AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

RAAE

Review of Agricultural and Applied Economics
Acta Oeconomica et Informatica
***ISSN 1336-9261, XXII* (Number 2, 2019): 106-111**
doi: 10.15414/raae.2019.22.02.106-111

REGULAR ARTICLE

FARMERS' RISK ATTITUDES, LOCATIONS AND DECISIONS TO ADOPT IMPROVED RICE VARIETIES IN OGUN STATE NIGERIA

Omotuyole Isiaka AMBALI

Address:
Olabisi Onabanjo University, College of Agricultural Sciences, Faculty of Agricultural Management and Rural Development, Department of Agricultural Economics and Farm Management, PMB 0012 Ayetoro, Ogun State, Nigeria.
E-mail: tuyoleambali@gmail.com

ABSTRACT

Farmers' willingness to taking risky decisions has important economic implications. However, while such attitudes have been previously examined, the relationship between farmers' risk attitudes and locations has not attracted research attention. This study examined the relationship between rice farmers' risk attitudes and locations, as well as the correlation between farmers' risk attitudes and past investment decisions (adoption of improved rice technology). The study utilized survey and experimental data collected across the four agricultural zones in Ogun State Nigeria. The data were descriptively analysed using frequency tables, histogram, principal component and correlation analyses. The results showed that most sampled farmers avoid taking risky prospects, with those located in the rural agricultural zones tend to avoid risk taking than their counterparts in other locations. More importantly, rice farmers' risk attitudes negatively correlated with adoption decisions. This correlation evidently confirmed spatial relationship in risk attitudes and farmers' pattern of adoption. Similar patterns of adoption and risk attitudes suggest spatial heterogeneity which have consequences on farmers' investment decisions, income and wealth accumulation.

Keywords: agricultural zones, investment decisions, rice farmers, risk attitudes
JEL: O1, O3, R1, R2

INTRODUCTION

Ability to take risky investment decisions may reflect in the income of farmers. This has multiplier effects on the economic development of a nation. Indeed, risk-taking individuals may have higher propensity to invest in economic activities that are associated with higher degree of risk and uncertainty but give higher economic returns. Specifically, decisions to adopt improved agricultural technology have been identified as important factor to improving farmers' income and livelihoods. In other words, investment decisions are often influenced by the attitudes of farmers toward risk taking.

The above assertion has been widely corroborated by many studies which conclude risk aversion negatively affect investment decisions especially adoption of improved agricultural technology (**Marra *et al.*, 2003; Liu, 2013; Barham *et al.*, 2014; Barham *et al.*, 2015).** No doubt, everyday life experience including decisions on the choices of food, children education, investment in productive economic activities, etc. are associated with risk and uncertainty. Since such decisions may have positive or negative economic consequences, it suggests the need to pay special research attention to the risk attitudes of farmers.

Much has been reported about the risk attitudes of farmers in the developing countries (**Harrison *et al.*, 2010; Brick *et al.* 2012**). However, the relationship between farmers' locations, risk attitudes and investment decisions has not received the desire attention in the literature. This study fills these gaps by examining the effects of farmers' locations in risky decision making and analyse the relationship between farmers' risk preferences and adoption of improved rice varieties as past investment experience. As earlier noted, rice farmers may show similar patterns of risk behaviour due to geographical proximity as well as the ecological conditions in the environment where they operate. Such behaviour may also be attributed to social interaction and interpersonal communication which are common phenomenon in rural areas. Therefore, this study extends knowledge on the potential correlation between experimental risk decisions and real life investment decisions.

Locations are important spatial variable that may be correlated with decision making with respect to experimental risk and real life economic investment. For instance, farmers may be spatially correlated on farm decisions with one another attributable to the presence or absence of social interaction, informal communication, as well as the existing climatic conditions in the area where they live. Like many individuals, rice farmers do rely on the information provided by their neighbours to make decisions that affect their daily activities including engagement or investment in new economic opportunities. However, while locations may be physically measured, risk attitudes are latent or intrinsic in nature. Therefore, the objective of this paper is to examine how rice farmers' risk attitudes correlate in space and with past investment decisions.

DATA AND METHODS

This section covers a brief description of the study area followed by the explanation on the nature of the risk experiment, the data collection method and the analytical methods applied.

The Study Locations

This study uses the experimental and survey data from Ogun State, Nigeria. The field work was carried out between March and May, 2016 across the four agricultural zones of Ogun State Agricultural Development Programme (OGADEP hereafter). These agricultural zones reflect the socio-economic and climatic conditions of farmers. For example, the northern part of Abeokuta zone is derived savannah vegetation while the southern part is rain forest. The Ilaro zone is derived savannah vegetation in the north and rain forest belt and mangrove swamp in the south. The Ilaro zone has the attributes of rural compared to Abeokuta zone. Ikenne is the closest zone to Abeokuta zone which it bounds in the west. The vegetation of this zone is mainly rain forest belt. The Ikene zone is also more rural relative to Abeokuta zone. Like Abeokuta zone, Ijebu-Ode zone combines both rural and urban features. The northern part is mainly rain forest belt while the southern part is mangrove swamp comprising vegetation. Given the above slight variation in the features of the Study Area, it is expected that rice farmers may behave differently across the four agricultural locations.

The Experiment

Advancement in the literature reveals risk attitudes' elicitation methods depend on nature and context. The readers are referred to **Charness et al. (2013)** for a comprehensive review on the risk preferences elicitation methods including the advantages and disadvantages. **Harrison and Rutstrom (2008)** equally summarized the different ways of eliciting individual risk attitudes.

The laboratory-based methods have been used mostly among the educated subjects who are computer literate and have good knowledge of information and communication technology (ICT). This study adapted the panel lotteries used by **García Gallego, *et al*, 2012** which was built on S**abater-Grande and Georgantzis (2002)** (SGG hereafter) but modified the nomenclatures to small gain one (SG1), small gain two (SG2), large gain one (LG1) and large gain two (LG2) because all the four treatments are in the gain domains. The original SGG lotteries were presented in the Spanish currency, peseta while all the follow-up studies presented their experiments in Euro (**Attanasi, *et al*., 2018)**. In this study, the experiment is conducted in Nigerian currency using 1 Euro to 225 Nigerian Naira as exchange rate. The reader is referred to a recent study which compares risk attitudes across elicitation methods: SGG, HL and self-reported. **Attanasi *et al.* (2018)** provides a distinction between SGG, HL (MPL) and self-reported risk elicitation methods. Supported with empirical evidences, they reported that subjects showing risk averse attitudes under the HL are equally averse to risk under SGG. However, subjects classified as risk neutral and risk loving under HL were risk averse under SGG.A significant positive correlation is also reported between the risk ordering under HL and SGG and between SGG and self-reported risk method.

The panel lotteries are summarized in Table 1. The probabilities vary across the rows in each panel. Rice farmers who avoid taking risky decisions are more likely to choose from the first few rows (top five options) while risk neutral and risk loving subjects may prefer payoffs that are closer to the bottom (last five rows). The term risk avoidance is used in place of risk aversion in this study because the parameter of the utility function is not estimated.

It follows that avoidance of zero earning and higher rewards indicates risk aversion. Only one of the panels in each treatment determines the earnings. However, this task was not incentivized due to high rewards involved and to prevent non-rice farmers from participating in the experiment.

As at the time of the experiment, the average rewards associated with the SG1 and SG2 are below the average minimum farm labour wage rate of 1,500 Naira. On the other hand, the rewards associated with the LG1 and LG2 are above the wage rate at that time. Both rewards (small and large) are presented to farmers to reflect their farm income and the reality of the economic situation in the study area. At times, farmers run at loss on their farm business. On another time they make profit at margin or at equilibrium. In addition, this variation in average rewards assists in the examination of the real risk attitudes of farmers as well as sensitivity to change in rewards (farm profit).

Data Collection Methods

Rice farmers were individually interviewed across 46 different locations (towns and villages). A total number of 329 rice farmers were drawn from the predominant rice growing areas in the four OGADEP zones with 328 fully completed questionnaires used for final analysis. The questionnaire composed of two main sections: risk experiment and the socio-economic characteristics of the respondents. The data collected on the adoption of high yielding rice varieties as past investment decisions as well as the experimental data are used in this study. The risk attitudes of rice farmers were elicited using the choice experiments described above.

The data collection was assisted by trained post-graduate students as enumerators. Before the field work, enumerators were illustrated with the record sheets which serve as guide in addition to the information on the use of the smart phone software (technology) called open data kit (ODK collect). The data were electronically recorded. Notwithstanding, the geographical point systems (GPS) of many locations were manually recorded due to poor or absence of mobile networks. Farmers were contacted at different locations including homes and farms. The risk experiment was conducted first, followed by questions on the socio-economic factors.

Experimental Instruction

After welcoming rice farmers with brief explanation on the importance of the survey, experiments and the potential impact of the study, instructions were read out to

individual farmers as follows. The experiment has four panels with ten options each, the winning prize or payoff in each panel is the amount of Naira shown under the heading "amount". The ten blue balls imply hundred per cent chances (sure) of winning while one blue ball represents ten per cent chance of winning a payoff. Conversely, the red balls imply loss. Subjects earn nothing if they do not win the lottery. Your earning would be determined by tossing a four-sided die. In other words, only one panel would be used for payment with any of the number 1, 2, 3 or 4 occurring from a toss of four-sided die determines the payment panel. For instance, if you choose option seven and one appears during die toss, you will win N563 if any of the balls 1, 2, 3 or 4 is drawn from the bag and nothing otherwise. Lastly, the record sheet was shown to farmers to make their choices. The explanation given for other treatments is similar to that of small gain one. Each subject is shown with a bag containing ten mixed blue and red balls which represent the winning and losing probability in the risk experiment. The experiment is not incentivized.

The data collected were analysed using frequency tables, histogram, principal component analysis and correlation analyses.

RESULTS AND DISCUSSION

This section presents the results of the findings starting from the socio-demographic characteristics of rice farmers. This is followed by farmers' risk attitudes. The correlation between risk attitudes and past investment decisions is presented last. The centroid as the starting point, an average distance of 5.91 km is covered in Ilaro agricultural zone and approximately 19 per cent of the sample came from this zone (Table 2). With reference to the centroid, the average distances covered in Abeokuta, Ikenne and Ijebu-ode zones are 20.46 km, 40.72 km and 126.30 km respectively. The proportion of these three zones to the total sample includes 28 per cent, 26 per cent and 27 per cent, respectively.

Rice Farmers' Risk Attitudes across Stakes

Average values are computed for each treatment due to high correlation between the risk attitudes obtained across panels. The distribution of rice farmers' risk attitudes with respect to average treatment (SG1, SG2, LG1 and LG2) are depicted in Figure 1. Note that the closer the probability to 1, the higher the tendency to avoid risk taking. The mean probability values are 0.79, 0.64, 0.73 and 0.59 respectively for SG1, SG2, LG1 and LG2 (median: 0.85, 0.65, 0.75 and 0.60, respectively) indicating rice farmers generally avoid risk taking when confronted with outcomes or lotteries with sure amount relative to when faced with the more risky lotteries. A sizeable proportion of farmers are highly willing to take risk when confronted with SG1 compared to SG2. More so, rice farmers are motivated to taking risky decisions when faced with large stake. The reason may be attributed to the fact that most subjects tend to favour less risky outcomes which are the main attribute of the SG1 and LG1 lotteries but motivated to taking risky decisions under SG2 and LG2 lotteries which have no sure outcomes. On the other hands, it reflects the sensitivity of subjects to risky outcomes as well as the size of stakes.

Table 1: Risk Panel Lotteries' Payoffs

Panel Lotteries for Four Treatments (currency in Nigerian naira)										
P	1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1
$X(SG1)$										
Panel 1	225	251	282	322	376	451	563	751	1,126	2,251
Panel 2	225	251	282	322	376	451	564	753	1,129	2,259
Panel 3	225	251	283	324	379	455	570	762	1,145	2,295
Panel 4	225	252	284	326	382	460	578	774	1,165	2,340
$X(SG2)$										
Panel 1	0	26	57	97	151	226	338	526	901	2,026
Panel 2	0	26	57	97	151	226	339	528	904	2,034
Panel 3	0	26	58	99	154	230	345	537	920	2,070
Panel 4	0	27	59	101	157	235	353	549	940	2,115
$X(LG1)$										
Panel 1	22,500	25,002	28,128	32,148	37,507	45,010	56,265	75,024	112,540	225,090
Panel 2	22,500	25,012	28,150	32,186	37,567	45,100	56,400	75,234	112,900	225,900
Panel 3	22,500	25,056	28,250	32,358	37,834	45,500	57,000	76,167	114,500	229,500
Panel 4	22,500	25,112	28,375	32,572	38,167	46,000	57,750	77,334	116,500	234,000
$X(LG2)$										
Panel 1	0	2,502	5,628	9,648	15,007	22,510	33,765	52,524	90,040	202,590
Panel 2	0	2,512	5,650	9,686	15,067	22,600	33,900	52,734	90,400	203,400
Panel 3	0	2,556	5,750	9,858	15,334	23,000	34,500	53,667	92,000	207,000
Panel 4	0	2,612	5,875	10,072	15,667	23,500	35,250	54,834	94,000	211,500

Source: Authors' Compilation (**Ambali, 2018**)

Table 2: Rice Farmers by Distance and Agricultural Zones

ADP Zones	Distance Mean	SD	Min	Max	Percentage of Total Sample
Ilaro	5.91	4.88	0	22.05	19
Abeokuta	20.46	7.25	9.71	58.32	28
Ikenne	40.72	9.76	33.44	65.26	26
Ijebu-Ode	126.30	17.46	105.47	143.83	27

Note: Distance is in km, SD = standard deviation, Min = minimum, Max = maximum
Source: Own data analysis, 2017

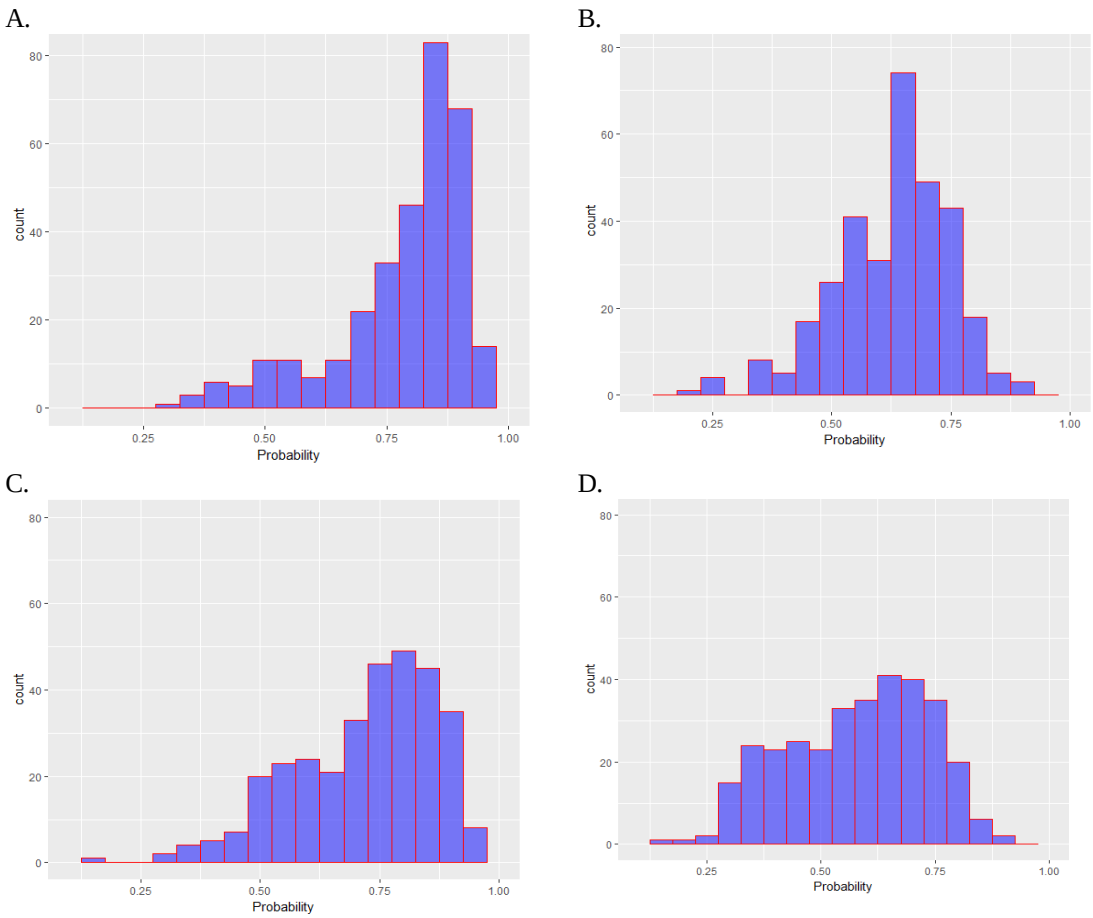

Figure 1: Distribution of Rice Farmers Showing Attitudes toward Risk Taking
Note: A, B, C and D represent SG1, SG2, LG1 and LG2, respectively. *The higher the probability, the less the willingness to risk taking. Willingness to risk taking is lower for SG1 than SG2. Willingness to risk taking is also lower for LG1 compared to LG2.
Source: Own data analysis **(Ambali, 2018)**

A slightly different pattern of risk attitudes is observed among the subjects in the developing country when compared to that reported by **García Gallego *et al.* (2012)** among subjects in a developed country. This variation may be attributed to three reasons. First, this study elicited the risk attitudes of farmers while the above study focuses on students. Thus, there is a difference in the educational level of the subjects which may have direct effect on individual behaviour. Second, the variation may be linked to the differences in age; on average, the students are younger than farmers. Lastly, the settings are different; this present study is conducted among farmers in developing countries.

Comparing across stakes, risk avoidance is higher in LG1 compared to SG1. Willingness to risk taking also increases for small relative to large stakes. These patterns of behaviour suggest that rice farmers risk attitudes move along the lottery stake and domains. Indeed, the fear of losing money may be a motivating factor for farmers to wanting to take risky decisions when faced with SG2 and LG2 lotteries which are more risky but less willing to take risk when faced with gain lotteries with sure outcome (less risky). Practically, rice farmers may be unwilling to adopt improved farm practices which offer higher but uncertain yield. Farmers are however likely to change their perceptions and preferences if they observe their

neighbours get more yield and income from growing improved rice varieties.

Rice Farmers' Locations and Risk Attitudes

The summary of the results of the component analysis relating to all the sixteen panels revealed that five components with Eigen values greater than one explain 57.9 per cent of the total variation in risk attitudes of the rice farmers (Table 3). The components are named after the treatments and panels they are more loaded. Component one refers to risk attitude towards SG1 because it explains greater proportions of panel 2 and panel 3 of this treatment, respectively. Component two explains larger percentage of the panel 3 and panel 4 of LG1, respectively. It therefore reflects risk attitude towards LG1. Component three explains higher percentage of the variation in panel 3 and panel 4 of LG2, respectively implying component three is loaded around attitude towards LG2. Furthermore, component four explains most of the variations in the SG2, panel 1 and panel 2 respectively. Thus component four can be referred to as risk attitude towards SG2. Lastly, component five explains higher proportion of the variation in SG2 of panel 3 and panel 4, respectively. Therefore, component five is called attraction to risk returns.

The principal components were summarized in line with agricultural zones to examine the relationship between farmers' locations and risk attitudes. Farmers in Ikenne and Ilaro zones are less willing to take risk with respect to SG1 and LG2 while those in Abeokuta and Ijebu-Ode zones show more willingness to risk taking. The additional advantage of the panel lotteries is the identification of the fifth component which captures attraction to risk, with some rice farmers attracted to risk taking in the SG2. Obviously, farmers in Ikenne zone are more attracted to the risk premium. In summary, rice farmers living in rural communities or agricultural zones are more averse to risk taking relative to those living in urban areas or agricultural zones.

Adoption Decisions and Risk Attitudes

In this study, farmers' risk attitudes are disaggregated across adoption groups to examine the correlation between farmers' past experience (adoption decisions) and risk attitudes (Table 4). The summary of the component analysis shows that non-adopters are less willing to take risky decisions relative to adopters with respect to SG1, SG2 (component two), LG1 and LG2. Note that the figures are compared across the column, thus higher component figures imply less willingness to risk taking or higher tendency to avoiding risk taking. This finding agrees with many empirical studies which conclude risk aversion behaviour has negative effects on investment decisions such as adoption of improved agricultural technology **(Marra, *et al.*, 2003; Barham, *et al.*, 2015)**. It specifically aligns with **Liu (2013)**, which examines ex-post adoption in China and conclude that risk averse farmers adopt Biotechnology (BT) cotton late.

CONCLUSIONS

This study examined the relationship between farmers' locations and risk attitudes, as well as the correlation between risk attitudes and farmers' past adoption decisions. The findings revealed that farmers behaved heterogeneously across locations while most sampled rice farmers avoid risk taking. Locations are important economic variables that determine the level of income and overall economic development. Most economic resources and developmental facilities, including infrastructural facilities, water, lands, schools, etc., are not usually equally or evenly distributed across locations. It follows that risk attitudes may be correlated with the availability or otherwise of these resources. In addition, locations will not only determine investment choices but also the level of income of individuals as well as the economic advancement of a nation. In most cases, farmers' locations are related with their decisions on crop production, harvesting methods, processing techniques, and distribution channels. Furthermore, rice farmers located in the more rural areas out of the four agricultural zones showed less willingness to risk taking. More revealing is the fact that rice farmers' risk attitudes are strongly related with their past investment decisions (adoption of improved rice varieties).

Table 3: Agricultural Zones and Rice Farmers' Risk Attitudes

Zones	SG1	LG1	LG2	SG2	Attraction to risk premium (SG2)
Abeokuta	-0.3786	-0.1041	-0.3813	0.07606	-0.2731
Ilaro	0.0033	0.5490	0.2796	0.3864	0.0055
Ikenne	0.2983	0.08805	0.3545	0.05066	0.1718
Ijebu-Ode	0.08995	-0.3736	-0.1607	-0.4045	0.1055

Note: Non-parametric Kruskal Wallis tests: The null hypotheses of same distribution across the four agricultural zones are rejected at 0.001. The figures are the summary of principal component analysis
Source: Own data analysis **(Ambali, 2018)**

Table 4: Correlation between Risk Attitudes and Adoption Decisions

	SG1	SG2_Comp1	SG2_Comp2	LG1	LG2
Non-adopters	0.0781	-0.0070	0.0489	0.0199	0.0313
Adopters	-0.7758	0.0698	-0.4859	-0.1984	-0.3106

Source: Own data analysis, 2018

Two main policy implications emanate from this study. First, rural areas should be adequately advanced with infrastructural facilities that would improve farmers' socio-economic conditions. At the micro-economic level, decisions are made especially with respect to production and distribution. Thus, infrastructural facilities will not only aid investment decisions, but also increase farmers' income and livelihood. Second, risk attitudes of individual farmers should be given specific attention in policy making because of the direct effects they have on the ability to make investment decisions. In short, risk aversion behaviour affects farmers' income and subsequently economic development. Further research should seek to investigate and identify factors that may explain the relationship between risk attitudes, locations and investment decisions of farmers in the developing countries.

Acknowledgement

The author appreciates the financial support by the Tertiary Education Trust Fund of Nigeria (TETFUND). The author equally thanks Professor Nikolaos Georgantzis and Dr. Francisco Jose Areal of the University of Reading for providing supervisory support to his PhD thesis from which this article is extracted.

REFERENCES

ATTANASI, G., GEORGANTZÍS, N., ROTONDI, V., & VIGANI, D. (2018). Lottery-and survey-based risk attitudes linked through a multichoice elicitation task. *Theory and Decision*, 84 (2018): 341–372. DOI: https://doi.org/10.1007/s11238-017-9613-0

AMBALI, O. I. (2018). Spatial Dependence in Decision Making: Implications for Improved Rice Technology Adoption Decisions in Nigeria, PhD Thesis, Department of Agricultural and Food Economics, University of Reading, United Kingdom.

BARHAM, B. L., CHAVAS, J. P., FITZ, D., RÍOS-SALAS, V., & SCHECHTER, L. (2015). Risk, learning, and technology adoption. *Agricultural Economics*, 46 (1): 11-24. DOI: https://doi.org/10.1111/agec.12123

BARHAM, B. L., CHAVAS, J.P., FITZ, D., SALAS, V. R., & SCHECHTER, L. (2014). The roles of risk and ambiguity in technology adoption. *Journal of Economic Behavior and Organization*, 97 (2014): 204-218. DOI: https://doi.org/10.1016/j.jebo.2013.06.014

BRICK, K., VISSER, M., & BURNS, J. (2012). Risk aversion: experimental evidence from South African fishing communities. *American Journal of Agricultural Economics*, 94 (1): 133-152. DOI: https://doi.org/10.1093/ajae/aar120

CHARNESS, G., GNEEZY, U., & IMAS, A. (2013). Experimental methods: Eliciting risk preferences. *Journal of Economic Behavior and Organization*, 87 (2013): 43-51. DOI: https://doi.org/10.1016/j.jebo.2012.12.023.

GARCÍA GALLEGO, A., GEORGANTZÍS, N. JARAMILLO-GUTIÉRREZ, A., & PARRAVANO, M. (2012). The lottery-panel task for bi-dimensional parameter-free elicitation of risk attitudes. *Revista Internacional de Sociología (RIS), Special Issue on Behavioral and Experimental Economics*, 70 (1): 53-72. DOI: http://repositori.uji.es/xmlui/handle/10234/62219.

HARRISON, G. W., HUMPHREY, S. J., & VERSCHOOR, A. (2010). Choice under Uncertainty: Evidence from Ethiopia, India and Uganda. *The Economic Journal*, 120 (2010): 80-104. DOI: https://doi.org/10.1111/j.1468-0297.2009.02303.x

HARRISON, G. W., & RUTSTROM, E. E. (2008). Risk Aversion in the Laboratory: Risk Aversion in Experiments. *Research in Experimental Economics*, 12 (2008): 41-196. DOI: https://doi.org/10.1016/S0193-2306(08)00003-3.

LIU, E. M. (2013). Time to change what to sow: Risk preferences and technology adoption decisions of cotton farmers in China. *Review of Economics and Statistics*, 95 (4): 1386-1403. DOI: https://doi.org/10.1162/REST_a_00295.

MARRA, M., PANNELL, D. J., & GHADIM, A. K. A. (2003). The economics of risk, uncertainty and learning in the adoption of new agricultural technologies: where are we on the learning curve? *Agricultural Systems*, 75 (2-3): 215-234. DOI: https://doi.org/10.1016/S0308-521X(02)00066-5

SABATER-GRANDE, G., & GEORGANTZIS, N. (2002). Accounting for risk aversion in repeated prisoners' dilemma games: An experimental test. *Journal of Economic Behavior and Organization*, 48 (1): 37-50. DOI: https://doi.org/10.1016/S0167-2681(01)00223-2.