

## Evaluation of Risk Attitude among Small Scale Soybean Farmers in Kaduna State, Nigeria

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**Keyword:** Risk attitude, soybean farmers, Safety first model of risk aversion, Tobit regression.

### Abstract

This research investigated the analysis of risk attitude among small scale soybean farmers in Kaduna State, Nigeria, with the aim of classify risk attitude and generating reliable information on the determinants of risk attitude of the decision-making behaviour of soybean farmers. Multi-stage sampling techniques were employed in selection of 210 soybean farmers. Safety first model of risk aversion and Tobit regression model were used to analysis risk attitude and factors influencing risk attitude of soybean farmers respectively. Some of the important findings from research are: the results showed that risk aversion centred on (1.33). This implies that soybean farmers in Kaduna State were risk preferring (that is high risk). Also, results obtained show that 1.43%, 20.95% and 77.62% of soybean farmers were low, medium and high risk attitude, respectively. The results of determinants of risk attitude revealed that among soybean farmers in Kaduna State, the variables that were significant include year of experience in soybean production at  $p < 0.01$ , major occupation at  $p < 0.1$ , cooperative society at  $p < 0.05$ , off-farm activities at  $p < 0.1$  and technical efficiency at  $p < 0.05$ . The implication of these findings revealed that these major determinants had great impact on the risk attitude among soybean farmers in the study area. Also, technical efficiency is one of determinants of risk attitude in the study area. The study concluded that the majority of soybean farmers are risk preferring and soybean is an important cash crop in the study area. The

study recommended among others that soybean farmers in the study area should create better marketing information systems for efficient input procurement and output disposal.

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## Introduction

Soybean (*Glycine max (L) Merril*) is one of the most valuable crops in the world due to its multiple uses as a source of livestock and aquaculture feed, protein and vegetable oil for human diet and bio-fuel. According to United State Agency International Development (USAID), (2016) Nigeria is the second-largest producer of soybean in sub-Saharan Africa, with a production of 679, 000 MT in 2014. Soybean is mainly produced in the northern parts of Nigeria, with the North Central and North West zone accounting for approximately 97% of production. The major producing States are Benue, Kaduna, Kano, Taraba and Nassarawa (USAID, 2016). The crop can be successfully grown in many States in Nigeria using low level of agricultural inputs utilization. Its cultivation in Nigeria has expanded as a result of its nutritive and economic importance and diverse domestic usage. It is also a prime source of vegetable oil for the international market. Soybean has an average protein content of 40%, more protein-rich, and a good balance of amino acid than many of the common vegetable or animal food sources found in Nigeria. Soybean seeds also contain about 20% oil on a dry matter basis, 85% unsaturated and it is cholesterol free. Soybean is good for food such as soy-milk, soy-cheeses, *daddawa*, and infant weaning food. It has therefore, tremendous potential to improve the nutritional status and welfare of resource-poor people particularly in developing countries like Nigeria. Soybean can also contribute to enhance sustainability of intensified cropping system by improving soil fertility through nitrogen fixation, permitting a longer duration of ground cover in the cropping sequence, and providing useful crop residues for feeding livestock, the haulms provide good feed for sheep and goat and control the parasitic weed (*Striga hermonthica*) as observed by International Institute of Tropical Agriculture (IITA), (2009).

Agricultural production is subject to great many uncertainties. Yet more people in Nigeria earn their livelihood from this sector than from all other sectors put together. In rural Nigeria, households that depend on income from agriculture (either self-employed or as agricultural labour) accounted for nearly 70% of population (Jirgi, 2013). Any farm production decision is typically associated with multiple potential outcomes with different probabilities. Weather, market developments and other events cannot be controlled by the farmer but have a direct incidence on the returns from farming (RERAD, 2010). Also, farming is a financially risky occupation. On a daily basis, farmers are confronted with an ever-changing landscape of possible prices,

yields, and other outcomes that affect their financial returns and overall welfare. The consequences of decisions or events are often not known with certainty until long after those decisions or events occur, so outcome may be better or worse than expected (Olarinde, Manyong, and Akintola, 2010). Most investors prefer to invest their capital in other industrial enterprises rather than agriculture. The result is that there is a slow growth in agricultural output, a growth not even sufficient to maintain the increase in population. The reason for this unwillingness to invest in agriculture can be found in the risks and uncertainties which surround agricultural production. Most agricultural decisions are taken in the environment of risk and uncertainties. Farmers have to take decisions now which will affect their production later. The greatest problems facing farmers, whether new or old are those of risks and uncertainties (Akinola, 2014).

Although definitions of risk vary within the literature, in agriculture, risk is uncertainty that affects an individual's welfare, and is often associated with adversity and loss (Olarinde, *et. al.*, 2010). Risk is also uncertainty that "matter" and may involve the probability of losing money, possible harm to human health, repercussions that affect resources (irrigation, credit), and other types of events that of a person's welfare (RERAD, 2010). Risk as defined by Salman, (2011) is a condition in which the results of any decision or course of action are not definitely known but will probably fall within a known range. Risk is a situation where each action leads to one of a set of possible outcomes, each outcome occurring with a known probability (Debertin, 2012). It is a measure of the effect of uncertainty in the decision maker. It also refers to variabilities or outcomes, which are measurable in an empirical or quantitative manner (Effiong, Enyenihi and George, 2014). Based on literatures reviewed, a lot of researches have been conducted in the area of agronomic practices of soybean production but not much has been done in the aspect of econometric estimation of the crop in term of risk attitude. Hence, this study is designed in an attempt to fill the research gap.

### **Problem Statement:**

Nigeria's domestic production of soybean is trending upwards, but still lags behind the rapidly growing demand from the poultry industry for soybean meal and vegetable oil processors because of low yield, poor agronomic and post-harvest practices. However, soybean demand is projected to increase to 2.3 million MT by 2020, because of a steady increase in poultry sector consumption. Nigeria's installed annual soybean crushing capacity is estimated at approximately 600,000 MT. An estimated 255, 000 tons of soybeans were crushed in 2010/2011 production season, representing only 42 percent of installed processing capacity. There is a domestic annual shortfall of about 100, 000 tons for soybean meal and 300, 000 tons for vegetable oil (USIDA, 2016).

Smallholder farmers face many risks in their farming activities, depending on their ability to absorb risk and their psychological attitudes towards risk, the risk inherent in a new technology or input choice will affect farmers differently (Knight, Weir, and Woldehanna, 2003). Dercon and Christiaensen (2011) explicitly showed that Ethiopian farmers are constrained in technology adoption by risk. Furthermore, Boucher, Carter and Guirkingner (2008) argued theoretically that a class of farmers is risk rationed in Peru; that is, due to risk, some farmers will not try to access the formal credit market, even if it would raise their productivity and income levels. Overcoming such barriers to risk, then, could help farmers in developing countries improve their livelihoods along several dimensions. Hardaker, Huirne and Anderson (2004) define risk as uncertainty or imperfect knowledge with exposure to unfavourable consequences. To take a risk is to allow for the possibility of loss or failure in achieving one's desired objectives. In agriculture, uncertainties about yields and prices that have direct bearing on farm productivity and profitability constitute the most significant sources of risk for farmers. The farmers' attitudes to risk, then, largely determine how they act on perceived opportunities and challenges in the field. In line with this, farmers' attitudes to risk have long been studied for their relevance to on and off-farm decision making. Attitude to risk may greatly vary among individuals, but it has been asserted in the literature that farmers' preference or aversion to risk directly impacts on what is done in the field and how post-production and marketing operations are executed (Domingo, 2015).

Thus, although the topic of risk has received attention in recent times but mostly on sources and management, this research was focused on risk attitude and its determinants. It is therefore a topic that deserves serious attention and research. Hence, there is a need to study the risk attitude of the farmers in order to establish their decision-making behaviour. It is for this reason that this research is being designed to address the following research questions:-

- What are the individual risk attitudes of soybean farmers?
- What are the factors influencing the farmers' attitude towards the risk associated with soybean production?

#### Objectives of the Study:

The broad objective of this study is to estimate the risk attitude among soybean farmers in Kaduna State, Nigeria.

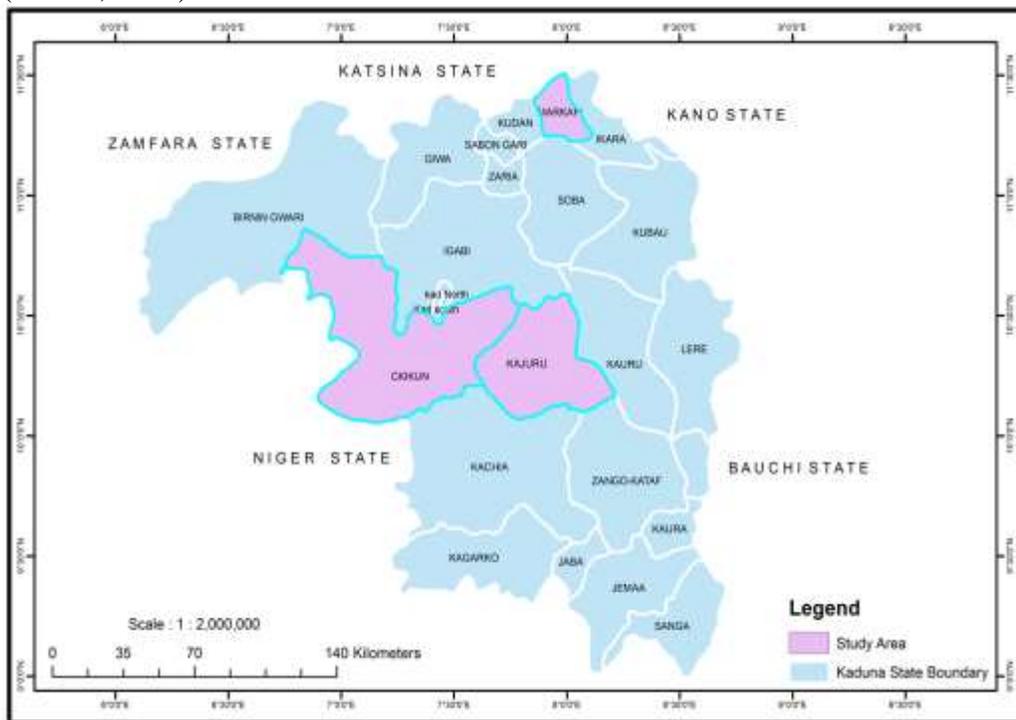
The specific objectives were to:

- i. examine the types of risk attitude among soybean farmers;
- ii. determine the factors influencing risk attitude among soybean farmers

**METHODOLOGY**

**The Study Area**

Kaduna State is located at the centre of Northern Guinea savannah. It lies between latitudes  $9^{\circ}10' - 11^{\circ}30'$  north and longitude  $6^{\circ} - 9^{\circ}10'$  east. It has a total area of about 67,000 square kilometres (KADP, 2007) with a population of 6,066,562 people comprising of 3, 112, 028 males and 2, 954, 534 females, the estimated population of Kaduna State as at 2015 would be 8, 252, 366 people with annual population change 2006-2015(+1.4% per year) (NPC 2016). The total arable land of the state is estimated to be about 2,148,700 hectares. There are two distinct climatic seasons in the State, namely wet and dry seasons. The wet season spans the period between April/May to September/October while the dry season spans the period between October/November to March/April. The average annual rainfall in the State is about 1,482.99mm. The highest mean temperature occurs between the month of March to May and the range is between  $35^{\circ}\text{C}$  to  $36^{\circ}\text{C}$ . The minimum air temperature is usually recorded during the harmattan period which occurs between November to February with the range between  $18^{\circ}\text{C}$  to  $23^{\circ}\text{C}$ . The total annual evapo- transpiration rate varies from 1.560mm in the north to 1.490mm in the south (KADP, 2007). The State shares boundaries with Niger State to the west, Zamfara, Katsina and Kano States to the north, Bauchi and Plateau States to the east and FCT Abuja and Nassarawa State to the south. The State consists of 23 local government areas as shown Figure 3. Agriculture is the main stay of the economy of Kaduna State with about 80% of the people actively engaged in farming (KADP, 2007).



**Figure 1: Map of Kaduna State Showing the Study Area.**

**Sampling Techniques:** Sampling of soybean farmers was based on the list of registered soybean farmers provided by KADP in Kaduna State.

Multistage sampling technique was employed. The first stage involved a purposive selection of three LGAs each from Kaduna State on the basis of their high concentration of soybean farmers. Chikun, Makarfi and Kajuru LGAs were chosen from Kaduna State. In the second stage, soybean farmers were stratified into small scale on the basis of hectarage sizes, convenient and appropriate strata since there is more homogeneity in method of farming, cultural practices, overall outlook of farmers and other characteristics within small scale farmers. The third stage involved a simple random selection of 20% of each stratified small scale soybean farmers by the use of random digits (numbers). This was done in order to reduce the cost of data collection. The breakdown of sample selection showed that 73 soybean farmers from Kajuru LGA, 67 soybean farmers from Chikun LGA, and 70 soybean farmers from Makarfi LGA in Kaduna State. Hence, the sample for the study was two hundred and ten (210) heads of soybean farm families ( $n = 210$ ). The breakdown of sample procedure is given in Table 1.

**Table 1: Summary of Sample Selection**

State	LGA	Number of registered soybean farmer	Stratified Small scale soybean farmer	Selected soybean farmers (20%)
Kaduna	Kajuru	3,963	363	73
	Chikun	2,012	334	67
	Makarfi	2,655	348	70
Total	<b>3</b>	<b>8,630</b>	<b>1,045</b>	<b>210</b>

**Methods of Data Collection:** The data for the study were collected from primary sources. The data were collected using structured questionnaire with the help of trained enumerators.

**Tools of Analysis:** The analytical tools used in achieving the objectives of the study were Safety first principles of risk attitude and Tobit regression model.

**Safety first principles of risk attitude:** The level of farmers' risk aversion (objective i) was determined by following (Moscardi and de Janvry, 1977) econometric approach. As far as the measurement of risk attitudes is concerned, the safety first approach seems appropriate for describing the behaviour of low income farmers due to the stark reality of the 'disaster' level (Moscardi and de Janvry, 1977). After the

determination of the technical efficiency, the risk aversion was then introduced in the model of production function cited earlier as a safety-first rule. According to this rule, an important motivating force of the decision maker in managing the productive resources that he controls and, in particular, in choosing among technological options is security of generating returns large enough to cover subsistence needs. Assuming that the safety-first rule holds, the degree of risk aversion manifested by individual small-holder farmers can be derived from observed behaviour (Moscardi and de Janvry, 1977). Given a production technology, the risk associated with production and market conditions, the observed level of factor use reveals the underlying degree of risk aversion. The most significant variable will be selected. The most determinant (in term of direct variables) of the soybean yield was then singled out. Assume that the randomness of the net income that a farmer derives from yield uncertainty and assume also that from the relationship between input vector (X) and (Y) as represented by model of the production function, the coefficient of variation (CV) of yield is:

$$\theta = \frac{\delta_Y}{\mu_Y} \dots\dots\dots (1)$$

Where;

- $\theta$  = coefficient of variation of yield;
- $\delta_Y$  = standard deviation of yield;
- $\mu_Y$  = mean yield;

And given input price ( $P_{xi}$ ) and a given product price ( $P_{yi}$ ), the preference order can be maximized with respect to input levels. The resulting first order conditions are:

$$P_y f_i \frac{\mu_y}{X_i} = \frac{P_{xi}}{1 - \theta K_{(s)}} \dots\dots\dots (2)$$

Where;

- $P_{xi}$  = input price (₦)/Kg;
- $X_i$  = input vector (most significant input);
- $P_{yi}$  = output price in (₦)/ha;
- $f_i$  = elasticity of production of the ith input;
- $K_{(s)}$  = risk aversion parameter;
- $\theta$  = coefficient of variation;
- $\mu_Y$  = mean yield.

The value of the risk aversion parameter was deduced from observed levels of product and inputs by solving equation (2) as follows:

$$K_{(s)} = \frac{1}{\theta} \left[ 1 - \frac{P_{xi}}{P_y f_i \mu_y} \right] \dots\dots\dots (3)$$

Equation (3) provides a measure of risk aversion  $K_{(s)}$  that was derived from each farmer’s knowledge of production function, the coefficient of variation, product and input prices and observed levels of input use. Following Moscardi and deJanvry (1977), the risk aversion parameter  $K_{(s)}$  was used to classify farmers into three (3) distinct groups:

- Risk averter/avoider (low risk averse)-  $(0 < K_{(s)} < 0.4)$ ;
- Risk neutral (intermediate risk averse) –  $(0.4 < K_{(s)} \leq 1.2)$ ;
- Risk preferring (high risk averse) -  $(1.2 \leq K_{(s)} \leq 2.0)$ .

**Tobit regression model:** To determine factors influencing risk aversion among soybean farmers (objective ii), also, the Tobit model was applied with risk aversion level as a dependent variable and fifteen independent variables; age, education, experience, household size, farm size, major occupation, sex, marital status, cooperative society, off-farm activities, access to credit, technical efficiency, allocative efficiency, economic efficiency and location were used. The adopted Tobit model combines the properties of multiple regression and Probit/Logit model. In this study, it captures the intrinsic risk decision of the sampled soybean farmers (whether or not the farmer is attitudinally lowly or highly averse to risk). More importantly, it simultaneously considers the degree or extent of risk aversion (Olarindeet *al.*, 2010). This dual purpose of the Tobit model necessitated its choice for this aspect of the analysis.

The Tobit model can be specified as:

$$K_i = \lambda_0 + \lambda_1 V_{1i} + \lambda_2 V_{2i} + \lambda_3 V_{3i} + \lambda_4 V_{4i} + \lambda_5 V_{5i} + \dots\dots\dots + \lambda_{15} V_{15i} \dots\dots\dots (4)$$

Where;

- $K_i$  = Risk aversion level (Range number);
- $V_{1i}$  = Age of soybean farmers (Year);
- $V_{2i}$  = Level of education (Point scale);
- $V_{3i}$  = Years of experience (Year);
- $V_{4i}$  = Household size (Unit number);
- $V_{5i}$  = Farm size (Hectare);
- $V_{6i}$  = Major occupation (Point scale);
- $V_{7i}$  = Sex (Dummy variable);
- $V_{8i}$  = Marital status (Dummy variable);
- $V_{9i}$  = cooperative society membership (Dummy variable);
- $V_{10i}$  = Off-farm activities (Dummy variable);
- $V_{11i}$  = Access to credit (Dummy variable);

- $V_{12i}$  = Technical efficiency (Range between 0-1);
- $V_{13i}$  = Allocative efficiency (Range between 1- $\infty$ );
- $V_{14i}$  = Economic efficiency (Range between 0- $\infty$ ); and
- $V_{15i}$  = Location (Dummy variable).

## RESULTS AND DISCUSSION

### Measurement and Categorization of Soybean Farmers’ Risk Attitudes

Farmers’ preference or attitude towards risk explains many observed economic decisions. Therefore, knowledge of farmers’ attitude towards risk has important implications for the adoption of new farm technologies and the success of rural development programme (Akinola, 2014). Following the procedure outlined in the methodology, (that is, equation 1 to 3) the soybean farmers were categorized into risk attitude groups. Seed ( $X_1$ ) was found to be most important input affecting soybean production in Kaduna State. Based on the procedure of equation (3), a risk-aversion parameter,  $K$  for each soybean farmer was estimated and used to classify soybean farmers into these risk-aversion groups. The results show that risk aversion centred on  $K = 1.33$ . This implies that soybean farmers in Kaduna State are risk preferring- high risk (that is  $1.2 < K < 2.0$ ). Also, results obtained show that 1.43%, 20.95% and 77.62% of soybean farmers in Kaduna State were low, medium and high risk attitude, respectively (Table 2). This is consistent with the conclusion of Akinola, (2014) that many farmers are not low risk averse as been assumed in literature. This result corroborates the inferences of Ayinde *et al.*, (2008) that many farmers are risk preferring or seeking.

**Table 2 : Categorization of Soybean Farmers by Risk Attitude group**

Risk aversion group	(K= 1.33)	
	Frequency	Percent
Low risk ( $0 < K < 0.4$ )	3	1.43
Medium risk ( $0.4 \leq K \leq 1.2$ )	44	20.95
High risk ( $1.2 \leq K \leq 2$ )	163	77.62
Total	210	100.0

### Determinants of Risk Attitude among Soybean Farmers

In order to determine the effect of risk attitude to production efficiency and some important socioeconomic variables on soybean farmers in Kaduna State, a Tobit regression analysis was run. The Tobit regression (Table 3) for the three results show that the estimates of sigma ( $\sigma$ ) are different from zero, indicating good fit and correctness of the distributional assumption specified. The log likelihood functions for the three results are also fairly high. The log likelihood value can be used to compare

the goodness of fit for different models, its value here, in combination with the high significant of the estimates of the sigma ( $\sigma$ ) indicates that at  $p < 0.01$  significant level, the combined socio-economic characteristics and farm production efficiency prove that the relative differences in the risk attitudes of the three results are as a result of the differences in the degree or extent of risk aversion resulting from the differences in the individual effects of the hypothesized independent variables. These results imply that the specific characteristics and production efficiency are actually important in identifying different categories of farmers based on their risk attitudes in the study area as shown in the Table 3.

**Table 3: Factors Influencing Risk attitude with Production Efficiency**

Variables	Coefficient	t-ratio
Constant	-1.5747	-1.27
Age (Year)	0.0047	0.28
Education (Level)	0.0865	0.94
Experience (Year)	1.1515	45.82***
Household size (Number)	-0.0134	-0.59
Farm size (ha)	-0.0164	-0.09
Major occupation	0.3907	1.87*
Sex	-0.1583	-0.27
Marital status	-0.1583	-0.27
Cooperative society	0.5283	2.52**
Off-farm activities	-0.4108	-1.76*
Access to credit	0.3022	1.12
Technical efficiency	-0.0199	-2.63**
Allocative efficiency	0.0157	0.34
Economic efficiency	-0.0007	-0.18
Location	-	-
Log likelihood function	970.1347	
Sigma	1.1367	

**Note:** \*\*\*, \*\* and \* indicate statistical significant at the  $p < 0.01$ ,  $p < 0.05$  and  $p < 0.1$  level respectively.

The Tobit regression result in Table 3 reveals that age, level of education, experience, major occupation, membership of cooperative society, access to credit, and allocative efficiency were the variables with a positive sign while household size, farm size, sex, marital status, off-farm activities, technical efficiency and economic efficiency were the variables with a negative sign among the soybean farmers in Kaduna State.

The positive sign implies that the variable has a direct influence on risk attitude of the soybean farmers meaning that increase in these variables lead to increase in risk aversion of the soybean farmers while the negative sign indicates that variable has an inverse relationship on risk attitude of the soybean farmers meaning that increase in these variables lead to decline in risk attitude of the soybean farmers. The coefficients of most of the explanatory variables have the expected signs. The negative expected sign on each of the variables implies that risk preferring farmers tend to take more risk as the magnitude of the variables becomes pronounced. Also, the positive expected sign on each of the variables implies that risk preferring farmers tend to risk averse as the magnitude of the variables becomes pronounced.

Age: With respect to age, it is assumed *ceteri paribus* that older farmers tend to be less inclined to take risk than young ones. While some studies have found that risk aversion increases with age (Effiong *et al.*, 2014), others have not found a significant effect for this (Akinola, 2014). In the results of Kaduna State age is positive. This implies that the higher the age of the farmer, the less risk averse he will be. This supports the findings of Jirgi, (2013) and Haneishiet *al.*, (2014) who found out that older people having dealt much more in risky economic game at high stakes might be more willing to take risks at high levels than young people. Age may also be indexing for the wealth status of the household and accumulation of social capital. Older farmers are more likely to have accumulated more wealth than younger farmers. Moreover older farmers are more likely to have greater social capital and networks, which serve as some form of traditional insurance or fall-back strategies in the process of decision making.

Education: Table 3 shows that level of education which is a proxy for human capital development was found to have a positive but not significant among soybean farmers in Kaduna State. The result conforms to the *a priori* expectation that the more educated farmers will be more willing to bear risk than the less educated ones. This is in line with the findings of Olarineet *al.*, (2010) who reported that at low game levels, education variable had little influence on risk aversion, but at higher game levels, it generally reduce the level of risk aversion and was often statistically significant. The result also agrees with finding of Effiong *et al.*, (2014) whose findings show that schooling had a positive impact on the risk taking.

Farming experience: This is statistically significant at  $p < 0.01$  level and positively signed for soybean farmers in Kaduna State. It shows that a unit in the years of farming experience will lead to an increase in the reduction of risk on output of farmers by 1.1515. Effiong *et al.*, (2014) observed that the longer the years of farming experience, the more efficient the farmer becomes because the number of years a farmer has spent in the farming business may clearly give an indication of the practical knowledge he has acquired. This is an advantage to reduce farming risk which will help to boost production in any pre-determined period in farming business.

Household size: It was negatively related to risk attitudes and non-significant in Kaduna State. There are two opposing interpretations as to the nature of the relationship between household size and risk attitude. The larger the household size, the greater will be the total consumption needs of the farm family and thus, the less willingness to bear risk. However, to the extent that larger household and thereby enhances its income generating potential, the effect of a large household size on risk attitude may be neutralised. The negative signed among soybean farmers in Kaduna State, indicating decrease in risk attitude.

Farm size: It was negatively related to risk attitudes in three results but it did not significantly influence risk aversion in Kaduna State. This implies that the farm size had indirect influence on risk attitude among the soybean farmers in the study area suggesting that increase in this variable lead to decrease in risk aversion.

Major occupation: It had a coefficient of 0.3907 and significant at  $p < 0.1$  for soybean farmers in Kaduna State This implies that a unit increase in primary occupation will lead to an increase in the reduction of the risk on output by 0.3907 among soybean farmers in Kaduna State. However, this shows that due to specification in farming, it will help boost output which in turn will help to reduce risk in production. This is consistent with the results of Effiong *et al.*, (2014)

Sex: In this study, sex was found to be inversely related to risk attitudes and it is not significant. This implies that the higher the gender of the soybean farmers, the less risk averse he will be. This result agrees with the findings of Effiong *et al.*, (2014).

Marital status: This was not significant but it is negatively signed with coefficient of -0.1583 for soybean farmers in Kaduna State. This however implies that a unit increase in the marital status for soybean will result in decrease in the reduction of risk on output by 0.1583. This result agrees with the findings of Effiong *et al.*, (2014).

Membership of farming group: It was equally found to be a significant determinant of risk attitudes. This variable is expected to have positive impact on the risk bearing ability of farmers because it enhances farmers' access to credit, other production inputs such as fertilizer, agrochemicals and improved seed as well as reduces production cost. The result here shows that membership of a farming group had a positive relationship with risk attitude coefficient in Kaduna State and statistically significant at  $p < 0.05$  level among soybean farmer in Kaduna State, implying that members exhibit more risk preferring behaviour than non-members. In Nigeria, the cooperative societies and farmer groups are not well organised such that farmers can transfer their individual risks to them. They are not well recognised by the government. Under these conditions the farmers' risk-bearing ability in these groups is further threatened.

Off-farm activities: This was significant at  $p < 0.1$  level and carried a negative regression of -0.4108. This implies that a unit increase in off-farm activities of the soybean farmers would lead to decrease in the reduction of risk on the output. The

negative correlation between risk attitude and non-farm employment suggest that soybean farmers reallocate time away from farm related activities such as adoption of new technology and gathering of technical information that is essential for enhancing risk attitude. This confirms with *a priori* expectation that non-farm activities supplements the farmers to meet annual farm income and subsistence needs hence if it decreases, risk attitudes will increase because subsistence need may be at risk. Having off-farming activities was found to reduce risk aversion, a result also found by Ayinde (2008) and Amaefulaet *al.*, (2012).

Technical efficiency: It was negatively related to risk attitude and significant at  $p < 0.05$  level for the soybean farmers in Kaduna State. This implies that holding all other factors constant, the risk aversion coefficient is expected to be reduced by -0.02% among the soybean farmers in Kaduna State. Thus, the higher the TE level, the lower risk aversion they will be. Dhunganaet *al.*, (2004) reported that risk aversion was positively related to technical efficiency. The reason of not consistent with the findings Dhunganaet *al.*, (2004) is that their risk attitude centred around low risk (that is, risk averse) but this result centred on risk preferring.

Allocative efficiency: It was positively related to risk aversion and non significant for soybean farmers. This implies that as allocative efficiency increase, the risk aversion increases. This finding is not consistent with that of Dhunganaet *al.*, (2004) who reported that risk aversion was negatively related to allocative efficiency.

Economic efficiency: It was negatively related to risk attitude and non significant for the soybean farmers in Kaduna and Kano States. This is in line with the findings of Dhunganaet *al.*, (2004) who reported that risk aversion was negatively related to economic efficiency.

Location: It was negatively related to risk attitude and statistically significant at  $p < 0.05$  level among soybean farmers in the study area. This implies that holding all other factors constant, the risk aversion coefficient is expected to be reduced by -0.0101%. Thus the higher the location, the lower risk averse they will be.

## Conclusion

This study has empirically examined the econometric estimation of attitude towards risk among small scale soybean farmers in Kaduna State. The following conclusions were drawn based on the major findings of the study. It is evident from the findings that small scale soybean farmers' exhibit high risk attitude and not all are low-risk averse as been assumed in literature. Socioeconomic and production efficiency (technical efficiency, allocative efficiency and economic efficiency) variables had significant impact on risk attitude in the study area.

## Recommendations

The following recommendations are made based on the major findings of this study. The recommendations are aimed at addressing the issues discussed on farm risk attitudes and factors affecting risk attitudes among the soybean farmers in Kaduna State.

- i. The knowledge concerning the risk attitude of farmers, important sources of risk and management strategies should serve as a guide to formulating and implementing insurance and agricultural development policies that will improve the agricultural sector.
- ii. Nigerian Agricultural Insurance cooperation (NAIC) should be made more functional to assist the small scale farmers.
- iii. Finally, programmes and policies that incorporate the risk aversion indices and those encompass the element of natural, social, economic and technical risks and their controlling measures as identified in this study should be put in places for small scale farmers. There is a possibility that such programmes and policies may produce the desired effect and improve the efficiency of crop management and production.

## REFERENCES

- Agricultural Media Resources and Extension Centre (AMREC) (2007); "Mapping of Soybean Production Areas in Nigeria". University of Agriculture, Abeokuta, Nigeria. Report of a Survey; Promoting Pro-Poor Opportunities in the Commodity and Service Market (PrOpCom), Abuja, Nigeria.
- Ajetomobi, J. O. and Binuomote S. O. (2006)., "Risk aversion among poultry egg producers in southwestern, Nigeria". *International Journal of Poultry Science* 5 (6): 562-565.
- Akinola, B. D. (2014): "Risk Preferences and Coping Strategies among Poultry Farmers in Abeokuta Metropolis, Nigeria". *Global Journal of Science Frontier Research*, Vol (XIV) Issue V Version I.
- Alimi, T. and A. B. Ayanwale (2005). Risk and Risk Management Strategies in Onion Production in Kebbi State of Nigeria. *Journal of Social Science*, 10(1): 1-5.
- Amaefula, C., Okezie, C. A. and Mejeha, R. (2012): "Risk Attitude and Insurance: A Causal Analysis". *American Journal of Economics*, 2(3): 26-32.
- Antle, J. M. and C. C. Crissman (1990). Risk, Efficiency, and the Adoption of Modern Crop Varieties: Evidence from the Philippines. *Economic Development and Cultural Change*, 38(3):517-537.
- Aye, G. C. and K. O. Oji (2014); Effect of Poverty on Attitudes of Farmers in Benue State, Nigeria.
- Ayinde, O. E. Omotesho, O. A. and M. O. Adewumi (2008). Risk Attitudes and Management Strategies of Small-Scale Crop Producer in Kwara State, Nigeria: A Ranking Approach. *African Journal of Business Management* Vol.2 (12) pp. 217-221.
- Binswanger, H. P. (1980). Attitudes toward Risk: Theoretical Implications of an Experiment in Rural India. *The Economic Journal*, Vol. 91(364), 867-890.
- Dercon, S. and L. Christiaensen, (2007). Consumption Risk, Technology Adoption and Poverty Traps: Evidence from Ethiopia. *World Bank Policy Research Working Paper* 4257.
- Dillon, J. L. and Scandizzo, P. L. (1978). Risk Attitudes of Subsistence Farmers in Northeast Brazil - A Sampling Approach. *American Journal of Agricultural Economics* 67(1985): 779-793.
- Dhungana, B. R., Nuthall, P. L. and G. V. Nartea (2004): Measuring the Economic Inefficiency Nepalese Rice Farms Using Data Envelopment Analysis. *Australian Journal of Agricultural and Resource Economics* 48(2): 347-369.

- Domingo, S. N., Kevin, A. P. and Mullen, J. and Jones, R. (2015): Risk Aversion among Smallholder High-Value Crop Farmers in Southern Philippines. *Discussion Paper Series No. 2015-03*.
- Hardaker, B. J., Huirne, R. B. and Anderson, J. R. (2004). *Coping with Risk in Agriculture*. New York, USA: CAB International.
- Harwood, J., Richard, H., Keith, C., Janet, P. and A. Somwaru, (1999). "Managing Risk in Farming: Concepts, Research, and Analysis". *Agricultural Economic Report No 774*. Economic Research Service, U. S. Department Agriculture.
- Harrison, G. W., Lau, M. I. and Rutström, E. E. (2007). Estimating Risk Attitudes in Denmark: A Field Experiment. *Scand. Journal of Economics*, 109(2), 341-368.
- Hurley, M. T. (2010): A Review of Agricultural Production Risk in the Developing World. Working Paper, *Harvest Choice*.
- Idrisa, Y. L.; Ogunbameru, B. O.; and Maduke, M. C. (2012); "Logit and Tobit Analyses of the Determinants of Likelihood of Adoption and Extent of Adoption of Improved soybean seed in Borno State, Nigeria". *Greener Journal of Agricultural Science* Vol. 2(2), PP 037-045.
- International Institute of Tropical Agriculture (IITA) (2009); *Farmers' Guide to soybean Production in Northern Nigeria*.
- Just, R. E. (2003). "Risk Research in Agricultural Economics", *Agricultural System*, 75:123-159.
- Jirgi, A. J. (2013). "Technical Efficiency and Risk Preferences of Cropping Systems in Kebbi State, Nigeria". Unpublished Ph. D. Thesis, Department of Agricultural Economics, University of the Free State, Bloemfontein, South Africa.
- Kaduna State Agricultural Development Programme (KADP), (2007); "A Report of the Village Listing Survey". Kaduna State, Nigeria.
- Kanwar, S. (1999). The Demand for Labour in Risky Agriculture. *Oxford Development Studies*, 27(1):129-144.
- Kim, T. H. (2008). The Measurement of Farmers' Risk Attitudes using a Non-Structural Approach. *Journal of Rural Development*, 31(2), 18.
- Knight, F. (1921). *Risk, Uncertainty and Profit*, New York: Harper and Row Publishers.
- Knight, J., Weir, S. and T. Woldehanna (2003). The Role of Education in Facilitating Risk-Taking and Innovation in Agriculture. *Journal of Development Studies* 39(6):1-22.
- Kurosaki, T. (1997). Production Risk and Advantages of Mixed Farming in the Pakistan Punjab. *Journal of Development Economics* 35:28-47.
- Lennart, H.; Subal, C. K.; and Almas, H. (1996): "DEA, DFA and SFA: A Comparison". *The Journal of Productivity Analysis*, 7, 303-327.
- Lins, D. A., Gabriel, S. C. and Sonka, S. T. (1981). An Analysis of the Risk Aversion of Farm Operators: An Asset Portfolio Approach. *Western Journal of Agricultural Economics*, 6(1) 15-29.
- Moscardi, E. and A. de Janvey (1977); "Attitudes towards risk among peasants: An econometrics Approach"; *American Journal of Agricultural Economics* 59(4): 710-716.
- Moschini, G. and D. A. Hennessy (2000), *Uncertainty, Risk Aversion and Risk Management for Agricultural Producers*, in Gardner, B. and G. Rausser (eds), *Handbook of Agricultural Economics*, Amsterdam: Elsevier Science Publishers.
- National Agricultural Extension Research Liaison Service (NAERLS) (2013): "Agricultural Performance Survey of Wet Season in Nigeria".
- National Population Commission (NPC) (2006); "Population Census Figures of the Federal Republic of Nigeria", N.P.C., Abuja, Nigeria.
- Organisation for Economic Co-operation and Development (OECD) (2009), "Managing Risk in Agriculture": *A Holistic Approach*. OECD, Paris.
- Olarinde, L. O.; Manyong, V. M. and Akintola, J. O. (2010); "Attitudes towards risk among maize farmers in the dry savanna zone of Nigeria: some prospective policies for food production". *African Journal of Agricultural research* Vol.2 (8); PP. 399-408.
- Olawuyi S. and T. Olawuyi (2015). Risk Management Strategies Adoption of Farming Households in Kwara State of Nigeria: A Pragmatic Approach. *International Academic Conference*, London.
- Parikh, A. and Shah M. K. (1994). Measurement of Cost Inefficiency with Safety First Measure of Risk. *American Journal of Agricultural Economics* 11 (1994) 197-206.

- Pandey, A. and S. Pandey (2004). Risk Fertilizer Use in the Rain fed Rice Ecosystem of Tarlac, Philippines. *Journal of Agricultural and Applied Economics* 36(1):241-250.
- Pyle, D. and Turnovsky, S. (1970). Safety First and Utility Maximisation in Mean Standard Deviation Portfolio Analysis. *The Review of Economics and Statistics*, 52(1), 75-81.
- Qiqi C.; Junbiao Z. and Lu Z. (2015); “Risk Assessment, Partition and Economic loss Estimation of Rice Production in China”. *Journal sustainability* Vol.7; 563-583.
- Ramaswami, B., Ravi, S. and S.D. Chopra (2003); “Discussion Paper in Economics: Risk Management in Agriculture”. Discussion Paper 03-08; Indian Statistical Institute, Delhi Planning Unit, India.
- Environmental Research and Analysis Directorate (RERAD): (2010); “Risk and Risk management Strategies in Agriculture: *An Overview of the Evidence*”
- Rose, E. (2001). Ex Ante and Ex Post Labour Supply Response to Risk in a Low-Income Area. *Journal of Development Economics* 64:371-388.
- Rosegrant, M. W. and J. A. Roumasset (1985). The Effect of Fertilizer on Risk: A Heteroscedastic Production Function with Measurable Stochastic Inputs. *Australian Journal of Agricultural Economics* 29(2):107-121.
- Rosenzweig, M. R. and H. P. Binswanger (1993). Wealth, Weather Risk and the Composition and Profitability of Agricultural Investments. *Economic Journal* 103(416):56-78.
- Roy, A. D. (1952). Safety First and the Holding of Assets. *Econometrica* , 20(3).431-449.
- Salman, K. K. (2011); “Explaining the Implication of Climate Change and the Associated Farmers’ Risk Preferences in Nigeria Agricultural Economy”. *Journal of American Science* Vol. 7(8). PP 784-787
- Saliu, L. A. (2013); “Economics of Poultry Egg (Layer) production in Chikun and Igabi Local Government Areas of Kaduna State, Nigeria”. Unpublished M. Sc. Dissertation, Department of Agricultural Economics and Extension, Bayero University Kano, Nigeria.
- Shahabuddin, Q., Mestelman, S. and D. Feeny (1986); Peasant Behaviour towards risk and Socio-economic and Structural Characteristics of Farm Households in Bangladesh. *Oxford Economic Papers* 38(1): 122-130.
- Shankar, B., Bennett, R. and S. Morse (2008). Production Risk, Pesticide Use and Genetically Modified Crop Technology in South Africa. *Applied Economics*, 40:2489-2500.
- Smale, M., Just, R. E. and H. D. Leathers (1994). Land Allocation in HYV Adoption Models: An Investigation of Alternative Explanations, *American Journal of Agricultural Economics* 76(3): 535-546.
- Smith, J. and G. Umali (1985). Production Risk and Optimal Fertilizer Rates: A Random Coefficient Model. *American Journal of Agricultural Economics* 67(3):654-659.
- Sonny N. D., Kevin A. P., John M. and R. Jones (2015); Risk Aversion among Smallholder High-Value Crop Farmers in the Southern Philippines. Discussion Paper Series No. 2015-03.
- Sowunmi F.A.; and J. O. Akintola (2010): Effect of Climatic Variability on Maize Production in Nigeria. *Research Journal of Environmental and Earth Sciences* 2(1): 19-30.
- United State Agency International Development (USAID) (2016): “Nigeria Early Generation Seed Study”. Country report. Pp 51-53.
- Vargas Hill, R. (2009). Using Stated Preferences and Beliefs to Identify the Impact of Risk on Poor Households. *Journal of Development Studies*, 45(2)151-171.
- Villano, R. A. and E. Fleming (2006). Technical Inefficiency and Production Risk in Rice Farming: Evidence from Central Luzon Philippines. *Asian Economic Journal* 20(1): 29-46
- Wale, E. and A. Yalew (2007). Farmers’ Variety Attribute Preferences: Implications for Breeding Priority Setting and Agricultural Extension Policy in Ethiopia. *African Development Review* 19(2):379-396.
- Young, D. L. (1979). Risk Preferences of Agricultural Producers: Their Use in Extension and Research, *American Journal of Agricultural Economics*, 58(4).