

Original Research Article

Post-liberalization import demand for rice in Ghana: trends, determinants and relevant policy implications

ABSTRACT

In response to post-liberalization surges in rice imports (*to help meet deficits in supply*) and the general adverse implications thereof on the local rice industry of Ghana, government efforts have through recent policy measures been channeled towards reducing rice imports by 30 percent (*by the year 2018*). To inform policy decision on how this can be achieved, effort was made in this study to assess pre- and post-liberalization trends in rice imports, domestic demand and production and to analyze the response of post-liberalization rice import demand to key supply-side indicators using Johansen co-integration technique. Estimates from the trend analysis reveal that, increasing deficits observed in rice supply (and surges in imports) in the liberalization period is not as a result of stagnation in annual growth rates for production or declines on the other hand, but rather due to general exceedance in annual growth rates for demand over that for production. Results from the Johansen co-integration test reveal that, recent surges in rice imports are founded on increasing domestic demand for rice and poor adjustment of the local rice industry to increments in domestic rice demand, irregularities in local rice supply and poor quality of local rice, a less competitive local rice industry, and inelastic short-run response of import volumes toward increments in average price of imported rice. Efforts to minimize rice imports should be directed towards rescaling current production, ensuring regular supply of local rice on domestic markets, and improving upon the quality of local rice in Ghana

Keywords: Trends; supply deficit; co-integration; trade liberalization; import surge

1. INTRODUCTION

The fear of potential shocks (*due to uncertainty*) from global rice markets (*as occurred in 2007-2008*), increasing consumer demand and increasing annual drainage of foreign exchange (*through importation of large quantities of rice to meet deficits in domestic supply*) have intensified government efforts in Ghana to promote rice production. The focus of rice policy in Ghana pre-and post-liberalization of trade has been to achieve self-sufficiency in rice and to maintain adequate buffer stock for price stabilization and food security in periods of shortfall. Ranging from mechanization and promotion of commercial farming through levying of subsidies on purchase of tractors in the pre-liberalization period, to improving productivity and competitiveness of the rice subsector post-liberalization, rice-subsector related efforts by the government to enhance food security and reduce poverty have been primarily channeled towards reducing influx of imported rice on local markets. Not only does influx of imported rice help bridge deficits in supply (on the positive side), but it also creates unfair competition (*due to subsidies usually levied on rice by exporters (stimulating dumping), thereby making it less expensive, although better* [1]) on the local rice market. As discovered by [2], unfair competition created on domestic rice markets by influx of imported rice led to a significant decline in market share for local rice from 43 percent in the year 2000 to 29 percent in 2003. Along this development, a total of about 66 percent of rice producers reportedly recorded negative returns between the years 2002 and 2004, and stability of incomes realized from domestic rice production was shaken [2,3], thereby inducing some degree of fear in the local rice industry. Such fear, according to [1], triggers a drift of farmers from the rice sub-sector into cultivation of more profitable vegetables like okra, cabbages, tomatoes, fresh maize, and onions among others, thereby exposing the country to potential shocks from the world market.

To prevent (or minimize) such exposition, various policy measures and strategies have since the year 1987 to date been implemented with a purpose of improving the country's performance in meeting the ever increasing demand for rice. Efforts under various policy measures have been directed towards increasing local rice production and promoting its consumption, increasing incomes of rice farmers and improving upon the competitiveness of the local rice industry. Among such measures/projects/strategies are the Agricultural Services Rehabilitation Project (ASRP, 1987-1990), Medium Term Agricultural Development Program (MTADP, 1991-2000), Growth and Poverty Reduction Strategy (GPRS I (2003-2005) and GPRS II (2006-2009)), Food and Agriculture Sector Development Policy (FASDEP I (2003-2006) and FASDEP II (2008-2010)), and the National Rice Development Strategy (NRDS (2008-2018)). To minimize influx of imported rice, thereby minimizing competition on domestic rice markets, emphasis (*notably under FASDEP I*) has been placed on imposition of high tariffs on rice imports. With the exception of the year 2008 where import duty on rice was removed (*due to the global commodity and financial crisis*), rice imports have since the year 2003 been subjected to 20 percent import duty (FOB price, compared to 10 percent in Côte d'Ivoire [4]), 12.5 percent Value Added Tax (VAT), 2.5 percent National Health Insurance Levy (NHIL), 0.5 percent Export Development and Investment Fund Levy (EDIF), 1 percent Inspection Fee, 0.5 percent ECOWAS Levy, and 0.4 percent Ghana Customs Network (GCNET) [5]. In as much as these policy measures have been quite effective at increasing rice production, the same cannot be said about their performance in helping to meet domestic demand (food self-sufficiency).

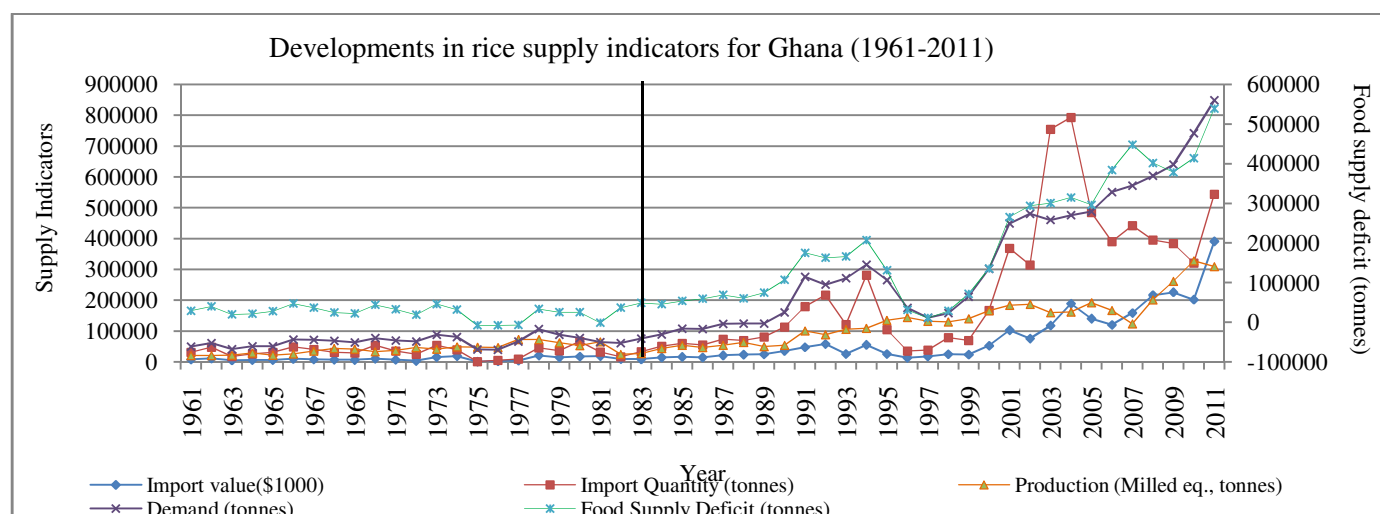


Figure 1 Developments in rice supply indicators for Ghana (1961-2011)
Data Source: FAOSTAT and own computation

As shown in Figure 1, although production increased from 26,680 tonnes in 1983 (*marking the onset of trade liberalization in Ghana*) to 309,471 tonnes in 2011 (an increase of 1059.94 percent), deficit in food supply¹ as well increased from 48,434 tonnes in 1983 to 539,375 tonnes in 2011 (an increase of 1013.63 percent). Along these developments, demand increased from 75,114 tonnes in 1983 to 848,846 tonnes in 2011 (an increase of 1030.08 percent). These developments in production and demand have since the onset of trade liberalization triggered surges in both volume and value of rice imported into the country. From relatively lower volumes of 30,485 tonnes in 1961 and 16,358 tonnes in 1982, quantity of rice imported into the country, as shown in Figure 1, increased from 32,825 tonnes in 1983 (*a more or less stagnation in volume between 1961 and 1983*) to as high as 543,446 tonnes in 2011 (an increase of 1555.59 percent over the volume for 1983). Besides this surge in imports, the quantities of rice imported into the country were even much higher in the years 2003 and 2004 when the country imported respective volumes of 755,026 tonnes and 792,961 tonnes (*these latter developments have been generally attributed to the major decline in world market price for rice during the period 2000-2003 and to low CIF prices for imported rice, which have generally been lower than the wholesale price for domestic*

¹ Defined as the gap (difference) between demand and production (thus, Demand – Production)

rice in Ghana [6]). Along these developments in volume of imports, rice import bill for Ghana increased from \$7.04 million in 1961 (\$ 8.39million in 1982) and \$8.04 million in 1983, to as high as \$390.75 million in 2011 (an increase of 4760.03 percent over the value for 1983). Minimizing the annual volume and value of rice imports and boosting local rice production have been among the top priorities of food policy in Ghana over the past decade. With FASDEP II and NRDS (*most recent policy measures/strategies*) purposed on reducing rice imports by 30 percent, doubling local rice production by the year 2018 and promoting its consumption through quality improvement, the current study is purposed on informing policy decision on what needs to be done to ensure achievement of these goals (***placing more emphasis on the import reduction goal***). To reach such prescription, emphasis in this study is placed on analyzing trends in imports, production and demand (pre- and post-liberalization periods), and the response of rice imports to dynamics in relevant supply-side indicators during the liberalization period (*where the surge in imports is witnessed*). The latter task is addressed using Johansen full information maximum likelihood approach, while the former is pursued through the use of appropriate trend regression lines deduced from a compound growth rate equation. The latter task covers the period 1983-2011, while the former (trend analysis) covers the period 1961-2011.

2. METHODOLOGY

This study is primary structured into two parts. The first part focuses on estimation and comparison of trends in rice imports, production and demand before and after liberalization of trade in Ghana. This is to help provide information of relevance to policy makers (and possibly agribusiness investors) on significant changes observed in average annual growth rates for the aforementioned supply indicators pre- (1961-1982) and post- (1983-2011) liberalization of rice markets in Ghana. In the second part, emphasis is placed on analyzing response of rice imports to dynamics in key supply-side indicators.

2.1 Trend Analysis

In analyzing trends in imports, production and demand, emphasis in this study is placed on estimating and comparing average annual growth rates for pre- (1961-1982) and post- (1983-2011) liberalization periods in Ghana and over the period 1961-2011. Average annual growth rates for the respective indicators per the aforementioned periods are estimated using least-squares regression. Dubbed the least-squares (average annual percentage) growth rate, r , is estimated through fitting of a least-squares trend regression line to the logarithm of volumes for the respective supply indicators. The primary regression equation is deduced from the following compound growth rate equation

$$Y_{it} = Y_{i0}(1 + r)^t \quad (1)$$

Where Y_{it} represents volume of the variable of interest (in this case - import quantity, production, demand (all in tonnes)) at time t , Y_{i0} is the initial volume of the variable of interest and r is the average annual percentage growth rate. A logarithmic transformation of equation (1) yields the following expression:

$$\ln Y_{it} = \ln Y_{i0} + t \ln(1 + r) + e_{it} \quad (2)$$

Where "e" represents a disturbance (error) term

Letting $\alpha_{i0} = \ln Y_{i0}$ and $\alpha_{i1} = \ln(1 + r)$ yields the following expression:

$$\ln Y_{it} = \alpha_{i0} + \alpha_{i1} t + e_{it} \quad (3)$$

From equation (3), t represents "Time trend" (1961-1982, 1983-2011, and 1961-2011), α_0 and α_1 are the parameters to be estimated. If α_{i1}^* is the least-squares estimate of α_{i1} , then the average annual percentage growth rate, r , is obtained as follows:

$$r = [\text{antilog}(\alpha_{i1}^*) - 1] \times 100 \quad (4)$$

2.1 Johansen Full Information Maximum Likelihood Approach

In as much as key economic variables influence and are influenced by other economic, trade-related and policy variables, understanding the magnitude and direction of such influences is a vital step towards devising and implementing sustainable and growth enhancing measures. In investigating relationships among key economic variables in a given economy, several approaches have been used. Noted among such approaches are co-integration techniques. Studies founded on co-integration techniques have so far been primarily guided by three basic approaches (*besides the use of Autoregressive distributed lag modelling approach [7]*), namely the Engle-Granger two-step procedure [8], the Phillips-Ouliaris residual based test [9] and the Johansen full information maximum likelihood criterion [10], the latter being regarded a superior approach over the former two. Founded on the assumption of a single co-integrating equation among variables in a system, the Engle-Granger and Phillips-Ouliaris approaches are respectively based on OLS estimation and testing of residuals. In contrast to this, the Johansen procedure allows for empirical determination of the number of co-integrating vector(s) and co-integration variables are built directly from maximum likelihood estimation. The Johansen approach involves four basic steps; *selection of variables based on theory and identification of the order of integration of the variables under investigation (through a unit root test), appropriate specification of a vector autoregression (VAR) and lag order selection (based on noted information criteria (SC^2 , AIC^3 , HQ^4 , LR^5 , FPE^6)), a test for number of co-integrating equations in the system (based on a trace test statistic or maximum eigenvalue test statistic), and if any found, a subsequent estimation of a vector error correction model (VECM).* Johansen full information maximum likelihood approach is founded on a VAR, expressed simply as follows:

$$Q_t = \Pi_1 Q_{t-1} + \Pi_2 Q_{t-2} + \dots + \Pi_p Q_{t-p} + \mu_t \quad (5)$$

Where Q_t is a $(J \times 1)$ vector of $I(1)^7$ variables, Π_1 through Π_p are $(K \times K)$ matrices of long-run coefficients, and μ_t is a $(J \times 1)$ vector of white noise errors. Following a confirmation of existence of at least one co-integrating vector by the trace or maximum eigenvalue test, equation (5) can be re-parameterized or expressed in appropriate error correction form as follows:

$$\Delta Q_t = \Gamma_1 \Delta Q_{t-1} + \Gamma_2 \Delta Q_{t-2} + \dots + \Gamma_{p-1} \Delta Q_{t-p+1} - \Pi Q_{t-p} + v_t \quad (6)$$

Where $\Gamma = \Pi_1 - I$, $\Gamma_2 = \Pi_2 - \Gamma_1$, $\Gamma_3 = \Pi_3 - \Gamma_2$ and $\Pi = I - \Pi_1 - \Pi_2 - \dots - \Pi_p$

This facilitates estimation of both short-run and long-run effects, with the former effects guided by and consistent with the latter. From equation (6), the symbols Γ_1 to Γ_{p-1} represent $(M \times M)$ matrix of short-run coefficients and v_t is an error term. The symbol Π determines the extent to which the system under investigation is co-integrated and is dubbed the impact matrix. The number of co-integrating vectors in the system under investigation is basically reflected by the rank of the impact matrix. Under co-integration investigations, the impact matrix holds two basic components, decomposition of which yields two matrices α and β . The speed of adjustment (correction) in the system is reflected by the matrix α , while the matrix β contains a total of r co-integrating (long-run) equations.

In expressing the first equation of the system (which is usually the primary equation under investigation) as

$$\Delta Q_{1t} = \gamma_{11} \Delta Q_{t-1} + \gamma_{12} \Delta Q_{t-2} + \dots + \gamma_{1p-1} \Delta Q_{t-p+1} - \Pi'_1 Q_{t-p} + v_{1t} \quad (7)$$

² Schwarz (Bayesian) information criterion

³ Akaike information criterion

⁴ Hanna-Quinn information criterion

⁵ Sequential modified LR test statistics (each test at 5% level)

⁶ Final prediction error

⁷ Variables that are non-stationary at level, but become stationary on first difference

Where y_{ij} represents the first row of Γ_j , $j=1, 2, \dots, p-1$, and Π'_1 is the first row of the impact matrix (Π), ΔQ_t to ΔQ_{t-p+1} are expected to and **must** be stationary. Holding unto the assumption that v_{1t} is stationary, for the equation to yield any meaningful associations, the expression $\Pi'_1 Q_{t-p}$ must be stationary [11; 12]. As earlier mentioned, the decision on whether VAR or VECM is a more appropriate specification for investigating relationships in a given system is based on the existence or otherwise of co-integrating vectors. Testing for existence or otherwise of co-integrating vectors is based on two likelihood ratio (LR) tests, namely, a trace test and a maximum eigenvalue test. The trace test is based on a joint null hypothesis of ' r ' co-integrating vectors against an alternative of more than ' r ' co-integrating vectors, while the maximum eigenvalue test conducts separate tests on the individual eigenvalues for a null hypothesis of ' r ' co-integrating vectors against an alternative of ' $r+1$ ' co-integrating vectors. Due however to its robustness towards skewness and kurtosis in the residuals, the trace test is usually preferred to the maximum eigenvalue test [13]. The test statistic for the respective tests is expressed as follows:

Trace test

$$J_{trace(r)} = -T \sum_{i=r+1}^n \ln(1 - \lambda_i) \quad (8)$$

Maximum eigenvalue test

$$J_{max} = -T(1 - \lambda_{r+1}) \quad (9)$$

Where T represents the number of observations and λ is the i th largest canonical correlation [11].

3. PRELIMINARY ANALYSIS AND MODEL SPECIFICATION

As a vital step in the data generation process and in informing decision on whether VAR or VECM is a more appropriate specification for investigating the determinants of post-liberalization import demand for rice in Ghana, order of integration of the respective variables covered was ascertain through a unit root test, appropriate number of lags to include in the long and short-run equations (as well as in the test for co-integrating vectors) was identified through a lag order selection criteria (based on the aforementioned information criteria), and the number of co-integrating equations identified through a Johansen co-integration test (based on trace and maximum eigenvalue tests statistic). Appropriate normalized and error correction equations are specified afterwards (following a confirmation of at least one co-integrating vector). In the next two sections, results from the unit root test, lag order selection and co-integration test are presented, followed by appropriate model specifications.

3.1 Unit Root Test, Lag Order Selection and Co-integration Test

Based on trade theory and as expressed in equation (10), annual volumes of rice import are presumed to be driven by local rice production, average price of imported rice, domestic demand for rice, and terms of trade index of exports of a named country (in this case Ghana). By this, the current study covers annual volumes of rice imported by Ghana ($ImpQuan$ (in tonnes)), local rice production (milled equivalent, $Milricepro$ (in tonnes)), average price of imported rice ($ImpPrice$, (in \$/tonne, CIF)), domestic demand for rice ($FoodTon$, (in tonnes)), and terms of trade index of exports (an index reflecting the ratio of export price index to import price index for Ghana). All variables are expressed in logarithmic form. Data on volumes of rice import, local rice production and demand (consumption) were gathered from the agricultural production and trade database of FAO (FAOSTAT), while that for annual terms of trade index of exports were gathered from UNCTADSTAT (United Nations Conference on Trade and Development-statistics)

$$\ln(ImpQuan_t) = f(\ln(Milricepro_t), \ln(ImpPrice_t), \ln(FoodTon_t), \ln(ToTExp_t)) \quad (10)$$

210 Given volume (tonnes) and value (\$1000, CIF) of rice imports, the average price of imported rice was
211 computed as follows:

$$212 \quad ImpPrice_t = \left(ImpVal_t / ImpQuan_t \right) \times 1000 \quad (11)$$

213
214 Data on annual values of rice import were gathered from the agricultural trade database of FAO
215 (FAOSTAT).

216 As a check for consistency in order of integration of the respective variables, two options were made use
217 of in the Phillips-Perron unit root test carried out in this study; option1 allowed for intercept and trend at
218 level, and intercept on first difference, while option 2 allowed for intercept (no trend) at level, and none on
219 first difference. As shown in Table 1, all the variables are integrated of order 1 (thus, they are $I(1)$) under
220 both options. By this, they are non-stationary at level, but become stationary on first difference (and at the
221 1 percent significance level).

222

223 **Table 1. Phillips-Perron Unit Root Test**

Variables	Option 1				Option 2			
	Level Adj. t-stat Lags	N-W Lags	First Difference Adj. t-stat N-W		Level Adj. t-stat N-W	Lags	First Difference Adj. t-stat N-W	Lags
Ln (ImpQuan)	-2.4104	2	-4.9995***	2	-1.6736	3	-4.9528***	1
Ln (MilricePro)	-3.4749	0	-8.9908***	15	-1.8597	5	-5.4206***	4
Ln(ImpPrice)	-1.3444	0	-4.4807***	1	-0.9774	1	-4.4589***	1
Ln (FoodTon)	-2.3235	1	-3.3175***	2	-1.0040	2	-2.9952***	2
Ln (ToTExp)	-2.9666	19	-4.5114***	5	-1.1655	0	-4.4749***	4
Critical, 5%	-3.5806		-2.9763		-2.9719		-1.9539	

224

225 From results of the lag order selection criteria, as shown in Table 2, the sequential modified LR test
226 statistic (LR), Final prediction error (FPE) and most importantly Schwarz information criterion (SC) and
227 Hannan-Quinn information criterion (HQ) selected lag order 1, while Akaike information criterion (AIC)
228 selected lag order 2. Consequently, lag order 1 was utilized in subsequent specifications and in the co-
229 integration test.

230 **Table 2. Var Lag Order Selection**

Endogenous variables: LNIMPQUAN LNMILRICEPRO LNIMPPRICE LNFOODTON
LNTOTEXP

Exogenous variables: C

Date: 03/23/15 Time: 10:38

Sample: 1983 2011

Included observations: 27

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-20.15977	NA	4.44e-06	1.863687	2.103657	1.935042
1	66.73693	135.1726*	4.70e-08*	-2.721254	-1.281435*	-2.293120*
2	93.14449	31.29785	5.24e-08	-2.825518*	-0.185850	-2.040606

* 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

In ascertaining the number of co-integrating equation in the current system, a Johansen co-integration test was performed. As shown in Table 3, both the trace test and maximum eigenvalue test confirmed existence of one co-integrating equation across four basic assumptions (the first two assume no linear deterministic trend in data, while the latter two assume linear trend in data). Under a fifth assumption based on quadratic trend in data however, the trace test found no co-integrating equation among the variables, while the maximum eigenvalue test found one. In the current study however, option 3 (which allows for inclusion of intercept (no trend) in both short- and long-run equations) is preferred to the other options.

Table 3. Johansen Co-integration Test

Date: 03/23/15 Time: 10:40
 Sample: 1983 2011
 Included observations: 27
 Series: LNIMPQUAN LNMILRICEPRO LNIMPPRICE LNFOODTON LNTOTEXP
 Lags interval: 1 to 1
 Selected (0.05 level*)
 Number of Cointegrating
 Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	1	1	1	1	0
Max-Eig	1	1	1	1	1

*Critical values based on MacKinnon-Haug-Michelis (1999)

Selection of option 3 over the other options is based on the F-statistic observed, the adjusted R-squared figure, the AIC and SC estimates observed, and outcome of the residual diagnostic tests. Based on the outcome of the lag order selection and Johansen co-integration test, VECM with a period lag is deemed a more appropriate specification for the current study. Long-run and short-run equations in this regard are specified in the next section.

3.2 Model Specification

Based on the outcome of the unit root test, lag order selection and Johansen co-integration test, the normalized (co-integrating) equation for the current study is expressed as follows:

$$\ln(\text{ImpQuan}_t) = \beta_0 + \beta_1 \ln(\text{Milricepro}_t) + \beta_2 \ln(\text{ImpPrice}_t) + \beta_3 \ln(\text{FoodTon}_t) + \beta_4 \ln(\text{ToTExp}_t) + u_t \quad (12)$$

Long-run a priori expectation: $\beta_1, \beta_2 < 0$; $\beta_3, \beta_4 > 0$; $\beta_0 < > 0$

The corresponding error correction equation as employed in this study is expressed as follows:

$$\Delta \ln(\text{ImpQuan}_t) = \gamma_0 + \gamma_1 \Delta \ln(\text{ImpQuan}_{t-1}) + \gamma_2 \Delta \ln(\text{Milricepro}_t) + \gamma_3 \Delta \ln(\text{ImpPrice}_t) + \gamma_4 \Delta \ln(\text{FoodTon}_t) + \gamma_5 \Delta \ln(\text{ToTExp}_t) - \alpha \hat{u}_{t-1} \quad (13)$$

Short-run a priori expectation: $\gamma_2, \gamma_3 < 0$; $\gamma_4, \gamma_5 > 0$; $\gamma_0, \gamma_1 < > 0$

Where

$$\alpha \hat{u}_{t-1} = \alpha (\delta \ln(\text{ImpQuan}_{t-1}) - \beta_0 - \beta_1 \ln(\text{Milricepro}_{t-1}) - \beta_2 \ln(\text{ImpPrice}_{t-1}) - \beta_3 \ln(\text{FoodTon}_{t-1}) - \beta_4 \ln(\text{ToTExp}_{t-1})) \quad (14)$$

From equations (12, 13 and 14), the symbols β , γ , and α respectively reflect long-run effects, short-run effects and speed of adjustment of the system under investigation (thus annual volumes of rice import). The negative sign in front of the symbol ' α ' in equation (13) indicates that adjustments are made toward restoring the long-run relationship. All other variables hold their original definitions (As in equation (10)). In as much as the original short-run equation applies a period lag on all the variables on the right hand-side of equation (13), the modified form as employed in this study applies a period lag only on volumes of import. In spite of the differences in lag specification between the original and modified short-run equations, short-run estimates observed in this study are guided by and consistent with long run estimates. In contrast to the Engle-Granger approach where the two equations are independently estimated, the first equation from the system of equations generated through the Johansen full information maximum likelihood approach was copied into an OLS estimation frame to allow modification of lags (to reflect realities on the ground). With this, every equation in the system captures both long-run and short-run effects, ensuring consistency in effects and guidance of short-run estimates by long-run effects.

4. RESULTS AND DISCUSSION

This section is structured into two basic parts; the first part focuses of presentation and discussion of results from analysis of trends in rice imports, production and demand. In the second part, long-run and short-run estimates for equations 12 and 13 are presented and discussed.

4.1 Trends

A country's performance in meeting supply and food consumption needs is primarily driven by trends/developments in relevant supply indicators. Food demand, production and import quantity are the primary foundations of Ghana's performance in rice supply. Noted in agricultural policy documents, Ghana is reported to have been virtually self-sufficient in rice supply during the period 1975-1977, and was by estimates based on FAO data (*Commodity Balances –FAOSTAT*) and as shown in table 4, 62.78 percent sufficient in meeting food consumption needs and 54.37 percent sufficient in meeting rice supply needs (including food, seed, waste, processed and other uses) during the period 1961-1982 (*pre-liberalization period*). The country's performance in meeting both supply and food consumption needs dropped from the pre-liberalization levels to 37.41 percent and 40.79 percent respectively for supply and food consumption needs during the period 1983-2011 (*liberalization period*). The relatively better performance of the country in the pre-liberalization period is attributed to differences in growth rates between production, demand and imports during the two periods (pre- and post-liberalization). With rice production increasing at a significant average annual rate of 4.85% in the pre-liberalization period (as shown in Table 4), growth rates for imports and demand were relatively smaller and insignificant. During the pre-liberalization period, quantity of rice imported into the country decreased at an average annual rate of 3.10 percent (*although the country was not completely self-sufficient*), while demand increased at an average annual rate of 1.45 percent. In the liberalization period (*per definition in this study, 1983-2011*) however, growth rates for demand and import quantity exceeded that for production. With import quantity and demand increasing at respective annual rates of 9.41 percent and 8.06 percent in the liberalization period, production increased at an average annual rate of 7.21 percent.

Table 4. Trends in Rice Import, Production and Demand (1961-2011)

Growth in Rice Import Quantity (pre- and post-Liberalization)					
Period	Variables	Coefficient	Std. Error	t-statistic	Growth rate, %
1961-1982	Constant (α_0)	10.4149***	0.4688	22.2148	
	Time (α_1)	-0.0315	0.0382	-0.8254	-3.1009
	R-squared	0.0329			

1983-2011	Constant (α_0) Time (α_1) R-squared	10.7132*** 0.0899*** 0.6083	0.2264 0.0139	47.3141 6.4754	9.4065
1961-2011	Constant (α_0) Time (α_1) R-squared	9.4450*** 0.0685*** 0.5273	0.2688 0.0093	35.1413 7.3933	7.0901
Growth in local milled rice production (pre- and post-liberalization)					
1961-1982	Constant (α_0) Time (α_1) R-squared	10.0485*** 0.0474*** 0.5591	0.1154 0.0094	87.0403 5.0362	4.8541
1983-2011	Constant (α_0) Time (α_1) R-squared	10.6621*** 0.0696*** 0.8761	0.0822 0.0050	129.7059 13.8185	7.2079
1961-2011	Constant (α_0) Time (α_1) R-squared	9.9642*** 0.0481*** 0.8608	0.0802 0.0028	124.3114 17.4062	4.9276
Growth in rice demand (pre- and post-liberalization)					
1961-1982	Constant (α_0) Time (α_1) R-squared	10.9060*** 0.0144 0.1253	0.1047 0.0085	104.1594 1.6927	1.4504
1983-2011	Constant (α_0) Time (α_1) R-squared	11.3967*** 0.0775*** 0.8679	0.0949 0.0058	120.1351 13.3180	8.0582
1961-2011	Constant (α_0) Time (α_1) R-squared	10.4550*** 0.0565*** 0.8628	0.0934 0.0032	111.9936 17.5536	5.8127
Performance in rice supply			1961-1982	1983-2011	1961-2011
Supply self-sufficiency ⁸			54.37	37.41	39.74
Food self-sufficiency ⁹			62.78	40.79	43.67

***1%

Source: output of OLS estimation of regression trend line and own computation (for performance in rice supply)

These estimates imply that, increasing deficits observed in rice supply in the liberalization period is not as a result of stagnation in annual growth rates for production or declines on the other hand, but rather due to general exceedance in growth rate for demand over that for production (as production is still increasing at a significant rate, although below annual rates for demand). Regardless of the insignificant annual growth rates for demand and imports in the pre-liberalization period, volumes of rice imported by Ghana increased at an average annual rate of 7.09 percent over the period 1961-2011, while demand increased at an average annual rate of 5.81 percent. Production on the other hand increased at an average annual rate of 4.93 percent. Along these developments, the country's supply self-sufficiency (*defined as production/total domestic supply*) stood at 39.74 percent over the period 1961-2011, while food self-sufficiency (*defined as production/demand*) stood at 43.67 percent. Bridging of the country's rice supply deficit and minimizing imports in the process, may by current estimates, require rescaling¹⁰ of production

⁸ Supply self-sufficiency = local rice production / total domestic rice supply , total domestic rice supply = local rice production + imports – exports + domestic stock variation

⁹ Food self-sufficiency = local rice production / domestic rice demand for human consumption

¹⁰ This could be achieved through both intensification and area expansion, rather than generally relying on area expansion as is currently the case

(since the gap is widening in spite of increasing production) and possible minimization of post-harvest losses (ensuring as well, regular availability of local rice on domestic markets through improvements in road infrastructure and network).

4.2 Response of Rice Import Demand

A country generally resorts to import to help bridge gaps in supply when domestic production efforts (*bearing in mind variation in stock*) directed towards meeting demand is limited. Intensification of such effort is expected to, *all things being equal*, reduce reliance on imports. Such was the a priori expectation on the association between local rice production and annual volumes of rice imports by Ghana. In as much as this expectation is affirmed in both the short and long-run equations (as shown in Table 5), the short-run effect although relatively less significant, is found to be higher than the long-run effect by magnitude.

Table 5. Long and Short-run Determinants of Post-liberalization Rice Imports

Variables	ln(ImpQuan)	Variables	D (ln(ImpQuan))
		D (ln(ImpQuan(-1)))	-0.0869 (0.1375)
ln (Milricepro)	-0.8109*** (0.1201)	D(ln (Milricepro))	-0.9101** (0.3597)
ln (ImpPrice)	-1.0052*** (0.1336)	D (ln (ImpPrice))	-0.6199* (0.3317)
ln (FoodTon)	2.0108*** (0.1024)	D(ln (FoodTon))	2.2789*** (0.4433)
ln (ToTExp)	0.4280* (0.2110)	D (ln (ToTExp))	-0.1607 (0.7240)
C	0.0223	C	-0.0053 (0.0703)
		$\hat{u}_{t-1}$	-0.7929*** (0.2561)
		R-squared	0.7257
		Adj. R-squared	0.6434
		Log-Likelihood	-2.4971
		F-statistic	8.8180
		Akaike AIC	0.7035
		Schwarz SC	1.0394
		Hannan-Quinn criter.	0.8034
		Durbin-Watson stat	1.9466
		Jarque-Bera stat [Prob.]	0.6872 [0.709]
		B-G LM-Stat 1 [Prob.]	0.0146 [0.905]
		B-G LM-Stat 2 [Prob.]	0.8736 [0.434]
		ARCH F-Stata [Prob.]	0.0121 [0.913]
		Sample (adjusted)	1985 – 2011
		Included obs. After adjustment	27

***1%, **5%, *10%
Source: EViews Output

A 10 percent increase in local rice production may lead to a 9.10 percent decrease in rice imports in the short-run and 8.11 percent decrease in imports in the long-run. These inelastic responses of rice imports toward increments in local rice production reflect a relatively less competitive local rice industry, possibly constrained by quality, irregularity in supply and market penetration issues, the latter attribution being based on the relatively lower magnitude of the long-run coefficient compared to that for the short-run. In as much as the short-run effect is much closer to unity than the long-run effect, irregularities in local rice supply (as a result of low yields, and infrastructural constraints), coupled with poor quality of local rice

paves room for imported rice to penetrate domestic markets in the short-to-medium term. Such penetration, which exposes consumers and importers to high quality rice, enhances shielding of imported rice from competition in periods of boom in local rice production, thereby leading to reduced responsiveness of rice imports toward increments in local rice production in the long-run. The short-run effect is found significant at the 5 percent level, while the long-run effect is significant at the 1 percent level. Although annual volumes of rice imports are noted to yield approximately unitary elastic response toward increments in average price of imported rice in the long-run, the short-run response is found inelastic. Given limited capacity of the local rice industry in meeting rice consumption needs, poor quality of local rice, and the important (and increasing) role of rice in Ghanaian diets, importers and consumers of rice tend to reflect a general inelastic response toward increments in price of imported (high quality) rice in the short-run. By this, for every unit increase in the average price of imported rice, there is a proportionately less decrease in volumes of rice imported (and consumed) in the short-run, and this decrease is found weakly significant (at the 10 percent level). This reflects a strong preference for imported rice by importers and consumers of rice in Ghana. Given the '*purchasing power dumping*' influence from increments in price, every 10 percent increase in the average price of imported rice may lead to a 6.10 percent decrease in volumes of rice imported by Ghana in the short-run. In spite of the strong importer and consumer preference for foreign rice, in the long-run, every 10 percent increase in the average price of imported rice may lead to a 10.05 percent decrease in volumes of rice imported into the country. This elastic long-run responsiveness of volumes to price of imported rice could be an opportunity for Ghana to boost local rice production and consumption. This opportunity can however only be exploited to the maximum if Ghana is able to rescale current production, improve upon the quality of local rice and ensure a regular supply of it, and to appropriately identify and meet importer and consumer rice needs (emphasizing sensory attributes). The long-run effect is found significant at the 1 percent level.

Until current production of local rice is rescaled and quality improved upon, increasing domestic demand for rice may be the major stimulator of rice imports by Ghana. As shown in Table 5, for every unit increase in domestic demand for rice, there is a correspondingly higher increase in volumes of rice imported into the country. This generally high responsiveness of rice import volumes toward increments in domestic rice demand reflects a weak local rice industry, limited in capacity of adjusting to shocks in domestic rice demand. For every 10 percent increase in domestic demand for rice, the volume of rice imported into the country may increase by 20.11 percent in the long-run and 22.79 percent in the short-run. Both effects are found significant at the 1 percent level. This association between demand and imports indirectly reveal that, recent surges in rice imports can be attributed not only to increasing domestic demand for rice, but also to poor adjustment of the local rice industry to shocks in domestic demand for rice. Reflecting trade openness and the degree to which a given amount of exports sold (or exchanged/sacrificed) can cover imports needed, terms of trade index of exports is deemed a relevant supply-side determinant of many trade-related variables including imports and exports. Increasing export price index of a given country over the import price index leads to an increase in the terms of trade index of exports. In such situation, fewer exports could be exchanged for a given volume of imports and this mostly leads to an increase in volumes of imports and exports. The terms of trade index however deteriorates whenever import prices rise faster than export prices. In such situations, a greater volume of exports have to be sold to finance a given amount of imports needed. This usually leads to a decrease in volume of imports and exports. The magnitude of increment or decline in imports following changes in terms of trade index of exports however depends on the priorities and policy goals set by a given country. With rice being regarded a political and strategic commodity in Ghana, every 10 percent increase in the terms of trade index of exports may lead to a 4.28 percent increase in the volume of rice imported by the country in the long-run, and this effect is found (weakly) significant at the 10 percent level. The short-run effect is however found insignificant. These insignificant short-run and inelastic long-run effects indicate a strong shielding of the local rice industry (*in spite of its limited capacity in adjusting to shocks in domestic demand*) by policy makers against competition from foreign rice even in times of increasing terms of trade index of exports (which is deemed favorable for both imports and exports).

The joint effects of all the variables (*as reflected by the F-statistic*) is found significant at the 1 percent level, and about 64.34 percent (*based on the adjusted R-squared figure*) of the variations in volume of rice imports are explained by the variables covered in this study. A total of about 79.29 percent of deviations from the long-run equilibrium are restored in the current period, and this restoration is found

significant at the 1 percent level. This generally high speed of adjustment hints at possible irregularities in local rice supply, triggering increments in imports following short period of decline in imports. Having diagnosed the residual series for appropriate standard Gaussian assumptions, the residual series from the VECM is found normally distributed (based on the Jarque-Bera statistic), non-serially correlated (based on the B-G LM statistic) and homoscedastic (based on the ARCH F-statistic). In evaluating the stability of the short-run dynamics and reliability of the estimated coefficients using the CUSUM and CUSUM of squares tests, the plots remained within the 5 percent boundary (see Figure 2). This indicates that the null hypothesis of a 'correctly specified regression equation' cannot be rejected since the plots of these statistics remain within the critical bound [14].

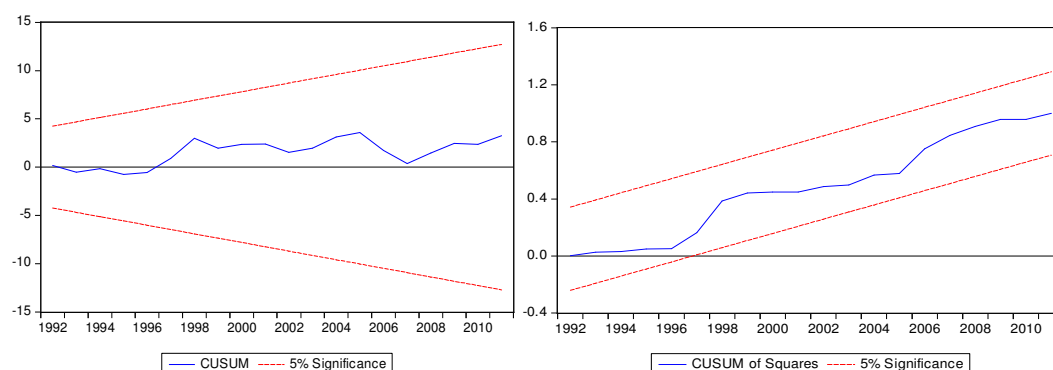


Figure 2 Stability Tests of Coefficients
Source: EViews Output

In summary, recent surges in rice imports, based on current estimates, are founded on increasing domestic demand for rice and poor adjustment of the local rice industry to increments in domestic rice demand, irregularities in rice supply and poor quality of local rice, a less competitive local rice industry, and inelastic short-run response of import volumes toward increments in average price of imported rice (reflecting a strong preference for imported rice by importers and consumers in Ghana).

5. CONCLUSION

The fear of potential shocks from global rice markets, increasing consumer demand and increasing drainage of foreign exchange due to surges in annual imports has intensified government efforts in Ghana to promote rice production. From a normal commodity like any other food crop pre-liberalization of trade, rice has not only become an important part of the average Ghanaian diet, but also a very important political crop and strategic commodity in Ghana due to post-liberalization import surges and the general adverse implications thereof (including reduction in market share of local rice, instability of incomes realized from local rice production, drifting of local rice producers from the rice sub-sectors *(thereby exposing the country to potential shocks from the world market)*, and other food insecurity and poverty implications). In response to such surges and implications thereof, FASDEP II and NRDS (most recent policy measures/strategies in Ghana) amongst other policy measures were initiated and are currently being implemented. Among the primary goals for initiating and implementing FASDEP II and NRDS is reduction of rice imports by 30 percent (by the year 2018). To inform policy decision on measures needed to ensure achievement of the import reduction goal, the current study assessed pre- and post-liberalization trends in imports, demand and production and analyzed the response of post-liberalization rice import demand to dynamics in relevant supply-side indicators.

From the trend analysis, it was discovered that, increasing deficits observed in rice supply in the liberalization period is not as a result of stagnation in annual growth rates for production or declines on the other hand, but rather due to general exceedance in growth rates for demand over that for production (as production is still increasing at a significant rate, although below annual rates for demand). Estimates from the long- and short-run equations estimated (using Johansen full information maximum likelihood approach) reveal that, recent surges in rice imports are founded on increasing domestic demand for rice

and poor adjustment of the local rice industry to shocks in domestic rice demand, irregularities in rice supply and poor quality of local rice, a less competitive local rice industry, and inelastic short-run response of import volumes toward increments in average price of imported rice (reflecting a strong preference for imported rice by importers and consumers in Ghana). Efforts to achieve the 30 percent rice import reduction goal of FASDEP II and NRDS should be directed towards rescaling current production (through harmonization of intensification and area expansion measures (*as against the sole focus on area expansion measures*) and minimization of post-harvest losses), ensuring regular supply of local rice on domestic markets (through improvements in road infrastructure and network) and improving quality of local rice on domestic markets. Measures to improve quality of local rice on domestic markets should include appropriate identification of importer and consumer needs (in terms of sensory attributes) for rice.

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