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Effects of Gender and Other Factors on Agricultural Commercialization in Peri-urban and Rural Cassava Farms of Rivers State, Nigeria

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Abstract: The study was designed to investigate into the level of cassava commercialization, extent of gender effects and other factors on household commercialization index (HCI) of cassava in both rural and peri-urban areas of Rivers State, Nigeria. The study used a stratified random sampling technique to select 50 cassava farmers each from Etche and Ekwerre LGAs of the state (i.e. 100 farmers in all). A set of structured questionnaire and interview schedule was used to retrieve information from the farmers. Data analysis was done using descriptive statistics, Chow test and truncated regression analysis model based on Maximum Likelihood derived from Censored Normal or TOBIT approach. It was found that significant difference exist in the HCI of rural farmers (49%) and peri-urban (40%). The drivers of HCI varied across the areas but on the whole it was noted that gender, farm size, distance to market, labour, farming experience, price of cassava and access to market information significantly influenced the probability of expanding the scale of commercialization of cassava in the area. It was recommended that government and interested bodies should give priority to women in designing and implementing cassava commercialization programmes policies that will improve farmers access to land and also help build on capacities of the farmers to commercialize such as access to extension service, establishment of market information service (MIS), development of market and transport infrastructure were recommended too.

Key words: Commercialization, agriculture, household commercialization index, truncated regression, Tobit model, cassava, Rivers State.

1. Introduction

Agricultural commercialization involves the transition from subsistence farming to increased market-driven production [1]. It is commonly measured as the ratio of percentage value of marketed output to total farm production [2]. Liverpool, Ayoola and Oyeleke [5] rightly noted that the pressing challenge for Nigeria lies in maintaining and improving current economic growth indicators (which stood at 7.3% as at 2007) and translating the recent gains into an improved standard of living for the majority of its citizens. World Bank [3] noted that poverty was staggering in Nigeria with 50-70 percent of her households living below US$1 a day. Agriculture employs about 70 percent of the country's labour force and accounts for about 31 percent of the nation's GDP [4]. Hence the importance of this sector in national development and poverty alleviation cannot be overemphasized.

In fact commercialization of agriculture is very relevant in attaining this objective. The potentials for further economic growth in Nigeria lies in successful implementation of development policies aimed at increasing growth in agricultural sector [5], but unfortunately agriculture in Nigeria is still characterized by mostly small-scale farmers with an average of about 2 hectares of land which are fragmented holdings [6]. Another problem noted by Liverpool, Ayoola and Oyeleke [5] is the sector's inability to harness the entire human capital available.

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Nkonya et al. [7] in an International Food Policy Research Institute (IFPRI) study found that differences across gender were evident in Nigerian regions surveyed with respect to productivity, profitability and uses of land management practices thus underlying the need for agricultural programmes to take these gender differences into account when designing programmes that target certain audiences. The relevance of gender consideration in commercialization of agriculture in Nigeria is therefore reechoed and the time to consider such study is now. For instance, the IFPRI report noted that male-headed households obtained higher profitability from tomato and yam while female headed households obtained higher profitability for leafy vegetables. Liverpool, Ayoola and Oyeleke [5] noted that while women may be increasingly involved in the production of agricultural commodities and attention directed towards assisting them these efforts have been largely restricted by the lack of adequate information about women's actual contribution to the agricultural sector and their problems therein. This leaves a yawning gap for more empirical analyses of gender effects in agricultural commercialization drive in order to attain economic growth; hence the need for this study whose results would provide relevant data for evidence based planning of poverty alleviation, gender inclusion and economic development programmes at national and state levels in Rivers State, Nigeria and Africa at large.

The focus of the study on cassava was deliberate given the importance of cassava in Nigerian households and economy especially in Rivers State. Nigerian cassava production is by far the largest in the world; a third more than production in Brazil and almost double the production of Indonesia and Thailand [8]. In fact Project Coordinating Unit (PCU) [9] gave a most conservative estimate of production at 28 million tonnes in 2002. International Fund for Agricultural Development (IFAD) [8] indicated on the basis of the belief that a growing demand for cassava will spur rural industrial development and contribute to the economic development of producing, processing and trading communities and well-being of numerous disadvantaged people in the world, the development of the Global Cassava Development Strategy was established. The Strategy was endorsed at the International Validation Forum jointly organized by the Food and Agriculture Organization of the United Nations (FAO) and IFAD held in Rome, Italy in April 2000. It suggests that industry analysis in cassava producing countries should be undertaken to indicate current status, strengths, weaknesses and issues for attention and action needed to resolve pressing constraints and take advantage of markets and business opportunities as well as to encompass finding of committed national champions. The above background justifies the need for this study.

1.1 Objectives of the Study

The major objective of this study is to find out the level of commercialization of cassava farms and their major drivers in Rivers State, Nigeria. Specifically the study will determine the household commercialization status of cassava in the study area; ascertain the determinants of cassava commercialization in the area and find out whether differences exist across gender in the commercialization levels of cassava farmers in the area.

1.2 Conceptual and Theoretical Framework

Omeh [10] noted that commercialization theory implies market driven production, the major objective of which, in agriculture, includes generating more income, expanding food production to meet people's demand and those of local industries to be able to serve the needs of both domestic and foreign markets at the same time creating employment opportunities. Commercialization can be facilitated through research and extension services, liberalization, development of rural infrastructure and markets, access to scarce resources [10].

The concept of agricultural commercialization is related to the theory of the farm-firm growth, an area where, according to Olayide and Heady [11], production economics theory had done very little in presenting theoretical formulations for the parameters and variables involved in farm growth. Apart from the common perspective of seeing firm growth as an "increase in amount either of output, or size or of sale of any given business", Butcher and Whittlesey in Olayide and Heady [11] viewed growth of the farm-firm as a parametric measure of input-output relationship over time. Olayide and Heady [11] maintained that under growth and the ever increasing adjustment problems, farm production must make certain important contributions to economic growth if it is to evolve a virile agribusiness framework. Farm production, to contribute meaningfully to growth, should, inter alia produce high earnings from exports, ensure interregional optimization of supply and demand for farm products and adequately meet emergency demand for farm products. In their own words they stressed:

These contributions of the farm production component of agribusiness emphasize the fact that it should mean much more than supplying the subsistence needs of the farm families. It should progressively move into a commercialized and contract oriented business enterprise. It should approach the optimum efficiency plane of production asymptotically, if it is to fully and adequately provide the needs of the manufacturing component of agribusiness [11].

Commercially-driven farm production entails modernization of systems, which depends heavily on the intensification of production processes, adoption of new technology and farm mechanization. As the marketed share of agricultural output increases, input utilization decisions and output combinations are progressively guided by profit maximization objectives. This process leads to the systematic substitution of non-traded inputs with purchased inputs, the gradual decline of integrated farming systems, and the emergence of specialized high-value farm enterprises [1]. Commercial orientation of smallholder agriculture leads to a gradual decline in real food prices due to increased competition and lower costs in food marketing and processing (Jayne et al. in Ref. [1]). These changes improve the welfare of smallholder farmers in two ways: for consumers, low food prices increase the purchasing power for food, while for producers a decline in food prices enables the reallocation of limited household incomes to high-value non-food agribusiness sectors and more profitable non-farm enterprises. Promoting investments in agricultural commercialization could reduce poverty but requires great shifts in priority setting in the rural and peri-urban areas (Geda et al., in Ref. [1]). According to IFAD [8], the potential benefits of higher product prices and lower input prices due to commercialization are effectively transmitted to poor households when market access is guaranteed.

The main drivers of commercialization include an increased market demand for food arising largely from population growth and demographic change; urbanization; the development of infrastructure and market institutions; the development of the nonfarm sector and broader economy; rising labour opportunity costs; and macroeconomic, trade and sectoral policies affecting these forces [12]. At the farm level, commercialization is mainly affected by agro-climatic conditions and risks; access to markets and infrastructure; community and household resource and asset endowments; the development of local commodity, input, and factor markets; laws and institutions; and cultural and social factors affecting consumption preferences, production, and market opportunities and constraints [13]. In their research findings, Mejeha and Nnanna [14] indicated that farm size, annual farm income, level of education, farming experience and membership of cooperative society were the significant drivers of agricultural

commercialization among tuber crop farmers in Abia State, South East Nigeria.

2. Research Method

2.1 Study Area

The state lies between longitude 6°50′ E and latitude 4° 45′ N [15]. bounded on the South by the Atlantic Ocean, to the North by Imo and Abia States, to the East by Akwa Ibom State and to the West by Bayelsa and Delta states. The land surface or Rivers State can be grouped into three main divisions: the fresh water, the mangrove swamps; and the Coastal Sand ridges zone [15]. The state is made up of 23 Local Government Areas (LGAs). Total annual rainfall decreases from about 4,700 mm on the coast to about 1,700 mm in extreme north of the State. It is 4,698 mm at Bonny along the coast and 1,862 mm at Degema. Rainfall is adequate for all year round crop production in the State. The mean monthly temperature is in the range of 25 °C to 28 °C. The main root crops are yam, cassava and cocoyam; while the grains are maize, lowland rice and beans. Other crops grown for food include vegetables, melon, pineapples and plantain. The major cash crops are oil palm products, rubber, coconut, raffia palm and jute.

2.2 Data Collection and Sampling Technique

The major sources of data were primary and secondary sources. Primary data used were obtained through the use of a set of structured questionnaire administered on sampled cassava farmers in the study area. A list of cassava farmers in the state was obtained from Rivers State Agricultural Development Project. From this list, a stratified random sampling procedure was used to select a total of 120 cassava farmers from 2 Local Government areas (LGAs), Etche and Ekwerre LGAs, which represent rural and peri-urban areas of the state. The secondary data sources include articles in learned journals, institutional publications, online publications and text books.

2.3 Analytical Method

Household Commercialization Index (HCI): The first step in this study's analysis was to determine the Household Commercialization Index for all farm household sampled. Strasberg et al [16], Mejeha and Nnanna [14] are among some notable researchers who applied the HCI in evaluating the commercialization level of farmers in their studies. HCI is expressed as follows:

$$HCI = \sum Gross\ value\ of\ crops\ sold \Big/ \sum Gross\ value\ of\ crops\ produced \times 100\% \quad (1)$$

The index measures the extent to which household production is oriented towards the market. It ranges from zero to 100 percent. A value of zero is indication that the farmer is operating under subsistence agriculture; while the closer the index is to 100 the higher the degree of commercialization. Mejeha and Nnanna [14] recorded mean commercialization indices of 45.57 and 88.22 for two groups of cassava farmers; 32.54 and 61.89 for yam farmers; 30.22 and 49.73 for potato farmers and 28.19 and 47.04 for cocoyam farmers in Abia State, Nigeria. Omiti [1] found that farmers in peri-urban areas sold higher proportions of their output than those in rural areas. They equally noted that while distance from farm to point of sale was a major constraint to the intensity of market participation, better output price and market information were key incentives for increased commercialization.

Chow test for non-separability of data: Data used in this study were drawn from two LGAs that have different poverty levels, agricultural potential and other socioeconomic characteristics. However, a more robust test of predictive accuracy was necessary in order to determine whether it was more appropriate to estimate a pooled sample model or separate site-specific models following Johnston and DiNardo

[17] and Omiti et al [1]. This study used Chow's seminal test to establish whether data from both districts were significantly different [18]. With the null hypothesis that the coefficients are equal across the subsamples (Eq. 2):

$$H0: \beta L + \beta P = 0 \quad (2)$$

where β is the coefficient estimate, and L and P represent rural and peri-urban areas respectively. To constitute the Chow test, three separate linear regressions were estimated simultaneously by the: one model for the pooled data (whole sample from rural and peri-urban areas) and separate regressions for the rural and peri-urban data. Using the residual sum of squares (RSS) for the restricted (whole sample) and unrestricted (subsample) models, an F-test was formulated as follows (Eq. 3):

$$F^* = \frac{RSSW-(RSSL+RSSP)}{(RSSL+RSSP)} * \frac{(T-2K)}{K} \quad (3)$$

where F* is the test statistic RSSW = residual sum of squares for the whole sample RSSL = residual sum of squares for the rural sample RSSP = residual sum of squares for the peri-urban sample T = total number of observations in the whole sample K = number of regressors (including the intercept term) in each unrestricted subsample regression 2K = number of regressors in both unrestricted subsample regressions (whole sample).

The computed F* was then compared with the respective value of F (K, T-2K) at the 5% level of significance. Because the computed test statistic was greater than the respective F-statistic in all the cases examined for this study, the null hypothesis was rejected and it was concluded that the subsamples were significantly different (Table 1).

Therefore, separate models were estimated for the rural and peri-urban data and at the same time a whole sample regression was estimated to compare coefficients with those derived from the subsamples (See Table 3).

The HCI for all farm households were first computed and the index for the entire sample serves as the dependent variable that was used in the regression analysis that follows in the next step. A truncated regression model was then applied to analyze determinants of commercialization (HCI) of farm output sold. The truncated model applies to the non-limit observations of computed HCI and is given as

$$E[y_2 \, I \, y_2 > O, X,^k \; y_1] = \beta \, X^k + \alpha y_1 + \delta \frac{\theta(-\beta x^k + \alpha y_1)/\delta)}{1-\Phi \, (-\beta x^k + \alpha y_1)/\delta)} \quad (4)$$

In which y2 is the kilograms of crops sold and Φ is the probability density function. The last term on the right-hand-side of equation [4] is the inverse Mills ratio. The lower truncation of HCI is zero. To have the participation equation convincingly identified requires that at least one regressor not in the quantity equation appears in the participation equation. Deaton [19] held that this condition will rarely be met in practice. Although the explanatory variables in the truncated regressions are identical, nonlinearity of the inverse Mills ratio allows the identification condition to be met [20]. Observations on households who do not sell their produce are excluded, i.e. the lower bound of the truncation (which was set at 20% or 0.20 HCI value. Xk = vector of variables (k = price, distance, household size, price information service, farm size, family labour, hired labour, sex). Price = average

Table 1 Chow test results.

Chow Breakpoint Test: 50 . Null Hypothesis: No breaks at specified breakpoints. Equation sample: 1 100			
F-statistic	2.390***	Prob. F(11,78)	0.01
Log likelihood ratio	29.047***	Prob. Chi-Square(11)	0.00
Wald Statistic	26.291***	Prob. Chi-Square(11)	0.00

NB: "***"= figures significant at 1% statistical level.

Source: Output from Eviews package based on field data (2011) by the authors.

sub-county price Naira/kg; Distance = distance to crop selling market in km; farm size = farm size in hectares; household size = number of residents in the household; Price information service = a dummy variable for receiving price information (1/0); sex = dummy for gender (1 = female, 0 = male), family labour = mandays of family labour input used in the farm per year, hired labour = mandays of hired labour input used in the farm per year, Education = years spent on attaining education; Φ = the cumulative density function; β and α = the coefficients to be estimated; and μ_1 = an error term, symmetrically distributed around zero. The model assumes normal distribution with constant variance (Greene, 2005).

$$Y_i^* = \beta_i X_i + \mu_i \quad (5)$$

where Y_i^* is the percentage of output that is sold, is the vector of parameters to be estimated, X_i is the set of explanatory variables and i is the error term. A zero value of Y_i^* is observed when a household has no surplus to sell but has excess demand on the commodity. On the other hand Y_i^* = 100 if a household sells all output. The specific variables to be estimated in have already been specified.

Because of the predetermined selection of only market participants in this study, the data collected do not allow use of selectivity models such as those applied in similar studies by Goetz [21], Omamo [22] and Lapar, Holloway and Ehui [23]. Nevertheless this study builds on past works carried out separately in Kenya and Uganda by Omiti et al [1] and Komarek [24] respectively. They found that the most appropriate model to use in this type of analysis is the truncated regression model.

3. Results and Discussion

3.1 Level of Commercialization of Cassava Farms in the Study Area

Results of estimated HCI for the two categories of farmers surveyed are presented in Table 2. The mean level of HCI in the entire sample survey is 44 percent. This implies that only 44 percent of the cassava products harvested are sold for profit. This index is relatively low and worrisome. The result shows that rural farmers in the state appear to be more commercially driven in their own cassava production than the peri-urban producers. Their respective HCIs are 49 percent and 40 percent. This may not be surprising when one notes that in a big city such as Port Harcourt from whose suburb the peri-urban farmers were selected the possibility of farmers delving into other job opportunities that the city provide will be very high. Thus while many of the rural cassava producers may be focused on their survival by relying almost fully on their farms as a source of income to provide for the family needs and investments the peri-urban farmer may tend to see farming as a recreational activity (or home gardening to provide food) or extra source of income for the family. The standard deviations of the estimates are very low which is good. The findings did not deviate so much from that of Mejeha and Nnanna [14] who noticed a HCI in the range of 45.75 to 88.22 among cassava farmers in Abia State of Nigeria. A test of hypothesis about the difference in the mean estimates of the two areas (rural and peri-urban areas) had earlier confirmed that the difference is significant, thus

Table 2 Estimates of the commercialization indices in peri-urban and rural cassava farms in Rivers State, Nigeria.

	Peri-urban (N = 50)	Rural (N = 50)	Total sample (N = 100)
Parameter	Ekwere LGA	Etche LGA	Pooled (Rural and Peri-urban)
Cassava farms HCI mean	40%	49%	44%
Standard deviation	0.11	0.50	0.13

Source: Field Survey (2011).

enabling us to discuss further findings based on separate equations.

3.2 Determinants of Farm Commercialization on Cassava Farms in Rural and Peri-urban Areas of Rivers State

The results of the truncated regression analyses to estimate the factors influencing commercialization of cassava in the study area are presented in Table 3. The pooled model served as a guide in our validation procedure. For instance before running the Chow test, the pooled model was estimated with an OLS model which gave a very high adjusted R-square value of 78 percent (See Appendix 1) and also gave an F-ratio estimate of 36.87, a statistic found significant statistically at 1 percent. In terms of the model fitness test of the truncated regression model, all the sigma and the log likelihood statistics of the three categories of the model (peri-urban, rural and pooled) had p values of 0.00 indicating that they were statistically significant at 1 percent statistical level. This is a confirmation of the models' fitness. These along with the log likelihood estimates of the truncated model, 145 (See Table 3) which is relatively higher than the OLS estimate of 144 gave along with agreement of the estimates with theoretical expectations gave us the confidence to go on with application of the truncated regression model as our analytical model. Eight of the ten explanatory variables of the pooled result of the truncated regression model estimates showed a significant influence on the level of commercialization index (HCI) among the farms surveyed. These include distance to market, farming experience, farm size, family and hired labour, access to market information service and sex or gender. Apart from family labour and distance to the nearest sales market (both significant at 5% alpha) the other variables (out of the significant ones) were significant at 1 percent level of statistical significance. Most of the variables' slope coefficients estimated were properly signed too. Only

Table 3 Results of the truncated regression analyses to estimate the factors influencing commercialization.

	Peri-urban model N=50			Rural model N=50			Pooled model N=100		
VARIABLE	Coefficient	z-Statistic	Prob.	Coefficient	z-Statistic	Prob.	Coefficient	z-Statistic	Prob.
Intercept	0.05NS	1.26	0.21	0.25***	3.05	0.00	0.13**	2.75	0.01
HHSZ	0.00NS	1.17	0.24	0.00NS	-0.28	0.78	0.00NS	0.48	0.63
DISTOMKT	-0.01***	-6.61	0.00	0.00NS	-0.03	0.98	-0.01**	-2.29	0.02
EDUCYRS	0.00NS	0.70	0.49	-0.01*	-1.87	0.06	0.00NS	-1.14	0.25
FARMEXP	0.00NS	1.42	0.15	0.01**	2.43	0.02	0.00***	3.22	0.00
FAMILYLAB	-0.01***	-2.73	0.01	-0.01NS	-0.76	0.45	-0.01**	-1.99	0.05
FARMSZ	0.04***	2.76	0.01	0.09***	2.92	0.00	0.06***	3.18	0.00
HIRDLAB	0.00***	7.18	0.00	0.00NS	0.81	0.42	0.00***	3.69	0.00
MKTINFOSRVC	-0.02***	-4.83	0.00	-0.02**	-2.42	0.02	-0.01***	-2.72	0.01
PRICEPKG	0.01***	4.34	0.00	0.00NS	1.28	0.20	0.01***	3.07	0.00
SEX	0.07***	5.90	0.00	0.06**	1.66	0.10	0.06***	3.07	0.00
Mean dependent var	0.40			0.49			0.44		
S.E. of regression	0.03			0.07			0.06		
Log likelihood	109.24			66.36			145.58		
Avg. log likelihood	2.18			1.33			1.46		
Akaike info criterion	-3.89			-2.17			-2.67		
Schwarz criterion	-3.43			-1.72			-2.36		
/sigma	.027	9.78	0.000	.064	9.65	0.000	.05804	13.46	0.000
LR chi2(10)	133.24		0.000	72.04		0.000	157.41		0.000

Method: ML-Censored Normal (TOBIT) (Quadratic hill climbing Left censoring (value) series: 0.20 (20%). Source: Output from econometric packages based on field data analyzed by authors (2012).

years of formal education gave an unexpected sign (negative) though this was not so in the peri-urban equation. The fact that sex indicated a significant z-statistic affirms our earlier suspicion that there could be gender effects in the determination of commercialization of cassava farming in Rivers State. This finding agrees with Nkonya et al.'s [7] who noted gender differences in level of food crop production in some parts of Nigeria.

With particular reference to Rivers State it appears that as the gender tends towards females there is increased probability of commercialization in cassava farming in the area. This is more so as most of the farms in the area were owned or operated by women thus underlying the often reiteration on the significance of women in agricultural production and commercialization in Nigeria. The findings on distance to market's z-statistic also indicate that the shorter the farmers' proximity to the output market the higher the probability of the household increasing their index of commercialization. Price incentive has been found to be significant motivation source as increased unit price of cassava sends signals of likelihood of increased profitability in cassava to the farmers and they will then expand the volume of cassava sold relative to the one consumed in the house. The two foregoing findings are in tandem with Pingali & Rosegrant [12] and IFAD [8] who respectively noted that market access and price were major influences on level of agricultural commercialization. Access to market information was also found to be a significant determinant of commercialization as one who has information is more capable of taking informed decisions about where to source inputs and sell products at relatively more advantageous terms. Labour input quantity (both family and hired) and farm size which were significant implies that production resource inputs are very relevant to determination of cassava commercialization level. Those who use more inputs as increased land acreage and adequate quantity of labour are more likely to expand their commercial frontier in the business of cassava production. That experience proved to be one of the significant determinants is informative that learning takes place over the years through practice and with time the farmers can only get better in producing cassava commercially. The above findings agree with the findings of many other authors including Pender, Ehui and Place [13]; Omiti et al [1] and Omiti et al [14]. While the peri-urban households indicated that gender, family/hired labour, farm size, unit price of cassava in the supply market were the major determinants of probability of increasing household commercialization index of cassava in the study area, the rural area's equation shows that gender (sex), distance to market, farming experience, family labour, and access to market information increased or decreased the probability of commercializing cassava production in the areas respectively. A striking finding in this contrast is that while peri-urban farmers' commercialization level appeared to be influenced by price of cassava their counterparts in the rural areas appeared not to be really driven much by price, implying that those in the rural areas keep attempting to produce more for the market as that appears to be their sole means of livelihood, hence disregarding the price signals. Thus it could be implied that the rural farmers could be more vulnerable to fluctuations in prices of the commodity than their peri-urban counterparts. It was also noted that while hired labour played a more significant role in peri-urban farming family labour was more important for those in the rural areas. While education and distance to markets played significant roles in commercialization of cassava in the rural areas this was not so in the peri-urban areas of the state.

4. Conclusion

The study showed that commercialization of cassava in Rivers State was still low relatively (HCI = 44%) and differs across rural and peri-urban farms with rural farms leading in the drive for

commercialization of the enterprise. The influence of gender in this regard was very significant with bias for commercialization favouring women. Since the tendency of a farmer being a woman increased the probability of commercialization of cassava in the study it would be instructive to policy makers and government planners to give priority attention to women in designing programmes that will help boost investment and entrepreneurship in cassava farm business in the state. The significance of market information access, education and farming experience all point to the need for policy design that will build the capacities of the cassava farmers in the area so as to enable them get more successful in commercializing their farms. This will require the development of a market information service (MIS) and increased access to agricultural extension service by the farmers in the state. Capacity building programmes for the farmer will equally improve the contribution of input of labour to farm business in the area. It is also recommended that government and stakeholders should help develop the marketing and transport infrastructure in the state to help the farmers achieve higher level of commercialization thus alleviating poverty and hunger in the process. There is also need for policies that will improve access to more land by farmers for commercial agriculture.

References

[1] Omiti, J., Otieno, D., Nyanamba, T., and Mc Cullough, E. 2009. "Factors Influencing the Intensity of Market Participation by Smallholder Farmers: A Case Study of Rural and Peri-Urban Areas of Kenya." *Afjare* Vol. 3 No 1 March.

[2] Haddad, L. J., and Bouis, H. E. 1990. *Agricultural Commercialization, Nutrition and the Rural Poor: A Study of Philippine Farm Households.* International Food Policy Research Institute (IFPRI), Washington, DC.

[3] World Bank. 2007. World Development Report 2006. Agricultural Retrieved on 28th January, 2009. http://devdata.worldbank.org/wdi2006/contents/Table3_2 htm.

[4] World Bank. 2008. World Development Indicators Online (WDI) database. Accessed on 30th June, 2009. http://devdata.worldbank.org/dataonline.

[5] Liverpool, S. L. O., Ayoola, G. B., and Oyeleke, R. (n.d.). *Enhancing the Competitiveness of Agricultural Commodity Chains in Nigeria*. International Food Policy Research Institute (IFPRI) Brief No. 12.

[6] Walabai, E. 2005. *Gender Dimensions of Nigerian Agriculture*. Washington DC.: World Bank.

[7] Nkonya, E., Pender, J., Kato, E., Onobowale, O., Philips, D., and Ehul, S. (n.d.). *Enhancing agricultural productivity and profitability in Nigeria*. Internationa Food Policy Research Institute (IFPRI) Paper Brief No. 19.

[8] International Fund for Agricultural Development (IFAD), 2004. "The Global Cassava Development Strategy: A Cassava Industrial Revolution in Nigeria." In *The Potential for a New Industrial Crop,* edited by Philips, T. P., Taylor, D. S., Sani, L., and Akoroda M. O. International Fund for Agricultural Development Food and Agriculture Organization of the United Nations: Rome.

[9] Project Coordinating Unit (PCU). 2003. *Crop Area Yield Survey*. Abuja, Nigeria: Federal Ministry of Agriculture and Rural Development: Project Coordinating Unit.

[10] Omeh, N. G. 2006. *Determinants of Commercialization of Cassava Production in Abia State, Nigeria.* Unpublished undergraduate research project submitted to the Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike.

[11] Olayide, S. O., and Heady, E. O. 1982. *Introduction to Agricultural Production Economics.* Ibadan: Ibadan University Press.

[12] Pingali, P. L., and Rosegrant, M. W. 1995. "Agricultural Commercialization and Diversification: Processes and Policies." *Food Policy* 20 (3): 171-86.

[13] Pender, J., Ehui, S., and Place, F. 2006. "Conceptual Framework and Hypotheses." In *Strategies for Sustainable Land Management in the East African Highlands,* edited by Pender, J., Place, F., and Ehui, S. World Bank and International Food Policy Research Institute (IFPRI), Washington, DC.

[14] Mejaha, R. O., and Nnanna, I. N. 2010. "Effects of Root and Tuber Expansion Programme (RTEP) on Commercialization of State Food Crops in Abia State, Nigeria." In *Commercial Agriculture, Banking Reform and Economic Downturn: Setting a New Agenda for Agricultural Development in Nigeria,* edited by .Nmadu, J. N., Ojo, M. A., Mohammed, U. S., Baba, K. M., Ibrahim, F. D., and Yisa, E.S. *Proceedings of 11th Annual National Conference of National Association of Agricultural Economists (NAAE),* Federal University of Technology, Gidan Kwano, Minna, 30th November-3rd December, 66-71.

[15] Rivers State Government. 2007. People of Rivers State.

2007 Dairy of Rivers State, Government House, Port Harcourt.

[16] Strasberg, P. J., Jaynes, T. S., Yamamo, T., Nyoro, J., Karamja, D., and Strans, J. 1999. *Effect of Agricultural Commercialization on Food Crop Input Use and Productivity in Kenya*. Policy Synthesis. Michigan State University International Development Working Paper No. 71, 1-4.

[17] Johnston, J., and DiNardo, J. 1997. *Econometrics Methods.* New York: McGraw Hills. Available at https://www.scribd.com/doc/125990924/Jack-Johnston-and-John-Dinardo-1997-Econometric-Methods.

[18] Chow, Gregory C. 1960. "Tests of Equality between Sets of Coefficients in Two Linear Regressions." *Econometrica* 28 (3): 591-605.

[19] Deaton, A. 1997. *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy.* New York: Johns Hopkins University Press, Baltimore. Greene, WH, 2003. *Econometric Analysis*. Macmillan.

[20] Wooldridge, J. M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge: MIT Press.

[21] Goetz, S. 1992. "A Selectivity Model of Household Food Marketing Behavior in Sub-Saharan Africa." *American Journal of Agricultural Economics* 74: 444–52.

[22] Omamo, S. W. 1998. "Farm-to-market Transaction Costs and Smallholder Agriculture: Explorations with a Non-Separable Household Model." *Journal of Development Studies* 35: 152-63.

[23] Lapar, M. L., Holloway, G., and Ehui, S. 2003. "Policy Options Promoting Market Participation among Smallholder Livestock Producers: A Case Study from the Philippines." *Food Policy* 28: 187-211.

[24] Komarek, A. 2010. "The Determinants of Banana Market Commercialization in Western Uganda." *African Journal of Agricultural Research* 5 (9): 775-84.

Appendix 3

Ols Results for the Pooled Regression

Dependent Variable: HCIP11				
Method: Least Squares				
Date: 01/24/12 Time: 13:08				
Sample: 1 100				
Included observations: 100				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.141105	0.048796	2.891757	0.0048
HHSZ11	0.001531	0.003128	0.489352	0.6258
DISTOMKT11	0.006367	0.002980	2.136462	0.0354
EDUCYRS11	-0.002270	0.002010	-1.129389	0.2618
FAMEXP11	0.004398	0.001457	3.017604	0.0033
FAMLAB11	-0.010677	0.005541	-1.926936	0.0572
FARMSZ11	0.063948	0.020579	3.107456	0.0025
HIRDLAB11	0.001906	0.000533	3.578369	0.0006
MKTINFOSRC11	-0.013276	0.005281	-2.514070	0.0137
PRICEPERKG11	0.006984	0.002402	2.908018	0.0046
SEX11	0.055168	0.018695	2.950922	0.0040
R-squared	0.805554	Mean dependent var		0.443958
Adjusted R-squared	0.783706	S.D. dependent var		0.129871
S.E. of regression	0.060400	Akaike info criterion		-2.672200
Sum squared resid	0.324683	Schwarz criterion		-2.385631
Log likelihood	144.6100	Hannan-Quinn criter.		-2.556220
F-statistic	36.87096	Durbin-Watson stat		1.935025
Prob(F-statistic)	0.000000			