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Impact of institutional credit on agricultural productivity in India: A time series analysis

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ABSTRACT

The institutional credit has always been perceived as a critical factor for agricultural development in India through complementing working capital, easing liquidity and investment constraints. The present study has examined the trends and regional variations in institutional credit flow to agriculture in India for the period 1991–92 to 2016–17 using compound annual growth rate. Further, impact of institutional credit on agricultural productivity was also assessed using panel data regression. The study is based on the secondary data collected from various published sources. Results indicated that institutional credit to agriculture in real terms has registered a significant positive growth during the past four decades and the highest annual growth was observed during 2001–02 to 2010–11. Scheduled commercial banks have emerged as the dominant source of agricultural credit. However, cooperative banks are still the major sources of production credit. Regional analysis showed that southern states had access to highest production and investment credit per hectare, while eastern and northeastern states had the least credit outreach per hectare. Panel data regression model testified that institutional credit has a significant and positive impact on agricultural productivity. Therefore, the study has suggested for better access to credit of smallholders especially in eastern, western and north eastern states through simplification of procedures.

Key words: Agricultural productivity, Credit outreach, Institutional credit, Panel data model, Regional variations

Agriculture is characterized by high initial fixed capital investment and a lag between expenditure and income. Credit is one of the basic inputs in agriculture. This necessitates timely availability of credit at affordable rates as a precondition for improving rural livelihood and fast-tracking rural development (Kumar *et al*. 2015). The rural credit system is of great importance given that majority of the Indian farmers possess marginal and small land holdings with poor financial savings. Role of institutional credit in rural poverty alleviation is also well documented (Khandkar and Faruquee 2003, Awotide *et al.* 2015, Kumar *et al.* 2017). In the last three decades, institutional credit not only facilitated survival of small and marginal farmers but also aided large farmers in enhancing their income (Das *et al.* 2009).

Agricultural credit growth in India mainly followed the path of supply led approach. Over the years, concentrated efforts of government such as nationalisation of banks (1969 and 1980), establishment of Regional Rural Banks (RRBs) (1975) and National Bank for Agriculture and Rural Development (NABARD) (1982), financial sector reforms (1991), introducing Kisan credit cards (1998) and doubling agricultural credit plan (2004) helped increase the share of institutional credit in total agricultural credit. Consequently, the share of informal credit in total agricultural credit has declined from 93% in 1951 to 36% in 2013 (Mohan 2006, Kumar *et al*. 2017).

Credit constraints have significant adverse impact on farm efficiency, productivity and profitability (Feder 1990, Chavas and Aliber 1993, Sabasi and Kompaniyets 2015, Guirkinger and Boucher 2008). There exists a significant positive relationship between variable inputs usage and disbursement of production credit (Sidhu *et al*. 2008, Kumar *et al*. 2013, Karlan *et al.* 2014). According to Narayanan (2016), 10% increase in the credit flow in nominal terms leads to 1.7% increase in fertilizers consumption, 5.1% increase in pesticides consumption and 10.8% increase in tractor purchases. Prior literature reports enhancement in farm performance and acreage due to removal of credit constraints (Blancard *et al.* 2006, Dong *et al.* 2010). Role of institutional credit in the economic wellbeing of farm households is well documented (Das *et al*. 2009,

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Narayanan 2016, Kumar *et al*. 2017). Lack of access to institutional credit can adversely affect the adoption of modern technology and capital formation.

The current policy regime emphasises increasing agricultural productivity for enhancing farmers' welfare (Chand 2017) and the institutional credit has always been perceived as a critical factor for agricultural development in India. Therefore, it is pertinent to establish causality of credit with productivity. Given this background, the present study has been undertaken to assess: (i) the trends and regional bias in the institutional credit flow to agriculture, and, (ii) the impact of institutional credit on agricultural productivity in India.

MATERIALS AND METHODS

The present study is based on the secondary data collected from various sources for the period 1991–92 to 2016–17. Data on the state-wise value of output from agriculture was collected from statistical publications of the Ministry of Statistics and Program Implementation (MOSPI), Government of India. State-wise institutional credit disbursement data was collected from NABARD. The data was then deflated using GDP deflator at 2011–12 prices. To study the trends in region-wise lending, as per Reserve Bank of India (RBI) guidelines, states were grouped into different regions, viz. Northern (Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Rajasthan, Chandigarh, Delhi), North-eastern (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura), Eastern (Bihar, Jharkhand, Odisha, Sikkim, West Bengal, Andaman & Nicobar Islands), Central (Chhattisgarh, Madhya Pradesh, Uttar Pradesh, Uttarakhand), Western (Goa, Gujarat, Maharashtra, Dadra & Nagar Haveli, Daman & Diu) and Southern (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Lakshadweep, Puducherry, Telangana). Data on gross cropped area and the gross irrigated area were collected from the Land use statistics reports of Directorate of Economics and Statistics (DES), Ministry of Agriculture and Farmers welfare, Government of India (GoI). Data on state-wise fertilizer consumption was collected from the Handbook of statistics on Indian states published by RBI.

Compound Annual Growth Rates (CGRs): The trend in region-wise disbursement of institutional credit over the years was estimated using CGR. CGR can be written as:

$$Yt - abt\ eut \quad (1)$$

where Y_t, institutional credit outlay at time't'; *a,* intercept; *b,* regression coefficient; t, time variable; u_t, an error term corresponding to t^{th} observation.

The equation (1) is estimated after transforming it to logarithmic form as follows:

$$In\ Y_t = In\ a + tln\ b + u_t \quad (2)$$

The CGR (r) is computed using the relationship:

$$r = \{antilog(In\ b) - 1\} \times 100 \quad (3)$$

Panel data regression: Panel data analysis has advantages over ordinary least square (OLS) regression models in terms of increased precision in estimation and capturing unobserved individual heterogeneity that may be correlated with regressors (Bruderl and Ludwig 2015). State wise value of output from agriculture (crop sector) per hectare was used as an indicator of agricultural productivity. A balanced panel was constructed for 13 major Indian states for the period 1991–92 to 2015–16. The major agricultural states included in the study were Andhra Pradesh, Gujarat, Bihar, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal. These states together contributed 87% of total value of output in agriculture and allied sector during TE 2015 (MoSPI 2015).

To estimate the impact of institutional credit on productivity, fixed effect model (FEM) and random effect model (REM) were used. Hausman specification test was used to identify the best model between FEM and REM. The FEM has constant slopes but intercepts differ according to the cross-sectional (states) unit. For *i* classes, *i–1* dummy variables are used for designating a particular state.

$$Y_{it} - \alpha_i + \beta_1 X_{1\,it} + \beta_2 X_{2\,it} + \beta_3 X_{3\,it} + e_{it} \quad (4)$$
$$e_{it} \sim IID(0,\ \sigma_e^2)$$

In the REM, the intercept is assumed to be a random outcome variable, whereas the random outcome is a function of a mean value plus a random error

$$Y_{it} - \alpha + \beta_1 X_{1\,it} + \beta_2 X_{2\,it} + \beta_3 X_{3\,it} + w_{it} \quad (5)$$
$$w_{it} = \in_i + e_{it}$$

Where Y_{it}, Value of output from agriculture (crop sector) expressed as ₹/ha in the i^{th} state (i=1 to 13) and t^{th} year (t=1 to 21); X_1, Institutional credit (₹/ha); X_2, Irrigation coverage (share of gross irrigated area in the gross cropped area expressed in % age); X_2, Fertilizer consumption (kg/ha); w_{it}, composite error term including $\in_i$ which is a cross section error component and e_{it}, which is a combined time series and a cross-section error component; α_i, β_i, β_2, β_3, parameters to be estimated.

RESULTS AND DISCUSSION

Trend in institutional credit disbursement to agriculture: The overall institutional credit disbursement for agriculture and allied activities in real terms has increased tremendously from ₹ 107742 crores during 1991–92 to ₹ 836937 crores in 2016–17 (Fig 1). A significant increase in institutional credit disbursement is evident during the early 2000s. Contribution of SCBs in the overall institutional credit disbursement surpassed co-operative banks from 2004 onwards. Enhanced institutional credit disbursement has resulted in reduced role of informal agencies as credit sources (Kumar *et al.* 2010, Pradhan 2013).

During 1991–92 to 2016–17, total institutional credit flow to agriculture has witnessed a significant positive growth rate of 10.37% (Table 1). The agricultural credit flow from SCBs has registered an annual growth rate of 12.45%. RRB's lending to agriculture has grown at an annual rate

Fig 1 Trend in flow of institutional credit to agriculture and allied activities in real terms. *Source*: NABARD

of 13.52%. Whereas, cooperative banks have witnessed lowest growth (4.88%). The sub-period wise analysis of flow of institutional credit to agriculture shows that the SCBs and RRBs had registered the highest growth rates during 2001–02 to 2010–11. It was mainly due to the government policy of doubling agricultural credit in 2004 for the next three years in order to boost the agricultural production.

Over the years, the share of cooperatives in total institutional credit to agriculture has declined from about 41% during the period 1991–95 to 17% during the period 2012–16. On the other hand, the share of SCBs has increased significantly from 52% to 70% during the same period. Concentrated support extended from the central government to SCBs and RRBs through recapitalisation to cleanse their balance sheet aided this process (Jumrani and Agarwal 2012). Since the financial restructuring of co-operatives were under the purview of state governments, they were not provided with such a financial support (Satish 2007). However, it is interesting to note that cooperatives lent over half of the total production credit during Triennium ending 2016–17. Whereas, SCBs disbursed about 80% of total investment credit during the same period.

Table 1 Compound annual growth rates of institutional credit flow to agriculture (%)

Period	Co-operatives	SCBs	RRBs	Total
1991–92 to 2000–01	6.43	1.61	7.35	4.20
2001–02 to 2010–11	-4.10	20.42	17.24	12.08
2011–12 to 2016–17	15.81	6.50	12.42	8.79
1991-92 to 2016–17	4.88	12.45	13.52	10.37

Source: Authors' calculation using data from NABARD

Region-wise distribution of institutional credit to agriculture: Flow of institutional credit to agriculture is not homogeneous across the different regions of the country as shown by varying share in total institutional credit and credit flow per ha of gross cropped area (Table 2). Southern states had received the highest amount (₹135036/ha) of institutional credit per ha followed by northern states (₹ 51772/ha) during 2016–17. Whereas, eastern (₹ 31123/ha), western (₹ 33181/ha) and north-eastern (₹ 33807/ha) states received a lower amount. The share of institutional credit to agriculture was also strikingly low in these regions for the study period.

During 2016–17, production and investment credit disbursed per ha of gross cropped area were highest in southern states of Andhra Pradesh, Telangana, Tamil Nadu, and Kerala. Agriculturally advanced states of Punjab and Haryana and hill state of Uttarakhand also had high production credit per ha (Fig 2). However, North eastern states, and Jammu and Kashmir had received the lowest production and investment credit per ha. These inter-state and inter regional disparities in institutional credit

Table 2 Region-wise flow of institutional credit by SCBs and RRBs in India

Region	Share in total institutional credit (%)				Amount outstanding per ha[1] (₹)			
	1991–92	2001–02	2011–12	2016–17	1991–92	2001–02	2011–12	2016–17
Northern	16.89	19.08	21.25	20.27	4400	5744	27773	51772
North-eastern	2.33	1.34	1.40	1.81	3773	3600	15151	33807
Eastern	12.59	10.43	10.16	9.95	2703	4217	20628	31123
Central	20.10	20.42	17.83	19.75	3133	4008	22536	37929
Western	12.54	12.82	11.30	12.51	5098	6740	21947	33181
Southern	35.55	35.92	38.06	35.70	8637	14400	76118	135036
All	100	100	100	100	4624	6452	30692	53808

Note: [1] in real terms

Source: Authors' calculation using data from RBI and DES, GoI

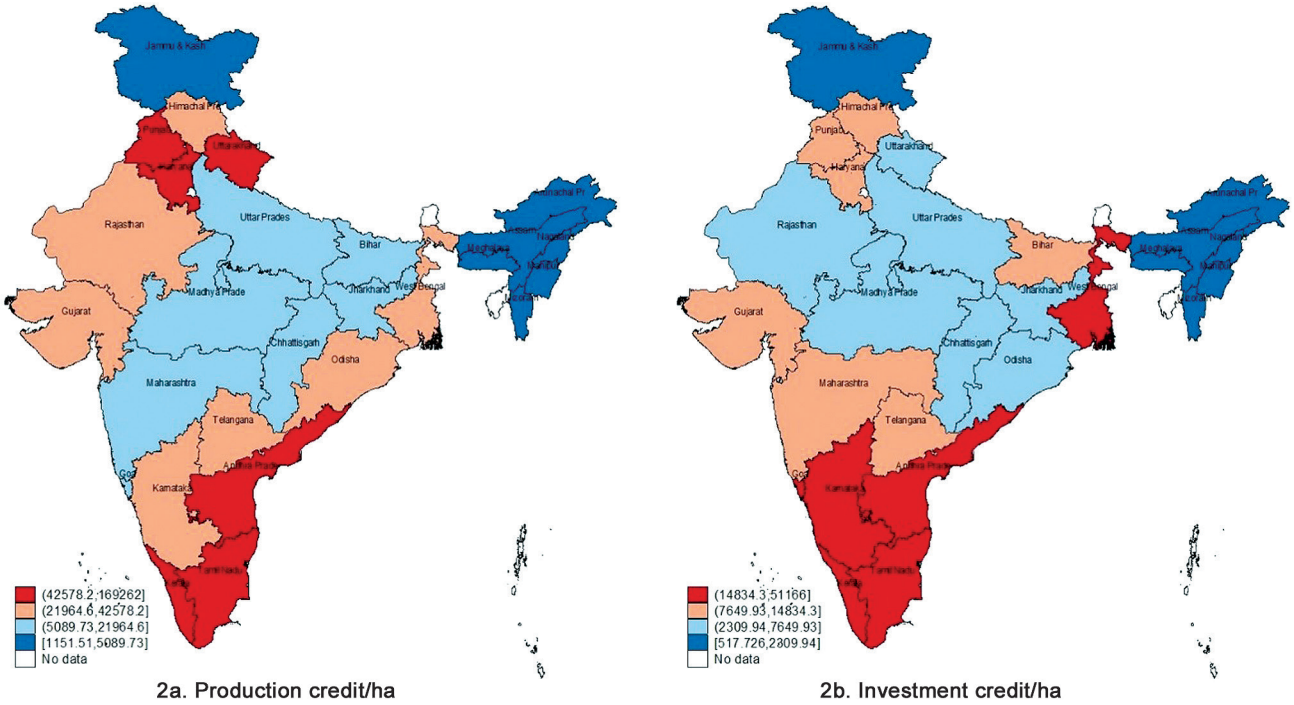

Fig 2 State-wise production and investment credit per ha during 2016–17.
Source: Authors' calculation using data from NABARD and DES, GoI

outreach may be due to varying resource endowments and technology adoptions. Therefore, there is a need for increase in investment in capital formation to improve the resource base in backward regions.

Kisan Credit Card scheme: The Kisan Credit Card (KCC) scheme was a milestone in the rural credit history of India. The KCC scheme was instituted in 1998–99 as a flagship program to disburse short term agricultural credit. The scheme was meant to expand credit outreach and simplify the credit delivery process. Later in 2004, investment credit was brought under KCC scheme making it a single window for availing rural credit. Based on the number of cards issued, the KCC scheme was branded as a major success in the rural credit delivery system. On an average, two-thirds of the farming households possess KCCs in India (Kumar *et al.* 2010).

Figure 3 slows the state-wise distribution density of KCC during 2016-17. Odisha had the highest density of KCC (one card per 1.09 ha) followed by Kerala (one card per 2.06 ha) and Andhra Pradesh (one card per 2.07 ha). Gujarat (one card per 4.61 ha) and Rajasthan (one card per 4.03 ha) had the lowest density of KCC.

Impact of institutional credit on agricultural productivity-Panel data model: The panel was constructed for 13 major states for the period 1991-92 to 2015-16. The model specification was done using the Hausman specification test. This test revealed that fixed effect and random effect models were indifferent enough to accept the null hypothesis. Therefore, random effect model was applied for the estimation.

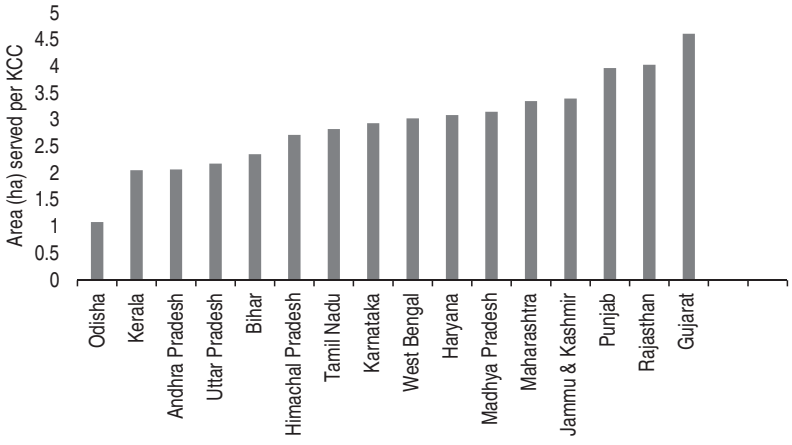

Fig 3 State wise distribution of KCC in India during 2016–17.*Source*: Authors' calculation using data from NABARD and DES, GoI

The results of the random effect model are presented in Table 3. The results indicated that institutional credit has a significant positive impact on the value of output from agriculture which is a proxy for crop productivity. The other variables such as irrigation coverage and fertilizer consumption also had a significant and positive impact on productivity. Earlier literatures also support the positive impact of institutional credit on agricultural productivity (Hazarika and Alwang 2003, Foltz 2004, Das *et al.* 2009, Diagne and Zeller 2001, Kannan 2011, Awotide *et al.* 2015, Kumar *et al.* 2017).

This study sought to investigate the trends and impact of institutional credit on

Table 3 Panel data regression results by using random effect model

Variable	Value of output from agriculture[a] (crop sector) (₹/ha)
Institutional credit (₹/ha)	0.21***
	(0.01)
Irrigation coverage (%)	585.27***
	(95.43)
Fertilizer (Kg/ha)	72.94***
	(18.78)
Constant	13382.06***
	(3343.06)
R Squared	0.90
Wald chi-square	3028.12
Prob>chi square	0.00
Observations	325
Number of years	25

Note: [a]in real terms; Standard errors in parentheses; ***represents 1% level of significance

agricultural productivity in India. The institutional credit flow to agriculture in India has been increasing over the years with the rise being more pronounced during 2001–10. There was a structural shift in the institutional flow of agricultural credit with a rising share of SCBs and RRBs. Cooperatives were the major sources of production credit whereas, SCBs were the major lenders of investment credit. We found a persisting disparity in institutional credit outreach to different regions. Per ha disbursement of institutional credit was highest in southern states, whereas eastern states received the lowest amount during the study period. Panel data model revealed a significant and positive impact of institutional credit on agricultural productivity. These results highlight the need for expansion of credit outreach through simplification of procedure for loan disbursement. There is also a need to ensure equitable credit distribution across regions with specific focus on credit hungry eastern, western and north eastern states.

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