Factors influencing in adoption of livestock insurance with special reference to Haryana

Shyam Prakash Singh and BS Chandel

Received: 05 February 2019 / Accepted: 12 March 2019 / Published online: 22 June 2019
© Indian Dairy Association (India) 2019

Abstract: In spite of the concerted efforts put forth by the Government, the adoption of livestock insurance has been very low in the country. The reasons for its lack of adoption could be related with implementation and efficacy of the scheme, and socio-economic conditions of the farmer. In logit relationship, the paper found that increase in herd size and share of crossbred animals in the herd raised the probability to adopt the livestock insurance. Any efforts on the part of Government, Extension and Research Organizations to promote commercialization of dairy farming and up-gradation of germplasm of animals will go a long way in supporting the livestock insurance in the country.

Keywords: Adopters, Factors influencing, Haryana, Livestock insurance, Risk

Introduction

An animal supports more than one function in the livelihood of a mankind and especially that of resource-poor household. As cited by Rangnekar (2006), livestock performs four major roles and functions (1) output function: related to producing food and

non-food products, (2) input function: related to providing inputs for crop production, transport, etc., (3) risk coverage or asset function: related to raising money in times of need, and (4) Socio-cultural functions: related to social status, culture, etc. Milk being the major product accounts for 65% of the value of livestock output; the production of which is concentrated on small, marginal and landless households. The marginal and small landholders account for about 69 per cent of the total milk production (Parthasarathy and BIRTHAL, 2008). Putting both the facts together hints at that these households have greater dependence on livestock. Because of which these households are more vulnerable to any risk related with animal and its production. The factors of risk in dairy sector are related with animal, production (inputs), marketing (losses) and the prices. Among these factors, risk related with animal is the major caused by the morbidity and mortality of animal, infertility and disease infection. To protect the farmers against risk of animal, the Government of India introduced livestock insurance scheme on a pilot basis during the years 2005-06 and 2006-07 of the 10th Five Year Plan (2002-07) in 100 selected districts. The scheme continued for same districts during the 11th Five Year Plan (2007-12) which was further extended to other districts in the country. Under the scheme, the crossbreed and high yielding cattle and buffaloes were insured at maximum of their current market price. The Livestock Insurance Scheme has been formulated with the twin objectives of providing protection mechanism to the farmers and cattle rearers against any eventual loss of their animals due to death and to attain qualitative improvement in livestock and their products. Basic risk covered by livestock insurance is death in consequences of illness or accident, diseases and emergency slaughtering. The amount of premium depend on animals' species, breed, and age of animal, level of risk, milk production and current market value. This scheme does not cover loss due to injury, death or liability directly or indirectly caused by disease arising out of external parasites, theft, clandestine sale, pollution war and invasion, etc.

Adoption of Livestock Insurance Scheme

In spite of the concerted efforts put forth by the Government in terms of subsidy in the premium collected, the numbers of milch animals insured are very low i.e. 0.85 per cent of the milch animals insured in 2015-16 in the country. The same were 0.48 per cent in

Shyam Prakash Singh (✉) and BS Chandel
Division of Dairy Economics, Statistics and Management,
ICAR-National Dairy Research Institute, Karnal-132001, Haryana
Email: shyamsingh7296@gmail.com, Mobile: +918017501429

2006-07, the year of start of Livestock Insurance Scheme. Among the available information, the highest numbers of milch animal insured was in Karnataka (9.26%) and it was 3.46 per cent in Haryana (GOI, 2017). The reasons for its lack of adoption could be related with implementation and efficacy of the scheme, and socio-economic conditions of the farmer. As far the efficacy of the scheme is concern, the earlier study by Singh et al. (2016) found that livestock insurance scheme in Haryana has functioned effectively by settling about 87 per cent of the insurance claims on an average and was, also, found financially viable in the short and long run for the insurance companies. This shows that there is nothing wrong with the implementation of the scheme but there may be other reasons and factors which need to be determine and addressed to improve the adoption of livestock insurance by the farmers. Therefore, the present study was taken up with the objectives to determine the factors affecting adoption of livestock insurance scheme implementation.

Materials and methods

In order to meet objectives of the study, data were collected from 150 farmers comprising of 75 each from livestock insurance adopters and non-adopters from all six blocks of Karnal district of Haryana. The study was targeted at the selected state and the district keeping in view the dairy development in the area and prosperity of the farmers so that the effect of these two factors can be removed from the analysis of factor determinants. The data was collected through personal interview method on a pre-tested structured schedule.

In order to determine the factors influencing the adoption of livestock insurance by the farmer, binominal logit model was used. Since, the value of dependent variable was 1 for adopter and 0 for non-adopter; the logistic distribution constrains the value of probability between 0 and 1. The model can be expressed as

$$\text{logit}(p_i) = \ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \sum_{i=1}^n \beta_i X_{ij}$$

$$\text{In Logistic Distribution Function, } p_i = \frac{1}{1 + e^{-(\beta_0 + \sum \beta_i X_i)}}$$

$$p_i = \frac{1}{1 + e^{-z_i}} = \frac{e^{z_i}}{1 + e^{z_i}} \text{ if } Z_i = \beta_0 + \sum \beta_i X_i$$

$$\text{and } (1 - p_i) = 1 - \frac{e^{z_i}}{1 + e^{z_i}} = \frac{1}{1 + e^{z_i}}$$

Where

p_i = Probability of i^{th} farmer having purchased the livestock insurance,

$1-p_i$ = Probability of i^{th} farmer having not purchased the livestock insurance,

$\ln(p_i/(1-p_i))$ = Natural log of odd ratio,

$\hat{\alpha}_0$ = Intercept or constant term,

$\hat{\alpha}_i$ = Vector of response coefficient,

X_i = Set of explanatory variables.

Depending upon the explanatory variables included, logit model was postulated as

$$\ln[p_i/(1-p_i)] = \beta_0 + \beta_1 \text{EDU}_i + \beta_2 \text{HS}_i + \beta_3 \text{PCB}_i + \beta_4 \text{RLI\&FI}_i + \beta_5 \text{EXP}_i + \beta_6 \text{FS}_i + \beta_7 \text{SOCIAL}_i + \beta_8 \text{DVH}_i + \epsilon_i$$

Where

EDU_i = Formal education of farmer of the i^{th} farmer,

HS_i = Herd size (number of milch animals) of the i^{th} farmer,

PCB_i = Percentage of cross breed in a herd (%) of the i^{th} farmer,

$\text{RLI\&FI}_i$ = Ratio of livestock income to farm income (ratio) of the i^{th} farmer,

EXP_i = Experience of the i^{th} farmer in number of years,

FS_i = Farm size (ha.) of the i^{th} farmer,

SOCIAL_i = Social participation score of the i^{th} farmer,

DVH_i = Distance of Veterinary Hospital/Dispensary from the i^{th} farmer.

ϵ_i = Error term or stochastic term

The choice of explanatory variables was mainly based on the general working hypothesis and partly on empirical findings from literature and opinion of the experts in the field of economics. A positive or negative sign was assigned depending upon the potential influence of a particular variable on having the livestock insurance. The description of explanatory variables included in the logit regression is given in (Table1).

The marginal effects of variables were obtained from the logit regression results by the following equation:

$$\frac{\Delta P_{ji}}{\Delta X_{ji}} = P_{ji} (\beta_j - \sum R_{ki} \beta_k)$$

Where, $\hat{a}$ and P represent the parameter and likelihood of one of the choices. Marginal likelihood gives better indications and represents changes in dependent variable for a given change in a particular explanatory variable while holding the other explanatory variables at their sample means.

Results and discussion

The independent variables included in the final logit regression were the formal education of farmer (EDU), herd size (HS), percentage of cross breed in a herd (PCB), ratio of livestock income to farm income (RLIFI), experience in dairying (EXP), farm size (FS), social participation score (SOCIAL) and distance of veterinary Hospital/Dispensary (DVH). There were very few adopter farmers gone for livestock insurance who took livestock loan. The results were contrary to the study of Sendil and Mishra (2013) which concluded that the loan amount taken to purchase animal was the significant factor influencing adoption of insurance. However, the results in the present study should be interpreted in the context of the study area where the highest proportion of animals were insured in the small herds and the farmers have larger share of income from crops which help them to make investment in dairy farming and loan is not the sole criteria to go for insurance of dairy animals.

The mean value of the independent variables used for the analysis of determinants of livestock insurance adoption is presented in (Table 2). As is evident from the table, there was not much difference in the average value of variables of ratio of livestock income to farm income (RLIFI) and distance from veterinary hospital/dispensary (DVHD) between the two groups of farmers.

Nevertheless, mean values of education level, herd size, percentage of crossbred animals in the herd, farm size and social participation score were substantially higher for the farmers adopted livestock insurance. Contrary to the assumptions, the average experience of the farmers in dairying was higher for non-adopters of the livestock insurance and that may be the reason

that the variable was having negative effect on probability of adoption of the insurance.

Factors Determining Adoption of Livestock Insurance

The result of binary logistic regression model of livestock insurance is presented in (Table 3). The model was estimated using maximum likelihood method. The P-value for the model fit was zero up to five decimal place and highly significant at ($p < 0.001$) with eight degree of freedom, indicating that at least one of the parameters in the model is nonzero. The McFadden's R-square or Pseudo R^2 is 0.31, indicating that 31 per cent of the variations in probabilities of participating in livestock insurance was explained by the covariates defined in the logistic model.

The signs of all the variables were as per expectation mentioned in Table 1 except in case of experience (EXP) and the distance of veterinary hospital/ Dispensary (DVHD). The sign of DVHD was expected to be positive assuming that more the distance from veterinary hospital, higher the probability of farmer to go for livestock insurance. Since the coefficient is non-significant, it may be considered as good as zero and causing no effect on adoption of livestock insurance. The experience of the farmer in dairying was found to be significant at one per cent level of probability which means as the experience increased the probability to adopt livestock insurance decreased. There may be two reasons for the same- one, the level of education decreased with the increase of experience and the farmers with more experience in dairy farming were not properly understanding the formalities of the livestock insurance and another that farmer works more confidently with livestock as experience increases and found livestock insurance less relevant.

The other two variables found statistically significant were the herd size (HS) and percentage of crossbred animals (PCB). They were significant at 5 per cent level of probability. All other factors such as education (EDU), ratio of livestock income to farm income (RLI& FI), farm size (FS), social participation score of the dairy farmer (SOCIAL) and distance of veterinary hospital/ Dispensary (DVHD) were found statistically non-significant and considered to be not influencing the adoption of livestock insurance. The positive signs of the variables HS and PCB indicate that the

Table1 Description of independent or explanatory variables included in logit model

Sl. No.	Variable	Definition	Expected sign
1	EDU	Formal education of farmer (number of years studied e.g. primary = 5, middle= 8 etc.) (number)	+
2	HS	Herd size (number of milch animals)	+
3	PCB	Percentage of crossbred in a herd (%)	+
4	RLI& FI	Ratio of livestock income to farm income (ratio)	+
5	EXP	Experience of the farmer in dairying in number of years	+
6	FS	Farm size (ha.)	-
8	SOCIAL	Social participation score of the dairy farmer	+
9	DVH/D	Distance of Veterinary Hospital/Dispensary	+

greater the value of these variables, the higher is the probability for farmers to participate in livestock insurance.

Odds Ratio Estimates of Independent Variables

The value of odds ratio of independent variable shows the change in odds ratio per unit change in independent variable, i.e. the chance of adopting livestock insurance as compare to not adopting insurance. The odds ratio for each variable was obtained by exponentiating the coefficient of the variable and the same are presented in (Table 4) along with standard error and interval of confidence. Perusal of the table shows that odds ratios were greater than one for all variables which have positive effect on the adoption of livestock insurance. This means that for a unit increase in variable, the odds increase in favour of adoption of livestock insurance. These odds figures were less than one for the variables having negative influence in the adoption. However, the discussion has been restricted to only significant variables i.e. EXP, HS & PCB.

From the odds ratios of the herd size (HS) and percentage of crossbred animals (PCB), it could be inferred that for one unit increase in these variables, the odds in favour of adoption of livestock insurance increased by 21 per cent and 2.8 per cent, respectively. In the case of experience (EXP), for one year increase in experience, the odds of adoption of livestock insurance decrease by 8.6 per cent. Thus, herd size was having the highest influence on increase in odds ratio in favour of livestock insurance adoption.

Marginal Effect of Factors on adoption of Livestock Insurance

Marginal effects show the change in probability when the predictor or independent variable increases by one unit. For continuous variables, this represents the instantaneous change given that the unit may be very small. All the significant variables in the analysis were continuous. The marginal effects of each of them are given in (Table 5).

Table2 Independent variables, their units of measurement and mean values

Variable	Unit	Farmers adopted Livestock insurance (n=75)	Farmers not adopted livestock insurance (n=75)	Overall (n=150)
EDU	Number of years	8.15	4.24	6.19
EXP	Number of years	24.61	36.57	30.59
HS	Number of milch animals	7.85	4.64	6.25
PCB	% of crossbred	31.26	12.20	21.73
RLIFI	Ratio	0.51	0.50	0.50
FS	Ha.	2.99	1.75	2.37
SOCIAL	Score	29.16	13.11	21.13
DVHD	Kms.	3.36	3.36	3.36

Table3 Estimated coefficients and their level of significance of factors influencing dairy livestock insurance adoption

Parameter	Estimate	Standard Error	Z	p-value	95 % Confidence Interval	
					Lower	Upper
Constant	1.104	1.388	0.795	0.426	-1.617	3.825
EDU	0.010	0.060	0.159	0.874	-0.109	0.128
EXP	-0.090***	0.026	-3.427	0.001	-0.141	-0.038
HS	0.191**	0.096	1.979	0.048	0.002	0.380
PCB	0.027**	0.011	2.389	0.017	0.005	0.049
RLIFI	-0.772	1.450	-0.532	0.595	-3.614	2.071
FS	-0.102	0.136	-0.752	0.452	-0.369	0.164
SOCIAL	0.011	0.009	1.266	0.205	-0.006	0.028
DVHD	0.056	0.150	0.371	0.701	-0.238	0.349

** and *** shows significance at $p < 0.005$ and < 0.001 level

Log-Likelihood of Constants only Model = LL(0)	-103.972	McFadden's Rho-squared
0.314		
2*[LL(N)-LL(0)]	65.389	Cox and Snell R-square
Df	8	Naglekerke's R-square
p-value	0.00000	0.471

Table 4 Odds Ratio Estimates of the independent variables

Parameter	Odds Ratio	Standard Error	95 % Confidence Interval	
			Lower	Upper
EDU	1.010	0.061	0.897	1.137
EXP	0.914	0.024	0.868	0.962
HS	1.210	0.117	1.002	1.462
PCB	1.028	0.012	1.005	1.051
RLIFI	0.462	0.670	0.027	7.933
FS	0.903	0.123	0.691	1.179
SOCIAL	1.011	0.009	0.994	1.028
DVHD	1.057	0.158	0.788	1.418

Table 5 Individual variable derivatives averaged over all observations. (Marginal effect)

Parameters	Marginal Effect
Constant	0.173
EDU	0.001
EXP	-0.014
HS	0.030
PCB	0.004
RLIFI	-0.121
FS	-0.016
SOCIAL	0.002
DVHD	0.009

The marginal effect of experience variable indicates that as the level of experience increases, the probability to purchase livestock insurance decrease by 1.4 per cent keeping all other factors constant. On the contrary, increase of herd size (HS) and percentage of crossbred animal in the herd (PCB) increased the probability to adopt livestock insurance. The marginal effect of HS indicated that as the number of milch animal holding increases by one unit, the probability of purchasing livestock insurance increases by 3 per cent while other variables were fixed at their mean values. Sherrick et al. (2004) found in their study on Midwestern farmers that besides leveraged, less wealthy and riskier, farmers operating larger acreages engage more extensively in insurance. These insurance users place higher values on risk management in general and consider insurance as one among several risk management practices. The marginal effect of one unit increase i.e. 1 per cent, in the percentage of crossbred animal in the herd on the probability to adopt livestock insurance was very negligible i.e. 0.40 per cent. The marginal effect of ratio of livestock income to farm income (RLIFI) variable was the highest negative but found statistically non-significant.

Conclusions

The study concludes that herd size and percentage of crossbred animals in the herd were having positive effect on the adoption of the insurance. Between these two variables, the odds ratios of the herd size (HS) indicated 21 per cent increase in odds ratio with one unit increase in herd size. In case of PCB, odds ratio

increase by 2.8 per cent while the probability increased by 0.40 per cent with one per cent increase in PCB. It implies that raising herd size and composition of high yielding animals in the herd will encourage farmers to go for livestock insurance. The effect of experience in dairying on adoption of livestock insurance was negative which contrary to the expectation. The one year increase in experience decreased the odds ratio by 8.6 per cent and probability by 1.4 per cent. The concerted efforts on the part of Government, Extension and Research Organizations to promote commercialization of dairy farming and up-gradation of germplasm of animals will go a long way in supporting the livestock insurance in the country.

Acknowledgements

The authors thank the Director, ICAR-National Dairy Research Institute, for providing financial assistance and infrastructure to carry out the research work. First author also acknowledges financial assistance in the form of institute fellowship during the period of M.Sc. research project and thank the “farmers” of Haryana, who freely shared all their data and viewpoint.

References

- Bharati RC, Azad NK, Singh KM, Chakraborti S, Chandra N, Singh SP (2014) Factors affecting adoption of crop insurance in Bihar. *J Agri Search* 1(2):102-107
- Dalal A, Gopinath K, Shah S, Panda G (2012) A Case for livestock insurance IFFCO-TKIO General Insurance cooperative limited. *J Int Labour Organ Micro-insurance paper No.17*, Geneva, Switzerland
- GoI (Government of India) (2017) Basic Animal Husbandry Statistics-2017, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, New Delhi
- Njavro M, Par V, Drazenka P (2007) Livestock insurance as a risk management tool on dairy farms. *Poljoprivreda (Osijek)* 13 (1): 78-84
- Parthasarathy RP, Birthal PS (2008) Livestock in mixed farming systems in South Asia. National Centre for Agricultural Economics and Policy Research, New Delhi, India; International Crops Research Institute for the Semi-Arid Tropics, Patancheru, 502324, Andhra Pradesh, India. 156 pp.

- Rangnekar DV (2006) Livestock in the livelihoods of the underprivileged communities in India: A review. International Livestock Research Institute, Nairobi, Kenya. <https://cgspace.cgiar.org/handle/10568/29061>
- Rostami F, Shabanali HM, Mohammadi H, Irvani H (2007) Determinant Factors in Adopting Insurance (Case Study: Wheat Farmers in Hersin, Kermanshah). *Econ Agric Dev* 15 (60): 1-21
- Sendil RK, Mishra A (2013) Factors motivating adoption of cattle insurance among cattle rearers. *Int J Res Econ Soc Sci* 3(2):39- 45
- Sharma A (2010) Livestock insurance: Lessons from the Indian experience. Institute for Financial Management and Research. Centre for Insurance and Risk Management. http://www.ifmr.co.in/wpcontent/uploads/2011/03/Livestock_Insurance_Anupama.pdf.
- Sherrick BJ, Barry PJ, Ellinger PN, Schnitk GD (2004) Factors Influencing Farmers' Crop Insurance Decisions. *American J Agricul Econ* 86 (1): 103-114
- Singh SP, Chandel BS, Horo A (2016) Is that high claims plug widening of livestock Insurance Scheme? A case study of Haryana State. *Indian J Econ Dev* 12(1a): 525-530
- Williams R (2015) Logistic Regression, Part I: Problems with the Linear Probability Model (LPM), University of Notre Dame, <https://www3.nd.edu/~rwilliam>.