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Drivers for the Adoption of Risk Management Practices by Farmers in Ghana: Critical Inquiry from the Wa East District

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ABSTRACT
This study seeks to identify the drivers for the adoption of risk management practices among farmers in the Wa East District. The study adopts both Poisson regression and negative binomial models to identify the determinants of adopting risk management practices. However, a statistical test for over dispersion indicates that the Poisson regression model suites the data best. A semi-structured questionnaire was used to collect data from 200 farm households selected through a multi-stage sampling process. The results revealed that farmers in the Wa East District are characterized by low level of formal education, operating under small scale and lack specialization. Many farm enterprises are kept by a farmer as a way of avoiding production and marketing risk. Farmers were observed to have been practicing many risk management tools with low concentration on financial risk tools. Many variables were hypothesized to have influence on the intensity of adoption but are not found significant. The significant variables include level of education, production capacity and access to services. Therefore, stakeholders interested in marketing agriculture in the Wa East District through promotion should include among their incentives ways of enhancing farmer adoption of risk management practices. Specific concentration should be on provision of credit and extension services to farmers. Farmers with some level of formal education, many farm enterprises and larger farm sizes are adopters of the intensity of risk mitigation measures. Any policy set to promote better farming practices to avoid risk should not fail to include these categories of farmers.
Keywords: Adoption of Risk management practices, Wa East District, Poisson Regression, Negative Binomial Distribution, Farmers

1.0 INTRODUCTION

The Problem statement or Gap for this study is that, Smallholder farmers in rural developing country face risky decisions regularly in their daily lives (Ihli *et al*., 2013). Such people constitute over two-thirds of the world poorest people who are located in rural areas and engage in subsistence agricultural which is highly risky and an uncertain venture (Todaro & Smith, 2009). Changes in weather and damage to crops or livestock from disease or pests make output uncertain (Austin, 1992). While output prices (one of the marketing mix) are incentive to improvement in global crop supply, price volatility on the other hand discourages agricultural investment in terms of crop expansion (Haile and Kalkhul, 2013). This implies that reducing price volatility can be a potential of increasing food supply. Breen *et al* (2013) therefore, added that derivative products have the capacity to offer farmers protection from price volatility. In Africa investment levels are frequently suboptimal partly because the agricultural sector is perceived as risky and yielding unattractive returns on investment. This therefore, poses a challenge to agribusiness to act as the engine of economic growth.

In Ghana, the agricultural sector still remains the main support in terms of the provision of food and employment (Institute of Statistical, Social and Economic Research, 2011). Crop production and livestock keeping are largely ruralcomprising 85% of rural households, 92% of rural Savannah (Ghana Statistical Service, 2008) and 86% of households in the Upper West Region (Inkoom and Nanguo, 2011) whose livelihoods are vulnerable to climatic shocks, market volatility, rising prices of agricultural inputs, post-harvest losses and human risk (National Development Planning Commision, 2005). Finding measures to reduce these risks remains the main supply side challenges to financing agricultural investment (MoFA, 2007).

While crop productivity is associated with the intensity of input use, yield can be increased through better farming practices (Diao, 2010). Efforts have therefore, been made by the Government of Ghana to respond to uncertainties in the agricultural sector to ensure emergency preparedness in a number of ways. The lunching of the Food and Agricultural Sector Development Policy (FASDEP) II and the Savannah Accelerated Development

Authority (SADA) suggest strategies that aim at promoting agricultural sector risk reduction. For instance, the introduction of high-yielding and short duration crops varieties, development of effective post-harvest management strategies (MoFA, 2007) and the creation of a Special Northern Ghana Risk Finance Instrument to support farmers are interventions to managing production risk.The Upper West Agricultural Development Project(UWADEP) intended to improve food security and increase the income of small holders through farmer training and demonstration, support to technology generation, marketing, processing, livestock development and supply of rural financial service (International Fund for Agricultural Development, 2005) is an additional effort towards mitigating production risk.

Farming in general is an uncertain venture which can lead to loss resulting from risk associated with production, processing, marketing, financing, and legal and personnel. These events occur at different times in different places with different intensities among farmers all over Ghana. Effective planning needs to be done by farm managers to offset variability in value of agricultural output. This is achievable through the adoption of risk management tools to softening the consequences of taking risky actions and undesirable results (Kay *et al*., 2008).

Despite all efforts to up-scale smallholder farmer productivity so as to enhance livelihoods, output of farm products remains variable due to risk and uncertainties hence households' annual income is very small especially in the Upper West Region.Weather, product, factor and price uncertainties are the chief causes of the dynamic nature of crop and animal production especially in the rural environment (Barnard and Nix, 1979).

The Wa East District is noted for the production of food and livestock making it the 'food basket' of the region. However, farming activities in the district is not free from the dynamic production environment given the irregular pattern of rainfall, bush burning and unpredictable market forces (Wa East District Assembly, 2006). Supply of perishable commodities such as fresh okro and tomatoes in the production season often exceed market demand resulting in total loss of revenue due to marketing and demand deficiency. Soybeans, maize and groundnut which are the major cash crops are faced with the challenges of price volatility and uncertain demand. Diseases associated with health hazards attack farmers in the district thus posing a threat to human life and agricultural production. Several risk management tools are available for farmers to adopt so as to reduce the variability of possible outcomes, set minimum income or price level, maintain flexibility of decision making and improve the risk bearing ability of farm managers (Kay *et al*., 2008), however, farmer adoption of these practices in the district is believed to be low. It is anticipated that these challenges could be curtailed if appropriate risk management practices are adopted by farmers in the district. It is based on this problem that the study seeks to identify the drivers for the adoption of risk management practices among farmers in the Wa East District.

2.0 REVIEW OF PREVIOUS STUDIES

A number of past and present empirical studies have been carried out on risk management among farm enterprises. Such studies exclusively concentrated on the identification of risk sources or outlining risk management strategies. For instance, Okereke (2012) investigation into the challenges of risk management among farmers in the Ebonyi state in Nigeria outlined inadequate finance, pest attack, input acquisition problem, disease and pest attack as the main challenges. The affected farmers therefore, adopted copying strategies as flexibility in farm operation, use of fertilizer, membership of self-help organizations and adoption of improve crop varieties. The reports of past studies such as Lien *et al.* (2003) and Miller *et al.* (2004) do not deviate from recent findings. Lien *et al* (2003) presented 33 sources of risk to Norwegian farmers to rank. Their ranking results indicated that uncertainty about government support, prices and disease are the main sources of risk. They further indicated that key strategies to manage risk include disease prevention, off-farm investment, price contracts and adoption of insurance technology. Several alternatives for mitigating risk are therefore, available for the farmer, yet an optimal risk management decision often rely on sound analysis of the entire portfolio of policies (Lubben *et al*., 2013).

Miller *et al.* (2004) are of the view that production, marketing, financial, legal and human risk can best be mitigated via mechanisms such as avoidance, reduction, retention and transfer. Carter (1985) experience suggests that the use of price floors by government to protect downside risk is reliable in managing risk in agriculture. This underscores the role of government in mitigating risk. Similarly, Coble (2000) points out that government policy and private risk management tools can complement one another to reduce risk. A study on the instability and risk in agriculture maintains that risk management challenges include absence of information to operate a sound programme but can be avoided through government intervention as it has the potential to remain extensive (Goodwin, 2000). Makki *et al* (2001) added that price uncertainty generated by consumer concerned is the major risk facing farmers and recommend improvement in infrastructure and modification of

risk management tools (to accommodate new risk) as ways of lowering farm-level risk. Ihli *et al* (2013) presented a diverse view of how government should intervene in mitigating risk. They observed that subsidizing idiosyncratic risk encourages production to take place on more individual risk. This they believe encourages moral hazards and adverse selection.

In situations of uncertainty, farmers sometimes resort to diversification as risk management strategy. Lien *et al.* (2003) termed this as off-farm investment. Kallas *et al* (2009) observed that farmers receiving higher output prices have alternative economic activity besides farming. Such farmers are often more likely to adopt risk management practices. Rimal and Schmitz (1999) experience in the United States report that farmers' response to froze action is by adoption of diversification as risk reduction strategy. Diversification strategy spreads the risk among various enterprises that can lower risk.

Efforts to raise productivity among smallholder farmers suffered from failure to provide adequate insurance against the risk of crop shortfalls (Todaro & Smith, 2009). Insurance induces cultivators to switch to higher yielding production methods (Mobarak and Rosenzweing, 2013). Marko*vić et al* (2013) investigation supports this. Their simulation results using data on maize yield from central Srem point out that application of indirect-index insurance can reduce weather risk significantly. As insurance remain a reliable strategy of risk reduction, farmers do not want to transfer all risk through it due to high cost (Schaper*et al.,* 2009). Miller *et al.* (2000) therefore, observe that crop insurance rating should allow premium rates to decrease with growers' expectation. The review of literature has therefore, revealed that farmers are not very much ignorant about risk in farming or ways of avoiding. Suresh Kumar *et al*. (2011) observation in Tamil Nadu supports this proposition. They found out that more farmers (65%) are aware of risk management practices especially crop insurance. They therefore, discovered that crop area, presence of risk in farming and income are determinants factors for the payment of premium for insurance while education and social participation will increase awareness of risk mitigation measures. Farmers' awareness of insurance as a risk mitigating measure may remain elusive if adoption level remains low. Po*ćuć*a (2013) presents a strong argument in favour of this position. He maintains that farmers have not developed awareness about the advantages of insurance because suppliers of insurance services have no economic motive to extend their services to them. This has an effect of reducing demand for insurance in agriculture. Consistent with this observation, Breen *et al* (2013) maintained that farmers often lack knowledge of how to apply risk management tools. This implies that availability and awareness of risk mitigation tools may serve as necessary but not sufficient condition for avoiding risk.

Farm operations often fail to use integrated approach in managing risk (Eidman, 1985) but rely on the use of single risk reducing measures. This appears not to be the ideal case since farm enterprises are faced by different kinds of risk. Nowadays, many farmers are trying to adopt a combination of measures to mitigate risk (Makki *et al*., 2001). Recent empirical studies on the determinants of risk status of farmers often point out a number of factors. Prominent among them include socio-demographic, economic and communication factors (Nmadu *et al*., 2012; Ndunda and Mungatana, 2013). Nmadu*et al*., (2012) believe that these factors have different effects on the risk status of farmers while Ndunda and Mungatana, (2013) point out that they have significant effect on farmers choice of risk reduction interventions. Rahelizatovo and Gillespie (2004) study on the adoption of best management practices identify a number of determinant factors. Their Poisson and negative binomialmodels present significant variables to include farm size, output, contact with extension service and being risk averse. All these factors are observed to have positive relationship with the intensity of adoption. In addition, Kouame and Komenan (2012) report that asset; measured by the value of livestock, farming experience, age and social network all have significant and positive effect on farmer desirability of minimum price insurance. However, lager families represent high labour force hence household size is reported to have a significant but negative effect.

3.0 METHODOLOGY

Malhotra and Birks (2007) indicated clearly that the research design (methodology) serves as a framework or blueprint for conducting marketing or business research. It specifies the details of the procedures necessary for obtaining the information needed to structure or solve research problems. The following methods were therefore, employed.

3.1: Data Requirement and Variables

Cross sectional data on the production activities for the 2012/2013 agricultural year were collected through the administration of household questionnaire. The survey was conducted on 200 households in the Wa East District

selected by a multi-stage sampling procedure. This involved first selecting 10 communities at random and then selecting 20 respondents from each community. Data from the survey covered household demographics characteristics and risk management strategies. Secondary sources of data on the risk management practices available to farmers were collected through a review of previous studies from books and publications from journals. Twenty-four (24) risk management tools (grouped under production, marketing, legal financial and personal risk tools) available for farm managers were identified and shown in Table 1.1.

Table 1: Tools for managing risk

Production Risk Tools	**Financial Risk Tools**
Stable enterprise	Fixed interest rates
Diversification	Self-liquidating loans
Insurance	Liquid reserves
Share leases	Credit reserves
Custom farming	Owner equity
Input procurement	
Extra production capacity	
Marketing Risk Tools	**Personal Risk Tools**
Spreading sales	Health insurance
Contract sales	Life insurance
Hedging	Safety precautions
Commodity options	Backup management
Flexibility	
Legal Risk Tools	
Business organization	
Estate planning	
Liability insurance	

Source: (Kay *et al.,* 2008)

3.2: Analytical framework

Adoption decisions have been demonstrated using binary choice models such as the logistic regression (e.g Fernandez-Cornejo *et al.*, 1994; Chianu *et al.*, 2007; Nzomoi *et al.*, 2007; Pruitt *et al*, 2012) or probit regression (e.g Johannes *et al*, 2010; Nkegbe *et al.*, 2011) when the depended variable is categorical and follows a Bernoulli distribution. However, adoption decision can be modelled using count data when the event of interest is generated by the Poisson process (see Ramìrez and Shultz, 2000; Singh *et al.*, 2008). The number of risk management practices adopted by a farmer is a measure of count outcome. The literature (e.g Grogger and Carson, 1991; Greene, 2003; Cemeron and Trivedi, 2005) indicates that the Poisson regression is the natural stochastic model for count data. This study adopts count data model where the depended variable (number of risk management practices adopted) is an observation of discrete events generated by the Poisson process.

Statistical theory maintains that, as the number of observations increase, the probability of success will fall and the binomial distribution will approach the Poisson distribution. Following Green (2003), the probability *(P)* of obtaining *x*number of success out of a total of *n*independence trials is represented by the binomial distribution:

$$P(Y = x) = \frac{n!}{(n-x)!x!} P^x (1-P)^{n-x} \quad (1)$$

As the number of observation ***n*** approaches infinity, the probability of success ***P*** decreases and the binomial distribution converges asymptotically to the Poisson distribution.

$$lim_{n\to\infty} \frac{n!}{(n-x)!x!} P^x (1-P)^{n-x} = \frac{\lambda^x e^{-\lambda}}{x!} \quad (2)$$

Where: $\lambda = np$; the mean number of risk management practices adopted.

The primary equation of the model is its probability density function specified as:

$$f(y/x_i) = \frac{\lambda^y e^{-\lambda}}{y!} \quad (3)$$

Where: y = 0, 1, 2 . . .
A formulation for λ_i is the log-linear model specified as:

$$Ln\lambda_i = x_i'\beta \quad (4)$$

Taking the effect of linearity of equation (4) yields

$$\lambda_i = exp(x_i'\beta) \quad (5)$$

The expected value per period equals the variance of the Poisson distribution. i: e$E[y/x_i] = var[y/x_i] = \lambda_i$. The marginal effect is β_i obtained by taking the first order derivatives of equation (5) .Where β_i is the estimates of the coefficients for the marginal effect and x_i is the *i*th socioeconomic characteristic of households.This means that the coefficients for the marginal effects of the Poisson model can be interpreted as the proportionate change in the conditional mean if the *j*thregressor changes by one unit. The Poisson distribution is restricted for count data and sometimes has its conditional mean different from the conditional variance resulting in overdispersion. A statistical test for overdispersion is desirable after running the Poisson regression model (Cemeron and Trivedi, 2005). The hypothesis is stated as:

H_o : $\alpha = 0$

H_A : $\alpha \neq 0$

In the presence of over dispersion (if the null hypothesis is rejected) the negative binomial model which is more generalized will be adopted. This is specified as

$$f\left(y_i/\lambda, \alpha\right) = \frac{\Gamma(\alpha^{-1}+y)}{\Gamma(\alpha^{-1})\Gamma(y+1)}\left(\frac{\alpha^{-1}}{\alpha^{-1}+\lambda}\right)^{\alpha^{-1}}\left(\frac{\lambda}{\lambda+\alpha^{-1}}\right)^{y} \quad (6)$$

Where:α is the coefficient of over dispersion and λ is the mean. The empirical specification of the model is:

$$LnY = \beta_0 + \beta_1 GEN + \beta_2 AGE + \beta_3 EDU + \beta_4 EXP + \beta_5 LAB + \beta_6 ASSET + \beta_7 ENT + \beta_8 FMSIZE + \beta_9 FM_{INC} + \beta_{10} CREDIT + \beta_{11} EXT + \mu_i \quad (7)$$

Raw data from the field were coded and entered into the SPSS spread sheet where appropriate transformation was done. The processed data were transferred into the STATA software to generate the Poisson regression estimates. Table 2 shows the definition, unit of measurement and *a priori* expectations of the covariates.

Table 2: Variables definitions, units of measurement and hypothesized relationships

Variable	Definition	Unit of measurement	Expected Sign
Y	Risk management practices	Number of farm risk management practiced/adopted	
GEN	Gender	Dummy (If male then 1; else 0)	+/-
AGE	Age	Years	+/-
EDU	Level of Education	Years Spent at School	+
EXP	Experience	Years	+
LAB	Labour	No. of household adults at the farm	+
ASSET	Value of Farm Asset	Ghana Cedis	+
ENT	Farm enterprises	Number of different crops produced	+
FMSIZE	Farm Size	Hectares	+
FM_INC	Farm Income	Ghana Cedis	+
CREDIT	Access to Credit	Dummy (If accessed credit then 1; else 0)	+
EXT	Access to Extension	Dummy (If yes 1; else 0)	+

4.0: RESULTS AND DISCUSSION

4.1: Descriptive Statistics

The studies found that majority (75%) of the farmers are male while only 25% are females. This result is consistent with the findings of Bashiru *et al* (2014) who reported that farming in the Upper West Region is predominantly done by men while their female counterparts then to engage more in trading and agro-processing.The survey further, reveals that average age of farmers is 34.79 with standard deviation 9.49. The average suggests that farmers are within the productive age cohort. Farmers generally have low level of formal education. Average number of years spent at school is 2.45 with standard deviation of 1.15. This observation suggests that farmers will have weakness with regard to reading and understanding agricultural promotion programmes. On average, farmers have 9 years of farming experience with a standard deviation of 7. This suggests that they have at least some level of experience that will enables them adopt some risk mitigation measures to avoid crop failure. Summary statistics of farmer demographic characteristics are shown in Table 3.

The study observed mixed results of farmers' access to services; notably credit and extension service. From Table 3, many (70%) of the sample farmers do not have access to farm investment resources such as credit. Only 30% have access to credit. However, about 65% of them have access to extension services. Only 35% lack access to extension service.

Farmer production capacity has been observed using a combination of indicators. These indicators include labour force; measured by the number of adults from the household working providing labour to the farm, asset value, farm size and farm income. The statistics are shown in Table 3. The production capacity of the farmers such as average farm size of 1.91 hectare indicates that the farmers are basically smallholder farmers. Farmer adopts an average of only 7 risk management practices out of the 24 that were presented to them during the survey.

Table 3: Summary Statistics

Variable	**Statistics**	
	Freq	*Percent*
Gender		
Male	150	75.0
Female	50	25.0
Access to credit		
Yes	60	30.0
No	140	70.0
Access to extension Service		
Yes	130	65.0
No	70	35.0
	Mean	***Std. Deviation***
Age	34.79	9.49
Level of education (Years spent at school)	2.45	1.15
Years of farming experience	9.00	7.00
Number of household adults working at the farm	3.00	2.0
Asset value (GH₵)	700.00	54.69
Enterprise (number of different crops cultivated)	4.00	1.00
Farm size (ha)	1.91	0.57
Farm income (GH₵)	3426.70	2307.57
Number of risk management tools practiced/adopted	7.46	3.00

Source: Field Survey, 2013

Further analysis of the risk management practices observed among respondents is shown in Table 4. Common risk management practices among the farmers in the Wa East District include: Stable enterprise (maintaining some enterprises all year round), diversification (changing of enterprises to avoid some types of risk), extra production capacity, spreading of sales to take advantage of different market conditions, flexibility in decision making, liquid reserves, health insurance, safety precautions and backup management (getting someone to take up management position in the absence of the farmer).The results indicated that more than 50% of the farmers adopt in each case these measures. Some risk management tools were observed not to be practiced by farmers at all. They include crop insurance, hedging, commodity option, estate planning, liability insurance and life insurance.

Table 4: Summary Statistics of Risk Management Tools/Practices

Risk Management Practices	Number of Adopters	Percentage of Adopters	Number of Non-Adopters	Percentage of Non-Adopters
Production Risk Tools				
Stable enterprise	173	86.5	27	13.5
Diversification	167	83.5	33	16.5
Insurance	0	0.0	200	100.0
Share leases	11	5.5	189	94.5
Custom farming	2	1.0	198	99.0
Input procurement	14	7.0	186	93.0
Extra production capacity	120	60.0	80	40.0
Marketing Risk Tools				
Spreading sales	148	74.0	52	26.0
Contract sales	78	39.0	122	61.0
Hedging	0	0.0	200	100.0
Commodity options	0	0.0	200	100.0
Flexibility	111	55.5	89	44.5
Legal Risk Tools				
Business organization	60	30.0	140	70.0
Estate planning	0	0.0	200	100.0
Liability insurance	0	0.0	200	100.0
Financial Risk Tools				
Fixed interest rates	4	2.0	196	98.0
Self-liquidating loans	97	48.5	103	51.5
Liquid reserves	101	50.5	99	49.5
Credit reserves	6	3.0	194	97.0
Owner equity	17	8.5	183	91.5
Personal Risk Tools				
Health insurance	123	61.5	77	38.5
Life insurance	0	0.0	200	100.0
Safety precautions	130	65.0	70	35.0
Backup management	139	69.5	61	30.5

4.2: Drivers for the Adoption of Risk Management Tools/Practices

The drivers for the intensity of adoption of risk management practices were identified using count data models. The Poisson and negative binomial models were fitted. The results in Table 5 indicate the absence of overdispersion since *dispersion equal mean* of the Poisson distribution. The null hypothesis of equality of mean and variance of the Poisson distribution cannot be rejected. Once the estimated alpha coefficient is not statistical different from zero, there is enough evidence that the conditional mean is equal to the conditional variance and the negative binomial model reduces to the Poisson model. Thus, the Poisson model is considered for further analysis and discussion. The estimated Pseudo R-squared value is low (6.4%), but overall significance of the Poisson model, as reported by the Likelihood Ratio Chi-squared value, is satisfactory (significant at 1%). This suggests that farmers' intensity of adoption of risk management practices is influenced by the set of covariates. Five (5) variables were observed to have a significant influence on adoption of the management practices. They include level of education (EDU), number of enterprises kept (NUM_ENT), farm size (FRMSIZE), access to credit (CRED) and access to extension service (EXT).

Table 5: Coefficient Estimates of Drivers for Adoption of Risk Management Practices

Variable	Poisson Estimates				Negative Binomial Estimates		
	Coefficient	Standard Error	Z	$\frac{dy}{dx}$	Coefficient	Standard Error	Z
Constant	1.43044	0.23946	5.97		1.43044	0.23946	5.97
GEN	-0.08796	0.08674	-1.01		-0.08796	0.08674	-1.01
AGE	-0.00236	0.00607	-0.39		-0.00236	0.00607	-0.39
EDU**	0.01515	0.00713	2.12	0.113	0.01515	0.00713	2.12
EXP	0.00972	0.00848	1.15		0.00972	0.00848	1.15
LAB	-0.02589	0.01729	-1.5		-0.02589	0.01729	-1.5
ASST	0.00001	0.00003	0.19		0.00001	0.00003	0.19
NUB_ENT**	0.04731	0.02322	2.04	0.3447	0.04731	0.02322	2.04
FRMSIZE**	0.14777	0.07110	2.08	1.0766	0.14777	0.07110	2.08
FM_INC	0.00001	0.00002	0.76		0.00001	0.00002	0.76
CRED*	0.11325	0.06482	1.75	0.8445	0.11325	0.06482	1.75
EXT***	0.19990	0.06312	3.17	1.418	0.19990	0.06312	3.17
Lnα					-17.71	310.0217	
A					0.00	0.00001	
Observation	200				Likelihood-ratio test of α		0.0
LR chi2(11)	64.10				Chibar^2(1)		0.00
Prob> chi^2	0.00				Prob> chibar^2		0.498
Log likelihood	-468.97				Dispersion =		mean
Pseudo R^2	0.064						

***; **; and * mean significant at 1%, 5% and 10% significant levels, respectively

From Table 5, the marginal effect $\left(\frac{dy}{dx}\right)$ of the Poisson model is the proportionate change in the conditional mean (average number of risk management practices) given a change in the *j*th explanatory variable by one unit.The marginal effects are estimated for variables that were observed to have a significant influence on intensity of adoption.

Level of formal education of a farmer has an influence on the intensity of risk management practices. The coefficient is positive and significant at 5%. This suggests that an increase in the level of formal education of a farmer will have a proportionate increase in the intensity of adoption of risk management practices. As level of formal education increase by one year intensity of adoption will increase by 0.113. Formal education enables one to read and understand agricultural practices such as risk mitigation measures. This finding agrees with that of Suresh Kumar *et al* (2011) who maintained that education increase the level of risk mitigation measures.

It is a common practice of smallholder farmers in the Wa East District to keep a combination of enterprises. Such farmers have higher propensity of adopting many risk mitigation measures. The results in Table 5 indicate that the number of enterprise has an influence on intensity of adopting risk management practices. The effect of this is positive and significant at 5%. Its marginal effect implies that additional enterprise of a farmer will increase intensity of adoption of risk management practices by 0.3447. This observation appears convincing since different crop enterprises have different management practices. Farmers keep different enterprises as a way of avoiding total crop or market failure. In some cases they keep a combination of both drought and water resistance crops to minimize loss.

The scale of production of the farmer also determines the intensity of adoption of risk mitigation measures. Larger farm sizes are associated with higher intensity of adoption. The effect of farm size was observed to be significant at 5%. An increase in farm size by one hectare will attract 1.0766 intensity of adoption of risk management practices. Related previous studies also confirm the positive effect of farm size on intensity of adoption. For instance, Rahelizatovo and Gillespie (2004) point out that farm size has positive influence on the adoption of integrated pest management. Such farmers are associated with more risk than those with smaller farm sizes and this explains why they adopt more risk mitigation tools.
Access to services such as credit was observed to have a significant influence on intensity of adoption. Its influence is positive and significant at 10%. Credit is an investment resource which enables the farmer to adopt risk mitigation measures especially those that require the payment of premium. The survey reveals that access to

credit have a positive influence on the intensity of adoption. The effect of credit is positive. Farmers who access credit have an average of 0.844 intensity of adoption more than those without access to credit. Credit in itself is a risk mitigation measure that offers the farmer the flexibility to adopt more risk management tools.

Extension agents give advice to farmers on better farming practices. However, not all farmers often have access to these services. The survey reveals that the effect of extension is positive and significant at 1%. Farmers with access to extension have an average of 1.418 intensity of adoption of risk mitigation tools than those without access. This result is justified since extension service gives orientation to the farmer on good production and marketing practices.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This study seeks to identify the drivers for the adoption of risk management practices among farmers in the Wa East District. The study adopts both Poisson regression and negative binomial models to identify the determinants of adopting risk management practices. However, a statistical test for over dispersion indicates that the Poisson regression model suites the data best. A semi-structured questionnaire was used to collect data from 200 farm households selected through a multi-stage sampling process.

The survey finding implies that farmers in the Wa East District are characterized by low level of formal education, operating under small scale and lack specialization. Many farm enterprises are kept by a farmer as a way of avoiding production and marketing risk. Farmers were observed to have been practicing many risk management tools with low concentration on financial risk tools. Many variables were hypothesized to have influence on the intensity of adoption but are not found significant. The significant variables include level of education, production capacity and access to services.

The study therefore, recommends that stakeholders interested in promoting agriculture in the Wa East District should include among their incentives ways of enhancing farmer adoption of risk management practices. Specific concentration should be on provision of credit and extension services to farmers. Farmers with some level of formal education, many farm enterprises and larger farm sizes are adopters of the intensity of risk mitigation measures. Any policy set to promote better farming practices to avoid risk should not fail to include these categories of farmers.

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