academicJournals

Vol. 13(17), pp. 897-903, 26 April, 2018
DOI: 10.5897/AJAR2015.10213
Article Number: 62B8CF156838
ISSN 1991-637X

http://www.academicjournals.org/AJAR

African Journal of Agricultural Research

Full Length Research Paper

Uncertainty, risk aversion, and management strategies – A case of cocoa farmers in Osun State Nigeria

Agboola, Timothy Olusola[1], Balogun, Olubunmi Lawrence[2]* and Elugbaju, Dolapo Abigail[1]

[1]Department of Agricultural Economics and Extension, Osun State University Osogbo, Nigeria.
[2]Department of Agricultural Economics and Extension, Babcock University, Ilishan-Remo, Ogun State, Nigeria.

Received 24 July, 2015; Accepted 20 November, 2015

Risk is a major issue that affects so many aspects of people's livelihoods in the developing world. It is imminent in all management decisions of agricultural systems, as a result of fluctuations in price, yield and resource uncertainty. Hence, uncertainty, risk aversion and management strategies were investigated among the cocoa farmers in Osun State, Nigeria. Primary data employed in the study were obtained from 102 cocoa farmers selected through a multi-stage sampling technique. Data were analyzed using descriptive statistics and multivariate probit model. Results showed that farmers view rainfall as the most important source of risk and uncertainty and majority of the farmers utilized mixed cropping as a risk management strategy in their farms. The result of multivariate probit model indicated that age of farmer negatively influenced the probability of precautionary savings while household number and access to information determined their choice of social network as risk management decisions used in the farms. The study recommends government policies and institutional mechanisms that reduce risk (such as crop insurance) and those that facilitate farmers' access to assets like off-farm investments in order to manage risks.

Key words: Livelihoods, precautionary savings, social network, mixed cropping, agricultural systems.

INTRODUCTION

Background information

The importance of cocoa in the economy of Nigeria cannot be over emphasized. In Nigeria, the popularity and earnings from cocoa have made the sub-sector an area of interest to policy makers especially due to its contributions to total Gross Domestic Product (GDP) and being the highest foreign exchange earner among all agricultural commodities (Oduwole, 2004; Alamu, 2013). An export oriented industry like the cocoa industry, the relative size of consumer surplus is of interest to policy makers on account of its implication for research financing, efficiency and international equity. Nigeria is an important player in the cocoa sector and as such, the Nigeria output has effects on the international aggregate output and price level. Agricultural production is highly

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

characterized by risk and uncertainty (Ayinde et al., 2008). Particularly, production decisions are generally made under the environment of risk and uncertainties. Yield, product prices, and to a more limited extent, input prices and quantities are usually not known with certainty when investment decisions are being made. In many cases, farmers are confronted with risk of pests and diseases which may cause product prices to decline (Ayinde et al., 2008).

Risk is a major issue that affects so many aspects of people's livelihoods in the developing world. It affects whether people can own and maintain assets and endowments, how these assets are transformed into incomes via activities and how these incomes and earnings are translated into broader development outcomes (Euphrasie, 2009). According to Salimonu and Falusi (2009), apprehension of risk induces certain behaviour into a farmer and this would grossly affect enterprise selection and consequently his resource use and allocation pattern. The rural poor are risk averse as they are always skeptical of losing the little resources that they have at their disposal and thus specialize on the risk-low return activities (Collier and Gunning, 1999). These farmers are therefore more of risk minimizers contrary to the neo-classical principle of profit maximization (Salimonu and Falusi, 2009). In rural areas, risk is present in all management decisions of agricultural systems, due to price, yield and resource uncertainty. The existence of such risks has been found to alter household behaviour in ways that at first glance seem suboptimal. Indeed, farmers take their decisions in a risky environment such that the consequences of these decisions are often not known with certainty until long after those decisions occur. As a result, outcomes may be better or worse than expected. In the empirical literature, many researchers have found that risks cause farmers to be less willing to undertake activities and investments that have higher expected outcomes, but carry with them risks of failure (Adebusuyi, 2004; Alderman, 2008).

It is also common to observe that farm households in developing countries are reluctant to adopt new technologies even when those technologies provide higher returns to land and labour than traditional technologies. They also use less fertilizer, improved seeds and other production inputs than they would have used if they simply maximized expected profits. One aspect of this reluctance is reaction to risk. Hence, knowledge on how farmers make decisions as well as their attitudes towards risks is important in determining the strategies for agricultural development.

According to Adegeye and Dittoh (1985), most agricultural decisions are taken in the environment of risk and uncertainty. Farmers will have to make decisions now, which will affect their production later. The farmers are not sure of weather, government policies, and new changes in technology – factors which make it difficult for them to predict the future with certainty. Agricultural risks are important as they cause fluctuations in income and consumption. The failure to cope with income risk is not only reflected in household consumption fluctuations but affects nutrition, health and education and contributes to inefficient and unequal intra-household allocations (Dercon, 2002). All households in the same area are affected at the same time. Therefore, nobody in the same area can help the other. Assistance has to come from outside the affected area. Rosenzweig and Stark (1989) found that Indian families marry their daughters in distant villages as a coping strategy against covariate risks. Salimonu and Falusi (2009) identified cooperative society, borrowing of money and off farm-work as major risk management strategies used by Nigerian food crop farmer.

Although traditional risk management strategies mitigate only a small part of overall risk (Alderman, 2008; Dercon, 2000), in the absence of insurance and financial markets, households use a combination of these strategies as substitutes to deal with agricultural risks. According to Tomek and Hikaru (2001), farmers are assumed to select a combination of strategies that, for example, maximize net expected returns (profits) subject to the degree of risk they are willing to accept. Clearly, risk management strategies in agriculture vary with farm characteristics and the risk environment (Hope and Lingard, 1992). Farmers' risk perceptions, risk attitudes, objectives as well as the available resource base, influence their decisions and actions.

In Osun State, rural households producing cocoa are exposed to a variety of income uncertainties, both market related such as price variations, as well as non-market related, such as unstable weather patterns and pest/disease of cocoa plants. Dealing with risk in cocoa sector in Osun State remains of crucial importance, not only for farmers but also for the government given the importance of cocoa in the economy of the country. The broad objective of this study was to determine the risk and uncertainties and risk aversion of cocoa farmers. The specific objectives of this study were to:

1. Identify the risks and uncertainties involved in cocoa production by farmers.
2. Examine the factors that influence farmers risk management adoption decisions.

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

Risk management can be defined as choosing among alternatives to reduce the effect of risk (Harwood et al., 1999). Farmers with access to risk management information and the knowledge to use it have the key to profitable and competitive farm operations. The problem is that smallholder farmers and limited resources

producers often struggle to find and use appropriate information (Salimonu and Falusi, 2009). The decision of reducing farm risks is usually made at the household level. Decisions on reducing farm risk are very much dependent on the geographic and socio- economic possibilities. The identification of the sources of risk is important because it helps to choose the appropriate management strategy (Pennings et al*.,* 2008). According to Wencong et al*.* (2006), the decision maker's risk preference affects the type of agricultural activities and corresponding scales that are selected. It also affects micro agricultural production structure and stable growth of households' income. Given a fixed amount of productive resources such as arable land, capital and labor force, the combination of production activities with the highest level of expected income/risk would be selected if the decision maker was a risk taker. For combinations of activities with a lower risk level, diversification might reduce risks to some extent at a cost of total return. Risk management strategies can be classified into two broad categories; ex-ante risk management and ex-post strategies. Farmers implement ex-ante strategies because of lack of mechanisms to cope with risks ex-post. Natural hazards can be managed by irrigation, crop insurance and by growing resistant varieties. Market risks are managed by price stabilization programs, provision of information and credit subsidies. Social and state hazards on the other hand are political issues. The situation of smallholders can be improved by increasing their political participation in decisions which affect their welfare and their future (Ellis, 1998).

Valdes and Konandreas (1981) report that a particular producer may reduce yield risk by farming geographically dispersed plots of land. Others use cultural practices like growing short-season varieties that mature early in the season. Another strategy of managing risk is investing off-farm. A portfolio of farm and off-farm investments reduces risk (Mishra and Morehart, 2001). People diversify their assets, activities and income because of several reasons: to manage risk, to handle seasonality in farming activities, credit market failures and to iron out problems in labor markets (Ellis, 2000).

MATERIALS AND METHODS

The study was conducted in Osun State. Geographically, it lies on longitude 4° 69 E and latitude 70° 50 N. Osun State was created from old Oyo State on 27th of August, 1991. It comprises thirty local government areas (LGAs). The land area is about 10,245 sq. km. The population of Osun State, according to National Population Census 2006, is 3,423,535. The State is located in the South-western part of Nigeria. The State shares boundary with Oyo State in the west, Ekiti State in the east, Kwara State in the north and Ondo State in the South. The indigenous people of Osun State are the Yoruba sub-group of the Oyos, the Ijesas, the Ifes, and the Igbominas. It also consists of other immigrant. Osun State is blessed with abundant natural resources and has a rich, mixed vegetation of both forest and savanna types. The greatest assets of the state include rich forest resources, cocoa and oil palm plantations, coupled with growing medium sized industrial base and mining activities. Topographically in Osun State are considerable spans of plains less than 410 m above sea level. It has topical climate and is characterized by all year annual rainfall from of 1270 to 1524 mm. The abundance of rainfall makes the state a suitable place for planting cocoa.

Primary data were collected for the purpose of this study using structured questionnaire. Some of the data collected include: socio-economic/demographic characteristics, agricultural production activities, types of production risk and management strategies used by cocoa farmers. Multi-stage sampling technique was employed for this study. The first stage involved the purposive selection of Ife/Ijesha Agricultural Development Programme (ADP) zone from three ADP zones in the state. The zone was selected because of the prevalence of cocoa farming activities in the area. In the second stage, four Local Government Areas (LGA)s were selected from Ile-Ife/Ijesha ADP zone due to their involvement in cocoa production. Five communities were selected from each of these LGAs. The last stage involved random selection of 6 cocoa farmers from each of these communities. In all, only one hundred and two with correctly filled information were used for the analysis.

Analytical tools and models

This study employed a number of analytical tools based on the objectives of the study. The tools are: descriptive statistics and multivariate probit model.

1. Descriptive statistics: Descriptive statistics such as tables, frequencies, mean and percentages.
2. Multivariate probit model: The multivariate probit model was used to analyse risk reduction and management practices as well as factors that influence farmers risk management adoption decisions. It is a behavioural response model involving more than two possible outcomes are either multinomial or multivariate. Multinomial models are appropriate when individuals can choose only one outcome from among the set of mutually exclusive, collectively exhaustive alternatives.

In this research work, the risk management strategies are not mutually exclusive; considering the possibility of simultaneous utilization of multiple risk reducing strategies and the potential correlations among these adoption decisions. In this study, we examine factors influencing farmers' use of the following risk management strategies in the absence of formal insurance market: mixed cropping, savings andsharing risk within a social network. Strategies we are considering can be specified as follows:

$$Y_{ij}=x'_{ij}\beta_j+e_{ij} \quad (1)$$

Where Yij(j =1,...,m) represents the risk management alternatives (in our case$m$ = 3) faced by the ith producer (i =1,..., n) , $x'_{ij}$is a 1×k vector of observed variables that affect the risk management adoption decision, $\beta_j$is a k ×1 vector of unknown parameters (to be estimated), and e_{ij} is the unobserved error term. In this specification, each j Y is a binary variable and, thus, equation (1) is actually a system of m equations (m = 3 in this case) to be estimated:

$$Y_1=\alpha_1+x\beta_1+\varepsilon_1$$
$$Y_2=\alpha_2+x\beta_2+\varepsilon_2$$
$$Y_3=\alpha_3+x\beta_3+\varepsilon_3$$

With y_1, y_2, y_3 as a set off three latent variables underlying each of the risk strategy adoption decision such that y_i=1 if y_j>0. If the vector of random errors ε_{ij} were independently and identically distributed, estimating the unknown parameters of the model would be simple. One could consistently and efficiently estimate the β_j

Table 1. Socio-economic characteristics of cocoa farmers.

Variable	Frequency	Percentage
Sex		
Male	82	80.4
Female	20	19.6
Total	102	100
Level of Education		
Primary school	22	21.5
Secondary school	32	31.4
Tertiary	23	22.5
Vocational	11	10.7
No formal	14	13.7
Total	102	100
Marital status		
Single	6	5.8
Married	93	91.2
Widowed	2	2.0
Seperated	1	1.0
Total	102	100
Age		
21-30	6	5.8
31-40	20	19.7
41-50	49	48.0
Greater than 50	27	26.5
Total	102	100
Mean=46.5, SD=5.5		
Household size		
1-3	37	36.3
4-6	49	48.0
Above 6	16	15.7
Total	102	100
Mean=6.3, SD=2.7		

Source: Field Survey (2014).

parameters by a series of three independent binary probit or logit models.

However, as noted before, it is possible to adopt risk management strategies simultaneously and thus it is likely that these decisions are correlated. Consequently, the elements of ε_{ij} likely will experience stochastic dependence. Ignoring such dependency in multivariate choice models may lead to biased estimates of the choice probabilities and incorrect estimates of the standard errors of the parameters (Kiefer, 1982). Ashford and Sowden (1970) suggest that the dependence among the elements of ε_{ij} can be considered by assuming that ε_{ij} is multivariate normally (MN) distributed. Because of the MN assumption, this model has been called the multivariate Probit (MVP) model. Hence, in the MVP approach to estimate the unknown parameters in Equation (1), the error terms (across j =1,...,m alternatives) are assumed to have MN distributions with mean vector equal to zero. With the assumption of multivariate normality, the unknown parameters in Equation (1) can be estimated using Stata'smvprobit command which applies the method of simulated maximum likelihood (SML) that uses the Geweke-Hajivassiliour-Keane (GHK) smooth recursive conditioning simulator to evaluate the multivariate normal distribution. Cappellari and Jenkins (2003) stated that the simulated probabilities are unbiased and bound within the (0, 1) interval. The variance-covariance matrix V of the cross-equation error terms has values of 1 on the leading diagonal (for reasons of parameter identifiability).

Table 2. Profile of risk and uncertainty involved in cocoa production activities.

Risk/uncertainty	Number (%)
Land	34 (33.3)
Labour	71 (69.6)
Improved seedlings	64 (62.8)
Temperature	7 (6.9)
Rainfall	102 (100.0)
Diseases	89 (87.3)
Pests	83 (81.4)
Weeds	53 (51.9)
Transportation cost	51 (50.0)
Marketing	35 (34.3)
Price of cocoa	31 (30.4)
Total number of farmers	102 (100)

Source: Field Survey (2014).

RESULTS AND DISCUSSION

The socio-economic characteristics of the cocoa farmers are presented in Table 1. The result shows that 80.4% of the farmers were males and the remaining females. This is an indication that cocoa production in the study area is dominated by male farmers. Education is very important, especially in risk aversion and management as it will affect their decision to adopt management strategies and what type to adopt. Over three-quarters of cocoa farmers were literate with one form of education or the other while the rest had no formal education. The fact that majority of the farmers are educated is an indication that they might show some degree of risk aversion. Also education of the farmer plays vital role of efficiency in production; hence educated farmers will tend to adopt more sophisticated risk management tools than the less educated ones. Also, majority of the farmers were married and had an average household size of 6 members. Most of the cocoa farmers (67.7%) were between ages 31 and 50 years with only a few above 50 years of age. The mean age of household heads stood at 46.5 years, implying that majority of the respondents were in their active working age.

Table 2 presents the profile of risk and uncertainty involved in cocoa production activities. The result shows

Table 3. Risk management strategies used by Cocoa farmers.

Risk management strategies	Frequency	Percentage
Mixed cropplng	61	59.8
Precautionary savings	31	30.4
Social network	10	9.8
Total	102	100

Source: Field Survey (2014).

Table 4. Factors influencing the use of pest and weed control measures of cocoa farmers.

Parameter	Pest control			Weed control		
	Estimate	Standard error	Sig. (P-value)	Estimate	Standard error	Sig. (P-value)
Planting time	0.113	0.209	0.587	0.148	0.208	0.477
Improved seedlings	-0.137	0.090	0.127	-0.125	0.087	0.151
Work with labourers	0.005	0.091	0.958	-0.001	0.089	0.989
Intercept	-2.085***	0.412	0.000	-2.129***	0.411	0.000

Source: Field Survey (2014).

that farmers considered rainfall as the most important source of risk which is understandable because as rain hits the soil, it splashes soil particles on the plant which carries or habours some disease causing pathogens such as black pod disease. Heavy rainfall also causes flooding which sometimes leaves stagnant water and creates a conducive environment for disease causing organisms to grow, reduces soil aeration and thus reduces the activities of helpful organisms present in the soil. Risk and uncertainty, such as rainfall, diseases, pests and labour are higher among cocoa farmers with over 70% of the farmers experiencing it. Few cocoa farmers were moderately affected by improved seedlings, weed and transportation cost. Only 6.9% of cocoa farmers experienced adverse temperature while 33.3, 34.3, and 30.4% were faced with risk of deteriorated land, transportation cost and poor marketing of their product, respectively.

Risk management strategies used by cocoa farmers are shown in Table 3. Mixed cropping was adopted by majority (59.8%) of the farmers as management strategies to mitigate against risks and uncertainties in their cocoa farms. Farmers who utilize precautionary savings represented 30.4% while those who their membership of social network helped them to cope with risk and uncertaity was 9.8%.

Factors influencing the use of pest and weed control measures of cocoa farmers is presented in Table 4. Results from the table indicated that planting time, improved seedlings or labour management are not statistically significant and so do not influence pest or weed control practices. This indicates that pest control management practices such as pesticides, planting resistant variety, crop rotation and weed control practices like herbicides are employed no matter the planting time, labor management and use of improved seedlings. This is very important because these are the most important traditional management tools utilized by the farmers.

Table 5 depicts factors influencing risk management adoption decision by cocoa farmers in the study area. Result shows all the independent variables are not statistically significant, and so do not have effect on the type of farming been practiced. This therefore means that the choice to adopt mixed cropping as a management tool is unaffected by the farm characteristics, risk indicators and access to information. In case of precautionary saving, age of cocoa was the only significant variable. Age of a farmer negatively influenced the probability of savings for farmers. This indicates the older the farmers are, the less likely they are to save. The result shows that the average age of the farmers in the study area was 46.5 years. Cocoa farmers in the study area are less likely to have savings. An additional year to the age of the farmer will decrease the probability of precautional savings by 2.5%. However, household number and access to information are variables that significantly affected management decisions only in the social network in which the farmer belongs. The result also shows that the number of people living in the household was negative and significantly affected by their participation in social netwoks. The result indicates that an additional member to the household decreased the probability of farmer's participation in social netwok by 39.3%. And also access to information also negatively influenced the probability of social networks. This means that the more a farmer has access to information the

Table 5. Factors influencing risk management adoption decisions of cocoa farmers.

Parameter	Mixed farming practices			Precautionary savings			Social network participation		
	Estimate	Standard error	Sig.(P-value)	Estimate	Standard error	Sig.(P-value)	Estimate	Standard error	Sig.(P-value)
Age (yr)	-0.001	0.004	0.871	-025***	0.007	0.000	-0.006	0.011	0.601
Household number	0.062	0.067	0.352	0.016	0.098	0.874	-0.393**	0.198	0.047
Farm size (ha)	0.013	0.050	0.793	-0.001	0.079	0.993	0.037	0.148	0.804
Land Ownership	0.027	0.111	0.806	0.126	0.139	0.364	-0.367	0.346	0.289
Access to information	0.005	0.111	0.960	-0.071	0.152	0.641	-0.98***	0.232	0.000
Problem of pests and diseases	-0.018	0.142	0.899	-0.157	0.228	0.490	-0.006	0.284	0.983
Access to input	0.086	0.102	0.400	0.027	0.159	0.863	-0.397	0.267	0.137
Intercept	-2.597	0.499***	0.000	-0.842	0.627	0.179	0.701	1.010	0.487

Source: Field Survey (2014). *, **, *** Significant at 10, 5 and 1% respectively.

less his participation in social network.

CONCLUSION AND RECOMMENDATION

The study showed that most of the farmers are males and educated. The study also showed that most of the farmers adopted cropping an evidence of aversion to risk. The farmers were found to be risk averse implying that they were not fully insured by their self insurance strategies. In order to improve their welfare, policies that enhance access to insuring farm activities should be put in place. The result of the research also indicated that access to information and a large household size negatively affect farmers' participation in social networks. The study urgently recommends government policies and institutional mechanisms that reduce risk (such as crop insurance) and those that facilitate farmers' access to assets like off-farm investments in order to manage risks. It is also strongly suggested the need to group the farmers into societies, unions or cooperatives. This will certainly facilitate positive interactions especially on risk sharing, collective bargaining front, and also serve as a conduct for transmitting government extension recommendations to the farmer.

Conflict of interests

The authors have not declared any conflict of interest.

REFERENCES

Adebusuyi BS (2004). Stabilization of Commodity Market of Interest to Africa", Paper Presented at the Workshop on Constraints to Growth in Sub-Saharan Africa, organized by the Intergovernmental Group of Twenty-Four in Pretoria, South Africa.

Adegeye AJ, Dittoh JS (1985). Essentials of Agricultural Economics (New Edition). Impact Publishers Nig. Ltd. Ibadan. pp. 106-126.

Alamu SA (2013). Analysis of Seedling Subsidy Policy and Cocoa Production in South-West Nigeria. J. Educ. Soc. Res. 3(4):59-68.

Alderman H (2008). Managing risks to increase efficiency and reduce poverty", Background Paper for the World Development Report, World Bank.

Ashford JR, Sowden RR (1970). Multivariate probit analysis. Biometrics 26:535-546.

Ayinde OE, Omotesho OA, Adewumi MO (2008). Risk attitudes and management strategies of small scale crop producer in Kwara State, Nigeria: A ranking approach. Afr. J. Bus. Manag. 2(12):217-221.

Cappellari L, Jenkins SP (2003). Multivariate Probit Regression Using Simulated Maximum Likelihood. Stat. J. 3(3):278-294.

Dercon S (2002). Income Risk, Coping Strategies, and Safety Nets. World Bank Res. Obs. 17(2):141-166.

Ellis F (1998). Household Strategies and Rural Livelihood Diversification. J. Dev. Stud. 35(1):1-38.

Ellis F (2000). The Determinants of Rural Livelihood Diversification in Developing Countries. J. Agric. Econ. 51(2):289-302.

Euphrasie BHK (2009). Risk, Risk Aversion and Choice Of Risk Management Strategies By Cocoa Farmers In Western Cote D'Ivoire. Evidence from India. J. Polit. Econ. 97(4):905-926.

Harwood J, Perry J, Heifner R, Somwaru A, Coble K (1999). Managing Risk in Farming-Concepts, Research, and Analysis. Washington, DC: U.S. Department of Agric, Econ. Res. Service, AER-774.

Hope J, Lingard J (1992). The Influence of Risk Aversion on the Uptake of Set-Aside: A MOTAD and CRP Approach". J. Agric. Econ. 43(3):401-411.

Kiefer NM (1982). Testing for Dependence for Multivariate Probit Models. Biometrika 69:161-166.

Mishra AK., Morehart M (2001). Off-farm Investment of Farm

Households: A logit Analysis. Agric. Fin. Rev. Spring pp. 87-101.
Oduwole OO (2004). Adoption of Improved Agronomic Practice by Cocoa Farmers in Nigeria: A Multivariate Tobit Analysis. An Unpublished PhD Thesis. Dept. of Agricultural Economics and Extension, Federal University of Technology, Akure, Nigeria.
Pennings JME, Isengildina-Massa O, Irwin SH, Garcia P, Good DL (2008). Producers Complex Risk Management Choices. Agribusiness 24(1):31-54.
Rosenzweig MR, Stark O (1989). Consumption Smoothing, Migration, and Marriage: Evidence from Rural India. J. Polit. Econ. 97(4):905-926.
Salimonu KK, Falusi AO (2009). Sources of risk and management strategies among food Crop farmers in Osun State, Nigeria". Afr. J. Food Agric. Nutr. Dev. 9(7):1591-1605.
Tomek W, Hikaru H (2001). Risk Management in Agricultural Markets: A Review. J. Futures Markets 21:953-985.
Valdes A, Konandreas P (1981). Assessing Food Security Based on National Aggregates in Developing Countries. In: Valdes A (Ed.), Food Security for Developing countries, Boulder, Colo, Westview Press.
Wencong L, Aiqin X, Jian Y (2006). Modeling Risk Behavior of Agricultural Production in Chinese Small Households. Poster paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August 12-18, 2006. Retrieved March, 15, 2009 from http://purl.umn.edu/25656.