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Determinants of access to and intensity of formal credit: evidence from a survey of rural households in eastern India

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Abstract This paper aims to analyse the correlates of choice of source of credit and amount of institutional finance from survey of rural households in eastern India. The study uses primary data of 2,641 rural households across Bihar, eastern Uttar Pradesh and Jharkhand. Cragg's double hurdle model, which accounts for endogeneity between amount of formal finance borrowed and access of households to formal credit, is used to simultaneously identify the correlates of access and amount of formal credit. The results indicate that in eastern India, as much as 52% of households lack access to any type of loan, and the credit borrowed per household is Rs. 69,477, which is two-thirds of the national average of Rs. 103,457. The results of the exponential double hurdle model indicate that households with little land and education and belonging to disadvantaged social strata lack access to formal credit. Having a bank branch in the village or nearby distance is found to increase access and the amount borrowed.

Keywords Credit, double hurdle model, eastern India

JEL classification Q14, Q18, G21, C49, R51

1 Introduction

People in rural areas often lack a source of income that is immune to weather shocks, and diversification to forms of employment other than agriculture is often constrained by their inability to invest (Menon & Meulen 2011). Credit is considered as a catalyst for rural transformation (Kumar et al. 2011; Shandilya & Prasad 2003), and it plays an important role in enabling people to invest in alternate employment opportunities. The role of credit in alleviating poverty is well documented (Menon & Meulen 2011; Olomola & Gyimah 2014; Yuan & Xu 2015; Berhane & Gardebroek 2011; Besley 1995; Eneji et al. 2013; Eswaran & Kotwal 1989; Khandker 2005).

In the case of agriculture too, credit is considered as an important input alongside seeds and fertilizers (Rahman et al. 2014). Credit increases private investment in agriculture, accelerates the adoption of technology, promotes the optimal use of resources and improves the productivity of all inputs (Kannan 2015; Kumar et al. 2010). In agriculture, there is a time lag between investment and the return; credit is needed to smoothen the consumption (Giné 2011; Yuan & Xu 2015). However, about 40% of rural households in the country still depend on informal sources for credit, though formal credit sources lend at a subsidized rate (Government of India 2013).

Studies find that formal sources of credit often serve wealthy farmers and exclude poor small and marginal farmers (Cheng 2006; Pal & Laha 2015) as lending to them is risky – they have fewer assets to offer as security, and there is a possible asymmetric information bias and a higher probability of moral hazard (Chenaa 2018; Khoi et al. 2013; Mpuga 2010; Yuan & Xu 2015).

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Inherent risk and asymmetric information raise formal institutions' cost of credit; however, there is a ceiling to the maximum interest rate they can charge. Hence, formal institutions often treat lending to small and marginal farmers as inherently risky and try to avoid (Doan et al. 2010; Tadesse 2014). But it is the small and marginal farmers who need credit the most, because their income, savings and resources are poor (de Castro & Teixeira 2012; Chenaa 2018; Oluwasola & Alimi 2008). They depend on informal credit because they lack access to formal credit or only part of the total credit demand is met by formal financing (credit rationing) (Eneji et al. 2013). This dependence on informal credit and its exorbitant interest rates and unfavourable terms is stronger among small and marginal farmers and farmers from the weaker sections of society (Ramesh 2007). The credit structure is both the cause and the consequence of the class structure (Bhattacharyya 2005), as the exclusion of households in lower social classes from the ambit of formal credit prevents them from climbing up the ladder.

The Government of India realizes that farmers need access to the formal credit system to agriculture and it has taken several initiatives to expand it. The government nationalized private commercial banks in 1969 and 1980 and established Regional Rural Banks in 1975 and the National Bank for Agriculture and Rural Development (NABARD) in 1982. It launched Agricultural Credit Plans in 1994-95, the Kisan Credit Card Scheme in 1998-99, initiatives for doubling agricultural credit in 2004 and the Jan Dhan Yojana in 2014. It also launched debt waiver and debt relief schemes in 2008 and many state-specific loan waiver and interest subvention schemes (Kumar et al. 2015). The expectation was that increasing the number of formal lending institutions will crowd out informal lending and reduce farmers' dependence on informal loans (Pal & Laha 2015; Turvey & Kong 2010), but even after decades the share of informal credit sources has not decreased. In eastern India, where most of the population depend on farming and the density of the poor population is the highest, the share of informal credit has increased in 2013 compared to 2003 (Bhattacharjee & Rajeev 2014). It is important to understand the factors that determine the access of farmers to formal credit in the region.

The emerging literature on agricultural credit in transition countries focusses on the determinants of farmers' access to credit (Ciaian et al. 2012; Swain 2008). Similarly, this paper aims to identify the factors that determine farmers' choice of credit in eastern India. We also estimate the correlates of the amount of credit borrowed. The study is an improvement over other related studies in that we consider up to six loans taken by farmers to determine the choice of source of credit, unlike most studies that use information on only one loan. We use suitable econometric techniques to estimate the correlates of the amount of loan taken from formal sources to account for endogeneity and selection bias. The results will be of importance in understanding the behaviour of lenders. These will also help re-orient credit policies to improve the flow of institutional credit to agriculture.

2 Theoretical framework

The first step in modelling the access to credit and determining the correlates of the demand for credit is to understand the underlying theory. The analysis in the paper is built on the conceptual models developed by Modigliani (1986), Morduch (1995), Chen and Chiivakul (2008) and Hall (1978). According to Modigliani's life cycle model, a household's inter-temporal consumption varies with changes in family size and the uncertainties of the future and maintaining the same consumption level often becomes tough. The model proposes that a rational consumer should reallocate the income over their lifetime to maximize the total utility; they need instruments like credit to smoothen the consumption between present and future income. According to the model, the needs of consumption smoothening expenditure (or demand for credit) depend on the household's characteristics. The demand for credit depends also on future income, which in turn depends on individual characteristics like education and social network. We use these models and the supporting literature to select the variables for the study.

3 Data and methodology

3.1 Data

The primary data was collected from three eastern states using stratified multi-stage random sampling design with states as the strata, a district as the first-stage unit, a block as the second-stage unit, a village as the third-stage unit and a household as the ultimate unit of

Figure 1. Geo-location of sampling villages in eastern India

sampling. The number of districts in each state is allocated in proportion to the rural population in that state; Bihar has the highest rural population among the surveyed states. As a result, we selected 10 districts from Bihar, 8 districts from eastern Uttar Pradesh (UP) and 4 from Jharkhand. We selected the districts randomly and subsequently, from each selected district, we selected 2 blocks and from each selected block, we selected 2 villages. Finally, we randomly selected 30 households for the survey after listing all the households of each selected village. A total sample size of 2,641 households was surveyed for the study; 1,200 rural households from Bihar, 961 from eastern UP and 480 from Jharkhand. The sample size is calculated based on the power of the test. The geo-locations of selected villages are given in figure 1.

3.2 Methods

Following Bhattacharjee and Rajeev (2014), we define the incidence of borrowing as access to credit. We collect the details of a maximum of six loans taken by farmers and classify farmers into those who did not take a loan, those who took a loan from a formal source, those who took a loan from an informal source and those who took a loan from both formal and informal sources. We employ the multinomial probit model to identify the correlates of credit choice. We cluster standard errors at the village level along with district fixed effects to minimize the specification bias due to excluded variables.

To identify the correlates of amount of loan borrowed by institutional sources, ordinary least squares (OLS) regression cannot be used, as the data is censored. How much would a non-borrowing household borrow if it had access to credit? It is often difficult to answer this question. In simple terms, zero value of the dependent variable (borrowing from institutional sources) is not arbitrary; a farmer may not have access to credit or they may choose not to take a loan. When the factors determining access to credit are excluded, there will be a correlation between the error term and the independent variables, thus violating the assumptions of OLS, which can be termed as selection bias. The resultant bias is significant when a large section of agricultural households does not access institutional credit.

The literature suggests that it is ideal to use two-part models such as the Heckman selection model in this case (Wooldridge 2002), but the model is better suited when 'zero amount borrowed' is due solely to the lack of access to institutional credit. As we hypothesize that zero borrowing could be due to lack of access as well as other factors, and allow for zero in the second stage (amount borrowed) as well, the double hurdle model (Cragg 1971) is better suited for the case (Akpan et al. 2012; Pal 2002; Swain 2008; Wooldridge 2002). Hence, we employ the double hurdle model, which is an extension of the Tobit model. In the double hurdle model, households are summed to pass through two separate hurdles before they are observed as being borrowers of institutional credit: constraints to households' access and (2) factors which influence the amount borrowed from the institutional sources. The double hurdle model can be represented as follows:

Observed loan amount $y_i = d.y_i^*$ …(1)

Access to loan: $y_{i1} = \Sigma_{j=1}^{n} \alpha_j x_{ji} + c_1 + e_{i1}$ …(2)

$d = 1$ if $y_{i1} > 0$ and 0 otherwise

Loan amount: $y_{i2} = \Sigma_{j=1}^{m} \beta_j w_{ji} + c_2 + e_{i2}$ (3)

$y_i^* = y_{i2}$ *if* $y_{i2} > 0$ and 0 otherwise

where i represents the households, which varies from 1 to d (d being the total number of data points), y_i is the outcome variable, which can take only positive values, y_{i1} and y_{i2} are latent (intermediate) variables used to predict y_i. The independent variables x_{ji}'s explain y_{i1} and the independent variables w_{ji}'s explain

y_{i2}. The coefficients α_j's and β_j's, and the bias terms c_1 and c_2 are computed using the maximum-likelihood algorithm (Blundell & Meghir 1987; Newman et al. 2003). The components e_{i1} and e_{i2} are the errors assumed to be independent and normally distributed with zero mean and constant variance. Since the output prediction is dependent on two latent variables y_{i1} and y_{i2} (unlike Tobit model, where only one variable is used), the model is called the double hurdle model. In this model y_{i1} is access to institutional credit and y_{i2} is the amount of outstanding from institutional credit. The livestock and asset indices are constructed using the principal component analysis of variables concerning livestock and asset ownership. The weights generated by the first principal component are used in constructing the indices.

4 Results and discussion

We collect from the sample respondents the details of up to six loans taken by households and classify the households by the source of the loan (table 1). Only 48% of the households took any type of loan. The share of formal sources is only 21%. The number of households without any debt was highest in UP (60%) and Bihar (51%).

Table 2 describes the sources of the loans taken by households who took any loan. Bihar depends the most on informal loans; 48% of all households borrowed solely from them. Another 10% of households borrowed both from formal and informal sources. In eastern UP, 38% of households took a loan from informal sources and 32% Jharkhand, the extent depending on is still substantial and, respectively).

Table 3. Average borrowing per household (in Rs.)

States	Formal	Informal
Bihar	63,066	48,399
Eastern UP	114,973	32,930
Jharkhand	58,945	31,293
Total	79,492	40,575

The average credit obtained by households is given in table 3. The average borrowing in eastern India is Rs. 69,477, which is two-thirds of the national average of Rs. 103,457 per rural household (Government of India 2013). The loan taken by a rural household from an informal source averaged Rs. 48,399 in Bihar, the highest in eastern India. This high dependence on informal credit is worrisome given that most rural households in eastern India are dependent on agriculture and the density of poverty is the highest in the region. The share of institutional finance is lower in states where agricultural development is poor (Kumar et al. 2010).

To understand the correlates of the credit choice, we classify the households into those that did not take

Table 1. Sources of loan of rural households

	Bihar		Eastern UP		Jharkhand		Total	
	Number	%	Number	%	Number	%	Number	%
No loan	611	51	577	60	190	40	1,378	52
Formal (F)	228	19	182	19	132	28	542	21
Informal (IF)	298	25	169	18	112	23	579	22
Both F and IF	63	5	33	3	46	10	142	5
Total	1200	100	961	100	480	100	2641	100

Table 2. Sources of loan amongst households

Particulars	Unit	Bihar	Eastern UP	Jharkhand	Total
Availed loan	Number	467	312	223	1002
Formal	%	41.1	52.6	48.9	46.4
Informal	%	48.2	38.5	32.3	41.6
Both	%	10.7	9.0	18.8	12.0

credit, took credit from a formal source only, took credit from an informal source only and took credit from both formal and informal sources. In the multinomial probit framework, we included the hypothesized correlates derived from the theoretical framework and the literature review. The summary of key variables (mean values and mean difference) is given in table 4 and the results of the probit analysis (marginal effects) are described in table 5. For the probit analysis, we consider households taking a loan from formal sources as the base. This enables us to identify correlates that will influence the household's decision to borrow or not

Table 4. Summary of key variables

Variable	Unit	Non-borrower	Borrower	Mean difference
Membership in cooperative	Dummy (=1 if yes, 0 otherwise)	0.08	0.16	-0.086***
Aware of loan waiver scheme	Dummy (=1 if yes, 0 otherwise)	0.72	0.81	-0.083***
Benefitted by loan waiver	Dummy (=1 if yes, 0 otherwise)	0.03	0.09	-0.059***
Aware of PMFBY	Dummy (=1 if yes, 0 otherwise)	0.40	0.46	-0.066***
Farming experience	In years	26.08	25.14	0.94
Like farming as profession	Dummy (=1 if yes, 0 otherwise)	1.47	1.52	-0.050**
Receive information from Krishi Vigyan Kendra (KVK)	Dummy (=1 if yes, 0 otherwise)	0.02	0.02	0.00
Receive information from State Agricultural University (SAU)	Dummy (=1 if yes, 0 otherwise)	0.00	0.00	0.00
Receive information from Agriculture Technology Management Agency (ATMA)	Dummy (=1 if yes, 0 otherwise)	0.00	0.01	0.00
Receive information from private extension agency	Dummy (=1 if yes, 0 otherwise)	0.00	0.01	0.00
Received training	Dummy (=1 if yes, 0 otherwise)	0.04	0.06	-0.020**
Attended Krishi Mela	Dummy (=1 if yes, 0 otherwise)	0.12	0.18	-0.060***
Have livestock	Dummy (=1 if yes, 0 otherwise)	0.71	0.80	-0.087***
MGNREGA worker	Dummy (=1 if yes, 0 otherwise)	0.17	0.19	-0.02
Have Kisan Credit Card (KCC)	Dummy (=1 if yes, 0 otherwise)	0.02	0.28	-0.268***
Have Jan Dhan account	Dummy (=1 if yes, 0 otherwise)	0.32	0.41	-0.095***
Heard direct benefit transfer	Dummy (=1 if yes, 0 otherwise)	0.67	0.79	-0.119***
Member of political party	Dummy (=1 if yes, 0 otherwise)	0.05	0.07	-0.024***
Belongs to SC category	Dummy (=1 if yes, 0 otherwise)	0.20	0.22	-0.02
Belongs to ST category	Dummy (=1 if yes, 0 otherwise)	0.05	0.06	0.00
Belongs to OBC	Dummy (=1 if yes, 0 otherwise)	0.58	0.55	0.03
Crop loss	Dummy (=1 if yes, 0 otherwise)	0.69	0.72	-0.03
Gender of primary decision maker	Dummy (=1 if male, 0 otherwise)	0.95	0.97	-0.018**
Bachelor's degree	Dummy (=1 if yes, 0 otherwise)	0.05	0.05	0.00
Has Antyodaya card	Dummy (=1 if yes, 0 otherwise)	0.05	0.06	-0.014*
Years of education	In Years	4.80	5.04	-0.24
Annual household income	Rs	1,53,384	1,51,581	1803.03
Share of nonfarm income	%	48.89	45.71	3.183***
Landless households	Dummy (=1 if yes, 0 otherwise)	0.31	0.22	0.088***
Marginal farmers	Dummy (=1 if male, 0 otherwise)	0.50	0.52	-0.01
Small farmers	Dummy (=1 if male, 0 otherwise)	0.13	0.17	-0.038***
Medium and large farmers	Dummy (=1 if yes, 0 otherwise)	0.06	0.09	-0.038***
Land	Acres	10.60	10.82	-0.220***
Age	Years	50.77	48.84	1.937***

Table 5. Correlates of choice of sources of credit of rural households: results of multinomial probit model (marginal effects)

	Availed formal loan-base					
	No loan		Informal loan		Loan from both sources	
Variable	Coefficient	*P* value	Coefficient	*P* value	Coefficient	*P* value
Ln(Age)	-8.647	0.011	-2.247	0.613	-1.477	0.852
Ln(Age)2	1.226	0.007	0.242	0.682	0.174	0.868
Belongs to SC/ST	-0.092	0.483	0.182	0.215	-0.235	0.304
Ln(Years of Education)	-0.251	0.277	-0.792	0.001	-0.406	0.262
Have Antyodaya card	-0.055	0.743	0.260	0.206	-0.042	0.882
Ln(Land)	-2.988	0.000	-3.799	0.000	1.030	0.351
Aware of loan waiver scheme	-0.418	0.003	-0.069	0.713	-0.096	0.715
Heard Direct Benefit transfer	-0.208	0.095	0.050	0.773	0.706	0.042
Aware of PMFBY	-0.213	0.078	-0.391	0.011	-0.151	0.446
Membership in cooperative	-1.001	0.000	-0.467	0.016	-0.356	0.249
Received training	-0.030	0.893	-0.134	0.647	0.059	0.879
MGNREGA worker	-0.158	0.202	-0.063	0.704	0.181	0.474
Member of political party	-0.396	0.072	-0.395	0.094	0.058	0.881
Share of nonfarm income	0.014	0.776	-0.026	0.647	0.148	0.031
Income from remittances	0.174	0.284	0.533	0.003	0.263	0.272
Has Jan Dhan account	-0.101	0.382	0.366	0.007	0.507	0.017
Extension contact	-0.385	0.002	0.007	0.960	0.299	0.137
Has livestock	-0.196	0.402	0.069	0.799	0.293	0.468
Asset index	0.067	0.668	0.230	0.154	0.285	0.287
Livestock index	0.161	0.447	0.246	0.343	0.666	0.034
Distance to nearest bank	-0.114	0.294	0.155	0.312	0.238	0.181
_cons	24.892	0.000	15.717	0.079	-16.680	0.269

borrow from an informal source. The negative and statistically significant coefficient for a variable indicates that higher the value of the variable, greater the chance that the household would take formal credit, and vice versa.

The results clearly indicate that farmers wanting to avail themselves of credit face constraints like small landholding size, poor awareness of schemes like Pradhan Mantri Fasal Bima Yojana (PMFBY) and Jan Dhan Yojana and absence of membership in groups like cooperatives. The results also indicate that as the age of the head of the household increases, the probability of availing formal credit increases, as the age of the farmer is a proxy for the farmer's experience and social network. Households depend on informal sources of credit if their education is poor, landholding is small and awareness of schemes like PMFBY, Direct Cash Transfer (DCT) and loan waiver is low and if they are not members of cooperatives. Notably, the probability of taking a loan from both formal and informal sources increases with an increase in the share of non-farm income and livestock index.

To simultaneously model the amount borrowed through formal finance and the factors of access, we use Cragg's double hurdle model (table 5). To select the appropriate functional form (between linear and exponential models), Akaike information criterion (AIC) and Bayesian information criterion (BIC) values are used after estimating both the models. As the exponential model has the lowest AIC and BIC values (see table 7), all the subsequent discussions are with respect to the exponential model.

The results of the Cragg's double hurdle model are provided in table 6. With respect to access to formal finance (selection equation), age, landholding, awareness about schemes, membership in cooperatives,

Table 6. Determinants of amount borrowed and access: results from Cragg's double hurdle model

Variables	Linear model				Exponential model			
	Outcome equation		Selection equation		Outcome equation		Selection equation	
	Coefficient	*P* value	Coefficient	*P* value	Coefficient	*P* value	Coefficient	*P* value
Ln(Age)	1.518	0.672	4.967*	0.085	0.214	0.527	4.967*	0.085
Ln(Age)2	-0.125	0.791	-0.695*	0.067	-0.021	0.637	-0.695*	0.067
Belongs to SC/ST	-0.326***	0.001	0.004	0.964	-0.033***	0.001	0.004	0.964
Ln(Years of Education)	0.466***	0.000	-0.077	0.515	0.045***	0.000	-0.077	0.515
Have Antyodaya card	-0.374***	0.000	-0.027	0.765	-0.034***	0.000	-0.027	0.765
Ln(Land)	1.845***	0.000	1.558***	0.001	0.164***	0.000	1.558***	0.001
Aware of loan waiver scheme	0.252**	0.034	0.181*	0.052	0.026**	0.022	0.181*	0.052
Heard Direct Benefit transfer	0.170	0.111	0.156*	0.071	0.015	0.141	0.156*	0.071
Aware of PMFBY	0.005	0.953	0.040	0.604	0.002	0.797	0.040	0.604
Membership in cooperative		0.291***	0.005		0.291***	0.005		
Received training		0.021	0.891		0.021	0.891		
MGNREGA worker	-0.112	0.272	0.121	0.194	-0.009	0.326	0.121	0.194
Member of political party	0.158	0.198	-0.102	0.486	0.015	0.185	-0.102	0.486
Share of nonfarm income	0.002	0.935	0.066**	0.016	0.000	0.943	0.066**	0.016
Income from remittances		-0.180**	0.029		-0.180**	0.029		
Has Jan Dhan account	0.078	0.312	0.061	0.393	0.009	0.213	0.061	0.393
Extension contact	0.077	0.315	0.162**	0.034	0.006	0.385	0.162**	0.034
Have livestock	0.179*	0.079	0.134	0.348	0.018*	0.068	0.134	0.348
Asset index		-0.018	0.826		-0.018	0.826		
Livestock index		-0.218*	0.082		-0.218*	0.082		
Village has bank	0.148*	0.076	0.134*	0.086	0.013	0.110	0.134*	0.086
Distance to nearest bank	-0.028**	0.027	0.003	0.807	-0.003**	0.030	0.003	0.807
Household size	0.017	0.150		0.002	0.124			
ln(Crop loss %)	-0.025	0.296		-0.002	0.364			
Constant	0.866	0.900	-14.059**	0.013	1.314**	0.044	-14.059**	0.013
lnsigma	-0.115***	0.000			-2.473***	0.000		

Table 7. Model selection criteria for double hurdle models

Model	Observations	AIC	BIC
Linear	2564	3354.754	3617.973
Exponential	2564	2263.948	2527.167

share of non-farm income and extension contact will increase the access of the households to formal credit. Landholding is considered as proxy for assets in case of rural agricultural households. Higher the size of holdings, farmers will have more pledgeable assets to offer as security and obtain loan. Further, extension contact and membership in cooperatives are a proxy for the farmer's social network. It is obvious that a farmer with better network will have more access to formal credit. Awareness of various government schemes is closely related to the awareness of formal financial institutions and its advantages. So, it is clear that farmers with this awareness have a greater probability of accessing formal sources of credit. The results are consistent with the results of probit analysis discussed earlier. Interestingly, having a bank branch in the village increases the access of households to formal finance.

The coefficients of the outcome equation indicate the correlates of formal credit taken by households. The results indicate that the households belonging to weaker social strata, that is, SC/ST, belonging to below poverty line (as indicated by having Antyodaya card) and lesser land holdings have lower credit per household. This result is consistent with the earlier literature and our hypotheses (Olomola & Gyimah 2014). Education of head of household and awareness of loan waiver

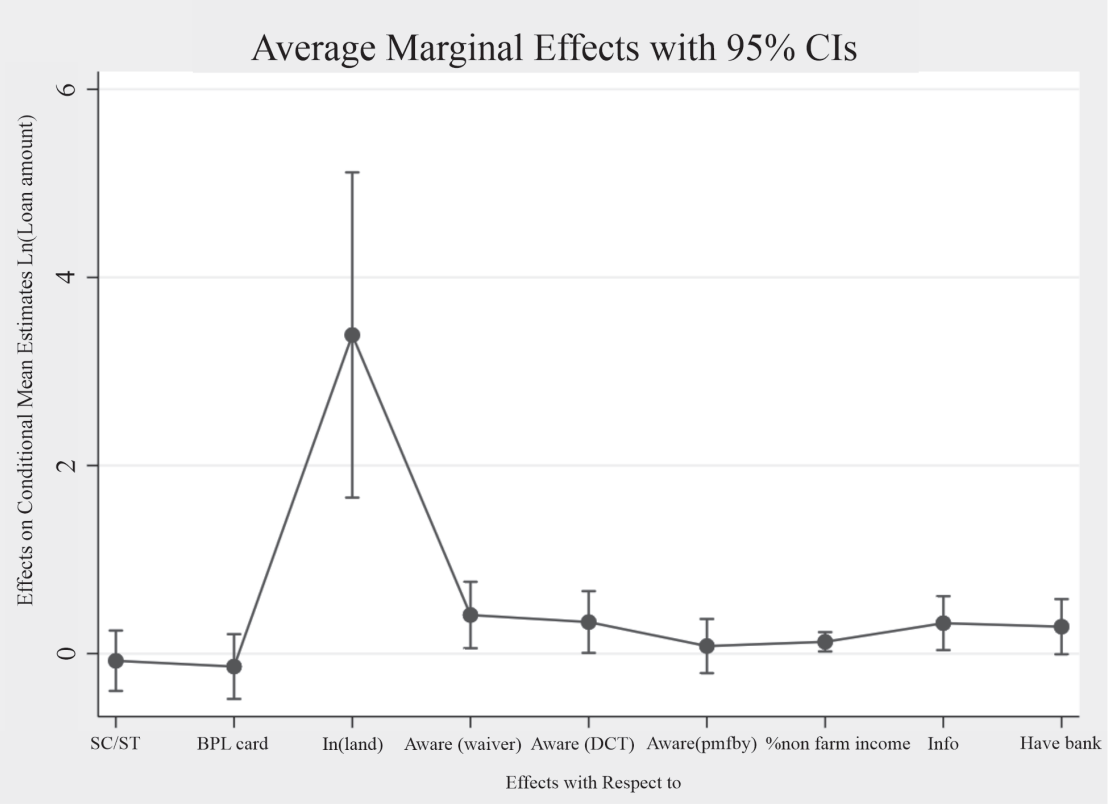

Figure 2. Marginal effects of factors determining the amount borrowed from formal finance

schemes also increases the amount borrowed. It is worth noting that as the distance to bank branch increases, the amount of formal loans decreases. With increase in distance, the transaction cost of getting formal finance increases in terms of higher cost on travel and opportunity cost of time. Marginal effects of the outcome equation are given in Figure 2, which indicates the relative importance of the variables in influencing the amount borrowed. From the results it is clear that the formal financing institutes still cater only to wealthy, educated households belonging to upper social strata and that the weaker sections, who need the credit most, are excluded from the ambit of formal finance.

5 Conclusion

Credit is an established means of transforming rural areas economically, and its potential in alleviating poverty is well established. Hence, credit will be an important instrument for achieving 'zero poverty', which is the first Sustainable Development Goal (SDG), particularly so in the case of eastern India, which has the highest density of the rural poor. Using primary data of rural households in eastern India, this study analyses what influences the access of households to formal finance and the amount they borrow. Nearly half the households in the region has no access to either formal or informal credit, and the amount per borrowing household is two-thirds of the national average. Further we found that the weaker sections of the society, with low asset base and education are often excluded from formal financing. Having a bank at less distance was also found to positively influence the amount borrowed from the households. In light of these findings, it is clear that future government policies on credit must exclusively focus on increasing the access of credit in eastern India. Measures should be taken to ensure that the distribution of credit is equitable. Expansion of bank branches in eastern India and also creating awareness are also equally important in bringing about transformation of eastern India and a right step in achieving Sustainable Development Goals of no poverty.

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