A Brief Article

Statistical Modeling of Determinants of Institutional Credit to Farmers in Rural India

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Since independence, Government of India has stressed that for the development of country as a whole, welfare of farmers is important and accordingly always extended all possible support to farmers through policy interventions. Special emphasis has been led by Government to make institutional credit accessible to farmers in rural India; however, it is found that there are many factors which are a deterrent. Study of determinants of Availing of Institutional Credit by Farmers is important for policy makers. This paper attempts to undertake the statistical modeling of determinants of Availing of Institutional Credit by Farmers in Rural India with the help of large scale data on "Situation assessment survey of agricultural households" conducted by NSSO. It is found that social group, religion, education of family head, type of farmer and housing condition of farmer are significant contributing factors in availing of institutional credit.

Keyword: Institutional Credit, Farmers, NSSO, Rural India, Odds, Logistic Regression

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Section I
Introduction
By and large, India continues to be a rural agrarian society, the shift towards other sectors has been steady but slow. The productivity of agriculture in India is still very low. Post-independence, inclusiveness of farmers in overall growth has been prioritized by the Governments. However, the financial condition of this segment has still not reached the desirable standards, which may be perhaps due to the long history of exploitation and neglect in the pre-independence era. Indigenous systems of credit had to develop as a consequence of seasonal needs and fluctuations in order to facilitate smoothing of consumption pattern of farmers over the year. Because of the high risk (dependence on monsoon) inherent in traditional farming activity, the prevalence of high interest rates was the norm rather than an exception, and the concomitant exploitation and misery that often resulted. Development of rural credit systems has therefore, been found to be intrinsically very difficult and an issue of continuing official concern for over a century. Till date, in rural sector, it may be seen that level of indebtedness is high among the agricultural households. The 70th round of National Sample Survey (NSS), which was on Situation Assessment Survey of agricultural households, was conducted during 2013. The Survey reveals that about 52 per cent of the agricultural households in the country were estimated to be indebted. The average amount of outstanding loan per agricultural household was Rs.47000/- (approx.).

Post-independence the Government of India took many steps to institutionalize the system of credit to the farmers and rural sector. Regional Rural Banks (RRBs) were established under the provisions of an Ordinance passed on September 1975 and the RRB Act 1976 to provide sufficient banking and credit facility for agriculture and other rural sectors. The National Bank for Agriculture and Rural Development (NABARD) was set up in 1982 as a nodal institution for providing credit in rural India. Many other initiatives were taken time and again. Recently, also (w.e.f. 1st January, 2016) the Reserve Bank of India has upped the priority sector lending target of RRBs from 60 to 75 per cent. However, whether sufficiency of institutional sources of credit for all segments of farmers has been met or not needs to be studied. As per NSS Situation Assessment Survey, at all India level, about 60 per cent of the outstanding loans were taken from institutional sources which included Government(2.1 per cent), Co-operative society (14.8 per cent) and banks (42.9 per cent). Among the non-institutional sources, agricultural/professional money lenders (25.8 per cent) had the major share in terms of outstanding loans.

The Farmer Suicide Crisis which has deepened in recent years has triggered many a debates. Arguments have been made that despite providing a dedicated financial institutional set up for the rural areas, financial inclusiveness of the farmer, particularly the small and marginal has not been achieved. NSS survey also reveals that share of institutional loans increases with increase in land
possessed. For the agricultural households covered in the lowest size class of land possessed (less than 0.01 ha), only about 15 per cent of the outstanding loans were from institutional sources (government, co-operative society, bank), whereas the share was about 79 per cent for the households belonging to the highest size class of land possessed (more than 10 ha). To ascertain this theory further for other segmentation divides, it is important to analyze the factors which have an impact on availing of institutional credit by farmers. Determinants of Institutional Credit have been studied in past also. Kumar, Mishra, Saroj and Joshi in their IFPRI discussion paper on ‘Institutional versus Non-Institutional Credit to Agricultural Households in India’ have concluded that Formal lenders are explicitly biased toward families with large farms, and as a consequence, marginal and small farmers are left out.

With this backdrop the present study has been formalized to undertake the statistical modeling of determinants of Availing of Institutional Credit by Farmers in Rural India. Factors like social group, religion, family size, education of family head, type of farmer and housing condition of farmer have been studied for possible impact on availing institutional credit.

Section II
Data Source

The study utilizes individual household level data of "Situation assessment survey of agricultural households" conducted by National Sample Survey Office (NSSO). The Situation Assessment Survey of Agricultural Households was conducted by NSSO during January to December, 2013 to capture the condition of agricultural households of the country in the context of policies and programmes of Government of India. In the survey, for comprehensive assessment of the situation of farmers, information was collected on various aspects related to consumer expenditure, income and productive assets, their indebtedness, information on crop loss, crop insurance, awareness about Minimum Support Price (MSP), etc.

The survey was conducted for the two agricultural seasons (1st July, 2012 to 31st December, 2012 and 1st January, 2013 to 30th June, 2013) in whole of rural India through interview method. A stratified multi-stage design was adopted for the selection of sample at different stages. The First Stage Units (FSUs) were the census villages (Panchayat wards in case of Kerala) and the Ultimate Stage Units (USU) were households. Both FSUs and USUs were selected by Simple Random Sampling Without Replacement (SRSWOR). Total Number of 4529 villages and approximately 35000 households were surveyed in two visits (one for each season).

Section III
Concepts

An agricultural household for this survey was defined as a household receiving
some value of produce more than Rs. 3000/- from agricultural activities (e.g., cultivation of field crops, horticultural crops, fodder crops, plantation, animal husbandry, poultry, fishery, piggery, bee-keeping, sericulture etc.) and having at least one member self-employed in agriculture either in the principal status or in subsidiary status during last 365 days.

To measure indebtedness, information on the amount of loan outstanding on the date of survey (i.e; the day on which data was collected from the household) was collected from each surveyed agricultural household. Along with this, information on source and nature of the loan was also collected. The information included all kinds of outstanding loans irrespective of the purpose for which loans were taken. Institutional sources of credit included Government, Co-operative society and banks.

Section IV
Methodology

Dependent and Independent Variables: It is known that banks prefer to give loans to those farmers which are less averse to risk and have better economic credibility. In general, households with advantageous social positions can be assumed to have a better economic condition as well. Better education can also help in better understanding and fulfillment of procedural requirements.

In this study, effect of independent variables like social groups, religion, family size, education of family head, type of farmer and housing condition of farmer on availing of "Institutional Credit by Farmers" has been studied.

Hypothesis Setting: It has been hypothesized that factors like higher education, better social and economic positions improve the prospects of availing institutional credits. It can also be hypothesized that in larger families, a member can be deputed dedicatedly to pursue with banks and hence they have better prospects of availing Institutional credit.

Software used: SPSS has been used to carry out the statistical analysis.

Method: Regression analysis is a form of predictive modeling technique which investigates the relationship between a dependent (target) and Independent variables (predictors). In this paper also regression analysis has been used to model the relationship between Quantitative response variable and a set of Independent variables (Predictors). In case of a simple linear regression, the mean of the response variable is modeled as a linear function of the predictors and can be expressed as follows.

\[ E(Y/X) = \beta_0 + \beta_1 X_1 \] (1)

In this model, "Institutional Credit to Farmers" has been taken as a dependent
variable and social groups, religion, family size, education of family head, type of farmer and housing condition of farmer are taken to be Independent variables. So the equation one can be written as

\[ E(Y/X_1, X_2, X_3, X_4, X_5, X_6) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 \]  

(2)

Here, dependent variable (Institutional Credit to Farmers) is categorical with two categories and can be coded as:

Institutional Credit to Farmers \( (Y) = 1 \), if Farmers are Availing Institutional Credit 0, otherwise

So the dependent variable follows Bernoulli probability distribution with mean \( p \) which represent that farmers are Availing Institutional Credit and \( 1-P \) represent that farmers are Not Availing Institutional Credit.

So Equation 2 can be written as

\[ P = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 \]  

(3)

Since the range of both sides of Equation 3 is not equal as \( P \) is the Probability, its value lies within the interval \([0, 1]\) and the Right Hand Side of the equation 3 is unbounded and can take values from \(-\infty \) to \(+\infty \), so instead of fitting a model for \( P \) we use a transformation of \( P \). We shall consider the most commonly used transformation, the log of the odds of "Institutional Credit to Farmers".

The odds means ratio of probability of happening of an event to probability of not happening of the event, which can be defined as follows:

\[ \text{Odds} = \frac{\text{Probability (Success)}}{\text{Probability (Failure)}} = \frac{P}{1-P} \]

Now Equation 3 can be written as

\[ \log \left( \frac{P}{1-P} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 \]  

(4)

With this model the range of values of Left Hand Side is also between \(-\infty \) to \(+\infty \), which is the same as the range of the Right Hand Side of the equation.

The Equation 4 is the linear model on logit scale, which is the most common form of the Logistic Regression Model. So Logistic Regression will be an appropriate statistical technique to find out the effect of social groups, religion, family size, education of family head, type of farmer and housing condition of farmer on "Institutional Credit to Farmers".

An alternative and equivalent way of writing the Logistic Regression Model in equation 4 is in terms of Odds
\[
\frac{P}{1-P} = \text{Exp} \left[ \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 \right] \\
(1-P) = \frac{1}{1 + \text{Exp} \{-\left( \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 \right)\}} \tag{5}
\]

Here \( P \) is the probability of Availing Institutional Credit by Farmers in rural India. The variables \( X_1, X_2, \ldots, X_6 \) are independent variables and \( \beta_0, \beta_1, \ldots, \beta_6 \) are logistic regression coefficients corresponding to the independent variables.

The independent variables are categorical in nature and for each independent variable, one category is selected as a reference category and comparisons are made between other categories of independent variable with respect to the reference category. A positive estimate of logistic regression coefficients will indicate an increase in Odds of Availing Institutional Credit by Farmers, while a negative estimate will indicate a decrease in Odds of Availing Institutional Credit by Farmers with respect to the reference category for a given independent variable when all others independents factors are controlled. To test the significance of each independent variable Wald statistic has been computed at 95 per cent level of significance. Wald Statistics is the square of ratio of the logistic regression coefficient to its standard error.

**Section V
Findings and Discussion**

Table given below, gives results of binary logistic regression analysis on Institutional Credit to Farmers. The different categories of independent variables along with the reference category are given in 1st column. The 2nd column headed as B gives the estimates of binary logistic regression coefficients and the 3rd column gives their standard errors. Wald statistics for testing the significance of individual variables has been computed in column 4. Columns 5 and 6 give the degree of freedom (DF) of the Wald Statistics and its significance. Odds ratio, i.e. the magnitude of Odds of Institutional Credit to Farmers belonging to any category as compared to the reference category for a given individual variable is given in column 7. The last two columns depict the lower and upper limit of confidence interval of Odds Ratio.

The results indicate that the binary logistic regression coefficients of social group, religion, education of family head, type of farmer and housing condition of farmer are significant, thus these are contributing factors for availing institutional credit by farmers. It has been observed that logistic regression coefficients of all the categories of social groups, religion (except muslim and others), education of family head, type of farmer and housing condition of farmer have a positive effect on dependent variable. A positive estimate of logistic regression coefficients indicates an increase in Odds of Availing
institutional credit, while a negative estimate indicates a decrease in Odds of Availing institutional credit with respect to the reference category for a given independent variable when all others independents factors are controlled. It may also be observed from column 6 that all the coefficients (except schedule caste in case of independent variable 'social group', Sikhism in case of independent variable 'Religion' and Just Literate in case of independent variable 'Education of Family Head') are found to be statistically significance (<0.05) at 95 per cent level of significance.

<table>
<thead>
<tr>
<th>Factors</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>DF</th>
<th>Sig.</th>
<th>Exp(B) (Odds Ratio)</th>
<th>95 % C.I. for EXP(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social Group</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>(® Schedule Tribe)</td>
<td>0.033</td>
<td>0.054</td>
<td>0.37</td>
<td>1</td>
<td>0.543</td>
<td>1.034</td>
<td>0.929</td>
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<td>Schedule Caste</td>
<td>0.276</td>
<td>0.047</td>
<td>34.463</td>
<td>1</td>
<td>0.000</td>
<td>1.317</td>
<td>1.201</td>
</tr>
<tr>
<td>Others Backwards Caste</td>
<td>0.339</td>
<td>0.05</td>
<td>46.212</td>
<td>1</td>
<td>0.000</td>
<td>1.404</td>
<td>1.273</td>
</tr>
<tr>
<td><strong>Religion (® Hindu)</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Islam</td>
<td>-0.15</td>
<td>0.047</td>
<td>10.257</td>
<td>1</td>
<td>0.001</td>
<td>0.861</td>
<td>0.785</td>
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<td>Christianity</td>
<td>0.427</td>
<td>0.078</td>
<td>30.299</td>
<td>1</td>
<td>0.000</td>
<td>1.532</td>
<td>1.316</td>
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<tr>
<td>Sikhism</td>
<td>0.15</td>
<td>0.079</td>
<td>3.548</td>
<td>1</td>
<td>0.060</td>
<td>1.161</td>
<td>0.994</td>
</tr>
<tr>
<td>Others Religion</td>
<td>-0.448</td>
<td>0.142</td>
<td>9.943</td>
<td>1</td>
<td>0.002</td>
<td>0.639</td>
<td>0.483</td>
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<tr>
<td><strong>Education of Family Head (® Iiterate)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Just Literate</td>
<td>0.117</td>
<td>0.143</td>
<td>0.666</td>
<td>1</td>
<td>0.414</td>
<td>1.124</td>
<td>0.849</td>
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<tr>
<td>Literate</td>
<td>0.474</td>
<td>0.027</td>
<td>305.207</td>
<td>1</td>
<td>0.000</td>
<td>1.607</td>
<td>1.524</td>
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<td><strong>Type of Farmer (® Marginal)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Small</td>
<td>0.593</td>
<td>0.032</td>
<td>353.203</td>
<td>1</td>
<td>0.000</td>
<td>1.810</td>
<td>1.702</td>
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<tr>
<td>Semi-Medium</td>
<td>0.794</td>
<td>0.034</td>
<td>553.290</td>
<td>1</td>
<td>0.000</td>
<td>2.213</td>
<td>2.071</td>
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<tr>
<td>Medium</td>
<td>0.864</td>
<td>0.057</td>
<td>228.845</td>
<td>1</td>
<td>0.000</td>
<td>2.373</td>
<td>2.122</td>
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<tr>
<td>Large</td>
<td>0.878</td>
<td>0.070</td>
<td>159.366</td>
<td>1</td>
<td>0.000</td>
<td>2.406</td>
<td>2.099</td>
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<tr>
<td><strong>Housing Condition (® Kuccha)</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-Pucca</td>
<td>0.149</td>
<td>0.055</td>
<td>7.402</td>
<td>1</td>
<td>0.007</td>
<td>1.161</td>
<td>1.043</td>
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<tr>
<td>Pucca</td>
<td>0.558</td>
<td>0.051</td>
<td>121.247</td>
<td>1</td>
<td>0.000</td>
<td>1.747</td>
<td>1.582</td>
</tr>
<tr>
<td><strong>Family Size(® Large)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear</td>
<td>0.042</td>
<td>0.033</td>
<td>1.667</td>
<td>1</td>
<td>0.197</td>
<td>1.043</td>
<td>0.978</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.027</td>
<td>0.034</td>
<td>0.650</td>
<td>1</td>
<td>0.420</td>
<td>1.028</td>
<td>0.962</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.313</td>
<td>0.068</td>
<td>375.718</td>
<td>1</td>
<td>0.000</td>
<td>0.269</td>
<td></td>
</tr>
</tbody>
</table>
As development process of India is going on, so it is important to ensure Institutional Credit to the farmers belong to the lower end of the social ladder. The Odds of Institutional Credit to farmers are higher for the Social Groups 'Other Castes' and 'Other Backward Castes (OBC)' as compared to 'Scheduled Tribes (ST)' in rural India. It may be observed that the Odds of Availing Institutional Credit by OBC farmers is 32 per cent more as compared to the ST Farmers, the same for 'Other Castes' Farmers is higher by 40 per cent. This indicates that the advantaged group of society in rural India is availing institutional credit in a significantly better manner as compared to tribal groups. This also indicates that somehow the financial institutional set up has not been able to achieve equal level of inclusiveness amongst social groups as far as tribals are concerned. However logistic regression coefficient associated with 'Scheduled Castes (SC)' is found to be insignificant.

Religion of the farmers has emerged as one of the determinants of Availing of Institutional Credit in rural India, as it can be seen that Odds of Availing of Institutional Credit by Muslim farmers are 14 per cent less as compared to the Odds of Availing of Institutional Credit by Hindu farmers. However, Odds of Availing of Institutional Credit by Christian farmers are 53 per cent higher compared to the Odds of Availing of Institutional Credit by Hindu farmers. Since, the Wald Statistics in case of Sikh Farmers is not significant at 95 per cent level of significance, so no inference has been drawn for this category. The finding that the Muslim farmers are less likely to Avail Institutional Credit seeks immediate intervention by government towards their financial inclusiveness.

Education of family members, especially head of family has always been considered as important criteria for Institutional Credit by the Financial Institutions in the rural part of the country. It may be observed that the Odds of Availing of Institutional Credit by literate farmers are 61 per cent more compared to the Odds of Availing of Institutional Credit by illiterate farmers in rural India. This clearly indicates that illiteracy is barrier for farmers in Availing of Institutional Credit, which may be due to the inhibition of the illiterate/just literate towards paper work. Similarly, it is found that large farmers are Availing of Institutional Credit in a greater manner which may be because of multiple reasons. When compared with 'Marginal Farmers', the Odds of Availing of Institutional Credit are increased by more than half for the small farmers. In fact, it can be seen that as the land holding size of farmers goes up Odds of Availing of Institutional Credit by them also goes up. The Odds of Availing of Institutional Credit by small farmers are 81 per cent higher compare to the Odds of Availing of Institutional Credit by Marginal Farmers in rural India. The same figures for Semi-Medium, Medium and Large Farmers are 121 per cent, 137 per cent and 141 per cent. In India housing conditions can be considered economic wellbeing and one of the determinants for any type of Institutional support. This found that the Probability of Availing of Institutional Credit is higher for farmers having Pucca House. The Odds of Availing of
Institutional Credit by farmers having pucca house is 75 per cent more than the farmers having Kuccha house. This figure is 16 per cent in case of semi-pucca house of the farmers.

Section VI

Conclusions

Large scale data on "Situation assessment survey of agricultural households" conducted by NSSO has been used in this paper with an objective to investigate the determinants of Availing of Institutional Credit by Farmers in Rural India. For such studies, logistic regression technique is one of the most appropriate statistical techniques and accordingly, has been used in this study. India is a country with vast agricultural land and more than 50 per cent population dependent upon agricultural. Government has played the role of catalyst in ensuring the institutional credit to farmers in rural India; however, it is found that not all are availing institutional credit at the same level.

This paper attempts to undertake the statistical modeling of determinants of Availing of Institutional Credit by Farmers in Rural India and found that social group, religion, education of family head, type of farmer and housing condition of farmer are significant contributing factors in Availing of institutional credit. It may be observed that the advantaged group is Availing Institutional Credit much more effectively compared to tribals. Religion of the farmers has emerged as one of the determinants of Availing of Institutional Credit in rural India, as it can be seen that Odds of Availing of Institutional Credit by Muslim farmers are 14 per cent less as compared to the Odds of Availing of Institutional Credit by Hindu farmers. Increase in education level of head of family is found to have a positive effect on probability of Availing of Institutional Credit, so has been the increase in land holding of the farmers. Farmers with pucca house are also found to fare well relatively. The findings of the paper suggest that all segments are not availing institutional credit at par; thus, it becomes important to study further in detail the possible reasons behind this.

So it may be concluded that Availing of Institutional Credit by large farmers, having pucca house, belonging to advantage group of society and literate class is more than their counter parts in rural areas. These aspects are important for policy makers and need to be worked on. Further, the same analysis at disaggregate level for rural India can be more relevant for policy point of view.
References


