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Poultry Farms Risk Management by Insurance: Evidence from Ghana

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study assessed poultry farmers' decision to pay for poultry insurance in the Dormaa Municipality of Ghana, from a random sample of 100 commercial chicken producers. The paper employed the Contingent Valuation and Tobit models. The results showed that 72% of farmers are willing to pay GHS 31.00 or 3.10% on average of the chicken value of GHS 1000.00 ($263.52) to insure. Poultry farmers with multiple income sources tend to substitute insurance for other forms of occupation. The study found risk influence producers decision to insure because they have moderate frequency and impact. Prior experience with insurance, severity of disease serve as incentives for insurance and age serve as disincentive for agricultural insurance which require capacity building programmes to strengthen farmers demand for insurance whilst insurers take advantage of this potential market to sell viable insurance products.

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1. INTRODUCTION

Poultry production is militated by production risk notwithstanding its contribution to food security and poverty reduction. The sub-sector grew by 7.2% in 2014 [1] and the commercial sector which is mainly chicken production contributes protein and employment. But the sub-sector is constrained by significant uncertainties and risks. These include high inputs prices, frequent outbreak of Gumboro, yearly occurrence of New Castle Disease [2,3,4,5]. The Highly Pathogenic Avian Influenza incidence which occurred shortly in 2007 had greater negative impacts on producers and consumers [6]. Risk is compounded by weather variability [7] and it hinders the adoption of best farm practices with resultant reduction in output which may negatively affect producers' access to finance [8].

The responses to production risk are varied due to the influence of social, economic and institutional factors. Producers might respond to risk by using measures such as sale of farm assets, inefficient methods of production, keeping uneconomical stock levels etc. But these traditional methods may further deepen the impact of risk. However, risk shared through formal insurance can effectively mitigate the negative effects. High risk farmers are more likely to pay for insurance contracts at higher coverage levels [9]. [10] study identified nature of risk, cost/returns of insurance, farm size, and income diversification and premium subsidy as factors of insurance.

Agricultural insurance is developed despite the risk of being systemic or likely occurrence of moral hazard and adverse selection. Most agricultural risks are covariate in nature which might hinder insurers to supply the product [11]. If farms in a given location face systemic risk the farms might be exposed to the risk and react differently. But some risk due to overcrowding looses, and diseases from Gumboro, fowl pox, New castle are farm specific. Poultry insurance is practiced in Australia, Bangladesh, China, New Zealand, Republic of Korea, India, Nigeria and Mexico on commercial basis [12].

The farmer's decision to insure depends on risk preferences conditioned on farmer, farm and socioeconomic characteristics [13]. Thus, [8] study analyzed food crop farmers' willingness to insure in the Kintampo Municipality of Ghana. However, the determinants of farmer's decision to insure may be varied due to differences in risk aversion and riskiness as a result of dissimilar characteristics arising from differences in geographical location, enterprise type and the socioeconomic characteristics of the farmers. Again the farmers should bear the cost of insurance to create a win-win situation for the insuree and insurer. In view of this the research questions that are necessary to be addressed are the characteristics of the risk, available risk management options and the factors which influence farmer's decisions to pay for insurance? Following section one, is section two on the analytical tools used for the study. Part three presents the results and discussions of the study while the final section covers the conclusions.

2. MATERIALS AND METHODS

2.1 Examining the Frequency of Occurrence of Perceived Perils on Poultry Production

$$F = \frac{\sum_i^N f_j}{N} \quad (1)$$

Where F is the average frequency of a named peril, $f_{i\,=}$ frequency of occurrence of the *j-th* peril as reported by *i-th* farmer = 100.

Average frequency from 1 to 2 times in five years is classified as low frequency and average frequency from 3 to 5 times in five years is classified as high frequency.

2.2 Perceived Impact of Perils on Poultry Production

The impacts of the named perils have been described in the category of low, Average and High depending on the mean score. The mean score for each peril is calculated from scores of low (1), average (2) and high (3) (Table 1).

2.2.1 Classifying farmers into risk attitude

Risk attitudes have been classified into risk aversion, risk neutral and risk loving based on the scores of a set of questions in Appendix 1. Farmers whose total score fell in the range 1 to 21 have been classified as risk averse. On the other hand a farmer with total score within 22 to 35 has been assigned risk loving based on

answers from a 3-likert scale of strongly disagree (1), not sure (2) and strongly agree (3).

Table 1. Indicators for determining the impact of a peril

Impact	Indicators	Percentage (%)
	Absolute	
Low	Below 1.50	Below 50
Average	1.50 – 2.39	50 – 79
High	2.40 – 3.00	80 – 100

Source: Author computation

2.3 Estimation of Factors that Influence Farmers' Willingness to Pay for Poultry Insurance Scheme

2.3.1 Theoretical framework

Farmers decide to use insurance in addition to production factors in a bid to maximize expected utility of end-of-period wealth, subject to physical and technical constraints [14]. Thus the determinants of insurance drive the original return distribution and minimize the deviation of the insured return from uninsured return distributions. Hence risk attitude of farmers, the riskiness of the enterprise and risk management options in turn depends on farm, farmer characteristics and the use of other risk competing management techniques. The amount of premium, a dependent variable, is a continuous variable that is censored at a lower bound of zero and an upper bound of infinity is estimated by the Tobit model in equation 1 unlike OLS model which can result to biased and inconsistent estimates [15]. By the Tobit model, variables which positively influence the probability to insure also increase the mean value of the dependent variable [16]. The specific determinants are age, educational level, household size, poultry farming experience; poultry farm size, multiple incomes, farmer's exposure to insurance, impact of diseases and frequency of diseases [14,10,13,8].

2.3.2 Empirical model specification

The Tobit model is given by equation (2):

$$Y_i = \beta_1 Age_i + \beta_2 Agesquare_i + \beta_3 EDU_i + \beta_4 HHSIZ_i + \beta_5 PFEXP_i + \beta_6 PFSIZ_i + \beta_7 MULINC_i + \beta_8 INSEXP_i + \beta_9 IMPDIS_i + \beta_{10} FRQDIS_i \quad (2)$$

$y_i\ is$ the dependent variable (premium censored at zero). The explanatory variables used in the model, how they were measured and their a priori expectations are as shown in Table 2.

2.3.3 Sample size and sampling technique

The study has been based on data on socio-economic characteristics of the respondents, nature of perils and the premium payments with a well-structured questionnaire. The contingent valuation method was applied to solicit for premium from one hundred (100) poultry farmers from a total of one hundred and seventeen poultry farmers (117) in the Dormaa Municipality by simple random technique. Respondents who indicated their willingness to participate in the insurance stated their premium to insure a baseline value of GHS 10000.00 coverage rate of 95% of the flock.

Table 2. Summary description of variables

Variable	Description	Measurement	Expected sign (+/-)
AGE	Age of farmer	Number of years	+
AGE^2	Age square	Measured as square of age	-
EDU	Education	None_0; Primary level_1:Junior Secondary/Middle School level_2;SeniorSecondary/Vocational level_3;;Tertiary_4;	+/-
HHSIZ	Household size	Number of dependents of farmer	-
INSEXP	Farmers' exposure to insurance	Dummy (1= yes, 0 = otherwise)	+/-
PFEXP	Farming experience	Number of years	+
PFSIZ	Poultry farm size	Number of birds	+
MULINC	Multiple income sources	Dummy (1 = yes, 0 = Low)	-
IMPDIS	Impact of disease	Dummy (1 = high, 0 = Low)	+
FRQDIS	Frequency of disease	Dummy (1 = high, 0 = Low)	+

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics

The table below presents the distribution of age, farming experience, educational level and number of birds. It can be revealed that middle age with considerable experience is significant among the respondents of mainly small and medium scale of production systems as noted by [3]. The sizes of the farms and adherence to the recommended practices might favor the supply of insurance.

Table 3. Socio-economic characteristics of farmers

Characteristic	Frequency	Percentage
Age		
21-30	5	84
31-40	32	8
41-50	36	2
51-60	15	3
61-70	12	3
Total	100	100
Experience		
Below 10 years	28	28
10-20	53	53
21-30	15	15
Above 30 years	4	4
Total	100	100
Educational level		
Tertiary	10	10
SHS/Voc/Tech	52	52
Middle/JHS	33	33
Primary	4	4
No education	1	1
Total	100	100
Number of birds		
1000-5000	43	43
5001-10000	34	34
Above 10000	23	23
Total	100	100

Source: Survey data (2014)

3.2 Risk Management

Maize stocks are held to control for shortage to offset the high price of it due to weather vagaries. Risk is also managed by the sale of farm assets or diversification of income. Very little proportion of the farmers invests in treasury bills to provide additional income. The business is quite labour intensive so a large proportion of them use family labour which is more reliable.

3.3 Farmers Willingness to Pay for Poultry Insurance Scheme

Willingness to pay for insurance is (Fiqure 1) at a mean premium of GHS 31.00 for the hypothetical insurance coverage of GHS 10,000.00 per 1000. This premium constitutes 7.5% of the sum insured which might be low to meet the cost of insurance.

3.4 Farmers' Risk Attitude and Willingness to Pay for Insurance

Risk aversion is the key risk attitude. Willingness to pay for insurance is high partly due to risk aversion (Tables 4-6). Insurance might be costly due to the associated cost and the expected cost from reinsurance to manage the systemic nature of farm risk [9]. Insurance can be subsidized to sustain it [7].

Table 4. Farmers risk attitude and willingness to pay for insurance

Risk attitudes	Total number	Number willing to pay
Risk averse	58	46
Risk loving	29	16
Risk neutral	13	10
Total	100	72

Source: Survey data (2014)

Table 5. Chi-square test for relationship between risk attitude and willingness to pay for insurance

	Value	Df	P. value
Pearson chi-square	5.767[a]	2	0.056
Likelihood ratio	5.515	2	0.063
Linear-by linear association	5.197	1	0.023

a. 1 cells (16.7%) have expected count less than 5. The maximum expected count is 3.64

3.5 Major Occupation of Farmers and Willingness to Participate in Insurance Scheme

Poultry farming is the main economic activity of the respondents besides cocoa production, trading and teaching service. None of those who indicated poultry keeping as a secondary occupation is willing to pay for insurance and this association is significant. Poultry farmers with multiple income sources might substitute for insurance (Table 7).

Table 6. Major occupation and farmer's willingness to pay

Major occupation	Frequency	Willingness to pay
Poultry farming	88	72
Cocoa farming	8	0
Trading	3	0
Teaching	1	0
Total	100	72

Source: Survey data (2014)

Table 7. Chi-square test for relationship between major occupation and willingness to participate in poultry insurance

	Value	df	P. value
Pearson chi-square	35.065[a]	4	0.000
Likelihood ratio	35.142	4	0.000
No. of valid cases	100		

a. 5 cells (70%) have expected count less than 5. The minimum expected count is 0.28

The perils have low frequency of occurrence with the exception of theft and poor quality day old chick is the least source of risk for the producers. Whilst sources of risk from flood, periodic shortage of maize, disease, and windstorm are less frequent but have considerable influence on poultry production to influence the demand for it.

Table 8. Nature of perils by frequency vs. impact

Frequency	Perceived impact		
	High	Average	Low
High			Theft
Low	Flood	Maize shortage	Poor quality day old chicks
	Water pollution	Disease incidence	
		Windstorm	

Source: Survey data 2014

3.6 Factors Influencing Poultry Farmers' Willingness to Insure

The factors such as age, prior experience with insurance and impact of disease as found by the study positively influence the probability to insure as well as the premium. Younger farmers with adequate level of maturity are quite innovative and knowledgeable to use insurance to manage risk. Similarly, farmers in Nigeria who are very old are less likely to pay for insurance [17]. The study found perceived impact of poultry diseases positively

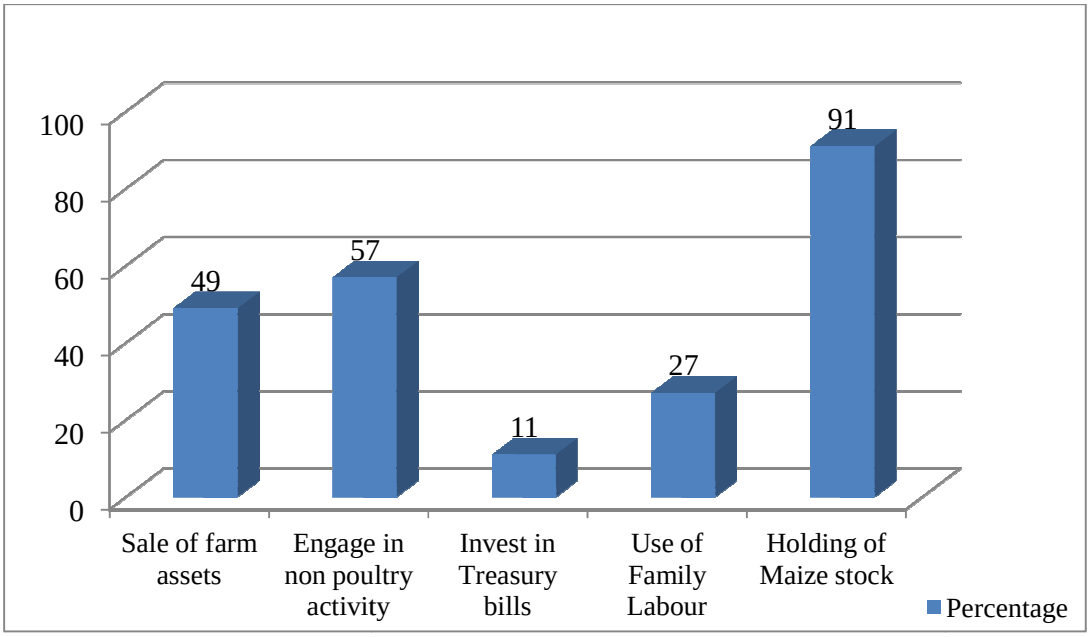

Fig. 1. Risk management strategies used by poultry farmers in Dormaa
Source: Survey data (2014)

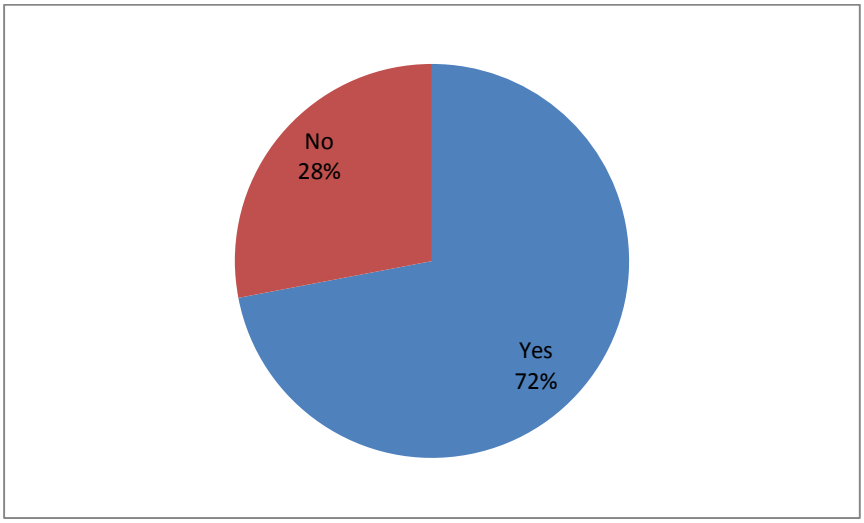

Fig. 2. Proportion of farmers willing to pay
Source: Survey data (2014)

Table 9. Tobit regression estimate of willingness to pay the maximum premium

Variable	Coefficient	Std. error	P> IZI
AGE	6.876***	2.039	0.001
AGE^2	-0.085***	0.028	0.000
EDU	-0.079	1.713	0.963
HHSIZ	-1.589	1.512	0.296
PFEXP	0.537	0.393	0.176
PFSIZ	0.000	0.000	0.551
MULINC	-4.519	3.569	0.209
INSEXP	16.61***	5.556	0.004
IMPDIS	3.291***	1.233	0.009
FRQDIS	1.139	1.459	0.437
CONS_	-133.9	46.34	0.005

*NB: *** denotes 1% significance*
Source: Survey data (2014)

influence decisions to purchase insurance. In a related study by [18] high perceived impact of a peril positively influence farmers' decision to insure. Insurance is used to stabilize returns in the production process [10] but this has the potential to cause adverse selection in the presence of information asymmetry [13]. Multiple sources of income tend to negatively affect insurance decisions but the relationship is weak. Prior favorable experiences about insurance also influence insurance decisions positively which is consistent with the results of [18].

4. CONCLUSIONS

This study modeled farmers' decisions to pay for poultry insurance scheme in Dormaa Municipality. The study found that poultry insurance might be purchased mainly by the farmers who are engaged in the occupation. The results further revealed that perils such as diseases, periodic shortage of maize, windstorm, and flood are frequent and have moderate impact to influence producer's decision to insure. Risk aversion behavior might partly influence decisions to insure. Very old farmers are less likely to purchase livestock insurance and if extent of severity of a peril is considerable insurance is likely to be purchased. Good exposure with the insurance product will stimulate the demand for it. This study emphasized capacity building programmes for older farmers to deepen awareness and need for insurance. Insurers should formulate feasible plans to sell livestock insurance to the farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX 1

Table possible questions

I like experimenting with new ways of doing things
I take more chances than others
I am willing to take higher financial risk than others
I have to take higher risk in order to be successful in business
Am willing to try new technology and production methods even before others try them
In selling poultry products I prefer higher credit sales than lower cash sales
I usually don't like "playing it safe"

Source: Authors formulation

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