AGRODEP
African Growth & Development Policy modeling consortium
FACILITATED BY IFPRI

AGRODEP Working Paper 0005

April 2014

Post-Liberalization Markets, Export Firm Concentration, and Price Transmission along Nigerian Cocoa Supply Chains

Joshua Olusegun Ajetomobi

About the Authors

Joshua Ajetomobi Olusegun is a Professor at the Ladoke Akintola University of Technology (LAUTECH), Nigeria.

Acknowledgements

The author gratefully acknowledges the financial and technical contributions to the research by the African Economic Research Consortium, Kenya and UNU-WIDER, United Nations University, Helsinki, Finland. However, the views expressed in this paper, as well as any errors, are entirely attributable to the author.

Table of Contents

Abstract

This study examines whether major Nigerian export firms exert market power over Nigerian cocoa farmers in the form of incomplete price transmission. A common indicator of efficient and functioning markets is the presence of a high level of market integration, while a lack of integration could be an indication of private traders' market power. This study pays special attention to export firms' pricing behavior in the post-liberalization period. Our analyses are based on (i) monthly firm-level price data from major Nigerian cocoa beans exporting companies and (ii) monthly farm gate prices between 1986 and 2009. The analyses of the data were done within an error correction and co-integration model framework. The analysis of price transmission based on firm-specific export price data shows that none of the firms tend to exert market power over the cocoa farmers, unlike the situation in 1986 in which cocoa marketing boards were abolished (Delgado, 1986). This also suggests that the efficiency of the international cocoa marketing channel improves as a result of market liberalization. It is highly probable that the government's abolition of cocoa marketing boards contributed to this development. Given the lack of evidence of market power, the temporary divergence between each major firm's export price series and farm gate prices might be due to short-term contracts between the export firms and foreign buyers, various capacity constraints, and/or exchange rate shocks.

JEL Classification Numbers: Q13, Q17, C32, L11, L66, D12, D4

Keywords: Supply Chain, Price transmission, Cocoa Exporting Firm, Nigeria

Résumé

Cette étude examine l'existence d'un pouvoir de marché exercé par les grandes entreprises exportatrices au Nigeria sur les producteurs de cacao sous forme de transmission des prix incomplète. Un indicateur traditionnel du fonctionnement efficace des marchés est le haut degré d'intégration entre eux, le manque d'intégration pouvant être une indication de pouvoir de marché des négociants privés. L'étude accorde une attention particulière à la politique de prix des entreprises exportatrices en période post- libéralisation. Les analyses sont basées sur (i) les données mensuelles de prix au niveau des principales entreprises nigérianes exportatrices de fèves de cacao (ii) les prix bord-champs mensuels entre 1986 et 2009. Les analyses des données ont été effectuées à l'aide d'un modèle à correction d'erreur dans le cadre de la co-intégration. L'analyse de la transmission des prix sur la base de données de prix à l'exportation des firmes individuelles montre qu'aucune des entreprises n'a tendance à exercer un pouvoir de marché sur les producteurs de cacao, contrairement à la situation qui a conduit à la suppression des organismes de commercialisation du cacao en 1986 (Delgado , 1986). Cela suggère également que l'efficacité de la chaîne de commercialisation internationale du cacao s'améliore à la suite de la libéralisation du marché. Il est très probable que la suppression par le gouvernement office de commercialisation du cacao a contribué à ce développement. Compte tenu de l'absence de preuve de pouvoir de marché, la divergence temporaire entre les prix à l'exportation des firmes et ceux bord champs peut être dû à des contrats à court terme que les entreprises exportatrices ont avec les acheteurs étrangers, diverses contraintes de capacité et / ou des chocs de taux de change.

Codes JEL : Q13, Q17, C32, L11, L66, D12, D4

Mots-clés: Chaînes d'approvisionnement, Transmission des prix, Firmes exportatrices de Cacao, Nigeria

1. Introduction

A key objective of the World Bank-led structural adjustment programmes (SAP) implemented in most sub-Sahara African nations since the mid-1980s was the elimination of barriers to trade. Despite social and political pressures, most countries in the region extended their SAPs to agricultural markets in the hopes of improving integration along agricultural supply chains. In Nigeria, an SAP was implemented in mid-1986. The new regime should have increased transmission of global signals to local producers; however, post-liberalization challenges may have hindered market integration. At present, private industries, firms, and corporate bodies are free to engage in domestic trading and exportation of agricultural products. Initially, there were many registered exporters and buying agents, but now only a few large companies dominate the export of agricultural commodities. Buying agents and farmers are still many, and prices vary from location to location and continuously throughout the buying seasons. If the post-liberalization markets were characterized by perfect competition, then margins should vary across space by differences in transaction costs by infrastructure conditions, distance to ports or buying centers, fuel prices, technology, and other transport costs. If, however, the private agents who now interface directly with farmers have the ability to exert oligopsony or monopsony power, then margins will also contain rents that allow part of the efficiency gains to accrue to the private intermediaries; these may vary according to institutional relationships.

With these points in mind, there are three basic research questions. Is the post-liberalized Nigerian cocoa export market characterized by imperfect competition? Has realization of the expected benefits of liberalization been hampered by the activities of private agents large enough to influence market outcomes? Are prices being transmitted efficiently between exporting/processing firms and farm gates? This study evaluates the degree of price transmission in the Nigerian cocoa supply chain within the framework of a co-integration and error correction model. Econometric tests give consideration to the special time series characteristics of agricultural prices.

In the next section, the structure, policies, and challenges of the Nigerian cocoa supply chain are reviewed. The third section discusses the advantages and disadvantages of empirical methodologies used in the literature to evaluate market integration. The fourth section presents the empirical results, while some conclusions are drawn in the final section.

2. Structure of the Nigerian Cocoa Market

This section describes the structure of Nigeria's cocoa market from production to export pricing. Emphasis is laid upon production, pricing, and the framework of the supply chain.

2.1 Production and Export

Nigeria is the world's sixth largest producer of cocoa, contributing about 7% of global production in 2009 (Table 1). This is in sharp contrast to 1964, when Nigeria was the second largest producer. The total world cocoa production in 1964 was about 1.5 million tonnes, and Nigeria contributed about 19.77% of that total. In spite of this sharp decline in production, cocoa is still the second largest non-oil foreign exchange earner in Nigeria, after leather. It is produced in 16 states of the federation: Ondo, Crossriver, Oyo, Osun, Ekiti, Ogun, Edo, Kogi, Akwa Ibom, Delta, Kwara, Ebonyi, Rivers, Taraba, and Adamawa. Annual production stood at 240,000 tonnes in 2009; about 98% of the cocoa produced is exported.

Cocoa provides means of livelihood, sustenance, and employment to over five million Nigerians. The export revenue in 2009 was about US$136.7 million. Production is dominated by smallholder farmers with an average farm size of 2 hectares, while export is dominated by three firms: Agrotrader Nigeria Ltd, Cocoa Products Nigeria Ltd, and Stanmark Cocoa Company Nigeria Ltd. Major market destinations for Nigerian cocoa are Netherlands, U.K, France, Germany, Spain, Italy, USA, and Japan. Other markets being explored include the emerging economic powers of China and India.

Table 1: World Production of Cocoa Beans

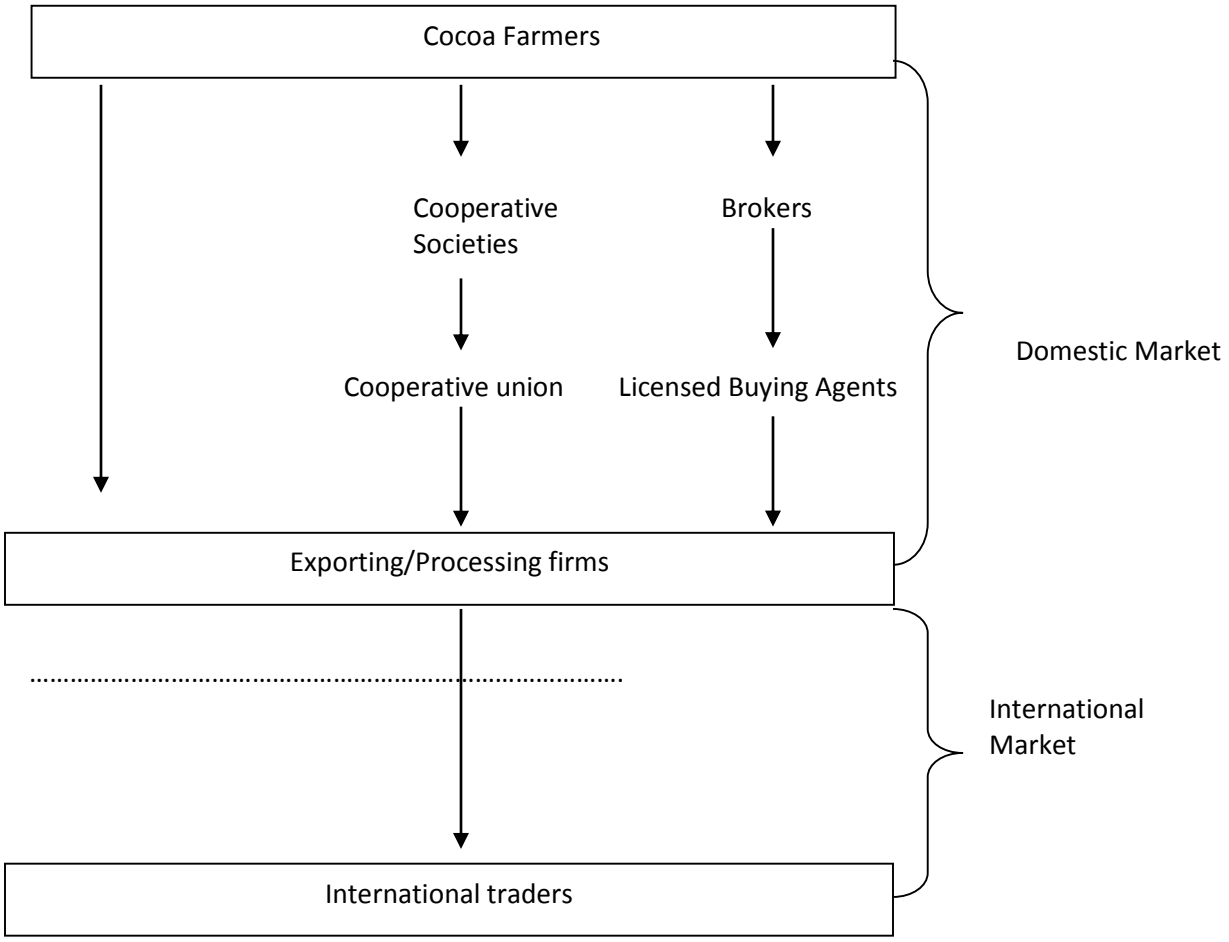
	2008		**2009**	
Country	**Thousand tones**	**Percent**	**Thousand Tones**	**Percent**
Africa	2687	72	2484	71
Cameroon	185	5	210	6
Cote d'Ivoire	1382	37	1222	35
Ghana	729	19.5	662	19
Nigeria	220	5.9	240	7
Others	171	4.6	150	4
America	453	12.1	456	13
Brazil	171	4.6	157	5
Ecuador	111	3	112	3
Others	171	4.6	187	5
Asia and Oceania	591	15.8	575	16
Indonesia	485	13	475	14
Papua New Guinea	52	1.4	52	1
Others	54	1.4	48	1
World Total	3731	100	3515	100

Source: ICCO, www.icco.org/statistics/production.aspx

A simplified version of the Nigerian domestic cocoa supply chain is shown in Figure 1. The country's many farmers (about 300,000) are the basic starting point of the chain; they sell their cocoa beans either directly or indirectly to an exporting/processing firm. The indirect approach usually takes place via a cooperative and/or a local buyer. This local buyer can either be a broker or a Licensed Buying Agent (LBA);

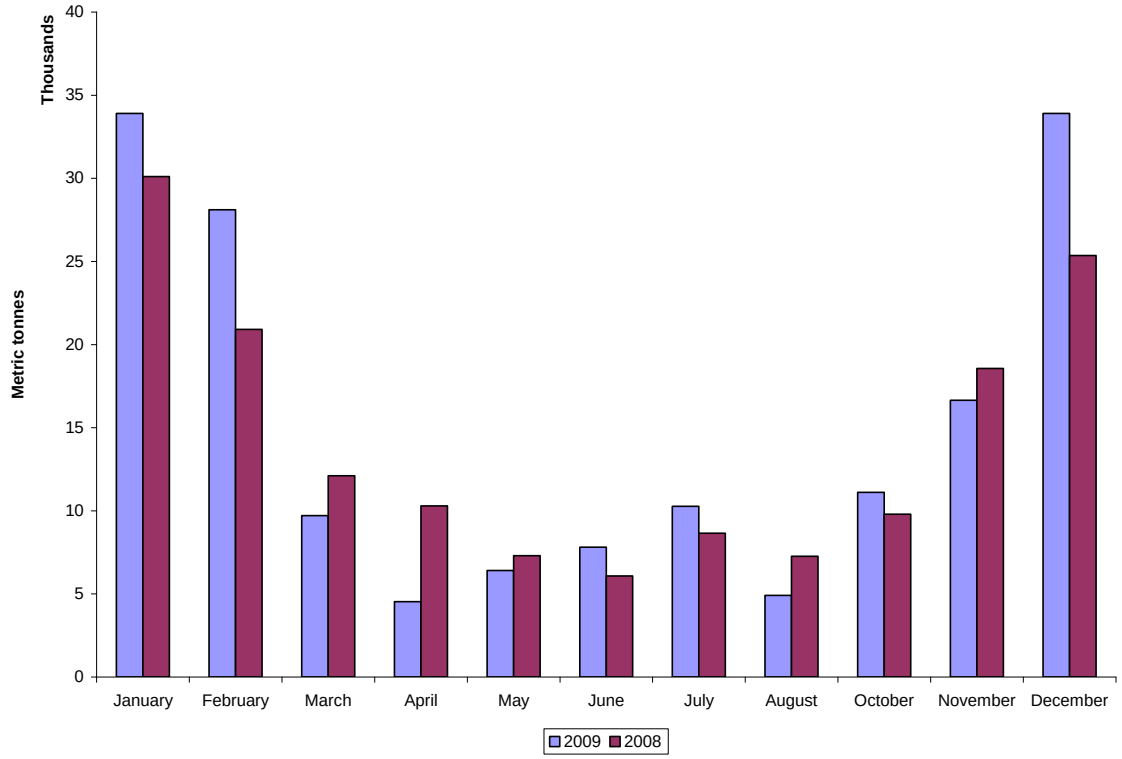
brokers buy dry cocoa beans from farmers at the farm gate and sell to LBAs. Alternatively, farmers sometimes sell their cocoa together when they belong to cooperative societies. Like licensed buying agents, cooperative societies grade cocoa beans and sell to exporting/processing firms. From the collection centers located in big towns, cocoa beans are transported to exporters' warehouses in Lagos and/or the Calabar port area. The warehouses belong to companies formally registered with the government as cocoa exporters for each cropping season. These exporters can be either expatriates or local firms. A breakdown of the country's total export data for 2008 and 2009 is shown in Figure 2. Total exports in 2008 were 167,555 metric tonnes. This value declined by about 7.19% in 2009 due to unfavorable climatic condition (Com-Watch 2009). At present, about 123 cocoa exporting firms (both local and expatriate) are registered with Nigeria Export Promotion Council (NEPC).

Figure 1: Supply Chain of Cocoa in Nigeria



Source: Author's design

Figure 1: Breakdown of cocoa export data in Nigeria 2008 – 2009



Source: Federal produce inspection service department

Despite liberalization, Nigeria's cocoa export market remains dominated by three limited liability companies: Agro-trader, Cocoa Products, and Stanmark. In recent times, these companies accounted for about one-third of all Nigeria's cocoa exports (Table 2). All three dominant companies are better positioned in terms of access to major source markets; they are all located in Ondo state, the largest cocoa producing state in the country. Their competitive edge may also be attributed to the business and policy environment, which encourages private traders to support farmers, fund research, and engage in extension services to raise both farmers' productivity and the quality of their product. Stanmark Nigeria Ltd, for instance, has organized about 42 cocoa farming communities into viable cooperative societies. The firm holds regular consultative forum with the farmers before any major intervention in terms of input subsidies and quality control. Stanmark Nigeria Ltd represents the only major direct contact that cocoa farmers have with the end user.

Access to a $15 million loan (the largest loan obtained so far by a single cocoa exporting/processing firm in Nigeria) boosted Agrotrader Ltd's cocoa beans exports. Through the loan, the firm was able to alleviate the credit constraints of many farmers; farmers received the fund as bonds from local buyers working for the export firm. A major disadvantage of this process is the tendency to reduce the real worth of the farmers' output. Apart from this type of bond, cocoa farmers mobilize funds through their cooperative societies. The

interest rate varies from 10-15% depending on whether the payment period is one year or eighteen months, respectively. Many farmers, however, cannot access such loans because of poor savings. The competitive edge that Cocoa Products Ltd has over many export firms might be due to its ownership structure. Formerly owned completely by Ondo state (the leading cocoa producer in Nigeria), 90% of its shares have been acquired by Skye Bank under the privatization of public-owned enterprises.

In contrast to its very concentrated export supply situation, Nigerian cocoa production is less concentrated, with about 30,000 cocoa farmers accounting for all cocoa beans produced in the country. Many cocoa farmers are contracted to the exporters with whom they deal. Some of these exporters, however, have established agents in the cocoa farming localities to directly take on the risk involved in purchasing and dealing with farmers. Now that cocoa marketing boards have been abolished and a few firms dominate exports, if the post-liberalization market were characterized by perfect competition, then margins should vary across space by differences in transaction costs determined by infrastructure conditions, distance to port or buying center, fuel prices, technology, and other transport costs. If private agents who now interface directly with farmers have the ability to exert oligopsony or monopsony power, then margins will also contain rents that allow part of the efficiency gains to accrue to these private intermediaries; these may vary according to institutional relationships.

Table 2: Breakdown of Annual Cocoa Export in 2009 by Exporting Firms

Company	Export data	% of total
Agrotrader	20000	12.80
Stanmark	12000	7.67
Agrotrader	15000	9.60
Others	109320	69.93
Total	156320	100.00

Sources: Company files and Federal Produce Inspection Service Department

At present, the challenges facing the export firms can be divided into two broad categories: local and international.

The local challenges include:

- unregulated market structure,
- multiple taxation and levies by Federal, State, and Local governments as well as unions,
- high cost of borrowing,
- inadequate supply of quality input materials such as pesticides,
- lack of infrastructure facilities such as electricity, road networks, treated water supplies, and communication facilities,

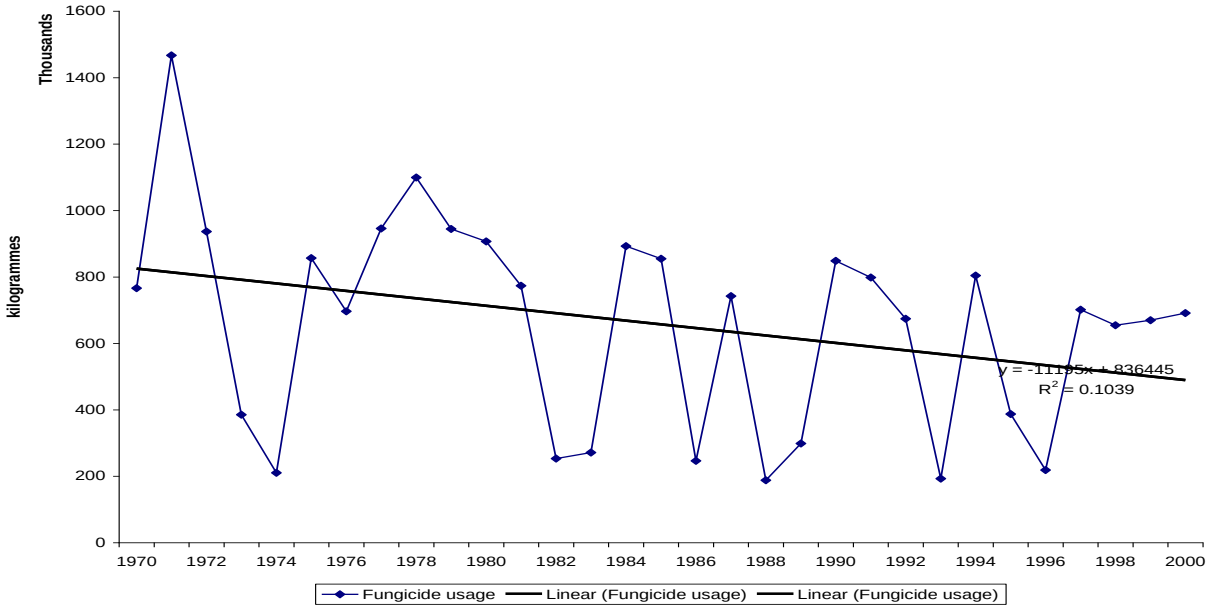
- inadequate trade information and poor storage and warehousing facilities, and
- price instability due to incessant fluctuation of the price of raw materials, finished products, and local exchange rates.

The international challenges include:

- lack of a new EU/EPA agreement and unfavorable EU import duties, causing an annual loss of about $30 million to processing factories,
- Higher cost to local processors because of zero import duties on raw cocoa beans by EU,
- Nigeria's refusal to endorse the interim Economic Partnership Agreement (EPA), which makes products from Nigeria more expensive than products from neighboring countries,
- high cost of jute bags and the use of poor quality bags for cocoa storage,
- use of pesticides that do not conform with the Maximum Residues Level (MRL), the maximum allowed concentration of pesticides in or on food and agricultural products,
- non-conformance to zero level ochratoxin, and
- use of child labor in cocoa beans sourcing.

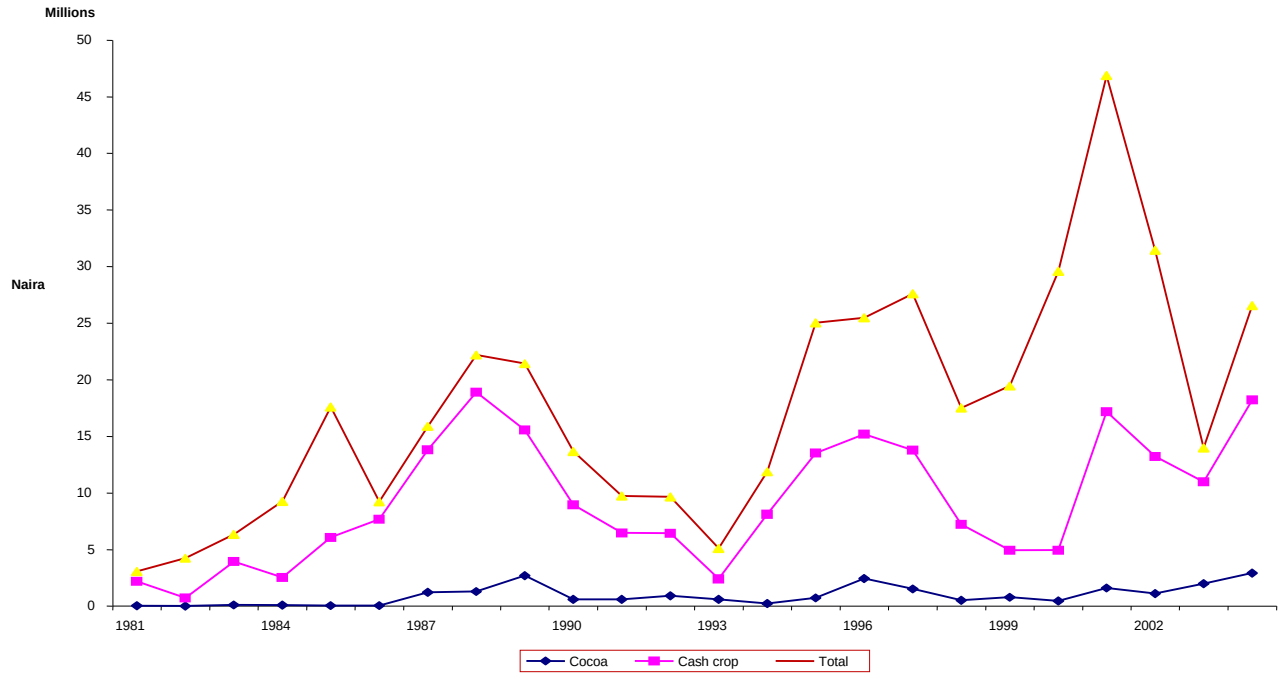
The greatest local challenges are associated with the availability and affordability of pesticides and the high cost of borrowing. Since 1986, the Nigerian government has removed subsidies on purchased inputs and abolished the NCB's and Nigerian Produce Marketing Company's intermediary roles. Farmers therefore rely on the forces of demand and supply to determine the price of pesticides. Figure 3 shows that the use of fungicide (the most reliable pesticide used by cocoa farmers to fight phytophtora pod rot – the most important limiting factor in the Nigerian cocoa industry) has fallen following the abolition of the NCB. Recently, the European Union (EU) passed legislation on the Maximum Residue Levels (MRLs) allowed on cocoa beans and their products. In response, efforts are now being intensified to seek measures to reduce fungicide usage. The Cocoa Research Institute of Nigeria (CRIN) has been mandated to screen and recommend potential cocoa fungicides and spraying equipment in Nigeria. With the new EU legislation, some of the fungicides still undergoing screening, as well as previously recommended pesticides, have been banned. This new regulation, which came into effect on September 1, 2008, has left very few fungicides for use on cocoa, both on-farm and in post-farm activities. The downward trend of fungicide usage following cocoa market liberalization is shown in Figure 3.

Figure 3: Fungicide usage: 1970-2000



In order to ensure a regular supply of high quality cocoa beans, some export firms are assisting cocoa farmers through the supply of agrochemicals, equipment, seedlings, and soft loans. One important way for Nigerian export firms to access funds is through government-instituted Export Expansion Grants (EEGs). The EEG implementation committee consists of Nigeria Export Promotion Council (NEPC), Federal Ministry of Finance (FMF), Nigeria Custom Service (NCS), the Central Bank of Nigeria (CBN), Federal Ministry of Commerce, Federal Ministry of Industry, and the Special Adviser to the President. The EEGs are supposed to pay non-oil exporting firms about 30% of their export value in the form of a tariff and duty waiver; the idea is essentially to protect export firms from any failure of formal financial institutions to meet their credit needs. However, the scheme has been plagued by irregular payments. The low share of the value of a loan from the Agricultural Credit Guarantee Scheme Fund (ACGSF) to the cocoa sector from 1981 to 2007 is shown in Figure 4.

Figure 4: Values of Loan Allocated to Cocoa Sector from Agricultural Credit Guarantee Scheme Fund



Following Abbot (2003), in specific terms, the problems facing exporters in this post-liberalization era can be organized into five categories: (1) spatial oligopsony where few buyers are serving many remote farmers; (2) exporter concentration where market power among concentrated exporters could lead to large exporter margins; (3) missing markets for quality where quality premia are not passed back to cocoa farmers; (4) scale economies in assembly, distribution, and transportation; and (5) lack of market information. The central focus of this study is to test for the possibility of non-competitive behavior and hence the possibility of market power existing among the major exporters. Since the basic statistical evidence provided in this section may not support the possibility of market failure, formal analyses that focus on the dynamics of price formation and transmission may be necessary to show an external expression of market power. This type of analysis is still lacking for the Nigerian cocoa sector.

2.2. Prices

Within the supply chain, economic agents in Nigeria encounter several types of cocoa prices: farm gate price, individual export price, border price, and global price.

2.2.1 Farm Gate Price

Farm gate prices are domestic prices paid directly to farmers in cash by the brokers or agents at the point of sale. In this post-liberalization period, these are usually a residual of the f.o.b price after transportation, conditioning, taxes, and other marketing costs, such as rents paid to traders or exporters. This stands in

contrast to the situation in the pre-liberalization period, when the farm gate price and marketing margins were mandated and any rents were collected exclusively by the government in the form of taxes. The statistics obtained on these prices depend on the enumeration area of the National Bureau of Statistics; the farm gate prices may therefore vary from state to state because they are calculated as the average price for the major producing regions.

2.2.2 Border Price

The reference (border) price is the import (c.i.f.) or export (f.o.b.) price of a commodity used for calculating the market price support price gap, measured at the farm gate level. In this study, the Lagos port prices (the average export prices collated by the federal inspection service departments) are used as the border price for the nation as a whole, while the national farm gate price refers to the average farm gate prices of the producing states. The accuracy of this price depends on the enumeration area covered by the National Bureau of Statistics when collecting the data.

2.2.3 Individual Export Prices

These are discounted world prices set by an exporter as a function of cocoa future prices on international markets. Once in the hands of the exporter, the cocoa product is shipped to processors who pay the c.i.f price represented by the International Cocoa Organization (ICCO) price. In this study, the individual export price is computed as the average export price achieved by an exporter for all markets served by that firm at a particular period of time.

2.2.4 Global Price

The global price (ICCO) depends on trading in futures for cocoa beans. Cocoa futures contracts are mainly traded on London International Financial Futures Exchange (LIFFE) and the New York Board of Trade (NYBOT). Each agent along the cocoa supply chain receives a share of the global price; Nigerian cocoa is usually exported at a discount from the global price due to quality differences. After exporters pay all fiscal and quasi-fiscal levies, the margin between the export price and the farm gate is split between the exporters and the local intermediaries.

3. Materials and Methods

3.1 Review of Past Studies

Researchers have relied on formal analyses that focus on the dynamics of price formation and transmission to establish plausibility of market power. At present, this type of research is still at a low ebb in Nigeria. However, several works have been done in Sub-Sahara Africa (SSA) (Abdulai, 2000 for Ghana; Rashid, 2004 for Uganda; Kuiper et al., 2006 for Benin; Meyers, 2008 for Malawi; Negassa and Meyers, 2007 for

Ethiopia; van Campenhout, 2007 for Tanzania; and Moser et al., 2009 for Madagascar). In this section, a brief review of such literature is presented.

In the West Africa sub-region, a few researchers (Fold (2002 and Losch 2002 and Abbot and Wilcot 2004) provide insight into how the market structure of West African cocoa has changed, and may continue to change, due to market liberalization. The authors provide anecdotal evidence supporting the possibility that liberalization resulted in backward integration by multinational grinders, leading to subsequent market power exertion. Many researchers, however, have analyzed market power using price transmission in vertically integrated supply chains for other commodities in other parts of the world (Chavas & Mehta, 2002, Guillotreau et al., 2003, Zachariasse & Bunte 2003, Sheperd, 2004 and Muldoon and Johnston, 2006). Chavas and Mehta (2002) developed a reduced-form model of price transmission in a vertical sector, allowing for refined asymmetric, contemporaneous and lagged, and own and cross price effects. They used their model to analyze wholesale-retail price dynamics in the US butter market; the analysis provides strong evidence of asymmetric price transmissions and showed the complex nature of nonlinear price dynamics in a vertical sector and their implications for the distribution of future prices. Muldoon and Johnston (2006) explore market chain issues for the live reef food fish trade in the Asia-Pacific region and find that with supply dominated by artisanal fishers in developing countries, there are concerns that gains are being unevenly distributed along the supply chain. Moss & Guerra Galindo (2001) investigated market power among Mexican processors. In a standard regression of the world-producer price spread, neither processor concentration nor total exports were statistically significant. The authors conclude that the evidence indicates neither market power among processors nor Mexico's ability to affect world market prices.

Cramon-Taubadel and Goetz (2007) analyze whether market power was exerted by exporting companies over Israeli citrus growers in the form of asymmetric price transmission. The study investigates vertical price transmission across international borders, i.e. in the context of Israeli grapefruit exports to France. They explicitly account for possible changes in exporters' pricing behavior in the post-liberalization period. The researchers apply an error correction model (ECM) to disaggregated firm-level Israeli grower price and French import price data. An ECM is estimated individually for each of the major exporting companies within a seemingly unrelated regression (SUR) framework. The results show asymmetric price transmission in the years immediately following liberalization, but symmetry in the second half of the 1990s. The growers' losses due to asymmetry amounted to as much as 2.5% of their total revenues; these results suggest that liberalization improved the efficiency of the Israeli citrus international marketing channel, but that this took time and was probably accelerated by government intervention.

Alam et.al (2010) examines price transmission between the wholesale and retail levels of the rice market in Bangladesh in the context of the changing market environment. They also examine whether the wholesale market dominates the retail market and whether the price relationship is symmetric with respect to price

increases and decreases. The authors use average wholesale and retail rice prices for Bangladesh collected from FAO and different published series of the Statistical Yearbook and the Economic Trend. The results show that wholesale and retail prices are integrated and that, in line with the industrial organization theory, the wholesale price plays a strong role in determining retail prices. Results also confirm that consumers' concern about asymmetric price transmission holds true.

Zhang et.al 2009 describes how governance mechanisms were formed linking small-scale apple farmers in China with export markets. The authors indicate that institutional innovations have improved the efficiency of price transmission and generated higher profit margins for various actors in the Chinese apple supply chain, in particular for small-scale farmers. Their report shows that Chinese apple exports are highly coordinated through ongoing long-term network relationships and vertical integration.

Saha and Mitura (2008) investigate the dynamics of price transmission between Canadian beef markets along the supply chain and the impact of bovine spongiform encephalopathy (BSE) on prices. Retail price models are estimated for the provinces accounting for the major share of national demand, while farm price models are estimated for the beef cattle-producing provinces. A model for the processing level is also estimated with the national industrial prices of beef and provincial farm prices of beef cattle. The results indicate that retail beef prices in the major consuming provinces adjust either faster or at a greater magnitude to increases in industrial prices than to decreases. Furthermore, industrial prices adjust faster and at a greater magnitude in response to rising farm prices of beef cattle in Ontario and Quebec than they do to falling prices. The impact of BSE on retail prices has been small and negative for Alberta and Ontario and positive for Quebec and British Columbia. The impact of BSE on industrial prices has also been small and positive. In contrast, a strong and sustained negative influence of BSE on farm prices is evident in the results for the beef cattle-producing provinces.

In Nigeria, only one major research work is found to be related to this study. Oguntade and Folayan (2006) employ a co-integration technique to assess the efficiency of price transmission between the central market in Lagos and the source market (Ondo and Ekiti State) for cocoa beans. The annual data covered 1986-2003 and were obtained from the states' produce departments, Central Bank of Nigeria publications, Federal Office of Statistics, and the International Cocoa Organization (ICCO). The authors find that the deregulation policy has not reduced cocoa price efficiency in Nigeria. However, the study is somewhat limited because the analysis of market efficiency in the liberalization period is restricted to a spatial-level analysis. There is a dearth of information on the nature of price relationships in the vertical level under the new market structure. In addition, they did not control for the effects of the small sample size. In the mark-up model, prices are determined by the upstream supply chain and passed to the downstream. An examination of market functioning at the vertical level in the Nigerian cocoa sector is important to evaluate how private traders and the market are affecting farmers. This will help policymakers to identify at what

level of the marketing chain marketing inefficiencies exist and to enact appropriate policies to correct such inefficiencies.

3.2 Analytical Framework

In line with normal practice as shown in the literature review (Cramon-Taubadel and Goetz 2007), an ECM model approach was utilized in this study. This requires co-integration of the time series, i.e. a long-run equilibrium exists. The first step in such co-integration analysis is to test all the time series variables for stationarity. To achieve this, an augmented Dickey-Fuller (ADF) was performed to test whether the data are difference stationary or trend stationary. The ADF tests can be expressed as in the following equation.

$$\Delta p_t = c + \rho p_{t-1} + \beta_t + \sum_{j=1}^{k} d_j \Delta p_{t-j} + \varepsilon_t \qquad (1)$$

where p_t, is the respective price series, Δ is the first difference $(p_t - p_{t-1})$ operator, and ε_t denotes the white noise error term. Equation (1) tests the null of a unit root, $(\rho > 0)$, against a stationary alternative, $(\rho < 0)$. Once the price series are found to be non-stationary at levels but stationary at first difference, a test of co-integration is carried out using Johansen and Juselius (1990, 1992) maximum likelihood estimation technique. Once co-integration is confirmed, a long-run equilibrium relationship between the data series p_{it} and p_{jt} is estimated as

$$p_{it} = \alpha_o + \alpha_1 p_{jt} + \mu_t \qquad (2)$$

where t = 1…….T. The residual vector μ_t represents the short-run deviations from the long-run equilibrium. It is usually lagged by one period and enters the ECM as the error correction term ECT ($ECT_t = p_{it-1} - \alpha_o - \alpha_1 p_{jt-1}$)

$$\Delta p_{it} = \beta_o + \sum_{n=1}^{k} \beta_{1n} \Delta p_{jt-n+1} + \sum_{m=1}^{l} \beta_{2m} \Delta p_{it-m} + \phi ECT + \varepsilon_t \qquad (3)$$

3.3 Overview of the Dataset

The analyses are based on the following secondary data: (i) monthly firm-level price data from nine major Nigerian cocoa beans export firms, separated into the three largest and others; and (ii) monthly farm gate prices. All the monthly data cover 2000-2009; they are all expressed in Nigerian Naira per metric ton and are deflated with the Nigerian monthly consumer price index (1985=100). The data showing the evolution of the monthly real prices for the largest export firms (namely, Agrotrader, Stanmark, and Cocoa Products) compared to the monthly farm gate price series are shown in Figures 5-8. These figures show that, between

2000 and 2002, there was a high degree of integration between farm gate prices and export prices of Agrotrader and Stanmark. This is taken into consideration by a using dummy variable to cover the period in the co-integration equation. It is likely that the pricing behavior of the major cocoa exporters changed from late 2002 and 2003, as the divergence between prices increases during that period. This volatility might be due to exchange rate shocks and the rising costs of transportation, marketing, and transactions. Furthermore, exporters might have adjusted their long-run pricing approaches following difficulties financing their operation and the need to meet high quality requirements on the global market, given increasing competition from cocoa exporters in Ghana and Cote d'Ivoire.

Figure 5: Agrotrader and Farm Gate Price Series

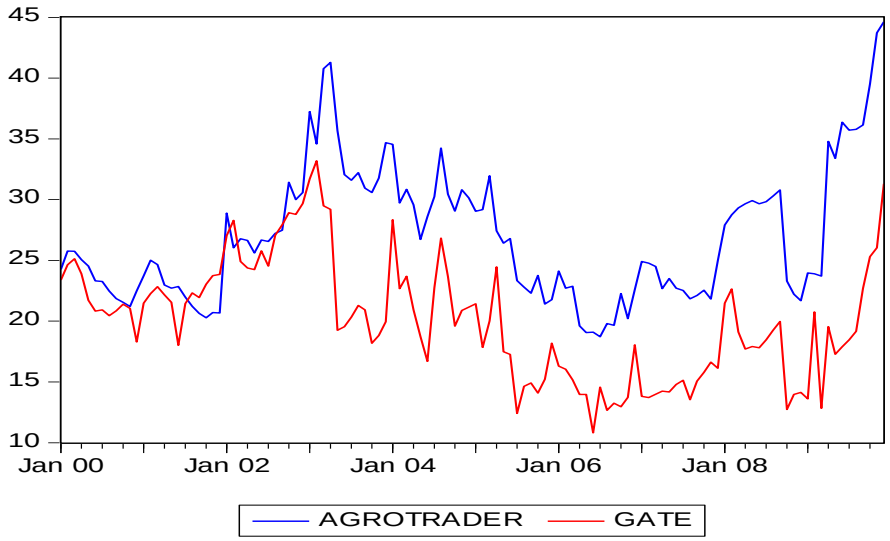


Figure 6: Stanmark and Farm Gate Price Series

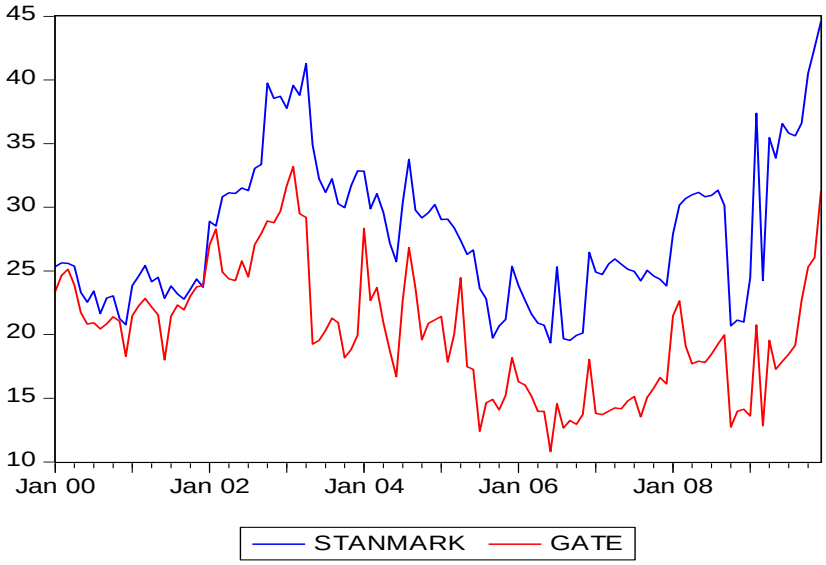


Figure 7: Cocoa Product and Farm Gate Price Series

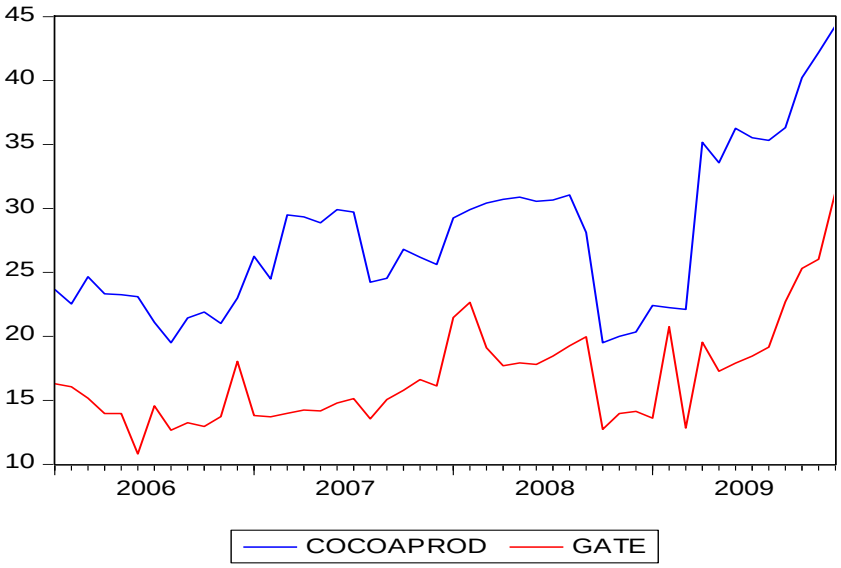
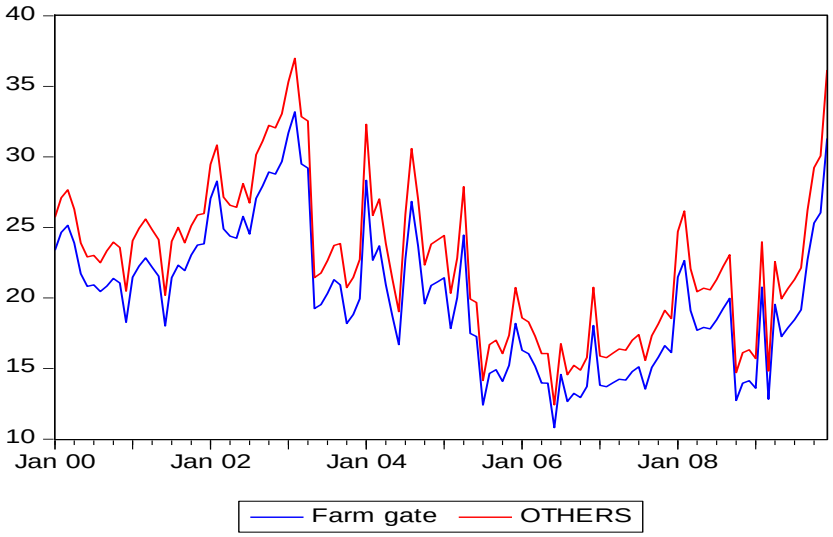


Figure 8: Other firms and farm gate price series



These graphical illustrations indicate that integration may be questionable between individual export firm's prices and farm gates.

4. Empirical Results

4.1 The Unit Root Test

Table 3 presents the summary of the unit root test statistics. The ADF test was first performed by including up to 12 lagged terms of the difference terms in the regression. Akaike information Criteria (AIC) was used to select the appropriate lag length. The ADF results were derived from a regression analysis which maximized the AIC. Though a visual inspection of the datasets shows seasonal variation in each variable, there is no persistent change in the pattern over time. In response, seasonal dummies are incorporated into the ADF stationarity test modeling. The null hypothesis (presence of unit root in levels) is not rejected for all the price series. Given that integrated markets are those whose series show a unit root and become stationary after differencing (d) times, the results indicate that the following market pairs can further be tested for co-integration, given the focus of the study: Agrotrader – Farm gate, Stanmark – Farm gate, Cocoa Products – Farm gate, other firms – farm gate.

Table 3: Unit Root Test Statistics for Annual Cocoa Market Prices

Variable	Regression equation	Lag	t-ADF Levels	Lag	t-ADF 1st difference	Order of integration
Stanmark	I, SD, Tr	0	-1.890	0	-14.813	I(1)
Stanmark	I, Tr	1	-1.235	0	-16.081	I(1)
Cocoa product	I, SD, Tr	0	-1.628	0	-10.857	I(1)
Cocoa product	I, Tr	0	-1.644	1	-7.007	I(1)
Agrotrader	I, SD, Tr	0	-0.937	0	-11.133	I(1)
Agrotrader	I, Tr	0	-1.532	0	-11.821	I(1)
Others	I, SD, Tr	4	-1.270	0	-9.215	I(1)
Others	I, Tr	4	-2.287	3	-9.705	I(1)
Farmgate	I, SD, Tr	0	-2.368	0	-14.218	I(1)
Farmgate	I, Tr	1	-1.920	0	-13.806	I(1)

I = constant Tr = trend SD = seasonal dummies

4.2 Co-integration Test Results

The degree of vertical integration between each of the export firm's price series and the farm gate price series are tested with multivariate Johansen's maximum eigenvalue and trace tests. The relevant model tested is equation 4 for Agrotrader – farm gate, Stanmark – farm gate, and farm gate – others market pairs. The test results are presented in Table 4.

Table 4: Co-integration Test Statistics for Firm – Farm Relations

Price pair	Null hypothesis	Trace test	Critical value	Max. Eigenvalue	Critical value
Farmgate-Agrotrader	r = 0	70.765*	69.819	24.407	33.877
	r = 1	46.357	47.856	16.864	27.584
	r = 2	29.463	29.797	14.219	21.132
	r = 3	15.244	15.495	12.026	14.265
	r = 4	3.218	3.841	3.218	3.841
Stanmark- farmgate	r = 0	69.241	69.819	25.550	33.877
	r = 1	45.276	47.856	19.830	27.584
	r = 2	28.515	29.797	15.308	21.132
	r = 3	16.053*	15.495	13.650	14.265
	r = 4	4.419*	3.841	9.953*	3.841
Farmgate-Cocoa product	r = 0	7.547	15.495	4.759	14.265
	r = 1	2.788	3.841	2.788	3.841
Farmgate-others	r = 0	92.894	69.819	33.420	33.877
	r = 1	59.474	47.856	25.265	27.584
	r = 2	34.209	29.797	17.943	21.132
	r = 3	16.266	15.495	12.887	14.265
	r = 4	3.379	3.841	3.379	3.841

The model includes dummies to take into account the years 2000, 2001, and 2002, when high integration was found between the export price series of all firms and the farm gate price series except for cocoa product. For the integration between Cocoa Products and the farm gate price series, equation 3 is tested. At

5% level of significance, the Likelihood Ratio (LR) test based on the trace of the stochastic matrix indicates the presence of at least one, two, and four co-integrating vectors for Agrotrader, Stanmark, and other firms, respectively. The co-integrating test fails in the case of Cocoa Products.

In the absence of any additional restrictions, the co-integrating relationships are merely statistical rather than economic. By imposing one normalization restriction, the farm gate price series exactly identifies the system, implying that the farm gate and the export price series are pair-wise co-integrated except for Cocoa Products. In analyzing the co-integrating coefficients, the co-integrating vector is normalized with respect to the farm gate price series. The normalized co-integrating equations for the firms are presented in Table 5. The OLS test for co-integration between the farm gate price series and the Cocoa Products price series is also shown in this table. Johansen tests rejected the null hypothesis of co-integration between Cocoa Products and the farm gate price series. The relationship is estimated in first difference since both variables are I(1) and are not co-integrated. Though the results clearly show a case of market integration between farm gate and export price series, the price adjustments may not happen instantaneously. There could be some disequilibrium in the short run. The error correction model usually takes into account the adjustment of short-run and long-run equilibrium in markets, as well as the time required to remove disequilibrium in each period. The adjustment vectors for the market pairs derived from the Error Correction Model are presented in column 7 of Table 8. The results show that about 19-48% of disequilibrium is removed in each period, implying that the export firms take between 6 weeks and 5 months to adjust to a long-run equilibrium. As expected, other firms require a longer time to adjust to shocks compared with the major players.

As expected from an economic point of view, a positive and significant relationship exists between the farm gate price series and each of the export price series. The results suggest that there is no substantial distortion in the Nigerian cocoa market due to the activities of the private traders who act as intermediaries between the global market and the local farm gate. The present deregulation policy, which enhances farmers' access to price information through mass media and through healthy competition among stakeholders along the supply chain, may have contributed to improved market efficiency.

Table 5: Co-integrating Coefficients for Farm-Firm Relationship

Market pair	Independent	Beta	D1	D2	D3	Adj Coeff.
Farmgate-Agrotrader	Agrotrader	0.636* (0.076)	5.120* (1.251)	4.760* (1.280)	9.308* (1.217)	0.477 (0.158)
Farmgate-Stanmark	Stanmark	0.691* (0.105)	4.405* (1.656)	4.539* (1.636)	8.413* (1.709)	0.450 (0.105)
Farmgate-Cocoa product	Cocoa product	0.604* (0.090)	-	-	-	0.194 (0.096)
Farmgate-others	Others	0.834 (0.040)	-0.313 (0.524)	-2.957 (0.606)	-0.667 (0.608)	0.097 (0.375)

In parentheses are the standard errors. * denotes significant at 5% level

5 Summary and Conclusion

The primary objective of this study is to assess price transmission in the Nigerian cocoa sector using a vertically-related setup to determine whether emerging exporters exert market power in the post-liberalization market. To fully understand the structure of the market in the post-reform period, graphical illustrations of market integration are supplemented by time series tests within a co-integration and error correction framework. The results show that none of the firms tend to exert market power over cocoa farmers, unlike the situation that led to abolition of the cocoa marketing boards in 1986 (Delgado, 1986). This also suggests that the efficiency of the cocoa international marketing channel improves as a result of market liberalization. It is highly probable that the government's abolition of the cocoa marketing boards contributed to this improvement. Given the lack of evidence of market power, the temporary divergence between each major firm's export price series and the farm gate price series might be attributable to short-term contracts which the export firms have entered into with foreign buyers, various capacity constraints, and/or exchange rate shocks.

The adjustment vector for the farm-firm price relation indicates that about 19-48% of disequilibrium is removed in each period (one month). This implies that the export firms take between 6 weeks and 5 months to adjust to long-run equilibrium. Cocoa Products are the slowest to return to long-run equilibrium, while Agrotrader is the fastest. Early entry into the export business following market liberalization and better access to bank credit might have given Agrotrader an edge over other export firms.

Given the signal for high levels of efficiency in the Nigerian cocoa market, several policy implications can be made:

1. The Nigerian government should continue to support the private sector's free operation since their activities are enhance the incomes of poor cocoa farmers who mostly depend on the market to improve their productivity.
2. In order to control temporary price divergence, institutions that facilitate contract enforcement should be strengthened. This could be done through trade association mediation.
3. Now that there is no tendency for the private sector to create barriers to the cocoa trade, the government should improve transportation infrastructure and create a stable exchange rate of the nation's currency against the currency of consuming nations to sustain market integration.
4. An adequate flow of market information should be maintained; this will benefit cocoa farmers, particularly when there is an upward movement in global prices.

Finally, some of the limitations of these results should be noted. The farm gate prices were constructed as the average of all state-level farm gate prices and tested for integration with each individual exporter's border price. If the exporters operate in distinct geographical areas, this can produce a misleading result. The reports from the companies' data files show that the agents of the exporters' source for cocoa beans across all the producing states, regardless of the location of the firm and the shares of cocoa sourced from different locations, are not consistently recorded. The use of the average of all producing states is thus suitable for this kind of analysis.

References

Abbott, P., 2003. Towards More Socially Responsible Cocoa Trade. IATRC Working Paper 03-03. St. Paul, MN: International Agricultural Trade Research Consortium.

Abdulai, A., 2000. Spatial Price Transmission and Asymmetry in the Ghanaian Maize Market. *Journal of Development Economics* 63, p. 327–349.

Alam, M. J., Begum, J. A., Andrew, J. B., Mckenzie, M., Wailes, E. J., and Huylenbroeck, G. V., 2010. Testing Asymmetric Price Transmission in the Supply Chain in Deregulated Rice Markets in Bangladesh. Paper presented at the American Association of Agriculture and Applied Economics. AAEA, CAES, WAEA joint conference, Denver, Colorado, July 25-27

Baffes, J. and Ajwad, M. I., 2001. Identifying Price Linkages: A Review of the Literature and an Application to the World Market of Cotton. *Applied Economics*, 33(1), p. 1927–1941.

Barrett, C. B. and Mutambatsere, E., 2005. *Agricultural Markets in Developing Countries*. New York: Department of Applied Economics and Management, Cornell University.

Campenhout, V. B., 2007. Modelling Trends in Food Market Integration: Method and Application to Tanzania Maize Markets. *Food Policy,* 32(1), p. 112-127.

Chavas, J.-P. & Mehta, A., 2002. Price Dynamics in a Vertical Sector: The Case of Butter. Staff Paper 452. WI: University of Wisconsin-Madison.

Crammon-Taubadel, S. V., and Goetz, L., 2007. Asymmetric Price Transmission in the Israeli Citrus Export Sector in the Aftermath of Liberalization. Paper presented at the I Mediterranean Conference of Agro-Food Social Scientists, Barcelona, Spain, April 23rd - 25th, 2007.

Delgado, C. L., 1986. A Variance Components Approach to Food Grain Market Integration in Northern Nigeria. *American Journal of Agricultural Economics,* 68(4), p. 970-979.

Dickey, D.A., and Fuller, W.A., 1979. Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, 74, p. 427-431.

Engle, R. and Granger, C., 1987. Co-integration and Error-Correction: Representation, Estimation, and Testing. *Econometrica*, 55, p. 251-76.

Fold, N., 2002. Lead Firms and Competition in Bi-Polar Commodity Chains: Grinder and Branders in the Global Cocoa-Chocolate Industry. *Journal of Agrarian Change*, 2(2), p. 228-247

Gilbert, C. L., 1997. *Cocoa Market Liberalization: Its Effects on Quality, Futures Trading and Prices*. London: The Cocoa Association of London.

Guillotreau, P., Le Grel, L., and Simioni, M., 2003. Price-Cost Margins and Structural Change: Sub-Contracting Within the Salmon Marketing Chain Between France and Norway. Working Paper in *Agricultural Economics,* 2003-01. Toulouse: Institut Nationale de la Recherche Agronomique.

Harris, R. I. D., 1992. Small Sample Testing for Unit Roots. *Oxford Bulletin of Economics and Statistics*, 54 (4), p. 615 – 625.

Harris, R. I. D. and Judge, G., 1998. Small Sample Testing for Co-integration Using Bootstrapping Approach. *Economics Letters,* 58, p. 31-37.

Hooker, M. A., 1993. Testing for Co-integration: Power Versus Frequency of Observation. *Economic Letters,* 41, p. 359 – 362

Johansen, S. and Juselius, K., 1990. Maximum Likelihood Estimation and Inference on Co-integration – with Application to the Demand for Money. *Oxford Bulletin of Economics and Statistics,* 52, p. 169-210.

Johansen, S., and Juselius, K., 1992. Testing Structural Hypotheses in Multivariate Co-integration Analysis of PPP and the VIP for the U. K. *Journal of Econometrics,* 21, p. 11-44.

Kuiper, W., Lutz, C., and van Tilburg, A., 2003. Vertical Price Leadership on Local Maize Markets in Benin. *Journal of Development Economics,* 71, p. 417– 433.

Lahiri, K, and Mamingi, N., 1995. Testing for Co-integration: Power Versus Frequency of Observation – Another View. *Economic Letters*, 49, p. 121-124.

Losch, B., 2002. Global Restructuring and Liberalization: Cote d' Ivoire and the End of the International Cocoa Market? *Journal of Agrarian Change*, 2(2), p. 206-227.

Mundlak, Y. and Larson, D.F., 1992. On the Transmission of World Agricultural Prices. *World Bank Economic Review,* 6, p. 399-422.

Meyers, R., 2008. *Evaluating the Efficiency of Inter-Regional Trade and Storage in Malawi Maize Markets.* Report for the World Bank. East Lansing, MI: Michigan State University.

Moser, C. C., Barrett, C., and Minten, B., 2009. Spatial Integration at Multiple Scales: Rice Markets in Madagascar. *Agricultural Economics,* 40, p. 281-294

Moss, C. B. and Guerra Galindo, G. A., 2001. Quality differentiation and market power in the Mexican coffee markets: Theory and Evidence. Staff Paper 01-5. Gainsville, Florida: University of Florida-Gainsville.

Muldoon, O. and Johnston, W., 2006. The Impact of Mortality and Price Risk on Costs and Value Distribution along the Market Chain for Live Reef Food Fish: A Spreadsheet Analysis. Paper presented at the 2nd ACIAR workshop on the "Economics and Market Analysis of the Life Reef Fish Food Trade in Asia – Pacific", Penang.

Negassa, A. and Meyers, R., 2007. Estimating Policy Effects on Spatial Market Efficiency: An Extension to the Parity Bounds Model. *American Journal of Agricultural Economics,* 89, p. 338–352.

Oguntade A. E and Afolayan, J.A., 2006. Assessment of Price Information Transmission between the Central Market and Source Market for Cocoa in Southwestern Nigeria: A Co-integration Analysis. *Agricultural Journal,* 1(4), p. 198-204.

Okoh, R. N., 2005. The Integration of Nigeria's Rural and Urban Foodstuffs Markets. AERC Research Paper no 151. Nairobi: The Regal Press Kenya, Ltd.

Otero, J. and Smith, J., 2000. Testing for Co-integration: Power Versus Frequency of Observation – Further Monte Carlo Results. *Economic Letters,* 67, p. 5-9

Rashid, S., 2004. Spatial Integration of Maize Markets in Post-Liberalized Uganda. *Journal of African Economies,* 13(1), p. 103-133

Saha, B. and Mitura, V., 2008. Price Transmission along Canadian Beef Supply Chain and the Impact of BSE: 1995-2006. Agriculture and Rural Working Paper 91. Canada Ministry of Industry.

Sharma, R., 2002. The Transmission of World Price Signals: Concepts, Issues and Some Evidence from Asian Cereal Markets. Paper submitted to the OECD Global Forum on Agriculture, 2002.

Sheperd B., 2004. Market Power in International Commodity Processing Chains: Preliminary Results from Coffee Market. Draft report submitted to Groupe d'Economie Mondiale (GEM).

Wilcox, M. D., and Abbott, P.C., 2004. Market Power and Structural Adjustment: The Case of West African Cocoa Market Liberalization. Selected paper presented at 2004 AAEA Annual Meeting.

Zachariasse, V. and Bunte, F., 2003. How are Farmers Faring in the Changing Balance of Power Along the Food Chain? Mimeo. Paper presented at the Conference on "Changing Dimensions of the Food Economy: Exploring the Policy Issues," The Hague, February.

Zhang, X., Qiu, H., and Huang, Z., 2009. Linking Small Scale Farmers in China with the International Markets: A Case of Apple Export Chains. *International Food and Agribusiness Management Review,* 12(3), p. 89-110.

AGRODEP Working Paper Series

00001. *Poverty, Growth, and Income Distribution in Kenya: A SAM Perspective.* Wachira Rhoda Gakuru and Naomi Muthoni Mathenge. 2012.

00002. *Trade Reform and Quality Upgrading in South Africa: A Product-Level Analysis*. Marko Kwaramba. 2013.

00003. *Investigating the Impact of Climate Change on Agricultural Production in Eastern and Southern African Countries.* Mounir Belloumi. 2014.

00004. *Investigating the Linkage between Climate Variables and Food Security in ESA Countries.* Mounir Belloumi. 2014.