Assessing the Impact of Priority Sector Lending on Agricultural Growth in India: Insights from ARDL Analysis

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Abstract: *As agriculture is the Primary source of economic activity and source pertaining to acquire Sustainable Development Goals of zero poverty and zero hunger. The Reserve Bank of India, as the pillar of economic growth and development included agriculture as one among the eight-priority sector lending. This study is pertinent to how the Reserve Bank of India's Priority Sector Lending (PSL) rules will improve India's agricultural sector's financial inclusion. Additionally, the outcome of agricultural activities serves as the endogenous variable and Priority Sector Lending as the exogenous variable. Henceforth, this study intends to examine the effectiveness of these measures with reference to Sustainable Development Goals (zero poverty and zero hunger), by using secondary data. Subsequently, the research explores the actions taken by the government and the Reserve Bank of India (RBI) to enhance agriculture. Furthermore, this study aims to evaluate the effectiveness of these measures as of right now. The ARDL results show that there is a significant positive impact of Priority Sector Lending with a year lag on total agricultural production in India. Consequently, the study suggests that adequate financial support to agriculturalists under Priority Sector Lending will stimulate agriculture production and productivity for the overall development of the economy with zero poverty and hunger.*

Keywords: *Agricultural production, Priority Sector Lending, Reserve Bank of India, Sustainable Development Goals, Auto-regressive Distributed Lag model*

Introduction

Priority Sector Lending is a critical policy framework designed by the Reserve Bank of India (RBI) to ensure equitable loan availability to specified sectors deemed vital for inclusive growth and development (Reserve Bank of India, n.d.). The RBI requires banks to allocate a portion of their lending portfolio to identified priority sectors such as agriculture, small-scale industries, education, housing, and others, thereby facilitating overall economic stability, inclusive growth, and fostering a balanced and sustainable economy (Angadi, 1983). Consequently, the

agricultural sector is considered a primary sector in the economy (Misra, Chavan, & Verma, 2016). Moreover, the service sector contributes the lion's share of India's Gross Domestic Product (GDP) (Sharma, 2012). However, the agricultural sector plays a significant role as the largest employment provider and ultimately makes the economy self-reliant, fostering inclusive development by achieving the Sustainable Development Goals of zero poverty and zero hunger (Ahmed, 2010; FAO, 2021).

The expansion of the nation's essential needs relies on several sectors, and the government and the RBI hold that agriculture is one of the sectors that deserves prominence over others (Sahu & Rajasekhar, 2005). With this predominant role in the Indian economy, the agricultural sector is treated as one of the priority sectors (World Bank, 2020). As the RBI allocates lending to banks, they have the responsibility to promote the growth of this sector by providing adequate and timely financial assistance at an affordable cost (Rao, n.d.). In earlier days, agriculturalists mainly depended on informal sources of finance, including local money lenders, which in turn increased the debt burden on agriculturalists (Patel, 1996). To address this excessive dependence on informal financial institutions, the Government of India included agriculture and allied activities among the eight Priority Sector Lending (PSL) categories (Kaur & Sidhu, n.d.). The PSL to agriculture and allied activities is channelled through formal financial institutions, including Scheduled Commercial Banks (SCBs) and Regional Rural Banks (RRBs), at reasonable and affordable rates to help Indian agriculturalists meet their financial needs (Sharma, 2012; Desai, 2021).

This study attempts to investigate the RBI's Priority Sector Lending (PSL) policies with respect to India's agricultural sector, which is an important undertaking. Considering the scenario, between 1950 and 2020, the GDP's contribution from agriculture decreased significantly. As the foundation of the country's economy, agriculture is inextricably linked to factors that are essential to its expansion and survival. This research conducts a thorough analysis through secondary data provided by India's official documents. Agriculture production is defined here as the endogenous variable, where government-sponsored Priority Sector Lending is the core exogenous variable. In addition to that, Agricultural output is also impacted by other factors like fertiliser consumption and rainfall patterns. This research aims to unearth important insights through the analysis of complex relationships that exist between these variables. Since it makes significant contributions to the enhancement of rural livelihoods, national food security, and agricultural sustainability.

The RBI thereby ensures the smooth functioning of Priority Sector Lending by implementing various committee recommendations through SCBs and other formal financial institutions (Uppal, 2009; Narayan, 2022). Over the last several decades, the Indian economy has experienced several structural changes, including the economic reforms of 1991, the economic recession of 2008, the COVID-19 pandemic, climate change, and more (Desai, 2021; Mukherjee & Bhattacharya, 2020). In this context, it is important to stabilize the agricultural sector by injecting adequate financial support through Priority Sector Lending. Against this background, the present study aims to analyze the post-reform trends of Priority Sector Lending to agriculture and allied activities in India, as well as examine the impact of PSL on agricultural production (Granger & Engle, 1987).

Review of Literature

As a primary sector in the economy, agriculture enhances the other two sectors namely industrial and service sectors through its high forward and backward linkages. Agricultural development with adequate financial support will accelerate the development of other sectors also and which will stimulate rural development and economic growth. Since the pre-reform period, the percentage of bank credit allocated to agriculture has decreased dramatically across all bank groups, particularly in the wake of banking sector

reforms. Even Scheduled Commercial banks only lend money to wealthy farmers and businesses that generate high interest rates (Sahu et al., 2005 and Patel, 1996). After the economic reforms, the Commercial Bank credit has increased over the years (Rao, n.d., Angadi, 1983, Uppal, 2009 and Sharma, 2012). Since the economic reforms in 1991, Commercial Banks become the most powerful source of finance, especially agricultural credit specifically after the implementation of Priority Sector Lending. From the 2000s onwards there has been a positive impact of agricultural credit on Total Factor Productivity in agriculture especially under direct credit.

Some of earlier studies also analysed the strong relation of other factors like fertiliser consumption, gross cropped area, and rainfall on agricultural productivity (Misra et al., 2016). Along with that Jha et al., (2023) revealed that Carbon dioxide emission, Precipitation and Irrigation are also affecting agricultural productivity. The factors like reliability, responsiveness and tangibility under the processing of Priority Sector Lending to agriculturalists have a significant impact on customer satisfaction (Doss et al., 2023). Even though Desai (2021) and Ahmed (2010), found that bank profitability is adversely affected by agricultural credit. On the other hand, credit to the service sector has a positive impact on Bank profitability. However, Priority Sector Lending has a positive impact on the overall development of the economy (Kaur & Sidhu, n.d.). Based on these existing literatures the present study is going to analyse the overall agricultural growth through the Priority Sector Lending in India since economic reforms 1991.

Even though agriculture is one of the main pillars of the Indian economy, it still faces significant obstacles to growth and sustainability. Farmers encounter a multitude of challenges, including limited financial availability, market volatility, declining yields, weather distortions, and agricultural distress (Ministry of Agriculture and Farmers Welfare, 2022). Therefore, making Priority Sector Lending in agriculture a main objective is crucial to improving rural livelihoods and contributing to national food security (Kaur & Sidhu, n.d.). The Reserve Bank of India (RBI) has launched programmes through its Priority Sector Lending (PSL) policies to support agricultural development and to address these obstacles by increasing credit availability and boosting agricultural output by identifying agriculture as a priority sector for lending (Misra, Chavan, & Verma, 2016).

The intersection of RBI's programmes with the "No Poverty and Zero Hunger" Sustainable Development Goals (SDGs) emphasises the critical role that agriculture plays in achieving worldwide food security. This highlights the significance of assessing the effectiveness of RBI's PSL policies in relation to agricultural development (Sharma, 2012; Desai, 2021). This study aims to critically evaluate how these policies affect the expansion of agriculture, the improvement of livelihoods, and the achievement of SDGs of no poverty and zero hunger (Sahu & Rajasekhar, 2005).In order to guide policy improvements, foster sustainable agricultural practices, and strengthen the agrarian backbone of India's economy, it is imperative that RBI's initiatives be evaluated while addressing the multitude of challenges that farmers face worldwide for food security (Pesaran, Shin, & Smith, 2001). Moreover, most existing empirical literature comprises state-level studies that do not focus on the Indian context. Against this backdrop, this study examines the impact of Priority Sector Lending on the development of agricultural production in India.

Objectives of the study

This study is primarily focused on the effectiveness of the Reserve Bank of India's Priority Sector Lending on Agricultural growth in the post-reform period. The specific objectives are:

- To analyse the post-reform trend of Priority Sector Lending to the agricultural sector in India

- To study the impact of Priority Sector Lending on agricultural growth in India

Hypothesis of the Research Work

H_0: There is no impact of Priority Sector Lending on total agricultural production in India

Research Method

In order to determine the effectiveness of Priority Sector Lending to agricultural and allied activities in India, this study was conducted based on secondary sources of data collected from various issues of the Handbook of Statistics of Indian Economy, RBI (PSL to Agriculture and allied activities), Agricultural statistics at a glance, Ministry of Agriculture and Farmers welfare (Agricultural production), Fertiliser statistics of the Fertiliser Association of India (Fertiliser consumption) and Ministry of Earth and Science, India Meteorological Department (Rainfall). Additionally, this study is focusing on post-reform analysis covering the period from 1990-91 to 2021-22. The Auto-regressive Distributed Lag (ARDL) Model is used to predict the impact of the exogenous variables (Priority Sector Lending, rainfall, fertiliser consumption) on the endogenous variable (Agricultural production) by employing the EViews 12 statistical software.

1.The Unit root test

To ascertain whether time series data has a unit root, indicating non-stationarity, a statistical approach called the unit root test is employed. Granger and Engle created this methodology to deal with spurious regression, which is a problem in which non-stationarity causes unconnected time series data to appear to be correlated. The Augmented Dickey-Fuller (ADF) test is the most widely used unit root test. It determines if the coefficient of the lagged dependent variable in a regression model deviates significantly from zero. A time series data set is considered stationary if the unit root null hypothesis is rejected, which makes statistical inference and forecasting more trustworthy.

$$\Delta Y_t = \propto + \beta Y_{t-1} + \beta_1 \Delta Y_{t-2} + \beta_2 \Delta Y_{t-2} \ldots + \beta_p \Delta Y_{t-p} + u_t \quad \ldots\ldots (1)$$

The smoothened data after the natural logarithmic transformation has been checked for unit root or stationarity separately by using both the Augmented Dicky Fuller test and Philips Parron test to make the series with constant mean, variance, co-variance and auto-covariance to avoid spurious regression results due to non-stationary data and ultimately to find the order of integration for the selection of further analysis. The corresponding Augmented Dicky Fuller equation is stated in the equation (1). The null hypothesis for both the Augmented Dicky Fuller test and Philips Parron test is assumed that the data has a unit root or the series are non-stationary.

2.The Autoregressive Distributed Lag (ARDL) model

David Hendry introduced the Autoregressive Distributed Lag model which is used for the multivariate time series analysis. It is based on the general to specific methodology. ARDL is a short-run model because it has lagged values. However, we can derive the long-run information from the short-run equation by using the Bound test. The Autoregressive Distributed Lag (ARDL) model is used to examine the long-term relationship between variables. It enables the study of how factors interact dynamically across time, especially when there are both short- and long-term impacts present. Because the ARDL model allows for different orders of integration among the variables, it is particularly helpful when handling non-stationary time series data. The lagged values of the endogenous variable and the lagged values of the explanatory factors are included in the regression equation that specifies the ARDL model.

$$lAgri_t = \propto + \beta_0\, lAgri_{t-1} + \beta_1\, lPSL_t + \beta_2\, lPSL_{t-1} + \beta_3\, lPSL_{t-2} + \beta_4\, lFer_t + \beta_5\, lPSL_{t-1} + \beta_6\, lPSL_{t-2} + \beta_7\, lRain_t + \beta_8\, lRain_{t-1} + \beta_9\, lRain_{t-2} + u_i \quad \ldots\ldots (2)$$

The ARDL equation with one lag for endogenous variable and two lags for exogenous variables (ARDL (1, 2)) is stated in equation (2). Where ""

is the intercept term and the β_0 to β_9 denotes the coefficients of all the exogenous variables and their lagged values including the lagged values of the endogenous variable. The null hypothesis for the ARDL model stated that there is no long-run relationship or cointegration among the variables.

Analysis and Results

The deployment of Priority Sector Lending out of Scheduled Commercial Bank's total credit to agriculture and allied activities shows an upward trend along with the rise in agricultural production in India from 1990-91 to 2022-23 (Figures 1 and 2). A yearly average of 411169.31 crore rupees is deployed for agricultural credit under Priority Sector Lending (Table 1).

Figure 1: Deployment of Priority Sector Lending to Agriculture and allied activities in India (in crores)

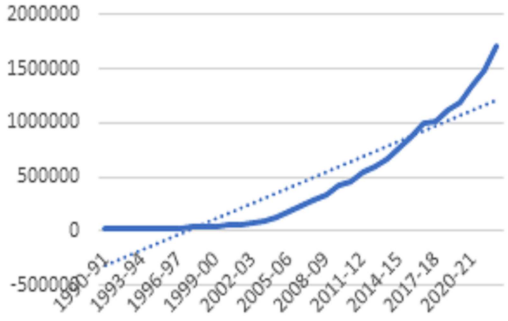
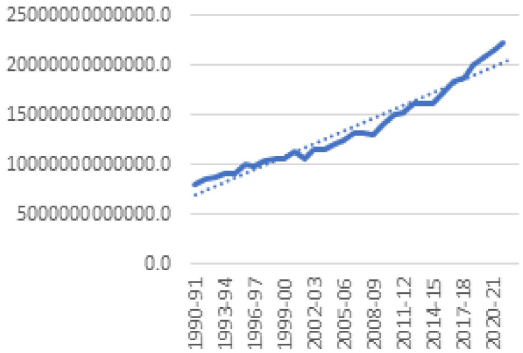


Figure 2: Total agricultural production in India (in tonnes)



Source: Handbook of statistics on Indian Economy, various issues and Agricultural statistics at a glance, Ministry of Agriculture and Farmers Welfare, 2022.

Table 1: Descriptive Statistics

Variables	Min.	Max.	Mean	SD
PSL	16750.00	1484923.00	411169.31	454741.28
Rainfall	972.80	1357.40	1156.92	103.63
Fertiliser	12154.50	32535.60	21051.45	6170.81
Agri. Production	7955746340700.00	22210922572396.60	13597823726818.20	4091959717469.06

Table 2: Pearson Correlation results

Variable	Agri. Production	PSL	Rainfall	Fertiliser
Agri. Production	1.00	.979*** (0.00)	-0.11 (0.55)	.931*** (0.00)

*** shows it is significant at 1% level

Values in parenthesis are level of significance

The Pearson correlation test revealed that there is a strong positive relationship (0.98) between Priority Sector Lending to the growth of agricultural production which is statistically significant at 1 per cent level of significance (Table 2). Whereas Multivariate time series analysis the Auto-regressive Distributed Lag model is used to check the relationship among the dependent and independent variables by including two more important factors which are having a valid influence on agricultural production namely rainfall and fertiliser consumption in India.

Table 3: The Unit root test results

Variables	Order	ADF	PP
lnAgri. Production	I(1)	-9.5153***	-9.9105***
lnPSL	I(1)	-7.1530***	-7.1372***
lnFertiliser	I(1)	-4.3868***	-4.2748***
lnRainfall	I(0)	-5.2498***	-5.2499***

*** indicates that the result is significant at 1% level of significance

Data smoothened by using natural log transformation to avoid seasonal fluctuations. Whereas, both the Augmented Dicky Fuller and Philips Perron test for checking unit root indicates that (Table 3) all the variables namely agricultural production, Priority Sector Lending, and fertiliser consumption are stationary at first difference I(1) except rainfall which is stationary at the level I(0) itself. Though there is a combination of I (0) and I (1) variables the prominently used multivariate time series analysis namely the Auto Regressive Distributed Lag model is employed to find out the relationship among the variables.

Table 4: Auto Regressive Distributed Lag Model results

Variables	Coefficient	Std. Error	t-Statistic	Prob.*
$lAgri_{t-1}$***	0.856807	0.115208	7.437033	0.0000
$lPSL_t$	-0.153326	0.085725	-1.788586	0.0888
$lPSL_{t-1}$**	0.211261	0.091997	2.296380	0.0326
$lFer_t$	-0.200090	0.114061	-1.754231	0.0947
$lFer_{t-1}$**	0.573783	0.157723	3.637909	0.0016
$lFer_{t-2}$*	-0.557741	0.122534	-4.551709	0.0002
$lRain_t$	-0.067803	0.079106	-0.857114	0.4015
$lRain_{t-1}$	-0.075037	0.074870	-1.002230	0.3282
$lRain_{t-2}$	-0.104526	0.067514	-1.548202	0.1373
C	7.236712	2.931323	2.468752	0.0227

R^2: 0.9932
Adjusted R^2: 0.99
F-statistic: 323.1723 (p=0.000)

The ARDL test results (Table 4) and equation (3) indicate that past year agricultural production has a positive impact (0.85) on current year agricultural production and past year Priority Sector Lending to agricultural and allied activities has a positive impact (0.21) on current agricultural production in India in the post-reform period which is statistically significant (p=0.05). Along with that, the past year fertiliser consumption (t-1) had positive influence (0.57) on the agriculture production in t^{th} period on the other hand fertiliser consumption at the time period t-2 have a negative influence (-0.56) on the t^{th} period agricultural production in India which is statistically significant (p=0.05). The results also shows that there is no statistically significant influence of rainfall on agricultural production due the undesirable climate change in India over the period.

Short run equation:

$$lAgri_t = 7.24 + 0.86\ lAgri_{t-1} - 0.15\ lPSL_t + 0.21\ lPSL_{t-1} - 0.20\ lFer_t + 0.57\ lFer_{t-1} - 0.56\ lFer_{t-2} - 0.07\ lRain_t - 0.08\ lRain_{t-1} - 0.10\ lRain_{t-2} \quad \text{.... (3)}$$

Table 5: The Bound test results

F statistic	I(0)	I(1)
4.7241	2.79	3.67**

** Indicates that the result is significant at 5% level of significance

The F Bound test results rejected the null hypothesis of no levels relationship at 5 per cent level of significance. The table 5 shows that the F statistic is greater than the critical value of upper bound I(0) which confirms that there is a presence of long-term relationship among the variables or in other words there exist cointegration among the variables. As a next step to assess the long run model, the Error Correction Model employed and the results (Table 6) indicates that there exists long-run effect of Priority Sector Lending (0.40) on agricultural production in India which is statistically significant at 10 per cent level of significance.

Table 6: Error Correction Model

Variables	Coefficient	Std. Error	t-Statistic	Prob.
PSL*	0.4046	0.2043	1.9805	0.0616
Fertiliser	-1.2853	1.1475	-1.1201	0.2760
Rainfall	-1.7275	2.1265	-0.8124	0.4261
C	50.5381	22.8583	2.2109	0.0389

* Indicates that the result is significant at 10% level of significance

EC = lAgri - (0.4046*lPSL -1.2853*lFer - 1.7275*lRain + 50.5381)

The Error correction form in table 7 shows that the coefficient of the cointegration equation shows a negative sign (-0.1432) which is statistically significant (p=0.000). Which affirms the existence of long-run causality among the variables.

Table 7: ARDL Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPSL)	-0.1533	0.0649	-2.3616	0.0285
D(LFER)	-0.2000	0.0910	-2.1975	0.0399
D(LFER(-1))	0.5577	0.0992	5.6212	0.0000
D(LRAIN)	-0.0678	0.0536	-1.2655	0.2202
D(LRAIN(-1))	0.1045	0.0506	2.0659	0.0520
CointEq(-1)*	-0.1431	0.0269	-5.3239	0.0000

Table 8: The Granger Causality test

Null Hypothesis	F-Statistic	P Value
PSL does not Granger Cause Agricultural Production	0.8414	0.4429
Agricultural Production does not Granger Cause PSL	0.5846	0.5648
Fertiliser does not Granger Cause Agricultural Production**	3.3142	0.0501
Agricultural Production does not Granger Cause Fertiliser	1.0266	0.3728
Rainfall does not Granger Cause Agricultural Production	0.5931	0.5602
Agricultural Production does not Granger Cause Rainfall**	6.2405	0.0063
Fertiliser does not Granger Cause PSL	0.4535	0.6405
PSL does not Granger Cause Fertiliser**	4.1071	0.0287
Rainfall does not Granger Cause PSL	2.7122	0.0859
PSL does not Granger Cause Rainfall	0.4266	0.6574
Rainfall does not Granger Cause Fertiliser	1.6582	0.2108
Fertiliser does not Granger Cause Rainfall	0.4889	0.6190

The Granger causality test (Table 8) employed to find out the direction of relationship among the variable and the result shows indirect feedback from Priority sector lending to agricultural production in India in the post-reform period. Firstly, Priority Sector Lending granger causes fertiliser consumption and secondly, fertiliser consumption granger cause agricultural production which is statistically significant at 5 per cent level of significance. Moreover, the Wald test for short run causality (table 9) indicates an existence of short run causality among the variables with the F value and chi square values are statistically significant at 0.01 level of significance.

Table 9: The Wald test results

Test Statistic	Value	df	Probability
F	82.45102	(3, 20)	0.0000
Chi-square	247.3531	3	0.0000

The robustness of the estimates is assessed by checking the classical linear assumptions of Normality of residuals, confirming no autocorrelation and Heteroscedasticity. The table 10 interprets these diagnostic test results which underlined the robustness of the estimates with the normality of residuals, no serial autocorrelation and homoscedasticity. Along with that, the stability test (Figure 3) shows that the CUSUM of squares (blue line) falls within the 5 per cent level of significance (dotted red lines) showing our estimates are stable. Figure 4 shows the cointegration graph which shows the equilibrium relationship among the variables in the long run.

Table 10: Diagnostic tests results

Assumptions	Null hypothesis	Test	P value
Normality of Residuals	Residuals are normally distributed	Jar que-Bera	0.5143
No Autocorrelation	No serial correlation	Breusch-Godfrey LM test	0.2114
No Heteroscedasticity	Homoskedasticity	Breusch-Pagan-Godfrey	0.6368

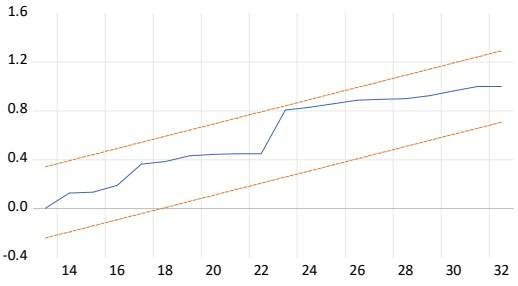


Figure 3: Stability Diagnostics

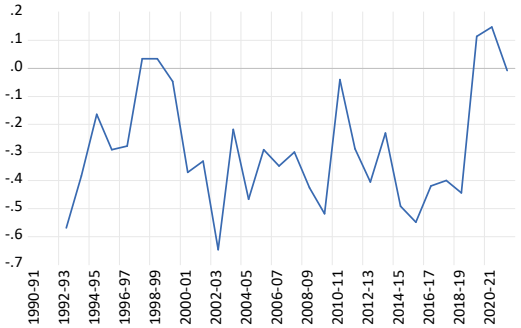


Figure 4: Cointegration graph

Source: *Compiled from the ARDL analysis by using EViews 12 statistical package.*

Conclusion and Implication

As a driving force in Indian rural areas, agricultural development has a widespread effect on attaining the Sustainable Development Goal of reducing poverty, and hunger and generating employment. Featuring that, this study concludes that financial support from the side of government creates a positive impact on the sustainable growth of the agricultural sector in India. Moreover, the Reserve Bank of India's Priority Sector Lending to Agriculture and allied activities has increased the total agricultural production in India since Economic reforms in 1991. Henceforth, this

significant relationship between agriculture production and Priority Sector Lending boosts the economy to attain sustainable growth with inclusive development. Subsequently, the government should make efforts to inject adequate financial support into the agriculture sector through Priority Sector Lending which facilitates the agriculture sector as an important vehicle for inclusive development of India.

Scope for Future Research

1.The present study can be extended by incorporating a longer time period and additional macroeconomic variables to improve the robustness and generalizability of the findings across different agricultural cycles.

2.Future research may explore disaggregated credit components under Priority Sector Lending, such as crop loans, allied activities, and agricultural infrastructure, to examine their differential impact on agricultural growth.

3.A comparative analysis using alternative econometric techniques or cross-country data may be undertaken to evaluate whether the effectiveness of priority sector lending policies varies across regions and policy frameworks, offering deeper insights for agricultural credit reforms.

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