The effect of price distortion on cocoa farmers' welfare: A partial equilibrium model approach

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ABSTRACT

There is a dearth of information on the effect of price distortion on the welfare of cocoa farmers. This study therefore investigated the impact of price changes on cocoa farmers' welfare. The study was carried out in the Southern Nigeria specifically Ondo, Oyo and Cross River States. Multi-stage random sampling technique was used to select 250 cocoa farmers from the study area and the data collected from the selected respondents were analysed using descriptive statistics and Partial Equilibrium Model (PEM). The result indicated that the mean age of the farmers was 48 years while 80.8% of them had formal education. Furthermore, the result showed that the Net Social Loss in Production (NSLp) was ₦308,411.24 per tonne while Welfare Loss in Production (WLp) was ₦429,432.36 per tonne. The study concluded that the existing policies on agriculture in the study area did not favour cocoa producers.

Key words: Price, distortion, welfare, cocoa, farmers.

Cocoa originated from around the headwaters of the Amazon in South America. Its cultivation and value spread in ancient times throughout Central and Eastern Amazonian and northwards to Central America. Cocoa was actually introduced into Nigeria from Equitorial Guinea by Chief Squiss Ibaningo in 1874. Since the introduction of the crop into Nigeria, it has grown to be a major export crop (Oyedele, 2007; Adedeji and Oluyole, 2017). Its cultivation has spread to various parts of Nigeria through various sources such as trade agents, Ministries of Agriculture and Research Institutes. Presently, cocoa is grown in most parts of Southern Nigeria extending from areas having 1100mm annual rainfall towards the North to the areas having 2500 mm rainfall towards the coast. As an important cash crop, cocoa plays a critical role in the economies of the major producers in Africa as a main export good and source of foreign exchange. In addition, smallholder farmers (farmers with less than five hectares of cocoa farm) typically grow cocoa, which generates work opportunities for an estimated 10.5 million Africans (Nwachukwu *et al*, 2011). Export of cocoa products from Nigeria was $822.8 million in 2010. This represents about 35% of the $2.32 billion earned from non-oil exports in 2010 (Mejabi, 2012). The main importers of cocoa from Nigeria are Holland, United States of America, Brazil and Britain. In Nigeria, Cocoa is largely produced on smallholders. The average delivery per farmer is less than 5 bags (roughly 300kg per hectare of cocoa) per season. In terms of capacity, Ondo State is rated as the largest cocoa producing state in Nigeria (NCDC, 2006). Cocoa prices are determined in the pre-liberalisation period by Cocoa Marketing Board and are fixed for the entire crop year (Oluyole and Usman, 2006). Fixing of price allows the cocoa farmers to be less vulnerable to fluctuations in world market prices. However, the price stabilization policy of the Cocoa Marketing Board denies the farmers the full benefits of the world price of cocoa. It was as a result of the inefficiencies of the Commodity Board system that the marketing board was abolished in 1986 and the after effects of the abolition was the liberalization by the federal government of the export pricing policy that enabled the marketing of cocoa beans to be handled by private cocoa merchants. The result of the new marketing system gave rise to free marketing operation that many industries, firms and corporate

bodies were freed to engage in domestic trading and exportation of cocoa beans. The prices are determined by the law of demand and supply in the international market. This has necessitated constant changes in the price of cocoa and this continually has effect on the farmers' welfare. However, according to Oluyole (2016), the effect of price changes on welfare can be captured by partial equilibrium model.

Partial equilibrium model (PEM) is an economic model used for analyzing very small markets or individual products. The model was proposed by Luta and Scandizzo (1980). Partial equilibrium requires economists to ignore all markets outside of the one being studied, and to assume that changes in that particular market will have no effect outside of that market, and vice versa. Hence, partial equilibrium analysis consists of the analysis of a particular market in isolation, without attention to how events in that market may affect events in other markets, and these may in turn affect the situation in the original market. According to Ronnie and Alan (2002), PEM concentrates on a particular subsection of the economy, with all other variables being treated as exogeneous to the model. It describes only part of the economic system capturing only the direct impact of (say) a policy shock on the relevant market, ignoring the impact on other areas of the economy as well as feedback effects from these to the original market. The partial equilibrium method can be used to trace the impact of shocks on the relationship between quantities (produced, imported, exported and consumed) and prices of a single commodity or group of commodities. Thus, for instance, one may assess how an increase in the protection of cereals affects production and consumption in the cereals market, without considering how changes in cereal production and consumption will impact on, say, land use or the demand for farm labour or the consumption of other foods, and how these will in turn affect conditions in the cereals market. PEM provides a useful model for research and analysis. The information derived from partial equilibrium analysis can be used by policy makers to estimate welfare effects (consumer and producer surpluses) associated with certain trade policies. PEM analyzes welfare effects of import policies by comparing the world market (or border) price and the prices prevailing in the domestic market in the policy period. According to Akhtar, (1999), there could be distortion between the border and the domestic prices as a result of free trade as well as imposition of trade restriction. Under the free trade condition, the domestic market of the importing country will be in competitive equilibrium as the domestic market price will be equal to the border price and the social welfare will be at maximum. With free trade, the importing country will be able to import and export freely all sorts of goods and services. However, with the imposition of trade restrictions (such as ban and tariff) which often influence the relationship between world price and the price of the domestic producers in the importing country distort this equilibrium leading to a decline in social welfare (Akhtar, 1999). A tariff raises the price of imports to home consumers, increases government revenue, and tends to increase the price for domestic producers of the import-competing commodity, thus providing an incentive for them to increase production and replace imports. Tariffs, therefore, increase the income of producers and government at the expense of consumers. A ban is a situation in which a particular commodity is disallowed from being imported into the importing country. In such a case, the domestic price increases and the consumer social welfare decreases. Partial equilibrium makes it clear that there could be distortion between the domestic price and the international (border) price. These two prices may also differ because of market failures as well as policy interventions. Market failure is the inability of markets to operate properly due to factors such as monopolistic elements, asymmetric information, transaction costs, externalities, and to a certain extent uncertainty and risk (Janvry and Sadoulet, 1995). However, the extent at which this price distortion had on cocoa farmers' welfare is what this study all about to investigate. Hence, the objective of this study was to determine the effect of price distortion on farmers' welfare.

MATERIALS AND METHODS

The study was carried out in the Southern part of Nigeria. In terms of cocoa production, Southern Nigeria can be taken as a proxy for Nigeria. This is because about 90% of the cocoa produced in Nigeria comes from the Southern Nigeria (NCDC, 2006). The study employed multistage random sampling technique to select cocoa farmers. The first stage involved a random

selection of three cocoa producing States from the cocoa producing States in Southern Nigeria. These include Ondo, Oyo and Cross-River States. The second stage involved a random selection of two Local Government Areas (LGAs) among the cocoa producing LGAs from each randomly selected State making a total of 6 LGAs. The randomly selected LGAs included Idanre and Ondo-East from Ondo State; Ido and Ona-Ara from Oyo State as well as Ikom and Etung from Cross-River State. The third stage involved a random selection of two communities from each of the randomly selected Local Government Areas thus making a total of 12 communities randomly selected for the study. A total of 250 cocoa farmers were randomly selected from the selected 12 communities. The data collected from the farmers were analysed using descriptive statistics and Partial Equilibrium Model (PEM). Descriptive statistics was used to describe the socio-economic characteristics of the farmers while the effect of price distortion on farmers' welfare was analysed with the use of Partial Equilibrium Model (PEM) as proposed by Luta and Scandizzo (1980). The impact of price changes on the welfare of farmers was evaluated based on the following measures as earlier utilized by Mashinini *et al,* (2005).

(1). Net social loss in production (NSLp): This is the loss to the society due to inefficiency in domestic production. The inefficiency in production may be due to sub-optimal allocation of resources due to rise in prices and the rise in price might be as a result of imposition of import restrictions on raw materials (Perali, 2003). Net social loss in production can also occur in a situation of free trade (that is, a trade without any restriction to importation) between two countries. In such a situation, if the border price is far below the domestic price, this will force the domestic price down and the local producer may not be able to cope well with the development, thus reduces their production efficiency and in some cases, it may even lead to an outright closure of production.

(2) Welfare gain of producers (Gp): This is the gain from producer trade. It is the amount by which producer's revenue exceeds variable production costs, hence it is the benefit accruing to producers in the market from selling goods. It is the amount producers actually receive for their output minus the minimum amount they would have willingly accepted for those units. In a demand-supply curve, welfare gain of producers is the area above supply curve up to the price received. The estimate of producer's gain depends on the quality of the estimated supply slope, it is expected that the higher the supply elasticity the higher the producer's welfare gain (Perali, 2003). If actual domestic price is higher than the estimated free trade price then producers are gaining but if the actual domestic price is lower than the estimated free trade price, producers are losing.

Net social loss in production, $NSLp = 0.5*e_s*t\hat{}2*V$

Welfare gain of producers, $Gp = t'V'-NSL_p$

Where:

e_s = Price elasticity of supply;

t = Implicit tarrif (NPC-1);

NPC = Nominal Protection Coefficient;

$t' = tPb/Pd$;

Pd = Domestic price for cocoa;

Pb = Border price for cocoa;

V' = Value of domestic production at domestic price (Pd*dom.prod.).

RESULTS AND DISCUSSION

Demographic/Socio-economic characteristics of cocoa farmers

Table 1 shows that cocoa farmers that were between the age 41-50 years had the highest proportion of 37.6%. The mean age for cocoa farmers in the overall was 48.35 years while the Standard Deviation (SD) was ±11.49. About 38.0% of the farmers had their age below the mean age, while about 50.0% of the respondent farmers had their age above the mean age of 45.4 years. Meanwhile, about 12.0% of the farmers fell within the mean age. Hence, there were more older farmers than their younger counterparts in the study area. This finding is in line with Oluyole *et al,* (2010) which found out that majority of cocoa farmers in Ondo State were relatively old. This may have negative impact on the farm size since young people are stronger and are expected to cultivate larger-size farm than older respondents. It might also have negative implication on the productivity of the cocoa farmers. It could also be observed in Table 1 that male farmers were more (78.8%) than their female counterpart (21.2%). This shows that majority of the cocoa farmers in the study area were male. The dominance of the male over the females may be attributed to the fact that male children are

considered in the inheritance of farm land in the study area. As regards the educational status, the respondent farmers with formal education (80.8%) were more than those with no formal education. This shows that most of the farmers in the study area had formal education. Education is a form of human capital; hence it could impact positively on farmer's ability to take good and well informed production decisions. Therefore, education of farmers could improve the productivity of the farmers. This finding is in line with Okunlola (2003) who found out that education influences adoption of new technologies by farmers and thus improves farmer's productivity. Table 1 also showed that 78.8% of the farmers had maximum of 5 hectares with the mean farm size of 4.04 hectares and standard deviation of ±4.05. Hence, the substantial proportion of the farmers in the study area are small scale farmers (having not more than 5 hectares of farm size). This is a typical characteristics of Nigerian farmers. Most Nigerian farmers are small scale farm holders and this has been the bane of agricultural development in developing countries. The result is in line with Ogunleye and Oladeji (2012) which found out that 80% of cocoa farmers in Ondo State had less than 6 hectares of farm size. One of the causes of small holding farms is the use of crude implements such as hoes and cutlass and lack of technical know-how that may be required to cultivate large farms (Akanni and Dada, 2012; Oluyole *et al*, 2017b). Regarding the age of the cocoa farms in the study area, about 38.8% of the farms were above 30 years of age and the mean age was 26.71 years. In general, the substantial proportion of the farms are too old and due to be rehabilitated. According to Oduwole (2004), diminishing returns sets on the yield of cocoa tree at the age of 25 years. Hence, after this age, the productivity of cocoa tree starts to be decreasing and would need to be replaced with the younger cocoa seedlings. This finding is in line with Oduwole (2004) and Ogunlade *et al*, 2017 who identified ageing cocoa farms as one of the factors responsible for the decline in cocoa production in South Western Nigeria. He observed that many farms were over 40 years old and such farms constitute a reasonable proportion of the cocoa farms in Nigeria. However, in another study conducted by Daramola *et al.* (2003), it was found that most cocoa farms in Ondo and Osun states are very old with low productivity while farms in Cross River state are relatively younger and mostly in productive phase.

Table 1. Socio-economic characteristics of cocoa farmers

Variables		**Frequency**	**Percentage**
Age (Years)			
≤ 30		9	3.6
31-40		62	24.8
41-50		94	37.6
51-60		51	20.4
61-70		28	11.2
>70		6	2.4
Total		250	100.0
Mean	48.35		
Standard Deviation (SD)	11.49		
Gender			
Male		197	78.8
Female		53	21.2
Total		250	100.0
Educational Status			
No formal education		48	19.2
Primary education		71	28.4
Secondary education		82	32.8
Tertiary education		49	19.6
Total		250	100

Farm size (Hectare)			
≤ 2		82	32.8
2.1-5		115	46.0
5.1-10		46	18.4
10.1-15		3	1.2
> 15		4	1.6
Total		250	100
Mean	4.04		
SD	4.05		
Age of farm (Years)			
≤ 10		71	28.4
11-20		48	19.2
21-30		34	13.6
31-40		37	14.8
41-50		41	16.4
>50		19	7.6
Total		250	100.0
Mean	26.71		
SD	18.47		

Source: Field survey, 2014.

The effect of price distortion on farmers' welfare

The effect of price distortion is shown in Table 2. The table showed that the domestic price (pd) of cocoa beans was 448,226.38 per tonne. This is the price that is paid to the producer. Border price (pb) is the prevailing price at the point of exit for an internationally tradable commodity and represents its shadow price and was estimated at ₦466,000.00 per tonne for cocoa beans. Due to the shortage of sufficient time series data, it was not possible to estimate the price elasticity of demand econometrically. Price elasticity of demand (e_d) was obtained from the research findings of Ebi and Ape (2014) which estimated the demand elasticity of cocoa in Nigeria to be -0.55. This means 100 percent change in the price brings about 55 percent changes in the quantity of cocoa demanded. This is so because cocoa has no close substitute. Elasticity of supply (e_s) for cocoa was calculated from the study data and was estimated at 7.90. The estimated supply elasticity (e_s) was high because of the nature of the crop (cocoa). Cocoa is a commercial crop and hence its supply is purely price dependent. If the price is high, farmers strive to increase their production and vice versa. The amount of protection provided to the domestic producers was estimated using Nominal Protection Coefficient (NPC). The NPC is a measure of the extent to which domestic price policy protects the domestic producer from the direct input of foreign market (Tsakok, 1990 and Oluyole *et al,* 2017a). NPC of 0.96 was obtained and this indicates that the cocoa producers were not protected and were not receiving support in their production activities.

The result of the analysis as shown in table 2 indicated that the Net Social Loss (NSLp) in production was ₦308,411.24 per tonne. Net social loss in production may be attributed to the low price being received by the farmers (low producer price). Cocoa buyers (middlemen) have a very strong influence in pricing/price manipulation in cocoa value chain. They buy cocoa at a very low price from the farmers and later sell it a very high price. Also, cocoa buyers are in the habit of providing loan to cocoa farmers with the agreement that cocoa proceeds from the farmers' farms must be sold to them. With this, the farmers must sell their produce to them even if they are buying at a lower price and all these results in net social loss. This is a very serious problem in cocoa business as revealed by Oluyole and Usman (2006) and it always results in reducing the amount of income accruable to cocoa farmers. One of the ways out of this problem is for farmers to group themselves into cooperative society and register with a viable cocoa exporter who will be

coming from time to time to buy their produce which they must have been pooled together. With this, their produce will be bought at a good price from them. Increase in NSLp may also be attributed to the policy of imposing taxes on producer of cocoa. This is done through an imposition of indirect tax on farmer's inputs such as fertilizer and chemicals. The tax may be inform of value added tax and this in most cases increases the price of the inputs beyond the farmers' reach Also, NSLp may be due to an inefficient distribution of subsidized production resources to get to the low producers. It is quite disheartening that the substantial proportion of the subsidized agricultural inputs are being hijacked by non-farmers who in turn sell them to the farmers at very exorbitant prices. In order to avert this, the government of Goodluck Jonathan introduced wallet system in which subsidized agricultural inputs were been distributed to farmers with the use of text messages to the farmers. The farmers would later go to the redemption centers with the text messages to collect their inputs. With this, the inputs were able to get to the farmers at subsidized prices.

It was also revealed in table 2 that a value of ₦429,432.36 per tonne was recorded as welfare loss of producers (Gp). This shows that the producers' revenue fell short of ₦429,432.36 per tonne. Hence, cocoa farmers were selling their produce (cocoa) at a price that is lower than the equilibrium price thus making them to record welfare loss. However, just like the case of net social loss in production, welfare loss might had been recorded as a result of low price being received by the farmers (low producer price), imposition of indirect tax on farmer's inputs such as fertilizer and chemicals as well as an inefficient distribution of subsidized production resources to get to the low producers. Therefore, the overall analysis has shown that the current policy on cocoa does not favour the producers.

Table 2. Effects of price distortions on cocoa producers' and consumers' welfare

Variable	Label	Value
Pd (N/ton)	Average domestic price	₦448,226.38
Pb (N/ton)	Average border price	₦466,000.00
e_d	Elasticity of demand of cocoa	-0.55
e_s	Elasticity of supply of cocoa	7.90
NPC	Nominal Protection Coefficient	0.96
NSLp (N/ton)	Net social loss in production	₦308,411.24
Gp (N/ton)	Welfare loss of producers	₦429,432.36

Source: Field survey, 2014.

CONCLUSION

The existing government policies on agriculture did not protect cocoa production in that cocoa domestic market price was lower than the border price thus making the Norminal Protection Coefficient (NPC) to be lower than one. The effect of this is that cocoa would have to be continually exported out in the raw form rather than being retained in the country to be converted to the intermediary or final products (value addition). Value addition on cocoa would increase employment and income from cocoa sub-sector. The study also showed that there was net social loss in cocoa production while there was welfare loss for cocoa producers; hence, the current market policies did not favour cocoa producers.

REFERENCES

Adedeji, A.R. and K.A.Oluyole. 2017. Status and the Determinants of Organic Cocoa Production in Nigeria. *Journal of Innovative Agriculture,*4(2): 9-14.

Akanni K.A. and A.O. Dada. 2012. Analysis of labour use patterns among small-holder cocoa farmers in Southwestern Nigeria. *Journal of Agricultural Science Technology,* 2 (1): 107-113.

Akhtar, M.R. 1999. Effects of Trade Liberalisation on Agriculture in Pakistan: Commodity Aspects. Working Paper 44, CGPRT Centre, ESCAP, United Nations, Bogor, Indonesia.

Daramola, A.G., J.A. Fuwape, T.I.Ofuya, J.O. Okunlola, I.A. Ajibefun, I.E.Okuku, D.O. Oke, E. Aladesaiye, K.B. Badaru, and A.O. Olaiya.2003. Evaluation of Sustainable Options for Rehabilitation for Small Holder Nigerian Farmers. *Sustainable and Competitive Cocoa System in Africa,* 16: 47-53.

Ebi, Bassey Okon and Ape, Ajene Sunday.2014. Supply Response of Selected Agricultural Export Commodities in Nigeria. *Journal of Economics and Sustainable Development*, 5(5): 47-57.

Janvry, A. and E.Sadoulet. 1995. Quantitative Development Policy Analysis. *Johns Hopkins University Press.*

Luta E, and P. Scandizzo .1980. Price Distortions in Developing Countries: Bias Against Agriculture. *European Review of Agricultural Economics,* (7): 5-27.

Mashinini, N.N., A. Obi and S. Herman van. 2005. Welfare Effects of Regulation of the Maize in Swaziland. Paper presented for the International Food and Agribusiness ManagementAssociation World Food and Agribusiness Symposium on Re-inventing of food chain: New Market, Customers and Products. Chicago, Illinois, USA. 25-28 June, 2005.

Mejabi Dayo. 2012. The Nigerian Cocoa Value Chain: Vertical Coordination for Improved Productivity. Cocoa Round Table Workshop, Akure, 16th August, 2012.

National Cocoa Development Committee. 2006. The National Cocoa Development Committee Intervention. *Cocoa Rebirth.* Published by National Cocoa Development Committee. 21.

Nwachukwu Ifeanyi Ndubuto, Nnanna Agwu, Jude Nwaru and George Imonikhe.2011. Competitiveness and Determinants of Cocoa Export from Nigeria. *Report and Opinion*, 2(7): 51-54.

Oduwole, O.O. 2004. Adoption of Improved Agronomic Practices by Cocoa Farmers in Nigeria: A Multivariate Tobit Analysis. Unpublished Ph.D thesis submitted to the Department of Agricultural Economics and Extension, Federal University of Technology, Akure, Nigeria.

Ogunlade M. O., K.A. Oluyole, E.A. Adeyemi, P.E. Aikpokpodion and S. Adebiyi. 2017. Bringing laboratory (soil test kits) to the door steps of small holder Cocoa farmers. *Journal of Innovative Agriculture*, 4(3): 6-10.

Okunlola J. O. 2003. Factors Associated with the adoption of food crops production technologies by small scale farmers in Niger Republic. *Ogun Journal of Agricultural Production* (In press).

Oluyole, K.A. and J.M. Usman. 2006. Assessment of the Economic Activities of Cocoa Licensed Buying Agents (LBAs) in Odeda Local Government Area of Ogun state. *Akoka Journal of Technology and Science Education*, 3 (1): 130-140.

Oluyole, K.A. 2016. Competitiveness of Cocoa Value Chain in Southern Nigeria. Unpublished Ph.D thesis submitted to the Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria.

Oluyole, K.A., R.A. Sanusi and E.O. Aigbekaen. 2010. Food Demand Among Cocoa Farming Households In Nigeria. *Proceedings of the 44th Annual Conference of Agricultural Society of Nigeria (ASN), Ogbomoso, held between 18-22 October, 2010.* Pp. 511-514.

Oluyole, K.A., A.T.Yahaya and E.E.O. Agbebaku. 2017a. Competitiveness of Tea Production and Challenges of Tea Value Chain in Taraba State, Nigeria. *Journal of Innovative Agriculture,* 4(1):10-16.

Oluyole, K.A., I. Ndagi, A.T.Yahaya, and E.E.O. Agbebaku. 2017b. Evaluation of the Status of Tea Consumption in Nigeria. *Journal of Innovative Agriculture,* 4(2):29-35.

Oyedele, J.O. 2007. Enhancing the Sustainability of Cocoa Growing in Nigeria. A Paper Presented at the ICCO Roundtable Congress on Sustainable World Cocoa Economy at Accra, Ghana. 3rd – 6th October, 2007.

Perali, F. 2003. Partial Equilibrium Analysis of Policy Impacts (part 1). National Agriculture. Policy Centre (NAPC) Syria. http.//www.napcsyryr.org/dwnldfiles/training_materials/en/tm_partial_equilibrium_analysis_I_en.pdf. Downloaded on 14/03/2014.

Ronnie, O.T. and M.Alan. 2002. General Equilibrium, Partial Equilibrium and the Partial Derivative Elasticities in a CGE model. Paper presented at the International Conference on Global Modeling. EcoMod2002, Brussels, July 4th to 6th, 2002. www.ecomod.net/conferences/ecomod2002/papers/otoole.pdf.Downloaded on 5/10/2012.

Tsakok, I. 1990. Agricultural price policy: A practitioner's guide to partial equilibrium analysis. Ithaca and London: *Cornell University Press*.