ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume 64 235 Number 6, 2016
http://dx.doi.org/10.11118/actaun201664062161

THE HECKSCHER-OHLIN MODEL AND THE PERFORMANCE OF COCOA PRODUCTS IN NIGERIA

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Abstract

VERTER NAHANGA. 2016. The Heckscher-Ohlin Model and the Performance of Cocoa Products in Nigeria. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 64(6): 2161–2172.

The Heckscher-Ohlin model based on Ricardo's theory of comparative advantage maintains that countries should specialize in the production and exportation of products that they have relative factor endowments. Therefore, Nigeria has taken advantage of its favourable climatic condition to become among the largest producers and exporters of cocoa products in the world. Given that cocoa is also the topmost non-oil export product and earnings in Nigeria, this paper assesses its performance and determines the effects of external factors on production in the country. Nigeria's performance in the global cocoa market has been somewhat below expectations. Using OLS and Granger causality, the OLS regression results reveal that exports, trade openness, area harvested and domestic consumption have a positive influence on cocoa production in Nigeria. The Granger test shows that there exists bidirectional causality between the world price, trade openness and yield per hectare to cocoa production in the country. The results further confirmed a unidirectional causality running from cocoa output to exports. The government of Nigeria and trading partners should create a sound environment and some incentives to stimulate cocoa producers and exporters to increase production for export performance and revenue generation in the country.

Key words: comparative advantage, export, H-O model, performance, processed, Nigeria

INTRODUCTION

International trade is identified as among the key forces that are driving globalization in recent decades. Both traditional and modern trade theories have attempted to explain the reason(s) why countries trade and the benefits derived from such transactions. The former strongly emphasizes that trade takes place due to the relative costs of production while the latter argues that there are many factors beyond the costs of production. One of the classical theories that are currently referred to by scholars is the Heckscher-Ohlin Theorem (H-O model), also known as the factor endowment (proportion) theory. The theory was coined by Eli Heckscher (1919), and Bertil Ohlin (1933) based on the Ricardian model of comparative advantage. The model argues that the pattern of production and trade between nations depends on the available domestic factors of production. The H-O model stresses that trade takes place because of the differential in the comparative costs of factors of production in countries. These factors (labour and capital) are either in abundant or insufficient within countries. Consequently, it has become imperative for nations to export products that they have a competitive production factor(s) and import inputs or goods that are scarce domestically (Blaug, 1992). The H-O theory further argues that factor endowments are immobile between nations, and countries utilize various combinations to produce a broad range of products. The output is likely to have constant returns to scale, identical factors and production functions in countries that trade.

In contrast to the Ricardian's comparative advantage which assumes that only one factor of production (labour) existed, the H-O model assumes that two factors of production (labour and capital) are available. This model is also known as the '2 × 2 × 2 model' which simply means two countries involve in trade, producing two products, and have two homogeneous factors of production. This formulation is based on the work of Paul Samuelson (1949) who develops a mathematical model from the original insights of the H-O assumptions, called the Heckscher-Ohlin-Samuelson (HOS) theorem. The HOS theory assumes that tastes, preferences and technologies are identical in countries, but that each product uses one of the factors more intensively, in a free market, and perfect competition exists in all markets.

Due to the tedious task of determining the pattern of trade in the world of various products, instead of the H-O model, Jaroslav Vanek (1968) extends the model to become Heckscher-Ohlin-Vanek (HOV) model. Vanek establishes for the first time, a testable prediction about, who imports what, who exports what and the factor content of trade. They argue that produced goods and services contain labour and capital factors. The HOV model maintains that nations would export the services of, their abundant production factors. This implies that in the capital-abundant nations, the capital-labour ratio is likely to be higher in production in comparison with consumption (Leamer, 1980). The HOV concept in mathematical terms: The capital-labour ratio for product X is simply K^X/L^X, whereas for Y is K^Y/L^Y. If $K^X/L^X > K^Y/L^Y$, then, production of product X is capital intensive relative to the production of product Y. Conversely, production of Y is likely to be relatively labour intensive: If $K^X/L^X > K^Y/L^Y$, then, $L^Y/K^Y > L^X/K^X$. Nation A is said to be capital endowed relative to nation B if $(K/L)^A > (K/L)^B$. In such a scenario, nation B is likely to be relatively labour abundant. By and large, H-O model concluded that the capital-abundant nation is likely to export capital-intensive goods, and in return, import labour-intensive goods. Similarly, labour-abundant nations may well export labour-intensive commodities, and in return, import capital-intensive products. However, results from some empirical tests have contradicted the H-O's hypothesis (see Leontief Paradox, 1953; country similarity theory by Linder, 1961; and Bowen, Leaner and Sveikauskus, 1987). Contrary to the H-O model, Leontief (1953) result shows a paradoxical conclusion that the USA, the world's most capital-abundant country – exported labour-intensive products and imported capital-intensive products. Similarly, Trefler (1993) empirically tested the model and established that Leontief was right, after all. Also, unlike the H-O model, Trefler also confirms that absolute levels of technology vary between developed and developing economies.

Also, in contrast to the H-O model, Linder (1961) finds out that export and import mainly take place in countries with similar factor endowments and technologies. Linder argues that countries with the same levels of per capita income and tastes are more likely to trade with each other. For instance, intra-trade in the EU member states and between the EU and North America could support Linder's hypothesis. Also, Bowen, Leaner and Sveikauskus (1987) results do not support the HOV hypothesis of a precise connection between factor content and factor supplies in 27 nations investigated. After calculating the ratio of 27 nations' factor endowments to their world supply and examining it trade, they found out that for nearly half the factors of production and commerce moved in the opposite direction to that which supposed to have been predicted based on the HOV hypothesis.

Given that cocoa is mostly produced in the less consuming countries and widely consumed in the less producing countries, it is significance to assess the pattern of its production and trade within the framework of H-O model and other trade theories.

Some studies have attempted to investigate the drivers of cocoa production in Nigeria and elsewhere the crop is grown. Verter and Bečvářová (2014a) determine the factors that drive cocoa exports in Nigeria. Their results indicate that trade openness; world prices and real effective exchange rates (REER) spur exports in Nigeria. Arguably, an increase in demand for the product in the global markets might lead the world price increase, this will, in turn, stimulate producers to increase production for exports and foreign earnings. They conclude that Nigeria has a comparative advantage in the exportation of cocoa beans to the world market. Verter and Bečvářová (2014b) also confirm that trade openness and production have a positive impact on cocoa exports in Ghana.

Darkwah and Verter (2014) investigate some determinants of cocoa production in Ghana. They find a long run equilibrium relationship between the variables in the model. Their result further reveals that farm size, export and economic growth have positive impacts on cocoa production in the country. Contrary to the expectation, their findings show an inverse relationship between the world price and exports. The Ghanaian government has a rigid pricing policy on the cocoa product to shield local farmers from price volatility. However, the cost of this system to the farmers appears to outweigh its intended benefits. Equivalently, Ndubuto *et al.* (2010) confirm that cocoa export has a positive influence on production in Nigeria. They also argue that Nigeria has a comparative advantage in cocoa production and export. Similarly, Amoro and Shen (2013) confirm a positive relationship between cocoa export and production in Cote D'Ivoire. On the other hand, findings by Abolagla *et al.* (2010); Amoro and Shen

(2013); Verter and Bečvářová (2014a) show an inverse connection between domestic consumption and export in Cote D'Ivoire, Nigeria and Ghana respectively. Yeboah, Shaik, Wozniak and Allen (2008) use a gravity model to estimate cocoa trade in countries. They find out that differences between the economic size of countries, resource endowments, and the sum of the bilateral GDP of the USA as well as the exporting nations were the primary drivers of the cocoa trade from the 16 major cocoa cultivating countries to the USA. They argue that Potential bilateral cocoa export products in the era of free trade could stimulate production and export.

In the same direction, Akanni, Adeokun and Akintola (2004) examine the effects of free trade on the principal agricultural products: cocoa, groundnut, palm kernel and palm oil in Nigeria. They confirm that trade liberalisation has a positive connection with these export products. They employ the government to formulate policies aimed at stimulating investment in these products to increase output and export. In the same direction, Yusuf and Yusuf (2007) determine the driving force export performance of three principal agricultural products: cocoa, rubber and palm-kernel in Nigeria. Their findings reveal that there exist both short run and long run equilibrium relationships between the variables.

Given that these studies did not include all the variables used in this article, this present study bridges the gap. Also, in the light that cocoa is the critical non-oil foreign exchange earner, this research is essential as the price of oil continued to dwindle on the world market, Nigeria can no longer depend solely on oil export as a source of government financing. There is an urgent need for the country to look beyond petroleum for foreign government revenues (Verter and Bečvářová, 2016), which cocoa has a vital role to play in the global market. Given that cocoa is the second highest export products in Nigeria after petroleum, this study aimed at determining the effects of external factors on the production of cocoa beans in the country. The study also assesses Nigeria's performance in cocoa products in the global markets.

MATERIALS AND METHODS

The statistical data for the study are obtained from the Food and Agriculture Organization of the United Nations (FAO), Central Bank of Nigeria (CBN), International Trade Centre (ITC), and the United Nations Conference on Trade and Development (UNCTAD).

No other agricultural export product comes to mind more than Cocoa in Nigeria. The study assesses the level of export trade specialisation to determine export performance of both primary and processed cocoa commodities in Nigeria between 1995 and 2012, using Trade Specialization Index (TSI), based on UNCTAD calculations, which is mathematically presented as follows:

$$TSI_{ji} = \frac{X_j^i - M_j^i}{X_j^i + M_j^i} \quad (1)$$

Where: TSI_{ji} is the index of trade specialization of economy j for goods i in a given period; i denotes the product or product bundle; j stands for the economy (nation or nation group); X_{ij} represents economy's j exports of goods i; and M_{ij} denotes economy's j imports of goods i. The range of values is between -1 and +1; the positive value signifies that an economy has net exports (thus, it specialises in the production of the given product). Conversely, a negative value means that an economy, imports more than it exports (net consumption). Thus, the index could reveal the performance of trade in cocoa products, such as beans and chocolate.

To empirically verify the effects of trade and other factors on cocoa production, the leading agricultural export product in Nigeria for the period between 1967 and 2013, an estimated regression model is specified as follows:

$$\ln QCP = \beta_0 + \beta_1 \ln QCX + \beta_2 \ln CWP + \beta_3 \ln OPEN + \beta_4 \ln ACH + \beta_5 \ln YIELD + \beta_6 \ln DCC + \varepsilon \quad (2)$$

Where lnQCP is the natural log of the raw quantity of cocoa bean production (tonnes). lnQCX is the natural log of the raw quantity of cocoa export (tonnes). lnCWP is the natural log of average daily cocoa bean prices at the New York/London (US ¢/lb.) markets. lnOPEN is the natural log of trade openness index ((Exports+ Imports)/Nominal GDP)*100), which is an indicator of free trade. lnACH denotes the natural log of the area of cocoa harvested, it is captured for the farm size of the crop. lnCYIELD is the natural log of cocoa yield per hectare, measured as hectogram per hectare (hg/ha) of harvested land in Nigeria. lnDCC is the natural log of domestic cocoa consumption (tonnes); and ε denotes the error term.

A priori expectation is for all the variables to have positive signs. In other words, all the explanatory variables are expected to have positive effects on cocoa production in Nigeria. Even though the aim of this article is centered on trade and cocoa bean production, area harvested, yield per hectare and domestic consumption are also included in the model because these variables may have played major roles in the variation of cocoa output in the country.

Finally, Granger causality test will be run after the unit root test. Before the Granger causality, an unrestricted vector autoregression (VAR) model will be performed. The VAR model is typically used for forecasting systems of interrelated multivariate time series data and for analysing the dynamic impact of random disturbances to the system. The most common approach for testing if there is a causal

relationship between two variables is Granger causality. The model was coined by Granger (1969) to answer the question of whether *x* causes *y* and see how much of the current *y* could be explained by previous values of *y* and then to see whether adding lagged values of *x* could improve the explanation. The mathematical representation of Granger causality is as follows:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + ... + \alpha_l y_{t-l} + \beta_1 x_{t-1} + ... + \beta_l x_{t-l} + \mu_t \quad (3)$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + ... + \alpha_l x_{t-l} + \beta_1 y_{t-1} + ... + \beta_l y_{t-l} + \mu_t \quad (4)$$

for all possible pairs of *(x, y)* time series in the group in the Granger equation. The reported F-statistics are the Wald statistics for joint hypothesis for the equation. The null hypothesis is that *x* does *not* Granger-cause *y* in the first regression and that *y* does *not* Granger-cause in the second regression.

COCOA PRODUCTION AND TRADE

Cocoa is grown on more than 10 million hectares worldwide (FAO, 2016). The global production of cocoa beans increased from 1.2 million tonnes in 1961 to 4.6 million tonnes in 2013. Similarly, global export also increased from 1.03 million tonnes in 1961 to 3.04 million tonnes in 2004, and then fluctuated and declined to 2.72 million in 2013 (FAO, 2016), but again rose to 3.4 million tonnes in 2015 (ITC, 2016a). This performance is recorded largely because of the high demand of the crop in the importing (consuming) economies, especially in North America and Europe, and recently, in some emerging economies.

Cocoa is the topmost agricultural products produced and exported in four West African countries: Cote d'Ivoire, Ghana, Nigeria and Cameroon. The production of the crop in these four countries also increased from 816 thousand tonnes or 65 % (Cote d'Ivoire 7 %, Ghana 35 %, Nigeria 17 % and Cameroon 6 %) in 1961 to 3.1 million tonnes or 64 % (Ivory Coast 32 %, Ghana 18 %, Nigeria 8 %, and Cameroon 6 %) share of world production in 2013 (Fig. 1). The performance and positions of these countries have changed significantly during the period under study. For instance, Cote d'Ivoire's market share sharply increased from 7 % in 1961 to 32 % in 2013 to become the highest producer in the world. Whereas Ghana and Nigeria's positions sharply declined to become the second and fourth positions respectively in the world, the position of Cameroon in terms of production and export remains consistent.

Similarly, these West African countries' exports also increased from 753 thousand tonnes or 73 % (Cote d'Ivoire 9 %, Ghana 40 %, Nigeria 18 % and Cameroon 6 %) of global export in 1961 to 1.7 million tonnes or 63 % (Cote d'Ivoire 30 %, Ghana 19 %, Nigeria 7 % and Cameroon 7 %) share of global exports in 2013. On country by country, just as experienced in the production, the export share of Cote d'Ivoire in the global market drastically increased from 9 % in 1961 to 30 % in 2013, while Nigeria and Ghana's exports reduced in the same period under study (Fig. 2). Even though cocoa output and export have increased over the years, the global market share of these countries has decreased.

The quantity of beans export in 2015 further shows some changes across countries. For instance, Cote d'Ivoire exported 1.3 million tonnes (or the second largest exporter), Ghana 662 million metric tons (or the second largest exporter), Cameroon 237 million metric tons (or the third largest exporter). Conversely, Indonesia and Nigeria declined from third and fourth in 2013 (Fig. 2) to become the thirteen and seventh largest exporters respectively in 2015 (Tab. II). Also, Cocoa trade performance in value in the major producing countries shows Cote d'Ivoire as the largest exporter of cocoa beans in 2015 with $3.5 billion (or 35 % share of global exports), followed by Ghana ($2 billion, or 20 % share of global exports) and Cameroon ($673 million, or 8 % of global exports). Surprisingly, Belgium recorded as the 5th largest exporter of cocoa beans with $531 million, while Nigeria recorded as the seventh largest exporter with $440 million (Tab. II). This is largely because the country re- exports parts of the unprocessed beans imported to the country.

Cocoa is the highest agricultural export product in Nigeria and the second leading export products in the country, after petroleum in terms of revenues. Nigeria is the fourth largest cocoa producer in the world, after Ivory Coast, Indonesia and Ghana, and the third highest exporter after Ivory Coast and Ghana. This implies that Ghana, Cote d'Ivoire and Nigeria have a comparative advantage in the production and exportation of this crop. This is mainly because of the favourable tropical climatic conditions in these countries and the other leading producing economies. As a result, these countries have taken their comparative advantage by cultivating the crop as postulated by the Ricardian and H-O model. Nonetheless, both the producers and exporters the products still face with many bottlenecks that impede them from enjoying the expected economies of scale in terms of production, exports and earnings.

Fig. 1 shows annual quantity of cocoa beans produced and exported in Nigeria between 1961 and 2013. The amount of cocoa output increased from 170 thousand tonnes in 1961 to 391 thousand tonnes, about 305 thousand tonnes in 1970 and then, drastically declined to 140 thousand tonnes in 1983. The product recorded the highest output in 2006, with 485 thousand tonnes, and then, declined to 367 thousand tonnes in 2013.

Irregular weeding, inadequate or untimely fertilizer application, diseases and pests, unfavourable weather, small-scale subsistence

farms (primarily rely on outdated farming practices) with high production costs, labour force, lack of improved seeds have been identified as among the reasons for low yield per hectare and overall total output in the Africa (ITC, 2001; Verter, 2016) relative to South American producing countries. Despite numerous challenges that cocoa farmers have faced from production to post-harvest, the crop is still among the major cash crops in Western Africa, where grown.

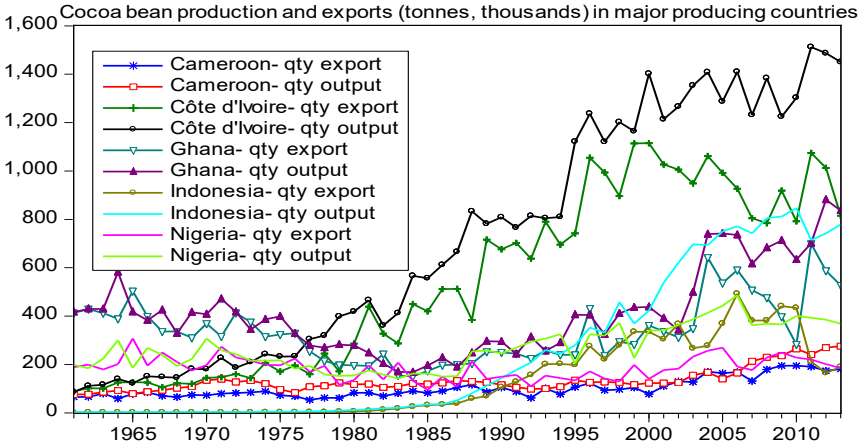
The quantity of cocoa exports in Nigeria has also slightly fluctuated in the same period under study. For instance, the quantity export increased from 106 thousand tonnes in 1987 to reach its peak in 2005 with 267 thousand tonnes, and then fluctuated over the years and declined to about 183 thousand tonnes in 2013. Nigeria recorded an average year-over-year of 55 % of cocoa exports as a percentage of domestic production between 1987 and 2013 (Fig. 1). This does not only signify that over 50 % of the raw cocoa product is exported, but also there is market access, albeit only in its primary form. It is also of great consequential to emphasize that, part of the remaining cocoa output (about 45 %) is processed (in the form of butter, paste, powder and cake) and exported, mostly within the African sub-regions. This suggests that Nigeria may have been exporting more than two third of its annual output of cocoa beans.

The Netherlands, Belgium, USA, Germany and Spain are the leading cocoa bean importing countries. Similarly, some of the key cocoa processing (chocolate) companies in the world are from these countries. Consequently, these countries have been the largest processors and exporters of chocolate and other food preparations containing cocoa products (Tab. I and II).

On the contrary, in the export value of all industries (both raw and processed cocoa products), Germany recorded the highest in 2015 with $5.4 billion (11.4 % of world exports), followed by Cote d'Ivoire ($5.3 billion, or 11.2 % of global exports), Netherlands ($4 billion), Belgium ($3.3 billion) and Ghana ($2.8 billion). Similarly, Germany also recorded as the largest exporter of chocolate and food containing cocoa with $4.3 billion (17 % of global exports), followed by Belgium ($2.7 billion, or 11 % of global exports), and the Netherlands ($1.8 billion, or 7 % of global exports). This shows that the major cultivating countries (i.e. Nigeria, Cameroon and Ghana) are not the major exporters of processed cocoa products (Tab. II) partly because these countries lack finance and technology to enjoy economies of scale and competitiveness in processed cocoa as posited by modern trade theories. Nevertheless, the overall development suggests that the export performance of some countries has been impressive even though their global share fluctuates over time.

The results of the merchandise trade specialisation index (TSI) in cocoa products in countries for the period between 1995 and 2012, is presented in Tab. I. The index shows that only Cote d'Ivoire recorded a positive trade balance in both raw and processed cocoa products throughout the period under study. Arguably, Cote d'Ivoire has performed better in both raw and processed cocoa products (Tab. I and Tab. II) than other cocoa-producing countries in Africa, such as Cameroon, Ghana and Nigeria. For instance, the result shows that Nigeria, Dominican Republic, Liberia and Uganda have been net consumers of chocolate and other food containing cocoa products throughout the period under review. This implies that these countries largely exports cocoa beans, and substantially import chocolate than they exported. Arguably, just as in other African cocoa producing countries, Nigeria does not have the competitive advantage in processed products, largely due to lack of modern technology and capital. As a consequence, Nigeria has been largely exporting labour-intensive cocoa beans and importing capital intensive chocolate and other food preparations containing cocoa products.

In terms of export competitiveness, Nigeria's cocoa bean export as a percentage of world exports also drastically decreased from 22.6 % in 1967 when



1: *Cocoa production and export (tonnes, '000) in Nigeria and major producing economies, 1961–2013*
Source: Author's analysis based on FAOSTAT, 2015

I: *Cocoa trade specialization index in cultivating and processing countries, 1995–2012*

Economy	Product	1995	2001	2005	2007	2009	2010	2011	2012
Nigeria	Cocoa, roasted or unbroken	1.00	0.97	0.96	1.00	0.99	0.99	0.00	0.30
	Chocolate, food preparations with cocoa	–0.24	–0.73	–0.66	–0.10	–0.53	–0.29	–0.90	–0.37
	Coffee, tea, cocoa	0.78	0.36	–0.14	0.85	0.85	0.76	–0.03	0.22
	Low-skill and technology-intensive	–0.98	–0.97	–0.87	–0.93	–0.91	–0.71	–0.69	–0.65
	Medium-skill and technology-intensive	–0.97	–0.99	–0.96	–0.98	–0.94	–0.96	–0.97	–0.94
Cameroon	Cocoa, roasted or unbroken	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Chocolate, food preparations with cocoa	–0.24	0.37	0.36	0.57	0.54	0.48	0.43	0.46
Colombia	Cocoa, roasted or unbroken	0.54	0.39	0.08	–0.25	0.10	–0.16	–0.40	–0.21
	Chocolate, food preparations with cocoa	0.12	0.35	0.53	0.45	0.38	0.19	0.27	0.13
Côte d'Ivoire	Cocoa, roasted or unbroken	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Chocolate, food preparations with cocoa	0.74	0.82	0.95	0.92	0.93	0.93	0.90	0.85
Dominican Rep.	Cocoa, roasted or unbroken	1.00	0.99	0.98	0.99	1.00	0.99	0.98	0.98
	Chocolate, food preparations with cocoa	–0.71	–0.65	–0.69	–0.78	–0.74	–0.58	–0.73	–0.70
Ecuador	Cocoa, roasted or unbroken	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00
	Chocolate, food preparations with cocoa	–0.15	–0.09	–0.52	–0.59	–0.65	–0.67	–0.20	–0.12
Germany	Cocoa, roasted or unbroken	–0.57	–0.77	–0.71	–0.68	–0.57	–0.48	–0.42	–0.45
	Chocolate, food preparations with cocoa	0.21	0.17	0.28	0.34	0.36	0.36	0.32	0.33
Ghana	Cocoa, roasted or unbroken	1.00	1.00	1.00	1.00	0.99	1.00	0.99	1.00
	Chocolate, food preparations with cocoa	0.96	0.33	0.15	–0.08	0.30	0.62	0.79	0.20
Indonesia	Cocoa, roasted or unbroken	0.99	0.84	0.84	0.89	0.88	0.85	0.82	0.77
	Chocolate, food preparations with cocoa	–0.12	0.38	–0.42	–0.13	0.08	0.18	0.06	0.01
Liberia	Cocoa, roasted or unbroken	1.00	0.94	0.98	1.00	1.00	1.00	1.00	1.00
	Chocolate, food preparations with cocoa	–1.00	–0.94	–0.97	–1.00	–0.97	–1.00	–1.00	–0.99
Netherlands	Cocoa, roasted or unbroken	0.12	0.10	0.15	0.18	0.08	0.17	0.16	0.09
	Chocolate, food preparations with cocoa	0.43	0.38	0.32	0.31	0.31	0.28	0.32	0.34

Source: Author's analysis based on UNCTAD

cocoa was the largest source of foreign earnings to 6.7 % in 2013 (Fig. 2) after crude oil took its place as the highest source of export revenues in the country. This may be attributed to the Nigeria's neglect in non-oil commodities that led to a decrease in domestic production and exports, also known as the 'Dutch disease'. As earlier noted, part of cocoa beans is locally processed before export, albeit in small quantity. Consequently, the share of the country in primary exports has reduced.

Even though locally processed cocoa export products, such as cocoa paste, butter, powder, cake and beverages have accounted for an insignificant percentage of the total output of cocoa beans in Nigeria and other in African nations (Tab. II), it has been increasing in recent years. Interestingly, markets for the processed cocoa products also have been expanding over the last few years. This development to some extent has provided the impetus for increased production, processing, value chain development and competitiveness in the sector.

External factors, such as inadequate capacity building in SPS (Sanitary and Phytosanitary) – low quality of cocoa that does not comply with international standards, volatility in the foreign exchange rate (Verter and Bečvářová, 2014a) and world price (Syrovátka and Darkwah, 2008; Syrovátka, 2009) trigger the demand and supply shocks in the global markets (Weymar, 1969; Verter, 2016).

Also, even though there is zero tariff in cocoa beans in the major importing economies (i.e. USA, EU and Japan), the tax on processed cocoa products are outrageous. Arguably, semi-processed and processed cocoa commodities still face with many bottlenecks, such as tariff escalation that impede exports and earnings from the cultivating countries to the consuming economies. For instance, in 2015, the major cocoa importing economies (i.e. EU, USA and Japan) did not charge tax (zero percent tax) on cocoa beans, whereas chocolate and other food preparations containing cocoa were changed for about 41 % in the EU market and 30 % in Japan (ITC, 2016b). Arguably, this is an indirect way of promoting raw cocoa export from the weak cultivating economies as posited by dependency theories.

RESULTS AND DISCUSSION

Given that time series data is prone to spurious regression results, the study carried out both

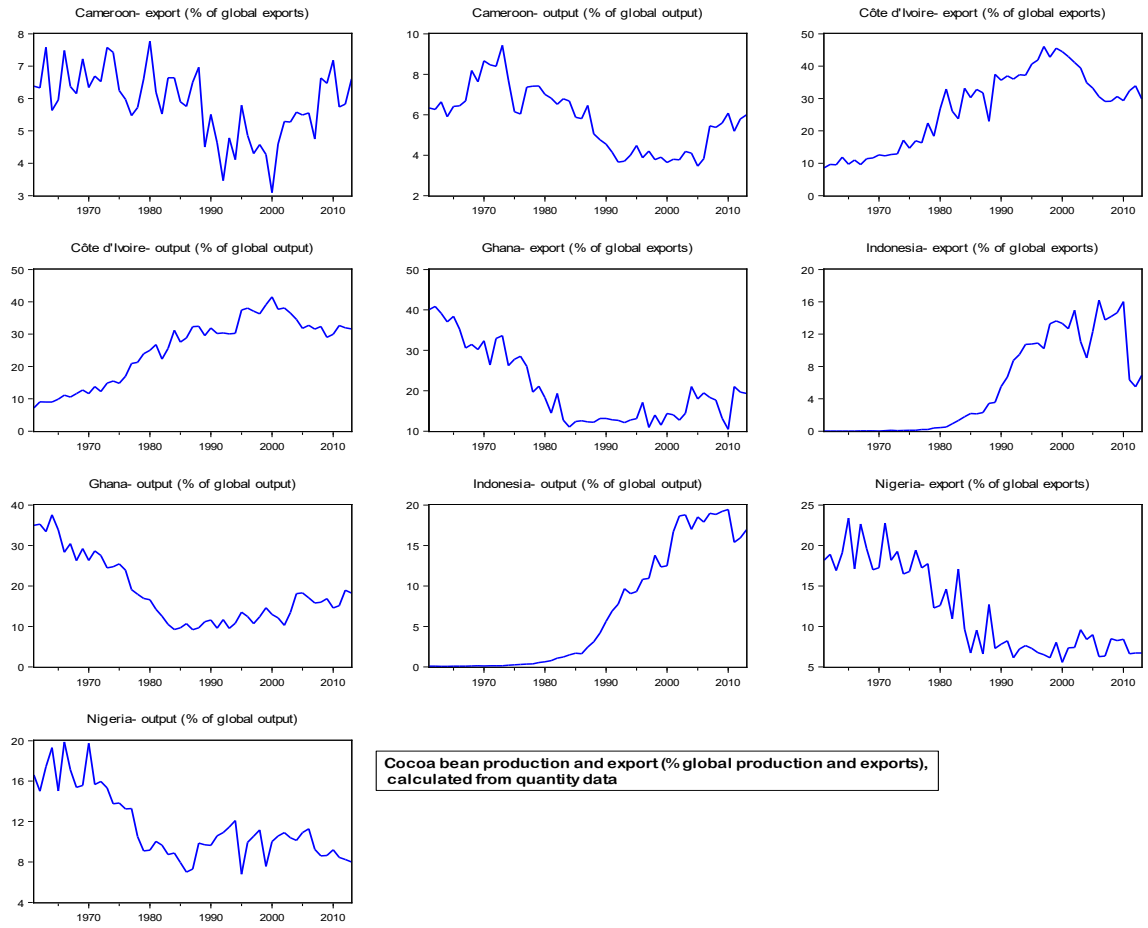
II: *Cocoa Trade Performance HS (US$ millions and %) in Nigeria and other major producers, 2015*

Country	Industry	GR	Export (US$)	Import (US$)	Net trade (US$)	Export (% of total exports)	Export (% of world exports)	Export growth (%)	Import growth (%)	Net Trade*
	All industries	2	5,272.7	4.5	5,268.1	57.49	11.19	2	4	99.8
Côte d'Ivoire	Cocoa beans	1	3,504.2	0	3,504.2	38.20	34.68	–1	–	100.0
	Chocolate+	33	134.1	4.5	129.6	1.46	0.53	23	4	93.5
	All industries	5	2,759.5	7.7	2,751.8	26.14	5.86	–6	13	99.4
Ghana	Cocoa beans	2	2,019.7	0.02	2,019.7	19.13	20.0	–7	–50	100.0
	Chocolate+	99	0.79	7.7	–6.9	0.01	0.0	–48	15	–81.5
	All industries	15	752.1	3.7	748.4	17.33	1.60	3	0	99.0
Cameroon	Cocoa beans	3	673.8	0	673.8	15.53	6.67	5	–	100.0
	Chocolate+	65	2.3	3.6	–1 3	0.05	0.01	8	1	–22.1
	All industries	71	812.4	29.6	782.8	4.43	1.72	9	2	93.0
Ecuador	Cocoa beans	4	705.4	2.0	705.4	3.85	6.98	11	–	100.0
	Chocolate+	57	20.1	29.2	–9.1	0,11	0.08	2	2	–18.5
	All industries	4	3,346.6	2,363.6	983.0	0.84	7.10	3	4	17.2
Belgium	Chocolate+	2	2,697.7	678.6	2,019.7	0.68	10.56	1	2	59.8
	Cocoa beans	5	531.2	831.3	–300.1	0.13	5.26	16	4	–22.0
	All industries	3	5,043.6	4,063.8	979.8	1.07	10.71	0	–1	10.8
Netherlands	Chocolate+	3	1,766.9	1,115.3	651.6	0.37	6.92	2	4	22.6
	Cocoa beans	6	505.5	1,842.5	–1,336.9	0.11	5.00	–2	–4	–56.9
	All industries	21	536.0	12.5	523. 4	1.05	1.14	–14	10	95.4
Nigeria	Cocoa beans	7	439.7	0.0	439. 7	0.87	4.35	–16	–	100.0
	Chocolate+	113	0.36	12.5	–12. 1	0.0	0.0	–5	10	–94.4
	All industries	25	374.8	260.4	114.3	0.20	0.80	–3	0	18.0
Brazil	Chocolate+	3	90.9	170.9	–80.0	0.05	0.36	–9	15	–30.6
	Cocoa beans	23	21.0	33.3	–12.2	0.01	0.21	64	–22	–22.6
	All industries	1	5,371.4	4,446.0	925.4	0.40	11.40	2	–1	9.4
Germany	Chocolate+	1	4,333.8	2,318.6	2,015.2	0.33	16.97	2	3	30.3
	Cocoa beans	14	64.3	871.1	–806.8	0.0	0.64	12	–10	–86.3
	All industries	11	1,307.8	293.8	1,014.0	0.87	2.78	–1	14	63.3
Indonesia	Cocoa beans	13	115.0	169.7	–54.8	0.08	1.14	–34	28	–19.2
	Chocolate+	48	36.6	85.6	–49.1	0.02	0.14	–8	22	–40.2
	All industries	10	1,399.2	1,502.9	–103.7	0.34	2.97	8	2	–3.6
Canada	Chocolate+	8	1,352.2	964.6	387.6	0.33	5.29	9	3	16.7
	Cocoa beans	49	1.7	214.6	–212.9	0.0	0.02	–6	–1	–98.4

Source: ITC, 2016a. Note: *ITC calculates Net Trade = (X – M)/(X + M) * 100

Augmented Dickey–Fuller (ADF) and Philips and Perron (PP) unit root tests to address the issue. Tab. III presents both ADF and PP test statistics. All the variables have become stationary after first difference. As stated above, both Ordinary Least Squares (OLS) regression and Granger causality tests were run after unit root tests. Similarly, diagnostic checklist tests for the OLS regression was done, and all the classical assumptions were fulfilled (Tab. IV). Also, based on the information criteria (Tab. V), an unrestricted Vector Auto- Regression (VAR) model was applied before the Granger causality estimation. To ensure the validity of the Granger test, VAR residual tests such as normality test and autocorrelation test were also carried out, and all the diagnostic tests were satisfied.

The OLS regression results are presented in Tab. VI. The results indicate that all the regressors in the model jointly influence cocoa production in Nigeria. The results further suggest that the lagged quantity of cocoa export (QCX) has a positive impact on cocoa production in Nigeria. This implies that the more cocoa exported, the more farmers will be stimulated to produce the product. The result is in line with the works by Ndubuto *et al.* (2010); Darkwah and Verter (2014) who also find a robust positive relationship between cocoa export and production in Nigeria and Ghana respectively.



2: *Cocoa bean output and export (% of global output and exports), 1961-2013*
Source: Author's analysis based on FAOSTAT

Practically, as presented in Fig.1, an average of over 50 % cocoa beans produced in Nigeria, Ghana and Cameroon have been exported between 1963 and 2013. Implying that there is a market access in cocoa products, albeit only in its primary form. It is also of great importance to emphasize that, part of the remaining cocoa beans, that are not exported are processed (in the form of butter, paste, powder and cake, chocolate), partly consumed locally, and the remaining exported (Tab. II), mostly within the producing countries' sub-regions. Also, the upward and downward export appears to have moved corresponding with its annual output. Arguably, development of cocoa production in Nigeria just as in other producing countries may have been encouraged by export trade. Cocoa is not just an important cash crop and principal export commodity for producing economies, but also a critical import for consuming countries, which typically do not have favourable climatic conditions for cocoa production. Consequently, consuming and processing countries (Tab. II) have to import the product as posited by the Ricardian and H-O models.

The results in Tab. VI further shows that lagged trade openness (OPEN) has a positive relationship with cocoa production in Nigeria. Holding other factors constant, a 1 % increase in trade openness proxied for free trade; it may spur cocoa farmers to increase production/output by 0.30 %. Trade openness partly indicates the size of the Nigerian economy in the world market or the integration of the country into the global economy. Even though agricultural commodities from developing countries, such as Nigeria face trade restrictions, such as tariff escalation and quotas in the importing advanced economies, they have been experiencing zero or lower tariff regimes in primary tropical commodities, such as cocoa beans.

The results also show a positive connection between lagged area cocoa harvested (ACH) and annual production in Nigeria. This signifies that all things being equal, a 1 % increase in the area cocoa harvested will bring a corresponding total output by 0.82 % in the country (Tab. VI). Holding other determinants constant, the more farmers expand their farm size, the more the total production of cocoa beans. This result in consonance with the works of Darkwah and Verter (2014) who also find a positive relationship between cocoa farm size and annual output in Ghana. In Nigeria, just as in Ghana, Cote d'Ivoire, Cameroon and Togo, cocoa

III: *ADF and PP unit root tests*

Variable	Levels	ADF test Statistics	PP test Statistics
LQCP	Level	–1.108590	–1.847257
	First difference	–9.902266	–10.88054
LQCX	Level	–1.218845	–4.695051
	First difference	–6.467914	–17.17496
LCWP	Level	–2.601160	–2.722836
	First difference	–5.948366	–4.837318
LOPEN	Level	–1.656502	–1.656502
	First difference	–8.099449	–8.112291
LACH	Level	0.002422	0.002422
	First difference	–6.992115	–6.992115
LCYIELD	Level	–1.459474	–3.156812
	First difference	–8.974311	–16.59412
LDCC	Level	–1.459474	–1.367182
	First difference	–8.974311	–8.974571

Note: McKinnon (1991) critical values are: –2.619 for 10 %, –2.960 for 5 % and –3.661 for 1 % levels

IV: *Diagnostic test for OLS*

Test	Test- statistic	P. value
Ramsey's RESET (squares and cubes)	0.8596	0.4310
Heteroskedasticity Test: White	36.7255	0.1003
LM test for autocorrelation up to order 1	1.54577	0.2212
Heteroskedasticity Test: Breusch-Pagan-Godfrey	5.65213	0.4633
Test for normality of residual	3.0232	0.2206
Non-linearity test (squares)	9.87435	0.1300
Heteroskedasticity Test: ARCH	0.1546	0.6941

V: *VAR lag order selection criteria*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	390.5464	NA	6.33e-17	-17.43393	-17.15008*	-17.32866*
1	438.6003	78.63373	6.80e-17	-17.39092	-15.12014	-16.54881
2	467.4793	38.06773	2.01e-16	-16.47633	-12.21861	-14.89736
3	529.6056	62.12629	1.81e-16	-17.07298	-10.82832	-14.75716
4	643.6782	77.77680*	3.00e-17*	-20.03083*	-11.79923	-16.97815

Note: * indicates lag order selected by the criterion

VI: *Determinants of cocoa bean production in Nigeria*

Variables	Coefficient	t-statistics
Cons	–0.0047 (0.0164)	–0.2884
LQCX_1	0.1027 (0.0518)	1.9825**
LCWP	–0.1410 (0.0819)	–1.7213*
LOPEN_1	0.2967 (0.1233)	2.4057**
LACH_1	0.8229 (0.2904)	2.8333***
LCYIELD_1	0.0351 (0.0965)	0.3637
LDCC	0.1015 (0.0262)	3.8810***
R-squared	0.5097	
Adjusted R^2	0.4362	
F(6, 40)	10.157	
Durbin-Watson stat	2.2395	

Note: *, ** and *** denote statistical significance at 1 %, 5 %, and 1 % levels respectively. Figures in Parentheses are the Standard errors

VII: *VAR Granger causality/block exogeneity Wald test*

Equation	Excluded	χ2- statistic	df	Prob.
DLQCP	DLQCX	1.6980	4	0.7911
	DLCWP	9.9875	4	0.0406**
	DLOPEN	7.9549	4	0.0933*
	DLACH	10.9576	4	0.0270**
	DLCYIELD	10.9612	4	0.0270**
	DLDCC	2.4318	4	0.6569
	All	28.9050	24	0.2237
DLQCX	DLQCP	9.9119	4	0.0419**
	DLCWP	2.4960	4	0.6454
	DLOPEN	4.4626	4	0.347
	DLACH	9.9284	4	0.0417**
	DLCYIELD	9.9168	4	0.0419**
	DLDCC	6.5320	4	0.1628
	All	32.3605	24	0.1183
DLCWP	DLQCP	10.5649	4	0.0319**
	DLQCX	3.0728	4	0.5457
	DLOPEN	10.2069	4	0.0371**
	DLACH	10.5559	4	0.032**
	DLCYIELD	10.5556	4	0.0320**
	DLDCC	2.5151	4	0.6419
	All	32.5784	24	0.1133
DLOPEN	DLQCP	14.5880	4	0.0056***
	DLQCX	6.2182	4	0.1834
	DLCWP	2.0415	4	0.7281
	DLACH	14.5879	4	0.0056***
	DLCYIELD	14.5934	4	0.0056***
	DLDCC	6.5307	4	0.1629
	All	47.6150	24	0.0028***
DLACH	DLQCP	5.3356	4	0.2546
	DLQCX	1.9601	4	0.7431
	DLCWP	4.5990	4	0.331
	DLOPEN	7.4956	4	0.1119
	DLCYIELD	5.3361	4	0.2545
	DLDCC	4.5761	4	0.3336
	All	27.8019	24	0.2685
DLCYIELD	DLQCP	9.0913	4	0.0589*
	DLQCX	1.5365	4	0.8202
	DLCWP	7.8608	4	0.0968*
	DLOPEN	5.5846	4	0.2324
	DLACH	9.1082	4	0.0585*
	DLDCC	2.1824	4	0.7023
	All	24.2663	24	0.4465
DLDCC	DLQCP	3.8524	4	0.4264
	DLQCX	1.1557	4	0.8853
	DLCWP	3.6194	4	0.4600
	DLOPEN	4.5350	4	0.3384
	DLACH	3.8449	4	0.4274
	DLCYIELD	3.8566	4	0.4258
	All	20.8462	24	0.6478

Note: ***, ** and * indicate the rejection of the null hypothesis at 0.01, 0.05 and 0.10 significance levels respectively. Original sample size: 1965–2013. Sample (adjusted): 1970 2013. Included observations: 44 after adjustments

farming is predominantly done by smallholder and subsistence farmers. Most of these farmers do not have the means (i.e. finance and technology) to expand their farms and enjoy economies of scale as have been witnessed in advanced countries.

Finally, the OLS results further show that domestic cocoa consumption (DCC) has a positive impact on production in Nigeria (Tab. VI). Arguably, consumption is an indicator of demand for cocoa products in the country. This to some extent would stimulate farmers to increase the plantation and the supply of the product in the market. Part of the local cocoa beans produced is domestically processed before final consumption as well as export.

The results from the **Granger causality** technique is presented in Tab. VII. The result suggests there is a bidirectional causality running from world price to cocoa bean output in Nigeria. Cocoa bean prices fluctuate at the world exchange markets, partly due to the difference in the level of global output and consumption, as well as differing degrees of speculations, which sometimes exacerbate supply, demand and price volatility. An increase in the world price of the beans would stimulate farmers to produce more for export, albeit only when they are compensated comparably with the world price, which is always the case in African producing countries. Arguably Governments and traders from these countries are inelastic at increasing farm gate prices when world price increases. On the other hand, they are elastic to decrease producer price when world price declines. Even though Nigerian Marketing Board, which used to fixed producer price was abolished in 1986 (Verter and Bečvářová, 2014a), few exporters that control the market still determine farm gate prices.

The result also confirms a bidirectional causality running from trade openness and yield per hectare to cocoa production in Nigeria. The findings further show that, a unidirectional relationship is running from area harvested to cocoa production in the country (Tab. VII). Historically, cocoa yield per hectare has been low in Nigeria relative to the other major producing countries such as Cote d'Ivoire, Ghana, Indonesia, Mexico and Brazil. Regular weeding, timely fertilizer application, diseases and pests control, favourable weather, pruning and improved seeds are likely to increase yield per hectare in the country and elsewhere the crop is grown.

A unidirectional is also observed from the quantity of cocoa bean produced, the area harvested and yield per hectare to the quantity of cocoa exports in Nigeria (Tab. VII). This signifies that cocoa export is triggered by the size of farms harvested, the level of yields and the overall output in the country.

Also, the result suggests there is a bidirectional causality running from yield per hectare to the world price. Furthermore, a unidirectional relationship is observed from trade openness and area harvested to the world price. A unidirectional relationship is also running from area harvested and yield per hectare to trade openness. Similarly, the results suggest that all the variables in the model jointly Granger- cause trade openness in Nigeria (Tab. VII). Given that cocoa is widely consumed, especially in non-cultivating countries in Europe, North America and some parts of Asia, the more the product is harvested and supplied to the global market, the more likely Nigeria will be integrated into the global economy.

CONCLUSION

The Heckscher-Ohlin model based on Ricardo's theory of comparative advantage maintains that nations should specialize in producing and exporting products that they have relative factor proportions. Given that cocoa is also the topmost non-oil export products and earnings in the country, this paper assesses its performance and determines the effects of external factors on production in the country. Using OLS and Granger causality, the OLS regression results reveal that exports, trade openness, area harvested and domestic consumption have positive influences on cocoa production in Nigeria. The Granger test shows that there exists a bidirectional causality between the world price, trade openness and yield per hectare to cocoa production in the country. A unidirectional is observed from cocoa bean production to exports in Nigeria. The Nigerian government and partners should create an enabling environment and some incentives to stimulate cocoa producers and exporters to increase cocoa production for domestic consumption, export and foreign earnings in the country.

Acknowledgements

The author appreciates the financial support from IGA FRRMS MENDELU (No. 2016/012): '*Agricultural Production, Trade and Economic Growth in the Sub-Saharan African (SSA) Countries*'.

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