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Drivers of Farmers' Marketable Supply of Pineapple in South East Nigeria

*Patience Ifeyinwa Opata Chinweoke Uzoamaka Ike
Department of Agricultural Economics, University of Nigeria, Nsukka

Abstract
Market volume of pineapple has been studied from different angles in the developing countries. However, model identifying the relative significance of household socio-economic and institutional attributes influencing marketable supply of pineapple at household level in South East Nigeria have rarely been estimated. In this study, discrete choice of multinomial logit model was used to estimate the market channel choices. Multistage sampling technique was used and data was collected from 100 small holder pineapple farmers. Data for the study was collected from sampled market outlets in South east Nigeria between May, 2015 and April, 2016. Multiple regression model was used to analyze factors influencing the marketable supply of pineapple in South east Nigeria. The results of this study showed that age of household head, educational level, extension services, family size, marketing distance, access to information and communication technology and need for credit were found to significantly influence volume of pineapple marketed. Therefore the need for credit and rural infrastructure that will enable them add value to pineapple. Access to infrastructure and credit ensure more volume of pineapple marketed as well as higher margins and consequently will be the key in promoting agric business in the study area.

1. Introduction

Pineapple (*Ananas comosus*) is the third most important tropical fruit in the world after banana and Citrus (Esiobu, Onubuogu, & Okoli, 2014). According to (FAO, 2015) the total world production of pineapple in 2013 was 24.8 million metric tons. Costa Rica is the largest producer of pineapple, accounting for 10% of global output, followed by Brazil and Philippines. Nigeria is the seventh largest producer of pineapple accounting for 1.42 million metric tons or 5.8% of the world output. Hence Nigeria is after Costa Rica, Brazil, Philippines, Thailand, Indonesia and India in world production of pineapple (Baruwa, 2013; Kleemann & Effenberger, 2010; M, 2016; Omo, 2014) . These countries produce the fruit primarily for fresh fruit consumers and the processing industry. About 80% of pineapples produced in Nigeria came from small scale farms (Awoyinka & Babalola, 2009).

However, Nigerian with an estimated population of 173.6 million as at 2012 (The World Bank, 2013), its rural dwellers, that constitute a large proportion of its population and produce about 90% of its food supply, are poor and unable to meet their food requirement (Gani & Adeoti, 2011). There is also the problem of inadequate vitamins in the diet. Pineapple is a delicious tropical fruit with a fine flavor and high nutritive value. It is one of the most important commercial fruit crops in the world. Pineapple has been significantly singled out in human nutrition for the supply of minerals and vitamins, such as A, B, and C which are not much in the staple foods of many tropical areas (Ogunniyi, Oladejo & Olawuyi, 2012). Pineapple as an economic crop has potentials for foreign exchange earnings. It can increase national income through the expansion of local industries and higher incomes for farmers involved in its production (Fawole, 2008). The fruits are also used for fruit juice, while in some parts of the world the fermented juice is used to make vine-gar and alcoholic spirit. Pineapple leaves are used for making cloth and rope, while the whole plant is used as a source of cooking energy.

Considering the prominent role agriculture plays in the livelihood of rural people, strategies aimed at reducing poverty and hunger centered on rapid growth in this sector. To this end, the major challenges confronting development actors and governments agencies in recent decades have been about assisting smallholders to increase their market participation in order to take advantage of economic opportunities

(Dorward, Kydd, & C., 2008; Greig, 2009; Kostov & Davidova, 2013; Zanello, 2012). In Nigeria, National effort to enhance the ability of small holders to participate in the market such as Agricultural Transformation Agenda (ATA), National Food Security Program (NFSP), Commercial Agricultural Development Project (CADP) etc have been made. But unfortunately The World Bank, (2013) show that poverty in rural areas has increased in Nigeria from 47 million to 119 million between 1980 and 2012.

Although the performance of the Nigerian economy as documented by (NBS, 2010; SMEDAN & NBS, 2013) showed that national GDP growth rate rose from 2005 to 2010 by 6.68%, but unfortunately the country had Human Development Index position of 153 out of 187 and unemployment is also highest at 41.6% among the age 15 to 24 ((NBS, 2010) also the inequality rose to Gini Index[2] of 48.83 in 2010 (The World Bank, 2013). Thus growth achieved during the period might not have trickled down adequately and there are still areas of high poverty incidence.

The income and economic welfare of the farmers are determined by agricultural prices, which in turn

influences their farm investment and production decision (Gani & Adeoti, 2011). Different studies on agricultural product marketing had shown that transaction costs (such as information negotiation and monitoring costs) and households characteristics (like age, education, family size etc) influences competitiveness of market chain (Baltenweck & Stall, 2007; Barret, 2008; Dorward et al., 2008; Esiobu et al., 2014; Gabre-Madhin, 2006; Xaba & Masuku, 2012). These factors make food crop marketing system inefficient in most African countries. As a result, farmers find it difficult to dispose of their produce at attractive prices and places of their choice due to perceived weaknesses in food crop marketing system. This orientation suggests that critical intervention assistance aimed to ensure broad-based, low cost access to competitive, well functioning markets including getting prices right requires significant investment by public sector (Ajala & Obiechina, 1987; Barret, 2008; FAOSTAT, 2010; Tiffin, Trail, & Mortimer, 2006). Despite the growing interests along this line, much less attention has been paid to pineapple marketing. There is need to reduce transaction costs prevailing along the market chain by identifying drivers of marketed supply. This requires a proper understanding of how the market chain is organized and operates. The drivers of marketed supply of small holders' pineapple producers have not been well understood. Moreover, very limited empirical studies have documented on determinants of market supply of pineapple in south east Nigeria. Therefore the driving force for initiating this study is to contribute to the discussion on the need to enhance the income generating ability of pineapple farmers by identifying factors influencing marketable supply. The study is built on the assumption that market participation decisions and marketable supply are made in sequence where producers initially decide whether to sell or not, and the quantity to sale. Therefore, to enhance the income of households, it is essential to investigate the factors influencing marketable supply of pineapple.

Hence, this work drew insight from pineapple marketing and asks: what contextual factors (socio-economic and institutional conditions) describe the agents participating in pineapple marketing? What marketing problems are associated with pineapple? Which factors determine the marketed supply of pineapple? Thus the main objective of this study is to analyze the key factors influencing the volume of sales by pineapple marketers. Stakeholders to benefit from this study are rural producers and marketers, agricultural institutes, researchers and policy makers who will be furnished with information that could increase market access and reduce poverty.

This study represents a departure from the generally coarse and purely descriptive approach such as frequencies, cross tabulations, mean ratios adopted in several studies investigating the volume of sales in the face of growing constraint to scale up food value chains (Babatunde & Oyatoye, 2009; Hernandez, 2009; Emeka, Akogwu, Ugwu, & Chika-Emeka, 2014; Enete & Okon, 2012; Enwelu, Asogwa, Nwalieji, & Ezeano, 2014; Fadipe, Adenuga, & Raji, 2015). The approach identifies and integrates socio-economic and institutional conditions that could influence volume of sales in regression model framework. This regression model links volume of sales to a set of socio-economic, technological and institutional variables (Baltenweck & Stall, 2007; Barret, 2008; Greig, 2009; Jari, 2009; Kostov & Davidova, 2013; Mainville, 2004; Take, 2007; Takele, 2010; Zanello, 2012). The findings are wide-ranging, suggesting how socio-economic and institutional characteristics influence market participations, particularly in terms of shifting their volume of sales.

The remaining sections of the paper proceed as follows. Immediately below we present literature review. Next, we present analytical framework around the volume of sales. Next, we describe research design, study area and data. In the proceeding section, we present and discuss findings. The final section concludes with an overview of the overall implications of our findings in relation to the broader concerns about food commercialisation in West Africa.

1. Literature Review

A basic approach to establish any study on scientific foundation is to review the empirical findings of other studies related to the one at hand. As this study aims to identify the determinants of volume of sales of pineapple with various household and transaction costs variables, it is compelling to lay the ground for these by contemplating related researches on market participations. There have been surveys of the nature of the effect of socio-economic variables in the volume of sales by smallholders in developing countries (Baltenweck & Stall, 2007; Barret, 2008; Dorward et al., 2008; Esiobu et al., 2014; Gabre-Madhin, 2006; Xaba & Masuku, 2012). These review focus on studies addressing the determinants of market participation, such as transaction costs (distance to roads, market and towns, transport availability, labour and population density), human capital (age, education, gender, extension training), physical capital (farm land and production stock), and financial capital (crop income, non farm income and credit). The following researchers worked on agricultural market participation and thus factors that determine the integration of farmers into the input and output market (Emeka et al., 2014; Enete & Okon, 2012; Enwelu et al., 2014; Fadipe et al., 2015).

In a study conducted in Taraba state, Nigeria (Gani & Adeoti, 2011) on market participation and rural poverty among farmers, it was found that marketing by smallholders farmers was constrained by poor infrastructure, distance from the market, lack of assets, inadequate market information and access to credit. Other authors were of the view that there were lack of bargaining power along with various credit bound relationships

with the buyers which led to exploitation of farmers during transaction where most of the farmers become price takers (Xaba and Masuku, 2012). Thus majority of the smallholders are unable to obtain a fair price for their produce. This results to farmers not being able to sustain their livelihood. Further, other researchers reported on structure of pineapple supply chains and argued that 20 to 30 percent of the pineapple are wasted as post harvest losses resulting in producer receiving low price for their produce, while at the other end the consumers are compelled to pay a higher inflated price for their purchases (Baruwa, 2013; Kleemann & Effenberger, 2010; Omo, 2014)

Inadequate volume of sales and poor information regarding price were among the major factors affecting commercialization of agriculture (Baltenweck & Stall, 2007; Barret, 2008; Dorward et al., 2008; Esiobu et al., 2014; Gabre-Madhin, 2006; Xaba & Masuku, 2012). Furthermore, (Ponguru and Kanna, 2016) and (Xaba and Masuku, 2012), in their study on value chain and market analysis in Ethiopia and Swaziland argued that the marketing of horticulture crops is affected by inadequate local markets, poor pricing system, lack of local markets to absorb supply, low produce prices, excess of intermediaries and poor marketing institutions and coordination of farmers. Several researchers further argued that poor handling and packaging of products, poor pricing systems, and information asymmetry affect marketing of pineapple (Emeka et al., 2014; Enete & Okon, 2012; Enwelu et al., 2014; Fadipe et al., 2015).

Marketing of pineapple tend to be disorganized due to the perishable nature of the crop. Pineapple start to lose their quality right after harvest and continued throughout the process until it is consumed as there is lack of storage facilities and stable price. Others found that imperfect market information advice for buying and selling; lack of cash, and credit availability to finance short-run inventories; insufficient facilities for storage and transportation, no uniform system of grade and standard to facilitate trading at a distance as the factors influencing market access (Hernandez, 2009; Jari, 2009; Kostov & Davidova, 2013; Mainville, 2004; Take, 2007; Takele, 2010).

3.1: Study area and data

The study area is South-east geopolitical zone of Nigeria. Five states constitute this zone: Abia, Anambra, Ebonyi, Enugu, and Imo, covering latitude 4^0 50'N to 7^0 10' N and longitudes 6^0 40'E to 8^0 30'E. The zone spreads over a total area of 78,618 km^2, representing 8.5% of the nation's total land area. The area has a total population of 16,381,729 (National Population Commission, 2007).

Three-stage sampling technique was employed for the study. In stage one, the states in the zone were stratified based on whether it is within a pineapple supply/surplus or a demand/deficit zone. In this sense, stratum 1 (pineapple supply zone) includes Enugu, Ebonyi and Imo states, while stratum 2 (pineapple deficit region) include Abia and Anambra states. We select a state from each stratum using a simple random sampling approach. This gave a total of two states – Enugu and Anambra – from where pineapple markets and respondents were selected. To select markets (stage two), purposive sampling approach was used. Here, six markets (three urban and three rural cocoyam markets) were selected. The urban markets are Nsukka main market, Enugu main market and Onitsha main market while the rural markets are Nkwo Ibagwa market, Orie/Nkwo Opanda, and Nkwo Adazi Nnukwu. The third stage involved the sampling of the respondent (stratified into producers, wholesalers and retailers) using a predetermined sampling frame drawn from the selected markets. Applying a random sampling approach, 100 producers were selected from a frame of 5000 households; 60 wholesalers from 2600; and 100 retailers from 5300. In all, 260 respondents whose responses formed the data used in the study were sampled.

Data collection was undertaken during 2014 and 2015, and primarily involved administration of three sets of different structured questionnaires to each category of respondents, including using open ended questionnaires for focus group discussions (one per market location). Secondary data were collected from journals, periodicals from Food and Agricultural Organization, International Food Policy Research Institutes, United Nations, World Bank, National Root Crop Research Institute, Umudike, conference proceedings, books and other the opinions of experts in the field of produce marketing as a way to triangulate the findings. We combined descriptive statistics and perspective along the analytical framework presented in the next section to analyze data

4.3: Diagnostic test for Regression model

Before subjecting data for regression analysis several econometric issues needed to be addressed prior to estimation. The variance inflation factor (VIF) was employed to test the existence of multicollinearity problem among explanatory variables. VIF shows how the variance of an estimator is inflated by the presence of multi-collinearity(Gujeranti, 1995). The independent variables that can affect the model i.e. those that have VIF more than 10 were removed from the model. This eliminates potential multicollinearity among explanatory variables.

The empirical model

The independent variables are the following socio-economic factors that were hypothesized as possible

determinants volume of pineapple marketed. Multiple regression analysis is an econometric tool used to estimate variables (Koutsoyiannis, 1977). It is used to determine how changes in a given variable (Independent variable) affect other variables (dependent variables). Multiple regression analysis was used in estimating the determinants of volume of pineapple marketed. The multiple regression model for the study can be expressed implicitly or explicitly. Mathematically, the implicit form is expressed as:

$$Y = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}X_{11}X_{12}, X_{13,} X_{14}) + \mu$$

Where

Y = Dependent Variable (quantity of pineapple supplied to the market) in 100kg bags

X_1- X_n = independent variable

X_1 = Age of producer (in years)
X_2 = Gender of market participant (male= 0 or female = 1)
X_3 = Levels of education (in years);
X_4 = Access to extension agents (No = 0 or yes = 1)
X_5 = Need for credit (No = 0 or yes = 1)
X_6 = processing costs (in $)
X_7 = storage costs (in $)
X_8 = Purpose for farming (commercial = 1 or personal use = 0).
X_9 = Households' size (No. of members)
X_{10} = Distance to market (in km)
X_{11} = Access to market information on price (0 or 1)
X_{12} = Size of land holdings (ha)
X_{13} = Income from other sources (in $)
X_{14} = Sources of finance (Self, formal, friends and relatives, NGOs)
X_{15} = Access to information and communication technology (access=1 or no access = 0)
X_{15} =; μ = error term

Econometric model specification of supply function in matrix notation is the following $Y = \boldsymbol{\beta}X + \mu$

Where: Y = quantity of pineapple supplied to the market

X = a vector of explanatory variables

$\boldsymbol{\beta}$ = a vector of estimated coefficient of the explanatory variables

μ = error term

The justification for inclusion of these variables is as follows. Farmers' age is used to account for his/her experience and it consequent influence in market participation, where the results in the literature are mixed. Although (Zanello, 2012) conclude that older farmers tend to participate in the market due to their experience in farming compared with the younger peers in Ghana, but (Xaba & Masuku, 2012) reported the opposite for Swaziland.

The use of the education level of the farmer as a market participation shifter is common (Emeka et al., 2014; Enete & Okon, 2012; Enwelu et al., 2014; Zivenge & Karavina, 2012). The education variables is also used as a surrogate for a number of factors. At the marketing level, access to information as well as the capacity to understand marketing mix is expected to improve with education, thereby, influencing market participation. Surprisingly, there were mix results on the effect of education on market participation of farmers in Nigeria. For instance (Enete & Okon, 2012; Fadipe et al., 2015) did not find any significant effect of education on market participation while (Gani & Adeoti, 2011) concluded that education of the household matters in increasing market participation.

Another key question of interest is whether market participation are related to the transaction costs such as (distance to market, family labour, land allocation to pineapple, need for credit, storage costs, processing costs, access to market information), as literature on these issues are mixed (Baltenweck & Stall, 2007; Barret, 2008; Dorward et al., 2008; Gabre-Madhin, 2006). The expectation is that farmers with lower transport cost participate in market and supply more because they were likely to recover their production and marketing costs (Xaba & Masuku, 2012) and (Gani & Adeoti, 2011). Surprisingly (Lapar, 2003) reported that better access to roads, markets or towns might increase the opportunity cost of labour and capital in agricultural production and marketing (especially where alternative opportunities exist and the return to labour and capital are higher) and might in turn reduce participation and sales. Market access would be improved with an increase in the flow of market information to the farmer, to broaden the information base of the farmer and reduce dependent on social capital, that is neighbors' friend and relations (Gani & Adeoti, 2011).

Results and Discussions

Decision-making behaviours influencing market participation cut across location-specific and people-related variables. The result on socio-economical characteristics that shape market participation age, educational level, gender, household size and marital status are presented in Table 1

Table 1: Socio-economic characteristics of market participants that affect market systems

Characteristics	Producers (n = 100)	Wholesalers (n= 60)	Retailers (n = 100)	Total (n = 260)
Age of Players				
21- 30 years	7 (7)	0(0)	2(2)	9(3.46)
31- 40 years	4(4)	5(8.3)	22(22)	31(11.93)
41- 50 years	48(48)	47(78.4)	55(55)	150(57.69)
51- 60 years	36(36)	8(13.3)	19(19)	63(24.23)
>60 years	(5)	0(0)	2(2)	7(2.69)
Educational Level				
No formal Education	28(28)	10(16.7)	25(25)	63(24.23)
Primary education	24(24)	23(38.3)	46(46)	93(35.76)
Secondary Education	38(38)	24(40)	24(24)	86(33.07)
Tertiary Education	10(10)	3(5)	5(5)	18(6.92)
Gender				
Male	88(88)	5(8.3)	4(4)	97(37.3)
Female	12(12)	55(91.7)	96(96)	163(62.7)
Household size				
1-3	14(14)	2(3.3)	4(4)	20(7.69)
4-6	59(59)	18(30)	30(30)	107(41.16)
7-9	24(24)	37(61.7)	63(63)	124(47.69)
>9	3(3)	3(5)	3(3)	9(3.46)
Marital status				
Single	19(19)	3(5)	10(10)	32(12.31)
Married	81(81)	57(95)	90(90)	228(87.69)

Source: Field survey 2014/15

Age: The age distribution of the sample was skewed towards the upper age group of 40 and above indicating that there were relatively high proportions of middle age respondents participating in the pineapple markets. Less than 16% of respondents were below 40 years. The cultivator/producers below 40 years were 11%; that of wholesalers were 5% and retailers 24%.

Education: Levels of education affect the level of participation in pineapple markets. From Table 1, a total of 24.23% did not have formal education. About 34% of retailer respondents had no formal, 10% of wholesalers, and 28% of producers. On the other hand 33, 35 and 6 percent of the respondents attended primary, secondary and tertiary education, respectively. Greater proportion of producers 38% and wholesalers (40%) had secondary education, while greater proportion of the retailers (46%) had primary education.

Gender: With respect to gender, result presented in Table 1 shows that 37% of the interviewed participants were male while 63% were female. Female dominated the pineapple wholesale and retail section of the market, while male dominated the producers section.

Household size and marital status: Household sizes are generally larger among the retailers where 63% have between 7 and 9 people in their family. The percentage of wholesalers with household size of between 7 and 9 people were 37% while that of farmers were 24%. The majority of the marketers among the producers, wholesalers, retailers were married (87%) while 13% were single.

Institutional Conditions that influences marketing participation

Extension services: Only about 67% of farmers, 3.3% of wholesalers and 15% of retailers have access to extension agents (Table 2). This results shows that in south east Nigeria, the majority of wholesalers and retailers, have no proper linkages with the extension services. Lack of proper linkage with the extension agent may result in lack of market information on prices, credits and grades and standards. Credit access: Credit is one of the business support services, especially for participating in the sale of more volume of pineapple. Table 2 also shows the major players among formal and informal financial institutions in providing credit to marketers of pineapple.

Table 2: Institutional Conditions that influences marketing participation

Socio-economic variables	Producers (n=100)	Wholesalers (n=60)	Retailers (n=100)	Total (n=260)
Extension service				
Access to extension services	67(67)	2(3.3)	15(15)	84(32.3)
No access to extension services	33(33)	58(96.7)	85(85)	176(67.7)
Need for credit				
Need for credit	78(78)	49(81.7)	69(69)	
No need for credit	22(22)	11(18.3)	31(31)	196(75.38)
Sources of finance				64(24.62)
Personal savings	61(61)	17(28.3)	80(80)	
NGO	28(28)	33(55)	7(7)	158(60.77)
Friends and relatives	7(7)	4(6.7)	4(4)	68(26.16)
Microfinance institution	4(4)	6(10)	9(9)	15(5.77)
Membership of co-operatives				19(7.30)
Member	62(62)	56(93.3)	6(6)	124(47.70)
Not a member	38(38)	4(6.7)	94(94)	136(52.30)

Source: Field survey, 2014/2015. Figure in parentheses are percentages.

Governments' Microfinance institution is weak in south east Nigeria and that is why their role in lending to the respondents (7%) is smaller relative to Non Governmental Organization that lent to 26% of marketers, as shown in Table 2.

Marketing problems

Table 3 shows the challenges faced by pineapple market participants ranked in order of importance.

Imperfect pricing system- Frequent low price at peak supply periods that do not depend on the real supply and demand interaction but the information collusion and gang up between buying participants. The intermediaries used to decide on the price of pineapple products. Wholesalers were mostly the beneficiaries and they controlled and regulated the chain. This problem was scored as the greatest problem by 97% of farmers, 40% of wholesalers and 63%

Table 3: Ranking of Challenges in cocoyam marketing.

Marketing constraints	Problems	Ranking
Imperfect pricing system	1	1(200)
Absence of law enforcement on standards-	2	2(128)
Lack of strong cooperatives	3	3(113)
Market research & information	4	4(105)
Inadequate credit	5	5(102)
Poor transportation facilities	6	6(101)
Lack of improvement for other actors in the channel	7	7(101)

Ranks and scores in total percentages of respondents in parenthesis

Source: Field survey, 2014/2015

Absence of law enforcement on standards- The prevalence of strong and wide market cheating by wholesalers like mis-weighing, collusion (low price quotation, price information) was identified as an important constraint to pineapple marketing. There were no identified and applied quality standards that resulted in absence of discriminatory pricing accounting for quality and grades. This problem was identified by 95% of farmers, 8% of wholesalers and 25% of retailers.

Lack of strong cooperatives- Although there are many unions and cooperatives in the study area which were established to safeguard farmers' and rights over their marketable produces, farmers were exposed to baseless traders, ultimately selling their produce at low price. Farmers were not coordinated to increase their bargaining power. There was no any marketing institution to safeguard farmer's interest and rights over their marketable produces. Rather, competition among farmers was the usual phenomenon. Beside this, the existing cooperatives lacked skill and capacity on how to go about on horticultural marketing reported. Lack of strong cooperative was reported by 70% of farmers, 13% of wholesalers and 30% of retailers.

Market research and information- the results show that there was inadequate availability of market research and marketing information which resulted to uninformed planting and marketing decisions. Most farmers obtained information on the local market from their neighbors. Many decisions were made following the leading farmers. Leading farmers can speed up technology replication but could also result in planting duplication and ultimately lower prices for crops of very perishable type. Market research and information was

scored as a problem by 70% of farmers, 20% of wholesalers and 15% of retailers.

Inability to access credit: Then the inability of the respondents to access credit facilities for their pineapple business was identified as a problem by 25% of farmers, 67% of wholesalers and 10% of retailers thus 102 in all. However, the result show that Non-Governmental Organization lent to 26% of players at 40% interest rate.

Poor road network: Poor road network especially to farms scored 72% by farmers, 18% by wholesalers and 11% by retailers and a total of 101.

Lack of improvement for other actors in the channel- Limited attention was given to other parts of the channel, like lack of attention for retailers in improving the stalls to improve the shelf life of the products. This problem was scored by 35% of famers, 25% of wholesalers and 46% of retailers.

Variable definition

Table 4: Definition of the variables specified in the regression model of volume marketed.

Variables	Description	Types	Sign
AGE	Age of household's head	Continuous	+
FS	Family size	Continuous	-
EDU	Educational level	Continuous	+
EXS	Assess to extension service	Dummy	+
NFCR	Need for credit	Dummy	+
ICTA	Access to information and communication technology	Dummy	+
SC	Storage costs	Continuous	+
MRD	Marketing distance	Continuous	+

Source: Field survey 2014/2015.

Table 4 shows the final socio-economic variables that were used for the regression model. The test of variance inflation factor (VIF) resulted in dropping some variables that were hypothesized to influence the volume of pineapple supplied to the market. Therefore, eight variables that were used for the multiple regression model were shown in Table 4.

Explanatory model for volume of pineapple marketed

This section presents the results of the regression model and discuses results of significant variables that determine volume of pineapple marketed in South East Nigeria. The variables in Table 4 were considered and tested for their significance. Table 5 shows the estimated coefficients (β values), standard error, t-ratios and significant values (P) of independent variables in the model.

The estimated model result showed how sensitive the dependent variable (volume of pineapple marketed) was to different socio-economic and institutional variables (explanatory variables). Seemingly, eight variables were finally used as independent variables. Seven out of the eight proposed variables were found to be significantly influential on the volume of pineapple marketed. Age, family size and access to information and communication technology, need for credit and marketing distance were found to be significant at 1% while education and extension service were significant at 5%.

The model result in Table 5 was based on the linear functional form model, the R^2 value of the model was 0.67 implying that the independent variables in the model explained only about 67% of the variability in volume of pineapple marketed. Storage cost was found to be insignificant and negatively related to volume of pineapple marketed. The coefficient of age was found to be positive while the P value shows statistically significant at 1%. This means that as age of farmers increases the probability of supplying higher volume increases.

Table 5: OLS estimates of the market volume functions corrected to selectivity bias

Variables	Std coefficient	Std error	t-ratio	p-value
Constant (a)		590.130	-1.621	.184
AGE (X_1)	.315	10.046	3.722	.000***
EDU(X_2)	.241	17.526	2.585	.011**
EXS (X_3)	-.236	201.100	-2.57	.012**
FS (X_4)	.346	39.641	2.812	.006***
NFCR (X_5)	325	277.959	-.050	.001***
ICTA (X_6)	.323	195.582	3.505	.001***
SC (X_7)	-310	199.234	3.356	.960

F = 25.898* ***, **, * show level of significant difference at 1 and 5 percent confidence level.
Dependent variable: Volume marketed
Sources: Field survey, 2014/2015.

This is in line with the *aprior* expectation of the study. Increase in age means increase in experience and as the older participants were more likely to have family labour that could help in handling more volume of pineapple. The coefficient of family size was also positive implying that increase in the family size increases the volume of supply. This was unexpected since income from pineapple is needed to feed and train the members of

the household thus reducing the volume of pineapple marketed.

Access to information and communication technology has a positive coefficient and this means that information is very important in marketing. However, extension service was found to be negatively related to volume marketed. Thus when there is more access to extension agents by farmers the less the volume supplied. This contradicts the *a priori* expectation since it is expected that access to extension agent means access to information on financial institution, high quality of processing instrument and other inputs and increases in capacity building. However, there are no proper linkages between extension personnel and farmers. Education has a positive coefficient and as this variable increases more volume were marketed. Need for credit was significant but has a positive coefficient. This means that as credit from Non-Governmental Organization (NGO) increases in level, the quantity of pineapple marketed also increased. However, there was no proper linkage between the microfinance institution and the farmers. Hence most farmers that sold high volume sourced their finance from personal savings or Non Governmental Organizations.

The f-calculated of 25.898 confirmed that the overall regression model had a good fit.

Test of hypothesis

Analysis of Variance (ANOVA) results shows that F-calculated = 25.898 and theoretical value of f at 5% level of significant is 2.50. Therefore, F-calculated > F-tabulated at 0.05 level of significance. This implies that the independent variables have contributed to the volume of pineapple marketed by farmers. Hence, we reject the null hypothesis and accept the alternative that the explanatory variables included in the model have significantly increased the volume of pineapple supplied.

Conclusion

The study focuses on the effect of personal characteristics such as age, gender, and attitude such as purpose of marketing as well as other socio-economic and institutional factors such as household size, education, access to extension services, need for credit, and distance to the market of the smallholders in South east Nigeria on their marketed supply. Understanding the effect of their attitude and barriers to commercialization of pineapple is important to inform agricultural and rural policies. The conceptual framework is based on market behavior theories (Barret 2008; Greig 2009; Zanello 2012; Kostov & Davidova 2013), suggesting transaction costs, institutional factors and other personal characteristics that influenced market behaviour.

The descriptive results show that their access to various factors of production are clear indications of their poor resource situation which constrained their ability to market participation. The results highlight the heterogeneity of farm households and the effects of their personal, socio-economic and institutional characteristics on their marketing behaviour. Seven out of the eight variables retained by the model are statistically significant in determining volume of pineapple marketed by households. The R^2 value of the model is 0.67 which implies that the independent variables in the model explained only about 67% of the variability in the volume of pineapple marketed.

The results of this work are similar to past studies on marketing constraints (e.g. Gabre-Madhin 2006; Barret 2008; Dorward et al. 2008), particularly on the need to get institutional capacities right in order to enhance market participation. This study empirically shows the significance of certain contextual factors, e.g. rural-urban linkages, as well as extension services for scaling up food standard (such as quality and weights), in reducing transaction costs and marketing distances associated with marketing in West Africa. However, to clarify pin down the characteristics effects of the identified variables on the marketable supply of pineapple beyond our study location, particularly in terms of broader concerns for food commercialization in Africa, suggest an opportunity for further research. Similarly further research can investigate the implication of our explanatory variables to direct market orientation across the subsistence-to-commercial marketing spectrum in West Africa.

Overall, we recommend that consumers should be educated on the nutritional content of pineapple through seminars and engagement with extension agents to encourage greater efforts towards commercialization of pineapple. The spill-over effect from this can translate into improving the standard of living of smallholders. Research and investment in pineapple should be encouraged by government to reduce the incidence of post-harvest losses and diseases outbreaks in the field and to alleviate poverty.

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