Determinants of farmers' off-farm work decisions: How important are domain specific risk and uncertainty attitudes?

Begho, TB

DOI:
10.22004/ag.econ.303708

Print publication: 01/05/2020

Document Version
Publisher's PDF, also known as Version of record

Determinants of farmers' off-farm work decisions: How important are domain specific risk and uncertainty attitudes?

Toritseju Begho
Scotland's Rural College (SRUC), UK

Contributed Paper prepared for presentation at the 94th Annual Conference of the Agricultural Economics Society, KULeuven, Belgium

15 - 17 April 2020

* Scotland's Rural College (SRUC), Peter Wilson Building King's Buildings, W Mains Rd, Edinburgh EH9 3JG
Toritseju.Begho@sruc.ac.uk

Abstract

The paper examines the relationship between off-farm work decisions and risk and uncertainty attitudes. Data was obtained from controlled lab-in-field experiment on farmers' choices over pairs of continuous prospects. The paper estimated parametric functional forms of the value and weighting functions based on cumulative prospect theory and examined the effect on important off-farm work decisions. The paper find evidence that farmers that participated in off-farm jobs were more averse to losses under conditions of risk but not so for uncertainty. However, these categories of farmers were more pessimistic about losses under both conditions (i.e. risk and uncertainty). The results also show that risk and uncertainty aversion significantly differ between farmers that participated in paid versus self-employed off-farm jobs. The result also shows that age, farm size, tenure, location, membership of association, location are significant determinants off-farm work decisions.

Keywords Risk, uncertainty, cumulative prospect theory, off-farm, decision making

JEL code D010 Microeconomic Behavior: Underlying Principles
D810 Criteria for Decision-Making under Risk and Uncertainty

Introduction

Like other enterprises, farm businesses are faced with uncertainty (and possibly risk) which is crucial in determining the possibility of a farmer achieving his/her farming objectives. Although farmers deal with uncertainties far more often; the literature has paid less attention to uncertainty compared to risk. The prominence of risk studies over uncertainty has meant that empirical findings about uncertainty are limited. In the broader literature, (see Boehlje & Trede 1977; Heifner, Coble, Perry & Somwaru 1999; Hardaker, Huirne, Anderson, & Lien 2004) the main uncertainties in agriculture have been classified into five main groups. First, production uncertainties arising from the uncertain natural growth processes of crops and livestock including weather related factors. Second, price or market uncertainties due to unpredictable changes in prices of both inputs and outputs. Third, financial uncertainties and fourth, institutional uncertainties resulting from uncertainties surrounding income/profit and government actions respectively. Fifth, human or personal uncertainties arising from problems with human health or personal relationships. These uncertainties in several applied literature (*e.g.* Hardaker 2004; Patrick 1998; Huirne *et al.*, 2000); have either been erroneously referred to as risk or both terms have been used interchangeably. According to Kaan (1998), the most significant of these uncertainties are prices and yield variability which makes farmers perceive

farming as a "*gamble*" since at the onset of the farming season there is no certainty that their efforts will pay off.

Although, small farmers in low/middle income countries are exposed to numerous uncertainties and risks, they have fewer options to cope as formal institutions or policy instruments do not provide commensurate protection. Consequently, their livelihood is vulnerable. In Nigeria, the case is not different as smallholder farmers who are among the poorest in the country (Ajibefun, 2002; Asogwa, Umeh & Ihemeje, 2012) make decisions under conditions of uncertainties and risk while these small farmers typically have limited access to insurance markets; and market failures further amplify farmers' exposure to risks and uncertainty.

The focus of this paper is on first estimating Nigerian farmers' risk and uncertainty attitudes then using these findings to explain off-farm decisions. Specifically, in this paper these decisions are restricted to off-farm jobs and the specific job choices farmers' make. These decisions are chosen due to their significance and impact on entire livelihoods of smallholder farmers. Although several studies that have examined off-farm participation and risk aversion, however most of these studies either did not consider uncertainty or elicited risk and uncertainty attitudes using non-experimental methods or estimated 'risk attitude' from descriptive statistics. The gap is filled in this paper using parametric approach and estimating econometric models from which reliable empirical evidence is provided.

Literature review

Some studies that examines the role of risk and uncertainty attitudes in farm production, investment and management decisions (*e.g.* Backus *et al.,* 1997; Senkondo, 2000; Haneishi *et al.,* 2014 and Brunette *et al.,* 2017) have often reported that risk and uncertainty attitudes have significant effect on various farm decisions. For instance, Brunette *et al.,* (2017) find a positive impact of the DM's risk aversion on harvesting decisions, Gong *et al.,* (2016) reported that risk averse farmers where more likely to increase pesticides application. Other studies have also focused on risk and uncertainty attitudes and individual decision making for instance; entrepreneurial decisions (Brockhaus, 1980), acquisitions (Pablo *et al.,* 1996), asset allocation (Riley & Chow, 1992), market behaviours (Fellner & Maciejovsky, 2007), rate of adoption (Just & Zilberman, 1983), farm diversification (Eke-Göransson & Rinman, 2012). However, studies examining the relationship between of risk and uncertainty attitudes and farmers' crop choice, off-farm jobs and harvesting decision participation are limited.

From a different perspective in the literature (see Reardon 1997; Bryceson & Jamal 1997; Chuta & Liedholm 1990), farmers in very poor and developing countries reportedly rely on off-farm activities as a cushion for anticipated risk. Sulewski & Kłoczko-Gajewska, (2014) have found that farmers who plan to engage in off-farm income earning activity may have a slightly higher than average level of risk aversion than those who do not. In contradiction Iqbal, Ping, Abid, Kazmi & Rizwan, (2016) who find that farmers who have earn income off-farm are less risk averse.

According to Islam (1997), it is typical of a risk averse farmer to take the decision to devote some of their productive resources to off-farm activities, with less risk and a more stable income not minding the lower returns from such off-farm farm activities. Mishra & Goodwin (1997), similarly asserts that; for the risk averse farmers', greater farm income variability leads to increased off-farm labour supply. Thus, the opportunity to compensate for the risk and uncertainty related to the variations in farm income is made possible by the off-farm sector. In a similar light, Domingo, Parton, Mullen & Jones (2015) report that progressive farmers are likely to take greater risk in order to achieve greater gains while the conservative will avoid risk. According to Baron (2011) overly risk-seeking individuals characteristically fail to diversify. Arguably, the proposition is that risk seeking farmers would be mostly full-time farmers who may be less likely to diversify to off-farm income activities. From the various perspectives, one conclusion that stands out is that; for risk averse farmers' off-farm activity is an effective strategy in the reduction of variability, risk and uncertainty.

Risk attitude have also been documented to influence the category of off-farm income activities chosen by DMs. King (1974) and Musetescu et al., (2007) reported that if the income earning activity is self-owned, the decision maker is more risk seeking. This corroborates Halek & Eisenhauer, (2001) findings of decreased risk aversion among self-employed. Further, Block, Sandner & Spiegel, (2015) that there exists a strong relationship between risk attitudes and the sources of work motivation. They conclude that in terms of necessity and opportunity, entrepreneurs show risk aversion towards the former and risk tolerance for the latter. Adopting similar approach, farmers could also be categorised into two groups. Farmers that participate in off-farm income activities primarily as a buffer against anticipated farm uncertainties and those that engaged in off-farm income activities because they spotted an investment opportunity.

Although the determinants of participation in off-farm activities have been widely studied (see among others the works of Mduma & Wobet (2005); Bezu *et al.,* (2009) [1], there is limited empirical evidence on the relationship between risk and uncertainty attitudes and decisions to be involved in off-farm income earning activities. In addition, the link between risk and uncertainty attitudes and the type of off-farm activities taken up has not been adequately examined. Ignoring this potentially critical factor can lead to faulty predictions and misleading conclusions hence the relevance of studies which addresses this gap.

As presented in Table 1, factors considered to be determinants of farmers' participation in off-farm activities are (but not limited to) age, gender, education, household size and income. For instance, Man (2009) found age and household size are significant factors influencing decision making in off-farm decisions among farmers in Malaysia. While off-farm participation decreased with age, the opposite was the case for household size in several studies. Christopher (2014) findings on farmers in Tanzania regarding household size however was contrary to Man (2009).

Table 1

Selected Studies on Determinants of Off-Farm Participation Decision

Factor	**Authors**	**Country**	**Statistical Models**	**Findings (Effects)**
Farm Size	Rahman (2013)	Bangladesh	Probit	Negative
	Bezabih *et al.* (2010)	Ethiopia	Logit	Positive
Age	Man (2009)	Malaysia	Logit	Negative
Gender	Beyene (2008)	Ethiopia	Probit	Positive
	Bezabih *et al.* (2010)	Ethiopia	Logit	None
Education	Rahman (2013)	Bangladesh	Probit	Negative
	Beyene (2008)	Ethiopia	Probit	None
Household size	Man (2009)	Malaysia	Logit	Positive
	Christopher (2014)	Tanzania	Tobit	Negative
	Raimondi *et al.* (2013)	Italy	Probit	Positive
Access to credit	Shehu & Abubakar (2015)	Nigeria	Probit	Positive
Farm income	Zahonogo (2011)	Burkina Faso	Logit	Negative

[1] Mduma & Wobet (2005); Bezu et al. (2009) examined the decision to participate and the determinants of activity choice in rural non-farm employment respectively. However, both studies focused mainly on other socioeconomic factors.

Risk & uncertainty attitudes	Sulewski & Kłoczko-Gajewska (2014)	Poland	Descriptive	Positive
Mental health related factors	This paper	Nigeria	Probit	Mixed*

** Effect depending on the different subjective value function (i.e. gain or loss) and conditions (risk or uncertainty)*

Bezabih, Gebreegziabher, GebreMedhin & Köhlin (2010) argue that the two main drivers of off-farm involvement decisions are disparities in wages and risk associated with the off-farm option. Of relevance to this study however is the risk factor. Sulewski & Kłoczko-Gajewska (2014) are among the few who have examined off-farm participation as a risk management strategy that is dependent on farmers level of risk aversion. They report that there was difference (though marginally above the average level) in risk aversion between farmers who planned to engage in off-farm income generating activities than farmers who did not. However, Sulewski, & Kłoczko-Gajewska (2014) did not examine uncertainty and estimated 'risk attitude' from simple descriptive statistics. The gap is filled in this paper using parametric approach and estimating econometric models from which reliable empirical evidence is provided.

Lottery-style experiments have featured significantly in studies of both normative and descriptive decision theories. Numerous studies adopting different methods have designed their lotteries payoffs as either real[2], hypothetical or both. It has been argued that using hypothetical payoffs as opposed to real payoff determines the quality of the result (see Kroll & Vogt, 2008). However Kahneman & Tversky, (1979), Irwin, McClelland & Schulze, (1992), Kühberger, Schulte-Mecklenbeck & Perner, (2002), Etchart-Vincent & L'Haridon (2011) suggest that individuals know how they would behave in actual situations and therefore they have no cause to conceal their genuine preferences.

As presented in Table 2, a considerable number of authors have applied, modified or adopted the Ordered Lottery Selection design (OL), Multiple Price List (MPL) design, Becker, Degroot & Marshak (BDM) Design among others in real and hypothetical cases. Notably, researchers

[2] For real payoffs, the DM at the end of the experiment will be offered some payment reflective of the outcome of the DM's choices during the experiment *e.g.* a DM can earn some physical money; while for hypothetical payoffs the none of the outcomes are real.

have applied lottery type experiments to a wide range of methodologies; and to address different objectives.

Table 2

Selected Popular Lottery Methods of Eliciting Risk and Uncertainty attitudes

Design	**Studies where adopted**	**Lottery type**
The Ordered Lottery	Binswanger (1980)	Real & Hypothetical
Selection (OL) Design	Clarke & Kalani, (2012)	Hypothetical
	Kouamé, (2013)	Real & Hypothetical
	Eckel & Grossman (2002)	Real & Hypothetical
The Multiple Price List	Holt & Laury (2002)	Real & Hypothetical
(MPL) Design	Deck, Lee, Reyes & Rosen (2008)	Real
	Couture, Reynaud, Dury, & Bergez, (2010)	Real & Hypothetical
	De Brauw, & Eozenou, (2014)	Hypothetical
	Clist, D'Exelle, & Verschoor, (2013)	Real
	Reynaud & Couture, (2012).	Hypothetical
Tanaka, Camerer &	Tanaka, Camerer & Nguyen (2010)	Real
Nguyen (TCN) Design	Liu & Huang, (2013)	Hypothetical
	Love, Magnan & Colson, (2014)	Real
	Bocquého, Jacquet & Reynaud (2014)	Real
Becker, Degroot &	Becker, Degroot & Marshak (1963)	Real
Marshak (BDM) Design	Isaac & James, (2000)	Hypothetical
	Harrison, (1989)	Hypothetical
The Random Lottery Pair	Hey and Orme (1994)	Hypothetical
Design	Battalio, Kagel and Jiranyakul (1990)	Real & Hypothetical
	Couture,Reynaud, Dury, & Bergez (2010)	Real & Hypothetical
Mixed Methods	Glöckner & Pachur (2012)	Hypothetical
	Donkers, Melenberg & Van Soest (2001)	Hypothetical
Bespoke methods	Hsee and Weber (1997)	Hypothetical
	Pahlke, Strasser, and Vieider (2015)	Real & Hypothetical

While Holt and Laury (2002) (HL) employed their lottery approach within the framework of the EUT, Tanaka, Camerer and Nguyen (2010) (TCN) relied on the PT. Other studies such as Bocquého, Jacquet & Reynaud (2014) compared preference from EUT and CPT using both single and mixed domain real payoff lotteries. In the discussion that follows, the merits and demerits of these popular elicitation methods are highlighted.

Overall, the findings from authors who have adopted the lottery style approach to elicit attitudes to risk and uncertainty particularly among the individuals in developing countries leaves fundamental gap for further research particularly as the results from experimental techniques applying such lotteries is contentious on one hand. For example, Reynaud & Couture (2012) in their comparison of Eckel and Grossman *vs*. Holt and Laury report that risk preference measures are affected by the lottery approach used. Similarly, Anderson & Mellor (2009); Ihli, Chiputwa & Musshoff (2013) corroborate this argument by documenting evidence of instability of elicitation methods. Since neither of the approaches is a win-all, this calls for further research in designing and testing alternative lottery-style experiments. On the other hand, these lottery experiments are mostly restricted to monetary payoffs and framed in a way that do not reflect everyday problems.

Besides the stated preference method (such as using lottery experiments as discussed above) which relies on direct elicitation from experiments or questionnaire; other authors' have elicited DMs' attitudes using revealed preference method to examine the relationship between DMs' behaviour in real risky/uncertain scenarios. However, this method have been criticised on the issue of external validity.

Data and Experiment

The data was collected from 158 farmers across two states in Nigeria using lab-in-field experiment. The experiment used in this study enabled the elicitation of risk and uncertainty attitudes of participant by observing their preference over a series of continuous prospect pairs across gains, loss and mixed domains. Each of the prospect pairs, one was more 'risky' and had a greater variance than the other. The prospect pairs where ranked according to those where switches would be made at different points in risk/uncertainty preference ladder and a subset of the prospect pairs were chosen that had a range of switching points at different points in the ladder. Each respondent was presented with the options to choose between the options.

Methodology

The paper determined risk and uncertainty attitudes from estimating Bayesian hierarchical Cumulative Prospect model by employing the cumulative prospect theory (CPT) (Tversky & Kahneman, 1992) where objective probabilities are transformed and decision weights are determined by the cumulative probabilities. The CPT postulates that the farmer judge 'riskiness' of a prospect in relation to a reference point, do not have the same risk attitude for gains and losses and tend to distort cumulative distributions. The estimation in this study permitted different subjective value function for gains (α), losses (*β*) in addition to accommodating separate weighting function for gains (γ^+ and γ^-) and losses ($\delta^+$and δ^-). A power utility and beta distribution weighting function were fitted. The curvature of the value function is determined by *α* and *β*. The current study assumes in respect of the curvature of the value function; values of $0 < \alpha, \beta < 1$ implies risk/uncertainty aversion and risk/uncertainty seeking in the domains of gains and losses respectively. The parameter λ on the other hand symbolizes differences in the weight attached to loss compared to gain.

The probit model was employed to investigate the determinants of farmers' off-farm work decisions**.** Given y_j represent a random variable with Bernoulli distribution with probability

$$\begin{aligned} Pr(y_j = 1|x) &= Pr(y_j^* > 0|x) \\ &= Pr(x_j'\beta + \varepsilon_j > 0|x) \\ &= Pr(\varepsilon_j - x_j'\beta|x) \end{aligned} \qquad (1)$$

Following the assumptions of independently and normally distributed error $\varepsilon_i \sim i.i.d.N(0,1)$

$$\begin{aligned} Pr(y_j = 1|x) &= 1 - \Phi\left(-\frac{x_j'\beta}{\sigma}\right), \sigma \equiv 1 \\ &= \Phi(x_j'\beta) \end{aligned} \qquad (2)$$

Φ represents the standard normal CDF and β denotes $kx1$ vector of coefficient.

Consider the regression model,

$$\begin{aligned} y_j^* &= X_j'\beta + \varepsilon_j \\ y_j &= \begin{cases} 1 & if\ y_j^* > 0 \\ 0 & otherwise \end{cases} \end{aligned} \qquad (3)$$

Where y_j^* in the case of this study represents farmers' choice regarding participation in off-farm income generating activities, the vectors of explanatory variables (described in Table 3) are denoted by X_j; β is the model coefficients representing the magnitude of the explanatory variables.

Let x denote $kx1$ vector of output and $Nx1$ vector of input represented by y; the product of the likelihoods of the individual observations results in the likelihood of the whole sample because observations are independent and identically distributed.

$$f(y|x,\beta) = \prod \Phi(x_j'\beta)^{y_j}\,[1-\Phi(x_j'\beta)]^{(1-y_j)}$$

$$f(y|x,\beta) = \prod \Phi_j^{y_j}(1-\Phi_i)^{1-y_j} \qquad (4)$$

The Log likelihood function is given by:

$$l \qquad nL = \sum_j y_j\, ln\, \Phi_i + \left(1-y_j\right) ln\left(1-\Phi_j\right) \qquad (5)$$

To obtain the average marginal effect for a continuous variable assuming other variables are kept at a constant $Pr(Y = 1|X = x)$:

$$\frac{\partial Pr}{\partial x_j} = \frac{1}{n}\sum_{j=1}^{n} \Phi(x_j'\beta)\beta \qquad (6)$$

Or discrete for the effect of a change on the probability P(Y = 1|X = x):

$$\frac{\partial Pr}{\partial x_j} = \frac{1}{n}\sum_{j=1}^{n} [\Phi(x_j'\beta|x_j^k = 1) - \Phi(x_j'\beta|x_j^k = 0)] \qquad (7)$$

While the marginal effect at means for a continuous variable and discrete variables respectively is denoted by:

$$\frac{\partial Pr}{\partial x_j} = \Phi(\bar{x_j'}\beta)\beta$$

$$\frac{\partial Pr}{\partial x_i} = \Phi(\bar{x_j'}\beta|x_j^k = 1) - \Phi(\bar{x_j'}\beta|x_j^k = 0)] \qquad (8)$$

In order to identify the determinants of preference for the type of off-farm income generating activities, this paper employs the Multinomial Probit estimation (MNP hereafter). The Off-farm income generating activity (hereafter OFIGA) types which make up the dependent variable are categorised into worker, self-employed and employee with No-OFIGA participation as the base outcome $i.e.\ i = 0,1,2,3$ where $0 = No\ OFIGA$, $1 = Self\_employed$, $2 = worker$ and $3 = paid\ employment$ as such a farmer j engages in an OFIGA i $(i \in N)$. Assuming the farmer seeks to maximize utility on the types of OFIGA, U_{ij} is determined by the farmers' characteristics $\mathcal{B}'X_{ij}$ as well as random error ε_{ij} presented as:

$$U_{ij} = \mathcal{B}'X_{ij} + \varepsilon_{ij} \sim N[0,\Sigma] \qquad (9)$$

Thus, the choice of OFIGA i that maximizes the utility of the jth farmer is:

$$U^*(\psi) = U[\kappa_b(\psi)\kappa_c(\psi)] \qquad (10)$$

Where ψ, κ_b, κ_c represents the farmers' characteristics, the base outcome occupation (No OFIGA) and the set of OFIGA alternatives. Thus, the probability of choosing OFIGA i by the jth farmer is:

$$P(OFIGA = i|\, \mathcal{B}, X_{ik}, \Sigma^*) = \int_{-\infty}^{\mathcal{B}^* X_1^*} \dots \int_{-\infty}^{\mathcal{B}^* X_{i-1}^*} f(\varepsilon_{i1,\dots,}^*, \varepsilon_{ji-1}^*) \partial\varepsilon_{i1,\dots,}^* \partial\varepsilon_{ji-1}^* \qquad (11)$$

In which case the PDF of the multivariate normal distribution is obtained from $f(.)$ under the assumption that the random error $N[0, \Sigma]$ having a covariance matrix

$$\sum = \begin{pmatrix} \sigma_1^2 & \sigma_{12} & \dots & \sigma_{1n} \\ \sigma_{12} & \sigma_2^2 & & \vdots \\ \vdots & & \ddots & \\ \sigma_{1n} & \cdots & & \sigma_n^2 \end{pmatrix} \qquad (12)$$

Four (4) models estimated using python were used to determine the effect of selected variables on the types of OFIGA engaged in by farmers. Model I estimated the effect of risk attitudes on types of OFIGA engaged in while Model II included socioeconomic characteristics in the estimation, Models III and IV are similar to Model II and III respectively but for uncertainty.

The independent variables and their expected signs drawing from earlier studies discussed in the literature are presented in Table 3. *A-priori* it is expected that age, gender, farm size and ownership of farm have a negative effect on OFIGA while marital status, education and farm hours either have a positive or negative relationship with OFIGA. As for the relationship between risk and uncertainty attitudes variables and OFIGA, the expectation was a negative relationship exist between α, γ^+ and OFIGA.

Table 3

Definition of Variables subjected to Probit and multinomial Probit Regression Models

Variable ID	**Description**	**Expected Sign**
Dependent		
Y_j	1= Farmer engages in off-farm income generating activities, 0=otherwise	
Independent		
α^+	Numerical value (Lower values = greater risk aversion for gains)	-
δ^+	Numerical value (Lower values = higher pessimism for gains)	-/+
γ^+.	Numerical value (Lower values = inverse S-shape)	-/+
α^-	Numerical value (Lower values = greater risk seeking for losses)	+
δ^-	Numerical value (Lower values = higher optimism for losses)	-/+
γ^-.	Numerical value (Lower values = inverse S-shape)	-/+
Age	Number of years	-
Gender	1 male, 0 otherwise	-/+
Marital Status	1 married, 0 otherwise	-/+
Household size	Number living in a farm household	
No Education	1 no formal education, 0 otherwise (Reference)	-
Primary Edu.	1 primary education, 0 otherwise	+
Secondary Edu.	1 secondary education, 0 otherwise	+
Tertiary Edu.	1 tertiary education, 0 otherwise	+
Farm size	Number of hectare	-
Farmtenure	1 farm owner, 0 otherwise	-
Farmtype	1 non-mixed, 0 otherwise	+
Farmhours	Number of hours spent on farm/day	-
Location	1 Rural, 0 otherwise	-
Cooperatives	1 member, 0 otherwise	-/+

Result and Discussions

The data used in this study was obtained from field experiments in which choices under conditions of risks and uncertainties were obtained using a continuous 'lottery-style' experiment. This paper employed a combination of parameters that measures subjective values of gains/losses as well as subjective probabilities as a determinant of farmers (off-farm participation) decision-making. Risk and uncertainty attitudes were treated as separate variables and farmers' attitudes estimated from Bayesian hierarchical Cumulative Prospect Theory (CPT) model. In addition, the Probit model was estimated to determine the relationship between risk attitude and decision to engage in off-farm jobs. Finally, for determining factors that influenced preference for the type of off-farm jobs, the multinomial Probit presented was estimated.

The results obtained from the Probit regression are presented in Table 3. Four (4) models were estimated to determine the effect of 'selected variables' on OFIGA participation. This selection was guided by the relationships identified from previous studies in the literature and discussed in section 1. Wald test confirm that the variables included in all estimated models are not simultaneously equal to zero at the 5% level (Model I: $\chi 2$ (6) =29.94, $p < 0.001$, Model II: $\chi 2$ (21) =78.51, $p < 0.001$, Model III: $\chi 2$ (6) =15.03, $p = 0.02$, Model IV: $\chi 2$ (21) =66.71, $p < .0001$). Models II and IV had the highest chi square values. These significant chi square values suggest that the inclusion of these variables enhances the model and results in a better fit. Models II and IV is chosen for discussion hereafter based on goodness of fit criteria including the AIC, pseudo R^2, likelihood ratio (lr) test and Wald test.

The results for the models incorporating risk and uncertainty parameters are similar. Therefore, the discussion in this section will be concurrent with any major differences highlighted. Whether or not farmers engaged in OFIGA was a-priori expected to be explained by risk and uncertainty parameters while controlling for age, gender, marital status, education, farm size, farm ownership, geographic location and time spent on the farm.

As presented in Table 4, β is positive and significant suggesting that farmers that are more risk averse in the loss domain are more likely to participate in OFIGA. This is rational, as farmers who engage in OFIGA may have done so to complement farm income with OFIGA that may have much lower income 'uncertainties' and possibly lower chances of monetary losses. Hence, these findings can possibly explain the view point of Canning (1992) and Bardhan et al., (2006) that OFIGA participation is mostly a risk management tool that 'pulls' risk averse

farmers (particularly for monetary gains) to participate in; with the objective of "cushioning" uncertainties associated with farm income. δ^- is negative and significantly affects OFIGA suggesting that a unit increase in δ^- (that being less pessimistic) will decreases the probability of participating in OFIGA holding other independent variables constant. In contrast with the findings regarding β, this result show that the manner in which farmers use probabilities may not reflect their risk preferences in its entirety since a risk averse farmer may be optimistic in terms of probability weightings.

As for the control variables, age has a significant negative relationship with OFIGA participation indicating that older farmers are less likely to partake in OFIGA compared to younger farmers. This is justifiable as it is common in the study area for younger farmers to have the physical capabilities to work off-farm. Bhatta & Arethun (2013) and Agwu, Nwankwo & Anyanwu (2014) in different context have reported similar results.

Table 4

Marginal Effect after Probit Regression Estimating the Effect of Risk/Uncertainty Attitudes on Off-farm Participation Decision

	With Risk Parameters				**With Uncertainty Parameters**			
	Model I		**Model II**		**Model III**		**Model IV**	
Variables	dy/dx	SE	dy/dx	SE	dy/dx	SE	dy/dx	SE.
α	-0.191**	0.094	0.075	0.080	-0.030	0.082	0.115	0.076
β	-0.021	0.077	0.117**	0.067	-0.353**	0.139	-0.150	0.124
γ^+	-0.009	0.112	-0.118	0.080	0.100	0.093	-0.079	0.092
γ^-	0.195**	0.089	-0.072	0.072	0.470**	0.165	0.146	0.144
δ^+	0.169	0.131	-0.066	0.103	-0.044	0.148	-0.126	0.156
δ^-	0.014	0.071	-0.156**	0.064	-0.035	0.051	-0.142**	0.072
Age			-0.010***	0.003			-0.009***	0.003
Gender			-0.076	0.061			-0.053	0.061
MStatus			-0.120	0.124			-0.251*	0.129
PriEdu			-0.072	0.073			-0.066	0.073
SecEdu			0.129	0.089			0.111	0.091
HigherEdu			-0.100	0.103			-0.127	0.124
HHsize			0.001	0.013			0.001	0.014
Farm Type			-0.448***	0.161			-0.507***	0.169
Farm Tenure			0.267**	0.117			0.217*	0.125
Farmhours			-0.030	0.019			-0.033	0.023
Farmsize			-0.204***	0.052			-0.206***	0.051
Location			0.113**	0.054			0.177***	0.060
Cooperative			-0.147**	0.073			-0.122	0.077
Rural			-0.340***	0.092			-0.120*	0.065
Mood			-0.285***	0.078			-0.279***	0.079

Note. Dependent variable = Participation in off-farm income generating activities (OFIGA) where OFIGA= *1 if Farmer engages in off-farm income generating activities, 0 otherwise*

*** p<0.01, ** p<0.05 and * p<0.1.

For the multinomial probit regression (MPR hereafter) the comparison is between the baseline "No OFIGA" and the three OFIGA categories i.e. employee, worker and self-employed. The results of the marginal effect after multinomial probit regression examining the determinants of the choice of OFIGA are presented in Table 5. Similar to the previous discussion, four (4) models estimated the effect of selected variables on the types of OFIGA engaged in by farmers. Model I estimated the effect of risk attitudes on types of OFIGA engaged in while Model II incorporates risk attitudes and socioeconomic characteristics in the estimation. Models III and IV are similar to Model I and II respectively but for uncertainty. A confirmation that the models are not simultaneously equal to zero was obtained from the Wald test at the 5% level (Model I: $\chi 2$ (18) =30.19, p =0.03, Model II: $\chi 2$ (63) =169.30, $p < 0.001$, Model III: $\chi 2$ (18) =39.54, p = 0.002, Model IV: $\chi 2$ (63) =177.03, $p < .0001$). Thus, the inclusion of these variables enhances the model and results in a better fit. Given the results for the risk and uncertainty models are similar, subsequent discussion in this section will refer to both models concurrently. Models III and IV are the most preferred models based on the criteria of the AIC, pseudo R2, likelihood ratio (lr) test and Wald test.

Employee relative to No-OFIGA

The significant negative value of α indicates that the relative probability of taking up fixed regular paid employment compared to engaging solely in farming reduces as farmers becomes less risk averse. That is, the chances of choosing to take up a regular paid employment are lower amongst farmers that are more risk seeking for gains. This is rational as it is expected to find more risk averse farmers participating in this category of OFIGA since risk averse farmers will prefer the ‘assured’ but possibly lower earnings from paid employment than to ‘gamble’ at earning more (albeit with possibility of earning less or nothing) by relying solely on farming. Thus, farmers taking up fixed regular paid employment as an off-farm activity may do so for the reason of providing a buffer against anticipated farm risk and as a “necessity” rather than taking advantage of an “opportunity” to make additional income as characterised by their risk seeking counterpart.

Table 5

Marginal Effect after Multinomial Probit Examining the Determinants of the Type of OFIGA

	With Risk Parameters				**With Uncertainty Parameters**			
	Model I		**Model II**		**Model III**		**Model IV**	
	dy/dx	SE	dy/dx	SE	dy/dx	SE	dy/dx	SE
1 = Employee								
α	-0.005	0.102	-0.038**	0.134	0.085	0.105	0.231*	0.140
β	0.172*	0.073	0.189	0.092	0.085	0.112	0.244*	0.134
γ^+	0.088	0.114	0.095	0.134	-0.008	0.117	-0.171	0.145
γ^-	-0.051	0.090	-0.037	0.108	0.032	0.135	-0.169	0.158
δ^+	-0.192	0.126	-0.163	0.175	-0.612***	0.206	-0.766***	0.267
δ^-	-0.079	0.080	-0.043	0.099	-0.248***	0.089	-0.388***	0.114
Age			0.003	0.004			0.005	0.004
Gender			-0.053	0.094			-0.052	0.094
MStatus			0.357	0.226			0.349*	0.208
PriEdu			0.173	0.107			0.156	0.103
SecEdu			0.030	0.134			0.019	0.120
HigherEdu			0.054	0.178			0.029	0.169
HHsize			-0.024	0.019			-0.027	0.019
Farm Type			-0.427**	0.171			-0.363**	0.179
Farm Tenure			0.068	0.127			0.003	0.138
Farmhours			-0.057**	0.029			-0.066**	0.031
Farmsize			-0.111	0.071			-0.101	0.081
Location			0.135	0.083			0.177**	0.087
Cooperative			-0.044	0.127			-0.105	0.117
Rural			-0.090	0.123			-0.124	0.093
Bipolar			-0.262	0.166			-0.282*	0.148
2 = Worker								
α	-0.166	0.114	-0.189	0.139	-0.330***	0.108	-0.442	0.130
β	-0.122	0.086	-0.111	0.105	-0.114	0.126	-0.123***	0.150
γ^+	-0.102	0.127	-0.105	0.152	0.346***	0.122	0.420	0.135
γ^-	0.102	0.099	0.063	0.13	0.255*	0.149	0.263	0.179
δ^+	0.236*	0.139	0.227	0.174	-0.034	0.208	0.104	0.242
δ^-	0.070	0.079	0.040	0.104	0.114	0.099	0.215*	0.120
Age			-0.002	0.005			-0.005	0.004
Gender			-0.011	0.094			0.024	0.102
MStatus			-0.310*	0.168			-0.381**	0.164
PriEdu			0.051	0.113			0.039	0.118
SecEdu			0.283**	0.140			0.325**	0.134
HigherEdu			-0.121	0.197			0.006	0.191

	With Risk Parameters				With Uncertainty Parameters			
HHsize			0.004	0.020			0.010	0.021
Farm Type			0.026	0.216			-0.128	0.211
Farm Tenure			-0.126	0.173			0.055	0.183
Farmhours			-0.033	0.034			-0.020	0.035
Farmsize			-0.147*	0.088			-0.174*	0.090
Location			0.042	0.087			0.028	0.094
Cooperative			0.202	0.148			0.211	0.139
Rural			-0.075	0.166			-0.059	0.109
Bipolar			-0.118	0.184			-0.103***	0.175
3 = Self-employed								
α	0.117	0.100	0.305***	0.117	0.317**	0.124	0.388***	0.122
β	-0.053	0.083	0.056	0.095	-0.158	0.110	-0.234*	0.131
γ^+	-0.034	0.102	-0.135	0.117	-0.377***	0.139	-0.419***	0.137
γ^-	0.057	0.094	-0.108	0.116	-0.024	0.131	0.004	0.158
δ^+	-0.125	0.116	-0.138	0.143	0.426**	0.208	0.524*	0.225
δ^-	-0.127*	0.071	-0.196**	0.087	-0.022	0.099	-0.009	0.119
Age			-0.015***	0.004			-0.013***	0.004
Gender			-0.023	0.096			-0.015	0.099
MStatus			-0.223	0.156			-0.299*	0.160
PriEdu			-0.314***	0.105			-0.273***	0.103
SecEdu			-0.154	0.116			-0.191*	0.109
HigherEdu			-0.039	0.156			-0.159	0.172
HHsize			0.023	0.020			0.022	0.019
Farm Type			-0.221	0.158			-0.175	0.183
Farm Tenure			0.463***	0.160			0.278	0.171
Farmhours			0.055**	0.030			0.045	0.030
Farmsize			-0.005	0.078			0.018	0.082
Location			-0.019	0.078			0.030	0.077
Cooperative			-0.367***	0.132			-0.276*	0.143
Rural			-0.285**	0.120			0.005	0.094
Bipolar			0.000	0.128			0.011	0.134

N = 158, Reference = *Farmer not participating in any off-farm job.*

*** p<0.01, ** p<0.05 and * p<0.1.

The result is however different for attitudes to uncertainty given that the probability of taking up fixed regular paid employment compared to engaging solely in farming increases with a increase in α. This suggest that the likelihood of choosing to take up a regular paid job is higher amongst farmers that are more uncertainty seeking for gains. This finding does not conform to

a-priori expectation as the greater tendency would have been to observe farmers that are uncertainty averse for gains having greater tendency to participating in all categories of OFIGA. A possible explanation could be that DMs become uncertainty seeking (possibly due to 'overconfidence'). Such overconfidence may arise from the propensity to set excessively optimistic prediction of uncertain events in the case where the probability density of outcomes are not clearly defined. The significant positive value of β suggest that a unit increase in β will increase the chances of engaging in fixed regular paid employment. In other words, farmers that are less risk seeking for losses under uncertainty are more likely to engage in fixed regular paid employment. This could be justified from the perspective that since the farm prospect has likelihood of loss in farm income, thus farmers that are averse to uncertainty will prefer the 'assured' earnings from OFIGA to complement farm income rather than rely solely on the farm earnings. As for the socioeconomic variables; marital status and location have positive effect on the type of OFIGA while farm tenure and time spent farming have negative effects on the type of OFIGA.

Worker relative to No-OFIGA

As presented in Table 5, the variable β is negative and significant for worker indicating that being uncertainty averse for losses decreases the probability of choosing to work off-farm in the worker category. Like the case of employee, this finding could be justified from the perspective that when the farm prospect has possibility of loss in farm income, farmers that are averse to uncertainty may prefer the 'assured' earnings from OFIGA. Regarding the controls, married farmers are less likely fall in the worker category; secondary education is significant and positive suggesting that the relative probability of working off-farm in the worker category against having no OFIGA is higher for farmers that have secondary education compared to those without any formal education. The size of the farm is significant and negatively related to farmers in the worker category indicating that probability of taking up paid employment reduces as farm size increases.

Self-employed relative to No-OFIGA

As presented in Table 5, the risk attitude variables α is significant with a positive value indicating that the relative probability of being self-employed compared to engaging solely in farming increases for farmers that are risk and uncertainty seeking for gains. That is, the relative probability of starting one's own business alongside farming compared to not participating in any OFIGA increases when risk (uncertainty) aversion for monetary gains decreases. One

explanation for this could be that not all farmers necessarily engage in OFIGA as a cushion for risk as often reported in the literature but rather may be driven by "opportunities" to make supplementary income not withstanding having to face additional uncertainties and risks.

In addition, β and δ^- are significant negative determinants of the type of OFIGA under uncertainty as presented in Table 5. This suggest that the relative probability of becoming self-employed alongside farming compared to engaging solely in farming decreases as uncertainty aversion and pessimism for losses increases. This could be justified from the perspective that when off-farm prospects have possibilities of resulting in income losses, farmers that are averse to uncertainty will be less willing to exploit off-farm "opportunities" to make supplementary income from self-employment specifically as the success of starting and sustaining a business involves a lot of decision making under uncertainties. Finally, considering the control variables; age, primary education and membership to cooperatives have negative effect on being self-employed.

Conclusion

Overall, the paper provides evidence that domain specific risk and uncertainty attitudes are important determinants of farmers' off-farm work decisions The paper also show that attitudes to risk as a driver of farmers' off-farm work decisions differs from that of uncertainty thereby justifying the rationale for separating risk from uncertainty when investigating similar issues.

The results in this paper suggest that farmers that engage in off-farm jobs may have done so to complement farm income by specifically choosing off-farm jobs that have much lower income 'uncertainties' and possibly lower chances of monetary losses. It provides further justification that off-farm jobs are mostly a risk management tool that 'pulls' risk/uncertainty averse farmers (particularly for monetary gains) with the objective of "cushioning" uncertainties associated with farm income. Regarding the result on risk averse farmers (for losses), these findings show that the way farmers use probabilities may not reflect their risk preferences in its entirety since a risk averse farmer may be optimistic in terms of probability weightings. The results also highlight that DMs could become uncertainty seeking possibly due to 'overconfidence'. Such overconfidence may arise from the propensity to set excessively optimistic prediction of uncertain events in the case where the probability density of outcomes is not clearly defined.

By expanding discrete to interval prospects and extending to off-farm work decisions, this paper shows the applicability of the interval prospect experiment to different contexts. We conclude that risk and uncertainty attitudes are dependent on context and content domains and

have significance to farm decision making. Ignoring this critical factor in examining determinants of farmers' off-farm work decisions can lead to faulty predictions and misleading conclusions.

Notes

1. Off-farm income generating activities referred to in this paper is when a farmer works off the farm to earn extra income for farm household.
2. OFIGA classified as worker refers to causal wage employment such as labourer, temporary factor workers etc., OFIGA classified as self-employed includes jobs such as food processors, hairdressing, transporting, tailoring, cobbling etc.

References

Agwu, N. M., Nwankwo, E. E., & Anyanwu, C. I. (2014). Determinants of agricultural labour participation among youths in Abia State, Nigeria. International Journal of Food and Agricultural Economics, 2(1), 157-164.

Ajibefun, I. A. (2002). Analysis of policy issues in technical efficiency of small scale farmers using the stochastic frontier production function: With application to Nigerian farmers (No. 1026-2016-82008).

Anderson, L. R., & Mellor, J. M. (2009). Are risk preferences stable? Comparing an experimental measure with a validated survey-based measure.Journal of Risk and Uncertainty, 39(2), 137-160.

Asogwa, B. C., Umeh, J. C., & Ihemeje, J. C. (2012). Analysis of poverty status determinants among smallholder farmers in Nigeria. Asian Journal of Agricultural Sciences, 4(1), 8-15.

Backus, G. B. C., Eidman, V. R., & Dijkhuizen, A. A. (1997). Farm decision making under risk and uncertainty. NJAS wageningen journal of life sciences, 45(2), 307-328.

Bardhan, Dwaipayan, Y. P. S. Dabas, S. K. Tewari, and Avadhesh Kumar (2006). "An assessment of risk attitude of dairy farmers in Uttaranchal (India)." In Agricultural Economists Conference, August, pp. 12-18.

Baron, J. (2011). Risk attitude, investments, and the taste for luxuries versus necessities. Frontiers in psychology, 2.

Battalio, R. C., Kagel, J. H., & Jiranyakul, K. (1990). Testing between alternative models of choice under uncertainty: Some initial results. Journal of risk and uncertainty, 3(1), 25-50.

Becker, Gordon M., M. H. DeGroot, and Jacob Marshak (1963), "An Experimental Study of Some Stochastic Models for Wagers," Behavioral Science, 3 (Summer), 199-202

Beyene, A. D. (2008). Determinants of off-farm participation decision of farm households in Ethiopia. Agrekon, 47(1), 140-161.

Bezabih, M., Gebreegziabher, Z., GebreMedhin, L., & Gunnar, K. (2010). Participation in off-farm employment, risk preferences, and weather variability: The Case of Ethiopia. Contributed Paper Presented at the Joint 3rd African Association of Agricultural Economies (AAAE), Cape Town, South Africa, 19-23.

Bezabih, M., Gebreegziabher, Z., GebreMedhin, L., & Köhlin, G. (2010). Participation in Off-Farm Employment, Rainfall Patterns, and Rate of Time Preferences: The Case of Ethiopia (No. dp-10-21-efd).

Bezu, S., S. Holden, and C.B. Barrett. 2009. Activity Choice in Rural Non-farm Employment: Survival versus Accumulation Strategy. Paper presented at the 8th Nordic Conference in Development Economics, 18–19 June 2009, Oscarsborg, Drobak, Norway.

Bhatta, B. P., & Arethun, T. (2013). Barriers to rural households' participation in low-skilled off-farm labor markets: Theory and empirical results from northern ethiopia. Springerplus, 2(1), 97.

Binswanger, H. P. (1980). Attitudes toward risk: Experimental measurement in rural India. American journal of agricultural economics, 62(3), 395-407.

Block, J., Sandner, P., & Spiegel, F. (2015). How do risk attitudes differ within the group of entrepreneurs? The role of motivation and procedural utility. Journal of Small Business Management, 53(1), 183-206.

Bocquého, G., Jacquet, F., & Reynaud, A. (2014). Expected utility or prospect theory maximisers? Assessing farmers' risk behaviour from field-experiment data. European Review of Agricultural Economics, 41(1), 135-172.

Boehlje, M. D., & Trede, L. D. (1977). Risk management in agriculture. Journal of the American Society of Farm Managers and Rural Appraisers, 41(1), 20-29.

Bougherara, D., Gassmann, X., Piet, L., & Reynaud, A. (2012, June). Eliciting farmers' risk and ambiguity preferences in the loss and gain. In 15. International Conference

Foundations and Applications of Utility, Risk and Decision Theory (FUR) (pp. 12-p).

Brockhaus Sr, R. H. (1980). Risk taking propensity of entrepreneurs. Academy of management Journal, 23(3), 509-520.

Brunette, M., Foncel, J., & Kéré, E. N. (2017). Attitude towards Risk and Production Decision: An Empirical analysis on French private forest owners. Environmental Modeling & Assessment, 22(6), 563-576.

Canning, P. (1992). Farm Buildings and Farmland: An Analysis of Capital Formation (No. 1800-1801). US Department of Agriculture, Economic Research Service.

Christopher, L. N. (2014). Analysis into the Factors influencing the Level of Small Scale Household Farmers' Off-Farm Income amongst the Grape Farmers in Dodoma Tanzania. International Research Journal of Social Sciences, 3(11), 8-16

Clarke, D., & Kalani, G. (2012). Microinsurance Decisions: Evidence From Ethiopia.

Clist, P., D'Exelle, B., & Verschoor, A. (2013). Nature's Frames, Reference Lotteries and Truly Risky Choice: Evidence from a Ugandan Field Lab.

Couture, S., Reynaud, A., Dury, J., & Bergez, J. E. (2010). Farmer's risk attitude: reconciliating stated and revealed preference approaches. In Fourth World Congress of Environmental and Resource Economists (pp. 10-2).

De Brauw, A., & Eozenou, P. (2014). Measuring risk attitudes among Mozambican farmers. Journal of Development Economics, 111, 61-74.

Deck, C. A., Lee, J., Reyes, J. A., & Rosen, C. (2008). Measuring risk attitudes controlling for personality traits. Available at SSRN 1148521.

Domingo, S. N., Parton, K. A., Mullen, J., & Jones, R. (2015). Risk Aversion among Smallholder High-value Crop Farmers in the Southern Philippines (No. DP 2015-03).

Donkers, B., Melenberg, B. and Van Soest, A. (2001) Estimating risk attitudes using lotteries: a large sample approach, Journal of Risk and Uncertainty, 22, 165–95

Eckel, C. C., & Grossman, P. J. (2002). Sex differences and statistical stereotyping in attitudes toward financial risk. Evolution and human behavior, 23(4), 281-295.

Eke-Göransson, C., & Rinman, M. (2012). Attitudes towards hedging by diversified and non-diversified farmers.

Etchart-Vincent, N., & l'Haridon, O. (2011). Monetary incentives in the loss domain and behavior toward risk: An experimental comparison of three reward schemes including real losses. Journal of Risk and Uncertainty, 42(1), 61-83.

Fellner, G., & Maciejovsky, B. (2007). Risk attitude and market behavior: Evidence from experimental asset markets. Journal of Economic Psychology, 28(3), 338-350

Glöckner, A., & Pachur, T. (2012). Cognitive models of risky choice: Parameter stability and predictive accuracy of prospect theory. Cognition, 123(1), 21-32.

Gong, Y., Baylis, K., Kozak, R., & Bull, G. (2016). Farmers' risk preferences and pesticide use decisions: evidence from field experiments in China. Agricultural Economics, 47(4), 411-421.

Halek, M., & Eisenhauer, J. G. (2001). Demography of risk aversion. Journal of Risk and Insurance, 1-24.

Haneishi, Y., Maruyama, A., Takagaki, M., & Kikuchi, M. (2014). Farmers' risk attitudes to influence the productivity and planting decision: A case of rice and maize cultivation in rural Uganda. African Journal of Agricultural and Resource Economics Volume, 9(4), 309-322.

Hardaker, J. B., Huirne, R. B., Anderson, J. R., & Lien, G. (2004). Coping with risk in agriculture. New York: CAB International, 1997.

Harrison, G. W. (1989). Theory and misbehaviour of first-price auctions. The American Economic Review, 749-762.

Heifner, R., Coble, K., Perry, J., & Somwaru, A. (1999). Managing risk in farming: concepts, research, and analysis. US Department of Agriculture, Economic Research Service.

Holt, C. A., & Laury, S. K. (2002). Risk aversion and incentive effects. American economic review, 92(5), 1644-1655.

Ihli, H. J., Chiputwa, B., & Musshoff, O. (2013). Do Changing Probabilities or Payoffs in Lottery-Choice Experiments Matter? Evidence from Rural Uganda(No. 24). GlobalFood Discussion Papers.

Iqbal, M. A., Ping, Q., Abid, M., Kazmi, S. M. M., & Rizwan, M. (2016). Assessing risk perceptions and attitude among cotton farmers: A case of Punjab province, Pakistan. International Journal of Disaster Risk Reduction,16, 68-74.

Irwin, J. R., McClelland, G. H., & Schulze, W. D. (1992). Hypothetical and real consequences in experimental auctions for insurance against low-probability risks. Journal of Behavioral Decision Making, 5(2), 107-116.

Isaac, R. M., & James, D. (2000). Just who are you calling risk averse?.Journal of Risk and Uncertainty, 20(2), 177-187.

Islam N (1997). The Nonfarm Sector and Rural Development : Review of Issues and Evidence, A 2020 Vision for Food, Agriculture and the Environment, IFPRI, Washington, DC, USA.

Johnson, S. L., Carver, C. S., & Gotlib, I. H. (2012). Elevated ambitions for fame among persons diagnosed with bipolar I disorder. Journal of Abnormal Psychology, 121(3), 602.

Kaan, D. (1998). Defining Risk and a Framework for Moving Towards Resilience In Agriculture. Risk and Resilience Agriculture Series.

Kroll, E. B., & Vogt, B. (2008). Attraction to Chance in Germany and Australia. An experimental study of cultural differences (No. 08006). Otto-von-Guericke University Magdeburg, Faculty of Economics and Management.

Lien, D. D., & Yu, C. F. J. (2014). Production and Hedging under Ambiguity: A Choquet Expected Utility Analysis. Available at SSRN 2476883.

Liu, E. M., & Huang, J. (2013). Risk preferences and pesticide use by cotton farmers in China. Journal of Development Economics, 103, 202-215.

Love, A., Magnan, N., & Colson, G. J. (2014). Male and Female Risk Preferences and Maize Technology Adoption in Kenya. In 2014 Annual Meeting, July 27-29, 2014, Minneapolis, Minnesota (No. 170241). Agricultural and Applied Economics Association.

Man, N. (2009). Factors affecting the decision making in off farm employment among paddy farmers in Kemasin Semerak. Pertanika Journal of Social Sciences & Humanities, 17(1), 7-15.

Mduma, J., and P. Wobst. 2005. Determinants of Rural Labor Market Participation in Tanzania. African Studies Quarterly 8(2)

Mishra, A. K., & Goodwin, B. K. (1997). Farm income variability and the supply of off-farm labor. American Journal of Agricultural Economics, 79(3), 880-887.

Musetescu R., Paun C., Brasoveanu I., & A., Draghici (2007): „Empirical evidence on riskn aversion for the Romanian capital market investors", Working paper no. 59

Nwankwo, U. M., & Wolfgang, B. (2008). The Effect of Information and Market Access on Adopters' Income Level. Income Stabilization in a Changing Agricultural World: policy and tools. Warsaw: Wies Jutra Limited, 140-157.

Pablo, A. L., Sitkin, S. B., & Jemison, D. B. (1996). Acquisition decision-making processes: The central role of risk. Journal of Management, 22(5), 723-746.

Pahlke, J., Strasser, S., & Vieider, F. M. (2015). Responsibility effects in decision making under risk. Journal of Risk and Uncertainty, 51(2), 125-146.

Patrick, G. F. (1998). Managing risk in agriculture. Midwest Plan Service.

Rahman, M. S. (2013). Socio-economic determinants of off-farm activity participation in Bangladesh. Russian Journal of Agricultural and Socio-Economic Sciences, 13(1).

Raimondi, V., Curzi, D., Bertoni, D., & Olper, A. (2013). Off-farm Labour Decision of Italian Farm Operators (No. 157120).

Reij, C., & Waters-Bayer, A. (2001). Farmer innovation in Africa: a source of inspiration for agricultural development. Earthscan.

Reynaud, A., & Couture, S. (2012). Stability of risk preference measures: results from a field experiment on French farmers. Theory and decision,73(2), 203-221.

Rosen, A. B., Tsai, J. S., & Downs, S. M. (2003). Variations in risk attitude across race, gender, and education. Medical Decision Making, 23(6), 511-517.

Senkondo, E. M. (2000). Risk attitude and risk perception in agroforestry decisions: The case of Babati, Tanzania. sn

Shehu, A., & Abubakar, N. (2015) Determinants of Participation of Farm Households in Non-Farm Enterprise Activities in Rural Nigeria. International Journal of Economics, Commerce and Management 3(6), 57-71.

Sulewski, P., & Kłoczko-Gajewska, A. (2014). Farmers' risk perception, risk aversion and strategies to cope with production risk: an empirical study from Poland. Studies in Agricultural Economics, 116(3), 140-147.

Tanaka, T., Camerer, C. F., & Nguyen, Q. (2010). Risk and time preferences: linking experimental and household survey data from Vietnam. The American Economic Review, 100(1), 557-571.

Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. Journal of Risk and uncertainty, 5(4), 297-323.

Zahonogo, P. (2011). Determinants of non-farm activities participation decisions of farm households in Burkina Faso. Journal of Development and Agricultural Economics, 3(3), 174-182.