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Competitiveness and Effects of Policies on Plantain Production Systems in Southwestern Nigeria

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Abstract

Plantain is one of the most important staple crops in Nigeria and has the potential to contribute to food security and economic development of the country. There is inadequate information on competitiveness, comparative advantage and effects of government policies on the commodity. The study therefore analyzed competitiveness and effects of government policies on plantain production systems in Southwestern Nigeria. Primary data were collected using structured questionnaire from 260 producers randomly selected from major production areas in the zone. Secondary data on port charges and world prices were also utilized. Data were analyzed using Policy Analysis Matrix (PAM). Results indicated that plantain production was privately and socially profitable in all the productions systems. Domestic resource cost ratio of 0.16 – 0.19 and social cost benefit ratio of 0.20-0.23 revealed that southwestern Nigeria had comparative advantage in the production of the commodity. The policy indicators and incentives structure such as the nominal protection coefficient on output (0.31-0.42) and input (1.02-1.04), effective protection coefficient (0.26-0.37), profitability coefficient (0.21- 0.32), subsidy ratio to produces (-0.51 to -0.62) and producers subsidy estimate (-1.70 to -2.02) showed that the producers were taxed and there exists transfers of resources from the systems. The study recommends formulation of policies which are consistent with the country's goals of agricultural transformation, food security and economic development.

Keywords:

Plantain, competitiveness, policy incentives, Southwestern Nigeria.

Introduction

Plantain is an economic crop which has a relatively high value in common with most other horticultural crops (Aina et al, 2012). Plantain is critical in bridging the gap between demand and supply of the basic carbohydrate staples (Fakayode et al, 2011). It is an important staple crop in the region (Cauthen et al, 2013) and play a key role in providing food security in food-scarce months when most other starchy staples are difficult to harvest (Akinyemi et al., 2010). Plantain cultivation is attractive to farmers due to relatively lower labour requirements compared to cassava, maize, rice and yam (Kayode et al., 2013). Available trade records and associated indices showed that Nigeria is one of the largest producers of plantain in the world (FAO, 2013). Nigeria is among the major producers of plantain in Africa and fifth in the world producing 2,722,000 metric tonnes in 2011 (FAO, 2012). Plantain and its products have the potential to serve as a vehicle for poverty reduction and source of livelihood for a majority of smallholder farmers and traders.

Despite the production potential of Nigeria in plantain, her role in world plantain economy is relatively minor and does not project a promising outlook (Akinyemi et al, 2010). Nigeria does not feature among plantain exporting nations (Akinyemi et al, 2010) and according to Agricultural Transformation Agenda (ATA), (2011), the country is not prominent in the export of agricultural commodities, her agricultural exports are negligible and represent about 0.2 percent of total exports. Her export share of plantain declined rapidly and has been eclipsed by many countries such as Ghana, Cote d'Ivore, Cameroon amongst others. Potential annual revenue of 1.6 trillion Naira has been lost due to the inability of Nigeria to maintain the 1961 market share in agricultural exports (ATA, 2011).

Plantain production in Nigeria is characterized

by low usage of agricultural inputs, low mechanization and irrigation intensity. This is due to Nigeria's low investment in agriculture averaging approximately 2% of government expenditure (Olomola, 2007). It is apparent that Nigeria, relative to most African countries, has a huge domestic market which can drive growth in agricultural and industrial production, including agro-based value addition. Poor infrastructure and high input costs (for example energy and credit) put Nigerian goods at a competitive disadvantage (ATA, 2011). In order for a commodity to contribute to food security and economic empowerment, analysis of its competitiveness is imperative.

Competitiveness can be defined as the set of institutions, policies, and factors that determine the level of productivity of a country (Martin et al., 1991). It is the fundamental determinant of the level of prosperity a country can sustain (Porter, 2005) and the ability of an economy to provide its population with high and rising standards of living and employment for all those willing to work, on a sustainable basis (EU Commission, 2003). The level of productivity determines the country's ability to sustain a high level of income; it is also one of the central determinants of the returns to investment, which is one of the key factors explaining an economy's growth potential (Martin et al., 2009).

A number of studies have been carried out on Competitiveness in Africa such as Ghada et al. (2014), Toure et al., (2013) and in Nigeria for grains like rice, maize (Ogbe et al, 2011, Liverpool et al., 2009, Oguntade, 2011 and Cassava (Liverpool et al., 2011, Ugochuckwu and Ezedinma, 2011), potato (Ugonna et al, 2013) and pineapple (Adegbite et al., 2014). The existing literature indicated lack of research in the use of Policy Analysis Matrix in the Plantain sub sector in Southwestern Nigeria. The study therefore aims to analyze the competitiveness, comparative advantage and effect of government policies on plantain production systems in Southwestern Nigeria. The outcome of the study is expected to assist relevant stakeholders in coming up with appropriate policies that will lead to the development of the plantain sub sector to the level where it shall be able to contribute to economic development and poverty reduction.

Materials and methods

Study Area

The study was carried out in Southwestern Nigeria. The zone was chosen because it is one of the major plantain growing areas in the country. Large volume of plantain is traded in urban centers located in the zone (Akinyemi et al, 2010). Also, the prospect for value addition is promising due to the presence of emerging processing industries. The South Western is one of the six geo political zones in Nigeria. The zone is made up of six states namely Lagos, Oyo, Ogun, Osun, Ekiti and Ondo states. It falls on latitude 60 to the north and latitude 40 to the south. It is marked by longitude 40 to the west and 60 to the east. It is bounded in the north by Kogi and Kwara states, in the east by Edo and Delta states in the south by Atlantic Ocean and in the west by the Republic of Benin. The zone is characterized by a tropical climate with distinct dry season between November and March and a wet season between April and October. The mean annual rainfall is 1480 mm with a mean monthly temperature range of 18^{o}C – 24^{o}C during the rainy season and 30^{o}C – 35^{o}C during the dry season. The Southwest Nigeria covers about 114,271 kilometers square land area. The total population is 27,581,992 and predominantly agrarian. Major food crops grown in the zone include cassava, plantain, cowpea and yam (NPC, 2006).

Sampling Technique and Data collection

The study employed multistage sampling technique. 10 high plantain production local government areas were selected from the zone followed by selection of two villages from each of the local government. In the last stage of the sampling, farmers were randomly selected from the villages using probability proportionate to size to give a total number of 260 producers from the zone. Primary and Secondary data were utilized for this study. Primary data were obtained through the use of well structured questionnaire. The primary data collected include: yield, input requirements, market prices for inputs and outputs, transportation cost, storage cost while secondary data include production subsidy, port charges, import and export tariffs and exchange rates. The secondary data were sourced from Nigeria Port Authority, the International Trade Statistics and the Central Bank of Nigeria.

Analytical framework

The study evaluated competitiveness and effect of policies on plantain production systems using Policy Analysis Matrix (PAM).

Policy Analysis Matrix (PAM)

PAM (Table 1) is a computational framework developed by Monke and Pearson, (1989) and augmented by Masters and Winter–Nelson (1995) for measuring input use efficiency in production, comparative advantage and degree of government interventions (Nelson, Panggabean, 1991). It is an accounting matrix of two basic identities. The first identity defines profitability as the difference between income and costs (rows), whereas the second measures the effects of the differences in incomes, costs and profits arising from distorting policies and market failures.

Measures of competitiveness

Private profitability

The private profitability demonstrates the competitiveness of the agricultural system given current technologies, prices of input and output and policy (Monke, Pearson, 1989, Pearson et al., 2003). The term private refers to observed revenues and costs reflecting actual market prices received or paid by farmers, merchants, or processors in the agricultural system. Private profit is calculated on the first row of the matrix and it is the difference between observed revenues and costs valued at market prices (private values) received by the producers.

$$D = A - (B + C) \quad (1)$$

Where: D = private profits; A = private revenue, B = tradable input cost at private price, C = domestic factor cost at private price.

Positive private profit indicates competitiveness of the agricultural system while negative private profits implied that the system is not competitive.

Private Cost Ratio (PCR)

PCR shows the private efficiency of the farmers and it is an indication of how much one can afford to pay domestic factors and still remain competitive (Monke, Pearson, 1989).

$$PCR = \frac{\sum_{j=k+1}^{n} a_{ij} P_k^P}{P_i^p - \sum_{j=1}^{k} a_{ij} P_j^P} = \frac{C}{A - B} \quad (2)$$

a_{ij} for ($j = k + 1$ to n) = technical coefficient for domestic input used in plantain production.

a_{ij} for ($j = 1$ to k) = technical coefficient for traded input used in plantain production.

P_k^p = price of domestic input evaluated privately; P_i^p = price of plantain fruit evaluated privately; P_j^p = price of traded input (₦) evaluated privately in plantain production, C = cost of domestic factors; A = revenues in private prices; B = cost of tradable inputs.

Thus PCR<1 indicates that entrepreneurs are earning profits while PCR>1 implies entrepreneurs are making losses; PCR = 1 indicates the breakeven point.

Item	Revenues	Cost of tradable inputs	Domestic factors	Profits
Private prices	A = P_i^P	B = $\sum_{j=1}^{k} a_{ij} P_j^p$	C = $\sum_{j=k+1}^{n} a_{ij} P_k^P$	D = $A - B - C$
Social prices	E = P_i^S	F = $\sum_{j=1}^{k} a_{ij} P_j^S$	G = $\sum_{j=k+1}^{n} a_{ij} P_k^S$	H = $E - F - G$
Effects of policy and other divergences	$I = A - E$	$J = B - F$	$K = C - G$	$L = D - H = I - J - K$

Note:

A = private revenue, B = tradable input cost at private price, C = domestic factor cost at private price, D = private profit, E = social revenue, F = tradable input at social price, G = domestic factor cost at social price, H = social profit; I = output transfer, J = input transfer, K = factor transfer, L = net policy transfer = [$D - H$].

P_i^P = price of plantain fruit produced evaluated privately (₦)
P_i^S = price of plantain fruit produced evaluated socially (₦)
a_{ij} for (j = 1 to k) = technical coefficient for traded input used in plantain production
a_{ij} for ($j = k + 1$ to n) = technical coefficient for domestic input used in plantain production.
P_j^p = price of traded input evaluated privately in plantain production (₦)
P_j^s = price of traded input evaluated socially in plantain production (₦)
P_k^p = price of domestic factor input evaluated privately in plantain production (₦)
P_k^s = price of domestic input factor evaluated socially in plantain production (₦)

Source: Monke and Pearson, 1989

Table 1: Policy analysis matrix.

Measures of comparative advantage

Social profitability

The social profitability is a measure of comparative advantage and efficiency because outputs and inputs are valued in prices that reflect scarcity values (Monke and Pearson, 1989). This is calculated on the second row of the Policy Analysis Matrix.

$$H = E - (F + G) \quad (3)$$

E = social revenue, F = tradable input at social price, G = domestic factor cost at social price, H = social profit.

A positive social profit indicates that the system uses scarce resources efficiently and the commodity has a static comparative advantage while negative Social profits indicate that the sector cannot sustain its current output without assistance from the government.

Domestic Resource Cost (DRC)

The Domestic Resource Cost (DRC) is a measure of relative efficiency of domestic production by comparing the opportunity cost of domestic production to the value generated by the product (Tsakok, 1990). The measure is calculated as the ratio of the cost of domestic resources and non-traded inputs of producing the commodity to the net foreign exchange earned or saved by producing the good domestically.

$$DRC = \frac{\sum_{j=k+1}^{n} a_{ij} P_k^S}{P_i^s - \sum_{j=1}^{k} a_{ij} P_j^S} = \frac{G}{E - F} \quad (4)$$

a_{ij} for (j = *1* to k) = technical coefficient for traded input used in plantain production. a_{ij} for (j = k + *1* to n) = technical coefficient for domestic input used in plantain production; P_k^S = price of domestic input evaluated socially (₦); P_i^S = prices of plantain fruit evaluated socially (₦); P_j^S = price of traded input evaluated socially in plantain production (₦); G = costs of domestic factor in social prices; E = measures revenue in social prices, F = cost of tradable input in social prices.

DRC<1 indicates comparative advantage in producing the commodity using domestic resources.

DRC>1 indicates comparative disadvantage in producing and requires policy interventions.

Social Cost Benefit ratio (comparative advantage)

A good alternative for the DRC is the Social Cost-Benefit ratio (SCB) which accounts for all cost and avoids classification errors in the calculation of DRC (Masters,Winter-Nelson, 1995). Social Cost/Benefit (SCB), which accounts for all costs (Fang, Beghin, 1999) while DRC may be biased against activities that rely heavily on domestic non traded factors such as land and labor.

$$SCB = \frac{\sum_{j=1}^{k} a_{ij} P_j^S + \sum_{j=K+1}^{n} a_{ij} P_k^S}{P_i^S} = \frac{F + G}{E} \quad (5)$$

a_{ij} for (j = *1* to k) = technical coefficient for traded input used in plantain production.

a_{ij} for (j = k + *1* to n) = technical coefficient for domestic input used in plantain production; P_j^S = price of traded input evaluated socially in plantain production (₦); P_k^S = price of domestic input evaluated socially (₦); P_i^S = private prices of plantain fruit evaluated socially (₦); G = costs of domestic factor in social prices; E = measures revenue in social prices; F = cost of tradable input in social prices.

SCBR ratio > 1 indicates that the system does not have comparative advantages.

SCBR ratio <1 indicates that the system have comparative advantages.

Measures of protection and effect of policies

The most common protection coefficients in PAM are the Nominal Protection Coefficient (NPC), the Effective Protection Coefficient (EPC), the Profitability Coefficient (PC), the Subsidy Ratio to Producers (SRP) and the Producer Subsidy Estimate (PSE).

Nominal Protection Coefficient (NPC)

The NPC is a measure of the extent to which domestic price policy protects domestic producers or consumers from the direct input or output of foreign markets (Tsakok, 1990). The NPC is calculated as a ratio of domestic price to border parity price. It can be calculated for the output (NPCO) and input (NPCI).

$$NPCO = \frac{Pi^p}{Pi^s} = \frac{A}{E} \quad (6)$$

$NPCO$ = Nominal Protection Coefficient on plantain fruit produced.

$$NPCi = \frac{\sum a_{ij} Pj^{p}}{\sum a_{ij} Pj^{s}} = \frac{B}{F} \quad (7)$$

NPCi = Nominal Protection Coefficient on input used for plantain production.

P_i^S = prices of plantain fruit produced evaluated socially (₦)

P_i^p = prices of plantain fruit produced evaluated privately

A = Private revenue

E = Social revenue

B = cost of tradable inputs in private prices

F = cost of tradable input in social prices

P_j^p = private prices per unit of tradeable input

P_j^s = social prices per unit of tradeable input

a_{ij}, *k+1* to *n* = coefficients for domestic resources and non traded inputs

a_{ij}, *1+k* = coefficients for traded inputs

NPCO > 1 = the domestic price is higher than the export price and the system is receiving protection.

NPCO < 1 = the domestic price is lower than the comparable world price and the system is not protected by policy.

NPCI > 1 = domestic input cost is higher than the input cost at world prices and the system is taxed by policy.

NPCI < 1 = domestic price is lower than the comparable world price and the system is subsidized by policy.

Effective Protection Coefficient (EPC)

This is the ratio of value added at domestic prices (A - B) to value added at world reference prices (E - F). The EPC combines the two NPC's to assess the overall effect of implicit tax and subsidy through both inputs and outputs (Beghin, Fang, 2002).

$$EPCi = \frac{VAD}{VAB} = \frac{A - B}{E - F} \quad (8)$$

VAB = value added at border price; *VAD* = value added at domestic price; *A, B, E, F* are defined above in PAM framework.

A value of EPC greater than one indicates a net subsidy to value added (Beghin, Fang, 2002).

EPC<1 represents a net disincentive.

Profitability Coefficient

The PC measures the incentive effects of all policies and thus serves as a proxy for the net policy transfer, since *L = (D - H)*. The index is calculated as a ratio of private profit to social profit (Pearson et al., 2003).

$$PC = \frac{P_i^P - \sum_{j=1}^{k} a_{ij} P_j^P - \sum_{j=k+1}^{n} a_{ij} P_k^P}{P_i^S - \sum_{j=1}^{k} a_{ij} P_j^S - \sum_{j=k+1}^{n} a_{ij} P_k^S} = \frac{A - B - C}{E - F - G} = \frac{D}{H} \quad (9)$$

PC = profitability coefficient

a_{ij} for (*j = 1* to *k*) = technical coefficient for traded input used in the value chain of plantain

a_{ij} for (*j = k* to *n*) = technical coefficient for domestic input used in the value chain of plantain

P_i^p = private prices of plantain output evaluated privately

P_i^S = private prices of plantain output evaluated socially (₦)

P_j^p = price of traded input evaluated privately in plantain value chain (₦)

P_j^S = price of traded input evaluated socially in plantain value chain (₦)

P_k^p = price of domestic input evaluated privately

P_k^S = price of domestic input evaluated socially (₦)

A, B, C, D, E, F, G, H is defined above in the PAM table.

PC < 1: net disincentives to production

PC >1: incentives to production

Subsidy Ratio to Producers (SRP)

SRP is the net policy transfer as a proportion of total social revenues (Monke, Pearson, 1989). The SRP shows the proportion of revenues in world prices that would be required if a single subsidy or tax were substituted for the entire set of commodity and macroeconomic policies.

$$SRP = \frac{L}{E} = \frac{(D - H)}{E} \quad (10)$$

D = private profit, *E* = social revenue, *H* = social profit; *L* = net policy transfer.

The positive value of SRP indicates the overall transfer from society to producer while Negative value of SRP means overall transfer from producer to society and taxpayers.

Producer subsidy equivalent (PSE) is a more complete measure of protection from trade as it accounts for factors affecting input and output prices (Monke, Pearson, 1989). The PSE is extracted

from the PAM as (L) divided by A. it measures the impact of policies on profits of as share of revenue. The negative value of PSE indicates overall transfer from producer to consumer and taxpayers while the positive value means the overall transfer from consumer to producer.

$$PSE = \frac{L}{A} \quad (11)$$

L = net policy transfer; A = private revenue

Results and Discussion

1. Competitiveness of plantain production systems

Four plantain production systems were identified in the study are: sole plantain, plantain/cocoa, plantain/cocoyam and plantain/cassava. The results of the analysis (Table 2) showed that plantain production was privately profitable in the four production systems. Positive private profit of ₦348,352/ha ($2,114.33/ha) was estimated for sole plantain production system, plantain/cocoa (₦303,150/ha), plantain/cocoyam (₦514,547/ha) and plantain/cassava (₦354,579/ha). This indicates that plantain production is competitive and the producers are realizing financial gains under existing policies, technologies, output values, input costs, and policy transfers. It also implies that farmers in the study area can produce plantain without transfer from government. plantain/cocoyam production system was the most competitive out of the four evaluated production system with a private profitability of ₦514,547/ha followed by plantain/cassava production systems (₦354,579), sole plantain (₦348,352/ha) while the least competitive production system was the plantain/cocoa (₦303,150/ha). The high private profitability recorded in plantain/cocoyam production system was due to additional income realized from the sale of Cocoyam tubers and the associated higher price per unit of Cocoyam.

The competitiveness of plantain production system was also confirmed by the private cost ratio (PCR). PCR is another indicator of competitiveness and is an indication of how much a system can afford to pay domestic factors and still remain competitive (Monke, Pearson, 1989). A ratio of PCR less than 1 indicates a profitable enterprise while a ratio greater than 1 indicates a non-profitable enterprise. The lower the PCR ratio the higher the competitiveness of the system (Rasmikayati, Nurasiyah, 2004). The result of the analysis (Table 4) indicated that the PCR of the production systems ranged between 0.27 – 0.36. PCR ratio of 0.30 was obtained for sole plantain production systems, plantain cocoa (0.35), plantain/cocoyam (0.27), plantain/cassava (0.36). The PCR value of plantain/cocoyam was also the lowest and this further confirmed competitiveness of the production system compared to the other systems of production. The PCR which was less than unity indicated that value added was relatively large in comparison with domestic factor costs. It also indicated that costs involved in the production were smaller than the corresponding benefits. Thus plantain production is profitable and competitive and the producers have incentives to expand production. Similar trends about profitability of plantain production enterprise were also reported by Baruwa et al, (2011), Kainga and Seiyabo, (2012). Baruwa et al, (2011) found that net returns accruing to an average plantain farmer was ₦65, 781.67 per ha per annum. Kainga and Seiyabo, (2012) reported that net income estimated from plantain production in Bayelsa was ₦223, 420.00 indicating that plantain production is competitive at the market price.

2. Social profitability and comparative advantage in plantain production systems

Result of the analysis (Table 3) indicated that plantain production is socially profitable in the study area. Positive social profit of ₦1,533,489.88/ha was estimated for sole plantain, plantain/cocoa (₦1,492,691.88/ha), plantain/cocoyam (₦1,593,610.88/ha) while

Production system	Revenue (₦)	Cost of tradeable input (₦)	Cost of domestic factors (₦)	Private profitability/ha (₦)	PCR
Sole plantain	591,969	92,926	150,691	348,352	0.30
Plantain/cocoa	591,969	127,380	161,439	303,150	0.35
Plantain/cocoyam	877,969	168,961	194,461	514,547	0.27
Plantain/cassava	669,249	113,975	200,695	354,579	0.36

Source: Field survey, 2013 (1$= ₦160)

Table 2: Competitiveness of plantain production systems in southwestern Nigeria.

Production system	Revenue (₦)	Cost of tradeable input (₦)	Cost of domestic factors (₦)	Social profitability/ ha (₦)	Domestic resource cost ratio	Social cost benefit ratio
Sole plantain	1,920,594.88	92,115	294,989.63	1,533,489.88	0.16	0.21
Plantain/cocoa	1,920,594.88	124,365	303,538	1,492,691.88	0.17	0.24
Plantain/cocoyam	2,092,194.88	166,974	331,610	1,593,610.88	0.17	0.26
Plantain/cassava	1,931,414.08	111,860	337,843	1,481,711.08	0.19	0.23

Source: Field survey, 2013 (1$= ₦160)

Table 3: Social profitability in plantain production systems.

positive social profit of ₦1,481,711.08/ha was realized in plantain/cassava production system. Positive social profit implied that the producers were utilizing scarce resources efficiently in the production of the commodity. It also indicated that the system can survive without government interventions. However, social profitability was highest in plantain/cocoyam production systems (₦1,593,610.88/ha) followed by sole plantain (₦1,533,489.88/ha), plantain/ cocoa (₦1,492,691.88/ha) while the least social profitability was obtained with plantain/cassava production systems (₦1,481,711.08/ha). The high social profitability in plantain/cocoyam system compared to the other system was due to additional revenue from cocoyam. This is an indication that yield component is a very important criteria in achieving positive or negative social profitability. The result of the social profitability analysis indicated that plantain could be produced in southwestern Nigeria for export.

The result of the analysis of Domestic Resource Cost (DRC) (Table 3) for plantain production system indicated that the DRC values were less than 1. A DRC value of 0.16 was obtained in sole plantain, plantain/cocoa (0.17), plantain/cocoyam (0.17) and plantain/cassava (0.19). This indicates economic profitability and comparative advantage in plantain production system. It also implies that the social net value added is greater than the social costs of domestic production factors. Based on comparative advantage ranking of the production system, the comparative advantage was higher (lowest DRC ratio) in sole plantain (0.16) while the least was obtained with plantain/cassava (0.19). The result of DRC is supported by the SCB ratio. SCB ratio of 0.21 was obtained in sole plantain, plantain/cocoa (0.24), plantain/cocoyam (0.26) and plantain/cassava (0.23) respectively. The result of the SCB indicates that the sum of tradable inputs and domestic factors costs are less than the gross revenue under the prevailing output and input market conditions. These results are supported by the findings of Liverpool et al. (2009) and Ugochuckwu and Ezedinma (2011). In Liverpool et al. (2009) and Ugochuckwu and Ezedinma (2011) social profitability was positive for staple crop production (rice) systems with DRC and SCB ratio less than one indicating that the country had comparative advantage in the production of the commodity.

3. Measures of protection and effects of policies on plantain production systems

The Nominal Protection Coefficient (NPC) is the ratio between the observed market price paid to producers of a given product and the good's underlying social opportunity cost. If NPCO is less than one, the domestic price of plantain fruit produced is lower than the comparable world price and the system is not protected by policy (Monke, Pearson, 1989) while NPCO greater than one indicates protection of the system. Nominal Protection Coefficient on output (NPCO) for the production systems were less than 1 (Table 4). NPCO value of 0.31 was obtained for sole plantain, plantain/cocoa (0.31), plantain/ cocoyam (0.42) and plantain/cassava (0.34). This implies that the domestic price of plantain fruit produced is less than the border price. This further implies implicit transfer of resources from the system and the system is unprotected by policy since the actors are earning less in private value compared to social value. The result of the NPCO in the plantain production system is also an indication that the outputs are under priced compared to the border price.

Nominal Protection Coefficient on Input (NPCI) is a ratio used to measure tradable input transfers. If NPCI exceeds one, the domestic input cost is higher than the input cost at world prices and the system is taxed by policy. NPCI less than one implied that the domestic price is lower than the comparable world price and the system is subsidized by policy. The NPCI on input such as chemical, fertilizers, sprayers (NPCI)

Production system	NPCO	NPCI	EPC	PC	SRP	PSE
Sole plantain	0.31	1.04	0.27	0.23	-0.62	-2.00
Plantain/cocoa	0.31	1.03	0.26	0.20	-0.62	-2.01
Plantain/cocoyam	0.42	1.02	0.37	0.32	-0.52	-1.23
Plantain/cassava	0.34	1.03	0.31	0.24	-0.58	-1.68

Note: NPCO, NPCI, EPC, PC, SRP and PSE are ratio and are used in measuring the level of protection received by a commodity.

Source: Field survey, 2013

Table 4: Protection coefficient and incentives in plantain production.

for the production systems were greater than one. NPCI value of 1.04 was obtained for sole plantain, plantain/cocoa (1.03), plantain/cocoyam (1.02) and plantain/cassava (1.03). This implies that input price at market price is greater than what is observed in the world reference price. The absence of incentives was further confirmed by the result of the Effective Protection Coefficient (EPC) that was less than one in the production system. EPC ratio compares valued added in domestic prices with value added in world prices. An EPC > 1 is an indicator that producers are protected, while an EPC < 1 indicates that producers are taxed (Monke, Pearson, 1989). EPC values of 0.27, 0.26, 0.37 and 0.31 were obtained for sole plantain, plantain/cocoa, plantain/cocoyam and plantain/cassava production systems indicating that the producers are taxed. The absence of incentives was further reinforced by the result of the profitability coefficient presented in Table 4. The profitability coefficient (PC) measures the impact of all transfers on private profits and indicates the proportion of incentives provided to producers through policy effects. PC equals the ratio of private profits to social profits. The profitability coefficient was also less than one for the production system. Profitability coefficient of 0.23, 0.20, 0.32 and 0.24 were obtained for sole plantain, plantain/cocoa, plantain/cocoyam and plantain/cassava productions system. Higher profitability coefficient of 0.32 obtained in plantain/cocoyam production system was due to combined income realized form plantain and cocoyam. The result of the analysis of the profitability coefficient indicates that private profits are less than the profits evaluated at world reference price indicating net disincentives to the producers. Subsidy Ratio to Producers (SRP) compared net policy transfer to value of output at world reference price. The positive value of SRP indicates the overall transfer from society to producer while negative value of SRP means overall transfer from producer to society and taxpayers. SRP values of -0.62, -0.62, -0.52 and -0.58 were obtained for sole plantain, plantain/cocoa, plantain/cocoyam and plantain/cassava production systems. The negative SRP indicates that the producers are taxed in the production of the commodity and there is decrease in gross revenue. The equivalent Producer Subsidy Estimate for the production systems were also less than one indicating implicit tax and transfer of resources from the system.

Conclusion

The result of the policy analysis matrix showed that plantain production was privately and socially profitable in all the production systems. Although, plantain/cocoyam production system was the most competitive out of the four evaluated production system with a private profitability of ₦514,547/ha followed by plantain/cassava production systems (₦354,579), sole plantain (₦348,352/ha) while the least competitive production system was the plantain/cocoa (₦303,150/ha). Additionally, social profitability was highest in plantain/cocoyam production systems (₦1,593,610/ha) followed by sole plantain (₦1,533,489/ha), plantain/cocoa (₦1,492,691/ha) while the least net social profitability was obtained with plantain/cassava production systems (₦1,481,711/ha). Social Cost Benefit ratio (SCB) of 0.21 was obtained in sole plantain, plantain/cocoa (0.24), plantain/cocoyam (0.26) and plantain/cassava (0.23) respectively indicating comparative advantage of the production systems. There was absence of incentives in the production system and this was revealed by the result of the Effective Protection Coefficient (EPC) that was less than one in the production system. Producer subsidy ratio of -0.62, -0.62, -0.52 and -0.58 were obtained for sole plantain, plantain/cocoa, plantain/cocoyam and plantain/cassava production systems respectively indicating that the producers were taxed in the production of the commodity and there is decrease in gross

revenue. The study therefore recommends formulation of policies which are consistent with the country's goals of agricultural transformation, food security and economic development.

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