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An analysis of factors affecting the flow of agricultural credit in Uttarakhand

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Abstract
Hill agriculture of Uttarakhand state characterize by fragmented and very small size of average holding of 0.40 ha, low input-low output production system largely dependent on rains and low risk bearing ability of farmer. Most of the farmers in 11 hill districts out of 13 in Uttarakhand state were able to produce food grains, which was adequate only for three to six months of their family requirements. Because of poor resource base they were unable to exploit the market opportunities arising due to changing economic environment. Agriculture credit can break the vicious cycle of poverty if effective credit support was available to farmers to diversify and modernize their agriculture. Experience indicates that many farmers do not come forward to borrow from institutional credit agencies and thus practice internal credit rationing. Evidences also indicate that many farmers did not get institutional credit in adequate quantity, at right time, at reasonable cost while many others did not have access to institutional credit at all.

Keywords: agricultural credit, hill agriculture, factors affecting agricultural credit.

Introduction
The economic growth and development of India continues to depend significantly on the growth and development of agriculture despite its declining share in national income, which stands at 19.6 percent according to 2005-06 statistics. With a break-through and powerful thrust of capital-intensive modern farm technology from the mid-sixties onwards through support of institutional credit, agriculture has shown impressive performance. Consequently, food grain production increased from 108 million tons in 1971 to 206.1 million tons in 2005 (Economic Survey, 2006)

During the two decades 1971-91 the formal agricultural credit system comprising the NABARD, rural and semi urban branches of commercial banks, co-operatives and RRBs, has expanded sizably in quantitative terms in response to the increasing need for effective credit support to farmers for the meeting working capital as well as investment needs. However, the benefits of this green revolution have been largely limited to areas having irrigation potential. For the dry land, watershed development programmes have achieved success in some locations but its benefits remain modest relative to that from green revolution. White revolution, based upon genetic improvement of cows, has been relatively better widespread but is perhaps restricted to certain section of farm community.

With growing pressures for commercialization and diversification of agriculture in response to largely market and trade factors, the need for efficient and effective institutional credit support has accentuated, besides other kinds of support such as policy and infrastructure.

Though, technology has played an important role in growth of agriculture but this has been possible in conjunction with the role of non-technological factors such as price, markets, institutions and finance. Effective credit support continues to be the most crucial of the non-technological factors particularly in areas where technological and yield gaps are significant and farmers have been unable to keep pace with fast changing economic environment. Credit has always been an important constraint in the production process for resource poor small and marginal farmers. Studies have shown that per unit requirement for small farmers is relatively higher when compared to large farmers due to poor resource base on the one hand and intensive use of inputs on the other (Sidhu and Gill, 2006) [8] As a result, there is growing concern to gear up the institutional credit in these areas. The flow of total bank credit was Rs 1, 43,728 crores, out of which Rs 6,11,678 crore went to agriculture and allied sector in 2005-06. Total flow of credit for agriculture and allied activities from co-operatives, RRBs and commercial banks were Rs 33,174 crore, Rs 15,170 crore and Rs 1,00,998 crore respectively. The direct agricultural advances increased from Rs 3,436 crore in 1980-81 to Rs 7, 94,797 in 2005-06 (Economic Survey, 2006). The SCBs branches in country in year 2005-06 is 69,118

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in which rural branches are 30,750 metropolitan branches are 11,173 metropolitan semi urban branches are 15,296 and 11,899 are urban branches (Basic Statistical Returns of SCBs, 2006, RBI).

As of March 2004, the total outstanding deposits by the scheduled commercial bank in Uttarakhand were Rs 17,232 crore. The state ranked third in the country in terms of per capita deposits that were Rs. 19,279. However total credit of Rs. 3,516 crore only was extended by scheduled commercial bank. According to 2003-04 statistics, bank credit to rural sector was a meager 1.03 percent (Rs 875 crore) of all India bank credit and total credit was only 0.39 percent of all India bank credit. Thus, credit deposit ratio of 20.4 percent was recorded in March 2004, which was lower than that all India credit-deposit ratio of 58.7 percent. With this credit deposit ratio, Uttarakhand ranks at 18th position. The credit-deposit ratio of banks in the state for rural sector was 22.6 percent against the corresponding all India figures of 43.7 percent (Monthly Review of Uttarakhand Economy, 2005). This indicates that credit off take in the state was low in all India ranking. As of September 2004, total deposits of Regional Rural Banks and State Cooperative Banks in Uttarakhand were Rs. 582 crore and Rs. 18,575 crores respectively with the credit of Rs. 198 crore and Rs. 3,542 crores respectively. The credit-deposit ratio of 34.02 percent for Regional Rural Banks and 19.06 Percent for State Co-operative Banks also indicate a low off-take of credit in the institutional credit system of Uttarakhand.

Therefore, it becomes imperative to find out the existing access to formal credit for different purposes by different size groups of farmers in hill agriculture of Uttarakhand, reasons for their non-participation in the institutional credit programmes and weaknesses/deficiencies in existing institutional agricultural credit system.

Therefore, an empirical investigation of Uttarakhand was undertaken to analyze the factors affecting the flow of agricultural credit in Uttarakhand.

Materials and Methods

This study was conducted in Tehri Garhwal and Almora districts, which are in hill area of Garhwal region and Kumaon region respectively in uttarakhand state. In the district multiple agencies are engaged in financing agriculture namely, commercial bank, co-operative bank and regional rural bank. There are 13 districts in Uttarakhand. Of these 7 districts namely Uttrarkashi, Chamoli, Tehri Garhwal, Dehradun, Pauri Garhwal, Rudra Pryag are in Garhwal region and 6 districts namely Haridwar, Pithoragarh, Almora, Nainital, Udham Singh Nagar are in Kumaon region.

Kumaon Region.

Production loan	Y (credit)	X_1 (caste)	X_2 (age)	X_3 (education)	X_4 (family/size)	X_5 (income/farm)	X_6 (holding/size)	X_7 (irrigatin)	X_8 (frag. /farm)	X_9 (insurance)	X_{10} (earner)
Credit	1										
Caste	0.464008	1									
Age	-0.36434	-0.05944	1								
Education	0.832036	0.716545	-0.1495	1							
Family size	0.779487	0.662541	-0.15527	0.689426	1						
Income/farm	0.40526	0.084488	-0.17607	0.433319	0.285391	1					
Holding size	0.550623	0.041535	-0.00135	0.440336	0.342659	0.212624	1				
Irrigation	0.621824	0.774598	-0.29185	0.763831	0.468558	0.306317	0.239417	1			
Fragment/farm	0.182484	0.466603	0.285771	0.385741	0.280143	0.219764	0.209283	0.449924	1		
Insurance	0.794883	0.333333	-0.16808	0.644167	0.594588	0.202406	0.476496	0.279533	0.034142	1	
Earner	0.381176	-0.48795	-0.14014	0.074166	-0.10445	0.270299	0.515455	-0.01025	-0.02332	0.35783	1

Investment Loan	Y (credit)	X_2 (age)	X_3 (education)	X_4 (family size)	X_5 (income/farm)	X_6 (holding size)	X_7 (irrigation)	X_8 (frag. /farm)	X_9 (insurance)	X_{10} (earner)	X_{11} (politics)
Credit	1										
Age	-0.37479	1									
Education	0.696107	-0.31174	1								
Family size	0.674528	-0.2216	0.846329	1							
Income/farm	-0.53763	0.510845	-0.39003	-0.31689	1						
Holding size	0.229328	0.383826	0.504222	0.375057	-0.01332	1					
Irrigation	-0.51397	-0.0523	-0.74267	-0.67776	0.14842	-0.71773	1				
Fragment/farm	0.018634	0.350987	0.39234	0.18288	-0.10788	0.739523	-0.60828	1			
Insurance	0.542916	-0.21645	0.576836	0.789883	-0.42596	0.032201	-0.44451	-0.03263	1		
Earner	-0.49445	0.071287	-0.77368	-0.80546	0.272705	-0.3644	0.624551	-0.2702	-0.82808	1	
Politics	0.688697	-0.62237	0.671271	0.636072	-0.55838	0.067353	-0.41018	0.037444	0.430331	-0.35635	1

Total Loan	Y (credit)	X_1 (caste)	X_2 (age)	X_3 (education)	X_4 (family size)	X_5 (income/farm)	X_6 (holding size)	X_7 (irrigation)	X_8 (frag/farm)	X_9 (insurance)	X_{10} (earner)	X_{11} (politics)
Credit	1											
Caste	0.157218	1										
Age	-0.29002	-0.03079	1									
Education	0.6175	0.460773	-0.22821	1								
Family size	0.616279	0.372564	-0.18811	0.779214	1							
Income/farm	-0.20686	0.200758	0.225404	-0.11863	-0.1443	1						
Holding size	0.234636	0.008708	0.187852	0.475474	0.36221	-0.00383	1					
Irrigation	-0.33853	0.277546	-0.16789	-0.06142	-0.17884	-0.20522	-0.22856	1				
Fragment/farm	0.028661	0.258793	0.311682	0.388243	0.21951	-0.05325	0.527229	-0.12726	1			
Insurance	0.53044	0.235702	-0.18487	0.601506	0.705415	-0.12002	0.212435	-0.17096	-0.01193	1		
Earner	-0.30293	-0.30861	-0.03308	-0.40198	-0.53022	0.193687	0.012093	0.308354	-0.17058	-0.32733	1	
Politics	0.685765	0.080845	-0.38089	0.472805	0.47943	-0.19184	0.030096	-0.40389	0.01228	0.342997	-0.26197	1

Garhwal And Kumaon Pooled.

Production loan	Y (credit)	X₁ (caste)	X₂ (age)	X₃ (education)	X₄ (family size)	X₅ (income/farm)	X₆ (holding size)	X₇ (irrigation)	X₈ (frag. /farm)	X₉ (insurance)	X₁₀ (earner)
Credit	1										
Caste	0.299088	1									
Age	-0.37826	-0.33902	1								
Education	0.659656	0.477325	-0.35237	1							
Family size	0.330226	0.654677	-0.1763	0.406843	1						
Income/farm	0.538734	0.450353	-0.44732	0.480099	0.174918	1					
Holding size	-0.16286	0.313737	-0.02646	0.193906	0.400571	-0.08359	1				
Irrigation	0.584017	0.74461	-0.35214	0.631563	0.47758	0.523774	0.144472	1			
Fragment/farm	0.024759	0.509046	0.148212	0.225597	0.499168	0.138819	0.393501	0.426669	1		
Insurance	0.545287	0.399275	-0.22316	0.60285	0.573668	0.287335	0.325111	0.496313	0.232931	1	
Earner	0.256944	-0.30248	1.21E-17	-0.06386	-0.0992	-0.00618	0.133896	-0.17684	-0.01858	0.121212	1

Investment loan	Y (credit)	X₂ (age)	X₃ (education)	X₄ (family size)	X₅ (income/farm)	X₆ (holding size)	X₇ (irrigation)	X₈ (frag. /farm)	X₉ (insurance)	X₁₀ (earner)	X₁₁ (politics)
Credit	1										
Age	-0.33014	1									
Education	0.555742	-0.25938	1								
Family size	0.584638	-0.17948	0.720601	1							
Income/farm	-0.12096	0.125705	0.098401	0.078094	1						
Holding size	0.21749	0.134202	0.367307	0.284193	0.376969	1					
Irrigation	-0.2997	0.011497	-0.36984	-0.41067	0.038215	-0.34816	1				
Fragment/farm	0.061268	0.044779	0.355397	0.239926	0.025405	0.52706	-0.19246	1			
Insurance	0.503722	-0.10777	0.502398	0.567009	-0.08612	-0.01587	-0.20923	-0.06375	1		
Earner	-0.33883	-0.02094	-0.18	-0.43286	0.038209	-0.30618	0.260672	-0.0445	-0.375	1	
Politics	0.490509	-0.63826	0.512673	0.422191	-0.18689	0.092557	-0.3305	0.072005	0.200446	0.022272	1

Total loan	Y (credit)	X₁ (caste)	X₂ (age)	X₃ (education)	X₄ (family size)	X₅ (income/farm)	X₆ (holding size)	X₇ (irrigation)	X₈ (frag. /farm)	X₉ (insurance)	X₁₀ (earner)	X₁₁ (politics)
Credit	1											
Caste	0.15728	1										
Age	-0.29416	-0.26979	1									
Education	0.540806	0.267282	-0.29262	1								
Family size	0.469508	0.329907	-0.16471	0.604809	1							
Income/farm	0.001901	0.216906	-0.02738	0.146504	0.046958	1						
Holding size	-0.01401	0.086704	0.05516	0.223179	0.336916	0.030807	1					
Irrigation	-0.17471	0.242907	-0.12561	0.018886	0.026237	-0.07677	0.150569	1				
Fragment/farm	0.029451	0.215668	0.092892	0.309116	0.330698	0.000236	0.425675	0.095441	1			
Insurance	0.482859	0.259281	-0.16537	0.537869	0.556378	0.005793	0.116177	0.044745	0.025943	1		
Earner	-0.17069	-0.11524	-0.02158	-0.13152	-0.31839	0.07752	-0.11348	-0.01734	-0.05085	-0.17129	1	
Politics	0.50132	0.110531	-0.40893	0.412415	0.290893	-0.06184	-0.06858	-0.34091	0.026215	0.175933	0.061549	1

Out of 7 districts of Garhwal region, one district namely Tehri Garhwal, and out of 6 districts of Kumaon region one district namely Almora was randomly selected. Total numbers of blocks in Tehri Garhwal and Almora district are 9 and 11 respectively. One block each namely, Chamba from Tehri Garhwal district and Takula from Almora district were selected randomly for the study. In Chamba block 214 villages and in Takula block 146 villages were found. A list of all villages financed by one or more institutions in the last five agricultural years (2000-01 to 2005-06) was prepared for selected blocks. Out of these, three villages from each block were selected randomly for the study. From the Chamba block, the three selected villages were Chaupariyal, Dikhol and Gunogi. From the Takula block, Falya, Tana and Bhawari were randomly selected.

A list of the all borrowers financed during the agriculture year 2000-01 to 2005-06 was prepared with the help of records of all institutional agencies operating in the study area. The farmers were categorized into three size groups on the basis of owned holing viz, size group I, size group II and size group III. Since majority of the farmers in the region of the state have small holdings ranging up to 1.75 acre (0-35 nali), borrowers with land holding up to 0.55 acre (11 nali) were designated as size group I, those ranging between 0.6 to 1.15 acre (12-23 nali) were kept in size group II and those with more than 1.15 acre (24 nali) designated as size group III on the basis of cumulative total method.15 borrowers from each

village were selected to make the sample size of 45 from each region. A separate sample of 20 more farmers who never took loan from institutional agencies was also taken randomly from each block to know the reasons for non-participation in credit and insurance. Thus 45 loanee farmers and 20 non-loanee farmers from each block were taken. Thus, the study was based on investigation of 90 loanee farmers and 40 non-loanee farmers. One commercial bank branch, one Primary Agriculture Credit Society (PACS), and one branch from each of Regional Rural Bank (RRB) were also selected from each selected block to meet the information needs of the stipulated objectives.

Data and its sources
The study was based on primary as well as secondary data; the relevant data was collected on structured schedules from the sample farmers through personal interview.
Information about the lending practices and procedure being followed was collected from selected branches of commercial bank, PACS and RRB. Secondary data on Qualitative and Quantitative parameters of commercial bank credit for Uttarakhand state as a whole was collected from Basic Statistical Return of RBI, various Issues. The survey data included amount credit obtained for different purposes from different agencies by different size group of farmers, their interest and non-interest costs of credit and reasons for non-

participation in formal agriculture credit programmes. Data was collected for reference year 2005-06.

Regression model
Linear and non-linear forms of regression equation were fitted to find out the factors affecting amount of credit taken by the borrowers from the institutional agencies. The estimated regression equations are given below

Linear
$y = a + bx_1 + bx_2 + bx_3 + bx_4 + bx_5 + bx_6 + bx_7 + bx_8 + bx_9 + bx_{10} + bx_{11}$

Log linear
$\text{Log } y = \log a + b_1\log x_1 + b_2\log x_2 + b_3\log x_3 + b_4\log x_4 + b_5\log x_5 + b_6\log x_6 + b_7\log x_7 + b_8\log x_8 + b_9\log x_9 + b_{10}\log x_{10} + b_{11}\log x_{11}$

Where;

Variable Description	Variable	Hypothesis
Amount of loan taken	y	+
Caste of borrower	x_1	+
Age (years)	x_2	+
Educational status	x_3	+
Family type (nuclear/joint)	x_4	+
Income of the family	x_5	+
Holding size (acre)	x_6	+
Irrigation intensity (percentage)	x_7	+
Number of land fragments per farm	x_8	-
Life insurance of the borrower	x_9	+
Earning hands per family	x_{10}	+
Political status	x_{11}	+

Measurement of variables
Estimation procedure of different variables cited above for multivariate regression analysis is given below.

1. Caste of the borrower
The variable was measured as binary variable
Upper caste   =1
Lower caste   =0

2. Educational status
Educational status was measured using scoring technique. Score were assigned in the following manner
Post-graduation   =4
Intermediate to graduation   =3
Sixth to primary   =2
Up to primary   =1
Illiterate   =0

3. Family type
This variable was quantified using scoring technique in the following manner
Joint family   =1
Nuclear family   =0

4. Life insurance
The variable was quantified using scoring technique in the following manner
Having life insurance   =1
Having no life insurance   =0

5. Number of earning hands
This variable was quantified in the following manner using scoring technique.
Only one income earner   =1
More than the one earner   =0

6. Political status
Political status was quantified in the following manner.
Member of any government/non-government body
                                                    =1
Not a member of any government/non-government body
                                                    =0

Results and Discussion
Flow of bank credit
The progress recorded by the commercial banks in financing the agriculture sector in Uttarakhand during March 2001 and March 2005 is presented in Table 1.

In March 2001, the share of agricultural advances in total bank advances across the thirteen districts ranged between 6.11 percent (Dehradun) to 44.23 percent (U.S. Nagar). Only four districts recorded a share above the state figure of 16.02 percent. After four years in March 2005, the share of agricultural advances across the thirteen districts ranged between 2.44 percent (Chamoli) to 44.25 percent (U.S. Nagar). Only 3 districts out of 13 were found to register share of agricultural advances above the state figure of 13.30 percent. In general, out of 13 districts only 4 districts had almost the same level of share as four years ago. In all other 9 districts the share of agricultural advances was much lower in 2005 than that in 2001.

Table 1: Share of agricultural advances to total advances of Schedule Commercial Banks in Uttarakhand (Amount in Rs. Thousand).

S. No.	Name of the district	March 2001		March 2005	
		Total advances given by banks	Advances to agriculture	Total advances given by banks	Advances to agriculture
1	Almora	639551	101963 (15.94)	1227844	140356 (11.43)
2	Bageshwar	159700	21040 (13.17)	359494	33809 (9.40)
3	Chamoli	298253	33732 (11.30)	3122974	76438 (2.44)
4	Champawat	114134	16585 (14.53)	506384	52714 (10.40)
5	Dehradun	5728593	350146 (6.11)	21620665	941587 (4.35)
6	Garhwal	883820	169533 (19.18)	1788962	211100 (11.80)
7	Haridwar	3905720	612303 (15.67)	9194120	1445455 (15.72)
8	Nainital	5814581	570915 (9.81)	5875244	579396 (9.86)
9	Pithoragarh	502519	31865 (6.34)	1186704	93575 (7.88)
10	Rudraprayag	101017	21002 (20.77)	366522	45240 (12.34)
11	Tehri Garhwal	560170	103498 (15.91)	2912933	223347 (7.66)
12	U.S. Nagar	3369711	1490739 (44.23)	8187453	3623758 (44.25)
13	Uttarkashi	255486	56197 (21.99)	877998	148892 (16.95)
	Total	22333309	3579518 (100)	57227297	7615667 (100)

Source: Basic Statistical Return of RBI, various Issues
Figures in parenthesis indicate percentage to total

Pattern of agriculture advances

Direct advances are given directly to farmers to support farm production. Indirect finance is given to such agencies and institutions, which indirectly support and contribute to farmers. The pattern of advances in terms of direct and indirect finances is presented Table 2.

Table 2: Advances to Agriculture by Commercial Banks, March 2001 and March 2005.

S. No.	Name of the district	Amount Outstanding, March 2001			Amount Outstanding, March 2005		
		Direct	Indirect	Total	Direct	Indirect	Total
1	Almora	101216 (99.26)	747 (0.73)	101963	135631 (96.63)	4725 (3.36)	140356
2	Bageshwar	18028 (85.68)	3012 (14.31)	21040	32322 (65.60)	1487 (4.39)	33809
3	Chamoli	33694 (99.88)	38 (0.11)	33732	75164 (98.33)	1274 (1.66)	76438
4	Champawat	16359 (98.63)	226 (1.36)	16585	47149 (89.44)	5565 (10.55)	52714
5	Dehradun	340417 (97.22)	9729 (2.77)	350146	733245 (77.87)	208342 (22.12)	941587
6	Garhwal	165486 (97.61)	4047 (2.38)	169533	207563 (98.32)	3537 (1.67)	211100
7	Haridwar	603178 (98.50)	9125 (1.49)	612303	1418053 (98.10)	27402 (1.89)	1445455
8	Nainital	388294 (68.01)	182621 (31.98)	570915	524000 (91.38)	55396 (9.66)	573396
9	Pithoragarh	31712 (99.51)	153 (0.48)	31865	92808 (99.18)	767 (0.81)	93575
10	Rudraprayag	21002 (100.00)	-	21002	45221 (99.95)	19 (0.04)	45240
11	Tehri Garhwal	103498 (100.00)	-	103498	164483 (73.64)	58864 (26.35)	223347
12	U.S. Nagar	1332955 (89.41)	157784 (10.58)	1490739	3265033 (90.10)	358725 (9.89)	3623758
13	Uttarkashi	55778 (99.25)	419 (0.74)	56197	146562 (98.43)	2330 (1.56)	148892
	Total	3211617 (89.72)	367901 (10.27)	3579518	6887234 (90.43)	728433 (9.56)	7615667

Source: Basic Statistical Return of RBI, various Issues

Figure in parentheses are percentage to total

The table indicated that in year 2001, 8 out of 13 districts had a share of indirect finance below 3 percent only. The situation in 2005 indicated that state level shares, by and large, remained same but in 8 out of 13 districts the share of indirect advances was below 5 percent. Given the weak socio-economic infrastructure in hills of Uttarakhand there is scope for increasing the share of indirect finance to strengthen distribution of fertilizers and other inputs, loans to electricity board, loans to farmers through PACS/FSS/LAMPS and other type of indirect finance.

Multivariate regression analysis (Correlation and regression analysis)

To identify factors affecting flow of credit with respect to production and investment loan, multiple regression analysis was done. Some important variables were hypothesized to be important determinants of credit flow.

Before undertaking regression analysis all the possible alternatives specifications of the explanatory variables were screened through zero order correlation matrix to select the best specification and also to check presence of multi-collinearity. The correlation coefficients were tested for their significance using the t-test. Finally, the variables were selected depending upon significant association with dependent variable, non-existence of multi-collinearity and policy use of variables.

Factor Affecting Institutional Borrowing
Correlation analysis

To identify factors affecting institutional borrowing with respect to production loan and investment loan, institutional credit borrowed (Y) by farmers was taken as dependent variable. In initial stage, 11 independent variables were identified. Zero-order correlation matrix was computed taking these variables for their screening on the basis of multi-collinearity and their association with dependent variable. Two independent variables were considered to have multi-collinearity, if the correlation between them was 0.70 or more. The correlation matrices, in respect of production loan and investment loan categories are given in Appendix-1.

Appendix-I
Correlation matrix with respect to production loan, investment loan and total loan.
GARHWAL REGION

Production loan	Y (credit)	X_1 (caste)	X_2 (age)	X_3 (education)	X_4 (family size)	X_5 (income/farm)	X_6 (holding size)	X_7 (irrigation)	X_8 (frag. /farm)	X_9 (insurance)	X_{10} (earner)
Credit	1										
Caste	-0.30423	1									
Age	-0.20576	-0.50574	1								
Education	0.218818	0.177667	-0.64255	1							
Family size	-0.21	0.736092	-0.26069	-0.00692	1						
Income/farm	-0.2436	0.681663	-0.61399	0.56309	0.294967	1					
Holding size	-0.22101	0.667551	-0.26018	0.316873	0.483613	0.332072	1				
Irrigation	-0.1213	0.73763	-0.26663	0.335075	0.715503	0.440187	0.600347	1			
Fragment/farm	-0.37289	0.625	-0.04428	-0.06218	0.795067	0.199058	0.619829	0.561812	1		
Insurance	0.134952	0.444444	-0.23615	0.515235	0.590766	0.340285	0.465631	0.807264	0.548611	1	
Earner	0.386327	-0.15811	0.156819	-0.32024	-0.09555	-0.31215	-0.05339	-0.44287	-0.01318	-0.18447	1

Investment loan	Y (credit)	X₂ (age)	X₃ (education)	X₄ (family size)	X₅ (income/farm)	X₆ (holding size)	X₇ (irrigation)	X₈ (frag. /farm)	X₉ (insurance)	X₁₀ (earner)	X₁₁ (politics)
Credit	1										
Age	-0.31761	1									
Education	0.57597	-0.21057	1								
Family size	0.553522	-0.12084	0.612365	1							
Income/farm	-0.06648	0.024767	0.232628	0.224718	1						
Holding size	-0.082	-0.16179	0.236156	0.148161	0.573384	1					
Irrigation	-0.07233	0.192953	0.004504	-0.06627	-0.14388	-0.05106	1				
Fragment/farm	0.142999	-0.24545	0.324	0.29234	0.048874	0.331585	0.304447	1			
Insurance	0.56314	0.026177	0.437936	0.315579	-0.03394	-0.17667	-0.02951	-0.11241	1		
Earner	0.304021	-0.1635	0.352742	-0.01643	0.06684	-0.07751	0.107073	0.192958	0.143105	1	
Politics	0.359858	-0.66878	0.397396	0.21567	-0.09128	0.158062	-0.26306	0.105002	0.009391	0.348608	1

Total loan	Y (credit)	X₁ (caste)	X₂ (age)	X₃ (education)	X₄ (family size)	X₅ (income/fam)	X₆ (holding size)	X₇ (irrigation)	X₈ (frag. /farm)	X₉ (insurance)	X₁₀ (earner)	X₁₁ (politics)
Credit	1											
Caste	0.166808	1										
Age	-0.30505	-0.44312	1									
Education	0.513734	0.113228	-0.34221	1								
Family size	0.265083	0.308642	-0.13705	0.412091	1							
Income/farm	0.066484	0.207568	-0.10825	0.25906	0.143231	1						
Holding size	-0.34045	0.133694	-0.03822	0.108105	0.353257	0.061008	1					
Irrigation	-0.29367	0.18718	0.047685	0.041788	0.348653	-0.17663	0.589957	1				
Fragment/ farm	0.002483	0.184414	-0.11343	0.228296	0.446633	0.011848	0.39864	0.393828	1			
Insurance	0.448361	0.265805	-0.10872	0.453762	0.390413	0.022481	0.089323	0.2532	0.054297	1		
Earner	0.382797	0.059761	-0.07333	0.189466	-0.09631	0.105477	-0.22684	-0.2897	0.076411	0.048877	1	
Politics	0.436728	0.14199	-0.46076	0.372992	0.107884	-0.00079	-0.12938	-0.29176	0.041896	0.032516	0.339422	1

The correlation results indicated that caste(x_1) of a borrower has multi-collinearity with family size (x_4) and irrigation intensity (x_7). Further, family size (x_4) is multi-collinear with fragments per farm (x_8). Therefore, caste, family size and fragments per farm variable were dropped and irrigation intensity was retained. However, irrigation intensity (x_7) and life insurance (x_9) of the borrower were found to have multi-collinearity. So, irrigation intensity was finally retained because of its relevance and higher association with production loan. There were no political involvement of the borrower took loan for production purposes. Numbers of earners in the family (x_{10}) and, per farm income (x_5) were found to have non-significant correlation with production loan. Hence x_5, x_{10}, and x_{11} were also not included in regression analysis.

In the investment loan category, it was found that all the borrowers in this category belonged to only upper caste. Family size (x_4) was found to have multi-collinearity with educational status (x_2) and borrower's life insurance (x_8).

Irrigation intensity (x_6) appeared to have multi-collinearity with the fragments per farm (x_7) and educational status (x_2) of the borrower. Number of earning persons (x_{10}) was highly correlated with the educational status (x_2) of the borrower.

On the basis of above results on correlation analysis, age of borrower (x_2), his educational status(x_3), holding size (x_6) and its irrigation intensity (x_7) for production loan category and, age (x_2), educational status (x_3), holding size (x_6), insurance (x_8) and political involvement (x_{11}) variables in investment loan category were, finally, selected as explanatory variables for inclusion in regression analysis.

Regression analysis
Multiple regression analysis was done in linear functional form separately for Garhwal and Kumaon region and jointly for both the region. The linear regression results on factor affecting institutional agricultural production credit (crop loan) and investment loan are given in Table 3.

Table 3: Regression results on factor affecting credit.

Variables		Garhwal	Kumaon	Total
A) Production loan				
i)	Intercept (A)	22592.39	34094.67	20309.69
ii)	Age (X₂) years	-136.05 (351.29)	-727.76*** (366.67)	-283.03 (359.36)
iii)	Education (X₃)	3720.42 (6494.98)	22429.32* (6731.44)	17467.44 (5955.69)
iv)	Holding size (X₆) acre	3162.54 (3793.51)	14102.07**** (8877.05)	10132.73** (4490.46)
v)	Irrigation intensity (X₇) (%)	102.66**** (330.98)	130.88 (296.38)	349.61**** (227.56)
Adjusted coefficient of multiple determination ($\overline{R}^2$)		0.31	0.73	0.51
No. of observations (n)		13	16	29
B) Investment loan				
	Intercept (A)	74199.89	12265.15	30886.64
i)	Age (X₂) years	-1136.49**** (1007.496)	-352.57 (3164.48)	-1110.22 (1581.52)
ii)	Education (X₃)	11821.86*** (6629.21)	28225.91 (38604.22)	12341.7 (13617.82)
iii)	Holding size (X₆) acre	-14255.67****	16786.41	26861.83****

		(13918.35)	(58055.31)	(23.81.42)
iv)	Life insurance (Y7)	25100.6*** (14685.15)	49229.14**** (49715.19)	63645.78* (24551.62)
v)	Political involvement (X11)	2740.508 (20880.31)	19398.7**** (78189.44)	54780.17**** (37528.94)
Adjusted coefficient of multiple determination ($\overline{R}^2$)		0.41	0.47	0.39
No. of observations (n)		23	22	45
C) Overall				
Intercept (A)		35219.03	29101.99	39984.1
i)	Age (X2) years	-370.89 (448.79)	-508.32 (1157.05)	-433.22 (709.13)
ii)	Education (X3)	8517.20*** (4860.40)	240001.59**** (18228.52)	1777.672*** (8281.17)
iii)	Holding size (X6) acre	-8583.30*** (5179.66)	5557.31 (27112.4)	-7340.03 (8649.29)
iv)	Irrigation intensity (X7) (%)	-275.47 (281.00)	-427.09 (523.25)	-260.01 (292.30)
v)	Life insurance (Y7)	24728.06* (9803.13)	33774.01**** (26432.09)	40301.21* (15638.87)
vi)	No. of earner in family (x10)	-8960.94 (9031.91)	-3015.59 (27022.52)	-17375.09 (13315.22)
vii)	Political involvement (X11)	13522.97 (14709.09)	124878.9* (49767.9)	64724.55* (26106.33)
Adjusted coefficient of multiple determination ($\overline{R}^2$)		0.48	0.53	0.41
No. of observations (n)		36	38	74

Figures in parenthesis indicate standard error of regression coefficient
Asterisk (S) indicate the level of significance at
* =1 percent, ** = 2.5 percent, *** =5 percent, **** =10 percent

The results suggest that age (x_2) has a significant negative effect on amount of production credit (Y) in Kumaon region. This means that age-wise younger borrowers take more amount of production credit than the older borrowers. However, the variable emerged non-significant for Garhwal region and the two regions jointly (ceteris-paribus). This suggests that bankers should target relatively younger people for accelerating their production loan business.

Level of education (x_3) of farmers appeared to have a significant positive effect on amount of production credit in Kumaon as well as the two regions together but non-significant for Garhwal region. This means that expanding education can be an important strategy to improve the outreach of banks to farmers for production loan. Size of land holding (x_6) of farmer has positive and significant effect on amount of his institutional production loan borrowings in Kumaon as well as in both the region together, but non-significant in Garhwal region (ceteris-paribus). This suggests that, larger farms borrow more of production loan than smaller farms in Uttarakhand. This shows a possibility that if farmers can pool their land in a cooperative set up, more production loan can be used.

The results show that irrigation intensity (x_7) measured here as a ratio of gross irrigated area to net irrigated area, has a significant positive effect on production loan borrowings in all the regions (ceteris-paribus). This implies with greater availability of irrigation all-round the year, more production loan can be absorbed. This appears quite natural because irrigation water is key to productivity. This brings out the importance of check-dams in hills to harvest rainwater and improve the irrigation water availability.

The adjusted coefficient of multiple determinations ($\overline{R}^2$) suggests that factors discussed above together explained 31 percent in Garhwal, 73 percent in Kumaon and together 51 percent s variation in amount of crop loan borrowing from all institutional sources. The constant term (A) of regression equation indicates the combined effect of the other variables affecting institutional credit amount not included in the regression analysis.

In case of investment loan, the regression results suggest that the age of the farmer (x_2) has a significant negative effect on amount of his institutional borrowing of investment loan (y) in Garhwal region but non-significant effect on the institutional investment loan borrowing in Kumaon and overall region (ceteris-paribus). This indicates that younger generation should be targeted in Garhwal region to increase investment loan business.

It was found that level of education (x_3) of a farmer has a significant positive effect in Garhwal but non-significant effect in Kumaon and both the region jointly, on amount of institutional borrowing of investment loan (ceteris-paribus). The result brings out that expanding education holds out the prospects of a more favourable investment loan business.

The results indicate that holding size (x_6) has a significant negative effect on investment loan amount in Garhwal but non-significant effect in Kumaon. However, on pooling of data from both the regions significant positive effect on investment loan amount in both the region is found. Results indicate that the farmers having low holding size take more loans for investment purposes in Garhwal region, while in Kumaon region, holding size is not a significant determinant of amount of investment loan.

Holding a life insurance policy (x_7) by a farmer was found to have a significant positive effect on amount of his institutional borrowing of investment loan in all the regions (ceteris-paribus). In other words, farmers having life insurance will have more institutional borrowing of investment loan. This may be because with life insurance policy, farmers feel more secure and therefore, are prepared to take risk to improve production capacity by converting investment loan into some kind of useful capital.

Political involvement (x_{11}) appears to have a non-significant effect in Garhwal but significant positive effect in Kumaon

and both the regions together, on amount of institutional borrowing of investment loan. This indicates that farmers having more political involvement will be more inclined for taking investment loan in all the regions.

The adjusted coefficient of multiple determinations ($\overline{R}^2$) appeared in the range of 0.39 to 0.47 under different regions indicating the percentage variation explained by the variables discussed above, in the level of investment loan taken by farm families. The constant term (A) of regression equation indicates the combined effect of the other variables affecting institutional credit amount not included in the regression analysis.

In case of total loan, the regression results suggest that age (x_2) has non-significant effect on institutional borrowing of total loan (y) in all the regions (ceteris-paribus).

It was found that level of education (x_3) of a farmer has a significant positive effect in all the regions, on amount of institutional borrowing of total loan (ceteris-paribus). The result brings out that expanding education holds out the prospects of a more favourable loan business.

The result indicates that holding size (x_6) has a significant negative effect on total loan amount in Garhwal, but non-significant in Kumaon and both the regions together (ceteris-paribus). Results indicate that the farmer having low holding size take more loan in Garhwal region while in Kumaon and both the region together, holding size is not a significant determinant of amount of measurement loan.

The results show that irrigation intensity (x_7) has a non-significant effect on total loan borrowings in all the regions (ceteris-paribus).

Holding a life insurance policy (x_7) by a farmer was found to have a significant positive effect on amount of his institutional borrowing of total loan in all the regions (ceteris-paribus). In other words, farmers having life insurance will have more institutional borrowing of total loan. This may be because with life insurance policy, farmers feel more secure and therefore, are prepared to take risk to improve production capacity by converting loan into some kind of useful capital.

Number of earning persons in a family (x_{10}) has a non-significant effect on institutional borrowings in all the regions (ceteris-paribus).

Political involvement (x_{11}) appears to have a non-significant effect in Garhwal but significant positive effect in Kumaon and both the regions together, on amount of institutional borrowing of investment loan. This indicates that farmers having more political involvement will be more inclined for taking investment loan in all the regions.

The adjusted coefficient of multiple determinations ($\overline{R}^2$) suggests that factors discussed above together explained 48 percent in Garhwal, 53 percent in Kumaon and together 41 percent s variation in amount of crop loan borrowing from all institutional sources. The constant term (A) of regression equation indicates the combined effect of the other variables affecting institutional credit amount not included in the regression analysis.

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