



Research Article

Socio-economic factors influencing uptake of agriculture insurance by smallholder maize farmers in Goromonzi district of Zimbabwe

Christopher Masara^{1*}, Lighton Dube²

¹Faculty of Agriculture and Natural Resources, Africa University, P.O Box MP 1320, Mutare, Zimbabwe.

²Faculty of Commerce and Law, Zimbabwe Open University, National Office, P.O Box MP 111, Mt Pleasant, Harare, Zimbabwe.

Despite a limited uptake by smallholder farmers in Zimbabwe, agriculture insurance is considered an effective tool for risk management in agriculture. The study used the Logit regression model to determine the factors that influence the uptake of agricultural insurance by smallholder farmer households in Goromonzi district of Zimbabwe using a random sample of 187 maize contracted farmers. The determinants that were of statistical significant and positively influence the uptake of agricultural insurance were age of head of household, source of extension information coming from non-governmental organisation, and farmer receiving advice on agricultural insurance. On the other hand, the determinants that significantly and negatively influence uptake of agricultural insurance are number of extension visits per month by AGRITEX and other governments departments, number of extension visits by other farmers, total income of households in a year and number of years a household head is in a farmer group. Based on the findings it is clear that the Government of Zimbabwe is not being supportive of agricultural insurance, despite having the largest number of extension staff at smallholder farmer's exposure. It is therefore recommended that the Government of Zimbabwe through the Ministry of Agriculture, Irrigation and Mechanisation must have a policy framework on agricultural insurance training and awareness at smallholder farmer level.

Keywords: Agriculture insurance, Smallholder farmers, Zimbabwe, Binary logistic regression

INTRODUCTION

Literature has shown that nowadays, agriculture has a more important role compared to other economic sectors, in terms of assuring required food for growing population in the world (Sadati *et al*, 2010; Rashid pour, 2013). However agriculture has always been a risky business. Unlike the industrial sector, agriculture production risks of crop and animal failure or decreased yields are caused mainly by adverse weather events (drought, excess precipitation and floods), followed in small part by pests, diseases and fire (Sadati *et al*, 2010). Rashid pour (2013) also noted that besides farmers facing production risk which is increasing by the day, they also face price risk due to agricultural trade liberalisation, as was the case of cotton in the past five to ten years. The variations in productivity induced by nature cannot be fully accommodated by farmers (UNCTAD, 1994).

Although it is true that for a long time, farmers have devised measures to limit risks through various measures such as crop rotation and diversification, inter-cropping, use of low yielding, drought, pest and disease tolerant varieties, tillage systems, contractual inter-linking, development of non-cropping and non-farm source incomes, socio-cultural strategies which distribute risk within the extended family, and informal financial arrangements (ibid).

***Corresponding author:** Christopher Masara, Faculty of Agriculture and Natural Resources, Africa University, P.O Box MP 1320, Mutare, Zimbabwe. Tel.: +263772730717. Email: chrismasara@gmail.com.
Co-author: Tel. +263 772 322 432. Email. dubelig@gmail.com

UNCTAD (1994) also noted that such measures implemented by farmers are helpful, but they are limited when it comes to catastrophic situations and aggregate group risks such as drought, floods, pest and diseases outbreaks to mention a few.

In a country like Zimbabwe, some of these potentially insurable risk-induced losses such as the effect of 2015/16 Cyclone El-Niño induced drought have strained the relationship between smallholder farmers and their business partners, especially financial institutions and buyers. Smallholder farmers continue to fail meeting their contractual obligations such as loan repayment and or supplying the required crop quota to contracted private companies. The diversity in risks farmers sometimes face reduces the efficiency of the traditional methods of risk management that are employed by farmers, hence the need to look for alternatives, such as agricultural insurance to strengthen the security of the farmers (MahulandStutley, 2010).

Insurance can be defined as a financial mechanism that aims to reduce the uncertainty of loss by pooling a large number of uncertainties so that the burden of loss is distributed (Mahul and Stutley, 2010; Tsikirayi *et al*, 2012). Generally, each policyholder pays a contribution to a fund in the form of a premium, commensurate with the risk he or she introduces. The insurer uses these funds to pay the losses (indemnities), suffered by any insured (Mahul and Stutley, 2010). On the other hand some literature describes agricultural insurance, as insurance that applies to crops, livestock, aquaculture and forestry (UNCTAD, 1994). Buildings and equipment are described as not being usually covered under Agricultural Insurance, although they may be insured by the same insurer under different policy (ibid). However it must be noted that the decision to buy insurance against risk in agriculture should be an economic one. In making that decision, two factors are critical: 1) How much loss can the manager (farmer) withstand without insurance? 2) What are the trade-offs between insurance costs and potential losses? (Casavant and Infanger, 1984; Mohammed and Ortmann, 2005). Therefore, insurance is more attractive to risk-averse farmers and in situations where risks warrant paying a premium significantly higher than the expected loss without insurance (Hardaker *et al*, 1997; Mohammed and Ortmann, 2005). However in developed countries, governments subsidise premiums, making the purchase of insurance more attractive (Mohammed and Ortmann, 2005).

As previously mentioned, despite the importance of agricultural insurance in mitigating risks of farming, agricultural insurance has not been comprehensively welcomed by smallholder farmers in Zimbabwe and some smallholder farmers are even refusing to accept agricultural insurance.

As was also noted by Makaudze and Miranda (2010), access to affordable private or government agricultural insurance could substantially reduce the vulnerability of smallholder farmers to insurable risks such as drought; promote efficient uses of scarce resources, while diminishing smallholder dependence on expensive and

ad hoc measures. Agricultural insurance can stabilise farmers' incomes and protect them from the impacts of crop failures; it can encourage farmers to adopt technologies that increase production; and it can reduce loan default risk; allowing farmers to secure more favourable credit terms (Binswanger, 1986). Agricultural insurance increases the investment in agricultural sector, as it plays a significant role in compensation of damages to agricultural enterprises, provide secure financial independence to farmers, leverage to access credit to mention a few. In the meantime, achieving these goals requires the identification and investigation of determinants influencing the low uptake of agricultural insurance in Zimbabwe. Literally there are limited subsidies farmers are receiving from the Government of Zimbabwe, except for public extension services.

It is upon this background that the researcher engaged in understanding the complexities and the context that cause low uptake of agricultural insurance by smallholder farmers in Zimbabwe.

METHODOLOGY

The study used a population of 357 farmers who participated in the Maize Contract farming programme in Goromonzi district during the 2013/14 agricultural season. The sample size of 187 farmers used for the study was determined using the ROASOFT sample size calculator with a margin of error of 5% and confidence interval of 95%.

A Logit or Probit model is used to estimate the factors that influenced adoption or uptake of a technology, because the dependent variable evokes a yes or no answer (Gujarati, 1998). It was however observed that, although there is statistical similarity between Logit and Probitmodels, which makes choice between them difficult, Logit model is computationally easier (Amemiya, 1981), hence its choice for this study.

Following Gujarati (1998), the logit model is specified as follows:

$$\ln (P_i / (1-P_i)) = \beta_0 + \beta_1X_1 + \dots + \beta_{13}X_{13} + e_i$$

Where:

P_i = probability of farmer accepting agricultural insurance

$1-P_i$ = probability of not accepting agricultural insurance

β_0 =Intercept

$\beta_i(1, 2, 3...13)$ =Regression coefficients

$X_i (1, 2, 3...13)$ =Independent variables and

e_i = error term.

The agricultural insurance uptake model was specified as follows:

$$\text{INSUuptake} = \beta_0 + \beta_1\text{AGE} + \beta_2 \text{INFORSOURCEngo} + \beta_3 \text{INFORSOURCEict} + \beta_4 \text{EXTpvt} + \beta_5 \text{EXTagritex} + \beta_6 \text{EXTothers} + \beta_7 \text{EXTict} + \beta_8 \text{INSUadvice} + \beta_9 \text{TOTincome} + \beta_{10} \text{EXPingroup} + \beta_{11} \text{TOTlandholding} + \beta_{12} \text{HIGHrisk} + \beta_{13} \text{EDUtertiary} + e_i$$

Where $\beta_0 - \beta_{13}$ are parameters to be estimated or independent variable and e_i is an error term. The descriptions of the dependent and independent variables are given in Table 1 together with the

Table 1. Agricultural Insurance Uptake Model Variable Description

Variable	Description	Variable Measurement	Hypothesis
DEPENDANT VARIABLE			
INSUuptake	Household taking agricultural Insurance	Dummy:1=yes,0=otherwise	
INDEPENDENT / EXPLANATORY VARIABLES			
AGE	Age of household head, showing experience in farming	Years	+
INFOSOURCEngo	Source of extension information coming from Non-governmental organisations or community based organisations	Dummy:1=yes otherwise	0= +
INFOSOURCEict	Source of extension information coming from information communication technology (ICT)	Dummy:1=yes otherwise	0= +
EXTprivate	Number of visits per month by private companies	Number in days	+
EXTagritex	Number of visits per month by AGRITEX and other government departments	Number in days	+
EXTothers	Number of visits per month by other farmers	Number in days	+
EXTict	Number of extension messages per month from information communication technology (ICT)	Number in messages	+
INSUadvice	Farmer receiving advise about insurance	Dummy:1= yes, otherwise	0= +
TOTincome	Total income of a household in a year	Dollars	-
EXPingroup	Number of years of experience of a farmer in a group	Number in years	+
TOTI and holding	Total land that a household has	Number in hectares	+
HIGHrisk	Taste of farmer to be a risk taker. High risk takers have high likelihood of up-taking a new technology	Dummy:1=yes, otherwise	0= +
EDUtertiary	Level of education of head of household up to tertiary	Dummy:1= yes, otherwise	0= +

hypothesized impact of the independent variables on the dependent variable.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Sample Households

Eleven percent of the sample households have irrigation facilities on their farms and the mean livestock units per farmer are 3.17 (Table 2). The average distance of the farm to the nearest town is 93 kilometres. Forty-five percent of the farmers indicated that they have access to markets for their agricultural inputs and produce. Almost 82 percent of the farmers receive most of their extension support from the public extension services. On average each household receives 27 extension visits from the public extension staff per year.

The log likelihood for the fitted model is -28.805 and is significant at Significant at 0.001 (Table 3). The Cox and Snell R square is 0.633 and Nagelkerke R square is 0.921. The Cox and Snell, and Nagelkerke R square are explaining the variations caused by the explanatory variables in the uptake of agricultural insurance to be at 63.3% and 92.1% respectively. The overall percent correct prediction of the model is at 97.2%.

The statistical analysis shows that an increase in age of head of household which is a proxy of years of experience in farming of head of household positively influences uptake of agricultural insurance. This is consistent with a *a priori* expectation. One year increase

in experience in farming increases the uptake of agricultural insurance by a smallholder farmer by 1.137 times at 10% level of significant. This might be explained by the fact that older household heads are often associated with long years of experience in farming. Other studies on adoption on agricultural insurance have shown similar results, Sadati, *et al* (2010) and Tsikirayi, *et al* (2012) noted that experience in damages, which comes with the number of years in farming positively influence a farmer's decision to take up agriculture insurance. Explanation for this result may be a repeated production shocks experienced by the household, which may prompt it to devise a 'safe' mechanism of taking insurance. Although Ng'ombe *et al* (2014) had a similar finding that age of head of household positively influences adoption of a new farming technology – contract farming in the Zambian context; the authors cautioned that such a finding applies up to a certain age. After a certain age, the determinant would negatively influence adoption of new agricultural technology and this finding highlights the relationship that relates to the life cycle hypothesis in economic theory (*ibid*). However, other authors who did not concur with the finding in this study and that of Sadati, *et al* (2010), are Mahammed and Ortmann (2005) and Akinola (2014), who showed that experience negatively influence uptake of agricultural insurance. These authors argued that older and more experienced farmers are less willing to purchase insurance because they might have acquired enough knowledge through time to deal with production risks without insurance. Old age was also viewed to increase risk aversion and a decreased interest in long-term investment in the farming technologies.

Table 2. Summary Statistics of the Sample Households

Variable	Mean	Std. Deviation
LIVESTOCK	3.17	4.531
IRRIG	0.11	0.319
Distance_Town_Km	92.52	24.825
MARKETS	0.45	0.498
EXTN_Public	0.82	0.386
Training_NonBlock	0.10	0.30
Training_FarmerFS	0.19	0.39
EXTN_Visits	26.50	26.15
HHSize	5.87	2.390
Area_Planted_Ha	1.76	1.744
Herfindhal_Index	0.54	0.22
AER_V	0.26	0.441
Improved_Farming	0.81	0.396

Table 3. Logit Regression Estimates of Factors Influencing Uptake of Agricultural Insurance

Variable	Coefficient	Std. error	Wald	Significance.	Odds ratio
Constant	-22.070	7.525	8.601	.003	000
AGE	.128*	.071	3.272	.070	1.137
INFOSOURCEngo	5.563**	2.388	5.426	.020	260.600
INFORSOURCEict	-2.554	2.284	1.250	.264	0.078
EXTpvt	.274	.434	.399	.528	1.315
EXTagritex	-.703***	.251	7.816	.005	0.495
EXTothers	-2.087**	1.067	3.826	.050	0.124
EXTict	.138	.108	1.622	.203	1.148
INSUadvice	14.349***	4.333	10.965	.001	1705369.607
TOTincome	-.002**	.001	5.020	.025	0.998
EXPingroup	-.276*	.147	3.546	.060	0.759
TOTlandholding	-.285	.226	1.590	.207	0.752
HIGHrisk	1.305	1.335	.955	.328	3.688
EDUtertiary	5.525	5.745	.925	.336	250.875
Log likelihood					-28.805 Sig 0.001
Cox & Snell R Square					0.633
Nagelkerke R Square					0.921
Overall percent correct prediction					97.2

*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level

Farmers who receive extension information from non-governmental organisations and community based organisations were 260.6 times more likely to uptake agricultural insurance than farmers who do not receive extension information from non-governmental organisations and community based organisations at 5% level of significant. This finding is consistent with *a priori* expectation and other studies such as Nahvi *et al* (2014) which found that farmers with high frequency of contacts with agriculture experts are more developed regarding crop insurance than those without. In fact, level of contact with experts is directly connected to farmer's awareness and knowledge. The higher the level of farmers' exposure to agricultural insurance

information, the higher the probability that such farmers would be able to get their agricultural enterprise insured. This result seems logical because people who communicate with formal and informal agricultural institutions and instructional programmes are more informed of the new technologies, facilities and opportunities than those who do not. Therefore there is positive reaction to new innovation, as farmers get awareness about benefits of agricultural insurance from non-governmental organisation.

Farmers who receive extension advice on insurance increase their chances of up taking agricultural insurance by 1.7 million times more than farmers who do not receive extension advice about insurance at 1%

level of significant. Akinola's (2014) concurs with this study's findings that receiving extension information on agricultural insurance is either through formal or informal education, positively influenced uptake of agricultural insurance. Akinola (2014) argued that since farmers would be knowledgeable about agricultural insurance they will be able to understand insurance procedures, policies and risk management mechanism of agricultural insurance. However access to information may also result in non-adoption or uptake of a technology. For instance, where experience within the general population about a specific technology is limited, more information induces negative attitudes towards its adoption, probably because more information exposes an even bigger information vacuum hence increasing the risk associated with it (Bonabana-Wabbi, 2002). It is therefore important to ensure information is reliable, consistent and accurate. Farmers need to know the existence of technology, its beneficial and its usage for them to adopt it.

Another determinant that is significant, but negatively influence uptake of agricultural insurance, is the number of extension visits by AGRITEX and other governmental departments. An increase of one day per month of extension visit by AGRITEX to a farmer household reduces the chances of a farmer up taking agricultural insurance by 0.495 times than otherwise at 1% level of significant. This finding is not consistent with a *priori* expectation, which says increase of number of visits by AGRITEX and other agricultural departments positively influences uptake of agricultural insurance. Wiggins (1986) whilst studying Sub-Saharan Africa public extension agents noted a key challenge to extension agents working with smallholder farmers that are subsistence-oriented. Smallholder farmers' situation with regards to technical dimensions are difficult to offer location-specific extension support on crop varieties, soil types, pest and diseases and farming systems unlike commercial production with limited and specific enterprises. Public extension agents are therefore forced to provide general extension information because of their diversity in roles and sometimes limited technical capacity to cover the diverse range of smallholder farmers' requirements. Wiggins (1986) also noted the limited resources of governments which characterise conditions that foster low morale such as lack of mobility, limited to no equipment and low salaries sometimes give an advantage to organisations working in private legal frameworks to perform better than government structures. All the above mentioned factors may have contributed to the negative influence on the role of AGRITEX and government department in farmers' up-taking agricultural insurance. Rashid pour (2013) also noted that governments' financial support, guaranteed price of insurance product and supportive and facilitating policies positively influence adoption of agricultural insurance. However such supportive policy frameworks which are expected to positively influence up take of agricultural insurance by smallholder farmers were not observed in the Government of Zimbabwe's key policy documents for the past three years such as the annual budgets, monetary policy reviews and the

Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZIMASSET) to mention a few.

Other determinants that are significant and negatively influencing uptake of agricultural insurance are number of visits of other farmers bringing agricultural information to fellow farmers and number of years a farmer has been in a farmers group. The data shows that an increase by one day per month of farmer bringing agricultural information to a fellow farmer household will reduce the chances of the visited household up-taking agricultural insurance by 0.124 times at 5% significant than otherwise. Whilst on the other hand an extra year a head of household stays in a group reduces the household's chances of up taking agricultural insurance by 0.6 times at 10% level of significant than otherwise. These determinants are both not consistent with the *priori* expectations. Other studies do not agree with the findings as was noted by Mwangi and Kariuki (2015), that social group enhances social capital allowing trust, idea and information exchange. Farmers within a social group learn from each other the benefits of usage of a new technology. Therefore increase in number of years a farmer belongs to a group or farmer visits fellow farmers would increase adoption of agricultural insurance. Because social networks effects are important for individual decisions, and that, in the particular context of agricultural innovations, farmers share information, learn from and with each other. Foster and Rosenzweig (1995) when studying adoption of Green Revolution technologies in India found that learning externalities within social networks increased the profitability of adoption, but also farmers appeared to be free riding on their neighbours' costly experimenting with the new technology. Bandiera and Rasul (2002) concurs with this study's findings by suggesting that, learning externalities generates opposite effects, such that the more other people engage in experimenting with new technology, the more beneficial it is to join in, but also more beneficial it is to free-ride on the experimenting of others. As a result of these contradictory effects, Bandiera and Rasul (2002) propose an inverted U-shaped individual adoption curve, implying that network effects are positive at low rates of adoption, but negative at high rates of adoption. On the other hand a further analysis based on the descriptive analysis shows that most farmers interviewed in this study did not indicate agricultural insurance as one of their core business of joining a group. Among the core businesses of groups mentioned were contract farming, conservation agriculture and general agriculture. These core business especially conservation farming is a mitigation measure to drought, which could be a major motivation for not taking Weather Index Insurance which was the only agricultural insurance on offer.

Total income of a household in a year also negatively influences uptake of agricultural insurance. An increase of one dollar in a household in a year will reduce that household from up-taking agricultural insurance by 0.998 times where determinant is significant at 5% level of significant than otherwise. This finding is consistent with a *priori* expectations. Other studies also revealed

that increased of income is a proxy of diversification in other enterprises (Mahammed and Ortmann, 2005), and it negatively influence uptake of agricultural insurance because of other options. High income provides a diverse risk management strategies, therefore farmers with high income might opt to invest in less costly risk management mechanisms elsewhere rather than on the farm. On the other hand Sadati, *et al* (2010) and Tsikirayi, *et al* (2012) do not concur with this finding to the study, as their findings revealed that high income increases the chance of farmers taking up agricultural insurance as farmers will be having money to buy insurance policies, as the farmers would be having enough cash to pay premiums, which are usually believed to be beyond the reach of many poor farmers. Mwangi and Kariuki (2015), also noted that high income has a positive impact on adoption of new technology. Income acts as an important strategy to overcome credit constraints faced by the rural households in many developing countries (Reardon *et al.*, 2007). High income therefore is reported to act as a substitute for borrowing capital in rural economies where credit markets are either missing or dysfunctional (Ellis and Freeman, 2004; Diiro, 2013). High income was found to be a source for cash to purchase agricultural insurance premiums.

CONCLUSION

Agricultural insurance is a confident-supporting tool for financial resources of agricultural producers and investors (Sadati *et al*, 2010; Nahvi *et al.*, 2014). It is an effective tool for risk management in agriculture and agricultural insurance uptake by smallholder farmers in Zimbabwe as a new technology it is dependent on many factors. In this study determinants influencing uptake of agricultural insurance by smallholder farmers in Goromonzi district of Zimbabwe were investigated and analysed using Logit regression model.

The study results showed that determinants that significantly and positively influence uptake of agriculture insurance by smallholder farmers are age of head of household (AGE), source of extension information coming from non-governmental organisation (INFOSOURCEngo), farmers receiving advice about insurance (INSUadvice), number of extension visits per month by AGRITEX and other government departments (EXTagritex), number of extension visits per month by other farmers (EXTothers), total income of a household in year (TOTincome), and years of experience of a farmer in a group (EXPingroup).

The findings to the study highlight that, although the interface of farmers and AGRITEX and other government departments is considered to be positively influencing adoption of agricultural new technology in Zimbabwe (Dube and Guveya, 2015), in this study it is otherwise. As was noted by Wiggins (1986) smallholder farmers' situations with regards to technical dimensions are difficult to offer location-specific advices unlike commercial production with limited and specific enterprises. Public extension agents in Zimbabwe may

be in a situation where are they being forced to provide general extension information because of the diversity of their roles and sometimes limited technical capacity to cover the diverse range of smallholder farmers' requirements. Wiggins (1986) also noted the limited resources of governments which characterise conditions that foster low morale such as lack of mobility, limited to no equipment and low salaries which sometimes give an advantage to organisations working in private legal frameworks to perform better than government structures. However, given the fact that AGRITEX and other government departments are the majority extension agents offering services to smallholder farmers in Zimbabwe, it is imperative that solution be found to increase knowledge and information to them. This study propose measures that addresses a policy gap that may have left training and awareness on agricultural insurance to be done by non-governmental and community based organisations, as is shown by the determinant positively influencing in uptake of agricultural insurance.

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