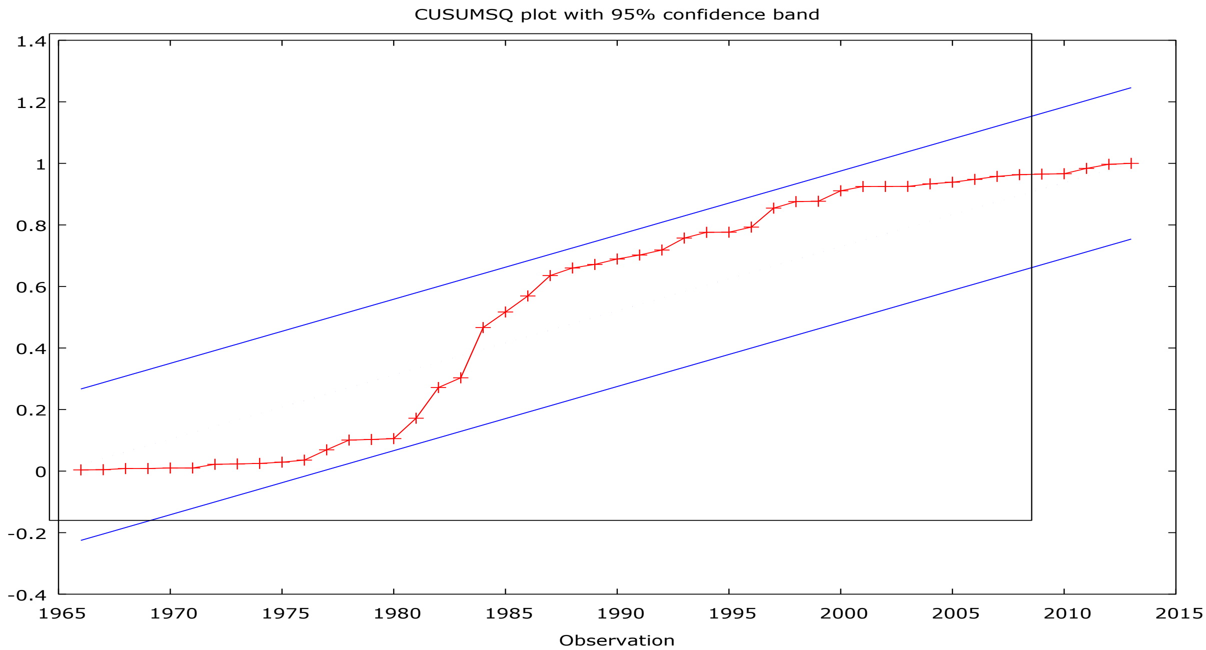

Figure 8. Plot of CUSUMSQ

3.4. Johansen Cointegration Test Results

3.4.1. Cointegration results with Export as the Dependent Variable

The results of the long run cointegration link between export and import with export as the dependent variable are shown in Table 9. The results using both the Trace test statistics and Maximum Eigenvalue Test values indicate the rejection of the null hypothesis of no cointegration. The results show that there is at least one cointegration rank. The conclusion is that there is significant cointegration link between export and import.

Table 9. Johansen Hypothesised Cointegration Results [Dependent variable= Export]

Eigenvalue	0.1357	0.1253
Null hypothesis	r=0	r≤1
Alternative hypothesis	r=1	r=2
λ_{Trace}	14.2650	6.8291
p-value	0.1741	0.0090***]
λ_{Max}	7.4355	6.8291
p-value	0.6695	0.0090***]
λ_{Trace}=Tracy statistic; λ_{Max}= Maximum Eigen-value The VAR estimation covered the period 1961-2013, It comprised two lags of each explanatory variable. A constant term entered into the unrestricted form. The null hypothesis is expressed in terms of cointegrating rank r.		

Author's computation, 2015: Note *** denotes significance at 1% level

The results of the estimated error correction model (Short run dynamics) are reported in Table 10. The results indicate insignificant negative link between export and import. There is significant positive link between lag values of export and current values of export at 5% level.

An increase of export lag 2 leads to about 51.9% increase in current values of export. The error correction term (ECM) is significant at 10% level and has expected a priori theoretical sign of negative. The value of -0.4551 indicate a moderate adjustment rate of about 45.5% from short run disequilibrium to long run equilibrium.

Table 10. Error Correction Results [Dependent var.=Export]

Variables	Coefficient	std. error	t-ratio	p-value
const	1.8408	0.8031	2.292	0.0266 **
$\Delta LNEX_{-1}$	0.51943	0.2435	2.133	0.0384 **
$\Delta LNIM_{-1}$	-0.1445	0.2222	-0.6505	0.5186
time	0.0056	0.0035	1.626	0.1109
ECM_{-1}	-0.4551	0.2282	-1.994	0.0522 *

Author's computation, 2015: Note ** and * denote significance at 5% and 10% levels

3.4.2. Cointegration Results with Import as Dependent Variable

The results of the long run cointegration nexus between export and import with import as the dependent variable are shown in Table 11. The results using both the Trace test statistics and Maximum Eigenvalue Test statistics indicate the rejection of the null hypothesis of no cointegration. The results show that there is at least one cointegration rank. The conclusion is that there is significant cointegration link between export and import.

Table 11. Johansen Hypothesised Cointegration Results [Dependent variable= Import]

Eigenvalue	0.1357	0.1253
Null hypothesis	r=0	r≤1
Alternative hypothesis	r=1	r=2
λ_{Trace}	14.2650	6.8291
p-value	0.1741	0.0090***]
λ_{Max}	7.4355	6.8291
p-value	0.6695	0.0090***]
λ_{Trace}=Tracy statistic; λ_{Max}= Maximum Eigen-value The VAR estimation covered the period 1961-2013, It comprised two lags of each explanatory variable. A constant term entered into the unrestricted form. The null hypothesis is expressed in terms of cointegrating rank r.		

Author's computation, 2015: Note *** denotes significance at 1% level

The results of the estimated error correction model (Short run dynamics) are shown in Table 12. The results show significant positive relationship between export and import at 1% level. The results show that 1% increase in export leads to about 72.85% increase in import. There is insignificant negative link between lag values of import and current values of import. An increase of import lag 1 leads to about 23.41% decrease in current values of import. The error correction term (ECM) is insignificant but has the expected a priori theoretical sign of negative. The value of -0.0365 indicates a low adjustment rate of about 3.65% from short run disequilibrium to long run equilibrium.

Table 12. Error Correction Results [Dependent var.=Import]

Variables	Coefficient	std. error	t-ratio	p-value
const	2.0242	0.8229	2.460	0.0178 **
$\Delta LNIM_{-1}$	-0.2341	0.2277	-1.028	0.3093
$\Delta LNEX_{-1}$	0.7285	0.2495	2.920	0.0055 ***
time	0.0079	0.0036	2.231	0.0307 **
EC_{-1}	-0.0365	0.2186	-0.1668	0.8683

Author's computation, 2015: Note ***, ** and * denote significance at 1%, 5% and 10% levels

4. Discussions

The main aim of the paper is to examine the issue of long run relationship between exports and imports for Ghana using time series data from 1961 to 2012, and Johansen cointegration test. The results overwhelmingly indicate that export and import are cointegrated irrespective of whether import is the dependent variable or export is the dependent variable in the estimated model. There is stable long run relationship between export and import during the period under discussion.

The results are consistent with those of Babatunde (2014) who used bound approach to cointegration, and Johansen cointegration test to determine long run link between export and import for Nigeria; Pillay (2014) who used Johansen model to determine stable long run link between export and import for South Africa; Ali (2013) for Pakistan; Al-Khulaifi (2013) for Qatar, and also consistent with that of Herzer and Nowak-Lehman (2006) who used import as the dependent variable and reported of significant long run link between export and import for Chile.

The results here are inconsistent with those of Hussein (2014) who used bound approach to cointegration and import as the dependent variable failed to find long run relationship for Algeria, Egypt, Morocco, Sudan, and Syria; Hye and Siddiqui (2010) who used variance decomposition method and reported of no cointegration between export and import for Pakistan; and Dumitriu et al. (2009) who used Engle-Granger and Johansen cointegration tests and reported that export and import are not cointegrated.

5. Conclusions

The main objectives of the paper have been achieved using real export and real import annual data for the period of 1961 to 2013. The results of the unit root test indicate export and import variables are unit root in levels and attained stationarity after first differencing. The use of the Johansen cointegration test indicates one cointegration vector between export and import.

The conclusion is that export and import are cointegrated and that there is stable long run relationship between exports and imports. The findings of the study indicate that macroeconomic policies have been effective in the long run and suggest that Ghana is not in violation of its international budget constraint. The results are not sensitive to the choice of the dependent variable between exports and imports.

In the face of the persistent trade deficit, there is the need to analyse the different policy options to manage trade imbalances. Restricting import through various tariff measures will not achieve the intended purpose since Ghana's economy is small but very open and that will affect export. Appropriate exchange rate adjustment policies should be favourable in boosting Ghana's export performance.

Future studies should consider the issues of structural breaks and causality since these issues have not been dealt with in the current paper. Other cointegration approaches such as the Autoregressive distributed lag model (ARDL) should also be considered in modelling the long run relationship between export and import.

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