

Does Access to Market Information Determine the Choice of Marketing Channel among Smallholder Yam Farmers in the Brong Ahafo Region of Ghana? A Multinomial Logit Regression Analysis

Edward Martey^{1*} Kwame Annin² Alexander Nimo Wiredu¹ Caleb Attoh³

1. CSIR-Savanna Agricultural Research Institute, Ghana P.O. Box TL 52, Tamale, Ghana
2. Math and Statistics Department, Kumasi Polytechnic, Ghana P. O. Box 854, Kumasi, Ghana
3. Audit Service, Cape-Coast, Ghana

*E-mail of the corresponding author: marteywayo@yahoo.com / eddiemartey@gmail.com

Abstract

Asymmetric or missing information is likely to cause market failure and greater access of farmers to knowledge about markets and prices, is a key element in the efforts of breaking the cycle of poverty. This study describes the yam marketing distribution channel in Brong-Ahafo region. It also quantifies the magnitude and direction of the effect of market information access on the choice of yam marketing channel using the Multinomial Logit regression analysis. The study is cross sectional in designs. A total of 250 smallholder yam farmers participated in the survey. Data collected was analyzed using StataSE 11. Results indicate that there are six main channels of yam distribution comprising of producers, assemblers, wholesalers and retailers. The study observes, inter alia, that age of household head, access to cell phone, farm size and output price determine the choice of rural market relative to urban market whilst gender of household head, number of years of formal education and distance to tarred road significantly influences the choice of cooperative market relative to urban market. Access to cell phone and the interactive term (cell phone access*location of household head) are the most influential determinants of rural market and market cooperative choice both statistically and numerically respectively. These results have implications for agricultural policy in Ghana.

Key words: Multinomial Logit, Brong-Ahafo, Market channel, Cell Phone, Market information

1.0 Introduction

1.1 Background and Problem Statement

Market information access plays a key role in market participation among most rural farmers. The choice of a marketing channel depends on the information of the channel available to the participants. Markets facilitate the exchange of commodities between producers and traders as well as create linkages between local, national and rural market. According to Pingali et al. (2007), smallholder farmers in most developing economies find it difficult to participate in markets because of numerous constraints and barriers. These are mostly reflected in the hidden costs that make it difficult to access input and output markets. Transaction costs are the embodiment of access barriers to market participation for most resource-poor smallholders (Delgado, 1999; Holloway et al., 2000). A fundamental transaction cost these farmers face is the cost of obtaining information (Shepherd, 1997). Though neoclassical economists essentially assume that information is costless, this assumption does not match reality, especially in developing countries (Stiglitz, 1988). The fact that information is not costless has important implications for contracts and transactions, as has been pointed out in work pioneered by Coase (1937) and later expanded in Coase (1960).

Market failure is more likely to be severe and distorting when there is asymmetric or missing information (Tracey-White, 2003). In rural areas of developing countries, markets may be too thin — leading to market power by agents — or the risks and costs of participating may be high (Hussain, 2003). Imperfections in information markets make costs of obtaining reliable information prohibitively high, creating welfare losses for participants and barriers to entry for others (DFID, 2005). Improved telecommunications can lower the cost of acquiring information, lower risks, and improve market efficiency. These services can offer previously unconnected farmers access to up-to-date price information and broaden market participation (Ferrand, Gibson, & Scott, 2004). Time and money can be saved by substituting travel to markets with telecommunications, and these savings can be especially important for small scale sellers. Information and communication technologies (ICT) allow potential participants to gather and communicate information through means such as radio, cell phones and computer networks. ICT reduce costs of connecting buyers and sellers. These cost savings, combined with quick access to information and instant communication with trade partners, open new market possibilities (Lyon, 2004). A key element in efforts to break the cycle of poverty has been to facilitate greater access of farmers to knowledge about markets and prices (Shepherd, 2000).

Nigeria is the leading producer of yam with 29 million tonnes, followed by Ghana with more than 5.7 million tonnes, and Cote d'Ivoire with 5.3 million tonnes (FAO Stats, 2012). According to the International Institute of Tropical Agriculture (IITA), (2007), average yam consumption per capita per day is highest in Benin (364 kcal), followed by Cote d'Ivoire (342 kcal), Ghana (296 kcal), and Nigeria (258 kcal). Yam occupies 11.2% of the total cropped area of Ghana (MoFA, 2010). It contributes about 16% of the value of agricultural GDP (AGDP) (NARSP, 1994) and an important staple food consumed largely in the semi-urban and urban centers in Ghana. Income from yam production and marketing activities constitutes about 45 percent of the total household income in the region (Ottoo et al., 2005). The study area ranks first as the most important yam producing region in terms of area under cultivation and volume of cultivation. Over 60 percent of households in the major yam producing districts in the region namely Techiman, Sunyani and Kintampo North and South are directly and indirectly involved in the activities of the yam industry (SRID, 2011). Generally, yam producers in the study area sell in the rural and urban markets as well as to market cooperatives. Yam marketing in the domestic market is primarily handled by producers, assemblers, wholesalers and retailers. These actors often perform more than one function. The channel of distribution is however not limited to the domestic market but with exporters playing an important role. Lack of adequate information on market dynamics normally lead to the yam glut situation during the peak season.

According to Dorward et al. (1998), Freeman and Silim (2001), IFAD (2003), Jayne et al. (2002), Kherallah and Kirsten (2002) and Killick et al. (2000), the problem of market access is linked to farmers' inability to meet market standards, low volumes of produce, wide dispersion of producers, presence of middlemen and perceived low prices in the formal market. Gender, educational levels, lack of information and ethnicity are also barriers to market access. The present study hypothesized access to market information as the major determinant of market channel choice. However, in order to empirically determine which factors influence market channel choice, a study of this nature becomes necessary. Following the discussions above, it becomes more imperative to quantify the effect of market information access on the choice of yam marketing channel by smallholder yam farmers in the study area. The specific objectives of the study are to describe the general distribution channel of the yam industry and secondly quantify the determinants and direction of the effect of market information access on the choice of yam marketing channel.

2.0 Materials and Methods

2.2 Study Area and Data Collection

Brong-Ahafo region covers an area of 39,557 square kilometres and shares boundaries with the Northern Region to the north, the Ashanti and Western Regions to the south, the Volta Region to the east, the Eastern Region to the southeast and La Cote d'Ivoire to the west. The northern part of the region lies in the savannah zone and is a major grain and tuber-producing region. The region has two main vegetation types, the moist semi-deciduous forest, mostly in the southern and southeastern parts, and the guinea savannah woodland, which is predominant in the northern and northeastern parts of the region. The study area has a tropical climate, with high temperatures and a double maxima rainfall pattern. Rainfall ranges, from an average of 1000mm in the northern parts to 1400mm in the southern parts. The total population of the region is 1,815,408 representing 9.6 per cent of the country's population. About 79.2 per cent of the population are economically active of which two-thirds (66.4%) are in agriculture/forestry/hunting. With the exception of the Sunyani district, agriculture is the major source of income for households in all the districts.

Primary data was collected through household survey. Structured household survey questionnaires were used to collect data on the demographic and socio-economic characteristics of yam producers and traders from a representative random sample of household heads in four purposively selected districts (Techiman, Kitampo North, Nkoranza and Wenchi) of Brong-Ahafo region. In addition, unstructured interviews were conducted with key informants at the community's level. A total of 250 households were enumerated for the study.

2.3 Method of Analysis

2.3.1 Multinomial Logit (MNL) Model

The MNL model is employed to quantify the determinants of the factors influencing marketing channel choice (rural market, urban market and market cooperative) by smallholder yam farmers in the study area. This model was used because it is the standard method for estimating unordered, multi category dependent variables. It also assumes independence across the choices, that is, it does not allow correlation or substitution between them (Wooldridge, 2008). The MNL is also chosen because it is widely used in studies involving multiple choices and easier to compute than its alternative, the Multinomial probit (Karki and Bauer, 2004; Hassan and Nhemachena, 2008). The probability of making a choice of a strategy from the alternatives is given as:

$$Prob(Y_j = i) = P_{ji} = \frac{\exp(X_j' \beta_i)}{\sum \exp(X_j' \beta_k)} \text{ where } 0 < P_{ji} < 1 \quad (1)$$

$$Prob(Y_j = i) = P_{ji} (\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k) = P_{ji} (\beta_0 + X\beta) \quad (2)$$

Where Y_j = probability with which a smallholder yam producer j chooses market i , $P_r(Y_j = i)$

Market i : 0 = urban market, 1 = rural market (base group) and 2 = market cooperatives

X_j is vector of household, production and marketing variables

β_i is the vector of coefficients associated with the i^{th} market choice

Appendix 1 shows the host of explanatory variables that are potentially expected to influence the choice of marketing channel by smallholder yam producers.

2.4 Description of Explanatory Variables

Age is used as a proxy measure of experience and availability of resources. It is possible that older and more experienced household heads are able to take better production decisions and have greater contacts, which allows trading opportunities to be discovered at lower cost than younger ones. Alternatively, it is possible that younger heads are more dynamic with regards to adoption of innovations both in terms of those that would enhance their productivity and enhance their marketing at a reduced cost (Sindi 2008; Enete and Igbokwe 2009). Gender influences access to resource. Females are more likely to participate in market than males. Education enables an individual to make independent choices and to act on the basis of the decision. Number of years of education is expected to positively influence choice of marketing channel. Farmers production capacity is determine by the number of members per family supply in the form of agricultural labor. A positive relationship is expected between household size and the quantity of yam supply to a particular market channel. Household membership of association/group increases access to information important to production and marketing decisions (Olwande, 2010). Number of extension contact is expected to influence marketing decision of households. According to Sindi (2008), the availability of credit is expected to lead to increased agricultural productivity and greater commercialization. According to Olwande (2010), farm size may have indirect positive impacts on market participation choice by enabling farmers to generate production surpluses, overcome credit constraints, where land can be used as collateral for credit, and allow them to adopt improved technologies that increase productivity. Cell phones are more likely to influence market decision since they are cost effective and accessible alternatives for farmers. The location of household head affects the signal coverage and thus the impact of this toll on decision making (Amaya and Alwayng, 2011). Means of transport determines the marketing choice of household heads either positively or negatively. Distance to the nearest tarred road will determine the type of market households will participate. Distance acts as a barrier to market entry by imposing transportation cost. The direction of the effect is either positively or negatively. Finally, output price serves as an incentive for producers in deciding the marketing channel to choose thus a positive effect on the choice of marketing channel.

3.0 Results

3.1 Yam Distribution Channel in Brong Ahafo Region

Yam marketing chain in Brong-Ahafo region consists of producers, assemblers, wholesalers and retailers. These actors often perform more than one function. The channel of distribution is however not limited to the domestic market but with exporters playing an important role. Six channels of yam distribution or marketing have been identified in the study area as shown in appendix 2. The geographical coverage and quantity of produce delivered by each channel is unique with the consumer being the end user in each case. The marketing and distribution channel is summarized as follows.

Channel One: It is the longest identified yam marketing channel. Aggregation of yam over a scattered geographical area is sold to wholesalers within the region. These wholesalers also sell to other wholesalers outside the region mostly in the Greater Accra Region. Finally, the yam is delivered to consumers through retailers. This channel was found to account for about 45% of total production in the region.

Channel two: Fifteen percent (15%) of production was found to be distributed by this channel. This channel does not involve wholesalers. The assemblers pass on the produce to retailers usually within the region for subsequent sales to consumers.

Channel Three: Yam producers in this channel transport their produce to retailers both within and outside the region (e.g. Kokomba Market in Greater Accra) thus incurring most of the marketing risk. Retailers in this channel are more organized thus making it virtually impossible for producers to sell directly to consumers

without passing through the retailers or wholesalers. This channel was found to distribute about 15% of total production in the region.

Channel Four: This channel is fairly simple. Retailers are not involved in this channel. Assemblers and wholesalers usually purchase yam from producers and sell to consumers within the district and region respectively. This channel was found to be the least channel through which yam is distributed within the region representing 3% of total production.

Channel Five: This channel transcends the domestic market. Exporters mainly from Mali and in some cases Burkina Faso purchase yam in bulk from either assemblers or wholesalers for export. This channel is identified to be the major channel through which yam from the region is exported representing 17% of total production.

Channel Six: Occasionally, some fairly organized farmer groups make contacts with exporters to directly take over their produce after harvest. This channel accounted for about 5% of total production in the region.

3.2 *Multinomial Logit Estimates of Market Channel Choice*

The multinomial logit model was used to estimate the parameters of the determinants of choice of market channel by farmers in Brong Ahafo region. The STATA software was used to estimate these parameters as well as the marginal effects. The urban market was chosen as base category and used as the comparison group since it is the mostly patronized market by most farmers. The chi-square value of 2652.60 is highly significant ($p > 0.0000$) at 1% significant level. This indicates that the explanatory variables included in the model jointly influence the farmers' choice of alternative market.

Results are presented in appendix 3. The marginal effects are estimated and presented in table 3.1 since the parameter estimates of the multinomial logit only provides direction and not probability or magnitude of change. From the result, the choice of rural market relative to urban market is significantly determined by age of household head, access to cell phone, farm size, interactive term (age*access to cell phone) and output price. The choice of market cooperative relative to urban market is significantly determined by gender of household head, number of years of formal education, distance to tarred road and the interactive term (cell phone access*location of household head). Access to cell phone and the interactive term (cell phone access*location of household head) are the most influential determinant of rural market and market cooperative choice both statistically and numerically respectively (Table 3.1).

Age of household head is significantly associated with a higher probability of choosing rural market. The probability of choosing rural market relative to urban market increases by 13% for every additional increase in the household head's age. It is believed that older households produce less and are not willing to sell their produce at a distant market due to the high transaction cost involved. Older households are less likely to take risk and adopt innovations unlike young household heads (Sindi 2008; Enete and Igbokwe 2009). However, older household heads with access to mobile phone are less likely to choose rural market relative to the urban market. The probability of older household heads with access to mobile phones choosing a rural market decreases by 13% for every additional year added to household head. The result is consistent with Amaya and Alwayng (2011) who established a positive relationship between age and market channel choice and a negative relationship between household head with access to cell phone and rural market choice. According to their conclusion, older farmers are more likely to participate in closer market. The age of household head do not have significant influence on the choice of market cooperative relative to urban market.

Gender of the household head is significantly associated with a lower probability of farmers' choice for market cooperative relative to the urban market. For female headed households, the probability of choosing market cooperative relative to urban market is 151% higher than male headed households. Females tend to be more aware of marketing channels because they are more networked socially and undertake most agricultural activities.

The probability of a household head to choose market cooperative relative to urban market increases by 10% for every additional year of education of the household head. However, number of years of formal education is insignificantly associated with a lower probability of choice of rural market. The result suggests that educated households will prefer urban market to rural market. Education is posited to influence a household's understanding of market dynamics and therefore improve decisions about the amount of output sold, inter alia (Makhura et al., 2001). The dynamics of the market cooperative systems requires some level of education to effectively engage in it. It is therefore concluded that educated households are better informed in terms of participating in market that guarantees a higher price quotation.

Distance to tarred road is significantly associated with a higher probability of participating in a market cooperative. The probability of choosing a market cooperative, increases by 3% for an additional increase in distance to the nearest tarred road. Though the effect of distance to tarred road on the probability of choice of the rural market was not significant, the negative sign means that distance to the nearest tarred road will lead to a

decrease in the probability of choice of this market channel. This means that producers will rather choose urban market probably due to market price being offered. Distance acts as a barrier to market entry by imposing transportation cost. According to Stifel et al., (2008) pp.1-15, “transport costs per unit of distance increases with the potential marketable load size. Farm households in very remote rural areas or geographic isolation through distance create a wedge between farm gate and market prices. This leads to a shift from production of profitable but highly perishable commodities such as fruits and vegetables to relatively storable low-value cereals”. Amaya and Alwayng (2011) also hold a similar view.

Cell phone is used as a proxy for access to market information. Farmers with access to cell phones are more likely to choose rural market relative to those without access. Farmers with cell phones have better access to market information, affecting decisions about where to sell. Cell phones expand opportunities, reduce search costs, strengthen farmer bargaining power, improve market efficiency, and lower risks. The probability of a farmer with access to cell phone choosing a market cooperative relative to urban market is higher than those without access to cell phone though not significant. The result is however startling since it expected that farmers with access to cell phone will choose urban market relative to rural and market cooperative. The finding is probably due to farmers established linkages with traders (bulklers) who come to buy directly from them both at the farm gate or village/community market. However, household heads in rural areas with access to cell phones are less likely to choose rural and market cooperative relative to rural market. The use of the cell phone enhances transaction with trading partners by reducing the search cost. Zivenge and Karavina (2012) found a significant positive relationship between mobile phone ownership and market choice. According to them, “farmers with mobile phones were likely to participate in the informal markets and most likely to get real time market prices, given that informal markets have flexible prices compared to formal markets”. Amaya and Alwayng (2011) also established a significant positive relationship between access to cell phone and market channel choice. Based on the result, it can be concluded that access to cell phone plays an important role in the choice of market channel.

Farm size plays a crucial role in the production process. It is also used as a proxy for wealth. Farm size is significantly associated with a higher probability of choosing a rural market relative to urban market. The probability of a household head to choose rural market relative to urban market increases by 20% for every additional acre of land under yam cultivation. This finding is consistent with Zivenge and Karavina (2012) who established a positive relationship between farm size and market choice. According to them, “farmers with more land were more likely to participate in their current marketing channel”. Farmers with more land have the ability to produce more *ceteris paribus* thus selling at their immediate market (rural market) to avoid post-harvest loss which is a critical issue in the yam industry. A high transportation cost is associated with selling in the urban market which most farmers would like to avoid especially where there is no incentive for selling in such market.

Finally, output price is significantly associated with a higher probability of choosing urban market relative to the alternative market channels. The probability of choosing an urban market increases by 49% for every additional increase in the output price of yam. Farmers are more responsive to market price relative to the transaction cost. Output price of yam serves as an incentive for farmers to produce as well as determines the marketing channel choice. Results from the survey indicate that the urban market commands higher price relative to rural market and market cooperative. It can therefore be concluded that, farmers are more likely to sell in the urban market in response to market price irrespective of the distance. As part of the Millennium Challenge Account (MCA), farmers are being trained to produce according to what the market requires rather than the anticipated market price. Zivenge and Karavina (2012) also found a positive relationship between producer price and the marketing channel. They concluded that farmers received higher prices from the informal market than from the formal market especially for farmers who are good negotiators.

Table 1: Marginal Effects of the Multinomial Logit Model on Market Channel Choice

Variable	Rural Market	Market Cooperative
Age of household head	0.1311***	0.0248
Gender of household head	-0.5762	-1.5142*
No. of years of education	-0.0249	0.1012**
Membership of farmer association	-0.2509	0.3670
Household size	0.0389	0.0977
Distance to tarred road	-0.0039	0.0316*
Existence of telephone in community	0.0980	-0.9850
Access to credit	-0.1481	-0.1789
Access to cell phone	9.3223***	0.8210
No. of extension contact	0.0042	-0.1915
Means of transport	0.2273	-0.7536
Farm size	0.2004***	-0.1508
Experience	0.0119	0.0045
Location of household	2.7272	0.8754
Output price	-0.4932*	-0.3207
Age*Access to cell phone	-0.1316***	-0.0334
Cell phone access*Location of household head	-2.6506**	-13.1852***

Source: Regression Estimation from Author's Household Survey Data (2011) ***p < 0.01, **p < 0.05 and *p < 0.10

4.0 Conclusion

The study identifies six major yam distribution channels in the Brong-Ahafo region of Ghana. The multinomial logit regression analysis showed that access to cell phone was the major determinant of market channel choice among yam producers. Other factors such as age, gender, education, farm size and output price significantly influences market channel choice. Better information access is fundamental in reducing transaction costs and price dispersion as well as increase incomes and welfare of producers. Investment in communication infrastructure in rural areas will increase the marketing channel choice of farmers irrespective of the age. It is also recommended that agricultural developmental organizations educate farmers on benefits of cell phone usage coupled with technical support in accessing of timely information on market. There is therefore the need to strengthen farmers' social networks. The Youth in Agriculture Programme (YIAP) must target young and dynamic graduates and the formalization of the land tenure systems by the Millennium Development Authority (MiDA) must be strengthened and sustained. Farmers must be supported with technology and credit by research and financial institution respectively to enable them expand their farm size. Finally, policy must aim at supporting women with credit and access to land.

Acknowledgement

The authors greatly acknowledged financial support by Kwame Annin, a departmental lecturer at the Department of Statistics and Mathematics in the Kumasi Polytechnic and the smallholder yam farmers that participated in the survey.

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Edward Martey was born in Mamprobi on the 22nd of June, 1982. He holds a Master of Philosophy and a Bachelor of Science in Agricultural Economics from the University of Ghana, Legon, Ghana in 2011 and 2007 respectively. He is currently an agricultural economist at CSIR-Savanna Agricultural Research Institute, Tamale, Ghana and a member of the Research Scientist Association in Ghana. Smallholder commercialization studies, econometric modeling, impact studies, establishment & management of innovative platforms and agrobiodiversity are his key area of research interest.

Kwame Annin was born in Cape Coast on 16th March, 1974. He holds a Master of Science in Statistics from University of Cape Coast, Cape Coast, Ghana in 2007 and Bachelor of Education in Mathematics from University of Cape Coast, Cape Coast, Ghana in 2004. He is a departmental lecturer at the Department of Statistics and Mathematics in the Kumasi Polytechnic, Ghana. Economic modeling and commercialization studies are his key area of research interest.

Alexander N. Wiredu was born in Accra on the 19th of February, 1981. He holds a Master of Philosophy and a Bachelor of Science in Agricultural Economics from the University of Ghana, Legon, Ghana in 2007 and 2004 respectively. He is the secretary of the Research Scientist Association in Ghana and the head of the economics section of the CSIR-Savanna Agricultural Research Institute, Tamale, Ghana. Impact evaluation studies, agricultural development policy analysis, agribusiness cluster development, value chain analysis & management of innovative platform are his key area of research interest.

Caleb Attoh was born in Korle-Gonno on the 27th of October, 1983. He holds a Master of Philosophy in Agricultural Economics from the University of Ghana, Legon, Ghana in 2011 and a Bachelor of Science in Agricultural Economics from the University of Ghana, Legon, Ghana in 2006. He is a member of the Association of Certified Chartered Economist (ACCE) and an auditor at the audit service, Cape Coast, Ghana. Economic modeling, industrial economics and commercialization studies are his key area of research interest.

Appendices

Appendix 1: Dependent and Explanatory Variables for the Multinomial Logit Model

Dependent variable			
Marketing Channel Choice (Dependent variable)		0 = Urban market 1 = Rural market and 2 = Market cooperative	
Explanatory Variables			
No	Variable	Specification	Expected Sign
1	Gender	1 if male and 0 if female	+/-
2	Age	Age of household head in years	-
3	Education level	Number of years of formal education	+
4	Household size	Number of members of household	+
5	Total land size	Total land size available to household head	+
6	Access to financial capital	1 if household received loan and 0 otherwise	+
7	Access to information through use of cell phones	1 if household owns a cell phone and 0 otherwise	+/-
8	Farmer Association	1 if household belongs to a farmer association and 0 otherwise	+/-
9	Existence of cell phone operators in the village	1 if there is existence of cell phone operators and 0 otherwise	+/-
10	Means of transport	1 if household owns a motor and 0 otherwise	+/-
11	Number of contacts with extension agents	Number of times in a year	+
12	Location of household	1 if household is located in rural area and 0 otherwise	+/-
13	Experience	Years	+
14	Output price	Ghana cedi	-
15	Distance from farm to nearest tarred road	Distance in km from farm to nearest tarred road	-
Interactive terms			
16	Age of household head and access to cell phone	Age of household head*Access to mobile phone	+
17	Access to cell phone and location of household head	Access to cell phone * Location of household head	+/-

Appendix 2: Yam Marketing Channel in Brong-Ahafo Region

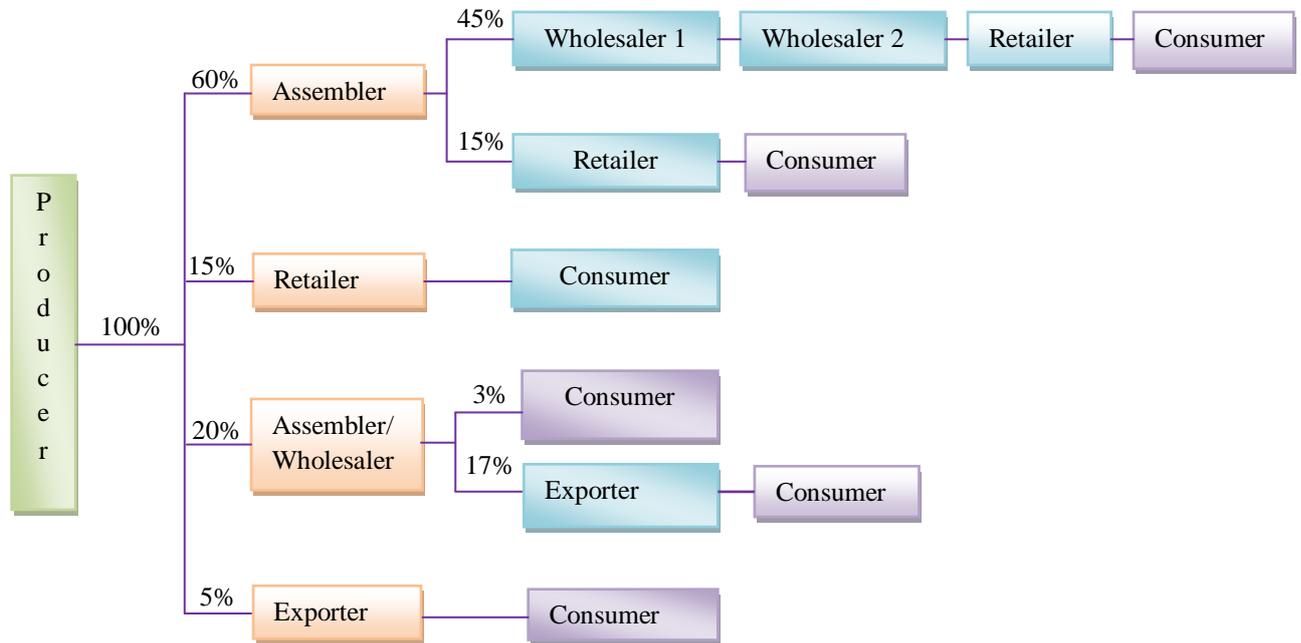


Figure 1: Yam Marketing Channel in Brong-Ahafo Region

Appendix 3: Multinomial Logit Estimates of Market choice

Dependent Variable: 0 = Urban market 1= Rural market and 2 = Market cooperative

Table 1: Multinomial Model Results for farmers' choice of market access

Variable	Rural		Market Cooperative	
	Coefficient	Std. Errors	Coefficient	Std. Errors
Constant	-12.1072	2.5638	-1.9174	2.8329
Age of household head	0.1612	0.0511***	0.0305	0.0520
Gender of household head	-0.7085	0.6701	-1.8620	1.0523*
No. of years of education	-0.0306	0.0324	0.1245	0.0536**
Membership of farmer association	-0.3085	0.4413	0.4513	0.6691
Household size	0.0478	0.0657	0.1201	0.1011
Distance to tarred road	-0.0048	0.0188	0.0388	0.0229*
Existence of telephone in community	0.1205	0.4298	-1.2112	1.2063
Access to credit	-0.1821	0.4718	-0.2200	0.7039
Access to cell phone	11.4633	2.5655***	1.0095	3.0492
No. of extension contact	0.0052	0.0400	-0.2355	0.1223
Means of transport	0.2795	0.3374	-0.9267	0.5975
Farm size	0.2464	0.0632***	-0.1854	0.1774
Experience	0.0146	0.0137	0.0055	0.0226
Location of household	3.3536	1.3125	1.0765	1.3613
Age*Access to cell phone	-0.1618	0.0524***	-0.0411	0.0648
Cell phone access*Location of household head	-3.2593	1.4014**	-16.2134	1.4139***
Output Price	-0.6065	0.3171*	-0.3944	0.5202
Number of Observation	250			
Base category	Urban market			
Wald Chi squared	2652.60			
Prob > chi2	0.0000			
Pseudo R-squared	0.1723			
Log pseudolikelihood	-160.3373			

Source: Regression Estimation from Author's Household Survey Data (2011) ***p < 0.01, **p < 0.05 and *p < 0.10