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Analysis of Ghana's Imports and Exports

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Abstract

The long-run relationship between exports and imports has been the subject of intensive research in developed and developing economies. This relationship is of importance due to the fact that it reflects the stability of foreign trade situation of a country. The main objective of this paper is to study and investigate the long-run relationship between exports and imports in Ghana's economy. A time series econometric techniques of unit root tests, Johansen cointegration and error-correction mechanism were applied. Annual data for real exports and real imports for the period 2002 – 2015 were used. The results of ADF unit root tests suggest that the two variables export and imports are integrated of order one. Johansen cointegration test revealed that, a long-run cointegrating relationship exist between exports and imports in Ghana. The error-correction model found a long-run unidirectional causality from imports to exports. This means that the short run fluctuations between exports and imports are sustainable since, in the long run, they will eventually converge towards an equilibrium state. The study confirms that Ghana is not in violation of its international budget constraints, and macroeconomic policies have been effective in bringing exports and imports into a long-run equilibrium.

Keywords: Export; Imports; Cointegration; Error-correction mechanism; Unit root tests.

1. Introduction

The relationship between exports and imports has attracted the attention of both researchers and policy makers. The fact that exports and imports constitute a major part of balance of payment in a country, unsustainable trade deficit depicts a violation of international budget constraints over time. The existence of long-run relationship between exports and imports is desirable to nations and was the subject of intensive research in developed and developing economies. Ghana is a small open economy that depends to a great extent on the outside world.

Most of government revenues come from exports of Gold, Cocoa, Timber, Crude oil and other non-traditional exports. Exports and imports compose a major proportion of GDP. From Table 1, exports as a percentage of GDP ranged from 26.1% to 40.6% during the period of study. Imports ratio to GDP varied from 42% to 66.9% for the same period.

Ghana has been recording steady growth in export from 2002 to 2015, showing a growth rate of 534.3 per cent over the period. This is as a result of the crude oil export from 2011. This growth was seen in all the major export commodities. Export in Ghana averaged US$595.6 million from 2002 until 2015, reaching an all-time high of US$1,439.4 million in March 2012 and a record low of US$103.9 million in October 2002.

In 2004 as a whole, Ghana's cocoa exports grew strongly, recording a growth rate of more than 30 per cent to push receipts beyond US$1.0 billion for the first time. Over three years of mass spraying of cocoa farms, the adoption of higher yielding varieties of cocoa and applications of nutritional supplements have led to increased productivity in the cocoa sector. This, together with improved price incentives as a higher proportion of world market price of cocoa is paid to producers, has increased cocoa exports substantially.

Imports increased throughout the period as imports exceeded exports making Ghana an import driven country. Import growth is driven by ever increasing growth in non-oil imports. Over the period, Ghana's imports averaged at US$821.8 million, reaching an all-time high of US$1,706.9 million in October 2013 and a record low of US$168.7 million in February 2002. Figure (1) depicts Exports to GDP and imports to GDP ratios for the period from January 2002 to December 2015.

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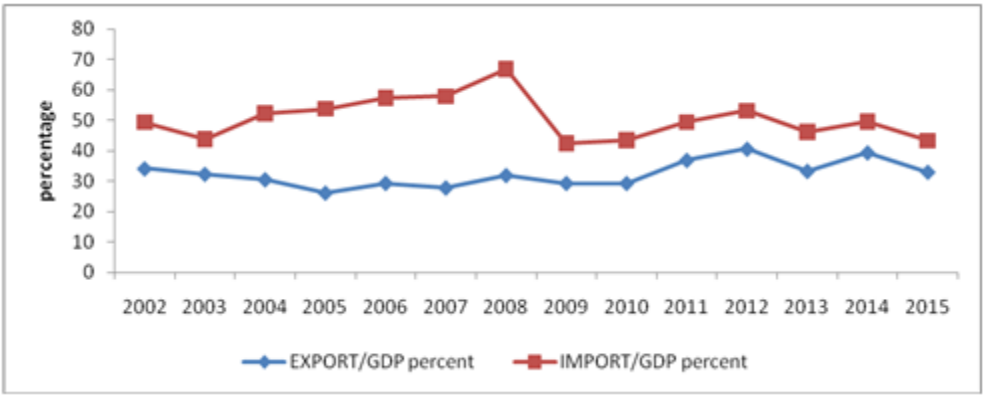
Table-1. Ghana's Exports and Imports as a percentage of GDP

YEAR	EXPORT_GDP in %	IMPORT_GDP in %
2002	34.1	49.3
2003	32.3	43.8
2004	30.5	52.3
2005	26.1	53.7
2006	29.3	57.4
2007	27.8	57.9
2008	31.9	66.9
2009	29.3	42.3
2010	29.3	43.4
2011	36.9	49.4
2012	40.6	53.1
2013	33.3	46.2
2014	39.4	49.6
2015	33.0	43.3

Fig-1. Exports to GDP and imports to GDP ratios for the period from January 2002 to December 2015.



The existence of long-run relationship between exports and imports, in other words, cointegration between these two, is desirable to the nations and this phenomenon has been tested empirically many times by researchers to check whether the trade deficits are present only in the short-run or not. The theoretical and empirical foundation of the examination of cointegration between imports and exports was laid by Husted (1992). studied quarterly US trade data between 1967 and 1989, having adjusted for the structural break in data, and concluded a long-run relationship between U.S. export and import pointing that its trade deficit had been a short-run phenomenon. In their paper Bahmani-Oskooee and Rhee (1997) investigated Korean export and import data applying Johansen and Juselius (1990) system-based cointegration technique and found trade sustainability. This means that, Korea's exports and imports are cointegrated and the coefficient on exports was positive, implying Korea does not violate its international budget constraint. Arize (2002) conducted a more comprehensive study recently, covering 50 countries' quarterly data, and identified long-run relationship between export and import for 35 countries including the United States, Indonesia and Malaysia using the Johansen cointegration technique. Therefore, it can be concluded that macroeconomic policies have been effective in the long run and suggests that these countries are largely not in violation of their international budget constraints. Uddin (2009) also reported on a study, time series behavior of total exports and total imports in Bangladesh. Johansen cointegration method was applied to data, and revealed existence of long-run equilibrium relationship between the two variables. Long term causality was also investigated and found to be bidirectional between exports and imports in Bangladesh. Baharumshah *et al.* (2003), using annual data from 1961 to 1999 and the Gregory and Hansen (1996) cointegration test, find support for a cointegration relationship between imports and exports for Indonesia, the Philippines, and Thailand, but not for Malaysia.

The results from a study by Rahman (2011) on the relationship between exports and imports of Indonesia and Malaysia, revealed the existence of cointegration between exports and imports for Malaysia, but were not found in the case of Indonesia. Annual data were used and variables were in real U.S. dollar. The study utilized Husted (1992) hypothesis for exports and imports, and applied Engle-Granger and Johansen cointegration approaches. Erbaykal and Karaca (2008) studied whether trade deficit in Turkey is sustainable or not. The paper examined the relationship between imports and exports. Quarterly data for the period from 1982-2005 were used. ADF unit root test was performed on both nominal and real values of variables. Exports and imports were found to be first difference stationary. Engle-Granger's cointegration test was performed and residuals of long-run relationship were found to be stationary, hence imports and exports are cointegrated, and long-run relationship between them exists.

Herzer and Nowak-Lehmann (2006) in a study of exports and imports of Chile, the long-run relationship was examined. Annual data for the period from 1960-2000 and real values for total exports and imports at local currency were used. Unit root tests were performed on variables, and were found to be stationary when differenced. Engle-Granger's method of cointegration used to test for cointegration, and variables were cointegrated. An error

correction model was specified, and the error correction term was found to be negative and statistically significant. This implies that a long-run Granger causality exists from exports to imports in Chile. A study by Ali (2013), recently analyzed the long run association between Pakistan's exports and imports. Empirical analysis revealed a long run relationship between the two variables. The error correction model results showed that exports and imports converge towards the long run equilibrium, indicating the effectiveness of macroeconomic policies in stabilizing the international trade balance in Pakistan. Similarly, Al-Khulaifi (2013) reported in the case of Qatar. Pillay (2014) examined the long run equilibrium relationship between South Africa's exports and imports using quarterly data from 1985 to 2012 and the Johansen's Maximum Likelihood cointegration technique. Imports was the dependent variable and the study found a statistically significant cointegrating relationship to exist between exports and imports.

However, some studies reported non-existence of cointegration between exports and imports. Using quarterly data for the periods 1967-1989 and 1967-1994 respectively, Fountas and Wu (1999) examined whether exports and imports are cointegrated in the United States. The study found no long-run relationship between exports and imports in the case of United States. Keong *et al.* (2004) explored the long run relationship between exports and imports of Malaysia by using cointegration techniques. The study concluded that short run fluctuations between the imports and exports were not sustainable and the imports and exports would ultimately converge towards long run equilibrium. Cointegrating relationship between exports and imports of some developed economies for Germany, Sweden, and the United States were reported, Irandoust and Ericsson (2004). But the study did not find any cointegration between the variables for the UK.

Similarly, Cheong (2005) in a commentary on Malaysian imports and exports argued that cointegration findings are not conclusive in the case of Malaysian economy. Using annual data for the period 1959-2000, he applied Johansen cointegration test and no cointegration was found In a report by Konya and Singh (2008) on investigating the presence of equilibrium relationship between exports and imports in India using annual data for the period from 1949/50 – 2004/05, Indian exports and imports were found to be integrated of order one. Johansen cointegration method was then performed on data, and failed to reject the no-cointegration hypothesis. Thus, Indian exports and imports do not exhibit a cointegration relationship and hence India is in violation of its international budget constraint.

In addition, Hussein (2014) examined the long-run cointegration between exports and imports for nine MENA (Middle East and North Africa) countries. The study explored the issue by applying the bounds testing approach to cointegration using annual data and reported cointegration between exports and imports for Iran, Israel, Jordan, and Tunisia indicate that these countries are not in violation of their international budget constraint. However, it failed to find long run relationship Algeria, Egypt, Morocco, Sudan, and Syria.

It can be said conclusively that in spite of a steady increase in the research on the relationship between imports and exports, existing research efforts failed to provide clear evidence on the existence of cointegration between exports and imports. This divergence in the literature can be attributed to methodological issues, data quality and specification error, and the measurement of the variable adopted.

2. Materials and Methods

In this paper, Husted (1992) who presents a simple theoretical model of a small open economy with no government where there is a representative consumer was followed. stated in Husted (1992), this economy produces and exports a composite good. The consumer can borrow and lend in the international markets using one-period instruments. His resources are output and profits from firms that are used for consumption and savings. The consumer's budget constraint in the current period is:

$$C_0 = Y_0 - B_0 - I_0 - (1 + r_0)B_{t-1} \quad (1)$$

Where C_0 is current consumption; Y_0 is output, I_0 is investment, r_0 is the one period world interest rate, B_0 is international borrowing that can be positive or negative, whereas $(1 + r_0)B_{t-1}$ is the stock of debt by the agent (or the country's external debt). The budget constraint must hold for every period. Therefore, they can be combined to obtain the intertemporal budget constraint by iterating (1) forward:

$$B_0 = \sum_{t=1}^{\infty} \mu_t TA_t + \lim_{n\to\infty} \mu_n B_n \quad (2)$$

Where$TA_t = X_t - M_t (= Y_t - C_t - I_t)$ represents the trade balance in period t (that is, income minus absorption),X_t are exports, M_t imports, $\lambda_0 = 1/(1 + r_0)$ and μ_t is the discount factor (the product of the first t values of λ). When the last term in equation 2 goes to zero, the amount that a country borrows (lends) in international markets equals the present value of the future trade surpluses (deficits).

Assuming that the world interest rate is stationary, Husted (1992) expresses (1) as:

$$Z_t + (1 + r)B_{t-1} = X_t + B_t \quad (3)$$

Where$Z_t = M_t + (r_t - r)B_{t-1}$. Solving forward as Hakkio and Rush (1991) do the next expression is obtained:

$$M_t + r_t B_{t-1} = X_t + \sum_{j=0}^{\infty} \lambda^{j-1} \left[\Delta X_{t+j} - \Delta Z_{t+j}\right] + \lim_{j\to\infty} \lambda^{t+j} B_{t+j} \quad (4)$$

where $\lambda = 1/(1 + r)$. The left-hand side consists of spending on imports and interest payments (receipts) on net foreign debt (assets). If we subtract X_t from both sides and multiply by minus one, the left hand side becomes the economy's current account. Assuming that both Z_t and $X_t$are $I(1)$, equation (4) can be rewritten as:

$$X_t = \alpha + MM_t - \lim_{j\to\infty} \lambda^{t+j} B_{t+j} + \varepsilon_t \quad (5)$$

where$\varepsilon_t \sim N(0, \sigma^2)$

Where$MM_t = M_t + r_t B_{t-1}$. Assuming that the limit term goes to zero, (5) we can obtain a testable equation:

$$X_t = \alpha + b * MM_t + \varepsilon_t \quad (6)$$

Where under the null hypothesis that the economy satisfies its intertemporal budget constraint, we expect $b = 1$ andε_t stationary. Thus, if both variables are $I(1)$, under the null, they are cointegrated, with a cointegrating vector (1,-1).

We have also assumed earlier that the world interest rate is stationary. Therefore, the term $r_t B_{t-1}$ would also be stationary. In practice, we can test for cointegration between exports and imports when we believe that the adjustment works essentially through the trade channel. Alternative theories, such as Gourinchas and Rey (2007) consider that changes in assets valuations have been very important in the last twenty years. If this is the case, we should also account for valuation effects and our regression would suffer from an omitted variables bias.

Engel and Granger (1987) state that if a bivariate $I(1)$ vector $\boldsymbol{Y}_t = (Y_{1t}, Y_{2t})'$ is cointegrated with cointegrating vector $\beta = (1, -\beta_2)'$ then there exists an error correction model (ECM) of the form

$$\Delta Y_{1t} = \delta_1 + \phi_1\left(Y_{1,t-1} - \beta_1 Y_{2,t-1}\right) + \sum_{j=1} \alpha_{11}^{j} \Delta Y_{1,t-j} + \sum_{j=1} \alpha_{12}^{j} \Delta Y_{2,t-j} + \varepsilon_{1t} \quad (7)$$

$$\Delta Y_{2t} = \delta_2 + \phi_2\left(Y_{1,t-1} - \beta_1 Y_{2,t-1}\right) + \sum_{j=1} \alpha_{21}^{j} \Delta Y_{2,t-j} + \sum_{j=1} \alpha_{22}^{j} \Delta Y_{2,t-j} + \varepsilon_{2t} \quad (8)$$

That describes the long-term relations of $Y_{1t}$and Y_{2t} . If both time series are $I(1)$ but are cointegrated (have a long-term stationary relationship), there is a force that brings the error term back towards zero.

As Engel and Granger (1987) representation theorem suggested, the existence of co-integration among the I(1) variables entailed the presence of short-run error correction relationship associated with them. The relationship represented an adjustment process by which the deviated actual import was expected to adjust back to its long-run equilibrium path. The attractiveness of the Error Correction Model (ECM), therefore, was that it provided a framework for establishing links between the short-run and long-run approaches to econometric modeling.

For this study, import expenditure and export income data was obtained from the central bank of Ghana. Annual data for real exports and real imports for the period 2002 – 2015 were used. Imports M_t and exports $X_t$are evaluated in US dollars and expressed in natural logarithms. The decision on the range of data was based on data availability.

3. Results and Discussion

The first step in the time series analysis was to determine whether the two series are stationary or non-stationary in nature. If the time series are $I(1)$, they have to be characterized by the presence of a unit root and their first difference by the absence of unit roots (Hendry and Juselius, 2001).

The Augmented Dickey Fuller (ADF) unit root test was used to determine whether the series was stationary or non-stationary. Thus, the null hypothesis is to test a unit root. The ADF tests for non-stationarity on logarithmic form of each of the series is shown in Table 2. The findings show that unit root tests applied to the variables at levels failed to reject the null hypothesis of non stationarity of all the variables. Consequently, both series have a unit root and their first differences do not have any. Thus, the variables M_t and X_t are first order difference stationary and are integrated $I(1)$. Thus, first differencing of the series yields a stationary series with finite variance. The result of unit test of this study is consistent with Erbaykal and Karaca (2008) in Turkey, where exports and imports were found to be first difference stationary.

Table-2. Augmented Dickey-Fuller Unit Root Tests

Series	t-statistics	Prob.	Critical Value		
			1%	5%	10%
L NRX	-12.01741	0.000	-3.471	-2.897	-2.576
LNMX	15.19884	0.000	-3.471	-2.897	-2.576

Before testing for cointegration, there is the need to determine the lag length of the estimation which must be small enough to allow estimation and high enough to ensure that errors are approximately white noise. The lag length selection procedure is based on four different information criteria: AIC, SIC, HQ and LR. The four information criteria conclude that the optimal lag length criteria for the exports and imports model is four. The uniformity of the conclusions from the Information Criteria is worthy of note due to the sensitivity of the Johansen procedure to lag length selection.

Cointegration association between X_t and M_t has been analyzed by using Johansen technique of cointegration. The results of the Johansen cointegration method of maximum likelihood method are reported in Table 3.

Table-3. Johansen Cointegration Tests (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob.	Max eigen Statistics	0.05 Critical value	P-value
None*	0.63103	256.5552	15.4947	0.0001	160.5223	14.2646	0.0001
At most 1	0.44925	96.0323	3.84147	0.0000	96.0323	3.84147	0.0000

The null hypothesis of no cointegrating vector is rejected against the alternative hypothesis both by the trace statistics and maximum eigenvalue statistic at 5 percent significance level. However, the null hypothesis of at least 1 cointegrating vector cannot be rejected in favor of alternative hypothesis of 2 cointegrating vectors by both trace statistic and maximum eigenvalue statistic. Thus, trace statistic and maximum eigenvalue statistic suggest at least one cointegrating vector between $X_t$and M_t. If we let $LNRM$ denotes log of imports, $LNRX$ denotes log of exports

and Δ denotes first difference, then, the result shows that there is one integrating equation, with a normalized cointegrating coefficient, namely $\Delta(\boldsymbol{LNRX}) + \mathbf{3.66}\Delta(\boldsymbol{LNRM})$

The existence of cointegration between exports and imports is similar to the findings of Bahmani-Oskooee and Rhee (1997) for Australia, Celik *et al.* (2011) for Turkey, Ali (2013) for Pakistan, Al-Khulaifi (2013) for Qatar, Pillay (2014) for South Africa.

Hence, a VEC model should be applied,

Let $LNRM$ denotes log of imports, $LNRX$ denotes log of exports and Δ denotes first difference

Then, the Short Run Equilibrium Equation is given by:

$$\boldsymbol{\Delta^2(LNRM)_t = -2.65\Delta(LNRM)_{t-1} + 1.09\Delta(LNRX)_{t-1} + 0.016}$$

It means that if exports increase by 1 unit then imports will increase by 1.09 unit during a month in the short-term. Also the Long Run Equilibrium Equation is given by:

$$\boldsymbol{\Delta(LNRM)_{t-1} = 0.412\Delta(LNRX)_{t-1} - 0.003}$$

The equation indicates that a unit increase in exports will lead to about 0.412 unit rise in imports in the long run. Thus the variables are positively related both in short and long run.

Table-4. Summary Results from VECM

	ΔLNRM	ΔLNRX
Constant	0.007 (0.475)	-0.0054 (-0.233)
ECT (-1)	0.643 (3.624)**	-0.446 (-3.674)**
R^2	0.86568	0.78112
Adjusted R^2	0.8614	0.77414
S.E.	0.1955	0.2955
F-Statistics	202.3604	112.0526

** denotes rejection of the hypothesis at 5 percent significance level.

The coefficient of the error correction term of export variable carries the correct sign indicating that if export is above its long run equilibrium relationship with imports, it will decrease to return to equilibrium. The error correction term in the model is statistically significant, confirming the existence of long run steady-state equilibrium between exports and imports. It also indicates that the speed of adjustment to equilibrium whenever there is a shock is about 44.6%. The coefficient of the error correction term of imports is positive and statistically significant at 5%.

Specifying error-correction model the result found a long-run unidirectional causality from imports to exports.

4. Conclusion

The main objective of this paper is to study and investigate the long-run relationship between exports and imports in Ghana's economy. Well-developed econometric techniques of unit root tests, Johansen cointegration and error-correction mechanism were applied. The results of ADF unit root tests suggest that the two variables export and imports are integrated of order one, this is evident from Johansen cointegration test, that there is a long-run cointegrating relationship between exports and imports in Ghana. The causal relationship between the two variables was investigated by specifying error-correction model. The result found a long-run unidirectional causality from imports to exports. This means that the short run fluctuations between exports and imports are sustainable since, in the long run, they will eventually converge towards an equilibrium state. The ultimate convergence towards equilibrium signifies the overall effectiveness of Ghana's past macroeconomic policies in stabilizing trade conditions, which does not exceed the inter-temporal budget constraint.

The study confirms that Ghana is not in violation of its international budget constraints, and macroeconomic policies have been effective in bringing exports and imports into a long-run equilibrium. Furthermore, Though Ghana's past macroeconomic policies have been effective in bringing its imports and exports into a long run equilibrium, the sufficient condition for sustainability of foreign deficit of Ghana has not been met. The policy implication for Ghana is that trade policy focus should be on reducing imports and find a way of raising exports in order to control the trade balance (deficits) at least in the short run.

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