Liberalized World Trade and Food Import Under Foreign Exchange Constraints in the CFA's Franc Zone of Sub-Saharan Africa

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Abstract: This paper finds a long-run relationship between food imports, commodities prices, exchange rates, food production, GDP, and trade openness in the CFA[3] zone of Sub-Saharan Africa. We use a panel Vector Error Correction Model with exogenous prices expanded beyond the Hemphill' approach (1974) on rice, wheat, maize, and sugar under fixed exchange rate constraint.

JEL Classification Codes: F1, Q12, O13, Q17, Q18

Keywords: International Trade, CFA Zone in West Africa, Food Imports, Food Prices, Cointegration, Food Security, Foreign exchange reserve and Exchange Rate, VECM, Sub Saharan Africa.

Selected paper prepared for presentation at the 2014 Southern Agricultural Economics Association (SAEA) Annual Meetings in Dallas, TX: Feb 1-4, 2014

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[3] CFA Zone Communauté Financière Africaine: **WAEMU & CEMAC**, formed in 1948. WAEMU (West African Economic and Monetary Union, are: Benin, Burkina Faso, Cote Ivoire, Guinee Bissau, Guinee Conakry, Niger, Senegal, Togo. CEMAC (Economic Community of Central African States) are: Cameroon, The Central African Republic, Chad, The Republic of Congo, Gabon and Equatorial Guinea.

I. Introduction

By definition, the countries in the WAEMU and CEMAC are small open economies under fixed exchange rate pegged to the euro and guaranteed by the French Treasury. Countries within the CFA (Communauté Financière Africaine) zone depend on developed countries for trade, foreign direct investment, financial development, and exchange rate regime. Understanding commodity dynamics in Sub-Saharan Africa's growing dependence on food imports plays a central role in economic development, international trade, food security, macroeconomic stability and inequality in the CFA region. Long-term policy response to minimize the corroding effects of higher food prices on trade deficit, growth, child education, and malnutrition, under exchange rate constraints is more than ever important in the CFA zone.

Rising global food prices coupled with poor agricultural productivity under exchange rate constraints and customs unions lead CFA's African government to homologate domestic prices of food import in the CFA's zone. According to FAO's recent report (2012), food trade deficit began a decade following the independence (60's) in most African countries. The Food import bill has kept increasing at a faster rate in the last 20 years, exceeding 1 trillion USD in 2013. Now, in an Africa where momentum grows gradually, the increase in food imports, especially with cereals such as rice, wheat, maize, and sugar is puzzling, and motivates the quest for answers. Whether CFA countries sustain the rising food imports of primary commodities in ensuring food security in the long run is not clear. This question depends exclusively on individual country's farm population, irrigation system, productivity of food supply chain, agribusiness enterprises, value chain financing, exchange rate adjustment, regional harmonization, and trade policies. Ramon E. Lopez and Vinod Thomas' (world

Bank, 1990) findings suggests: "More comprehensive assessment of import demand will be needed if the size and even direction of changes in import demand in response to policy reform is to be understood and anticipated (p.195)." Many studies in the literature and IMF's (2008) report show that exchange rate adjustment in the CFA zone had a limited scope in boosting regional trade, export revenue and paying the high food import bill. Moreover, FAO investigations in 2007 showed "only about 1/3 (19 out of 53) of African countries had enough agricultural export revenue to pay for their food import bills (P.1)." In countries such as Benin, Burkina Faso, Chad, Congo, Center African Republic, Mali, Niger, Senegal and Togo, the total export revenues of agricultural commodities from 1969 to 2012 are far short to cover the food import bills (See Graph: 1-5). Deaton (1999) further suggests that: "additional income from commodity price booms helps the economies of African producing countries, just as they are hurt by the loss of income during slumps" (p. 24). Moreover, Abbott (2009) and IMF (2008a) highlight negative macroeconomic consequences in developing countries noting deteriorating terms of trade and slow economic growth.

The literature highlights the rising food bill in CFA countries and their dependency on food imports, which left CFA countries with two options to address chronic imbalance of food trade deficit and food security. The first option requires CFA countries to boost agricultural production by mechanizing (machinery and fertilizers) and financing the agricultural sector while implementing extension programs, focusing on marketing of agriculture products, research and development. The second option requires CFA Countries to effectively gage their comparative advantage in major food and minerals exports in regional and international markets. The discussions with respect to these two policy options raise issues of optimality and sustainability of food import dependency in the long- run and the extent to which, the two options are related. However, even though the impact of volatile food prices varies across countries, some common impacts and policy options can be delineated in the CFA's zone of SSA (Mathur, 2010).

This paper contributes to the literature by first investigating the link between food import, food production, relative's commodities prices, GDP, and trade policies in the CFA countries for major commodities imported under customs union and regional tax harmonization. Second, this study provides extensions and applications of the import demand model specification and methods of estimation in analyzing food import dynamics to develop an understanding of the policy determinants and options in the CFA zone. The rest of the paper is organized as follows: Section 2 reviews the literature. Section 3 indicates the source of the data, and description of the variables. Section 4 presents the empirical model specifications. Section 5 performs various econometric techniques and test to analyze their performance. Section 6 analyzes the results and discusses the policy determinants of the parameters and their implications. Section 7 concludes.

II. Literature Review and Background

Literature review on food import demand and its policy implication in Sub-Saharan Africa is scarce especially in the CFA zone. There are a few studies that look at food import demand and dependency in developing countries using various methods with different focus (Moran (1988), Pritchett et al. (1988), Lopez & Thomas (1990), Egwaikhide 1999, Kargbo (2005), and (2007), Wodon & Zaman (2008), Bayo & Bernard (2012), Huppe et al. (2013). The existing literature on food imports in SSA can be divided into three sections: including FAO reports and World Bank studies this section addresses food import dependency in SSA. The focus is on consumer welfare, poverty, policy response to rising international food prices, and trade adjustment policies such as tariffs and quotas Wodon & Zaman (2008), World Bank (2008). Another section focuses on food dependency in SSA in relation to civil wars, ethnics division, political upheaval, weak institutions and lack of infrastructure, foreign exchange, and macroeconomic instability. For example, Kargbo (2007), Battleman (2013), and FAO (2006) focus on the symbioses of factors pertaining to ethnic conflict, urban migration, distortions in the agricultural sector, weak institution, lack of infrastructure, and macroeconomic adjustment policies on food imports. FAO's (2006) policy brief (No.1) finds that, "In as many as 17 countries of the region, conflicts have constrained the flow of food, and, in some cases, it is claimed that food has even been used as a tool to ensure the submission of populations (p. 2). Bazzi & Blattman (2013) explained how the effects of world prices of commodity exports have impacted GDP, government spending and investment.

The third section focuses on the progress of the theories, specification, and estimation methods in modeling food import dynamics in the long-run to understand policy options in developing countries. These studies are conducted in the traditional approach developed by Hemphill (1974), Sun-Dararajan (1986), Winters (1987), Pritchett et al. (1988), Antzoulatos and Peart (1998), and Moran (1988, 1989). Hemphill (1974) assumed and demonstrated that import demand is basically determined by foreign exchange obtainability, and the relationships of short-term reactions to eternal disequilibrium are based on the specification of the import-exchange equation**.** Moreover, Hemphill argued that most "of the empirical and theoretical studies of aggregate import behavior shows the flow of imports to be determined chiefly by aggregate economic activities and by import prices relative to prices of domestically produced goods. However, Hemphill argues that this relationship is uncertain for developing countries because of the effects of trade and exchange restrictions.

A pioneering study by Moran (1988) showed that "the traditional model of import behavior which looks only at GDP and real import prices as explanatory variables, failed to predict or explain the developing countries' import slumps in the early 1980s." (p. 2). A recent study by Kargbo (2005) argues that to capture the impacts of both nominal and real price changes and the dynamic process of long-term food price behavior, a vector error correction model (VECM) is required. Moreover, Kargbo (2005) argues that the methodology is very useful from a policy perspective, and has gained wide applications in the economics literature (see, Sims (1980), Oden (1986), Davidson and MacKinnon (1993), Johansen (2000). The authors stated that prior studies on policy impact in Africa have not pursued this particular line of inquiry (Johnson (1994), Kargbo (2000), and Jaeger & Humphreys (1988).The extensions and applications of the recent studies on food import demand model and food security in SSA are far from being exhaustive. That situation is typical of CFA zone countries where export earnings are very volatile (Graph 1-5), and access to foreign reserve is very limited under foreign exchange constraints and customs unions.

III. Empirical Model

Small open economies of the CFA zone of SSA with exchange rate and large informal sector are concomitant with less economic incentives. Therefore, empirical models that do not take into consideration the impact of import constraints, harmonization or homologation of price and customs union in the CFA zone are not effective. Countries in the CFA zone are subject to a foreign exchange constraint since December 26, 1945, and have experienced a devaluation of their currency (CFA) two times in 1948 and 1994. Hence, the CFA zone is a natural candidate for empirical investigation. According to the literature reviewed, there are mainly three approaches in modeling and estimating import demand: First, an import demand model under import controls and relatively stable over time. Second, an import demand model under foreign exchange availability. Third, an import demand which incorporate the quantitative restrictions of recovering structural demand parameters. This paper departs from Moran's model of aggregate import demand, which is specified as:

$$lnFODIM_{it} = H_t(P_{it}, P_{it}^s, PFOOD_{it}, GDP_{it}, MREER_{it}, OPEN_{it,}DOM_{it}) \qquad (\mathbf{1})$$

where $FODIM_{it}$ is import demand in country j, t = 1, 2. . . T, $PFOOD_{it}$ is real price index of cereals in year t = 1, 2 . . . T, GDP_{it} is Gross Domestically Product in country j, t = 1, 2 . . . T, P_{it}^s is price of domestic substitute, t = 1, 2 . . . T, P_{it} is aggregate price index, t = 1, 2 . . . T, $MREER_{jt}$ is real effective exchange rate in country j, t = 1, 2 . . . T, $DOMPF_{jt}$ is domestic food production in country j , t = 1, 2 . . . T, and $OPEN_{jt}$ is openness to trade in country j, t = 1,2 . . .T. Equation (1) has a set of assumptions (Moran ,1988):

Proposition 1: The function H_t is independent of time and H_t is a log linear homogeneous of degree zero (the no money illusion case). Therefore:

$$lnFODIM_{it} = \beta_0 + \beta_1 \ln\left(\frac{P_t}{P_t^s}\right) + \beta_2 \ln\left(GDP_{jt}\right) \qquad (\mathbf{2})$$

where the expected sign are $\beta_1 \leq 0$; $\beta_2 \geq 0$ (Y_t is real GDP).

Proposition 2: The variable total import is the correct index to adopt in the import function.

Proposition 3: The aggregate domestic price is proxies by the GDP deflator (P_t) which is assumed to the an appropriate parameter for domestic substitutes, especially for the CFA countries where the imported cereals are preferred to local fast foods by households in the urban, regional, and rural locations. ***Proposition 4***: Food import demand in the CFA zone adjusts with a lag to the anticipated quantities based on a simple "partial adjustment" mechanism and therefore is specified as:

$$\Delta \ln FODIM_{it} = \varphi(\ln FODIM_{it} - lnFODIM_{jt-1}), \ \ 0 \leq \varphi \leq 1 \qquad \textbf{(3)}$$

Proposition 5: The foreign exchange constraint can be ignored safely given that the real price of imports is exogenous such that countries in the CFA zone face an infinitely elastic import supply function. Based on *proposition* 1-5, the import function is specified as:

$$lnFODIM_{it} = \theta_0 + \theta_1 \ln\left(\frac{P_t}{P_t^s}\right) + \theta_2 \ln(GDP_{jt}) + \theta_3 \ln(FODIM_{jt-1}) + \theta_t \qquad (\mathbf{4})$$

where, $\theta_1(\beta_1\varphi)$, $\theta_2 = (\beta_2\varphi)$ are the short-term price and income elasticity, respectively, given that $\theta_i = 1 - \theta_3$ and the long-term elasticities are: $\alpha_{1it} = \frac{\theta_1}{1-\theta_3}$, and $\alpha_{2it} = \frac{\theta_2}{1-\theta_3}$

Equation (4) represents the benchmark model after Moran (1987, 1988). However given the scope of this study, this paper investigates the Hemphill (1974) and Winter (1985) extensions by introducing the foreign exchange constraints into the model. Hemphill derives an import model based on an optimization framework which provides enough arguments to assume that policymakers in the CFA zone dismiss the cost of adjustment to the long-run of foreign exchange receipts to pay for the high food import bill. Moreover, Hemphill introduced balance of payment instrument and assumed that the foreign exchange reserve is under its transitory and persistency mechanisms (Moran 1988, P.7). Therefore, an import demand function is derived based on a minimization approach to generate the Hemphill model:

$$FODIM_{it} = \alpha_1 + \alpha_2 FEX_t + REER_{t-1} + \alpha_3 \qquad (\mathbf{5})$$

In extension, Moran (1988) and Pritchett (1988) proposes a specification of an import function to recover the structural demand parameters, incorporating foreign exchange obtainability and exogenous prices express in log form:

$$lnFODIM_{jt} = \beta_0 + \beta_1 lnFEX_t + lnREER_{t-1} + \beta_3(lnP_{ip}^d - lnP_{ip}^w FODIM_{jt}) + \varepsilon_t \quad (\mathbf{6})$$

where $FODIM_{jt}$ is import demand and FEX_t and $REER_{t-1}$ represent foreign exchange receipts and foreign exchange reserves, respectively. P_{ip}^{d} represents the domestic price of substitutes or imported cereals, P_{ip}^{w} is the world price of imported food or border price of food imports in the CFA zone. However, instead of considering equation (**6**), this paper considers its VECM functional form and introduces new parameters to capture trade policy under customs unions and foreign exchange constraints. Factually, net income from foreign exchange have been falling and the CFA zone have been experiencing a loss or deficit in their accounts in terms of foreign exchange reserve, amounted to -25,535CFA in 2010 and -36,615 CFA in 2011, respectively, and a negative balance of payment variation of -15% in 2010 BECEAO annual report (2010).

In addition, intra-regional trade represents 5.7% of the WAEMU total trade and 0.1% of world exports. Most importantly, a large portion of foreign exchange reserves was used to cover the large food import bill. Most of the countries in the CFA zone do not have enough reserves and rely heavily on debt or food aid. Not only foreign exchange reserves is an important determinant of import demand for food in the CFA countries, but also foreign exchange reserve is the medium of exchange in the World market, and therefore acts as a constraint for CFA countries. As a result, if foreign exchange reserve increases one might expect to see countries increasing their import of food. Emran (2010) argues not to include foreign exchange reserve but also warns against the one to one relation between imports and foreign exchange reserve. Therefore, this paper does not include foreign exchange reserve to avoid the problem of near identity and most importantly; data on the CFA zone are not available. Under this framework, this paper contributes to the extensions of modeling food import by using a VECM to investigate the long-run relationships between food imports, relative commodity prices, real effective exchange rate, food production, GDP, and trade openness for imported cereals (Rice, Wheat, Maize, and Sugar) which is derived from a general utility function framework specified as:

$$FODIM_{it} = H_t\left(PFOOD_{jt,}GDP_{jt}, MREER_{jt}, OPEN_{jt}, DOMPF_{jt}\right) \qquad \textbf{(7)}$$

This paper follows Kargbo (2007) with assumptions of infinite supply elasticity in the long-run, as well as imported and produced cereals in countries within the CFA zone as perfect substitute. This will allow recovering the structural parameters when featuring the obtainability of foreign exchange rate for policy options and make judgment for major structural adjustments in quotas, tariffs, customs unions, etc. Theoretically, we expect the coefficient of $REER_{jt} \leq 0$ and that food imports to decrease as real exchange rates depreciate, while $PFOOF_{it}$ is expected to have negative effect on $FODIM_{jt}$ and GDP_{jt} is expected to be positive in the long-run. As $DOMPF_{jt}$ increases, we expect $FODIM_{jt}$ to decrease, and hence having a negative relationship in the long-run. We also expect $OPEN_{jt}$ to be positive/ negative like devaluation, and trade liberalization should pronounce more effect on import/export demand for diversification and larger responsiveness to economic incentives for less/more restrictive trade.

IV. Description of Data and Variables

We construct a new panel dataset from 1969 -2012 on commodities such as rice, wheat, maize, sugar, in all the CFA zone member countries (14 countries). The observations on import/export, domestic production and values of import/export are collected from mongabay.com/commodities, which draws exclusively from FAO official data sources and National Statistics Bureau in Africa. To ensure the quality and reliability of the data collected, we crossed examine the data in comparison with FAO, World Bank, and International Financial

Statistics (IFS). The gross domestic product (GDP), total population and real effective exchange rate (REER) index are measured in US dollar and are from the USDA official source. Total food imports (FODIM) and domestic food production per capita (DOMPFC) index are measured in millions per ton, and the index for trade openness (OPENESS) is measured as (ratio of total import + total export/ GDP), which is a good proxy devised to capture trade policy barriers such as tariffs, quotas, customs unions, and export taxes imposed by CFA countries Fajgenbaum et al (2000). The variable WPRICE is world import price index expressed in US dollars. Using the real effective exchange rate (REER), we assume that its equilibrium level will act in the model to detect and capture macroeconomic imbalances or instability constraints by fixed exchange rate and customs unions, and short-term domestic policies such as price controls or homologation.

V. Econometric Tests and Analysis

Baltagi argues "panel data are better at identifying and measuring effects that are simply not detectable in pure cross-section or pure time-series data"(2001, p.7). In this study, we use balanced panel data analysis, which will permit to control for heterogeneity in the CFA region given that Gabon, Chad and Cote-Ivoire are oil producer. Baltagi argues that "Time-series and cross section studies not controlling for this heterogeneity run the risk of obtaining biased results" (P. 5). Pooled/panel and uni-variate time series data tend to exhibit a time trend, and therefore the variables under investigation have means, variances, and covariance that are not time invariant. Given the indication that individual series are preliminary non-stationary, we applied the Levin-Lin & Chu (1992, 2002), Im-Pesaran-Shin (1997-2003), Breitung (2000), Hadri (2000); and Pedroni (1999) tests. We found that the Levin-Lin-Chu's (LLC) test was more restrictive in the panel series, and assumed that there was a homogeneous autoregressive parameter (AR) restriction, and the error term was independent across all series in the panel. The specificity of the LLC test is that like Im-Peseran-Shin (IPS), Breitung, and Hadri since they allow for panel lags specification for the Augmented Dickey Fuller (ADF) regression and also controls for the long-run variance estimation. However, the Im-Peseran-Test (IPS) and Breitung are less restrictive compared to the (LLC) as IPS tests for the null hypothesis (H_0) that all series in the sample contain a unit root against the alternative (H_A) where at least one series is stationary. In addition, given the heterogeneous aspect of countries in the CFA zone, the IPS panel root test takes into consideration the heterogeneous autoregressive behavior across panels in the sample. In addition, the Breitung Z statistic assumes the autoregressive constraint is constant across all panels in the sample. Table 1, 2, 3, 4, 5 displays the panel unit root tests and cointegration for rice, wheat, maize, and sugar.

VI. Results and Interpretations

The construction of the tests is adapted from Pedroni (1997a) in Table (1.b), which allows deriving the asymptotic distributions, and investigates the sample performances and efficiency of the seven (7) tests statistics. Each one of the variables for rice, wheat, maize and sugar was tested for stationarity. Table (1-4) displays the tests and the intuition behind the results and correlograms of each individual series indicate special properties of unit roots at level. We took the first-difference and the null hypothesis of unit root was rejected to conclude stationarity. After differencing the variables once, the cointegration tests procedure was carried out (Table 5). Then, we implemented the Pedroni panel cointegration tests and the rejection of the null hypothesis H_0 of no cointegration, which showed large positive values. Therefore, the results suggest cointegration at the 5% significance level. Next we implemented the VECM panel estimation to investigate possible endogeneity, correlation and heteroskedasticity of the residuals. Table 6 displays the estimation results. The signs of all the explanatory variables are consistent with expectation support by the literature. The coefficients of $REER_{jt}$ have the expected negative signs for all commodities. The coefficients of $PFOOD_{jt}$ have the expected negative signs as well for all commodities except for wheat. The model performed well as symptom of spurious regression model was not found. We also tested for normality of the residuals (H_0: no normal distribution and the H_A: normal distribution), serial correlation LM-test and autocorrelation and potential ARCH (H_A: no ARCH effect and the H_A: ARCH effect) effect under heteroskedasticity. The residual diagnoses for each commodity show evidence of stationarity and confirm the long-run cointegrating relationship among the variables in this study.

The findings suggest that although countries in the CFA zone are net exporters of non-cereal food staples, the collective behavioral analysis in our sample indicates that countries in the CFA zone are food-deficit while agriculture takes a large share in their GDP. The marginal propensity to import is positive for every country, so income level rises concomitantly with import level. The results in Table 6 show strong evidence of long-run relationship among the variables. A joint test, using the Wald test statistics indicates strong causal relationship in the short run among the variables and the error correction term, indicating the speeds of adjustment toward short run equilibrium for each commodity is negative. However, the cointegrating relationship fails to indicate the direction of causality. The long run relationship indicates that 10% of disequilibrium is corrected yearly to bring the system back to equilibrium. And its long-term effect on $FODIM_{jt}$ is ever lasting, affecting wheat and rice imports in the next period. The coefficients of GDP_{jt} in the cointegrating equation have the expected signs for wheat and sugar. However, rice and sugar have a negative coefficient and the deviation from the equilibrium is corrected at 95%, affecting rice and sugar imports in the long-run. The coefficients of $DOMPF_{jt}$ have the expected sign; cereal imports decrease in the long-run as domestic production increases. Most importantly, the coefficients of trade openness $OPEN_{jt}$ are all negative. Therefore, the more diverse and open these countries are, the better for regional markets to import their cereals in the CFA zone to strengthen regional integration in the WAEMU and CEMAC. In conclusion these findings are consistent with Kargbo' results (2005) who studied single countries in the CFA zone. Real effective exchange rate has significant real effects on agricultural commodities such as rice, wheat, maize and sugar, and also has the ability to change structurally the relative regional and domestic price of cereals in the CFA zone. Therefore, any policy options should take into consideration the variations of world commodity prices, which are the canvas by which trade deficit and macroeconomics instability in the CFA zone is recurrent. Moreover, exchange rate volatility under customs unions in the CFA zone exposes these countries at the mercy of food price volatility, and has serious impact on their terms of trade a investment, growth and macroeconomic stability.

VII. Conclusions

Improving the state of food security in the CFA zone requires steady macroeconomic performance, sustained economic growth, but most importantly an understanding of the relationship between food import, food production, relative commodities prices, growth, and trade for policies options. The transmission of volatility from the World food price and exchange rate constraint in the CFA zone constitute a challenge because many of the policies have focused on the cost side, which makes them less effective and flexible. Domestic food prices are not "self-correcting" and the adjustment mechanisms to restore equilibrium in the balance of payment have inflationary pressure in the region. CFA countries still remain vulnerable to subsequent food price shocks, and policymakers should center their attention on the adequate supply of certified quality of seeds, investment in technology, productivity, agricultural extension and marketing to curtail the cycle of food insecurity if governing is to anticipate. CFA countries have very limited foreign exchange reserve and their access to capital market and foreign loans cannot be used to support the rising food bill and uncertain export earnings**.**

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Note: Panel Unit Root Tests tables 1-4 : ** Probabilities are computed assuming Asymptotic Normality with a left hand side rejection area, except on the Hadri test, which is right sided and are in Parentheses indicating stationary Null hypothesis (common unit root process) Newey-West automatic bandwidth selection and Bartlett kernel. Note: Variables are in logarithm (L). LLC= Levin, Lin, Chu (2002), (LLC, Breitung, IPS) or stationary (Hadri) at least at the 5 percent level of significance. Number of observations (502) IPS= Im, Pesaran, Shin (2003). A * indicates the rejection of the null hypothesis of non-stationary.

TABLE 1: (Rice) Pool Unit Root Tests: Individual Effects Estimation: CFA Zone.

		Method			
Variables	(L)	LLC	Breitung	IPS	Hadri
LFOODIM	(L)	0.48383	2.43518	-1.0041	13.8129
		(0.6857)*	(0.9926)*	(0.1577)*	(0.0000)**
	(D)	-15.0048	-2.96409	-18.1496	1.96474
		(0.0000)**	(0.0015)**	(0.0000)**	(0.0310)*
LDOMPFC	(L)	6.55281	5.19096	2.98522	13.2152
		(1.0000)*	(1.0000)*	(0.9986)*	(0.0000)**
	(D)	-13.9537	5.89539	-20.4013	-8.4755
		(0.0000)**	(1.0000)**	(0.0000)**	(0.8017)*
LPFOOD	(L)	12.1052	8.54317	10.0108	2.34317
		(1.0000)*	(1.0000)*	(1.0000)*	(0.0096)*
	(D)	-16.6506	-12.386	-14.3679	6.3775
		(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**
LMREER	(L)	-1.83058	-0.96067	-0.33239	-1.83058
		(0.0336)*	(0.1684)*	(0.3698)*	(0.0336)
	(D)	-23.1502	-18.8307	-20.8435	-23.1502
		(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**
LRGDPC	(L)	5.15962	3.93495	1.7824	9.65481
		(1.0000)*	(1.0000)*	(0.9627)*	(0.0000)**
	(D)	-16.5024	-2.81714	-18.1671	-0.69876
		(0.0000)**	(0.0021)**	(0.0000)**	(0.7576)*
LOPEN	(L)	1.25557	3.32711	-1.00393	13.8124
		(0.8954)*	(0.9996)*	-0.1577	(0.0000)**
	(D)	-13.8465	-2.49336	-18.1492	1.96486
		(0.0000)**	(0.0063)**	(0.0000)**	(0.0310)*

TABLE 2: (Wheat) Pool Unit Root Tests: Individual Effects Estimation: CFA Zone

		Method			
Variables	(L)	LLC	Breitung	IPS	Hadri
LFOODIM	(L)	-0.0409	2.57356	-2.81695	4.29777
		(0.4837)*	(0.9950)*	(0.0024)*	(0.0000)**
	(D)	-16.0154	4.92262	-18.5793	2.80739
		(0.0000)**	(1.0000)**	(0.0000)**	(0.0025)*
LDOMPFC	(L)	-5.09827	-1.36632	-5.44677	4.22175
		(0.0000)**	(0.0859)*	(0.0000)*	(0.0000)**
	(D)	-12.7617	-1.44594	-15.3962	1.8418
		(0.0000)**	(0.0741)**	(0.0000)**	(0.0328)*
LPFOOD	(L)	-4.91964	-1.68464	0.12158	11.3857
		(0.0000)*	(0.0460)*	(0.5484)*	(0.0000)**
	(D)	-20.6817	-20.2424	-20.8376	7.74597
		(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**
LMREER	(L)	-1.41571	4.40961	-0.33239	-11.2665
		(0.0784)*	(1.0000)*	(0.3698)*	(0.0000)**
	(D)	-21.7501	-18.9548	-20.8435	-1.27809
		(0.0000)**	(0.0000)**	(0.0000)**	(0.8994)*
LRGDPC	(L)	5.03447	3.93495	0.18243	5.77116
		(1.0000)*	(1.0000)*	(0.5724)*	(0.0000)**
	(D)	-16.7255	2.40051	-17.5294	2.3961
		(0.0000)**	(0.9918)*	(0.0000)**	(0.0083)*
LOPEN	(L)	-0.12228	2.57361	-2.77262	7.82685
		(0.4513)*	(0.9950)*	-0.0028	(0.0000)**
	(D)	-14.5429	4.92262	-17.8185	4.19335
		(0.0000)**	(1.0000)**	(0.0000)**	(0.0000)**

TABLE 3: (Maize) Pool Unit Root Tests: Individual Effects Estimation.CFA Zone.)

		Method			
Variables	(L)	LLC	Breitung	IPS	Hadri
LFOODIM	(L)	-7.06626	-5.29798	-8.57789	5.61164
		(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**
	(D)	-21.8952	-10.2839	-18.5793	-0.86382
		(0.0000)**	(0.0000)**	(0.0000)**	(0.8062)*
LDOMPFC	(L)	2.42001	2.54429	0.4392	7.91558
		(0.9922)*	(0.9945)*	(0.6697)*	(0.0000)**
	(D)	-22.5489	-0.8794	-23.3846	2.65065
		(0.0000)**	(0.1896)*	(0.0000)**	(0.0040)*
LPFOOD	(L)	-1.99078	-2.03091	-1.68358	8.9379
		(0.0233)*	(0.0211)*	(0.0461)*	(0.0000)**
	(D)	-23.8135	-17.3497	-21.5212	1.17617
		(0.0000)**	(0.0000)**	(0.0000)**	(0.1198)*
LMREER	(L)	-1.4254	-1.65902	0.11295	11.2641
		(0.0770)*	(0.0486)*	(0.5450)*	(0.0000)**
	(D)	-21.7415	-18.9696	-20.8302	-1.27488
		(0.0000)**	(0.0000)**	(0.0000)**	(0.8988)*
LRGDPC	(L)	5.03447	4.40961	0.18243	5.77116
		(1.0000)*	(1.0000)*	(0.5724)*	(0.0000)**
	(D)	-16.7255	2.40051	-17.5294	2.3961
		(0.0000)**	(0.9918)*	(0.0000)**	(0.0083)*
LOPEN	(L)	-5.34655	-4.78722	-7.29764	5.30171
		(0.0000)*	(0.0000)*	(0.0000)**	(0.0000)**
	(D)	-21.5009	-8.64651	-21.4176	-1.40367
		(0.0000)**	(0.0000)**	(0.0000)**	(0.9198)*

TABLE 4: (Sugar) Pool Unit Root Tests: Individual Effects Estimation in the CFA Zone.

		Method			
Variables	(L)	LLC	Breitung	IPS	Hadri
LFOODIM	(L)	-0.66253	-4.29462	-0.03342	9.59339
		(0.7462)*	(0.0000)**	(0.4867)**	(0.0000)**
	(D)	-19.5324	-8.85402	-22.1641	0.81294
		(0.0000)**	(0.0000)**	(0.0000)**	(0.2081)*
LDOMPFC	(L)	2.42001	-0.50376	-0.31887	4.9479
		(0.9922)*	(0.3072)*	(0.37497)*	(0.0000)**
	(D)	-9.16231	7.24095	-18.1627	3.611
		(0.0000)**	(0.0000)**	(0.0000)**	(0.0002)*
LPFOOD	(L)	-3.69619	0.15164	-4.38467	10.9275
		(0.00001)*	(0.5603)*	(0.0000)*	(0.0000)**
	(D)	-13.8913	-9.56395	-14.2352	-0.70595
		(0.0000)**	(0.0000)**	(0.0000)**	(0.7599)*
LMREER	(L)	-1.4254	-1.65902	0.55927	4.41341
		(0.0770)*	(0.0486)*	(0.7120)*	(0.0000)**
	(D)	-21.7415	-18.9696	-19.2542	-1.27488
		(0.0000)**	(0.0000)**	(0.0000)**	(0.8988)*
LRGDPC	(L)	5.03447	4.40961	0.18243	5.77116
		(1.0000)*	(1.0000)*	(0.5724)*	(0.0000)**
	(D)	-16.7255	2.40051	-17.5294	2.3961
		(0.0000)**	(0.9918)*	(0.0000)**	(0.0083)*
LOPEN	(L)	-0.14147	-4.95548	-0.00865	8.55113
		(0.4438)*	(0.0000)*	-0.4966	(0.0000)**
	(D)	-20.7319	-11.0509	-21.7846	-0.65667
		(0.0000)**	(0.0000)**	(0.0000)**	(0.7443)*

Table 5: Pedroni Panel Cointegration Tests Commodities (Rice, Wheat, Maize, And Sugar): CFA Zone Series:

LFOODIM LDOMPFC LPFOOD LRGDP LREER LOPEN

H_A:	Common AR	coefs.	(Within-dimension)			(Between-dimension)	
Weighted Statistics	Panel V	Panel Rho	Panel PP	Panel ADF	Group Rho	Group Rho	Group Rho
RICE	-						
(Statistic)	7.085187**	-4.53451	-8.62802	-8.35623	-4.80132	-19.311	-11.1005
(Prob)	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**
WHEAT							
(Statistic)	2.678702**	-1.34759	-2.48488	4.51112	-3.57204	-7.58575	-7.93978
(Prob)	(0.0037)**	(0.0889)*	(0.00065)*	(0.0000)**	(0.0002)*	(0.0000)**	(0.0000)**
MAIZE							
(Statistic)	4.092524**	-7.25901	-11.1529	10.8716	-4.88122	-8.73133	-5.89706
(Prob)	(0.0000)**	(0.0000)**	(0.0000)**	(0.0000)**	(0.0161)*	(0.0000)**	(0.0000)**
SUGAR							
(Statistic)	9.408095**	-5.29388	-4.16097	-1.27398	-5.4072	-13.2469	-11.9668
(Prob)	(0.0000)**	(0.0000)**	(0.0000)**	(0.1013)*	(0.0000)**	(0.0000)**	(0.0000)**

** Probabilities are computed under Asymptotic Normality. Probabilities are in Parentheses indicating rejection of the Null hypothesis of no-cointegration with 5% level of significance. Newey-West automatic bandwidth selection and Bartlett kernel. The critical values are from Levin and Lin (1992), Table 3 (with N=6 and T=528). V, non-parametric variance ratio statistic; rho, non-parametric test statistic equivalent to the Phillips and Perron (PP) rho statistic; PP, non-parametric statistic equivalent to the PP t statistic; ADF, parametric statistic analogous to the augmented Dickey-Fuller statistic. A ** Indicate significance at 5% and *10% level for rejection of the hull of no-cointegration among the variables.

TABLE 6: VECM (Vector Error Correction Model Estimates) for commodities in the CFA Zone from 1969-2012. Series: D (LFOODIM) D (LDOMPFC) D (LPFOOD) D (LRGDP) D (LREER) D (LOPEN)

Commodities	Imports	Rice	Wheat	Maize	Sugar
LFOODIM	(-1)	1.000000	1.000000	1.000000	1.000000
LPFOOD	(-1)	-0.001409	0.580376	-0.938069	-0.227769
		(0.02629)	(0.54747)	(0.54353)*	(0.09206)*
		[-11.6136]***	[1.06011]	[-1.72587]**	[-2.47417]***
LDOMPFC	(-1)	-0.001409	-759901	-0.006851	-4.988546
		(0.00449)	(0.11213)	(0.09891)	(0.52157)
		[-0.31366]	[-6.77711]***	[-0.06927]	[-9.56441]***
LRGDPC	(-1)	-0.028058	1.240423	-0.068815	0.515049
		(0.00815)	(0.14253)	-0.13179	(0.20835)
		[-3.44059]***	[8.70289]***	[-0.52216]	[2.47208]**
LMREER	(-1)	-0.027085	-1.333237	-0.135793	-0.5294
		(0.01765)*	(0.61043)*	-0.46924	(0.33927)
		[-1.53494]	[-2.18409]***	[-0.28939]	[-1.56042]
LOPEN	(-1)	-1.015524	-1.710075	-1.029895	-0.685515
		(0.00385)	(0.15152)	(0.06523)	(0.07496)
		[-263.732]***	[-11.2858]***	[-15.7877]***	[-9.14465]***
C		1.595332	14.59882	4.916065	25.16263
Error Correction Term					
D (LFOODIM)		-0.267246	-0.108343	-0.473438	-0.235223
		(0.03467)	(0.04203)	-0.03789	(0.05450)
		[-7.70926]***	[-2.57790]**	[-12.4959]***	[-4.31635]***

Note: R-square (Rice)=0. 998, R-square A.j (Rice)=0.997 and D.W- Statistic 1.711. R2 = 0.7231; R-square (sugar)=0.99 Adjusted R-square (Sugar)=0.997 = 0.5987; DW = 2.546627; R-square (Wheat)=0.56, R-S A.J =0.55, R-square (maize)= 0.656685, R-square A.J=0.644721 * (Standard errors) **[t-statistics], significant at *10% **5 % level. #Note: countries are: Benin, Burkina Faso, Cote Ivoire, Guinee Bissau, Guinee Conakry, Niger, Senegal, Togo (WAEMU) and Cameroon, The Central African Republic, Chad, The Republic of Congo, Gabon and Equatorial Guinea (CEMAC).

<u>Graph</u> 1: Commodities (**Food Import**) by Countries in the CFA Zone: Rice - Wheat - Maize - Sugar, from [1969 - 2012]