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Test for asymmetry price relationship in Nigerian Cocoa market

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Abstract

Objective: To investigate the degree of asymmetry in the relationship between world price of cocoa and the local exporting firms' prices.
Methods: A Generalized Least Square Momentum Threshold Autoregressive (GLS MTAR) model was employed in the analysis of the data. The properties of the model are more significant in power when compared with the Engle and Granger symmetric test or the co-integration model developed by Ender and Siklos.
Findings: The main result show that a rise in the world price might lead to slower rise in cocoa exporting firm prices in Nigeria, while a decline in the world prices might cause a rapid fall in the exporting firms prices.
Application: The results suggest that there exists inherent competition among cocoa exporting firms in Nigeria who now interface between cocoa farmers and importers. At present therefore, the liberalization of the market could be said to be a right step in the right direction.
Keywords: Cocoa prices, Co-integration, GLS MTAR, Asymmetric Price Adjustment.

1. Introduction

A wide range of literature in Economics has focused on the relationship between prices, either spatially or vertically ([1-8]. Theoretically, the Law of One Price (LOP) is expected to regulate spatial price relations while pricing along production chains depends on production costs and degree of competition among the stakeholders. On a summary note, the literatures cited above show that factors affecting transmission can be classified into six namely, market power, increasing return to scale in production, product homogeneity and differentiation, exchange rate, transport and transaction costs, and border and domestic policies. All can affect both spatial and vertical price relationship but the first three have been investigated in reference to vertical price transmission. Several econometric applications have been developed to verify some of these sources. The approaches can be classified into the following three categories: First, the initial approaches which include correlation coefficients [9] and first difference specification. The second such as causality, cointegration and error correction model are classified as modern time series while the third such as Threshold Autoregressive (TAR) and parity models are classified as transaction based approaches. [10] Provides details of the merits and drawbacks of the models. For the purpose of this study, MTAR model was utilized to test investigate the level of asymmetry in the relationship between world cocoa prices and Nigerian domestic export prices. This paper proceeds as follows: the next section provide a brief background on Nigeria cocoa market economy, section three focuses on the econometric model and data description and sources while section four reports the results and discussion. The last section concludes.

2. Structure of Nigerian Cocoa market

Cocoa is the most important agricultural export commodity in Nigeria. In terms of market reforms, cocoa market in Nigeria has undergone two major reforms which are market regulation (1948 – 1985) and market liberalization (1986 – date). In the market regulation era, cocoa marketing was highly regulated through input price controls and subsidies, monopsonistic produce marketing boards, oligopolistic processing industries, and fixed wholesale and retail prices. Commodity prices were generally set below market levels by governments, implicitly taxing producers while subsidizing consumers. Under the regime, domestic markets were insulated

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from international price signals through tariffs and quotas on import, subsidies and taxes on export and fixed exchange rate policies [11-13]. In contrast, key reforms implemented within the free market approach introduced in 1986 include: institutional reforms and privatization, which recognized the role of the private sector in sustaining agriculture based exporting and processing activities; inflation control and the conduct of monetary policy; Others include liberalization of the exchange rate; export credits and expansion grants; and liberalization of trade in agricultural inputs and outputs. These measures were intended to lead to a reasonably rise in in farm-gate prices, timely payment to farmers and also ensure that the domestic producers receive a fair share from the international price for the commodity.

The new regime should have increased transmission of world signals to local producers if the discrepancies between the world price and the producer prices are reduced. This however depends on how exporting firms who now assumes the roles of the monopolistic marketing board manage market liberalization challenges that may have hindered integration. The main objective of this paper therefore is to examine asymmetric price relationship between world price of Nigerian cocoa and the exporting firms' average price using MTAR model.

3. Econometric model

Theoretically, the two-step approach developed by [14] provided a test for cointegration between two non-stationary prices I(1) using OLS method. The two prices in this study are world prices, WP_t and domestic prices, DP_t of cocoa. Symbolically:

$$DP_t = a + bWP_t + e \quad (1)$$

Where *a, b and e* are the constant, slope and random disturbance parameters respectively. The constant accounts for differences between transfer costs and quality while the slope is the elasticity of price transmission. In the first stage, equation 1 is estimated with OLS. In the second stage, a unit root test of equation 1 residual is performed using Dickey-Fuller test: The model is:

$$\Delta e_t = ce_{t-1} + w_t \quad (2)$$

Where w_t indicates a white noise disturbance term. The augmented version of Dickey-Fuller test (ADF) involving lagged values Δe_t will be more appropriate in case w_t is not white noise. If the residuals defined in (2) are stationary, the null hypothesis of no cointegration will be rejected. In a situation where price relationship is asymmetric, the Engle and Granger method has been adjudged to be inappropriate [15]. They came up with the momentum threshold autoregressive (MTAR) model as a better alternative. Symbolically, the MTAR model is:

$$\Delta e_t = I_t \lambda_1 e_{t-1} + (1 - I_t)\lambda_2 e_{t-1} + w_t \quad (3)$$

Where I_t is the Momentum Heaviside Indicator?

The residual, e_t is stationary if and only if $\lambda_1 < 0$, $\lambda_2 < 0$ and $(1+\lambda_1)(1+\lambda_2) < 1$ [16]. The null hypothesis $(\lambda_1 = \lambda_2 = 0)$ is tested with Φ -statistics. The null hypothesis of symmetric adjustment $(\lambda_1 = \lambda_2)$ can be tested with F- statistic (Tong 1990).

Observed that MTAR model may be made insignificant by Engle and Granger approach if asymmetric relationship exists. They proposed a more consistent MTAR approach which chooses a threshold endogenously. A shortcoming of consistent MTAR method is reported [17] He shows that its power properties are lower than the Engle and Granger method and proposed the GLS MTAR method. The GLS MTAR method utilizes the local-to-unity detrending which increases the power of the conintegration test [18-22]. This method is applied in this

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study. In the first instance, both DP_t and WP_t are detrended based on their statistical properties. The deterministic term is defined as $c_t = 1$ and the quasi differenced data are defined as follows:

$$\overline{DP}_\alpha = \left[DP_1, DP_2 - \alpha DP_1, \ldots\ldots DP_S - \alpha DP_{S-1}\right]$$

$$\overline{DP}_\alpha = \left[WP_1, WP_2 - \alpha WP_1, \ldots\ldots WP_S - \alpha WP_{S-1}\right] \qquad c_\alpha = \left[c_1, c_2 - \alpha c_1, \ldots\ldots, c_S - \alpha c_{S-1}\right]$$

Where $\alpha = 1 + k/S$ with S standing for the sample size and k representing a constant which defines the level of local-to-unity detrending. In order to compute the GLS detrended series, $\overline{WP}_t$ is obtained from $WP_t - \theta$ where θ is the slope of the regression of $\overline{WP}_\alpha$ against c_α. The same procedure is applied to get $\overline{DP}_t$. Using the detrended series, the following regression equation is estimated: $\overline{DP}_t = \delta \overline{WP}_t + \varepsilon_t$

(6)

The long-run model incorporating the threshold is as follows:

$$\Delta\varepsilon_t = I_t \gamma_1 \varepsilon_{t-1} + (1 - I_t)\varepsilon_{t-1} + \mu_t$$

And the Momentum-Heaviside Indicator can be described as:

$$I_t = \begin{cases} 1 & if \quad \Delta\varepsilon_{t-1} \geq 0 \\ 0 & if \quad \Delta\varepsilon_{t-1} < 0 \end{cases} \qquad (8)$$

The GLS MTAR model is adopted in this study its power properties are significantly higher than those of Engle and Granger and the Enders and Siklos cointegration models.

4. Data and empirical results

The analyses are based on the following secondary data (i) monthly firm-level price data from two largest cocoa beans exporting, namely, agro trader and stan mark cocoa firms, and (ii) monthly world price. Both data cover 2000 to 2009 because of inconsistencies in the previous years' data. All the data series are expressed in Nigerian (Naira) per metric ton and deflated with the Nigerian monthly consumer price index (1985=100). The data showing the evolution of the monthly real prices for the firms relative to the world price are shown in Figures 1 and 2. The price movements suggest the existence of asymmetries in the price transmission.

Figure 1. Agro trader versus ICCO

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Figure 2. Stanmark versus ICCO

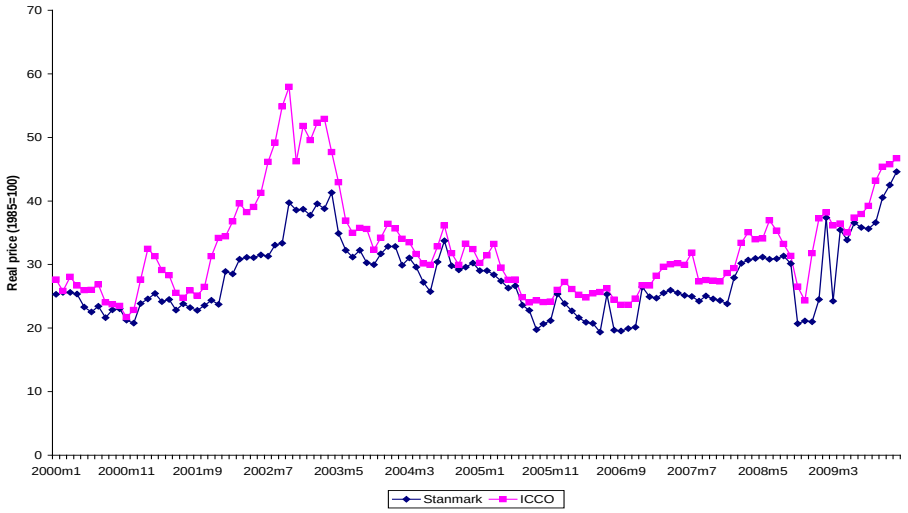

Table 1. Results of the MTAR model

	EG	λ_1	λ_2	$\Phi stat$	$\lambda_1 = \lambda_2$	LB-Q stat
Agro trader	–2.86 (1.1)	–0.11(0.9)	–0.32(3.1)	5.12 (1.0)	1.98[0.16]	2.14[0.71]
Stan mark	–6.71 (0.1)*	–0.17(1.2)	–0.64(5.1)	13.20 (0.1)*	6.58[0.01]	0.89[0.92]

Tables 1 and 2 show the output of the GLS MTAR. Table 2 succinctly indicates asymmetric price relationship between cocoa world price and average Nigerian exporting firms' prices. However, the response of Agrotrader to world price was not consistent with asymmetric when GLS MTAR model is applied. The results of the GLS MTAR model show that the immediate response of both Agrotrader and Stanmark firms to fall in the world price of cocoa is to reduce their prices. The rate of adjustment was 74% for Agrotrader and 78% for Stanmark. In contrast, their response to increase in world price was not as quick as their response to decline in price. The quick response to decline in price may be interpreted as a good competition expected among the exporting firms who now interface between the farmers and the importers following abolition of marketing board. Now that the freedom to become an exporter has increase, the bigger firms might respond quickly to decline in world price in order to dominate the market. An explanation for slower response to rise in world price might be very high cost of borrowing. The failure of Federal Government of Nigeria to sign European Partnership Agreement (EPA) may be another useful explanation. Another possible reason might be due to restrictions imposed on the use of pesticides with high level of residues by International Cocoa organization (ICCO).

Table 2. Results of the GLS MTAR model

	PR	λ_1	λ_2	$\Phi stat$	$\lambda_1 = \lambda_2$	LB-Q stat
Agrotrader	–3.12 (1)*	–0.19(2.26)	–0.74(5.80)	19.38 (1)*	12.40[0.00]	6.78[0.15]
Stanmark	–4.31 (1)*	–0.27(2.24)	–0.78(6.93)	26.55 (1)*	10.02[0.00]	3.55[0.47]

**Indicates significant at 5% probability level*

5. Conclusion

This paper tests for the presence of asymmetry in the relationship between world price of cocoa and the Nigerian exporting firms' prices using GLS MTAR model. The main result shows that a rise in the world price

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might lead to slower rise in exporting firm prices, while a decline in the world prices might cause a rapid fall in the exporting firm's prices. The results suggest that there exists inherent competition among the exporting firms. The bigger firms might be trying to eject smaller firms given the high freedom of becoming an exporter in the country in post-liberalization era.

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