An Analysis of Commercial Banks' Lending and Agricultural Growth in Nepal

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Abstract

Agriculture sector sharing almost one-fourth of GDP and two-thirds of employment remains as one of the crucial economic activities in Nepal. However, it faces persistent challenges in Nepalese economy, including limited access to finance. Commercial banks possess a vital role in addressing these challenges by providing credit to farmers, agribusinesses, and rural enterprises. Despite various policy measures and financial incentives, the effectiveness of commercial banks' lending in promoting agricultural growth remains sufficiently unexplored. This paper intends to fulfil this gap. The prime objective of this paper is to analyze the effects of commercial banks' lending on agricultural growth in Nepal. The study uses ARDL Bounds Testing approach to measure the impact of commercial banks' lending on agricultural growth in Nepal by using Time Series data for the period 1994-2023. Necessary data were gathered from three major secondary sources: Nepal Rastra Bank (NRB), Ministry of Finance (MOF), and National Statistics Office (NSO). This study found statistically significant positive relationship between Commercial Banks' lending and agricultural growth in Nepal. The impact of other control variables used in the study, irrigation and fertilizer, are also positive and significant in this regard. Furthermore, the provision of adequate and easy access to borrowing, irrigation facility, and timely availability of fertilizers could also boost the agriculture growth in Nepal.

Keywords: Agricultural growth, commercial banks' lending, time series, ARDL bounds testing

JEL Classification: Q10, E51, C22, C32

Introduction

The accelerating climate change and its adverse effects, population growth and changing nutritional preferences of the people, uncontrolled and unmanaged migration, natural disasters and pandemic, conflicts such as Russia - Ukraine war have threatened the food security and development of agricultural sector in the World (World Bank, 2022). Most of the countries, including Nepal, are facing tremendous pressure to establish and develop the sustainable food – security. World Bank estimates that global food demand will increase by 70 percent by the end of 2050 and at least US $80 billion annual investment should be made to meet this estimate (World Bank, 2022). To meet these challenges, to end hunger (Sustainable Development Goal-

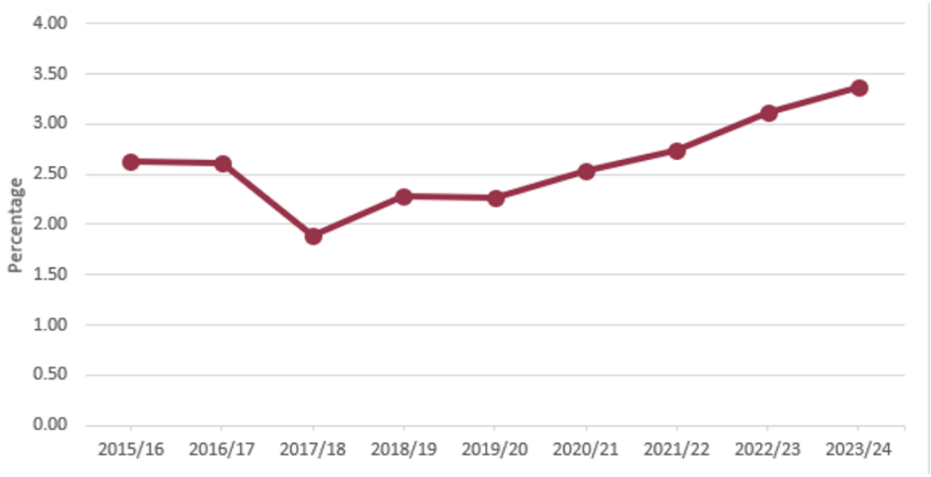
2 of United Nations to be achieved by 2030) and to achieve food security; policies need to be designed to support the farmers in order to get sufficient, cheaper and timely availability of agricultural credit.

The role of agriculture in any economy is significant and requires no additional justification. Agriculture provides not only food for mass population, but also source of industrial raw materials as well as creates employments (Udoka et al., 2016). Referring to Nepalese insight, agricultural sector contributing around one-fourth to the national GDP, remains low productive due to easy access to credit, limited irrigation and fertilizers, primitive technology, and vulnerability to climate change. About 50 percent of the Nepalese work force depend upon agriculture for their livelihood and it contributes around 24.1% of the GDP of Nepal (Economic Survey, 2023). In such situation, the agricultural loan enables the farmers to purchase fertilizers and seeds, machines and tools, better technique of production. The ultimate effect of agricultural credit is growth of overall production.

Agricultural development should be a key concern especially in the developing countries (Kumar, et al., 2010). It is known as a fundamental industry due to being the basis for the existence for the human race in the world. It plays a crucial role in creating employment opportunities, mainstay of life and supplementing the marginal and landless farmers. Basic objectives of economic development of developing countries such as output growth, price stability and poverty alleviation can be achieved with the sustained growth of agriculture (Abdulaziz, Kundu, & Malik, 2020). Besides the production of food items for the livelihood of people, agriculture supports to the environmental aspects as well. Moreover, food security, sustainable and environmental-friendly agricultural production are considered as the pre-condition for the transition of the economy to the developed stage (Patwary et al., 2023). It is a fact that people in this world are surviving due to food produced and supplied by the agricultural sector. Thus, agriculture credit is indispensable for agricultural development.

Figure 1

Budget Distribution in Agriculture (In %)



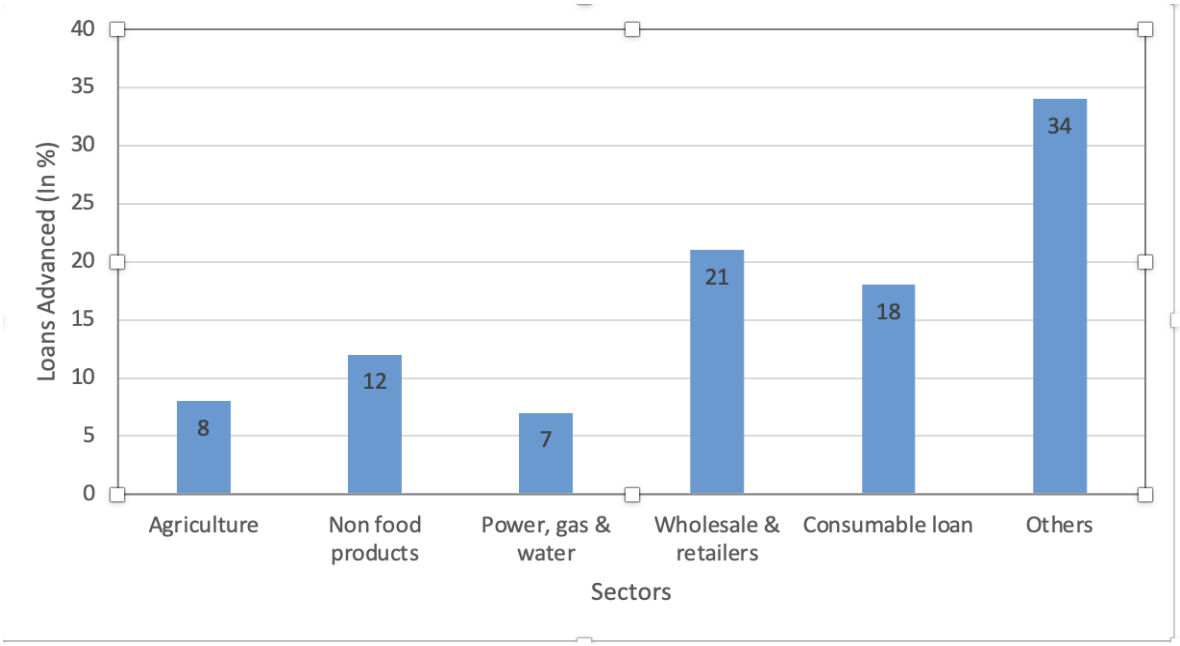
Note. MOF, 2024.

In F.Y. 2022/23, total outstanding credit by banks and financial institutions on agriculture was Rs 14472.2 million, which was only 3.7 percent of total loan. However, it drastically shrinks down at Rs 4495.6 million in F.Y. 2023/24 which was 1.1 percent of total outstanding

loan (NRB, 2024). The Figure 1 and Figure 2 summarize the situation of budget disbursement in agriculture and agricultural loan provided by commercial banks in Nepal.

Figure 2

Sector-wise Loan Advanced by Commercial Banks



Note. NRB, 2024

In F.Y. 2020/21, Nepal Rastra Bank (NRB) directed commercial banks to provide at least 11 percent of their total loan to the agriculture. However, the outstanding loan to agriculture was only 7.6 percent (MOF, 2021) and it is less than 11 percent in 2024 as well due to low supervision and weak actions against rules violating banks. Banks and financial institutions pay penalty to NRB rather than advancing credit to agriculture.

International researchers have conducted extensive empirical investigations to assess the influence of banking credit on agricultural sector growth. To the best of my knowledge, very few studies have been conducted covering the Nepalese economy. Nepalese farmers could not get timely finance facilities to assist their farm work which solve their financial constraints, and very less loan is advanced by banking sector. Thus, the extent to which commercial banks' lending assist to strengthen the agricultural sector is the main motivating factor of the research.

The objective of this study is to explore the effects of commercial banks' lending on agricultural growth in Nepal. As the main variable of interest of the study is commercial banks' lending, it is expected that such lending enhances the agricultural production and growth. Additional objective of the study to identify the effects of irrigation facility and fertilizers used on agricultural growth in Nepal.

The rest of the paper is organized as follows: section two is the review of literature followed by conceptual framework designed for the study; section three details research methodology including method and materials; section four present results; section five raps up with summary, conclusion and policy recommendations, and the area of further research.

Review of Literature

Most of the previous studies on the given topic have found positive and significant effect of banks' lending on agricultural growth in different nations. Most of the literatures are found in international perspective studies and there are very few Nepal-specific studies to identify whether agricultural credit really contributes for agricultural growth.

Agunuwa, Inaya and Proso (2015) investigated the impact of commercial banks' lending on agricultural productivity in Nigeria by using time series data for 33 years, 1980 to 2013. They used the OLS technique for the empirical findings. The study found positive relationship between banks credit and agricultural growth in Nigeria.

Likewise, Udoka et al. (2016) claimed that commercial banks credit supports for the agricultural production of Nigeria. By using the time series data for 44 years, spanning from 1970 to 2014, this study employed OLS estimation technique for empirical findings. Their result revealed that there is positive and significant relationship between banks' lending and agricultural production. The authors recommended that government should implement credit guarantee scheme for agricultural loan to the farmers. To explore the effect of agricultural credit on agricultural production in India, Hegde and Reddy (2017) used the Panel data analysis. This study argued that credit in agriculture supports positively and has significant impact on agricultural growth.

Mathusamy et al. (2018) stated that commercial banks' credit plays an auxiliary role in developing agricultural production in Sri Lanka by using time series data for 12 years, from 2005 to 2017. The study employed ARDL bounds testing and ECM model for their empirical analysis. Their results revealed that commercial banks' credit to agriculture has positive relation to increase agricultural and overall GDP of Sri Lanka. Commercial banks and other lending institutions play an enormous contribution in the development of Indian agriculture.

Exploring the effects of commercial banks' agricultural credit on growth of agriculture, Florence and Nathan (2020) claimed that the commercial banks' lending has gradually increased in agriculture in Uganda. Using quarterly time series data over the period of 10 years, from 2008 to 2018, this study used the ARDL bounds testing approach to identify the relationship between commercial banks' credit and Uganda's agricultural GDP performance. This study found positive and significant long-run relationship between dependent and independent variables. This study claimed that agricultural credit enhances the agricultural growth.

Many African countries are accelerating towards the improvement of agricultural sector, which is considered as an essential development priority to attain the zero-hunger goal of U.N. to be achieved by 2030. Empirical studies found that credit constraints and inability of rural farmers to access financial institutions are major bottleneck for agricultural development in Sub-Saharan Africa (SSA). By employing the Panel data estimation technique and Cross-Sectional dependence in a panel of 8 west African countries, Kassouri and Kacau (2022) found that agricultural credit has positive relation with agricultural growth in 8 west African countries during the study period, from 1994 to 2014.

Agricultural sector, which is also prime sector, contributes 13.47 % to GDP of Bangladesh and around 40.36 % of the total labour force of Bangladesh are involved in this

sector (Patwary, Islam, & Mosharrafa, 2023). They used the time series data for 28 years, from 1991 to 2018, and employed econometric tools such as ADF, Johansen Cointegration test and VECM models for empirical findings on the effects of banks' agricultural credits on agricultural growth. The findings revealed that agricultural credit provided for farmers have positive long-run relation with agricultural growth. This study suggested that agricultural growth supports for industrial growth as well as service sector.

Agricultural modernization supported by modern seeds and tools ensures higher productivity. It should be supported by agricultural credit to small farmers. Exploring the impact of credit, its utilization, misused and factors determining the agricultural credit in Pakistan, Chaiya et al. (2023) designed a mixed research design using a semi-structured questionnaire to collect the data from 316 farmers in Mardan district. Data were analyzed by using statistical tools such as Paired t-test, ANOVA, and multiple regression. Result showed that agricultural credit enhances the crop production in study area. The study found that farmers' age, experience, farm size, farm income, etc are major determinants of agricultural credit.

How is the effectiveness of credit risk management policies applied by commercial banks' lending in agriculture? To explore this issue in Ghana, Nyebar et al. (2023) used a qualitative research approach to evaluate the implementation of credit risk management policies and its effects by commercial banks in agricultural sector. This study was supplemented by semi-structured interviews with credit managers as well. The interview result showed that lack of collateral, lack of insurance, poor productivity, underdeveloped export market, etc, are major challenges for credit even though credit supports for agriculture growth.

Very few Nepal-specific studies are found on exploring the role of commercia banks' credit on agricultural growth in Nepal (Dulal, 2023; Bhatta, 2014; Ghimire & Bista, 2023). In this context, Dulal (2023) employed ARDL approach by using the time series data covering the period of 15 years, 2005 to 2020. This study found positive long-run relationship between banks' lending and growth of agriculture in Nepal. Likewise, Bhatta (2014) used the primary data collected from survey of 100 farmers to explore the impact of agricultural credit on farm productivity of Kailali district of Sudur Paschim Province. This study found that agricultural credit helps to achieve higher productivity. Ghimire and Bista (2023) also claimed that banks' credit positively contributes for agricultural and GDP growth in Nepal.

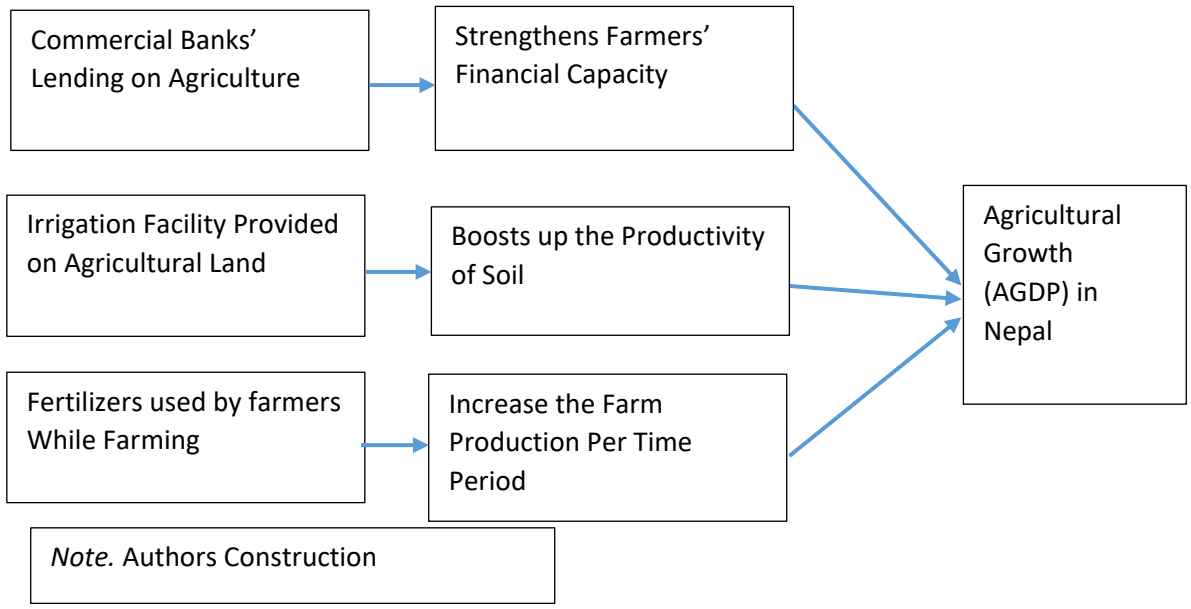
A number of studies are conducted by international researchers and policy makers to identify the effects of banks' lending on agricultural growth in their countries. To the best of my knowledge, very few studies have been conducted especially covering the Nepalese economy by using aggregate time series data. Thus, there is dearth of literature, and my study found the research /knowledge gap in the field of effects of commercial banks' lending on agricultural growth in Nepal. So, empirical research is quite important to explore the extent to which commercial banks' lending promotes agricultural growth in Nepal. Hence, our study is expected to add value in the field of literatures. Another value added by this study is that it assists the planners, research practitioners and policy makers on agricultural sector to explore the extent to which agricultural loan by commercial banks supports for agricultural growth.

Conceptual Framework

After reviewing previous studies and using authors' own institution, the conceptual framework of the study is as sketched in Figure 3.

Figure 3

Conceptual Framework



The main variable of interest of the study is commercial banks' lending. Increase in banks' lending to farmers fills the financing needs of farmers in the beginning of farming season. Farmers can manage all the necessary materials required for farming. It increases the agricultural production. Likewise, irrigation facility and fertilizers used also help bring increase in agricultural output.

Methods and Materials

This section deals with the variables used in the model, sources of data, model specification and estimation followed by results of empirical findings and interpretation of the results.

Data and Method

This study is designed to explore the effect of commercial banks' lending on agricultural growth in Nepal based on secondary data. It uses the extended set of annual time series data for 30 years, spanning from 1994 to 2023 published by Nepal Rastra Bank (NRB), National Statistics Office (NSO), Economic Survey of various issues published by ministry of Finance (MOF). ARDL bounds testing approach is employed for the empirical findings. Unit root for stationary of time series data is checked by using the ADF Unit root test. Empirical results are obtained by using EViews 10 software.

Table 1

List of Variables Used and Sources of Data

Code	Variables	Sources	Units
AGRGDP	Agriculture real gross domestic product	NSO	NRs. Millions
RCBL	Real commercial banks' lending	NRB	NRs. Million
IRRI	Irrigated land	MOF	Hectares
FER	Fertilizers	MOF	Metric tons

Note. Author's illustration, 2025.

An Empirical Model Specification

This study aims to examine the effects of commercial banks' lending on agricultural growth in Nepal. For this, we adopted the model used by (Patwary et al., 2023) including IRRI and FER as outlined in equation 1.

$$AGRGDP_t = f(RCBL_t, IRRI_t, FER_t) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Converting the functional equation into linear form:

$$AGRGDP_t = \beta_0 + \beta_1 RCBL_t + \beta_2 IRRI_t + \beta_3 FER_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots (2)$$

Writing the functional relation in log-linear form, it becomes the log-linear equation as:

$$Ln\ AGRGDP_t = \beta_0 + \beta_1 Ln\ RCBL_t + \beta_2 Ln\ IRRI_t + \beta_3 Ln\ FER_t + \varepsilon_t \quad \ldots\ldots (3)$$

Where $AGRGDP_t$ = Agriculture real GDP at time period 't' as dependent variable, $RCBL_t$ = Real commercial banks' lending at time period 't' as core independent variable, $IRRI_t$ = Irrigated land at time period 't' as first control variable, FER_t = Fertilizers used at time period 't' as second control variable, and, β_0 = Constant or intercept where the expected sign may be positive or negative. ε_t = Stochastic error term.

Hypothesis of the Study

Depending upon the given research question and objective of the study, the null and alternative hypothesis set for this study are as follows:

Null Hypothesis (H0): $\beta_0 = \beta_1 = \beta_2 = \beta_3 = 0$

i.e., The commercial banks' lending, irrigation and fertilizer have no significant effects on agricultural growth of Nepal.

Alternative Hypothesis (H1): $\beta_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$

i.e., The commercial banks' lending, irrigation and fertilizer have significant effects on agricultural growth in Nepal.

Among the methods developed to investigate cointegration, Pesaran and Shin (1999) developed and used the ARDL bounds testing approach to identify cointegration (Dahal, 2013, Lamsal, 2023). The general form of the ARDL Model following Pesaran and Shin (1999) is given as:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_k Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \ldots + \alpha_q X_{t-q} + \varepsilon t \quad \ldots.. (4)$$

Where, Yt = dependent variable at time period t, Y_{t-i} = lagged values of Y, β_I = coefficients of lagged values of Y, $X_{t-i.}$ = lagged values of independent variable 'X'.α_I = coefficients of lagged values of 'X'. and, εt = error term

Estimation of Auto Regressive Distributed Lag (ARDL) Model

This study employed the ARDL bounds testing model developed by Pesaran and Shin (1999). The ARDL model has several advantages as compared with other time series cointegration techniques; such as Engle and Granger (1987), Johansen's approach (1988). These two approaches are used only to identify the long run relationship and they are not appropriate for small size of sample. Firstly, ARDL model can be applied even in case of small size of samples. Secondly, it estimates the short-run and long-run relationship between the selected variables and; thirdly, it can be used if the data are stationary at I (0) or I (1) or the combination of both; i.e, regardless of order of integration (Pesaran et al., 2001; Dahal, 2013; Lawal, et al., 2016; Mamun & Kabir, 2023; Lamsal, 2023; Lamsal, 2024).

Having gone through a number of advantages of ARDL approach, this study employs the bounds test in order to identify the cointegration among the selected variables for the model. To identify the cointegration among the selected variables as stated in equation (3), the ARDL framework is as outlined in equation (5) and the error correction model in equation (6).

$$\Delta \text{ Ln (AGRGDP)}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta \text{ Ln (AGRGDP)}_{t-i} + \sum_{i=1}^{q} \alpha_{2i} \Delta \text{ Ln (RCBL)}_{t-i} + \sum_{i=1}^{q} \alpha_{3i} \Delta \text{ Ln (IRRI)}_{t-i} + \sum_{i=1}^{q} \alpha_{4i} \Delta \text{ Ln (FER)}_{t-i} + \alpha_{11} \text{Ln (AGRGDP)}_{t-1} + \alpha_{12} \text{Ln (RCBL)}_{t-1} + \alpha_{13} \text{Ln (IRRI)}_{t-1} + \alpha_{14} \text{Ln (FER)}_{t-1} + \varepsilon_{1t.} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

And the corresponding Error Correction Model (ECM) is given as:

$$\Delta \text{ Ln (AGRGDP)}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta \text{ Ln (AGRGDP)}_{t-i} + \sum_{i=1}^{q} \alpha_{2i} \Delta \text{ Ln (RCBL)}_{t-i} + \sum_{i=1}^{q} \alpha_{3i} \Delta \text{ Ln (IRRI)}_{t-i} + \sum_{i=1}^{q} \alpha_{4i} \Delta \text{ Ln (FER)}_{t-1} + \beta \text{ ECT}_{t-1} + \varepsilon_{1t.} \quad \ldots\ldots (6)$$

Where, α_{1i}, α_{2i}, α_{3i} and α_{4i} = short run dynamic coefficients of model's adjustments in long run equilibrium, α_{11}, α_{12}, α_{13} and α_{14} = long run coefficients, β = Speed of adjustment parameter with negative sign, ECT = Error correction term.

Result and Discussion

Unit Root Test

The empirical results of ADF test for Unit Root for order of integration is given in Table 2.

Table 2

Result of ADF Test for Unit Root

Variables	Model	Level: I (0)		First Difference: I (1)	
		t-statistic	p-value	t-statistic	p-value
Ln AGRGDP	Intercept	- 4.791363	0.0006	- 3.253909	0.0276
Ln RCBL	Intercept	0.048713	0.9557	- 5.472319	0.0001
Ln IRRI	Intercept	- 2.620848	0.1004	- 5.925244	0.0000
Ln FER	Intercept	- 1.214202	0.6544	- 5.950477	0.0000

Note. Author's estimation using EViews10.

Table 2 illustrates that all the variables selected in the model are stationary at level; I (0) and first difference I (1). It justifies that ARDL model is suitable for its estimation (Pesaran, et al., 2001).

Descriptive Statistics

The summary statistics of all variables of this study are presented in Table 3.

Table 3

Descriptive Statistics

	LN AGRGDP	LN RCBL	LN IRRI	LN FER
Mean	9.865980	8.176445	10.16479	11.05111
Median	9.904588	7.915806	10.20538	10.91355
Maximum	10.34252	10.08230	10.79988	12.90057
Minimum	9.054505	6.838050	9.334768	8.057377
Std. Dev.	0.346503	0.932817	0.401968	1.398666
Skewness	-0.664652	0.719313	-0.356185	-0.426479
Kurtosis	2.677524	2.638007	2.446825	2.347416
Jarque-Bera	2.338801	2.750854	1.016841	1.441752
Probability	0.310553	0.252732	0.601445	0.486326
Sum	259.9794	245.2934	304.9438	331.5332
Sum Sq. Dev.	3.481867	25.23428	4.685782	56.73170
Observations	30	30	30	30

Note. Calculated by the Author using EViews 10.

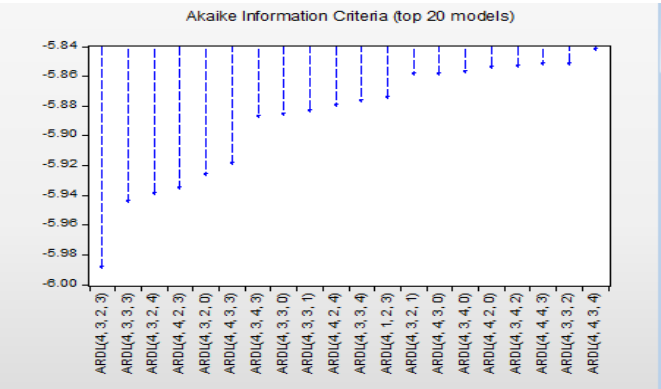
Data presented in Table 3 show the summary statistics of all the selected dependent and explanatory variables. It includes the estimated values of mean, median, standard deviation, etc. All the variables are normally distributed as the p-value of Jarque-Bera test is more than 5 percent.

Lag Length Selection

To estimate the ARDL model, Bounds Testing for cointegration and Error Correction models, Lag length is required (Pesanan et al., 2001; Dahal, 2013; Mamun & Kabir, 2023, Lamsal, 2023). The most popular Lag operators used by researchers include FPE, AIC, SC, and HQ. However, the optimal Lag length is selected according to AIC criteria. The lag length selected according to AIC criteria is ARDL (4, 3, 2, 3) as presented in Figure 4.

Figure 4

Lag Length Criteria on the basis of AIC



Note. Calculated by the Author using EViews 10

ARDL Model Estimation

The first step of ARDL bounds tests for cointegration, estimation of long-run coefficients and error correction model is the estimation of ARDL model based on lag length criteria. The required lag length criteria for our study is presented in Figure 6 on the basis of AIC criteria. The Auto Regressive Distributed Lag (ARDL: 4, 3, 2, 3) model is selected on the basis of Akaike Info Criterion. This study uses 30 years' time series data. The suitable lag length is automatically selected by the EViews 10, as per Akaike Info Criterion (Pesaran et al.,2001).

Based on the ARDL model, bounds test and long-run coefficients are estimated. Table 4 shows the empirical findings of ARDL model.

Table 4

Empirical Result of ARDL Model

Dependent Variable: Ln AGRGDP		Method: ARDL (4, 3, 2, 3)		
Variables	Coefficient	Std. Error	t-Statistic	Prob.
LNAGRGDP (-1)	0.178652	0.160119	1.115745	0.2906
LNAGRGDP (-2)	-0.257794	0.178155	-1.447020	0.1785
LNAGRGDP (-3)	0.446039	0.132122	3.375948	0.0071
LNAGRGDP (-4)	0.277295	0.112492	2.465011	0.0334
LNRCBL	0.011867	0.011595	1.023450	0.3302
LNRCBL (-1)	0.030076	0.011376	2.643798	0.0246
LNRCBL (-2)	-0.013581	0.014580	-0.931511	0.3735
LNRCBL (-3)	0.020674	0.012095	1.709315	0.1182
LNIRRI	0.005391	0.009683	0.556813	0.5899
LNIRRI (-1)	-0.007176	0.015743	-4.455812	0.6583
LNIRRI (-2)	0.033584	0.014022	2.395057	0.0376
LNFER	0.011524	0.004428	2.602768	0.0264
LNFER (-1)	0.001707	0.004333	0.393982	0.7019
LNFER (-2)	0.004855	0.004311	1.126331	0.2863
LNFER (-3)	-0.007870	0.004655	-1.690547	0.1218
C	2.797525	0.403549	6.932298	0.0000
R-squared	0.999243	Mean dependent var		9.966296
Adjusted R-squared	0.998109	S. D. dependent var		0.242766
S. E. of regression	0.010558	Akaike info criterion		-5.988685
Sum squared resid	0.001115	Schwarz criterion		-5.214472
Log likelihood	93.85291	Hannan -Quinn criterion		-5.765740
F-statistic	880.5748	Durbin-Watson stat		2.486161
Prob (F-statistic)	0.000000			

Note. Calculated by Using EViews 10.

ARDL Bounds Test for Co-integration and Error Correction Model

Bound tests for cointegration are carried out in order to identify the relationship between dependent and independent variables. It is an econometric tool that is used to identify whether there is a long-run relationship between the dependent and independent variables used in a study or whether there is a short-run relationship between them. According to Pesaran et al. (2001), the ARDL bound test is based on Joint F – Statistic, it is tested under the null

hypothesis (H0) i.e., there is no cointegration among the variables used in the model against the alternative hypothesis (H1) i.e., there is cointegration, using lower bound I (0) and upper bound I (1). Table 5 shows the empirical result of bounds test for cointegration, Table 4 shows the empirical findings of ARDL model and Table 7 shows the result of the Error Correction Model.

Table 5

Results of ARDL Bounds Test for Cointegration and Long-Run Form

Dependent Variable: D(LnAGRGDP) and Selected Model: ARDL (4,3,2,3)

F-Bounds Test				
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	14.94767	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Note. Calculated by Using EViews 10.

Data presented in Table 5 show the ARDL bound test results for cointegration. The F-Statistic for the bounds test is 14.94767 which is greater than the lower bound value of 3.65 and upper bound value 4.66 at 1 percent level of significance. Thus, the empirical result justifies that there is a long-run relationship between AGRGDP, RCBL, IRRI and FER.

Estimation of Long-Run Coefficients

Having gone through the cointegration of variables for long-run, the next step in ARDL model is to estimate the long-run coefficients. Equation (2) is the long-run model of this study. To estimate the long-run ARDL model, appropriate lag length is calculated according to AIC criteria. The appropriate lag length for the model is ARDL (4,3,2,3) as presented in Figure 6. Table 6 presents the estimated long-run coefficients using ARDL model. The Long Run estimated model is: LNARGDP = 7.8625 + 0.1378 * LNRCBL + 0.0894 * LNIRRI + 0.0287 * LNFER

Table 6

Estimated Long -Run Coefficients Using ARDL (4,3,2,3) Model based on AIC.

		Dependent Variable: LnAGRGDP Model Selected: ARDL (4,3,2,3) on the basis of AIC.		
Variables	Coefficients	Std. Error	t-statistic	Prob.
LNRCBL	0.137815	0.018166	7.586302	0.0000
LNIRRI	0.089375	0.041349	2.161473	0.0560
LNFER	0.028715	0.009519	3.016806	0.0130
C	7.862464	0.359710	21.85781	0.0000

Note. Calculated by using EViews 10.

Table 6 presents the estimated long-run coefficients using ARDL model. The correlation of LNRCBL, LNIRRI and LNFER with LNAGRGDP are positive and statistically significant at 1 %, 5 % and 1% level respectively. When commercial banks' lending increases by 1 %, it leads to 0.14 % increase in agriculture growth in the long-run. Likewise, a 1% increase in irrigation facility leads to 0.09 % increase in agriculture growth. Similarly, 1%

increase in fertilizers increases the agriculture growth by 0.03 % in the long run. The empirical findings indicate a statistically significant positive relationship between commercial banks' lending (RCBL) and agricultural real GDP growth (AGRGDP). This suggests that increased financial support from commercial banks contributes meaningfully to the growth of the agricultural sector. Additionally, the control variables, irrigated land (IRRI) and fertilizer used (FER), also show positive and statistically significant effects on agricultural productivity, highlighting their importance in enhancing agricultural output in Nepal. The results of the study show that increase in agricultural credit by commercial banks' have a positive relationship with agricultural growth in Nepal in long run, which is consistent with the result of previous research of Patwary, Islam & Mosharrafa (2023), Chaiya et al. (2023), Nyebar et al. (2023), Kassouri & Kacau (2022), Florence & Nathan (2020), Mathusamy et al. (2018), Hedge & Reddy (2017), Udoka et al. (2016), Dulal (2023) and Bhatta (2014).

The empirical finding of the error correction model is presented in Table 7. The coefficient of CointEq is negative (-0.355808) and the probability is significant. It indicates that there is a long-run equilibrium relationship between the variables selected in this study. The negative coefficient of error correction model (-0.35) shows that our model is theoretically correct and probability shows that it is statistically significant. The absolute value of coefficient of ECM indicates the speed of adjustment towards long-run equilibrium through a number of short-run adjustments. The model tends towards equilibrium by the speed of adjustment around 35.5 % per annum.

Table 7

ARDL Error Correction Regression

Dependent Variable: D(LNAGRGDP)
Selected Model: ARDL (4,3,2,3)

ECM Regression Case 1: No Constant and No Trend				
Variables	Coefficient	Std. Error	t-Statistic	Prob.
D(LNAGRGDP (-1))	-0.465540	0.094448	-4.929080	0.0006
D(LNAGRGDP (-2))	-0.723334	0.120374	-6.009045	0.0001
D(LNAGRGDP (-3))	-0.277295	0.087485	-3.169647	0.0100
D(LNRCBL)	0.011867	0.007392	1.605488	0.1395
D(LNRCBL (-1))	-0.007093	0.007328	-0.967841	0.3559
D(LNRCBL (-2))	-0.020674	0.008056	-2.566319	0.0281
D(LNIRRI)	0.005391	0.006518	0.827104	0.4275
D(LNIRRI (-1))	-0.033584	0.009965	-3.370226	0.0071
D(LNFER)	0.011524	0.002880	4.001806	0.0025
D(LNFER (-1))	0.003014	0.002590	1.163622	0.2716
D(LNFER (-2))	0.007870	0.002710	2.904147	0.0157
CointEq(-1)*	-0.355808	0.034784	-10.22906	0.0000

Note. Calculated by using EViews 10.

Residual Diagnostics

After estimating the empirical model, various residual diagnostic tests are conducted to assess the adequacy of the model and the behavior of its residuals. Specifically, tests for serial correlation (LM Test), heteroscedasticity and normality are performed to ensure the reliability

of the model. The results of these diagnostic tests are provided in Table 8. The results revealed that the estimated ARDL model was statistically robust; thus, the model was free from serial correlation, heteroscedasticity and residual is normality distributed.

Table 8

Results of Residual Diagnostics

Test	Serial Correlation Test	Heteroscedasticity Test	Normality Test
F – value	2.042159	0.566107	1.570320
Probability	0.1921	0.8453	0.456047
Conclusion	No serial correlation as the prob. > 10 percent	No heteroscedasticity as the prob. > 10 percent	Data are normal as the prob. > 10 percent

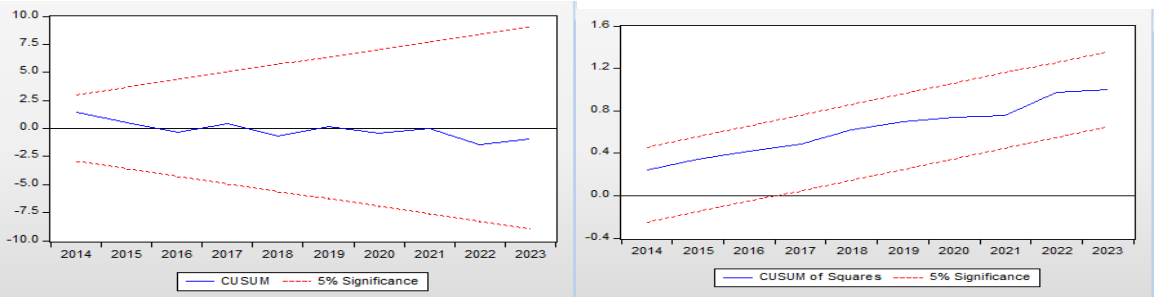
Note. Calculated by using EViews 10.

Stability Diagnostics

The stability test for the agricultural development (AGRGDP) model has been applied to investigate the stability of the long-run and short-run parameters. For the same, cumulative sum (CUSUM) and cumulative sum of squares (CUSUM SQ) tests are employed. It verifies the stability of the ARDL model for the structural break. Two red lines represent critical bounds at 5 percent level of significance. The results of the CUSUM and CUSUM of Squares tests are shown in Figure 5.

Figure 5

Plot of CUSUM and CUSUM SQ of Recursive Residuals



Note. Author's Calculation using EViews 10.

If the plot of CUSUM and CUSUM of squares lie within the critical bounds of 5 percent, it justifies that our model is stable. As shown in Figure 5, the plot of CUSUM and CUSUM of squares both are between the critical boundaries of 5 %. It justifies that our model is stable.

Conclusion and Policy Recommendations

This study has analyzed the impact of commercial banks' lending on agricultural growth in Nepal by employing an Auto Regressive Distributed Lag (ARDL) model. The empirical findings indicate a statistically significant positive relationship between commercial banks' lending (RCBL) and agricultural real GDP growth (AGRGDP). The positive association between commercial banks' lending and agricultural growth underscores the crucial role that financial access plays in the development of the agricultural sector. Farmers with access to credit are better positioned to invest in necessary materials and inputs and technologies, which in turn boosts agricultural productivity. Similarly, the significance of irrigated land and the use

of fertilizer emphasizes that investments in these areas are vital for sustaining and improving agricultural growth. Our study has added new knowledge and literature in the field of commercial banks' lending-agricultural growth interconnection in Nepal. It has added a new empirical finding, and thus, new knowledge in the field of academia, and justified that agricultural lending supports significantly for agricultural growth in Nepal.

To capitalize on these findings, policy recommendations include enhancing access to credit for farmers by developing targeted financial products and improving the efficiency of loan disbursement processes. Strong policies should be formulated by the NRB to regulate commercial banks' lending to agriculture as per the guideline of NRB rather than accepting fines. The trend of neglecting the directions of NRB shall be discouraged. Additionally, policies should support the expansion of irrigation infrastructure and provide subsidies or support programs for fertilizers. Encouraging private sector involvement in agricultural financing and implementing robust monitoring and evaluation mechanisms will further ensure that financial resources effectively contribute to agricultural development in Nepal.

Future Prospects of Research

This study has used the agricultural lending provided only by commercial banks, excluding the lending of other financial institutions credit. The future research shall be conducted by covering all the lending provided by commercial banks, development banks, finance company and microfinance. Likewise, additional research shall be directed towards exploring the relationship between microfinance lending and agricultural growth in Nepal in the academia because microfinance has changed the life style and poverty in Bangladesh.

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