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Role of Socio-economic Variables in Adoption of Crop Insurance: A Discriminant Function Approach

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ABSTRACT

This study examined the influence of the respondents' socio-economic characteristics on their adoption of crop insurance schemes. Discriminant analysis based on the criteria values of standardized canonical coefficient and correlation matrix identified that educational level, farm size, satisfaction level, awareness and access to source of credit were positive discriminators while negative coefficients were obtained for age, income level and number of earning members. Awareness about crop insurance scheme, satisfaction level of farmer respondent with respect to the insurance scheme and access to source of credit were the highest discriminant variables. The study made it amply clear that socio-economic characteristics of farmers exert a significant influence on their adoption of crop insurance schemes. Taking into cognizance the findings of the discriminant analysis it can be inferred that awareness about the schemes and their benefits have to be created among the farmers in order to motivate them to go for insurance of their crops.

Keywords: Socio-economic, crop insurance, discriminant analysis, adoption

The structure of the national economies throughout the world has undergone important changes in the 20th and 21st centuries. These changes have been carefully monitored and analyzed, especially in relation to the continuous population growth that needs more and more natural resources. While there is already no need to assess the weight of agriculture in the developed economies, recent studies have emphasized a decreasing trend of agriculture also for the developing and third world economies (Mare, 2010, Saikia 2011). Unexpected events with adverse results such as drought, typhoons, disease infestation, or earthquake can cause risks in farming activities. Almost annually, heavy crop damages have been reported as caused by floods, droughts, and other natural calamities. However, risks and uncertainties could be managed so that the impact could be minimized. Risk management is concerned with reducing the possibility of unfavorable outcomes, or at least softening their effects. One way of reducing risk is through agricultural insurance. When disasters happen, farmers and/or poor farming households will have less access to risk management options needed to cope with the consequences of such events. (Rola, *et al.*, 2013). They have advocated the best way to overcome all the threats to agricultural sector and to improve rural welfare through agricultural or crop insurance (Dragos and Mare 2014).

It has been repeatedly mentioned that crop insurance through indemnity payments serves as a cushion when uncertainties occur. Estacio and Mordeno (2001) expressed the view that crop insurance is a risk management mechanism designed to even out agricultural risks and blunt the consequence of natural disasters to make losses, especially to the more marginalized farmers, more bearable. Several studies have however reported that the extent by which income loss is reduced through indemnity is limited because of the small indemnity payment received (Alarkon, 1997; Bacani, 2005; Famorcan, 2006).

The government's concern over the failure of crops as a result of erratic environment has brought

crop insurance into the peasants' eye as a risk mitigating measure and saving farmers from losses. Success of any governmental initiative for the benefits of agrarian community depends on the socio-economic conditions of that community. Age, education, income levels etc. are the major components of socio-economic variables which influence the adoption or non-adoption of any initiatives of the government (Bharti *et al.,* 2014). Age of the farmer who manages the farms indicates his capacity to work. It also affects one's ability to adopt innovations and changes. Education is one of the factors which govern the decision making capacity of a framer by enhancing knowledge and awareness about the benefits and shortfall of the technology or initiatives of the government. The income of the farmer is also a major determinant in the adoption of insurance or any technologies. The low-income group comprises the impoverished lot and their meagre earnings can't support expensive initiatives or technologies (Bharti *et al.,* 2015).

Insurance is generally defined as the form of risk management primarily used to hedge against the risk of a contingent, uncertain loss. Insurance is likewise defined as the reasonable shift of the risk of a loss, from one unit to another, in substitute for payment. Agricultural insurance is not only limited to crops, but also covers livestock, forestry, and even aquaculture. It is indisputably an important measure to save farmers from risk and uncertainties. Hence, impact of socio-economic conditions of the farmers is an indication of perceived importance of crop insurance to the national economy through production of agricultural produces. Accordingly, the study aims to identify the socio-economic factors which influences the adoption and non-adoption of crop insurance in the state of Bihar

Discriminant Function Approach

Socio-economic variables play an important role in development of attitude of a person. These variables influence the behavior of a person. Discriminant analysis (function) can be used to identify the socio-economic characters which explain why an individual behaves in a way he/she does. It is a statistical tool used to determine which variables discriminate between two or more naturally occurring groups. It is a method used to classify an observation into one or several of *a priori* groupings dependent upon the individual characteristics. The discriminant function approach is an effective tool for classifying a set of observations into predefined classes. The purpose is to determine the class of an observation based on set of variables known as predictors or input variables. The model is built based on a set of observations for which the classes are known. This set of observations is sometimes referred to as the training set. Based on training set, the technique construct as set of linear functions of the predictor is known as discriminant functions. It is used to investigate difference between groups and to discard variables, which are little related to group distinction. If the means for a variable are significantly different in different groups, then this variable discriminates between the two groups. This allows the use of that variable to predict the group membership (Ellis, 2006).

MATERIALS AND METHODS

The study is based on primary data collected from 200 farmers out of which 100 were adopters. The sample was drawn from two districts of Bihar namely East Champaran and Sheohar out of which the former had the largest number of farmers adopting insurance schemes and on the other hand, the later had the lowest number of farmers opting for crop insurance schemes.

Discriminant analysis is also used to examine the factors which contribute to observe groupings (Gwary *et al.,* 2012). The grouping may be made *a priori* based on field observations or groups may be formed for example, through cluster analysis the second type of discriminant analysis is utilized to examine the factors which contribute most to explaining membership of different groups. In case, it is needed to hypothesize which factors are likely to be responsible for or at least associated with differences in the characteristics of the different groups.

In the context of present study two (2) *a priori* grouping were made to represent adopter and non-adopter of crop insurance schemes, that is, insured and non-insured farmers. Socio-economic characteristics of respondents were hypothesized to contribute to discriminating between the adopter and non-adopter groups. Discriminant analysis was employed to analyze the effects of the socio-economic characteristics of the respondents on

their adoption or non-adoption of crop insurance schemes and their discriminators between the two groups of respondents i.e. adopters and non-adopters. The model was specified as follows:

$$Z = b_Q + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8$$

Where,

Z = Total score on the discriminant function

b_1 to b_8 = beta coefficient (weights or discriminant function coefficients) in respect of socio-economic variables X_1, X_2, X_3..... X_8

Q = Status of participation (Adopter or non-adopter)

X_1, X_2,....., X_8 = socio-economic characteristics of the respondents (Discriminating variables).

Where,

X_1 = Age (years)

X_2 = Educational level (years)

X_3 = Income level (Rs.)

X_4 = Number of earning members

X_5, = Farm size (ha)

X_6 = Satisfaction level (satisfied=1, otherwise 0)

X_7 = Awareness level (aware=1 otherwise 0)

X_8= Source of Credit (Institutional =1, otherwise 0)

RESULTS

Descriptive analysis of socio-economic variables

Table 1 provides data relating to the mean and standard deviation of socio-economic characteristics of respondents for their status of adoption of insurance scheme. The data revealed varied trend in the mean and standard deviation of the variables considered. The respondents falling under non-adopter category have a mean age of 41.54 years and standard deviation of 10.95 which become 41.66 years and 11.14 in case of adopter respondents. In this way, mean age does not show much variation between adopter and non-adopter respondents. Similar is the case with educational level of respondents as there is not much variation between the two groups, on this account.

The mean income level of adopter and non-adopter groups of farmers was estimated as ₹ 3.4 and ₹ 3.2 thousand respectively. This implies that no distinction can be made between adopter and non-adopter groups on the basis of income level of the respondents.

Table 1: Descriptive statistics for selected socio-economic characteristics of adopters and non-adopters of crop insurance scheme

Variables	Adopters		Non-adopters	
	Mean	Std. Deviation	Mean	Std. Deviation
Age	41.6600	11.14581	41.5400	10.95298
Educational level	3.2800	1.35586	3.2200	1.35962
Income level	3.2000	1.08797	3.4000	0.98974
Number of earning member	1.1600	0.37033	1.1200	0.32826
Farm size	2.8500	1.54936	2.6260	1.63193
Satisfaction level	0.4000	0.49487	0.0000	0.00000
Awareness	0.5600	0.50143	0.0000	0.00000
Access to sources of credit	0.5000	0.50508	0.3600	0.48487

With respect to number of earning members, the result does not reveal much variation between the adopter and non-adopter groups. The mean and standard deviation values with respect to farm size for adopter and non-adopter groups of farmers also do not show much variation. However, the mean of satisfaction level, awareness and access to sources of credit is higher for adopter group than that for non-adopter group. This implies that farmers with higher level of satisfaction, awareness and access to sources of credit are more likely to adopt insurance schemes.

Relative importance of discriminating variables

In order to assess the relative importance of discriminating variables, the step wise procedure was adopted to select the best discriminating variables. The criteria for evaluating the relative contribution of each variable as discriminator between the two groups of respondents are the values of standardized canonical coefficients, structure coefficient, and Eigen values. Table 2 presents the result of discriminant analysis with respect to the status of adoption of insurance scheme by the respondents. The standardized discriminant function coefficients are used in expressing the relative importance of discriminating variables

selected for the purpose and entered in model. Standardizing the values is necessary so as to have a common scale of measurement for comparative purposes as the variables are not measured in the same unit.

The table revealed that among the eight socio-economic variables, five made positive contribution while the remaining three made negative contribution to discrimination between adopter and non-adopter of crop insurance scheme. The positive signs obtained for the standardized co-efficient for educational level, farm size, satisfaction level, awareness and access to sources of credit suggest that respondents' chance of adopting insurance scheme increased with increase in positive values of the selected variables. Negative coefficients were obtained for variables like age, income level and number of earning members. This implies that these variables have a negative influence on the decision to adopt crop insurance and they decrease the probability of respondents' adoption of crop insurance schemes.

Table 2: Un-standardized and standardized canonical discriminant function co-efficient for discriminating between adopter and non-adopter Farmers

Variables	USTD	STD
Age	(-) 0.018	(-) 0.203
Educational level	0.125	0.169
Income level	(-) 0.316	(-) 0.329
Number of earning member	(-) 0.010	(-) 0.003
Farm size	0.105	0.167
Satisfaction level	1.667	0.583
Awareness	2.389	0.847
Access to sources of credit	0.227	0.112
Constant	0.027	
Percentage of variance	100.0	

Key: USTD= Un-standardized; STD= Standardized

It is important to note that larger the standardized coefficient (b), larger is the respective variables' unique contribution to the discrimination (irrespective of the sign of coefficient) specified by the discriminant function. It is apparent from the analysis that awareness (b=0.847), satisfaction level (b= 0.583), income level (b= - 0.329) are the highest discriminating variables. The result indicates that appropriate attention has to be given to improve the awareness of respondents about insurance scheme, and to increase the level of satisfaction among respondents in order to motivate them to be more interested to get their crops insured.

Table 3: Structure Matrix of discriminating variables

Variables	Function
Age	0.005
Educational level	0.021
Income level	(-)0.090
Number of earning member	0.054
Farm size	0.066
Satisfaction level	0.537
Awareness	0.742*
Access to sources of credit	0.133

*Key: *Largest absolute correlation between each variable and the discriminant function*

Significance of socio-economic variables in discriminant analysis

Canonical correlation makes is possible to evaluate the significance of the contribution of the socio-economic characteristics of the respondents in the discriminant analysis.

Table 3 presents structure matrix of discriminant analysis. The matrix provides another way to study the usefulness of each variable in the discriminant function. The structure coefficients presented in the table 3 are the product amount correlation between the discriminating variables and discriminant function. The ability of a discriminant function to separate groups can be judged from the magnitude of the canonical correlation. If the total structure of coefficient is equal to or greater than 0.03 it is considered meaningful (Doppler, 2002). The analysis presented in table 3 indicated that the structure coefficient with the highest relationship to the function were awareness of respondents about crop insurance schemes (s=0.742), their satisfaction level (s = 0.537) and their access to sources of credit (s =0.133). Positive correlation implies that direct relationship implying their values increase in the same direction while negative correlation entails inverse relationship indicating that when one variable increases the other decreases concomitantly.

CONCLUSION

This study examined the influence of the respondents' socioeconomic characteristics on their adoption of crop insurance scheme. Results of discriminant analysis based on the criteria values of standardized canonical coefficient and correlation matrix identified that educational level, farm size, satisfaction level, awareness and access to source of credit are positive discriminators while negative coefficients are obtained for age, income level and number of earning members.

Awareness about crop insurance scheme, satisfaction level of farmer respondent with respect to the insurance scheme and provision of credit wise institutional source are the highest discriminant variables. The study made it amply clear that socio-economic characteristics of farmers exert a significant influence on their adoption of crop insurance scheme.

Taking into consideration the findings of the discriminant analysis it can be concluded that awareness about the schemes and their benefits have to be created among the farmers in order to motivate them to go for insurance of their crops. Another point to be taken care of is that higher satisfaction level of the insured farmers encourages the farmers and motivates them to get their crop insured. The insurance agencies have to make sure that the farmers who opt for insurance of their crops are satisfied to the maximum extent possible timely payment of indemnity to the affected farmers and less cumbersome process of documentation may help in that direction Liberal Provision of institutional sources of credit to the needed farmers should be encouraged.

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