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Determinants of farmers' decisions to cultivate crops in the Caprivi region of Namibia: A logistics analysis

J. M. Nyambe* and A. Belete

Department of Agricultural Economics and Animal Production, University of Limpopo, P/Bag 1106, Sovenga, 0727, South Africa.

Annually, rural farmers in the Caprivi region are faced with making difficult choices of whether or not to cultivate their crop fields. The choice farmers make is influenced by the presence of wild animals, climate risk factors, and prospects of future food aid-rollouts. This study investigates key identified determinants to rural farmers' decisions to cultivate their crop fields amidst the three mentioned influencers. Using a structured questionnaire, 253 respondents were interviewed on a face to face basis. Random sampling was used in selecting the respondents. The respondents resided in the flood plains where they had access to food aid for a period of 5 years. The central livelihood strategy for the respondents is agriculture. A logistics model was used to analyze the data. The results revealed that the household food bill, age of the head of the household, and the value and availability of food aid were essential determinants of a rural farmer's decision to cultivate his/her crop field. It also came out that rolling out food aid to rural farmers for a period of ≤ 5 years has little effect on their crop production commitments. A longer period may become a disincentive to crop farming in favor of food aid.

Key words: Livelihoods, climate risk, old age pension, food aid.

INTRODUCTION

Namibia is divided into 13 regions and the Caprivi region is one of these regions. Community conservancies have been established in communal areas of Caprivi region. Community conservancies are an alternative livelihood strategy for rural communities. The predominant livelyhood strategy is agriculture. In seeking to find ways to survive, rural people engage more in cultivating their crop fields than other off-farm livelihood strategies. Off-farm coping strategies are also common and they include basket weaving, fishing, clay pottery, cutting and selling grass and reeds, poles and firewood. Hunting and selling of game meat, as well as caving and selling of canoes are no longer popular. The reason for abandoning these is found in the establishment of community conser-vancies which brought environmental laws and their strict enforcement thereof. This entails that rural people are not

allowed to hunt, cut reeds, poles and grass without a permit. Now than decades ago, catching fish is subject to using permitted size of nets with prohibition of using nets that can catch baby fish. All these measures were not in place before community conservancies came into being. The Ministry of Fisheries and Marine Resources is in charge of the regulation that governs catching of fish, while conservancies fall under the Ministry of Environment and Tourism.

Climate risk factors, namely, flood and droughts are common in the Caprivi, wild animals have also become a source of frustration to rural farmers. All along, rural farmers in the flood plains blamed losses of their crops on climate risk factors. Their realization of how destructive wild animals are to crops has led to an increased disapproval of having community conservancies in close geographic proximity to crop fields and residential areas of rural dwellers. The animals that destroy crops are elephants, buffaloes, porcupines and hippos. The popular disapproval also emanates from animal-human conflict in

*Corresponding author. E-mail: mrnyambe@gmail.com.

which lives of rural people gets lost especially from elephants that often terrorize people.

Furthermore, the loss of crops has a serious bearing on food security situation in rural areas. Notwithstanding the importance of benefits rural communities derive from conservancies; however, community conservancies have exposed weaknesses of the existing Government's Rural Development Strategy. This also exposes a lack of clear nexus between the environment and tourism policy and the agricultural policy. This policy gap has necessitated carrying out this study whose objective is to investigate what influences rural farmers' decisions to cultivate their crop fields amidst existing destructive forces, namely, wild animals, drought and at times flood. It should also be noted that the farmers in the study area have been benefitting from donor provided food aid for the period of 5 years as a means of protecting them against hunger.

Livelihoods and food aid in the Caprivi region

The need to have access to secure livelihoods has not only been a subject of debate by development practitioners and sociologists, but also by classical economists. Alfred Marshall as cited by Froyen (1996) states "Forced interruption to labour is a grievous evil. Those, whose livelihood is secured, gain physical and mental health from happy and well-spent holidays. But want of work, with long continued anxiety, consumes a man's best strength without any return. His wife becomes thin, and his children get, as it were, a nasty notch in their lives, which is perhaps never outgrown". It has become obvious that when a community is faced with lack of employment opportunities as is the case in the study area, poverty becomes rife. Acquiring more knowledge through education is the promising vehicle to overcoming unemployment (Marshall as cited by Froyen, 1996).

Access to land and related natural resource factors remains crucial to the survival of rural households. Control and access to land and natural resources are both important for rural development (Kongolo, 2012). It is land on which extensive crop production takes place in rural areas. As land becomes scarce, under-utilized, occupied with buildings or turns not to be suitable for crop farming, the pressure to feed the nation mounts up. Betru and Kawashima (2010) argue that in Southern Africa, an increase in the population in Botswana, Zimbabwe, Malawi and South Africa has exacerbated the need to import cereal crops.

Notwithstanding the fact that crop farming is considered to be vital to the survivability of rural communities, rural farmers also engage in livestock farming as an additive to the historically attached-subsistence crop farming. This practice is common in many rural areas including the Caprivi region. In illustrating this conception, Mavimbela et al. (2010) shares that in a country like Swaziland, people rear livestock to serve the social and economic functions. Livestock can be marketed to provide required income needs, but is also a pertinent medium of exchange during marriage events. In seeking to improve the welfare of crop farming-reliant farmers in Nigeria, Dia et al. (2010) encourages farmers to keep records and to be taught on how to use the recommended quantities of agrochemicals.

As fighting poverty has become a global initiative, the United Nations has placed key strategic goals with the first Millennium Development Goal being that of eradicating extreme poverty and hunger. Poverty and hunger seem to go together (United Nations, 2012). Many people in developing countries continue to suffer from both poverty and hunger mainly as a result of persistent economic shocks at the household level (World Food Programme, 2010). These shocks combined with environmental factors play an important role of determining the direction of the demand for food and the price at which food is offered.

For example in Swaziland, the demand for food aid during the period 1985 to 2006 as caused by drought seems to have served as a stimulus to producing more maize. This was found to favour maize producers who speculated the likely changes in demand for food and thus they produced more maize in order to take advantage of the soaring maize price (Mabuza et al., 2009). Without addressing causes of food insecurity, the consequences can be debilitating on the rural poor. This can undermine their ability to engage in sustainable livelihoods.

Thus, rising food insecurity often calls for external intervention in the form of food aid. Many fears that food aid can make recipients to rely heavily on it and thus entrenching them into becoming dependents. These concerns are pertinent to policy makers and should not be taken lightly.

There are many ways in which food aid has been used by policy makers. These include the actual relief purpose, to meet short-term working capital needs and transport constraints, and also as a market development instrument. However, using food aid to serve the market development aspirations is not without concerns. Abdulai et al. (2004) cautions that in situations where food aid is rolled out for market development purposes, there is a need to carefully target the beneficiaries, and to coordinate the supply in such a manner that it should not invite negative consequences. After having touched the theoretical perspective, the shift now goes to the methodological approaches which this study has considered.

MATERIALS AND METHODS

Study area and data collection

Kabbe, Katima Rural and Linyanti constituency forms the flood plains. Rural farmers in the flood plains mainly cultivate riverine crop fields, but those in the Linyanti constituency and to a lesser extent those in Katima Rural constituency owns portions of forest-

based crop fields. The complete absence of forest-based fields is found in the greater part of the Kabbe constituency. For years, in addition to drought occurrence, crop fields have often been inundated by annual flood water. Annual rainfall in the Caprivi region is 653 mm (Ministry of Works and Transport, 2011). From the flood plains, 253 respondents were sampled using multi-stage cluster sampling approaches. Clustering was done for districts within each constituency before the final sample was drawn.

A structured questionnaire was used in collecting data. This occurred through face to face interviews with respondents. Data from the survey was entered in the Statistical Package for Social Scientists (SPSS) for analysis.

Analytical technique

There is a variety of analytical techniques on which a researcher can choose from. However, the nature of the study is influential on the choice of a technique to use. Hence forth, this paper fitted the use of a logistic regression model as opposed to other models. The challenge in using a logistic model is that it uses a complicated mathematical framework. Logistics model can handle a combination of qualitative and quantitative variables. Further, a logistic model can be applied to various research problems that vary from economics to other disciplines including the medical field.

Derived from the logic model, the logistic model can as well permit some complicated variants. This model belongs to models that are classified under the causal context and thus it is a useful tool for investigation (Cramer, 1991). Logistic models are a category of generalized linear models and they include log-linear regression, analysis of variance and multivariate statistical models. With logistic models, the response variable is generally dichotomous in that it takes two responses of a 1 or 0. While logistic models are heralded for their flexibility, their peer models such as discriminant analysis and principal component and cluster analysis are different. For example, unlike logistic model that can be used to predict the likelihood of participating in a group from a set of variables that are categorical, continuous, and discrete or even a mix of these variable types, discriminant analysis can also be used to predict group membership, but with only two groups. Logistic model can not only be reduced to dichotomous outcomes, but can be extended to include polytomous response variables (Gujarati, 1995; Press and Wilson, 1978).

Many scholars have used logistics regression model. Some of the users of logistic model in the area of agricultural studies include Govindasamy et al. (2010), in credit risk studies (Gouvêa and Gonçalves, 2007) in road accidents in Saudi Arabia (Al-Gamdi, 1996), in the education sector (Doğan and Sezer, 2009), and in explaining the intricacies of the logistic model and its usefulness (Pindyck and Rubinfeld, 1998). Logistic models have been used in epidemiological studies where predicting the probability of occurrence of illnesses is highly necessary. Further, the logistic model is based on the assumptions that a true conditional probability is a logistic function of the independent variable; observations are independent; independent variables are not linear combinations of each other, no multicollinearity and the sample is large enough (Vicky, 2009).

A logistic model can be written in mathematical logarithmic transformation format as:

$$S_i = \ln\left(\frac{\ell i}{1-\ell i}\right) = \Omega_0 + \sum_{i=1}^{n} \Omega_i X_i + \varepsilon_i$$

where s_i is the index level for the ith observation; ℓ_i is the probability of a yes outcome and $1-\ell_i$ otherwise; X_i is a vector of explanatory variables; Ω_i are parameters to be estimated and ε_i is the error term. On the decision to cultivate crops, the empirical log-linear model was constructed as follows:

$$S_i = \Omega_0 + \Omega_1 * \ln FOOD_{BL} + \Omega_2 * \ln AGE_{HHS} + \Omega_3 * \ln V_{FA} + \Omega_4 * \ln DST_{MKT} + \Omega_5 * \ln TOT_{FS} + \varepsilon_i$$

where $FOOD_{BL}$ = food budget; AGE_{HHS} = age of the head of the household; DST_{MKT} = distance to the urban market; and TOT_{FS} = total farm size.

RESULTS AND DISCUSSION

It is essential to first reflect on the socio-economic features of the respondents before entrenching into the technical results from a simulated output.

In Table 1, age of the respondent is important as it points to whether or not a respondent is a pensioner. As people grow older, their responsibilities gradually change. They begin to look after raising grand children and their chances of employability gets reduced. In Namibia, people over 60 years are entitled to a monthly old age pension which in 2012 stood at US$70. With regard to the distance from the home of a respondent to the urban market, this variable is important given the fact that most of the retail supplies are sourced from Katima Mulilo, the only urban centre in the Caprivi region.

Other areas that have development potential such as Bukalo, Ngoma and Cincimane are yet to become towns. As for the total farm size, the respondent's ownership of land is also pertinent due to the fact that most rural households are involved in agricultural practices in one way or another. Despite the communal land tenure system that has no provision for title deeds, land remains crucial to rural farming households. The primary use of land in the study area is subsistence agriculture. Thus, how much as in hectares, a respondent has can enlighten on population pressure on this factor of production.

Table 2 presents results of the logistic regression analysis. As stated earlier that logistic models do not use ordinary least squares (OLS) assumptions, the focus is on the likelihood outcome or log-odds. The results shows that food cost, age of the respondent, and the value and availability of food aid provided are significant, at 5% level of significance with p-values of 0.006, 0.042 and 0.048, respectively. A Hosmer-Lameshow test yielded a χ^2 of 6.311 which endorses the model's fitness to the data. The standard errors are satisfactory as they all reflect the closeness of the sample mean to the population mean. It implies that a unit change in the food bill of a rural household is expected to yield a 0.785 increase in the likelihood of the decision to farm, holding all other factors constant. This outcome confirms that when an impoverished rural household that has low income face a high food bill, this particular household will even participate more in agricultural activities to support itself. When food prices increases to a higher level, rural households loose the purchasing power of their disposable meager-income.

Table 1. Socio-economic characteristics of the respondents.

Item	Description	Statistics
Household size	In numbers of people (average)	5
Gender composition of respondents	Ratio of male to female respondents	96:157
Food budget	Average food budget per month (in US$)	44.75
Education level	Average number of years spent at school	6
Age of the head of the household	Average age expressed in years of existence	47
Distance to the urban market	Average expressed in hours from home to town	3
Marital status of the head of the household	Ratio of single to married heads of households	48:154
Remittances	Average receipts per month (in US$)	23
Total farm size	Average farm size owned expressed in hectares	6
Access to food aid	Recipients of food aid during the 5 year period	-
Old age pension	The value of old age pension in US$	54

N = 253; N$8.20 = US$1

Table 2. Estimates for parameters of logistic regression model.

Regressor	Parameter	Standard error	P-value	Likelihood
$FOOD_{BI}$	0.785	0.287	0.006	2.193
AGE_{HHs}	-1.398	0.687	0.042	0.247
V_{FA}	-0.002	0.001	0.048	0.998
DST_{MKT}	0.554	0.401	0.167	1.740
TOT_{FS}	0.252	0.378	0.505	1.286
Constant	1.705	3.397	0.616	5.504

Households, in such a situation, instead of abandoning their agricultural crop production commitments, they would continue to cultivate the crop field, because the options for maneuvering have been reduced.

The model simulation further revealed other imperative parameter outcomes. This includes the fact that a unit change in the age of the head of a household will reduce the likelihood of the decision to farm by 1.398, holding all other things constant. In this case, the age of the head of a rural household is essential in determining whether to cultivate the crop field or to rely on their available alternatives such as waiting for food aid. Moreover, old age is inversely related with the decision to cultivate the field. This means that as one gets older, less of the person's efforts will be devoted to active farming practices. In this sample, 38% of the respondents are ≥ 56 years of age and as such with years passing they may increasingly become less active in engaging in actual farming which demands their physical labour. Since heads of the households would usually reside with other members of the households who are younger, this finding did not ignore the role of young members of the household. Needless to say, young members of the household would most likely be the ones to provide their physical labour which ploughing the field requires. The consequence is that at a decision making level, old people would be gradually moving away from being active in those decisions that relates to farming and also in terms of their own physical involvement, while young ones will be taking over the roles.

The other side of this age category is that these would mostly likely to have taken early retirement if they worked before or could be preparing to retire at 60 years. However, the reality is that in this sample, the respondents are unemployed rural dwellers whose incomes are unstable and have on average, not having reached advanced education level beyond senior primary school. The implication in line with this age category is that food aid may become more attractive to pensioners as opposed to young people who are still in their active stages of life.

Another outcome is that a unit change in the value of food aid provided to respondents over an extended period of ≤ 5 years will reduce the likelihood of a household's decision to farm by 0.002, holding all other factors constant. The longer one is exposed to receiving food aid the less likely they will choose to cultivate their crop fields holding all other things constant. The overall results from the logistic regression sheds light on the fact that when food aid is rolled out for longer than 5 years to respondents who are approaching their retirement age, such may shift their livelihood choices to have to rely more on food aid. This inference is only confined to the age category of 56 and above. Distance to the urban market and the total

farm size proved to be insignificant.

Conclusions

The relationship between receiving food aid and the decision to farm is of interest to policy practitioners. As the global urge to wean dependents of food aid is mounting, some alternative ways to assist those currently relying on food aid should be found. In the Caprivi region, there is scarcity for better alternatives due to underdevelopment of the region. Rural communities should rely more on their own efforts, but the government and its development aid partners should assist with establishing fresh produce markets at future development centres such as Ngoma, Bukalo and Cincimane. Fresh produce markets may assist rural farmers to earn better incomes from buyers as opposed to having to transport their produce to a distant urban market considering that spoilage may occur in the process.

Food aid price signal is vital to supporting rural households. Thus as food price increases, those in rural areas who purchase some of their foodstuff from the urban centre tends to be squeezed. With uncertainty surrounding their low incomes, an upsurge in food prices would translate into a reduced disposable income which supposed to have been primarily spent on foodstuff. When this happens and compounded with poor harvests, donor and government support becomes highly necessary for needed emergency support to prevent hunger. Since the usual catalytic factors to reduced food security are wild animals and flood, a solution is needed with regard to how to secure crop fields from wild animals and also on how rural households' crops can be protected from annual climate risk factors especially floods.

Old age pension may for now appear to be a cushion against livelihood stress to many old rural dwellers; however, this social net adjusts slowly in relation to livelyhood needs. Although, old age pension is aimed at acquiring basic needs for the old people, its provision can be likened to be serving similar purpose to what food aid does. While an old age pension appears to be an income handout food aid that comes in the form of food parcels. In the same vein, the consequences of long term receipt of both support systems can be speculated to be as well related. Besides this parallel analogue, the role that both old age pension and food aid provision plays should not be underestimated in terms of the beneficial effect that they offer in the fight against hunger in the study area. The policy challenge with both instruments is on sustaining their provision. So far, old age pension has come to staywhen viewed from how it has been provided as an inherent support system from the apartheid regime that occupied both South Africa and Namibia. With regard to food aid, it is a new support programme that heavily depends of generous donor assistance. Therefore, in the event of reduced donor support, food aid will likely be halted or rolled out at a very small-scale level which will then leave many of its former recipients desperate.

In order to keep rural households in the study area afloat, all role players should be involved in seeking to find workable solutions to the challenges the people face. The Ministry of Agriculture should engage in disseminating food price predictions to their regional extension offices so that rural households may benefits from early food price warnings. The same should be done with regards to likely flood occurance. Currently, no food price signals are issued to rural households and its enactment will be of help to rural households in terms of making informed decisions on whether or not to cultivate their fields. The same interventions may assist in securing available food stock to guarantee rural households against future hunger incidences.

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