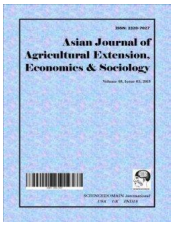

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# Agricultural Credit-led Agricultural Growth: A VECM Approach

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***Authors' contributions***

*This work was carried out in collaboration between all authors. Author SF has conceptualized the study and taken expert opinion on the research matter. Author WK has given the research methodology required for the study. All authors are collectively designed the review, performed the econometric analysis and included the practical inferences. The first draft of the manuscript is written with due diligence of available literatures by all the authors. Authors WK and SF managed the analyses of the study. Author MJ managed the literature searches and given valuable inputs in the discussion part. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aims:** To explore the agricultural credit potential, performance and relationship with agricultural growth in India's.
**Study Design:** The study is based on secondary data of agricultural GDP and agricultural credit (Direct Institutional Credit). At first, the performance of agriculture credit is conferred using compound annual growth rate of credit disbursement over the time and analyses the disbursement of agricultural credit of scheduled commercial banks to marginal, small, medium and large farmers. Further, the empirical research has conducted to explore the relationship between agriculture credit and economic growth in long-short run using time series data.
**Place and Duration of Study:** Time series data of Agricultural gross domestic product and farm

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credit has been taken from Hand Book of RBI and National Account Statistics (CSO) from the period of 1980 to 2011.

**Methodology:** The study uses Johansen Co-integration test to analyze the long term association between agriculture gross domestic product (AGDP) and Agriculture Credit. Moreover, Vector Error Correction Model is applied for understanding the long run and short run causality.

**Results:** Findings from the analysis suggest that over the period, agriculture gross domestic product is highly responsive to an increase in agricultural credits. A unidirectional causality is running from Agricultural credit to Agricultural Gross Domestic Product.

**Conclusion:** It can be concluded that Agricultural credit is a necessary input for inclusive agricultural sector growth. For financial and social inclusion, the government should take strong steps to disburse credit to agricultural sector as agricultural credit leads to production of agriculture and agriculture has the power to cause growth to all sectors of the economy inclusively.

*Keywords: Agricultural finance; institutional arrangements; agriculture growth; credit composition.*

**JEL classification:** Q14, O17, O13, H81.

## 1. INTRODUCTION

A well-established agriculture sector has the power to reduce the problems of poverty, unemployment and raw material supply. GDP growth originating in agriculture has been more successful in raising the income of the poorest 40% of the population than rest of the economy [1]. In the domestic front, Indian agriculture has a great responsibility of feeding 2nd largest population of the world. Agriculture sector provides employment to more than 50% population. According to Census of India 2011, 83.3 crore lives in the rural hinterlands out of total 121 crore population and they depends directly or indirectly upon agriculture and allied activities for their livelihood. Agriculture sector further provides growth and sustainability to the rest of the sectors in the Indian economy. Globalization leads to the phenomenal demand growth of the agricultural produce [2]. It improves the position of foreign exchange earnings. Food grain production reaches its record level in the year 2013-14 is 264.38 (3rd advance estimate by union ministry of agriculture). Starting from Pandit Nehru's exhortation soon after independence that "everything else can wait, but not agriculture", agricultural growth has all along been central to India's efforts at poverty reduction. It is unstated and much needed to invigorate the Indian agricultural after its continuous declining contribution in the GDP over the years [3]. Many factors such as rain falls, irrigation facility, quality of seeds, minimum support prices have important role in increasing production and productivity but timely availability of credit is most essential factor specifically for small and marginal farmer and in many cases may be a limiting factor for farmers having small land holdings [4].

Indian agriculture is struggling to get required liquidity since long. Generally, the vital flow of money is required at the time of pre-cultivation. Agriculture produces can be marketed after harvesting while the next cropping season demands further investment. There is a continuous time lag in getting return from cultivation practices. The decisions of purchase inputs, crop selection, land preparation, resource management depends upon the amount of liquidity in the hands of cultivator. The utilization of available money in the hands of cultivators is further faces shrinkages due to consumption expenditure, education, shelter, weddings etc. Farming can get higher yields by adopting suitable mechanization requires investment. They have option to diversified agricultural practices to increase income which is not possible without availability of surplus money. The dependency of agriculture on wind, precipitation, sunshine, heat, dryness, cloudiness and water reduces the chances of handsome normal return. Further, the almost regular occurrence of natural disasters is making the life more vulnerable for the community. So, providing credit to the farmers is the main concern for Indian government by empowering the farmers to manage risks and increase their income over time.

Indian farmers are mainly concerned for agriculture credit for purchasing key inputs which will be helpful for increasing their income over the years [5]. Borrowers of agriculture credit allocate more land to crops as compared to non-borrowers that leads to the significant increase in

the income of the borrowers [6]. Government policies are focusing to provide rural credit at low interest rates. The formal financial institutions are pioneering to reduce the influences of money lenders [7]. Agriculture Credit schemes are helpful to increase agricultural production and farmers' income [8]. The Government of India introduces different scheme and policies to improve the accessibility of credit to the farming community. These policies are intended to focus on providing timely and adequate credit support to farmers across the country. Separate schemes are floated for catering short term and long term requirement of credits of the farming community. The challenges of credit repayments are handled with interest subvention and/or aggressive rebates are offered to the borrowers [9].

In these circumstances, this study will explore the extent to which, if at all, institutional credit perform and support agricultural growth. It will begin with comprehensive review of literature in the first section. Later we will extract the objectives and explain the methodology. Performances of agricultural credit in the light of structural shifts, credit growth, credit momentum and dispersal will be explained in the next section. Lastly, the study examines agricultural credit led agricultural growth or vice versa.

## 2. RELATED LITERATURE

Agricultural credit is a critical input for agricultural community in India, it envisages with the absence of simultaneity with the realizable income and required expenditure. Buying seeds, plant protection materials etc are current farm expenses in farming needs short term credit to be repaid during the same year after harvest. The capital investment such as land improvement, sinking, repairing of wells, purchase of implements etc are for long term credit. The use of various farm inputs (such as chemicals, fertilizers, seeds, tube wells, equipments, tractors, labors and various rents etc.) increases the cultivation expenditure of farmers. So far the per capita income of farmers has not grown with the same rate as input prices and total cost of agricultural production. Consequently, farmers have little surplus money at their disposal and are forced to take huge amounts of loan. This has led to a surge in the growth of agricultural credit [10]. The evidences of various sources, status, performances, issues and impacts of agriculture credit are analyzed in different research studies (see Table 1).

**Table 1. Literature review of Indian agricultural credit**

| S. no. | Author | Year | ** | Findings |
|---|---|---|---|---|
| 1 | [11] | 1971 | 2 | Agriculture credit has direct relationship with the income level farm productivity and agriculture development. |
| 2 | [12] | 1992 | 3 | Institutional growth and higher lending volumes lead to modest increases in aggregate crop output |
| 3 | [13] | 1996 | 1 | The policy of agricultural price and subsidizing credit by government adversely affects interest rate in informal sector |
| 4 | [14] | 1997 | 1 | Lower demand for formal credit limits its role in enhancing agricultural development |
| 5 | [15] | 1997 | 1 | Remarkable relation between congruence of interest and recognition of entitlement set. |
| 6 | [16] | 2000 | 3 | Inter-state variation in disbursement of credit |
| 7 | [17] | 2001 | 1 | Providing formal credit at subsidized rates and in flexible amounts can increase efficiency of rural credit markets |
| 8 | [18] | 2002 | 3 | High incidence of bad debts in most of the rural finance institutions. |
| 9 | [19] | 2004 | 2 | Agriculture credit disbursement is more than targeted but get less than projected actual requirement of credit |
| 10 | [20] | 2005 | 2 | Farmers constrained by insufficient capital to invest in farm operations. |
| 11 | [21] | 2005 | 3 | Incidence of bank branches positively associated with credit supply to agriculture and share of agriculture credit to net bank credit declined after banking sector reforms. |
| 12 | [22] | 2005 | 4 | Effect of formal credit on agricultural output is either nonexistent or negligible |

| S. no. | Author | Year | ** | Findings |
|---|---|---|---|---|
| 13 | [23] | 2016 | 4 | There is favorable and significant impact of agricultural credit on agricultural growth. Direct agricultural credit has a much larger impact and hence needs to be encouraged. |
| 14 | [24] | 2006 | 3 | Agricultural credit has played a vital role in supporting agricultural production in India. Gaps in the flow of agriculture credit via institutional setup in India. |
| 15 | [25] | 2007 | 3 | Credit delivery to small and marginal holders is inadequate |
| 16 | [26] | 2007 | 3 | Agri-business oriented units capture significant proportion of direct finance as compared to small and marginal landholders. |
| 17 | [27] | 2007 | 2 | Causality between agricultural credit and output cannot be directly established |
| 18 | [28] | 2007 | 2 | Multiple pathways in which formal agricultural credit impacts production. |
| 19 | [29] | 2007 | 2 | Credit delivery to the agriculture sector continues to be inadequate |
| 20 | [30] | 2008 | 3 | The share of women in terms of both number of accounts and amount of loans is lesser as compared to male borrowers |
| 21 | [31] | 2008 | 3 | The multiagency approach to credit delivery in rural India has turned out to be ineffective. |
| 22 | [32] | 2009 | 2 | Transaction costs higher for obtaining credit from institutional sources than non-institutional sources |
| 23 | [33] | 2009 | 4 | Direct agricultural credit has immediate positive effect on productivity while indirect credit effects productivity with an year lag |
| 24 | [34] | 2010 | 2 | Cost of production and land size major factors in discriminating borrowers of cooperative and commercial banks |
| 25 | [35] | 2010 | 4 | Share of institutional credit to total credit has declined over past four decades. |
| 26 | [36] | 2010 | 2 | Elasticity of demand for inputs with respect to credit is quite significant. |
| 27 | [37] | 2011 | 3 | Flow of credit to small and marginal farmers is inadequate in relation to its demand |
| 28 | [38] | 2011 | 4 | Credit to agriculture sector has significantly reduced after WTO period |
| 29 | [39] | 2012 | 2 | Borrowings from formal sector are for longer duration and for productive purposes. |
| 30 | [40] | 2012 | 2 | Dearth of financial institutions is the principal demand side constraint while inadequate staff and dominance of large farmers are principal supply side constraints to credit |
| 31 | [41] | 2012 | 3 | The gap between small and large landholders in terms of amount outstanding per account is widening. |
| 32 | [42] | 2012 | 4 | Net margins on total output higher for beneficiary of Kisan Credit Cards than non-beneficiary. |
| 33 | [43] | 2012 | 4 | Higher credit use associated with increased use of input in production. |
| 34 | [44] | 2012 | 3 | Direct finance to agriculture increased for small and marginal holders during pre and post liberalization period. |
| 35 | [45] | 2012 | 3 | Commercialization of Indian agriculture has made it less profitable for the farmers. |
| 36 | [46] | 2012 | 2 | Elasticity of real agricultural GDP with respect to institutional credit to agriculture. |
| 37 | [47] | 2013 | 2 | Borrowers of formal sector have better access to electricity and irrigation facilities, belong to upper caste and have better access to infrastructure facilities. |
| 38 | [48] | 2013 | 3 | Institutional credit is restricted to less risky activities, informal credit used for non-productive purposes while role of micro-finance is dubious. |
| 39 | [49] | 2013 | 3 | Highest increase in total loans issued by scheduled commercial banks while lowest was for cooperatives during study period. |

| S. no. | Author | Year | ** | Findings |
|---|---|---|---|---|
| 40 | [50] | 2013 | 3 | Microfinance serves as an important tool to reduce income and consumption disparities. |
| 41 | [51] | 2014 | 2 | Institutional credit skewed towards resource-rich households. |
| 42 | [52] | 2014 | 3 | Presence of regional disparities in disbursement of credit. |
| 43 | [53] | 2014 | 2 | Institutional credit is utilized mostly for productive purposes. |
| 44 | [54] | 2015 | 2 | Expenses on children education, occupation, family size land size are significant determinants of agricultural credit. |

*Here, (**) Methodology; 1- Conceptual, 2- Exploratory Cross Sectional, 3- Descriptive, 4- Empirical*

Agriculture credit has gained importance among policymakers, bankers, educational institutions, and agricultural fraternities in developing economies [55,56,57,58]. There are various studies mentioning the need of agriculture credit for eradication of poverty, food availability and invigoration of rural structure [59,60,61]. The supply side of credit is more interesting and replicating the illusion of credit arrangement exists in the system. The lender's-side asks about the average interest rate, total credit supply and recovery of agricultural loans. The charges of institutional agencies are less than earlier but the procedures of getting loans and criteria of loan approval is too high. Generally, big farmers take the advantage of such credits because of their access to the credit institutions, ability to complete documentations and political influences. The major lending risk in agriculture is interest rate risk, liquidity risk, refinance risk and credit risk. Mostly researchers are focused on the demand side issues but very little research has found in supply side of agriculture credit.

Researchers have covered agriculture credit under micro and macro contexts. In the micro context the impact on rural population, gender, input arrangement, income, education etc are analyzed with reference to agriculture credit in the short and long run. Generally conceptual, exploratory and descriptive methodologies are used to explain micro contexts. The macro factor is analyzed with empirical analysis whereas the relationship between agriculture credit on production, GDP, agriculture and allied activities etc are extracted. Despite the stratospheric importance of agriculture credit in economic growth, there are huge financial crunches have reported among farming communities in developing economies. The comprehensive review of literature envisages the necessity of empirical research in the area of agricultural credit led agriculture growth or agriculture growth led agricultural credit for short & long run in India.

## 3. OBJECTIVE OF THE STUDY

Specific objectives are

- To analyze the performance of agriculture credit in India
- To analyze the co integration between Agricultural GDP and Agricultural credit
- To analyze long run and short run causality between Agricultural GDP and Agricultural credit

## 4. METHODOLOGY

### 4.1 Research Design

The study analyses the agricultural credit performance with respect to credit market structural shift, credit growth, institutional credit trend, disbursement of agriculture credit and credit dispersal between different farmers using exploratory data analysis. Further, the empirical analysis will be conducted to find the causal relationship between agriculture credit and agriculture gross domestic product.

### 4.2 Data Collection

This study is based on secondary data. Time series data of credit market shift, credit growth, institutional credit trend, credit disbursement, agricultural gross domestic product and farm credit has been taken from Hand Book of RBI and National Account Statistics (CSO) from the period of 1980 to 2011**.** The present study has conducted to find out the short run and long run causality between Agricultural gross domestic product and Yearly Disbursement of Agricultural credit.

### 4.3 Analytical Approach

To analyze the growth of credit disbursement over time Compound Annual Growth rate (see below 4.3.1) is calculated. For time series

analysis, series should be stationary. Therefore to check the stationarity of the series, Augmented Dicky-Fuller test (see below 4.3.2) is used [62] is used. From the ADF test, if it is found that all series are integrated at the same order than we can proceed for Johansen test of co integration. Juselius (1992) procedure has superior properties than the Engle-Granger two-step procedure [63]. If Johansen test of co integration provides that there is long run co integration among the variable then we can use vector error correction model (see below 4.3.3) for error correction term. To know the granger causality among variables the VEC Granger Causality/Block Exogeneity Wald Tests have conducted. To analyze the long run and short run causality between these two variable vector error correction models is one of the suitable approaches, because it considers better than other approaches and easy to analyze bidirectional causality.

#### 4.3.1 Compound annual growth rate

$$CAGR = \left(\frac{Ending\ value}{intial\ value}\right)^{1/n} - 1 \quad (1)$$

#### 4.3.2 Augmented dicky-fuller test

$\Delta Y_t = \alpha + \delta Y_{t-1} + \gamma_i \sum \Delta Y_{t-l} + et$
$H_0$: $\delta = 0$ (non stationary series) and $H_1$: $\delta \neq 0$ (stationary)

#### 4.3.3 Vector error correction model

$$\Delta AGDP_t = \beta 0 + \sum_{j=1}^{M} \beta 1j\ \Delta CR_{t-j} + \sum_{j=1}^{N} \beta 2j \Delta AGDP_{t-j} + \alpha E_{t-1} + u1t \quad (2)$$

$$\Delta CR_t = \delta 0 + \sum_{j=1}^{k} \delta 1j\ \Delta CR_{t-j} + \sum_{j=1}^{K} \delta 2j\ \Delta AGDP_{t-j} + \lambda C_{t-1} + u2t \quad (3)$$

Where AGDP is Agricultural Gross Domestic Product & CR is yearly agricultural credit disbursement.

## 5. PERCEPTIBLE EVIDENCES IN INDIAN AGRICULTURAL CREDIT

Development of agriculture credit has always been a knotty task and this is apparent from India's agriculture credit officialdom history. Intermittent failure of monsoons, unscientific farming practices and rural indebtedness, seasonal need for credit and other risks has ensured that high interest rates remain a norm rather than an exception with respect to credit. This problem was also noticed by our colonial masters and to eradicate such alarming wreckage, they called for a formal system of credit that seems to be a challenge. The establishment of Co-operative Society Act in 1904 and RBI rigorously promotion for co-operative credit during 1935-50 shows seriousness of the problem. Since then million of rupees are spending through various five-year plans but Indian farming community is still facing challenges in getting basic amenities in the rural India. About 13.34 crore households or 133.4 million families means 75% of rural population is not able to get sufficient income (less than 5000 Rs or 79$) to feed their families. India ranks 130$^{th}$ in the Human Development Index even worse than war-torn countries Iraq and Palestine.

### 5.1 Structural Shift in Credit Market

The structure of credit arrangement has improved from non-institutional agencies to institutional agencies over the years. The reduction of non-institutional agencies or informal sources of finance reduces the usury and exploitation of rural debtors. Table 2 depicts that credit flow has undergone a structural change from non-institutional to institutional but share of agriculture in national income has declined in these years.

### 5.2 Agricultural Credit Growth

Compound annual growth rate (CAGR) of agricultural credit is depicted in Fig. 1 from 1980 to 2010 with six sub periods. The perusal of Fig. 1 reveals that there has been not much clear trend in agricultural credit disbursement. But it can be seen that except 1986-90, in each sub-period CAGR in Agricultural Credit Disbursement is more than 10 per cent. After liberalization there was huge structural change in banking industry. In 1991 report of the Narasimham Committee brought many reform in Indian banking sector such as deregulation of interest rates, an easing of directed credit rules under the priority sector lending arrangements and reducing the entry barriers for both domestic and foreign players [64]. Impact of these reforms can be seen in the compound annual growth of credit disbursement to agricultural sector. Growth in sub-period of 1990$^{th}$ decade was 19.71 percent and 16.29 percent respectively.

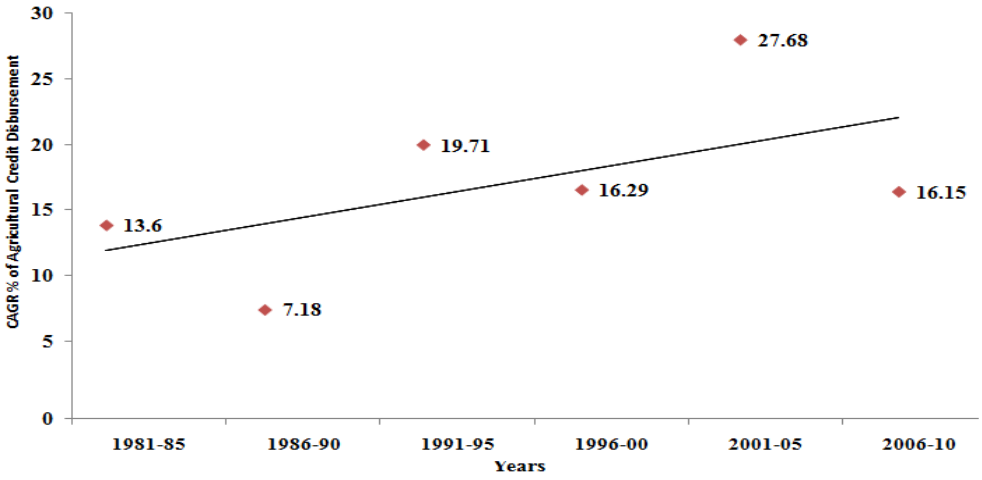


**Fig. 1. Five-yearly compound annual growth rates of agricultural credit**
*Source: RBI 2017*

A huge incremental jump of agricultural credit disbursement had taken place in 2001-2005. The CAGR in this sub-period was very high 27.68 percent while next subsequent sub-period growth was 16.15 percent. It indicates that from 2001 onwards huge rise in credit to agricultural sector. The reason behind this huge growth was in 2004 announced that it would have intention to increase the credit to agricultural sector by two times. The increase in the supply of credit to agriculture has been claimed to be one of the most significant achievements. The trend reveals that credit supply is fluctuating and growing over the period.

### 5.3 Institutional Credit Surge

There are many formal and informal agencies involved in providing agriculture credit in India i.e. commercial bank, cooperative bank regional rural bank, moneylender etc. Over the years percentage share in the credit disbursement by the commercial bank increases with significant rate and agricultural credit disburse by the cooperative bank has been declining. The overall institutional credit has gain momentum after globalization but incremental trend can be seen after 2000.

**Table 2. Credit flow to agriculture from different sources (In percent)**

| Sources of credit | 1951 | 1961 | 1971 | 1981 | 1991 | 2002 | 2012 |
|---|---|---|---|---|---|---|---|
| **Institutional Agencies** | **7.2** | **14.8** | **29.2** | **61.2** | **64.0** | **57.1** | **56.1** |
| Government | 3.3 | 5.3 | 6.7 | 4.0 | 5.7 | 2.3 | 1.6 |
| Co-op. society/ Bank | 3.1 | 9.1 | 20.1 | 28.6 | 18.6 | 27.3 | 29.4 |
| Commercial Banks + RRBs | 0.8 | 0.4 | 2.2 | 28.0 | 29.0 | 24.5 | 25.1 |
| Insurance | - | - | 0.1 | 0.3 | 0.5 | 0.3 | - |
| Provident fund | - | - | 0.1 | 0.3 | 0.9 | 0.3 | - |
| Other Institutional agencies | - | - | - | - | 9.3 | 2.4 | 0.35 |
| **Non-Institutional Agencies** | **92.8** | **85.2** | **70.8** | **38.8** | **36.0** | **42.9** | **43.9** |
| Landlord | 1.5 | 0.9 | 8.6 | 4.0 | 4.0 | 1.0 | 0.6 |
| Agricultural Money Lender | 24.9 | 45.9 | 23.1 | 8.6 | 6.3 | 10.0 | 8.1 |
| Professional Money Lender | 44.8 | 14.9 | 13.8 | 8.3 | 9.4 | 19.6 | 22.2 |
| Traders & Commission Agents | 5.5 | 7.7 | 8.7 | 3.4 | 7.1 | 2.6 | - |
| Relatives and Friends | 14.2 | 6.8 | 13.8 | 9.0 | 6.7 | 7.1 | 11.5 |
| Others | 1.9 | 8.9 | 2.8 | 4.9 | 2.5 | 2.6 | 1.5 |
| **Total** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

*Source: All India Debt & Investment Survey; RBI Bulletins of Several Years*

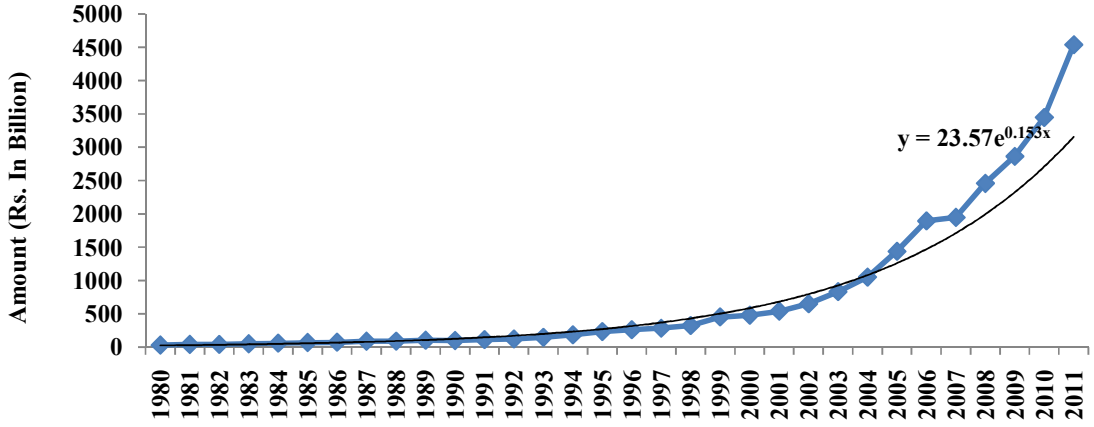


**Fig. 2. Year-wise all-India direct institutional credit for agriculture and allied**
*Source: RBI 2017*

From the Fig. 2, it is perusal that exponential growth in Direct Institutional Credit for Agriculture and Allied Activities from 1980 to 2011 had been 23.57%. From the graph it can be seen that in the decade of 1980's and 1990's there was no much yearly increment in the agricultural credit disbursement. But after 2000 there was sharp increment in the disbursement of institutional credit because government and 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 over a period of three years (Ministry of Agriculture 2007). A "comprehensive credit policy" was announced in June 2004. It included promises to raise agricultural credit by 30 per cent a year; to finance 100 farmers per bank branch (and thus five million, or fifty lakh, farmers in a year) [65].

### 5.4 Credit Disbursement: Target vs. Achievement

Each year Government makes planning for agriculture credit and set the target credit flow to agriculture sector but in the previous years the achievement has been more than the target. It shows that there is more need of credit in agriculture. From the Fig. 3, it can be easily understand that achievement of agricultural credit is more than the target. In 2004-05 the target of agricultural credit was Rs. 1050 (billion) while achievement was 1253.09 (billion). The target credit flow to agriculture and allied sector had been fixed at Rs.7000 billion during 2013-14 in union budget which is seven times more than 2004-05.In 2013-14 also achievement Rs. 7307.7 (billion) was more than the target Rs7000 (billion).

The infusion of credit in the agricultural system has not given retrospective benefit as far as conditions of cultivators are concern. Indian production yield is still lower in most of the crops when compare with China, Brazil and the U.S.A. India ranks second and third in the production of pulses and rice but its yield is lower among the competitive countries. There is substantial inter-state variations in production yield have noticed in India. Over the years, agricultural credit disbursement is more than the targeted but agricultural growth seems to be quite volatile, ranging from 5.8% in 2005-06, 0.4% in 2009-10 and -0.3% in 2014-15. Such volatility in agricultural production impacts the farm incomes as well as farmers' capacity to take loan for investing in their land holdings.

### 5.5 Credit Dispersal among Farmers

Total agricultural land has increased from 71 million hectare in 1971 to around 140 million hectare in 2012-13. The number of marginal land holdings (less than one hectare) increased from 36 million in 1971 to 93 million in 2011 and overall 86% of land holdings are less than 2 hectares. These small land holders are depending largely on credit arrangement to improve agricultural productivity; some of such needs are to protect the sizes of agricultural land holdings, to fight with the monsoon, to arrange adequate access of irrigation, to arrange quality seeds, to balance soil nutrients, to access modern technology etc.

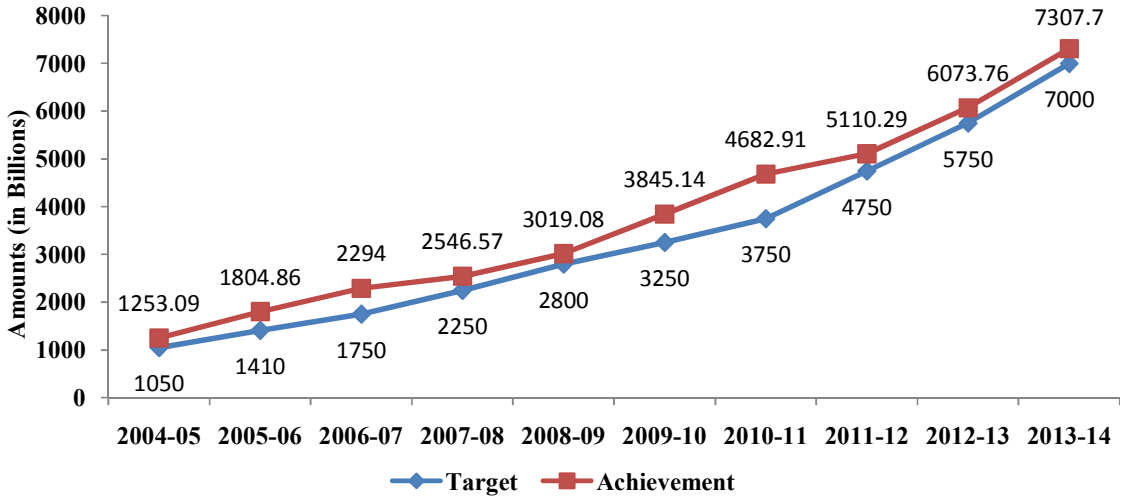


**Fig. 3. Year-wise target & achievement of agricultural credit trend in India**
*Source: RBI 2017*

**Table 3. Scheduled commercial banks' direct finance to different types of farmers**

| Type of farmers | Factors | 1980-81 | 1990-91 | 2000-01 | 2010-11 | Shifts over the years | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 1990 to 80 | 2000 to 1990 | 2010 to 00 |
| Marginal | No. of A/c* | 1586.8 | 1960.2 | 2382.4 | 9253 | 1.24 | 1.22 | 3.88 |
| | Amount** | 2.524 | 11.808 | 37.396 | 460.19 | 4.68 | 3.17 | 12.31 |
| Small | No. of A/c* | 692.6 | 1218.8 | 1860.3 | 9690 | 1.76 | 1.53 | 5.21 |
| | Amount** | 1.683 | 9.522 | 36.416 | 574.36 | 5.66 | 3.82 | 15.77 |
| Medium & Large | No. of A/c* | 790.2 | 898.8 | 1598.6 | 6044 | 1.14 | 1.78 | 3.78 |
| | Amount** | 5.938 | 17.818 | 71.349 | 854.55 | 3.00 | 4.00 | 11.98 |

** Number of accounts in thousands; ** Amount in billion rupees*
*Source: RBI, 2017*

Table 3 shows the farmers wise amount disbarment and number of farmers benefitted from 1980-81 to 2010-11. From 1980 to 1990 number of marginal farmers benefitted increased by 1.24 times while the amount disburse to them were increased by 4.68 times. In the year 2000-01 loan amount disburse to marginal farmers reached to Rs.37.396 billion. It was 3.17 times increase compare to 1990-91. There was huge increment in agricultural credit beneficiaries among the marginal farmers in 2010. It was increased by 3.88 time compare to 2000. As far as disburse loan amount was concern it was also increased by 12.31 times from 2000. In 1980-81 amounts Rs1.683 billion was disburse to small farmers, the amount was very low vis-à-vis number of beneficiary are also lowest. But in this decade beneficiaries are increased by 1.76 times and amount of credit was increased by 5.66 times. In this decade small farmers are benefitted maximum. In 2000 not very much change had occurred in the situation of small farmers, but 2000 onwards huge emphasis had given to small farmers in providing agricultural credit. Number of small farmers benefitted from agricultural credit facility was increased by 5.21 times and amount disburse to them sharply increased by 15.77 times in 2010 compare to 2000.there was not so much increment in medium and large farmers in the decade of 1980's and 1990's. But in 2010, beneficiaries of agricultural credit among medium and large farmers stood at 6044 thousand, 3.78 times of 2000 and the amount disburse to them was Rs. 854.55 billion which was 11. 98 times compare to 2000. From the above analysis it can be concluded that from 2000 onwards beneficiaries of agricultural credit are increased specially small and marginal farmers and the magnitude of loan amount is also increases sharply.

## 6. RESULTS AND ANALYSIS

ADF test results have been presented in Table 4, stationarity has checked with constant and no time trend 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 stationary at first difference. Now both series agricultural gross domestic product (AGDP) and agricultural credit (CR) are integrated on same order I (1) it confirms that Johansen test of co integration can be applied.

The appropriate lag selection can be obtained by using these 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. We have taken lag criteria with optimum lag suggested by FPE, AIC and HQ tests. The Trace statistic (22.915) and Max-Eigen statistics (21.788) value is more than the critical value, thus the null hypothesis (r = 0) is rejected (see Table 5). It implies that there is co-integration equation (CE) exists between the variables. So, there is a long term association between Agricultural gross Domestic Product and Agricultural Credit. Normalized equation indicates that there is positive relationship between both the variables.

From Table 6 it is found that error correction term is negative which indicate that there is convergence between the variables and existence of long run causality. It means that if there is any deviation in the long run relationship among variables then there is error correction mechanism and negative sign express that the system will go back to the long run equilibrium with 0.6% speed.

The model summary result (see Table 7) states that the coefficient of determination means R square of 52.69%. It implies that explanatory variables are explaining the dependent variable up to 52.69%. F-statistics reveals that the model is significantly robust. The value of Durbin-Watson statistics shows that there is no autocorrelation which is desirable. Overall model summary justify that the variables are separate to each other in the given lag.

### 6.1 Short Run Causality

Granger Causality test (see Table 8) has been conducted for short run. The result reveals that agricultural Credit (chi-sq =6.245, P=<0.5) is Granger cause of agricultural gross domestic product (AGDP). It is significant at 5 %. While Agricultural Gross Domestic Product (chi-sq= 1.386, P=0.4999) does not Granger cause of Agricultural Credit. Therefore it an be concluded

**Table 4. Augmented Dicky-Fuller test**

| ADF test | LAGDP | | LCR | |
|---|---|---|---|---|
| | Intercept | Trend and Intercept | Intercept | Trend and Intercept |
| At Level | 2.063 | -2.208 | 2.058 | -0.633 |
| At first difference | -8.288* | -9.072* | -5.021* | -6.122* |

** Stationary at 0.05 critical levels*

**Table 5. Johanson test of co-integration**

| Hypothesized no. of CE(s) | Trace statistic | 5 % critical value | Max-Eigen statistic | 5 % critical value |
|---|---|---|---|---|
| None (r=0)* | 22.915 | 15.494 | 21.788 | 14.264 |
| At most 1 | 1.1274 | 3.8414 | 1.1274 | 3.84146 |

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

*Note: Trace and Max-Eigen Statistic value indicate that there is one co –integration equation*

**Table 6. Long run causality and error correction term**

| | β | S.E | t-Statistic | *P-value* |
|---|---|---|---|---|
| ECT | -0.006 | 0.005 | -1.351 | 0.1898 |
| GDP(-1) | -0.697 | 0.187 | -3.729 | 0.0011 |
| GDP(-2) | -0.184 | 0.194 | -0.950 | 0.352 |
| CR(-1) | 80.050 | 48.786 | 1.641 | 0.1144 |
| CR(-2) | 112.029 | 46.218 | 2.424 | 0.0236 |
| Intercept | 7887.332 | 10274.920 | 0.768 | 0.4505 |

that a unidirectional causality running from Agricultural credit to Agricultural Gross Domestic Product is found.

**Table 7. Model summary**

| | |
|---|---|
| R-squared | 52.69% |
| Adjusted R-squared | 42.41% |
| Log likelihood | -319.1892 |
| F-statistic | 5.124552 |
| Prob(F-statistic) | 0.002655 |
| Durbin-Watson stat | 1.849111 |

## 6.2 Model Stability Test

Model stability test like serial correlation (see Table 9), test for heteroskedasticity (see Table 10) and test for residual normality (see Fig. 4) are also conducted and the results are desirable, means there is no serial correlation and heteroscedasticity in the model and residual is normally distributed. Results of stability tests are given below.

## 7. DISCUSSION

Previous researches acknowledge the role of agricultural credit in raising income of the rural poor and supporting the rest of the economy. Agriculture plays important role in financial and social inclusion to almost half of the India's population. The financially drained sector gets support in the form of institutional arrangements. The dearth of institutional credit arrangement may justify with its continuously increasing targeted-cum-achievement credit flows over the year. Five yearly CAGR reveals that credit growth during 1981-2010 mostly within the range

**Table 8. VEC granger causality/block exogeneity wald tests**

| Null hypothesis | Wald test/$\chi^2$ | P-value | Conclusion |
|---|---|---|---|
| D(LCR) does not Granger cause of D(LAGDP) | 6.245* | 0.044 | Causality |
| D(LAGDP) does not Granger cause of D(LCR) | 1.386 | 0.499 | No Causality |

** indicate significant at 5 %*

**Table 9. Table Breusch-Godfrey serial correlation LM test**

| Null : There is no serial correlation | Values | | Value |
|---|---|---|---|
| F-statistic | 0.1412 | Prob. F*(2,21) | 0.869 |
| Obs*R-squared | 0.3850 | Prob. Chi-Square*(2) | 0.824 |

** indicate that P-value is more than 5%*

**Table 10. Breusch-Pagan-Godfrey test for Heteroskedasticity**

| Null: Model is homoskedastic | Values | | Value |
|---|---|---|---|
| F-statistic | 0.7177 | Prob. F*(6,22) | 0.639 |
| Obs* R-squared | 4.7473 | Prob. Chi-Square*(6) | 0.576 |
| Scaled explained SS | 2.2416 | Prob. Chi-Square*(6) | 0.896 |

** indicate that P-value is more than 5%*

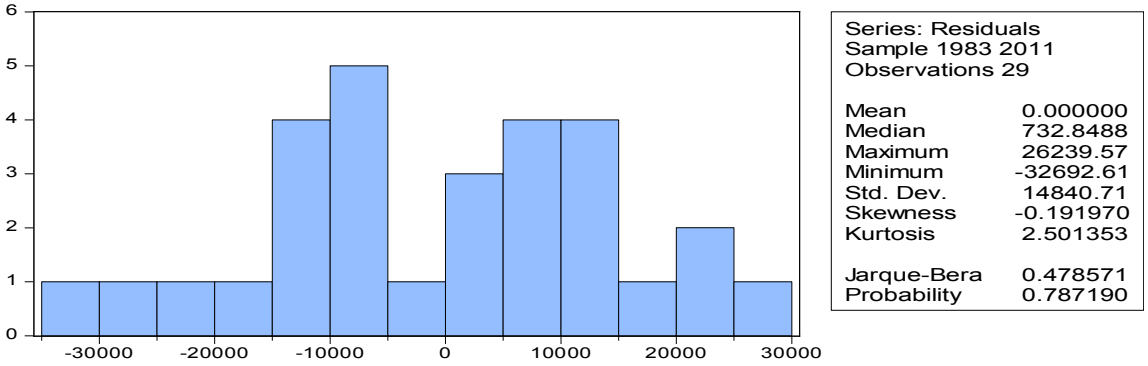


**Fig. 4. Jarque-Bera test for normality**

of 13% to 16% whereas there are more than 27% CAGR is reported during 2001-05. The Institutional credit trend reveals an upside surge from 2000 onwards. The support and protection introduced by new agricultural policy in 2000 may be the reason behind such surge. Farmers are getting input support and price protection. Certainly, their loan repayment capacity seems reliable and possible. So, Institutional credit growth registered a new peak. The credit dispersal analysis reveals that during 2000-2010 institutional lending speed surpasses its own historical records. The number of accounts and disbursed amounts goes many folds among marginal, small, medium and large types of farmers. The average annual credit growth has consistently moving upward with 10.68% (1982-1991), 17.13% (1992-2001) and 24% (2002-2012). So, the quantum of credit infusion is growing with big volume by institutional setups. Institutional credit looks promising with these findings however the supply side of credit gives more interesting version with non-institutional side.

Increasing insertions of credit amount by institutional setup has failed to narrow the growth prospect of non-institutional players. Since 1991 the institutional proportion of credit has declined whereas the non-institutional credit participation has grown. Currently about 45% of the credit facilitation is in the hand of non-institutional setup is a matter of great concern. The non-institutional side has registered a growth of about 7 basis point percentage from 1991 to 2002. It may indicate that Globalization in 1991 & new agriculture policy in 2000 created an impressive agricultural outlook for them. Agricultural productivity and profitability encourages provision for agricultural credit [23,24]. Land price appreciation and crop support prices are two major factors behind loan sharks attraction towards rural hinterland. The non-institutional agencies have very high interest rate with hypothecation of crops, assets/land as collateral. The objective of such lending is just to make high earnings. This causes huge burden on rural debtors. Various studies have identified the non-institutional sources as a major reason behind farmers' suicide [66,67,68,69,70]. So, the importance of institutional credit has been felt due to inherent defects in the non-institutional agencies [71].

The empirical analysis finds co-integration between agricultural growth and institutional credit. Hence, it is beneficiary to insert credit through formal sources. The positive relationship between variables suggests that agriculture credit is imperative for long term economic growth. The nature of relationships could be investigated via the analysis of estimated parameters from ECM model regression. The result shows negative but insignificant error correction term coefficient. The negative sign of error correction term entails that in the absence of momentum in the agricultural credit insertions, the model's deviation from the long run relation would be corrected by increasing the agricultural growth through other sources. These other sources could be direct or indirect government support. The non-market support can further cause distress because it doesn't give long term sustainable solution. The insignificant error correction term confirms the existence of disequilibrium relationship between agricultural growth and agricultural credit. Non-institutional credit and non-market supports appear to be the two major reason of not getting equilibrium relationship. It purports the existing indications on agricultural credit experiences the isolation from agricultural growth in the long run. Further, the analysis reveals the short run causality running from agriculture credit to agricultural growth while opposite is not found in VEC Granger Causality/Block Exogeneity Wald Tests. It means that the growth of agricultural credit can significantly affect the agricultural growth in the short run. It may further clarify the usage of agricultural credit is purely for the agricultural purpose. It nullifies the myth of credit utilization for non-agricultural purposes by the cultivators.

## 8. CONCLUSION

In this study, we have empirically investigated the nature of the causal relationship between the India's agricultural GDP and agricultural credit using the Granger causality test through the Vector Error-Correction Model over the period 1980 to 2011. Our results of the co-integration and the Johansen-Juselius maximum likelihood tests show that there is a long-run positive association between the India's agricultural GDP and agricultural credit. We find that in the short-run, the agricultural credit Granger-causes agricultural growth in India. At the same time, the increased Agricultural GDP does not drive agricultural credit. In other words, there is an evidence of a unidirectional Granger causality running from agriculture credit to agricultural growth. This insight lends a general support to the credit-led growth hypothesis. We can conclude that agricultural credit have potential to

play a role similar to that of other drivers of agricultural growth, particularly for developing countries, lends support to [23] who argue that increasing agricultural credit leads to increasing economic growth, and that the credit-led growth from agriculture may represent the optimal allocation of resources to get maximum productivity or production.

The policy implication needs to emphasize on 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 needs 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 district level may decrease the credit stress among farmers. Shifting agricultural support from non-market to market based approach is 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 based on quantitative or/and qualitative models. In the absence of optimal decision assessment model for customer credit risk evaluation and credit decision by commercial banks, the institutional lenders are reluctant to involve in agricultural credit [72]. 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 agricultural sector, because agricultural credit can leads to agricultural growth and it has been proven by many economist that agriculture has the power to grow all sector of the economy inclusively.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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