PRINT: ISSN 0970-9274 ONLINE: ISSN 2456-6608
J Hum Ecol, 54(1): 35-40 (2016)
DOI: 10.31901/24566608.2016/54.01.04

Analysis of Factors Responsible for Access to Food Security by Beneficiaries of Cooperatives: A Multinomial Logit Approach

F.D.K. Anim[1], P. K. Chauke and Maiwashe Aluwani

Department of Agricultural Economics and Agribusiness, University of Venda, Thohoyandou, 0950, South Africa
[1]Telephone: 015 295 9007; [1]E-mail:francis.anim@univen.ac.za

KEYWORDS Household. Food Consumption Score. Market. Membership

ABSTRACT This study was aimed at analyzing the levels of access to food security by beneficiaries of Ratanang Cooperatives in the Limpopo Province of South Africa using the multinomial logit regression approach. The results of the study indicated that beneficiaries of cooperatives who earned high income from farming and were able to have access priceless information on farm management were likely to be food secure. Comparatively, those beneficiaries who operated close to the marketing centres, had less trust in buyers, with less farming experience and not members of cooperative organization were likely to experience food insecurity. It was recommended that access to invaluable information and efficient farming to earn high income from farming should be set as priorities in cooperative faming.

INTRODUCTION

According to Manyamba et al. (2012), factors such as social, demographic and economic characteristics of household contribute to food security. Ignowski (2012) has also found out that employment and asset ownership have a larger effect on decreasing the probability of household food security. Studies show that when a household has a consistent income it is much easier for them to be food secure (Iram and Muhammed 2004). Studies by Thamaga-Chitja et al. (2004) also indicate that household demographics, farm size, agricultural activities and total seasonal harvest have impact on household food security. According to the Food and Agricultural Organization (FAO), more than 800 million people worldwide do not have adequate food. Population growth has been found to be the most probable global factor influencing food security. According to FAO studies, it took nearly million years for the earth human population to reach one billion people and the FAO studies indicate that during the next 10 years, another billion will be added (FAO 2009).

Agricultural output in Africa has been lagging behind population growth since the 1960's. Between 1965 and 1990, agricultural production grew at an annual rate of 1.7 percent, while there was annual population growth average of 2.8 percent. Food imports including food aid in the African region have increased substantially to offset the deficiencies at the current growth rates, the food gap is projected to increase to more than nine times the present gap by 2020 (Iram and Muhammad 2004). A survey by Statistics South Africa reported that an estimated 20 percent of South African households are in the group of moderate or severe food insecurity (DAFF 2010). According to Baiphethi and Jacobs (2009), there is sometimes confusion between national food security and household food security. Access to food at household level depends on how food markets and the distribution systems function rather than on total agro-food. At national level Gross Domestic Product (GDP), in particular commercial imports, are used to estimate food security. At household levels, several indicators are used to examine the status of food security (Aliber and Hart 2009). Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (Bonti-Ankomah 2001).

Food availability refers to the physical existence of food, be it from own production or on the markets. Food access is ensured when all households and all individuals within those households have sufficient resources to obtain appropriate food for a nutritious diet. However, it depends on the level of household resources such as capital, labour, and knowledge, and also on prices and function of the physical environment, social environment and policy environ-

ment, which determine how effectively households are able to utilize their resources to meet their food security objectives (Manyamba et al. 2012). Studies show that drastic changes in climatic conditions, such as during periods of drought or social conflict which may seriously disrupt food production and threaten the food access of affected households. Food Stability on the other hand, refers to the temporal dimension of nutrition security – that is, the time frame over which food security is being considered. It involves distinction of chronic food insecurity - the inability to meet food needs on an ongoing basis; and transitory food insecurity when the inability to meet food needs is of a temporary nature (Manyamba et al. 2012). In addition, it involves cyclical (where there is a regular pattern to food insecurity, for example, the "lean season" that occurs in the period just before harvest); and temporary (which is the result of a short-term, exogenous shock such as droughts or floods). Also civil conflict belongs to the temporary category, although the negative impact on food security often continues over long periods of time.

Objectives

The main objective of this study was to determine factors affecting the levels of food security in three groups of food secure, not food secure and indifferent in food secure using the multinomial logit regression approach.

METHODOLOGY

Data Collection

An interview schedule (semi-structured questionnaires) was used to collect data from 56 farmers on household' demographics, and various small-scale factors affecting household food security from beneficiaries of Ratanang Cooperative in the Tabazimbi District of the Limpopo Province during the 2014/5 growing season. Maize production was the main crop cultivated with other vegetables including spinach, cabbage and tomatoes grown on small scale.

Cross tabulation of Food Consumption Score (FCS) results. For example, groupings by FCS threshold, and of Food Access results (that is, groupings by level of food access) was used to generate a table noting food security groups: *j=1* for food secured (often have access to food), for not food secured (sometimes have access to food), *j=2* and *j=3* for indifferent in food security (not have enough access to food).The method of FCS was chosen as a sampling technique for data collection. This method has been used with success by previous researchers and it was considered appropriate for this study. It was also considered cost effective and the information pertaining to the method was readily available. Data was coded and was then transferred into the Statistical Package for Social Sciences (SPSS) version 22, for further analysis.

Multinomial Logit Model

Given that sampled farmers in the study areas have more than two alternative choices, the Multinomial Logit (MNL) model was applied to estimate factors affecting the levels of food security choices. The model is widely used in studies involving multiple choices that define the dependent variable (Gujarati and Porter 2009). Following Greene (2010), assuming that the probability that the $i,^{th}$ farmer chooses the j^{th} of 3 channels is P_{ij}, the probability that a smallholder farmer chooses alternative *j* can be explained by a MNL as:

$$P_{ij} = \frac{\exp(\beta_j x_i)}{1+\sum_{j=1}^{3}\exp(\beta)} \quad \text{for j=1,2,3} \qquad (1)$$

where x_i is a vector of contextual socio-economic characteristics of the i^{th} farmer,

β_j is a vector of regression parameter estimates associated with alternative *j*, and 1-*3* is the number of food security levels in the choice set. The coefficients of explanatory variables on the omitted or base category are assumed to be zero. The probability that a base category will be chosen is calculated as:

$$P_i(j=1|x_i) = \frac{1}{1+\sum_{j=1}^{3}\exp(\beta_j x_i)} \qquad (2)$$

The probabilities of the farmer being in the other two categories (j = 2 or 3) can be estimated as:

$$P_i(j=m|x_i) = \frac{\exp(\beta_j x_i)}{1+\sum_{j=1}^{3}\exp(\beta_j x_i)} \quad \text{For m>1} \qquad (3)$$

By differentiating equation (3) with respect to the covariates, the marginal effects of the in-

dividual characteristics on the probabilities can be estimated as:

$$\frac{\partial P_j}{\partial X_i} = P_j[\beta_j - \sum_{j=1}^{3} P_j\beta_j] = P_j[\beta_j - \overline{\beta}] \quad (4)$$

where is the probability of the farmer choosing market channel , andis a vector of regression parameter estimates associated with alternative (Greene 2010). The marginal effects could however not be estimated using the SPSS version 22. The main explicit assumption of MNL is that the variables do not have to be multivariate normally distributed. The MNL can, therefore, be estimated using continuous, dichotomous and ordinal explanatory variables. This is a much less restrictive assumption than the multinomial probit that assumes that the specified variables are all normally distributed. The MNL results are also relatively easy to interpret compared to the multinomial probit model (Dougherty 2002).

The empirical MNL model for factors affecting the levels of food security in the three categories or groups was specified as:

$$P_{ij} = \ln(P_j / P_1) = \beta_0 + \beta_1 DISTMK + \beta_2 TRUST + \beta_3 MKINF + \beta_4 INCOME + \beta_5 EXPER + \beta_6 FORG + \mu_i$$

Where = the parameters estimated P_{ij} is the probability of food security choicebeing chosen by respondent ; for food secure (often have access to food), for not food secured (sometimes have access to food), and for indifferent in food security (not have enough access to food). The description and measurement of the independent variables are presented in Table 1.

The MNL estimates *k*-1 models, where *k* is the number of levels of the outcome variables. In this instance using SPSS Version 22, beneficiaries who were *indifferent* in food security were considered the reference group and the model for *food secure* was estimated relative to those who were indifferent and for *not food secure* relative to those who were indifferent. Since the parameter estimates were relative to the reference group, the estimated interpretation of the MNL was that for a unit change in the predictor variable, the logit of outcome *m r*elative to the reference group was expected to change by its respective parameter estimate (which is in log-odds units) given the variables in the model are held constant. The explanatory variables and their expected relationship with the dependent variable are described in Table 1. A positive sign for an estimated coefficient indicated a high likelihood of choosing the alternative over the base category as that explanatory variable increases.

Table 1: Description of explanatory variables and expected signs

Variable	*Description*	*Expected sign*
DISTMK	Distance to the market in Km	-
TRUST	Level of perceived trust in buyers (1-6)[a]	+
MKINF	Market price information (1=yes; 0 Otherwise)	+
INCOME	Farm income from maize production per season (Rand)	+
EXPER	Farming experience of beneficiary (years)	+
FORG	Membership in farming association (1=yes; 0 otherwise**)**	+/-

[a]1= strongly agree; 2=disagree; 3=slightly disagree; 4= slightly agree; 5=agree; 6= strongly agree

RESULTS

Table 2 shows the case processing summary of the MNL regression. The marginal percentage lists the proportion of valid observations found in each of the outcome variable's group. Of the 56 subjects with valid data, 27 were not food secure compared to those who were food secure and indifferent. Thus, the marginal percentage for this group is (27/56) x 100 = 48.2%. Similarly, the marginal percentages for those who were food secure was 14.3 percent and those indifferent 37.5 percent.

Table 2: Case processing summary

Category	*Description*	*Observations*	*Marginal%*
1	Often (food secure)	8	14.3
2	Sometimes (not food secure)	27	48.2
3	not enough (indifferent)	21	37.5

Total sample size=56

Table 3 presents the results of the MNL regression model. The Likelihood Ratio Chi-Square which is used to test whether at least one of the predictors' regression coefficient is not equal to zero in the model was significant (P<0.000) and indicated the acceptance of the alternative hy-

Table 3: Parameter estimates

Often	*B*	*Se*	*Wald*	*P-value*	*Exp(B)*
Intercept	13.603	5.822	5.459	0.019	
DISTMK	-0.274	0.294	0.866	0.352	0.760
TRUST	-1.989	1.062	3.507	0.061	0.137
MKINF	0.451	1.638	0.076	0.783	1.570
INCOME	0.000	0.001	0.076	0.783	1.000
EXPER	-0.208	0.104	3.981	0.046	0.812
FORG	-1.008	1.361	0.548	0.459	0.360
Sometimes	*B*	*Se*	*Wald*	*P-value*	*Exp(B)*
Intercept	3.679	5.691	5.778	0.016	
DISTMK	-0.546	0.260	4.431	0.035	0.79
TRUST	-1.724	0.860	3.992	0.040	0.178
MKINF	1.409	1.236	1.299	0.254	4.092
INCOME	0.000	0.001	0.063	0.802	1.000
EXPER	-0.027	0.035	0.593	0.441	0.974
FORG	-1.059	1.132	0.876	0.349	0.340

-2Log likelihood= 111.723 (P<0.000), Chi-square =36.437 (P<0.000). The reference category = not enough (indifferent).

pothesis i.e. at least one of the coefficients in the model was equal to zero (Table 3). The parameter estimates are presented as "B's" in the second column of Table 3.

The Exp(B) are the odd ratios of the predictors. They represent the exponentiation of the coefficients. The odd ratios of the coefficients indicate the risk of the outcome falling in the comparison group, compared to the risk of the outcome falling in the referent group (not enough or indifferent) changes with the variable in question. An odds ratio greater than one indicates that the risk of the outcome falling in the comparison group relative to the risk for outcome falling in the referent group decreases as the variable increases. The results show that farmers who have market information (MKINF) and earn high farm income per season (INCOME) are more likely to be indifferent in food security as indicated by their EXp(B) and positive *B* signs. In general, if the odd ratio is less than one as with DISTMK, TRUST, EXPER and FORG, the outcome is less likely to be in the referent group, not enough or indifferent in food security.

DISCUSSION

Positive signs for the estimated coefficients, MKINF and INCOME indicated that there was a high likelihood of beneficiaries becoming food secure as access to market information and farm income increase. According to Little et al. (2001), prior to selling to various markets, farmers spend time and resources on finding relevant information on markets prices. Broader information on prices at different market channels can improve farmers' bargaining position, reducing search costs and creating an opportunity to choose the best options (Makoti and Waswa 2015). In this study, the variable MKINF indicated whether farmers used market price information before decided to sell their produce and the variable was set as a dummy variable (1 if the farmer used price information and 0 otherwise). The results show that farmers who have market information are more likely to earn high income and become food secure. Farm income from maize production per season (INCOME) is a variable which shows that the more farmers get income from their maize production the better will be their food security situation. As a result it was expected that increase in farm income will positively influence the level of food security situation.The results of the MNL regression confirm that farmers who have high farm income per season (INCOME) are more likely to be food secure.

Distance to main market (DISTMK) was measured by kilometers from the production area to the market. Farmers located farther from the market were expected to face high search costs. The further the production area is from the market, the less likely would the farmer be to participate

in that market since it implies higher transportation charges and less access to market information (Makoti and Waswa 2015). Therefore, it was hypothesized that the longer the distance to the market the more the likelihood of selling to brokers at farm-gate. However, the results of the regression indicates that farmers who stay close to the market centre are less likely to be food insecure.

Trustworthiness of buyers (TRUST) which indicates farmers' degree of trust towards buyers was considered an important variable affecting transaction costs, since higher levels of trust reduce the perception of risk and hence transaction costs in an exchange relationship (Little et al. 2001). This variable was hypothesized to positively influence farmers' level of food security, and was included as a categorical variable ranging from 1=low to 6=high to reflect farmers' perceptions of the trustworthiness of buyers. The results of the regression indicated that farmers who had low levels of perceived trust in buyers were less likely to be food secure.

In farming experience (EXPER), more experienced farmers may be better connected with being food secured (that is, have developed social capital) and may have more marketing experience. According to Reno et al. (2003), experience also reflects the ability to better negotiate. Therefore, high number of years of farming experience of beneficiaries was expected to increase the likelihood of becoming food secure. The results of the study indicates that farmers who have less farming experience are less likely to be food secure. Membership of a farmers' association (FORG) has been found to play a crucial role in determining household security level. Household membership in a farmer association or group may increase access to information critical to production and marketing decisions (Olwande and Mathenge 2012). Membership in a farmer association or group can also contribute towards reduced transaction costs and strengthen farmers' bargaining power. In this study, membership in a farmer association or group was expected to increase the likelihood of a household being food secured. However, the results of this study indicated that farmers who become members of farmers' association are less likely to be food secure. A plausible explanation could be that those farmers spend more unproductive time in attending meetings and negotiating for better deals on production factors than productive time for planting and harvesting which could result in high farm income for food security.

CONCLUSION

From the results of the study, it can be concluded that beneficiaries of cooperatives who earned high income from farming and are able to have access to valuable information on farming are likely to be food secure. Those beneficiaries who operated rather close to the marketing centres, had less trust in their buyers, had less farming experience and not members of any farmers' cooperative organization were likely to experience food insecurity.

RECOMMENDATIONS

It is recommended that for beneficiaries to be food secure, profit making from the sale of produce should be paramount in their farm planning and operations. The results of the regression indicated that farmers who had low levels of perceived trust in buyers were less likely to be food secure. The degree of trust of buyers should therefore be enhanced to enable farmers to negotiate high prices for their produce in order to make profit and become food secure. Market information and high income from farming should also be encouraged for sustainable food security among the beneficiaries.

ACKNOWLEDGEMENTS

Financial assistance from University of Venda, Research and Publications Committee, through project number CE/14/CE/01nn is greatly acknowledged.

REFFERENCES

Aliber M, Hart TGB 2009. Should subsistence agriculture be supported as a strategy to address rural food insecurity? *Agrekon,* 48(4): 434-457.

Baiphethi MN, Jacobs PJ 2009. The contribution of subsistence farming to food security in South Africa. *Agrekon,* 48(4): 459-482.

Bonti-Ankomah S 2001. Addressing Food Insecurity in South Africa. *A Paper Presented at the South African Regional Poverty Network Conference on Land Reform Poverty Alleviation in South Africa*. 4-5 June, University of Pretoria, Pretoria.

DAFF 2010. Food Security Strategic Outlook. Department of Agriculture, Forestry and Fisheries of South

Africa. *DAFF Working Paper on Food Security No.12*, Pretoria, South Africa.

Dougherty C 2002. *Introduction to Econometrics.* 4th Edition. New York: Oxford University Press.

FAO 2009. The State of Food Insecurity in the World. Food and Agriculture Organization of the United Nations. *FAO Report Series No. 13*, Rome, Italy.

Greene WH 2010. *Econometric Analysis.* 7th Edition. New Jersey: Prentice Hall, USA.

Gujarati DN, Porter DC 2009. *Basic Econometrics.* 5th Edition. New York: McGraw Hill.

Iram U, Muhammad SB 2004. Determinants of household food security: An empirical analysis for Pakistan. *International Journal of Social Economics*, 31(8): 753-66.

Little P, Mahmood H, Coppock DL 2001. When deserts flood: Risk management and climatic processes among East African pastoralists. *Climate Research*, 19:149-159.

Makoti A, Waswa F 2015. Rural community coping strategies with drought-driven food insecurity in Kwale County, Kenya. *Journal of Food Security*, 3: 87-93.

Manyamba C, Hendriks SL, Chilonda P, Musaba E 2012. Factors Contributing to Inequality in Food Security in South Africa: Implications for Agricultural Policy. *Paper presented on Strategies to Overcome Poverty and Inequality in South Africa.* September 3-7, University of Cape Town, South Africa.

Olwande J, Mathenge M 2012. Market Participation among Poor Rural Households in Kenya. *Paper presented at the International Association of Agricultural Economists (IAAE) Triennial Conference*, Foz do Iguacu, Brazil, 18-24 August.

Reno PL, Meindl RS, McCollum MA, Lovejoy CO 2003. Sexual dimorphism in Australopithecus afarensis was similar to that of modern humans. *Proc Natl Acad Sci* , 100(16): 9404-9409.

Thanaga-Chitja JM, Hendriks SK, Ortmann GF, Green M 2004. Impact of maize storage on rural household food security in northern KwaZulu-natal. *Journal of Family Ecology and Consumer Science*, 32(8): 8-15.

Paper received for publication on November 2015
Paper accepted for publication on March 2016