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An Economic Analysis of Agricultural Credit-led Agricultural Growth in India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Among all sectors, the agriculture sector will be the pillar stone for sustainable economic growth. Agriculture credit shows the pivotal role for efficient agricultural transactions. The study investigates the role of agriculture credit in India's agricultural credit through various economic analyses. The data was collected from various government websites such as RBI, Ministry of Statistics and Programme Implementation of India, Economic Survey of India. The results observed that institutional credit has a positive correlation with fertilizers consumed whereas consumption had a negative correlation with agricultural produces. The results further stated the co-integration and the Johansen-Juselius maximum likelihood tests the long-run positive association between India's agricultural GDP and agricultural credit and increased Agricultural GDP drives agricultural credit. Finally, the policy implication on two perspectives as to encourage institutional credit arrangement to reach farmers with easy operational facilities across the nation and non-institutional credit need to marginalize the informal sources.

Keywords: Agriculture; agricultural credit; agricultural growth; compound growth rate; farmers; GDP; granger causality; Johannsen cointegration test and vector error correction.

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1. INTRODUCTION

The agricultural sector lays a foundation for the sustainable growth of other economic sectors. The agriculture sector's contribution to Indian GDP was approximately 52 percent in 1950 – 51 whereas, in 2018 – 19, it was approximately 14 percent (Ministry of Statistics and Programme Implementation, 2019). This decrease of the agriculture sector's contribution to India's GDP is constant on a year-to-year basis, although the stream of credit to agriculture has expanded substantially. The primary roles of the agriculture sector in the Indian economy are to promote inclusive growth, increase rural income, and provide sustainable food security. Approximately 60 percent of the Indian population is dependent on the agriculture sector and it accounts for approximately 14 percent of India's exports. Since independence, the production of agriculture produces has witnessed significant growth. Earlier, the prime objective was to increase production, and extension activities were limited to providing physical inputs like fertilizers, seeds, etc. There is an extreme need for shifting from traditional subsistence agriculture to the commercialization of the agriculture sector.

Agriculture credit is a basic contribution alongside current innovations for higher efficiency in the agriculture segment. Availability of adequate and timely credit plays a crucial role in promoting the growth of agriculture as the focus has shifted from providing physical inputs to educating farmers about market conditions and latest technologies that help them in deciding what to produce, how to produce, and how much to produce, for which credit awareness is necessary. Despite various efforts by central governments, state governments, and financial institutions, the ampleness of credit and ideal accessibility of credit remain as the significant limitations for agriculture credit in India. Since 1951, credit plays an important role in the formation of strategies for the agriculture sector in India. Indian credit framework comprises formal and casual wellsprings of credit. Formal source of credit has three channels for credit dissemination, that is, commercial banks, cooperative societies, and micro-financial institutions. For the last couple of decades, it has been a tough time for the agriculture sector in India. The commitment of agriculture division in GDP is diminishing and the benefit of agriculture area is declining. There is immediate pressure on policymakers to reframe policies for the agriculture sector. Institutional credit is the most important concern that attracts the special attention of policymakers while drafting policies. Previous studies have primarily focused on institutional credit to the agriculture sector by public sector banks and cooperative societies, short-term credit to the agriculture sector, and credit under various government schemes to the agriculture sector.

A properly established agriculture sector has the ability to reduce the difficulties of poverty, unemployment, and raw material supply. GDP from agriculture has been more effective in increasing the revenue of the poorest 40 percent of the population in the country. Moreover, the agricultural sector plays a key role in the growth and sustainability of the rest of the sectors in the Indian economy. Furthermore, Globalization in agriculture has led to phenomenal increase in the demand of agricultural produces. It has improved the position of foreign exchange earnings. Hence, it is obvious that since Pandit Jawaharlal Nehru’s incitement shortly after independence that “everything else can wait, but not agriculture”, agricultural growth has been central to India’s efforts at poverty reduction right from the start.

This immense growth in the sector is also associated with several financial issues especially pertaining to liquidity. Money flow is a vital factor at the time of pre-cultivation because there is a huge demand for investment at the start of a new cropping season. Since, there occurs a time lag in receiving returns from cultivation practices, it becomes furthermore difficult to liquidate money flow during pre-cultivation. Several farm decisions like land preparation, crop selection, purchase of inputs and resource management depend on the amount of liquidity present with the cultivator. The use of available money with the cultivators has been shrinking over the years due to increased consumption expenditure, educational expenses, shelter costs, rising wedding expenses, etc. Higher yields in farming require adopting suitable mechanization and techniques that calls for huge investment. Hence, the farmers try to diversify the agricultural practices in order to rise the income which is not possible with the lesser amounts of money. Further the farming sector is highly dependent on natural factors like wind, precipitation, sunshine, heat, dryness, cloudiness, and water which are uncertain and tend to reduce the returns received from the crop making the community vulnerable to several financial shocks. This makes provision of credit to farmers a main concern for the government to empower farmers in managing their risks and increasing their income.

Agricultural Credit schemes in India are necessary to boost agricultural production and farmers' income. In recent times, Government policies majorly focus on providing low-interest rate rural credit and the formal financial institutions are working towards reducing the influence of money lenders in rural areas. The Government of India has introduced several credit schemes and policies to improve the credit accessibility to farmer. These are intended to focus on providing timely and adequate credit support to farmers across the country. Separate schemes are devised for farmers to meet the short-term and long-term requirements of credit. The challenges of credit repayments in agriculture are handled using interest subvention and/or aggressive rebates.

In this study, the correct effect of institutional credit on the agriculture area of India will be analysed and address the question of whether growing institutional credit will result in improvement of the agriculture sector in India or not alongside the impact of area cultivated, fertilizers consumed, and production of agriculture produced on gross value added in the agriculture sector of India.

2. REVIEW OF LITERATURE

A study by Das et al. [1] suggested that in a recent couple of years, institutional credit to the agriculture division had expanded, and on the other hand, the commitment of the agriculture segment in GDP had diminished. One of the issues in the disbursement of institutional credit is unequal regional distribution.

Bashir, Gill, and Hassan [2] concluded that credit and agriculture produce with special reference to the production of wheat had a positive correlation. Through credit by commercial banks to the agriculture sector, the living standards of people in rural areas were improving, poverty was reduced, and at large, it helped the economy of the nation to grow.

Dong, Lu, and Featherstone [3] found that one of the reasons for the low productivity of small farmers was credit constraints. Due to a lack of credit for acquiring adequate labor with capabilities and education, input, and resources, even young farmers were not be able to completely leverage physical farm capability. Farmers who were credit unconstrained had high agriculture productivity. Due to credit constraints and low productivity, farmers were forced to move from rural areas to urban areas in search of employment. The manufacturing sector exploits labor by employing them at a low cost that causes social problems and negatively impacts the education of farmers' children. By removing credit constraints, farmers would have adequate credit and high productivity that helps them to stay in rural areas.

Akoijam [4] suggested that the rural credit system is most important to strengthen agriculture and farmers' economic position in rural areas. For improving the agriculture sector of India, the focus must be given to increasing agriculture production, marketing of agriculture products, processing of farm produces, trading, and distribution of agriculture products, and this could be done through responsive rural credit. For making rural areas attractive, an environment should be created where agriculture is considered vibrant and responsive.

Narayanan [5] investigated that agriculture sector credit through formal channels and inputs of agriculture had a positive relationship during the period from 1996 – 2012; whereas, the relationship between credit to the agriculture sector and contribution of agriculture sector in India's GDP was negative. Agriculture credit and agriculture inputs had high elasticity, but overall, the impact on agriculture produce was not effective. Credit had a positive impact on agriculture input, but the negative impact of agriculture's contribution to GDP was due to the price of agriculture outputs.

According to Anwar, Farooqi, and Khan [6] the sustainable economic development of any economy depends on the sustainable development of the agriculture sector of that economy. For the growth of agriculture, a policy framework is required for the commercialization and modernization of this sector.

According to Ponnarasu and Mohanraj [7] Indian agriculture currently needs new policies that concentrate on inputs such as technology, better infrastructure, supply of power at subsidized rates, supply of fertilizers, seeds, tractors, last and most important, credit to the agriculture sector through formal sources of credit.

Saqib, Kuwornu, Ahmad, and Panezai [8] found that age, education, household size, the proportion of own land, experience, and total land holding of farmers influenced access and adequacy of credit. Farmers with higher landholding had more access to a formal wellspring of credit and farmers with lower landholding had more access to a casual wellspring of credit. Small farmers had a higher level of deficiency of credit.

Bharti [9] found that in most of the developing countries including India, the major economic activity was agriculture. The prime motive of developing countries is to develop a profitable agriculture sector. For developing a profitable agriculture sector, the major constraint is the absence of access to finance. No access to finance constraints could be removed through the promotion of microfinance institutions and the formation of appropriate policies. It is important to develop a self-reliant model rather than providing subsidies or grants. Accessibility of moderate and fitting credit would assist with converting agriculture into a beneficial endeavor.

Maia, Eusébio, and da Silveira [10] concluded that farmers who were engaged in agriculture activity on a large scale did intensive commercial farming, were educated and employed farm technology, and had more access to farm credit than those who lacked these characteristics.

A study by Nordjo and Adjasi [11] revealed that small farmers who had access to credit had a higher level of farm productivity. The availability of production credits along with access to farm credit could increase farm productivity at a much higher rate.

Mamatzakis and Staikouras [12] suggested that providing investment funds to the agriculture sector helped farmers increase their income, and on the other hand, direct payment of subsidies to farmers would harm their income.

Fowowe [13] suggested that the financial inclusion of farmers had a positive and huge effect on agriculture productivity. Strategies should be framed by the central bank for intensive financial inclusion of farmers that will result in increased agriculture productivity.

2.1 Objectives of the Study

- To study the major determinants of Gross Value Added (GVA) in the agriculture sector.
- To analyze the association between Agricultural GDP and Agricultural Credit in India.

2.2 Database

Data collected (secondary) from Statistics of Indian Economy from RBI, Ministry of Statistics and Programme Implementation of India, Economic Survey of India, Ministry of Food Processing Industries, and Agricultural & Produces Food Products Export Development Authority of India. Time series data from 1980-2018 were used for analyzing the association between Agricultural GDP and Agricultural Credit in India.
Note:

- AGDP – Agricultural GDP
- CR – Institutional Credit disbursed (in crores)

3. METHODOLOGY

3.1 Compound Growth Rate

Growth rates are used to evaluate the past performance of the economic variables. Compound growth rate analysis was done using the following formula:

$Y_t = ab^tU_t$

where, Y_t = Dependent variable for which growth rate has to be estimated (area, production, yield in year 't');
a=Intercept;
b=Regression coefficient;
t=Year which takes values 1, 2…. n;
U_t=Disturbance term in year 't'.

The equation is then transformed into log-linear and written as

$\log Y_t = \log a + t \log b + \log Ut$

This equation is then estimated using Ordinary Least Square (OLS) method.

The compound growth rate (g) was then estimated by the identity given in equation

g = (antilog of b - 1) × 100

Where
g=Estimated compound growth rate per annum in percent; b= coefficient value obtained from OLS

The statistical significance can be tested using 't' test

For the analysis of data, three methods have been employed. First, matrix correlation analysis to measure the degree of variables' movement with each other. Second, Cobb –Douglas function is used to understand and quantify the relationship between dependent and independent variables.

To analyze the relationship between gross value added (GVA) in the agriculture sector and institutional credit:

$$Y = AX_1^{\beta 1}.\ X_2^{\beta 2}.X_3^{\beta 3}.X_4^{\beta 4}$$

$$\text{Ln } Y = \beta_0 + \beta_1 \text{Ln}X_1 + \beta_2 \text{Ln}X_2 + \beta_3 \text{Ln}X_3 + \beta_4 \text{Ln}X_4 + \mu$$

where,
β_0 = Natural log of intercept A.
X_1 = Total Institutional credit sanction to agriculture sector (in crores)
X_2 = Area cultivated for the production of food grains and commercial crops (in Lakh hectares)
X_3 = Total fertilizers consumed for the production of food grains and commercial crops (in lakh tones)
X_4 = Production of agriculture produces (in lakh tonnes).
Ln Y = Natural log of gross value added to the agriculture sector
LnX_1 = Natural log of total institutional credit sanction to agriculture sector (in crores)
LnX_2 = Natural log of area cultivated for the production of food grains and commercial crops (in lakh hectares)
LnX_3 = Natural log of fertilizers consumed for the production of food grains and commercial crops (in lakh tonnes)
LnX_4 = Natural log of production of agriculture produces (in lakh tonnes)
$\beta_1, \beta_2, \beta_3, \beta_4$ = output elasticities
μ = Error term

3.2 Correlation Matrix

A correlation matrix is a table showing correlation coefficients between sets of variables. Each random variable (X_i) in the table is correlated with each of the other values in the table (X_j). This shows which pair of variables have the highest correlation. The diagonal of the table is always a set of ones because the correlation between a variable and itself is always 1.

3.3 Cobb-Douglas Function

A Cobb-Douglas production function models the relationship between production output and production inputs (factors). It is used to calculate ratios of inputs to one another for efficient production and to estimate the technological change in production methods.

The general form of a Cobb-Douglas production function for a set of n inputs is

$$Y = f(X_1, X_2..., Xn) = \gamma \prod_{i=1}^{n} x_i^{\alpha i}$$

where Y stands for output, x_i for input i, and γ and α_i are parameters determining the overall efficiency of production and the responsiveness of output to changes in the input quantities.

3.4 Augmented Dickey-Fuller Test

The time series analysis is to examine the stationarity of each time series selected. The Augmented Dickey-Fuller (ADF) unit root test (Dickey and Fuller, 1979) is used to examine the stationarity. The test is conducted by augmenting the preceding three equations by adding the lagged values of the dependent variable.

The ADF test here consists of estimating the following regression;

$$\Delta Y_t = \alpha + \delta Y_{t-1} + Y_i \Sigma Y_{t-1} + et$$

$$H_0\colon \delta = 0\ (non-stationary\ \ series) H_1\colon \delta \neq 0\ (stationary)$$

The hypothesis of ADF test:

- H_0: There is a unit root.
- H_1: No unit root and the time series are stationary (or trend-stationary).

3.5 Johansen's Co-integration Method

Johansen and Juselius (1990) developed a co-integration test for testing the long-term relationship between the variables. It means even if two or more series are non-stationary. they are said to be cointegrated if there exists a stationary linear combination of them. After establishing that the time series were stationary at the level or same order of differences, the maximum likelihood (ML) method of co-integration was applied to check to test the number of cointegrating vectors. The null hypothesis of almost 'r' co-integrating vectors against a general alternative hypothesis of 'r-1'integrating vectors is tested by trace statistics (Johansen 1999).

Trace Statistic ($\lambda - trace = -T \sum_{i=r+1}^{n} \ln(1-\lambda)$)

Maximum Eigen Value Statistic ($\lambda - \max = -T\ln 1 - \lambda i - 1)$

λ_i are the estimated Eigenvalues obtained and T is the number of observations. The number of co-integrating vectors indicated by the tests is an important indicator of the extent of co-movement of GDP and agricultural credit. An increase in the number of cointegrating vectors implies an increase in the strength and stability of its linkages.

3.6 Vector Error Correction Model for a Short-term Relationship

The co-integration analysis reflects the long-run movement of two or more series, although in the short-run they may drift apart. Once the series is found to be co-integrated, then the next step is to find out the short-run relationship along with the speed of adjustment towards equilibrium using an error correction model., represented by equations

$$\Delta AGDP_t = \beta_0 + \Sigma_{j=1}^{M} \beta_{1j} \Delta CR_{t-j} + \Sigma_{j=1}^{N} \beta_{2j} \Delta AGDP_{t-j} + \alpha E_{t-1} + U_{1t}$$

$$\Delta CR_t = \delta_0 + \Sigma_{j=1}^{k} \delta_{1j} \Delta CR_{t-j} + \Sigma_{j=1}^{k} \delta_{2j} \Delta AGDP_{t-j} + \lambda C_{t-1} + U_{2t}$$

AGDP is Agricultural Domestic Product & CR is yearly agricultural credit disbursement

where, ECT_{t-1} is the lagged error correction term; X_t and Y_t, are the variables under consideration transformed through natural logarithm; X_{t-1} and Y_{t-1} are the lagged values of variables X and Y. The parameter γ is the error correction coefficient that measures the response of the regressor in each period to departures from equilibrium. The negative and statistically significant values of γ depict the speed of adjustment in restoring equilibrium after disequilibria and if it is positive and zero, the series diverges from equilibrium.

3.7 Granger Causality Test

To know the direction of causation between the markets, the Granger causality test was employed (Granger, 1969). When a co-integration relationship is present for two variables a Granger causality test can be used to analyze the direction of this co-movement relationship. Granger causality tests come in pairs, testing weather variable X_t, Granger causes variable Y_t, and vice versa. All permutations are possible viz., univariate Granger causality from X to Y, or from Y_t, to X_t. bivariate causality or absence of causality. The Granger causality test analyses whether the unrestricted equation:

$$\ln X_t = \sum_{i=1}^{m} lnX_{t-i} + \sum_{j=1}^{m} \beta_j lnY_{t-j} + \varepsilon_{1t}$$

$$\ln Y_t = \sum_{i=1}^{m} lnY_{t-i} + \sum_{j=1}^{m} \beta_j lnX_{t-j} + \varepsilon_{2t}$$

Where X_t and Y_t are two different market prices series, In stands for price series in logarithm form. t is the time trend variable. The subscript stands for the number of lags of both variables in the system. The null hypothesis in both equations is a test that ln X_t, does not Granger cause ln Y_t. In each case, a rejection of the null hypothesis will imply that there is Granger causality between the variables. (Gujarati,2010).

4. RESULTS AND DISCUSSION

The outcomes show that all the factors are positively correlated with GVA from agriculture except the amount of fertilizer consumption. Institutional credit and production of agricultural products have significant correlation coefficients, that is 0.984 (0.008) and 0.874 (0.001) at the 1 percent level of significance, respectively with GVA in the agricultural sector. Institutional credit also has a positive correlation with the production of agriculture produces with a correlation coefficient of 0.914 (0.012) at a 1 percent level of significance. It is also observed that institutional credit has a positive correlation with fertilizers consumed whereas fertilizer consumed has a negative correlation with the production of agricultural produces. This might be due to the overuse of fertilizers leading to diminishing marginal returns.

4.1 Results of Cobb- Douglas Function

The value of the R-square is 0.94 which is high showing that 94 percent of the total change in the GVA in the agriculture sector of India can be explained by the four variables that are selected for the study. The calculated value of the F-statistics is 50.34, which is highly significant. This may be interpreted that the independent variables of the model significantly influence GVA in the agriculture sector.

Table 1. Correlation Matrix - Institutional credit and GVA

		Institutional Credit	Area Cultivated (Lakh hectares)	Fertilizers consumed (Lakh tonnes)	Production of Agriculture Produces (Lakh tonnes)	GVA in Agriculture Sector (Lakh crores)
Institutional Credit	Pearson Correlation	1				
	Sig. (2-tailed)					
Area cultivated (Lakh ha)	Pearson Correlation	0.349	1			
	Sig. (2-tailed)	0.307				
Fertilizer consumed (Lakh tonnes)	Pearson Correlation	0.244	0.156	1		
	Sig. (2-tailed)	0.515	0.661			
Agriculture Production (Lakh tonnes)	Pearson Correlation	0.914**	0.266	-0.313	1	
	Sig. (2-tailed)	0.012	0.436	0.376		
GVA in Agriculture Sector (Lakh crores)	Pearson Correlation	0.984**	0.416	-0.248	0.874**	1
	Sig. (2-tailed)	0.008	0.228	0.487	0.001	

*** Correlation is significant at the 0.01 level (2-tailed)*

Table 2. Regression analysis indicating the determinants of Agricultural GDP

	Co-efficients	Standard Error	t-stat	P-value
Intercept	-0.316	7.123	-0.444	0.965
Institutional credit (crores)	0.633	0.103	6.121	0.002
Area cultivated (Lakh ha)	0.443	0.784	0.565	0.592
Fertiliser Consumed (Lakh tonnes)	0.025	0.418	0.059	0.955
Production (Lakh tonnes)	-0.844	0.526	-1.605	0.171

Table 3. Statistical test results

Multiple R	0.98
R-Square	0.94
Adjusted R-Square	0.94
Observations	38
F-Statistics	50.34

The results further show that institutional credit and area cultivated for the production of food grains and commercial crops are positive and significant. Institutional credit, as the main variable, indicates that its coefficient is 0.633, which means that a 1 percent change in institutional credit will result in a 0.633 percent change in GVA from the agriculture sector of India. Area cultivated indicates that its coefficient is 0.443, which means that a 1 percent change in area cultivated for the production of agriculture produces will result in a 0.443 percent change in GVA in the agriculture sector of India. The coefficient of fertilizers consumed and total production of agriculture products is 0.025 and -0.844, respectively. The impact of the production on agriculture produces is insignificant and negative.

4.2 Augmented Dickey-Fuller Test

ADF test results have been presented in the table below. Stationarity has been checked with constant and no time trends as well as with a constant and time trend. It can be seen from the table that all the series are non-stationary at level but agricultural credit is stationary at the first difference and agricultural GDP is stationary at the second difference. Now both series agricultural gross domestic product (AGDP) and agricultural credit (CR) are integrated in a different order.

4.3 Johannsen's Cointegration Test

Johansen co-integration test was used to analyze the integration among agricultural GDP and Credit and the estimated results have been presented in the table below. Unrestricted co-integration rank test (Eigenvalue and trace statistic) indicated the presence of at least one co-integrating equation at a 5% level of significance.

The appropriate lag selection can be obtained by using tests like Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), Final Prediction Error (FPE), and Hannan Quinn Information Criterion (HQ), etc. Tests of FPE, AIC, and HQ are indicating that optimum lags are 3 while SC shows 2 lags. The lag criteria were taken using optimum lag suggested by FPE, AIC, and HQ tests. The Trace statistic (24.297) and Max-Eigen statistics (22.436) value is more than the critical values thus the null hypothesis (r = 0) is rejected. It implies that there is an existence of a co-integration equation (CE) between the variables. Hence, there exists a long-term association between Agricultural gross Domestic Product and Agricultural Credit.

4.4 Vector Error Correction Model for a Short-term Relationship

From the Table below, it is found that the error correction term is negative which indicates that there is a convergence between the variables and the existence of long-run causality. It means that if there is any deviation in the long-run relationship among variables then there is an error correction mechanism and negative sign express that the system will go back to the long-run equilibrium with 0.7% speed.

4.5 Granger Causality

Granger Causality test has been conducted to check for causality among the agricultural credit and agricultural GDP in the short run. The results reveal that agricultural Credit Granger causes agricultural gross domestic product. It is significant at a 1 percent level. At the same time, agricultural Gross Domestic Product Also Granger causes changes in agricultural credit. Therefore, it can be concluded that a bidirectional causality between agricultural credit and agricultural gross domestic product is found.

4.6 Compound Annual Growth Rate

From the above Fig. 1, it is perusal that exponential growth in Direct Institutional Credit for Agriculture and Allied Activities from 1980 to 2018 had been 16 %. From the graph, it can be seen that in the decade of 1980s and 1990s there was not much yearly increment in the agricultural credit disbursement. But after 2000 there was a sharp increment in the disbursement of institutional credit because the government and the commercial bank gave too much emphasis on agricultural lending. In 2004, the Government of India announced that it intended to double the flow of credit to agriculture for three years (Ministry of Agriculture 2007). A "comprehensive credit policy" was announced in June 2004. It included promises to raise agricultural credit by 30 percent a year; to finance 100 farmers per bank branch (fifty lakhs, farmers in a year)

Table 4. ADF test result

ADF TEST	LAGDP		LCR	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
At Level	2.484	3.262	6.978	2.156
At First Difference	0.440	-3.118	-1.135	-4.173*
At Second Difference	- 8.146*	- 8.342*	-	-

** Stationary at 0.05 critical level*

Table 5. Johannsen's Cointegration Test

Hypothesized No. of CE(s)	Trace Statistic	5 per cent Critical Value	Max-Eigen Statistic	5 per cent Critical Value
None (r=0) *	24.297	15.495	22.436	14.264
At most 1	1.861	3.841	1.861	3.261

** denotes rejection of the hypothesis at the 0.05 level*

Note: Trace and Max-Eigen Statistic values indicate that there is one cointegration equation

Table 6. Long-run causality and error correction term

	β	S.E.	t-statistic
ECT	-0.074	0.020	-3.695
GDP-(1)	-4.84×10^{-8}	1.8×10^{-8}	-2.729
GDP-(2)	-2.29×10^{-8}	1.4 x 10-8	-1.682
CR-(1)	0.017	0.173	0.100
CR-(2)	0.183	0.159	1.153
Intercept	39106.17	10358.0	3.775

Table 7. Results of the Granger Causality test

Null Hypothesis	P-value	Conclusion
D (LCR) does not Granger cause of D (LAGDP)	0.017*	Causality
D (LAGDP) does not Granger cause of D (LCR)	0.002**	Causality

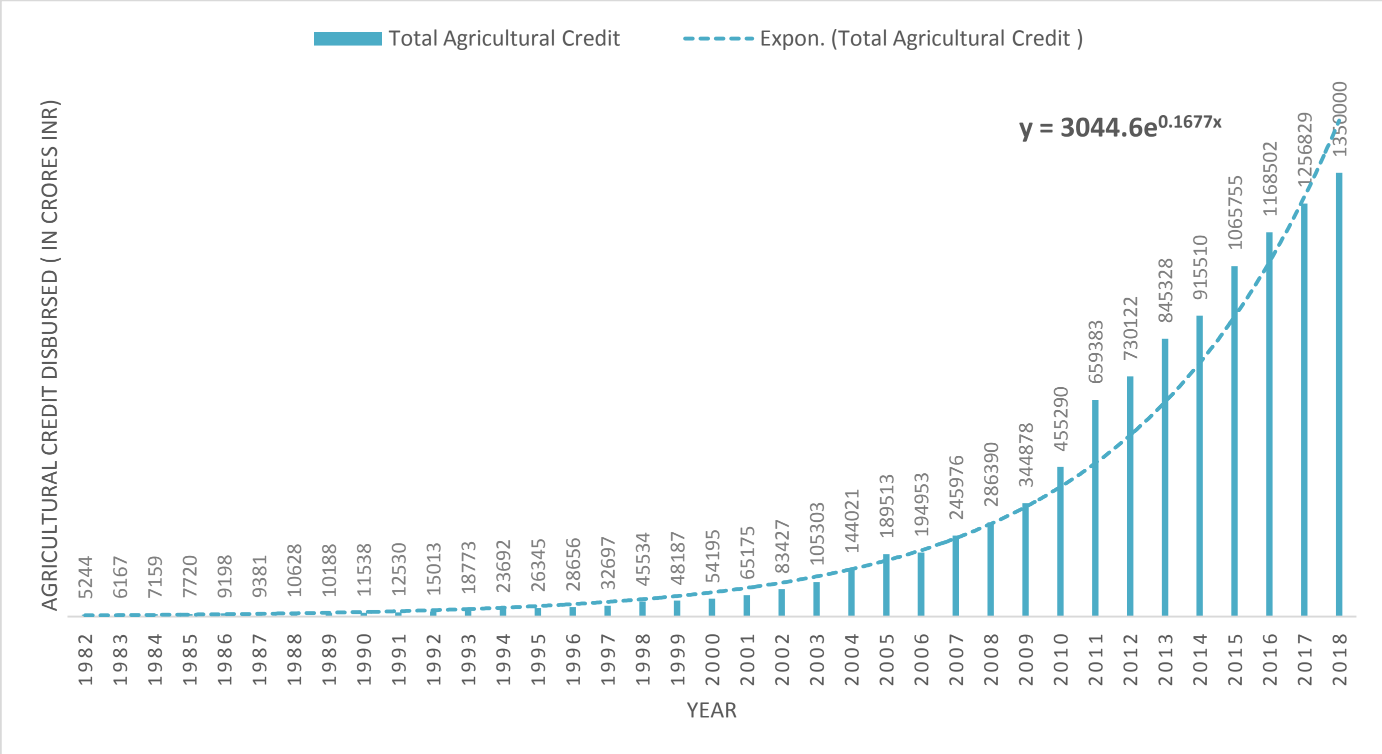

Fig. 1 . Total Agricultural credit Disbursed in India (1982-2018)

5. SUMMARY AND CONCLUSION

In this study, we have empirically investigated the nature of the causal relationship between India's agricultural GDP and agricultural credit using the Granger causality test through the Vector Error-Correction Model over the period 1980 to 2018. The co-integration and the Johansen-Juselius maximum likelihood tests show that there is a long-run positive association between India's agricultural GDP and agricultural credit. It is also observed that in the short run, the agricultural credit Granger causes agricultural growth in India. At the same time, the increased Agricultural GDP drives agricultural credit. In other words, there is evidence of a bidirectional Granger causality running from agriculture credit to agricultural growth. This insight lends general support to the credit-led growth hypothesis. We can conclude that agricultural credit has the potential to play a role similar to that of other drivers of agricultural growth, particularly for developing countries, lends support to those who argue that increasing agricultural credit leads to increased economic growth and that the credit-led growth from agriculture may represent the optimal allocation of resources to get maximum productivity or production.

The agriculture sector is one of the essential and priority-based sectors in India. From the results, it is evident that institutional credit assumes an important job in the development and improvement of the agriculture sector in India as it has a positive and significant impact on the GVA of the agriculture sector in India. Besides institutional loans, land cultivated also has a positive and significant impact on the agriculture sector. Consumption of fertilizers has a significant and positive impact on GVA by the agriculture sector in India, and production of agriculture produces has a negative and significant impact on the agriculture sector.

The policy implication needs to emphasize two perspectives. Firstly, it will encourage institutional credit arrangement with operational ease, reachability, and credit literacy among farmers across the nation. Lastly, non-institutional credit sources need to marginalize. It could be in the form of putting restrictions on selling hypothecated land or agricultural produces by informal sources. The Credit Grievance Redressal forum at the district level may decrease the credit stress among farmers. Shifting agricultural support from a non-market to a market-based approach is the right step towards achieving sustainable growth. If the supply side could be an area for future research, then we may find customer credit assessment, credit risk mitigation, and credit usage decisions would base on quantitative or/and qualitative models. In the absence of an optimal decision assessment model for customer credit risk evaluation and credit decisions by commercial banks, the institutional lenders are reluctant to involve in agricultural credit. Finally, it can be concluded that Agricultural credit is a necessary input for inclusive agricultural sector growth. For financial and social inclusion government should take strong steps to disburse credit for the agricultural sector because agricultural credit can lead to agricultural growth. The government should promote institutional credit to the agriculture sector not only through regional rural banks, cooperative societies, and scheduled banks that mainly include public sector banks but also through the private sector banks.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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