An analysis of factors influencing farmers' choice of green gram marketing channels in Mbeere south sub-county, Kenya

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ABSTRACT

This study sought to contribute to a better understanding of market dynamics of green grams as a traditional crop within a resource poor producer community in Mbeere South sub-County, Kenya. The study aimed to characterize the green gram marketing channels and to evaluate the factors that influence the choice of green gram marketing channel by the producers. A multinomial logit model was estimated through data from households growing green grams. Results show that 70 percent of farmers in the study site grew green grams. On average, each household has 1 to 2 acres of land under green grams production each year. Farmers used three marketing channels, rural retailers (58 percent), wholesalers (14 percent) and assemblers (26 percent). The multinomial results showed that Age of the farmer (P=0.06), access to credit (p=0.065), price of green grams (p=0.079), and selling as individuals (p=0.000) positively influenced the choice of rural assembler marketing channel. Gender of the household head (p=0.001), production cost (p=0.000) and use of mobile phone to access marketing information (p=0.019) positively influenced the probability of choosing rural retailer over wholesaler marketing channel. In conclusion, farmers prefer marketing channels where they incur low production and transport cost and that offer higher prices to maximize profits. The study recommended first, identification and prioritization of unique farmer-trader relations that enhance adaptive resilience and increase farmers marketing options. Secondly, interventions to enhance market-based signals e.g. price should be reinforced.

Keywords*: marketing channels, green grams, ASALs, market signals*

1 INTRODUCTION

Agricultural commercialization is an important pathway towards economic growth and development in most developing countries that rely on agriculture (Timmer, 1997). There is a consensus from research and policy makers that the future of food security and poverty eradication in developing countries is hinged on the commercialization of smallholder agricultural production (Jaleta *et al.*, 2009). An estimated 2.5 billion households are involved in agriculture, of which 1.5 billion households are in smallholder farming (World Bank, 2008). In Kenya, food production in the country is dominated by smallholders who account for 75 percent of the total agricultural output and 70 percent of marketed agricultural produce (GoK, 2010). Of the 75 percent of agricultural output produced by smallholder farmers, 25 percent comes from the arid and semi-arid lands (ASALs) (GoK, 2010). This represents 3.3 percent of total GDP, and one-quarter of national agricultural production (USAID, 2013).

Initiatives by the GoK to promote integrated approaches to sustainable development and food security have given rise to various programmes such as "Promotion of High-Value Traditional Crops". The project was implemented by the then Kenya Agricultural Research Institute (KARI) now renamed to Kenya Agricultural and Livestock Research Organization (KALRO). The project was implemented in Mbeere South for three years between 2010 and 2012. The aim of the project was to increase green gram production in the project areas through improved seed, better farm management and utilisation of water harvesting techniques. Since the inception of the project in 2010, farmers in Mbeere South have increased green grams production (Tegemeo, 2012). For example, before the inception of the project, the average green gram production was 1-2bag per acre (ibid). This production increased to 4bags per acre. Available evidence indicates that sustaining success in productivity-based agricultural growth critically depends on the expansion of market opportunities (Jaleta *et al.*, 2009). Although several studies have been undertaken on green gram productivity and value chain in Mbeere South (Tegemeo, 2012) there are no studies on characterizing green gram marketing channels and farmers' preference for marketing channels in Mbeere South sub-County. Also, it is not known which marketing channels that green-gram farmers prefer and the factors driving that preference. Lack of this knowledge hinders informed choice of marketing channels by farmers'. To increase farmers' access to markets, researchers and development practitioners need to understand how the green gram market channels are characterized, the bottlenecks to them operating more efficiently, effectively and equitably, and the factors influencing farmers' choice of these markets. This study addressed this knowledge gap by providing empirical evidence on farmers' preference for green gram marketing channels as well as the drivers of that preference in Mbeere South sub-County.

2 METHODOLOGY

2.1 Study area and sampling

This study was conducted in Mbeere South sub-County in Kenya. Mbeere South sub-County is located in a low-potential dry Semi-Arid Zone (GoK, 2009). It was selected because of its high potential in green gram production and presence of government intervention in promoting green gram production to help improve the small holders livelihoods. The main crops grown in the area are green grams, cowpeas, bananas and sorghum. This study used both primary and secondary data. First a focus group discussion (FGD) was conducted involving six women and seven men to understand the green gram marketing channels in Kiambere Location and was attended by representative farmers from all the sampled sub-locations. A schematic drawing of the marketing channel was done on flip charts with the help of farmers indicating the various options that they had in marketing their produce. On each node of the channel, the average price that they got for their produce was recorded. Quantitative data were collected by administering a structured household questionnaire to 266 randomly selected households in Kiritiri, Gachoka, Mwea, Makim, Siakago and Muringari locations. From a population of 800 households, a sample size of 266 respondents was obtained using the sample size formula below.

$$n=\frac{N}{1+N(e^2)}$$

where n= sample size, N= population size and e = confidence level. A 95 percent confidence level and a value of 0.05 were assumed based on (Mugenda and Mugenda, 2003

2.2 Theoretical framework

This study is anchored on the random utility model (RUM). RUM assumes that the decision maker has full discrimination capability to choose an alternative with the highest utility (Greene, 2003). It postulates that a consumer will make a rational choice to maximize utility subject to a set of constraints (ibid.). Therefore, if the costs that associated with using a particular alternative are greater than the benefits, households will be discouraged from using it and shift to another option that maximizes their utility. In real life, however, the decision maker seldom has perfect information implying that uncertainty has to be taken into account. The utility is therefore modeled as a random variable to account for this uncertainty. Let (U_{ij}) denote utility of individual i for alternative, j. According to Gujarati (2007), U_{ij} is composed of a deterministic component (V_{ij}) and a random part (ε_{ij}) such that:

$$U_{ij=V_{ij}} + \varepsilon_{ij} \qquad (3.1)$$

Following Greene (2003), suppose Y represents a choice set of marketing channels (Y ranges from 1 to c) available to farmer i (ranging from 1 to n). Let X_k represent a vector of attributes (ranging from attribute 1 to m) which influence choice of marketing channel, and U_i represent the utility derived from channel(y) chosen by the i^{th} farmer. Then, farmer i's choice of a marketing channel (i.e., y_i) is a function of channel attributes, farmer's attributes and institutional factors (Greene, 2003). That is:

$$y_i = y_i\,(x_k) + \varepsilon_{ij} \qquad (2.2)$$

Where $x_k$is the deterministic part and ε_{ij} the stochastic part to represent uncertainty. Following Greene (2003), the probability that a farmer chooses marketing channel *z* instead of another channel *j* in the choice set *Y* is given by:

$P(y_i=) = P(E(U_{iz}) - P(E(U_{ij})$ for all $z \neq j$. (3.3)

To operationalize equation (3.3),y_i can take multiple choices such that the dependent variable becomes a qualitative multiple choice response (Gujarati, 2009). Estimating the probability of channel choice using Ordinary Least Squares (OLS) yields inconsistent parameter estimates because the OLS technique does not limit the choice probability to the 0-1 bound (Gujarati and Sangeetha, 2007; Wooldridge, 2000). On the other hand, although both binary choice models such as logit and probit restrict the choice probability within the 0-1 bound, they are only appropriate for only two rather than multiple responses (Greene, 2003). The multinomial logit (MNL) is the model of choice for multiple discrete choice responses (ibid.).

According to Greene (2003), the MNL models the probability of choosing from a multiple choice set. It assumes that the error term is extreme-value distributed. Based on this assumption, the probability of farmer *i* choosing a particular marketing channel, *z*, is given as a logistic function:

$$P(y_i = Y|X_{i1},\ X_{i2} \ldots . X_{im}) = \frac{e^{\beta X_{ik}}}{\sum_{c=1}^{m} e^{\beta X_{ik}}} \text{for } z=1, 2, \ldots, C \qquad (2.4)$$

where β is a vector of parameters to be estimated; X_{ik} denotes the vector of explanatory variables that influence the choice of a marketing channel by farmer *i*. Taking logs in equation 3.4 and given that farmer *i*'s choice set of marketing channels is denoted by Y = 1, 2..., c, then log likelihood function of the MNL is given by (Greene, 2003):

The following MNL was fitted to the data:

Channel choice = B_0+ β_1HHsize+β_2EDUC + β_3AGE + $\beta 4$FARM_LAND + β_5COST_PRDN_ACTIVITY + β_6UNIT_TRANSCOST + β_7FREQ_TO_MKT + β_8GENDER + β_9CREDIT_ACCESS + β_{10}INDIV_SELLING+ β_{11}COOP_SELLING + β_{12}MIDDLECLASS+ β_{13}RICH + β_{14}PRICE + β_{15}GGVARIETY +B_{16}MOBILE_MKT_INFO+ β_{17}OFFINCOME +ε (3.6)

Table 1: Definition of variables included in the empirical model and their hypothesized signs

Variables	Variable description	Measurement	Expected Sign
CHOICE	Dependent variable indicating the various marketing channels 1= Rural assemblers, 2 =Wholesalers and 3= Rural retailers	Discrete multiple choice dependent variable	None
EDUC	Education of the household head in years	Number of years spent in formal education (years)	+
AGE	Age of the household head in years	Continuous variable capturing age in years (years)	+
FARM_LAND	Total cultivated by the household in acres	Continuous variable total cultivated land in acres (acres)	+
COST_PRDN_ACTIVITY	Aggregated cost for all activities in green gram production in KES	Continuous variable capturing total cost of production activities (KES)	-
UNIT_TRANSCOST	Unit cost of transport to the nearest market	Continuous variable capturing cost of transport in (KES)	-
FREQ_TO_MKT	How frequent the respondent goes to sell at the market	Categorical variable capturing frequency to market 1= Once a week, 2=Once a month 3= Once every three months	+
GENDER	Gender of the Household head	Dummy variable for sex of household head 1= Male; 0= Female	+
CREDIT_ACCESS	Whether the respondent has access to credit	Dummy variable 1 = Yes 0 = No	+
INDIV_SELLING	Whether the respondent sold green grams individually	Dummy variable 1 = Yes 0 = No	+
COOP_SELLING	Whether the respondent sold green grams in a cooperative	Dummy variable 1 = Yes 0 = No	+
MIDDLECLASS	Middle class wealth category of respondent	Dummy variable 1 = Yes 0 = No	+
RICH	Rich wealth category of respondents	Dummy variable 1 = Yes 0 = No	+
UNIT PRICE	Selling price of green grams per kg	Continuous variable capturing the unit selling price of green gram per kg (KES)	+
GREENGRAM VARIETY	Green gram variety farmers sold	Dummy variable 0= Local variety; 1= Improved variety (N26)	+
MOBILE_MKT_INFO	Use of mobile phone to access market information	Dummy variable 1= Yes; 0= Otherwise	+
OFFINCOME	Total annual off farm income in the household	Continuous variable capturing annual off-farm income in (KES)	+

Source: Author

2.3 Justification for inclusion of various variables in the empirical model

EDU was a continuous variable measuring the number of years the household head spent in formal education. A positive sign was hypothesized with more educated farmers being more likely to sell to more complex marketing channels. According to Girma and Abebaw (2012), years of formal education is linked to the critical thinking capacity of the farmer where he makes critical decisions to sell at the highest price while minimizing costs.

AGE was a continuous variable measuring the age of the household head in years. It was expected to have a positive effect on farmer's choice of a marketing channel. Older people are expected to have accumulated more knowledge than younger ones on marketing trends and opportunities hence they have forged trust with buyers. (Nyaupane *et al*., (2010) found the age of the household head to significantly affect the choice of marketing channels in Louisiana Crawfish Industry.

FARM_LAND measured the size of cultivated land by the household in acres. It was hypothesized to have a positive relationship with farmer's choice of marketing channels. Farmers with larger proportions of cultivated land may have higher production leading to greater market activities to offtake the surplus. Mathenge *et al*. (2010) found that larger cultivated land increases the potential for the household to have a marketable surplus, benefiting from economies of scale which translate into lower transaction cost and increased the probability of choice of marketing channels.

COST_ACTIVITY was measured as a continuous variable representing the total cost of production activities. It was hypothesized to have a negative relationship with the choice of marketing channel. This is because high costs of production could discourage farmers from producing and hence participating in the market (Girma and Abebaw, 2012). Higher production costs lower the profit margins, which has a bearing on the choice of marketing channels (Tsourgiannis, 2008).

TRANS _COST was measured as a continuous variable capturing the one-way transportation cost per unit of green grams transported to the market. The study hypothesized transport cost to have a negative relationship with the choice of marketing channels. Transport cost varies with mode of transport used and amount of produce being transported to the market. Hobbs (1997) noted that transaction costs (including transport cost) affect the choice of marketing channels with farmers preferring channels that attract lower transport cost.

FREQ_TO_MKT was coded as a categorical variable. It represented the number of times the farmer traveled to the market to sell his/her produce over the past 12 months. The values 1, 2 and 3 denoted access the market weekly, once a monthly and every three months respectively. The

study hypothesized the variable to be positively associated with the choice of the marketing channel. Frequency to the market embodies trust influencing repeated transaction with the trader. Hobbs (1997) found that long-standing relationship between market actors had a positive influence on the choice of livestock marketing channels in the United Kingdom.

GENDER was coded as a dummy variable representing the gender of the household with 1 denoting male household head and zero otherwise. Being male was expected to have a positive relationship with the choice of marketing channel. Men have a higher decision-making capability within the household shaped by the norms and roles set out for men in the African culture. Nyaupane *et al*.(2010) found that the choice of marketing channel crawfish in Lousiana was positively influenced by the gender of a household head with women preferring shorter channels compared to men.

CREDIT_ACCESS was coded as a dummy variable measuring whether or not the farmer had access to credit during the previous season. A value of 1 denoted that the household had had access to credit in the last season and zero otherwise. The study hypothesized a positive relationship between credit access and choice of marketing channel. Mburu *et al*. (2007) found that availability of credit services had a positive influence in choosing cooperatives as the most viable marketing channel for selling milk in central Kenya. Jari (2009) also found that farmers who had access to credit preferred more formal marketing channels.

INDIV_SELLING was coded as a dummy variable. The variable measured whether the respondent sold individually. This variable was a proxy for market arrangement to show the mode of sale farmers used while selling their green grams with a value of 1 denoting yes and 0 otherwise. The study hypothesized a positive relationship between marketing arrangement and choice of marketing channel with more farmers preferring to sell individually in less formal marketing channels. The cost of peer monitoring may be higher than the benefits of selling in a group (Stockbridge *et al*. 2003).Farmers who sell individually benefit from quick decision making and flexibility in the choice of marketing channels (Fafchamps, 2004).

COOP_SELLING was coded as a dummy variable. The variable measured whether the respondent sold in a cooperative. This variable was a proxy for market arrangement to show the mode of sale farmers used while selling their green grams with a value of 1 denoting yes and 0 otherwise. The study hypothesized a positive relationship between selling in a cooperative and choice of marketing channel with more formal marketing arrangement influencing choice of formal marketing channels. Githaiga (2007) found that farmers that sell in a group have a higher bargaining power than farmers who sell individually because they can sell in more complex markets while individual farmers are likely to sell to markets closer to their farms. Mathenge *et al*. (2010) found that producer groups can be good platforms for social capital formation and

through which farmers can obtain market information at a lower cost hence lowering the fixed transaction marketing costs.

WEALTH_CATEGORY The wealth category variable, WEALTH_CATEGORY, was derived from an asset index as described in Ahuja *et al*. (2003). Filmer and Pritchett (2001) promoted the use of principle component analysis (PCA) for estimating wealth levels using asset indicators to replace income or consumption data. First, eigen values were computed for the following variables: income, roof material, floor material, wall material, type of toilet, water source main season, water source short rains season, cultivated land. Second factors with a minimum eigen value of 1 were retained. These factors were then rotated based on the maximum variance method and only factors with a score greater than 0.4 were retained. The retained factors obtained above were used to determine which assets can be used to discriminate between households. All assets with meaningful loading on two or more factors were excluded.
Factor scores from PCA were obtained which were used as weights or coefficients on each asset. They were then used to compute the asset index using this formula (Ahuja *et al.*, 2003):

$$A_i = \sum_k f_k \frac{a_{ik} - a_k}{s_k} \qquad (3.7)$$

where:
A_i = value of asset index for the *i*th household
f_k = factor score coefficient for the *k*th asset obtained from PCA
a_{ik} = value of the *k*th asset for the *i*th household
a_k = the mean of the *k*th asset over all households
s_k = the standard deviation of the *k*th asset over all households
If the asset index for a particular household was less than the mean for all households, that household was designated as "poor"; if the index was between the sum of the mean plus one standard deviation, the household was designated as "middle class." All households with an index greater than the mean plus one standard deviation were deemed "rich" (Ahuja *et al.*, 2003).

UNIT_PRICE was captured as a continuous variable capturing green gram selling price per kg in KES. A positive sign was hypothesized with farmers likely to choose a channel which offered a higher price. Pricing plays a critical role while farmers are making decisions on which marketing channel to use. Mburu *et al*. (2007) found that more farmers in central Kenya chose the channel that offered a higher price for milk. Staal *et al.* (2006) also found a positive relationship between the price offered for milk and Marketing channel choice in Gujarat.

GREENGRAM_VARIETY was coded as a dummy variable with 1 representing the improved green gram variety (N26) and zero otherwise. This variable was hypothesized to have a positive association with farmers' choice of green gram marketing channels. Improved varieties are more

resistant to disease and drought and hence have higher yield, which could encourage farmers to sell the surplus (Nyaupane *et al.,* 2010). Wojciech *et al.*(2003) found that improved fruit variety positively influenced farmers' choice of peach marketing channels in Georgia, USA.

MOBILE_MKTINFO was coded as a dummy variable capturing the use of mobile phone to access marketing formation. The value of 1 denoted use of mobile phone and zero otherwise. The use of mobile phone was hypothesized to have a positive relationship with farmers' choice of green gram marketing channels in Mbeere South sub-County. Martey *et al*. (2012) used mobile phone as a proxy for access to market information by yam farmers in Ghana. The study found that farmers who used mobile phones to access market information were more likely to sell to the rural market.

OFFINCOME was measured as a continuous variable capturing household off-farm income in KES. Income was computed as a summation of all income sources from off-farm income by the household. Because marketing requires some initial cost, it was expected that income would have a positive effect on choice of green gram marketing channel in Mbeere South sub-County. By giving the farmers some money to access the market and search information on the available marketing options. Ngqangweni (2000) in South Africa found that farmers with higher off-farm incomes engaged more informal marketing channels than farmers with lower incomes.

3 RESULTS AND DISCUSSION

3.1 Socio-economic characteristics for green grams producers

Out of the sampled 266 households, 262 respondents were interviewed; the remaining three households were not available during the data collection exercise. Also, only 230 households grew green grams, 194 were involved in green gram marketing. Majority of the households preferred the rural retailers marketing channel at 58 percent, followed by assemblers marketing channel at 26 percent and wholesalers at 14 percent as shown in Table 3 below

Table 2: Distribution of survey households by marketing channel in Mbeere South Sub-County

Marketing channel	Number of households using the channel	Percentage
Direct sales to rural retailers	113	58
Direct sales to rural assemblers	52	26
Direct sales to wholesalers	29	14
Total	**194**	**100**

Source: Author's Analysis

Results show that 87 percent of the households were male headed; only 28 percent had accessed credit for their production within the last 12 months prior to the study and 99 percent of the population had some formal education with majority having only attained primary level at 67.7 percent. Even though majority of the households owned a mobile phone, only 38 percent used them to access marketing information. The farmers mainly sold their produce individually 90.2 percent, 5 percent in cooperatives and 5 percent sold collectively. The Improved green gram variety, N26 was most preferred at 71 percent compared to the local variety at 29 percent. Wealth classification of the households showed that 64.9 percent were "poor", 11.3 percent were "middle class" while the remaining 23.7 percent were "rich". The majority of "poor" (i.e., 57.1percent, "middle class" 72.7 percent) and "rich" (54.3 percent) households sold their green grams through rural retail outlets. The average production cost was KES 1027 (Range = 0-8000). Cost of production activities was significantly different across the marketing channels. Farmers who sold to rural retailers had the highest production cost at KES 1234.65 per acre, followed by those who sold to assemblers at KES 775.72 per acre. Those who sold to wholesalers had the lowest production cost of KES 642.31 per acre.

Table 3: ANOVA of socio-economic characteristics of survey households across different marketing channels in Mbeere South sub-County

Characteristic		Marketing channel			
		Rural assemblers	Rural retailers	Wholesalers	Pooled
Formal education	Mean	8.84	8.50	8.86	8.64
(Years)	SD	2.90	2.81	5.35	3.31
Age of household head	Mean	40.67	39.25	36.58	39.23
(Years)	SD	11.49	10.86	7.89	10.6
Household size	Mean	5.09	5.00	4.96	5.02
(Number)	SD.	1.92	2.05	1.88	1.98
Size of cultivated land	Mean	2.78	3.04	2.91	2.95
(Ha)	SD	1.98	1.94	2.10	1.97
Cost of Production	Mean	775.72	1234.65	642.31 ^{c*}	1027 *
Activity (KES)	SD	1101.97	1365.08	583.21	1227.90
Transport cost (KES)	Mean	120.27^{a**}	87.91	136.63^{c**}	103.78***
	SD	67.30	46.14	65.21	58.38
Price (KES)	Mean	48.5	50	46.5^{C*}	48*
	SD	8.6	9.6	8.0	8.5
Off farm Income (KES)	Mean	81,678	78,526	73,737	78,655
	Se	86,652	84,577	94,451	86,230

Source: Author's Analysis

Significant groups; a Rural retailers vs Assemblers; b Wholesalers vs Assemblers; c Wholesalers vs Rural retailers

***, ** and * denote statistical significance at 1%, 5% and 10% levels respectively

3.2 Factors influencing farmers' choice of green grams marketing channels in Mbeere South sub-County

The likelihood function testing the hypothesis that all the slope coefficients were simultaneously equal to zero was 95.20 (df = 32; p=0.000), indicating a good fit of the estimated model (Table 4). The McFadden R^2 was 0.213 implying that the response variables explained 21 percent variation in the model. A likelihood ratio index of between 0.2 and 0.4 is acceptable for cross-sectional data (Jarvis, 1990 quoted by Mbata, 1997). The age of household head, gender of household head, price of green grams and selling in a cooperative had a positive effect on farmers' choice of marketing channels. On the other hand, cost of transport,

cost of producing green grams and use of a mobile phone to access market information had a negative influence on the choice of green gram marketing channel.

Table 4: Maximum likelihood estimates of factors influencing farmers' choice of green grams marketing channels in Mbeere South sub-County

	Marketing channels					
	Rural assemblers			Rural Retailers		
Variables	**β-Coefficient**	**Std Error**	**Z-value**	**β-Coefficient**	**Std Error**	**Z-value**
HHSIZE	-0.040	0.265	-0.150	-0.162	0.222	-0.730
HHH_EDUC	0.013	0.103	0.130	-0.089	0.096	-0.930
HHH_AGE	**0.113***	0.060	1.890	0.080	0.053	1.510
COST_PRDN_ACTIVITY	-0.000	0.001	-0.330	**0.002***	0.001	-1.940
UNIT_TRANSCOST	**-0.024****	0.010	-2.380	**-0.037*****	0.010	-3.720
FREQ_TO_MKT	-0.954	0.943	-1.010	-1.426	0.896	-1.590
GENDER_HHH						
Male	0.806	1.559	0.520	**4.053*****	1.422	2.850
CREDIT_ACCESS						
Yes	1.713	1.176	1.460	0.585	1.087	0.540
INDIVIDUAL_SELLING						
Yes	16.106	1347.449	0.010	2.064	1.566	1.320
COOPERATIVE_SELLING						
Yes	18.930	1347.4	0.010	**4.640***	2.598	1.790
MIDDLECLASS						
Yes	0.144	1.144	0.130	-0.362	1.006	-0.360
RICH						
Yes	0.029	2.045	0.010	1.137	1.675	0.680
SALE_PRICE	**0.100****	0.040	2.480	**0.086****	0.038	2.280
GREENGRAM_VARIETY						
Improved N26	-0.984	1.156	-0.850	-0.535	0.989	-0.540
MOBILE_MKT_INFO						
Yes	**-3.900*****	1.327	-2.940	-0.669	0.878	-0.760
ANNUAL_INCOME	0.000	0.000	-1.180	0.000	0.000	-1.620
FARM_LAND	-0.101	0.257	-0.390	-0.229	0.224	-1.020
Constant	-18.464	1347.454	-0.010	-1.745	3.929	-0.440

Source: Author

†Farmer-wholesaler market channel was used as a reference.

n = 118; Log likelihood = -62.06; Pseudo R^2 = 0.431; LR Chi^2 (32) =95.20 Prob> Chi^2 = 0.0000

***, ** and * denote statistical significance at 1%, 5% and 10% levels respectively

The coefficients from multinomial logit can be difficult to interpret because they are interpreted relative to the base outcome. To better evaluate the effect of a unit change in covariates on the dependent variable, the marginal effects are examined (Greene, 2003). Table 7 presents the marginal effects of factors influencing the choice of green grams marketing channels in Mbeere South sub-County.

Table 5: Marginal effects of factors influencing choice of green grams marketing channels in Mbeere South sub-County

Variable	Marketing channels					
	Rural assemblers			Rural Retailers		
	dy/dx	Std Error	Z-value	dy/dx	Std Error	Z-value
HHSIZE	0.011	0.021	0.510	-0.018	0.022	-0.790
HHH_EDUC	0.009	0.009	0.960	-0.016	0.011	-1.430
HHH_AGE	**0.007***	0.004	1.860	0.001	0.004	0.330
COST_PRDN_ACTIVITY	**-0.000****	0.000	-2.490	**0.000*****	0.000	-3.430
UNIT_TRANSCOST	0.001	0.001	0.810	**-0.003*****	0.001	-3.980
FREQ_TO_MKT	0.021	0.057	0.370	-0.108	0.069	-1.570
GENDER_HHH						
Male	-0.198	0.122	-1.620	**0.460*****	0.084	5.450
CREDIT_ACCESS						
Yes	**0.143***	0.079	1.820	-0.075	0.086	-0.870
INDIVIDUAL_SELLING						
Yes	**0.248*****	0.033	7.540	-0.009	0.163	-0.060
COOPERATIVE_SELLING						
Yes	0.735	2.852	0.260	-0.541	2.852	-0.190
MIDDLECLASS						
Yes	0.053	0.084	0.630	-0.058	0.089	-0.650
RICH						
Yes	-0.091	0.126	-0.720	0.150	0.146	1.030
SALE_PRICE	**0.004***	0.002	1.780	0.004	0.002	1.430
GREENGRAM_VARIETY						
Improved N-26	-0.057	0.087	-0.660	0.008	0.091	0.090
MOBILE_MKT_INFO						
Yes	**-0.277*****	0.055	-5.030	**0.171****	0.073	2.350
ANNUAL_INCOME	0.000	0.000	-0.280	0.000	0.000	-0.750
FARM_LAND	0.008	0.020	0.390	-0.022	0.022	-1.030

Source: Author's Analysis

†Farmer-wholesaler market channel was used as a reference.

n = 118;***, ** and * denote statistical significance at 1%, 5% and 10% levels respectively

As expected *a priori* age of the household head (AGE) was positively and significantly related to choice of assembler marketing channel (p=0.06) (Table 5). Older farmers preferred the assembler marketing channel with a one year increase in age associated with a 0.7 percent increase in the probability of choosing rural assemblers' relative to wholesale marketing channel, *ceteris paribus*. This finding tallies with that of Adegbola and Gardebroek (2007) who reported that older farmers in Benin did not trust wholesalers instead preferring rural assemblers because they had developed a long term relationship.

As expected *a priori*, the unit cost of production of green grams (COST_PRDN_ACTIVITY) was negatively but significantly associated with the probability of a farmer choosing rural assemblers marketing channel (p=0.006). A unit increase in green grams production cost elicited a 0.01 percent decrease in the probability of a farmer choosing rural assemblers relative to wholesalers, *ceteris paribus*. Previous studies have found that increased cost of production hinders production and consequently reduces the marketable surplus (Kaplinsky, 2000). Alene *et al*. (2007) explain that smallholders in Africa often face high costs in production and marketing of agricultural outputs owing to the nature of their products and the institutional environment in which they have to operate. The increase in production cost reduces farmers' margins and hence may shy off from marketing their produce.

The unit production cost of green grams (COST_PRDN_ACTIVITY) was positively associated with the choice of rural retailer (p=0.000). Farmers were willing to market their produce through the rural retailer marketing channel even though they incur higher production costs; the channel also offered farmers the highest buying price which enabled them to offset their production cost. A unit increase in green grams production cost would increase in the probability that the farmer will choose the rural retailer marketing channel over the wholesaler channel by 0.01 percent, *ceteris paribus*. Kakaty and Borah (2011) found that farmers in Asam chose channels with higher margins to be able to cater for all their costs.

A negative and significant relationship was found between unit transport costs (UNIT_TRANSCOST) and the probability of choosing rural retailer marketing channel as compared to wholesalers (p=0.000). As expected *a priori* which hypothesized a negative relationship between transport cost and choice of marketing channel. Higher transport cost reduces the farmers margins hence farmers do not prefer channels where they will attract high transport costs. A unit increase in transport cost was associated with a 0.3 percent decrease in the probability that the farmer will choose rural retailer marketing channel relative to wholesalers', *ceteris paribus*. This finding is consistent with Jari (2009) who reported that farmers in South Africa preferred channels with least transaction costs including transport cost. In Turkey, Artukoglu *et al*. (2008) found that farmers with higher transport costs preferred to sell to brokers.

The gender of the household head (GENDER) was positively associated with the probability of choosing the rural retailer as opposed to wholesale marketing channel (p=0.001). Accordingly, being male increased the probability of choosing rural retailer over wholesale marketing channel by 46 percent, *ceteris paribus*. Men control the decision on income from agricultural produce and hence would like to sell to channels which give the highest margins. The rural retailer had the highest margins of KES 1070 compared to the wholesale channel KES 466. This is consistent with finding by the FAO (2002) found that men in Latin America control the income generated from the marketing of the agricultural products and will hence choose marketing channels with the highest margins.

Access to credit (CREDIT_ACCESS) was positively related to the probability of choosing rural assemblers' relative to wholesale marketing channel as expected *a priori* (p=0.065). Access to credit increases access to resources needed for production and to cover transport cost to the market. Change from no access to credit access increased the choice probability by 14.3 percent, *ceteris paribus*. Credit access allows farmers to purchase inputs e.g. improved seed, fertilizers which increase production which leads to a marketable surplus. The finding is consistent with Mburu *et al.* (2010) who reported that access to credit had a significant and positive relationship to choice of cooperative marketing of milk channel in Kenya. Access to credit increases an individual's access to resources needed to cater for production and marketing costs. Randela *et al*. (2008) found that availability of credit allows farmers to meet transaction costs of output and input markets in South Africa. Therefore, the positive relationship between credit access and choice of rural assemblers means that farmers who had access to credit are able to meet the production and marketing cost in the rural assemblers marketing channel.

Farmers' decision to sell individually rather than collectively through farmer groups/cooperatives (INDIVIDUAL_SELLING) was positively associated with the probability of choosing rural assembler instead of wholesale marketing channel at (p=0.000).this result was consistent with the *a priori* where a positive relationship was hypothesized. Accordingly, the decision to sell individually rather than collectively increased the choice probability by 24.8 percent, *ceteris paribus*. The cost of peer monitoring may be higher as compared to the benefits of selling collectively. Further, individual selling allows flexibility and direct relationship between the seller and the buyer. Rural assemblers are closest traders to the farmer hence can form a direct relationship with the farmers. These markets require minimum standard requirements. They allow farmers to sell both huge and small volumes of green grams from a minimum of 1kg to a maximum of several bags, therefore, farmers' who sell individually prefer the rural assembler marketing channel.

Contrary to *a priori* expectations, the use of mobile phone to access market information (MOBILE_MKT_INFO) was negatively but significantly related to the probability of choosing rural assemblers over wholesale marketing channel in Mbeere South sub-County (p=0.001).

Ceteris paribus, a change from not using to use of mobile phone decreased the probability of choosing rural assemblers as opposed to wholesaler marketing channel by 27.7 percent. However, use of mobile phone to access marketing information was positively and significantly related to the probability of choosing rural retailers marketing channel (p=0.019). *Ceteris paribus*, a change from not using to use of mobile phone increased the probability of choosing rural retailers as opposed to wholesaler marketing channel by 17.1 percent. Farmers who used their mobile phones to get market information had a chance of making a more informed decision on the choice of marketing channels. The findings are consistent with Jensen (2007) who reported that use of cell phone to access market information for fishermen in India made them chose more formal marketing channels and increased their profits by 8 percent.

As expected, a *priori* price of green grams (PRICE) was positively and significantly related to the probability of choosing rural assemblers over wholesale marketing channel (p=0.079). All else being equal, a unit increase in the price of green grams led to a 0.4 percent increase in the choice probability. High farm output prices increase farmers' income (Staal *et al*., 2006). Higher prices increase farmer's margins and act as motivation to produce more and get more income. This finding tallies with that of Mburu *et al*. (2010) who reported a positive relationship between price and choice of cooperative marketing channels among dairy farmers in the central highlands of Kenya. Households with a higher expectation of making profits from price signals are more likely to participate in the marketing of produce in the assembler marketing channel relative to wholesale.

4 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This study was carried out in Mbeere South sub-County to characterize existing green grams marketing channels, and to identify the factors influencing farmers' choice of green grams marketing channels in Mbeere South sub-County. A focus group discussion (FGD) was conducted with both men and women to understand the green grams marketing structure and the type of marketing channels that farmers use to market their green grams. The results of this study show that the main determinants for farmers' choice of rural assembler over wholesale marketing channel in Mbeere South sub-County are; (1) production and transport cost, with farmers preferring channels with lower costs, (2) market arrangement with farmers preferring to sell as individuals (3) unit price of green grams with farmer preferring channels with the highest price, (4) age of the household head with older farmers preferring assembler marketing channel. The main determinants for farmers' choice of rural retailers over wholesale marketing channel are (1) Gender of the household head with men in particular preferring channels with the highest returns, (2) transport cost, with farmers preferring channels with lower costs, (3) use of mobile phone to access market information, with farmers preferring channels where they can access marketing information through the phone, and (4) production cost farmers with higher production cost preferring the rural retailer marketing channel.

Based on the findings, this study recommends first, that special attention should be focused on the prioritization of unique farmer-trader relations that enhance adaptive resilience and increase farmers' marketing options in the ASALs. There is also need to invest more in availing platforms for access to market information regarding price, volumes and varieties needed via the mobile phone. Secondly, interventions to enhance market-based signals e.g. price should be reinforced. This includes Interventions that enhance green grams demand e.g. increasing green gram consumption and export opportunities.

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