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SOCIAL CAPITAL- A RISK SMART OPTION FOR ADDRESSING RISK ATTITUDES OF WOMEN RICE FARMERS IN NORTH-CENTRAL NIGERIA

SOSYAL SERMAYE - KUZEY-ORTA NIJERYA'DAKI KADIN PIRINÇ ÇIFTÇILERININ RISK TUTUMLARINA YÖNELIK RISKLI AKILLI BIR SEÇENEK

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ABSTRACT

The present research determined the risk attitudes of women rice farmers in North-central Nigeria. A structured questionnaire complemented with an interview schedule was used to collect field survey data of the 2020 rice cropping season from 376 farmers, and data analysis was achieved using both descriptive and inferential statistics. Generally, the empirical evidence showed that fear of capital loss due to the cultivation of thinly uneconomic holdings given the poor resource capital status of the farmers made most of the farmers caught in the web of risk averse. Furthermore, the gender-wise results showed gender discrimination viz. lack of access to and control of productive resources that owe to cultural and religious barriers makes most women farmers to be risk averter. Besides, diseconomies of scale due to non-utilization of social capital pool affected the disposition of most non-cooperative participating farmers towards risk preference. Based on the findings, it was inferred that gender and co-operative participation differentials impacted the farmers' risk attitudes. In addition, the empirical shreds of evidenceestablished that the risk gap was majorly due to discrimination effect-structural difference viz. gender and co-operative participation. Therefore, in order to address farmers' risk apprehension, there is a need for the farmers, especially women farmers, to take advantage of the social capital pool to break the jinx of gender discrimination viz. lack of access to and control over productive resources, thus achieving economies of scale. In addition, there is a need for overall gender budgeting mainstreaming by the policymakers, thus shielding women farmers from the vicious cycle of poverty.
Keywords: *Risk; Gender, Social Capital, Rice Farmers, North-Central, Nigeria*

ÖZ

Bu araştırmada, Nijerya'nın kuzeyindeki kadın pirinç çiftçilerinin risk tutumları belirlenmiştir. 2020 yılı pirinç ekim sezonuna ilişkin araştırma verileri yapılandırılmış bir anketle 376 çiftçi ile görüşülerek toplandı ve veri analizi hem tanımlayıcı hem de çıkarımsal istatistikler kullanılarak gerçekleştirildi. Genel olarak, ampirik kanıtlar ekonomisi zayıf küçük işletmelerin tarıma bağlı sermaye kaybı korkusunun çiftçilerin çoğunun riskten kaçınma davranışına neden olduğunu göstermiştir. Ayrıca, cinsiyet ayrımcılığı, kültürel ve dini engellere bağlı olarak üretken kaynaklara erişim ve kontrol eksikliği, kadın çiftçilerin çoğunu riskten kaçınan kişiler haline getirmektedir. İlaveten, sosyal sermaye fonunun kullanılmamasından kaynaklanan ekonomi ölçekleri, kooperatifi olmayan çiftçilerin çoğunun risk tercihini etkilemiştir. Bulgulara göre, cinsiyet ve kooperatife katılım farklılıklarının çiftçilerin risk tutumları üzerinde etkisinin olduğu sonucuna varılmıştır. Buna ek olarak, deneysel kanıtlar, risk açığının da büyük ölçüde cinsiyete ve kooperatif katılımı gibi etkisel-yapısal farklılıktan kaynaklandığını ortaya koymuştur. Bu nedenle, çiftçilerin risk endişesini gidermek için, özellikle de kadın çiftçilerin cinsiyet ayrımcılığının etkisinden kurtulup, kaynaklara erişim ve kontrol eksikliğini azaltmak için toplumsal sermaye fonundan yararlanması gerekmektedir. Böylece ekonomik ölçekler elde edilir. Ek olarak, kadın çiftçilerin yoksulluğun kısır döngüsünden korunmasında politika yapıcılar tarafından genel cinsiyet bütçelemesinin yaygınlaştırılmasına ihtiyaç vardır.
Anahtar Kelimeler: *Risk, Cinsiyet, Sosyal Sermaye, Pirinç Çiftçileri, Kuzey Orta, Nijerya*

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INTRODUCTION

There is no question that economic development has been considered a decisivefactor in reducing poverty (Leekoi *et al*., 2014). The incidence of poverty, however, still appears to be relatively highparticularly among women, even during a period of high economic growth. It seems to some degree that the issue of poverty is not affected by economic development. The commonness of risk among the poor is an important factor considered to explain the prevalence of poverty among rural households in developing countries. Agriculture is a risky activity by nature, and agricultural enterprises operate in a risky and uncertain situation, especially in developing countries (Ullah *et al*., 2015). Farmers have little to no control over rainfall and market prices in developing countries (Sadiq *et al*., 2019a). Farmers' worldwide struggle with a large degree of uncertainty all day long (Sadiq *et al*., 2019b), from not knowing what the weather vagaries are going to be like now, to wondering whether the next moment will increase or decrease market prices and even not being clear whether the Fulani herdsmen's cattle, pests and diseases will strike his promising various crops and livestock enterprises tomorrow (Onubuogu and Esiobu, 2016). Farmers are therefore compelled to make choices based on incomplete knowledge and facts.

In developing countries, the majority of women live in rural areas, relying mainly on agriculture as a means of livelihood. However, farming operations are subject to various types of risks that are likely to affect the income of women households adversely. Therefore, in particular, women households are vulnerable to systemic risks. Owing to their comparatively small survival margin, the consequences of dangerous events will likely be extreme for women households. as a result of an unexpected decrease in their incomes,the non poor can become poor. Similarly, the plight of those who are already poor will worsen and, ultimately, victims may have to face severe difficulties such as hunger, sickness, starvation, or, worse still, death. Thus, given the reported economic growth in developing countries, this risk related to agricultural activities explains the incidence of poverty. As a result, the incidence of poverty, particularly among women households whose source of income is agriculture, is relatively high. In addition, since most women farmers are poor, households that depend on rain-fed agriculture experience a negative effect on their welfare when risks (e.g. droughts and floods) arise because it has resulted in various income losses, reduction of consumption and wealth. Owing to cultural and religious barriers, the lack of financial intermediation, and formal insurance, credit market imperfections and insufficient infrastructure, most of these risks are made more complex.

Risks have competed in recent years, with profitability as a success metric for producers. Risk analysis is generally applicable to various areas of agriculture (Abayomi *et al*., 2013). risk perception plays an important role in framing decisions to resolve expected or experienced risks. (Hakorimana and Akcaoz, 2020). To understand the risk management techniques, one needs to thorougly understand his expectations related to the various dynamics of a risk event. The risk is connected to an individual farmer on a wider scale, but it has concerns for society. For example, because of potential risks attached to it, a risk-averse farmer could decide not to opt for modern technology, but his decision may lead to consequences for the national production and general welfare of society if all individuals act the same way. The well-being of the farmer's family and the continuity of farming as a business will depend on how farmers handle risks at thefarm level. This uncertainty significantly contributes to the inability of farmers to make appropriate decisions on production and output plans. The risk attitudes of farmers are an important concern not to be overlooked when evaluating decision-making methods under risk and uncertainty in agriculture. Depending on their priorities and funding sources, farmers exhibit different reactions and behaviors to changes. Such behaviors are important factors that influence the processes of spreading and embracing innovations in agriculture. Furthermore, for the future of agriculture, differences in personal behavior, which are among the reasons agricultural policies do not always deliver the expected results, are also significant. Risk perceptions in developing and developed countries are a central determinant of economic behavior (Sepahvand, 2019). Sepahvand (2019) noted proof of the relationship between individuals' gender and their risk prefernces.

To the best of our knowledge, literature shows various studies on farmers' risk behaviours in agriculture (Abdul *et al*., 2015; Isaac and Omowunmi, 2015; Yusuf *et al*., 2015; Onubougu and Esiobu, 2016; Yekti *et al*., 2016; Adjei *et al*., 2016; Ben-Chendo *et al*., 2016; Obike *et al*., 2017; Sadiq *et al*., 2019a&b; Hakorimana and Akcaoz, 2020) with little information that centered on risk attitudes of the weakest section-women gender (Adewumi *et al*., 2012; Cardenas *et al*., 2012; Faccio *et al*., 2016; Nelson, 2016; Sepahvand *et al*., 2017; Sepahvand, 2019) in the country and the developing countries at large. There is a line of literature that explores managerial risk and gender (e.g., Faccio *et al*., 2016; Sepahvand, 2019), in which the underlying theoretical viewpoint is that a threshold exists; productivity of women farmers would improve if they continue to take greater risk. Thus, based on this thrust, this studied attempted to determine the risk attitudes and the use of social capital pool as a strategy for overcoming risk behaviour of women rice farmers in North-Central Nigeria. The specific objectives were to determine the risk attitudes of women rice farmers; effects of idiosyncratic factors on farmers' risk attitudes; impact of gender and risk smart option-cooperative on farmers' risk attitudes; and, effect of gender and co-operative participation discriminations on farmers' risk attitudes.

RESEARCH METHODOLOGY

The North-Central region is geographically located in the middle belt of Nigeria and consists of six states *viz*. Benue, Nasarawa, Niger, Plateau, Kogi, and Kwara; and a Federal unity territory called Abuja. The region spanned from the west to around the serenity of the confluence of two major rivers- River Niger and River Benue. The geographical coordinates of the region are latitude 10˚ 20′ and longitude 7˚ 45′, and its vegetation cover is largely guinea savannah alongside mountainous and tropical vegetations. The mean cumulative annual and monthly rainfall of the region is 1247.52 ± 166.68mm and 103.96mm, respectively; while the annual mean temperatures hovered around minimum and maximum values of 22.55 ± 0.42˚C and 33.54 ± 0.23˚C. The mean is slightly above 50 percent for the relative humidity and varied between the small range of 50.08 and 52.75

percent. The monthly rainfall distribution ranges from May to October, with a uni-modal peak in August (274.23mm) (Olayemi *et al.,* 2014). The months of January and February are arid seasons (no rainfall), while April and November witnessed little spring, thus referenced as pre and post-rainy season transition periods, respectively. The inhabitants of the region majorly engaged in arable crop production alongside tree cropping, fishing, hunting, artisanal, civil service, and *Ayurvedic* medicines. In achieving a representative sampling size, a multi-stage sampling technique was adopted. Except for, all the state units and the Federal unity territory are suitable for cultivation of rice. Thus, three out of the seven units *viz* Niger and Kogi States; and FCT Abuja were conveniently selected. Given the preponderance of rice cultivation across the chosen units, two Local Government Areas (LGAs)/Municipal Area Councils (MAC) were randomly selected from each of the chosen units using Microsoft's inbuilt sampling analytical tool. Furthermore, using the same Microsoft sampling analytical tool, two villages were randomly selected from the chosen LGAs/MAC. Based on the sampling frame sourced from the States' Agricultural agencies and reconnaissance survey, a scale ratio of 18% was used to determine the representative sample size (Table 1). Thus, 376 active rice farmers that made the sample size were drawn through a simple random sampling technique. However, 16 out of the 376 questionnaires retrieved contained outliers, thus were eliminated. Therefore, a total of 360 valid questionnaires were subjected to the analysis. Using a straightforward cost route approach, a structured questionnaire complemented with an interview schedule is used to elicit cross-sectional data of 2020 rice cropping seasons from the farmers. Objective I, II, III, and IV was achieved using risk index-exploratory factor-minimum normalization model; censored regression, Average treatment effect, and Oaxaca-Blinder decomposition model, respectively.

Table 1. Sampling frame of rice farmers

States	LGAs/ MACs	Villages	Sample frame	Sample size
FCT Abuja	Kwali	Dabi	85	15
		Gada-biu	109	20
	Abaji	Yaba	100	18
		Pandagi	90	16
Kogi State	Yagba West	Omi	198	36
		Ejiba	220	40
	Kogi	Giryan	250	45
		Panda	180	32
Niger State	Borgu	Swashi	208	37
		Saminaka	170	31
	Katcha	Katcha	238	43
		Badeggi	242	43
Total	**6**	**12**	**2090**	**376**

Source: States' Agricultural Agencies, 2020
Note: District unit is called Municipal Area Council (MAC) and Local Government area (LGA) in FCT Abuja and State respectively.

Empirical model

Risk Index

Step 1:

Exploratory factor analysis: The exploratory factor-principal component analysis was used to reduce the production variables- output and inputs to weight. The Kaiser Mayer Olkin (KMO) test of sampling adequacy attained a mediocre level with a value of 0.692, more significantthan the threshold value of 0.50 benchmarked by Kaiser (1974) to be suitable for analysis. This indicates that there is a common variable applicable to all the factors and the sample is adequate. Besides, Bartlett's Sphericity test (BST) was significant at 1 percent, indicating that the rotated variables are not identity matrices. The Varimax rotated matrix generated four factors based on Eigen-value greater than unity, and these factors accounted for 69.72% of the total variation (Table 2).

Step 2: To obtain the risk index, the production variables were normalized-minimum normalization and then multiplied by their respective weight generated from the Varimax rotation. Presented below is the risk index model:

Normalization index

$$I_i = \frac{P_i - P_{minimum}}{P_{maximum} - P_{minimum}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where I_i is the normalized value of the i[th] farmer for a production component indicator; P_i is the actual production component value of i[th] farmer; $P_{minimum}$ is the minimum production component value; and, $P_{maximum}$ is the maximum production component value.

$$R_i = \frac{\sum_{k=1}^{n} W_k I_k}{\sum_{k=1}^{n} W_k} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

This can further be expressed as:

$$R_i = \frac{W_Y I_Y + W_{X1} I_{X1} + W_{X2} I_{X2} + W_{X3} I_{X3} + W_{X4} I_{X4} + W_{X5} I_{X5} + W_{X6} I_{X6} + W_{X7} I_{X7} + W_{X8} I_{X8}}{W_Y + W_{X1} + W_{X2} + W_{X3} + W_{X4} + W_{X5} + W_{X6} + W_{X7} + W_{X8}} \ldots\ldots\ldots\ldots (3)$$

Where, R_i = risk index; W = weight; Y= output (kg); X1-X8 are human labour, inorganic fertilizer, seeds, herbicides, pesticides, depreciation on capital items and farm size respectively.

Tobit regression model

Following Tobin (1958) as specified by Sadiq *et al*.(2020a & b), the Tobit regression model is presented below:

$$R_i^* = \alpha + X\beta + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$R_i^* = \alpha + X_1\beta_1 + X_2\beta_2 + X_3\beta_3 + X_4\beta_4 + X_5\beta_5 + \cdots + X_n\beta_n + \varepsilon_i \ldots\ldots\ldots\ldots (5)$$

Where:

R_i^* = Risk index value for i[th] farmer;

X_1 = Age (years); X_2 = Gender (male=1, female=0); X_3= Marital status (married =1, otherwise = 0); X_4 = Education (years); X_5 = Household size (number); X_6 = Experience (year); X_7 = Mode of land acquisition (inheritance =1, otherwise =0); X_8 = Distance from house to farm (DHF) (kilometer); X_9= Distance from house to market (DHM)(kilometer); X_{10}= Co-operative membership (yes = 1, otherwise = 0); X_{11} = Unit price of output (P_y)(N); X_{12} = Unit cost of human labour (N); X_{13} = Unit cost of fertilizer (N); X_{14} = Unit cost of seeds (N); X_{15} = Unit cost of herbicides (N); X_{16} = Unit cost of pesticides (N); X_{17} = Yield (kg); β_0 = constant; β_{1-n} = vector of parameters to be estimated; and, ε_i = white noise.

Average Treatment Effect (ATE)

ATE: It show the average difference in outcome between units assigned to the treatment and units assigned to the placebo (control). Following Lokshin and Sajaia (2011); Wang *et al*. (2017); Sadiq *et al*.(2020a & b) the equation is given below:

Risk index of male farmers/ co-operative participants is given by: $E(y_{1i}|I = 1; X) \ldots\ldots\ldots (6)$

Risk index of female farmers/ non-cooperative participants is given by: $E(y_{2i} \mid I = 0; X) \ldots. (7)$

Risk index of male farmers/co-operative participants if there is no gender/co-operative participation difference is denoted by: $E(y_{2i} \mid I = 1; X) \ldots\ldots (8)$

Risk index of female farmers/ non-cooperative participants if there is gender/co-operative participation difference: $E(y_{1i} \mid I = 0; X) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$

Where:
$E(.)$ = Expectation operator
y_{1i} = risk index of male farmers/ co-operative participants (dependent variable)
y_{2i} = risk index of female farmers/ non-cooperative participants (dependent variable)
I = Dummy variable (1 = male/co-operative member, 0 = female/ non-cooperative member)
X = Explanatory variables that is common to both male and female farmers/ co-operative and non-cooperative participants.

$$ATT = E(y_{1i} \mid I = 1; X) - E(y_{2i} \mid I = 1; X) \ldots \ldots \ldots \ldots (10)$$

$$ATU = E(y_{1i} \mid I = 1; X) - E(y_{2i} \mid I = 1; X) \ldots \ldots \ldots \ldots (11)$$

Average Treatment effect on Treated = ATT
Average Treatment effect on Untreated = ATU
Equations (10) and (11) were further simplified as:

$$ATT = \frac{1}{N_1}\sum_{i=1}^{N_1}[p\ (y_{1i} \mid I = 1; X) - p(y_{2i} \mid I = 1; X)] \ldots \ldots \ldots \ldots (12)$$

$$ATU = \frac{1}{N_2}\sum_{i=1}^{N^2}[p\ (y_{2i} \mid I = 0; X) - p(y_{1i} \mid I = 0; X)] \ldots \ldots \ldots \ldots (13)$$

Where, $N_1$and N_2 are number of male farmers/ co-operative participants and female farmers/non-cooperative participants respectively, and p= probability.

Oaxaca-Blinder Decomposition model

Using the standard Oaxaca-Blinder procedure (Oaxaca 1973; Blinder 1973) the extent to which the risk gap between the male and female farmers/ co-operative participants and non-cooperative participants can be explained by differences in observed human capital characteristics (Marwa, 2014; Revathy *et al.*, 2020; Sadiq *et al.*, 2020a&b).

$$ln\bar{Y}_{M/C} = \beta_0 + \beta_i \sum_{i=1}^{i} X_i + \varepsilon_i \ldots \ldots \ldots \ldots (14)$$

$$ln\bar{Y}_{F/NC} = \beta_0 + \beta_i \sum_{i=1}^{i} X_i + \varepsilon_i \ldots \ldots \ldots \ldots (15)$$

Where,
$\bar{Y}_{M/C}$= average risk index of men folk/co-operative association participants;
$\bar{Y}_{F/NC}$ = average risk index of women folk/non-cooperative association participants;
$X_{i-n} = explanatory\ variables$;
$\beta_0 = intercept$;
$\beta_{i-n} = parameter\ estimates$; and, $\varepsilon_i = stochastic\ term$.

Following Revathy *et al.*(2020); Sadiq *et al.*(2020a&b), equations 14 and 15 of the Oaxaca-Blinder decomposition can be explained as follow:

$$(ln\bar{Y}_F - ln\bar{Y}_M) = (\beta_{F0} - \beta_{M0}) + [\beta_{F1}(\bar{X}_{F1} - \bar{X}_{M1}) + \beta_{F2}(\bar{X}_{F2} - \bar{X}_{M2}) + \beta_{F3}(\bar{X}_{F3} - \bar{X}_{M3}) + \beta_{F4}(\bar{X}_{F4} - \bar{X}_{M4}) + \beta_{Fn}(\bar{X}_{Fn} - \bar{X}_{Mn})] + [\bar{X}_{M1}(\beta_{F1} - \beta_{M1}) + \bar{X}_{M2}(\beta_{F2} - \beta_{M2}) + \bar{X}_{M3}(\beta_{F3} - \beta_{M3}) + \bar{X}_{M4}(\beta_{F4} - \beta_{M4}) + \bar{X}_{Mn}(\beta_{Fn} - \beta_{Mn}) + (\varepsilon_F - \varepsilon_M) \ldots \ldots \ldots (16)$$

The risk gap is divided into two segments: one is the proportion attributable to differences in the endowments generating activities $(\bar{X}_F - \bar{X}_M)$ evaluated at the female group returns (β_F). This is taken as a reflection of endowment differential and it's termed endowment/ characteristics/ explained effect. The second segment is attributable to the difference in the returns $(\beta_F - \beta_M)$ that the female and male groups get for the same endowment generating activities($\bar{X}_F$). This segment is often taken as a reflection of discrimination or gender/co-operative participation differential and its termed discrimination or unexplained effect.

Table 2. Varimax rotation factor of production components

Items	EV	% of Var.	Factor 1	Factor 2	Factor 3	Factor 4
Output	2.318	28.975	0.631			
Labour	1.183	14.793		0.704		
Fertilizer	1.055	13.188				0.966
Seed	1.021	12.768	0.653			
Herbicides			0.799			
Pesticides					0.886	
Capital Dep.			0.753			
Farm size				0.801		
Total		**69.724**				
KMO	**0.692**					
BST	**362.65 (0.000)***					

Source: Field survey, 2020
Note: value in parenthesis is probability value; EV= Eigen value; Var. = Variance

RESULTS AND DISCUSSION

Farmers' Risk Attitudes vis-à-vis social-gender and economic dimensions

A perusal of Table 3 showed most (61.1%) of the farmers to be risk-averse; 34.7% were risk-neutral while a marginal proportion (4.2%) were risk lovers. The possible reason why the most were risk-averse is due to their poor resource status, thus the fear or apprehension of capital loss which is likely to endanger the wellbeing/sustainability of their livelihood. For the farmers with neural attitudes towards risk, the possible reason may be attributed to their economic capital position. Those with preference behaviour towards risk may be due to their innovativeness. The average risk index indicates that most of the farmers have aversive attitudes towards risk. Generally, it can be inferred that the risk attitudes of the farmers in the studied area are very poor, which owes largely to the cultivation of thinly uneconomic holdings among most of the farmers who are marginal to smallholder farmers. Furthermore, a gender-wise cross-examination showed similar risk trend behaviour with the general scenario for both men and women farmers. However, the disaggregated analysis showed that the women farmers are more risk-averse than their men counterparts; and less risk-neutral and risk preference than their men counterparts. On average, most of the women and men farmers are risk averse (-0.618) and risk neutral (0.014) respectively. The possible reason for poor women's attitudes towards risk may be attributed to lack of access to and control over productive resources caused by gender stereotype, a chasm created by the fusion of social and cultural barriers.

Thus, it can be inferred that women farmers are at the mercy of poverty vicious cycle: low investment, low output, low income, thus affecting the sustainability of the women's households' livelihoods. Besides, the co-operative-wise result, a social capital, reveals similar risk trend attitudes with the overall scenario for both co-operative and non-co-operative farmers.

The decomposition analysis showed farmers who didn't participate in the social capital pool to be more risk averse than their counterparts that explored the advantage of social capital. However, the non-co-operative member farmers are less risk neutral and risk lover than their counterparts that participated in co-operative organization. On average, most of the participating co-operative farmers are risk neutral as evidenced by the risk index value of 0.045. In controst, for the non-cooperative participating farmers, most are risk averse as indicated by the risk index value of -0.115. Thus, the possible reason for risk apprehension among most of the farmers that didn't belong to social organization may be attributed to lack of pecuniary advantages *viz.* bulk discount of input purchase, output market bargaining power, good access to credit either in cash or kind; which is a viable precursor to achieve and enhance economies of scale.

Table 3. Risk attitudes vis-à-vis gender and co-operative participation

Risk attitude index	Overall	Men	Women	CP	NCP
Risk averse (<0.00)	220(61.1)	177(60.6)	43(63.2)	149(57.5)	71(70.3)
Risk neutral (0-0.99)	125(34.7)	102(34.9)	23(33.8)	97(37.5)	28(27.70
Risk preference (≥ 1.00)	15(4.2)	13(4.5)	2(2.9)	13(5.0)	2(2.0)
Total	260(100)	292(100)	68(100)	259(100)	101(100)
Mean	-0.02936	0.014409	-0.061875	0.044732	-0.114708
Minimum	-0.6932	-0.6859	-0.6932	-0.6859	-0.6932
Maximum	2.5878	2.5878	1.5095	2.5878	2.1648

Source: Authors' own computation, 2020

Note: value in ( ) is percentage; CP and NCP are co-operative participation and non-cooperative participation respectively.

Determinants of Risk Attitudes among Rice Farmers

A cursory review of the results showed that the chosen model-Tobit regression fits the specified equation as evidenced by the significance of the LR Chi^2 at 1% significant level. Besides, it depicts that the parameter estimates in the model are different from zero at 10% freedom. In addition, the diagnostic test *viz.* the collinearity test showed absence of orthogonality between the predictor variables as indicated by the plausibility of all the explanatory variables variance inflation factors (VIF) within the threshold value of 10.0. Thus, it can be inferred that the estimated model is reliable for future prediction with certainty and accuracy.

The empirical evidences showed predictor variables *viz.* household size, distance from house to farm, distance from house to market, co-operative membership, unit price of output and unit cost of herbicides to be the factors that influenced risk behavior of rice farmers as indicated by their respective parameter estimates that are within the acceptable margin of 10% probability level.

The positive significance of the household size coefficient revealed that farmers with a large household size are favourably disposed to risk preference and this may be attributed to access to family labour at almost free cost. Thus, the likelihood of a farmer being disposed to a risk preference for a unit increase in his/her household will be 0.036 percent.

The positive significance of distance from house to farm and spread from home to markets coefficients showed how high labor productivity on-farm operations for farmers whose economic units are farther from their abode made them favourably disposed to risk preference. The possible reasons are that these farmers are less likely to face house choir disturbances and temptations of commercial activities that prevail in the markets. In addition, farmers whose houses are far from the markets have the advantage of adopting inventory accumulation to earn remunerative prices for their products as a barometer of monitoring marketing price regime. Therefore, the elasticity implication of a kilometer distance increase between a farmer's home and technical unit-farm; and likewise commercial centers-market, will lead to a rise in his/her disposition to risk preference by 0.035 and 0.042 percent respectively. In other words, the probability of farmers towards risk preference for an increase in the distances between their homes and production units; and likewise commercial units will be 0.035 and 0.042 percent, respectively.

The positive significant of the co-operative membership coefficient revealed that farmers that explored social capital pool were favorably disposed to risk preference. The possible explanation may be attributed to pecuniary advantages: bulk input discount, output marketing barging power, access to credit either cash or in-kind; which make them benefit from economies of scale in rice production. Therefore, the probability of farmers that belong to co-operative association to be favourably disposed to risk preference is 0.195 percent higher than their counterparts who are not co-operative organizations. The negative significant of unit cost of herbicides showed that high cost of herbicides affected farmers' disposition to risk preference. The possible explanation is that high cost of herbicides has implication/consequence on the cost of production because most farmers face diseconomies of scale due to the cultivation of thinly uneconomic holding,making them apprehensive of rice production risk. Thus, a unit increase in the unit price of herbicides will lead to a decrease in farmers' disposition to risk preference by 0.26 percent.

The positive relationships of unit costs of seeds and pesticides with farmers' risk attitudes, though non-significant, may be associated with the unit output price to cost of production ratio- a profit margin. The positive significant of the unit price of output coefficient indicated that remunerative output price encouraged farmers to be favourably disposed to risk preference.

In the same vein, though non-significant, high product yield which translates to high profit turnover ratio due to remunerative output prices incentivized the farmers to be favourably disposed to risk preference. Therefore, a unit increase in the prices of rice output will lead to an increase in farmers' disposition to risk preference by 0.99 percent.

The positive signs of marital status and educational level, though non-significant, revealed how the need to earn enlarged income for household sustainability and innovativeness that owes to information search make farmers favourably disposed to risk preference. Also, the positive sign of farming experience, though non-significant, showed how managerial efficiency in the rationalization of farm resources made the farmers inclined towards risk preference. The negative coefficient of age, though non-significant, depicted that aged/old farmers are not favourably disposed to risk preference. The possible reason is that at old age, the likely concern of a farmer is household food security rather than enlarged income for the quest to bequeath fortune.

Table 4. Determinants of risk attitudes of rice farmers

Variable	**Coefficient**	**t-stat**	**VIF**
Intercept	−1.6737(5.9358)	0.282^{NS}	
Age	−0.0048(0.0043)	1.125^{NS}	1.725
Gender	0.0809(0.1081)	0.748^{NS}	1.066
Marital status	0.0249(0.1167)	0.213^{NS}	1.377
Education	0.0025(0.0083)	0.301^{NS}	1.090
Household size	0.0361(0.0203)	1.779*	1.893
Experience	0.0014(0.0058)	0.254^{NS}	1.121
Mode of land acquisition	0.0872(0.0908)	0.960^{NS}	1.030
Distance from home to farm	0.0350(0.0133)	2.612***	1.141
Distance from home to market	0.0420(0.0119)	3.527***	1.382
Co-operative org.	0.1951(0.0974)	2.003**	1.100
Ln unit price of Output	0.9985(0.5151)	1.938*	1.069
Ln unit cost Labour	−0.3056(0.6756)	0.452^{NS}	1.064
Ln unit cost of Fertilizer	−0.1259(0.1963)	0.641^{NS}	1.141
Ln unit cost of Seed	0.0483(0.0645)	0.749^{NS}	1.093
Ln unit cost of Herbicides	−0.2639(0.1368)	1.929*	1.110
Ln unit cost of Pesticides	0.0470(0.0493)	0.954^{NS}	1.114
Ln Yield	0.0215(0.0687)	0.312^{NS}	1.314
Chi^2	52.41[0.000]***		
Normality test	8.23[0.016]**		

Source: Field survey, 2020 Note: *** ** * & NS mean significant at 1, 5, 10% and non-significant respectively. Ln = Natural logarithm; values in ( ) and [ ] are standard error and probability value respectively.

Impact of Gender and Social Capital on Farmers' risk attitudes

The treatment effect results of regression adjustment and inverse-probability weight estimators showed that gender differential has no impact on the risk attitudes of the farmers as indicated by Average treatment effect (ATE) coefficient that is not within the plausible margin of 10% degree of freedom (Table 5). This means that there is no difference between the risk attitudes of men and women farmers. In addition, for both estimators, within the men and female strata there is no difference in their risk attitudes as evidenced by non-significant of the Average treatment effect on treated (ATET) coefficients which were not different from zero at 10% probability level. However, the nearest-neighbor matching and the propensity score matching estimators revealed that gender differential has impact on the risk attitudes of the rice farmers as indicated by their respective ATE estimated coefficients within the acceptable margin of 10% probability level. Thus, this implies that the risk behavior of female farmers differs from that of their male counterparts. The possible reason for this behavioral trend may be attributed to cultural and religious barriers that induced gender stereotypes, gender discrimination, and gender bias, thus hindered women farmers' access to and control over production resources in the studied area. The ATE coefficients of the nearest-neighbor matching and propensity score matching estimators showed the risk attitudes of women farmers towards risk preference to be 14.06 and 9.2%, respectively less than that of the men farmers. Within each gender category, the nearest-neighbor matching estimator showed evidence of differential and no differential in risk attitudes within the men and women folks respectively, as indicated by their respective ATET coefficients ,significant and non-significant at 10% probability level. The non-significant of the ATET estimated coefficients of the two genders for the propensity score matching estimator indicate the absence of differences in risk behavior within the male gender and female gender. Therefore, it can be inferred that gender differential has impact on the risk attitudes of the women farmers.

Table 5. Impact of gender on farmers' risk attitudes

Items	Coefficient	t-stat	Coefficient	t-stat
	Regression adjustment		**Inverse-probability weight**	
ATE	-0.0812(0.0643)	1.26^{NS}	-0.0909(0.0640)	1.42^{NS}
ATET (Men)	0.0758(0.0679)	1.12^{NS}	0.0855(0.0684)	1.25^{NS}
ATET (Women)	-0.1043(0.0657)	1.59^{NS}	-0.1144(0.0695)	1.64^{NS}
Men (mean)	0.0197(0.0292)	0.67^{NS}	0.0216(0.0293)	0.74^{NS}
Women (mean)	-0.0615(0.0583)	1.05^{NS}	-0.0693(0.0567)	1.22^{NS}
	Nearest-neighbor matching		**Propensity-score matching**	
ATE	-0.1406(0.0627)	2.24**	-0.0921(0.0491)	1.87*
ATET (Men)	0.1587(0.0648)	2.45**	0.0832(0.0512)	1.62^{NS}
ATET (Women)	-0.0629(0.0839)	0.75^{NS}	-0.1299(0.0964)	1.35^{NS}

Source: Field survey, 2020/Note: ATE and ATET mean Average treatment effect and Average treatment effect on treated, respectively./Note: $^{***\ **\ *\ \&\ NS}$ means significant at 1%, 5%, 10% & Non-significant, respectively.

For the social capital, except inverse-probability weight estimator, all the other estimators indicated that co-operative membership has impact on the risk attitudes of the rice farmers as evidenced by their respective ATE estimated coefficients within the acceptable margin of 10% probability level (Table 6). This implies that there is difference between the risk attitudes of co-operative member farmers and non-cooperative member farmers. Thus, it can be inferred that access to pecuniary advantages among farmers that explored social capital pool has impact on their risk attitudes in rice production. The ATE coefficients of regression adjustment, nearest-neighbor matching and propensity-score matching estimators show that co-operative participating farmers' disposition towards risk preference is more than that of the non-cooperative farmers by 14.47, 13.87 and 12.69% respectively.

Within the co-operative category, except inverse-probability weights estimator, the regression adjustment, nearest-neighbor matching and propensity-score matching showed the presence of differences in the risk attitudes of the farmers as evidenced by their respective ATET estimated coefficients were within the plausible margin of 10% significant level.

Within the non-cooperative category, the plausibility of regression adjustment and inverse-probability weight estimators ATET estimated coefficients at 10% significant level revealed presence of difference in the risk behavior of the farmers while the nearest-neighbor matching and propensity-score matching estimators indicate absence of difference in the risk attitudes of the farmers as evidenced by their respective ATET parameter estimates that were not different from zero at 10% degree of freedom.

Table 6. Impact of co-operative on farmers' risk attitudes

Items	Coefficient Regression adjustment	t-stat	Coefficient Inverse-probability weight	t-stat
ATE	0.1446(0.0611)	2.37**	0.1138(0.0717)	1.59^{NS}
ATET (CP)	0.1607(0.0697)	2.30**	0.1152(0.0842)	1.37^{NS}
ATET (NCP)	-0.1035(0.0576)	1.80*	-0.1103(0.0559)	1.97*
CP (mean)	0.0290(0.0289)	1.00^{NS}	0.0311(0.0289)	1.08^{NS}
NCP (mean)	-0.1156(0.0535)	2.16**	-0.0826(0.0653)	1.27^{NS}
	Nearest-neighbor matching		**Propensity-score matching**	
ATE	0.1386(0.0528)	2.62***	0.1269(0.0621)	2.04**
ATET (CP)	0.1750(0.0589)	2.97***	0.1611(0.0709)	2.27**
ATET (NCP)	-0.0454(0.0616)	0.74^{NS}	-0.0390(0.0642)	0.61^{NS}

Source: Field survey, 2020
Note: CP, NCP, ATE and ATET mean Co-operative participant, Non-cooperative participant, Average treatment effect and Average treatment effect on treated, respectively.
Note: *** ** * & NS means significant at 1%, 5%, 10% & Non-significant, respectively.
Figure in ( ) is standard error

Risk Gap vis-à-vis Gender and Co-operative membership differentials

Shown in Tables 7 and 8 are the attitudinal risk gaps due to gender and cooperative membership differentials. A cursory review of the results showed marital status, educational level, farming experience, mode of land acquisition, co-operative membership, unit cost of hired labour, unit cost of inorganic fertilizer, unit cost of seeds and unit cost of herbicides to be the endowment factors that contributed favourably to the risk attitudes of women farmers (Table 7). While age, household size, distance from house to farm, distance from house to market, unit price of output, unit cost of pesticides and yield were the endowment factors that contributed favourably to the risk attitudes of the men farmers. From the empirical evidences, the contribution of different factors towards risk attitudinal differential between male and female farmers is mainly due to the differences in the estimated coefficients of the simultaneous risk equation. Furthermore, it was established that gender discrimination affect- a structural difference was the *de facto* responsible for the differential in risk behaviour between the two gender categories and accounts for 99.90%, while endowment effect- a human capital on the risk difference accounts for 0.10%. With an average risk attitudinal indexes of -0.06188 (risk averse) and 0.01441 (risk neutral) respectively for women and men farmers, the estimated risk index gap is -0.07628. Of the total risk gap (-0.076), gender discrimination and the difference due superior endowment of the men farmers accounted for -0.07636 and 0.000075 risk indices respectively. Therefore, due to gender discrimination women farmers were averse to rice production risk, hence indicating that the overall gap is due to discrimination. Thus, without gender discrimination, the average risk index of women farmers should be 0.01448 (risk neutral). The discrimination value represents 123.41% of the average risk index of the women farmers.

The findings showed the estimated risk index gap, endowment effect and discrimination effect to be -0.07628 (i.e. $\bar{Y}_F - \bar{Y}_M = -0.07628$), 0.012711[i.e. $(\bar{X}_F - \bar{X}_M)\hat{\beta}_F = 0.012711$] and -12.9465 [i.e. $(\hat{\beta}_F - \hat{\beta}_M)\bar{X}_M = -12.9465$] respectively. Thus, it can be inferred that risk gap between the genders is majorly due to the differences in the parameter estimates which is the basis for gender discrimination. The positive sign of the portion of the risk gap *viz.* endowment effect means that relative to the men farmers, on average, women farmers have more characteristics that are associated with risk preference. The results of risk gap vis-à-vis co-operative membership show age, marital status, household size, farming experience, mode of land acquisition, distance from house to market, unit cost of fertilizer, and unit cost of pesticides to be the endowment covariates that contribute favourably to the risk behaviour of co-operative participating farmers (Table 8). On the other hand, endowment covariates *viz.* gender, educational level, distance from home to farm, unit price of output, unit cost of hired labour, unit cost of seeds, unit cost of herbicides and yield contributed favourably to the risk attitudes of non-cooperative member farmers. It was observed that discrimination effect *viz.* co-operative participation accounts for 99.996% of the risk gap between co-operative participants and non-participants while characteristics effect *viz.* endowment factors accounted for 0.004%.

The risk gap is -0.15944 as depicted by the average risk indexes of 0.04473 and -0.11471 respectively for participants and non-participants. Out of the overall difference, an index of -0.15945 owes to participation in co-operative association while an index of 0.0000063 owes to superlative characteristics of the co-operative member farmers. Thus, it can be inferred that due to participation discrimination, non-cooperative members lost a magnitude risk index of -0.15945 towards risk preference. Of the average risk index of the non-cooperative member farmers, the discrimination value represents 139%. Therefore, without discrimination, the average non-cooperative member farmers should be risk neutral as evidenced by the risk index of 0.044738. Based on the empirical evidences the risk index gap is -0.15944 (i.e. $\bar{Y}_{NC} - \bar{Y}_C = -0.15944$), the characteristics effect is -0.00057 [i.e. $(\bar{X}_{NC} - \bar{X}_C)\hat{\beta}_{NC} = -0.00057$], and the discrimination effect is 14.314 [i.e. $(\hat{\beta}_{NC} - \hat{\beta}_C)\bar{X}_C = 14.314$]. Therefore, it can be inferred that the risk gap between co-operative participants and non-participants is majorly to participation discrimination i.e. differences in the coefficients. The negative sign of the endowment effect depicts that on the average, relative to non-cooperative participating farmers, the co-operative participating farmers have more characteristics that are associated to risk preference.

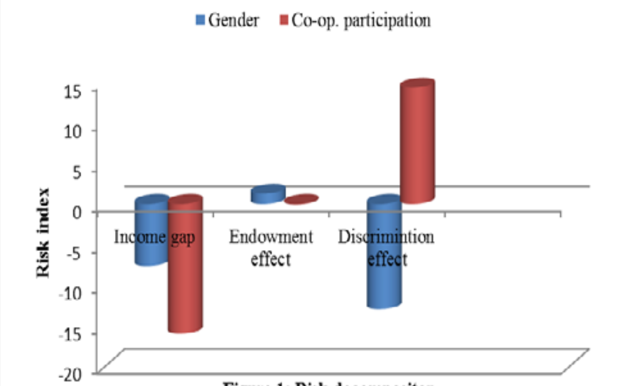

Figure 1: Risk decompositon

Table 7. Risk gap vis-à-vis gender

Items	Female	Male	$\bar{X}_F$	$\bar{X}_M$	$\beta_F(\bar{X}_F - \bar{X}_M)$	$\bar{X}_M(\beta_F - \beta_M)$
Intercept	11.57848	-1.26347				12.84195
Age	0.005743	-0.00523	41.074	41.592	-0.00297	0.456431
Marital status	0.044553	0.057354	0.89706	0.83219	0.00289	-0.01065
Education	0.021015	0.002324	8.5882	7.9658	0.01308	0.148888
Household size	0.028289	0.027069	3.9118	4.4178	-0.01431	0.005391
Experience	0.001825	0.002741	10.221	9.5514	0.001222	-0.00875
Mode of land acquisition	0.159534	0.033174	0.76471	0.72945	0.005625	0.092173
Distance from home to farm	0.035799	0.028	4.1029	4.399	-0.0106	0.034309
Distance from home to market	-0.0024	0.029809	6.3971	5.5137	-0.00212	-0.17759
Co-operative organization	-0.07025	0.156774	0.70588	0.7226	0.001175	-0.16405
Ln unit price of Output	-0.17094	0.661816	4.711151	4.703385	-0.00133	-3.91678
Ln unit cost Labour	-1.48399	-0.29728	6.794183	6.797304	0.004631	-8.06646
Ln unit cost of Fertilizer	0.167892	-0.00396	4.941142	4.881134	0.010075	0.838835
Ln unit cost of Seed	0.044898	0.045251	5.849382	5.617353	0.010418	-0.00198
Ln unit cost of Herbicides	-0.31064	-0.09496	7.569515	7.604496	0.010866	-1.64012
Ln unit cost of Pesticides	0.044153	0.007476	7.904593	7.918811	-0.00063	0.290445
Ln Yield	-0.08227	0.027349	7.72683	7.540781	-0.01531	-0.82664
Risk index	**-0.06188**	**0.014409**				
Risk index Gap	**-0.07628**					
Endowment Difference					**0.012711**	
Discrimination Difference						**-12.9465**
Overall risk index diff.						**12.95925**
% from overall risk index diff.					**0.098086**	**99.9019**
Contribution to Gap					**7.5E-05**	**-0.07636**
Without Discrimination					**0.014484**	**0.014484**
% of Discrimination in RI						**123.4088**

Source: Field survey, 2020

Note: RI = Risk index

Table 8. Risk gap vis-à-vis co-operative participation

Items	NCP	CP	$\bar{X}_{NCP}$	$\bar{X}_{CP}$	$\beta_{NCP}(\bar{X}_{NCP} - \bar{X}_{CP})$	$\bar{X}_{CP}(\beta_{NCP} - \beta_{CP})$
Intercept	-10.3093	4.154886				-14.4642
Age	0.004009	-0.0051	41.119	41.641	-0.00209	0.379354
Gender	-0.03223	0.168826	0.80198	0.81467	0.000409	-0.16379
Marital status	0.022474	0.033809	0.75248	0.88031	-0.00287	-0.00998
Education	0.001788	0.004458	8.3762	7.9691	0.000728	-0.02128
Household size	0.015571	0.029436	3.9307	4.4749	-0.00847	-0.06204
Experience	0.000442	0.001865	9.6733	9.6795	-2.7E-06	-0.01378
Mode of land acquisition	-0.01857	0.078104	0.75248	0.72973	-0.00042	-0.07054
Distance from home to farm	-0.01638	0.035276	4.2376	4.3842	0.002402	-0.22649
Distance from home to market	0.01561	0.027197	5.1683	5.8803	-0.01111	-0.06813
Ln unit price of Output	0.390212	0.560035	4.70944	4.703023	0.002504	-0.79868
Ln unit cost Labour	1.146525	-0.86846	6.810153	6.791424	0.021474	13.68463
Ln unit cost of Fertilizer	0.113688	-0.07302	4.878627	4.898138	-0.00222	0.914497
Ln unit cost of Seed	0.00015	0.052835	5.703616	5.650241	7.98E-06	-0.29769
Ln unit cost of Herbicides	-0.02111	-0.20986	7.587564	7.602002	0.000305	1.434838
Ln unit cost of Pesticides	0.023636	0.009541	7.716817	7.984224	-0.00632	0.112537
Ln Yield	-0.03346	0.029477	7.466285	7.619283	0.00512	-0.47957
Risk index	**-0.11471**	**0.044732**				
Risk index Gap		**-0.15944**				
Endowment Difference					**-0.00057**	
Discrimination Difference						**14.31388**
Overall risk index diff.						**14.3145**
% from overall risk index diff.					**0.003967**	**99.996**
Contribution to Gap					**6.33E-06**	**-0.15945**
Without Discrimination					**0.044738**	**0.044738**
% of Discrimination in RI						**139.0017**

Source: Field survey, 2020

Note: RI = Risk index

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings, it can be inferred that rice cultivation on thinly uneconomic holdings due to poor capital base and fear of capital loss made most of the farmers to be risk averse. Furthermore, results from decomposition *viz*. gender and co-operative association participation established that gender discrimination-gender stereotype: lack of access to and control over productive resources and diseconomies of scale-lack of pecuniary advantage made most of the female farmers and non-cooperative participating farmers to be vulnerable to risk averse. Generally, high cost of herbicides- liquid biocides was the major factor that plummeted farmers' favourable disposition to risk preference. Further, it was observed that gender and co-operative participation differentials have impact on the risk attitudes of the farmers. Empirical evidenceshowed that discrimination effect-structural difference *viz*. gender and co-operative association participation was majorly responsible for gap in the risk attitudes of the rice farmers. Therefore, the study recommends that the farmers form a viable co-operative organization, especially the women farmers, to achieve economies of scale and overcome the challenges posed by gender-discrimination-stereotype *viz*. poor access to and control over productive resources. In addition, the policymakers should make gender budget mainstreaming mandatory, thus insulating women farmers from vicious cycle of poverty.

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