

AGRICULTURAL CREDIT AND AGRICULTURAL PRODUCTIVITY IN BANGLADESH: AN ECONOMETRIC APPROACH

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Abstract

For a developing country like Bangladesh, ensuring food security through increased agricultural production is one of the important development goals. Providing agricultural credit to poor farmers (small, marginal and landless farmers) from formal credit sources can facilitate the timely and sufficient supply of agricultural inputs in order to promote the food production and improve the livelihoods of poor farmers. This study aims to investigate the impact of agricultural credit on agricultural productivity in Bangladesh. The empirical analysis employed annual time-series data that have been collected from Bangladesh Bank (BB), Ministry of Finance (MoF), and Bangladesh Bureau of Statistics (BBS) for the period of 2000 to 2019. This paper examined the short run and long run relationships between agricultural credit and agricultural productivity along with other control variables applying the autoregressive distributed lag (ARDL) bounds test approach. The findings of the study revealed that the short run and the long run relationships exist between the agricultural credit and agricultural productivity while the productivity of the agricultural sector also influenced by other dynamic variables like inflation, interest rate, and government expenditure on agriculture. This paper concludes that agricultural credit growth should increase to boost up the agricultural production, which would definitely be helpful in fostering economic growth in Bangladesh.

Keywords: *Agricultural Credit, Agricultural Productivity, ARDL, Economic Growth and Bangladesh.*

JEL Classification: *C22, O40 and Q14.*

1. Introduction

Bangladesh is predominantly an agricultural country. Agriculture is one of the prime sectors of the country's economy, which is considered as the nucleus of the rural economy where around 85 percent of rural workers are directly involved with agriculture. This sector employs 43 percent of the total labor force of the country. Although day by day the contribution of the agriculture sector to Gross Domestic Product (GDP) is becoming less, still the share of this sector to GDP is around 14 percent.

Moreover, ensuring food security through increased agricultural production is one of the important development goals, especially for the developing economy. Providing agricultural credit to poor farmers in the rural areas (small, marginal and landless farmers) from formal credit sources can facilitate the timely and sufficient supply of agricultural inputs in order to stimulate food production and improve the livelihoods of poor farmers.

Agricultural credit disbursement is essential in the short-term, intermediate-term and long-term basis to fulfill the financial needs of farmers based on different kinds of a crop cycle including farming activities. Short-term loans are mainly disbursed for seasonal agricultural production purposes. Long-term credits are generally provided for facilitating the farming

activities like purchasing of agricultural machinery with irrigation equipment and establishments of Agro-based industries.

2. Background

Since agricultural sector contributes significantly to increasing country's productivity with consideration to ensuring marginal food sufficiency along with creating employment opportunity, upgrading the standard of living and finally alleviate poverty. So far, the Government as well as the Bangladesh Bank has taken various initiatives for providing agricultural credit to the poor farmers from the formal sector banking channels. As timely disbursement of agricultural credit can meet farmers need to improve agricultural productivity. In this instance, along with specialized agriculture bank, namely, Bangladesh Krishi Bank (BKB) and Rajshahi Krishi Unnayan Bank (RUKUB), the state-owned commercial banks, private commercial banks and also foreign banks are involved with providing the credit facility to the rural farmers for enhancing the agricultural activities properly. Besides the banking institutions, the non-government organizations (NGOs) and micro finance institutions (MFIs) also have a stronger influence on agricultural credit markets. Nowadays, the formal sector credit sources are mostly covering the rural agricultural credit markets, but previously the informal sector had a greater influence in the rural credit market for agriculture.

Sometimes, in many developing countries, the lack of access to financial services is often considered as the main constraint in terms of proper utilization of the poor individual's economic potentials. The lack of credit also acts as a vital impediment to employment generation, savings-investment activities, consumption behaviors, etc. of the rural poor farmers. It is also argued that credit allows the farmers to invest in modern methods of cultivation, marketing, storage, and other farming activities. Like other developing countries, Bangladesh credit markets are somewhat underdeveloped with respect to coverage as well as the size of the loan. To some extent, such a situation has forced the credit-constrained farmers or poor households to borrow credit from informal sources at high-interest rates with risky terms and conditions. However, the central bank of Bangladesh has recently initiated the agricultural/rural credit policy and taken all scheduled banks, including foreign banks and NGO-MFIs under this credit program. So far, agricultural credit plays an important role to foster agricultural productivity hence the participation of all formal credit sources is one of the important prerequisites for financing the credit-constrained farmers for promoting the growth of the agriculture sector.

3. Objectives

In the old paradigm, like many other developing countries, the government of Bangladesh provided subsidized agricultural/rural credit through specialized agricultural banks (BKB and RUKUB) that lending to the agricultural sector expedites the agricultural production. In reality, the outcomes of such credit disbursements were not successful and sustainable belonging to huge default rates, including poor performance of specialized banks in where the credit was being provided even to the wealthiest borrowers.

In fact, the farmers of Bangladesh are normally resourced poor and such poor farmers constitute 80 percent of the total farming population of Bangladesh. Only 17 percent of small farmers have direct access to institutional agricultural credit. The present scenario tells the truth that there is a huge need for agricultural investment, thus the universal agricultural credit coverage to the poor section of farmers can have merit in order to ensure on-time agricultural production. If disbursing agricultural credit to poor farmers increase their agricultural production that will be the driver of sustainable growth in the overall agricultural sector and which will ensure food security and contribute towards poverty reduction.

Considering agricultural credit as one of the crucial factors towards sustainable development of the agriculture sector, which ultimately promotes agricultural production and livelihood of poor farmers, it is essential to conduct a comprehensive analysis that will explore the impact of agricultural credit on agricultural productivity. The rationale of the study based on the following research question:

What are the impacts of agricultural/rural credit on the productivity of the agriculture sector?

4. Review of Literatures

In Bangladesh, due to its high population density, around 1 percent of the country's total arable land is declining every year and where the annual increase of population is around 1.5 percent. Sustainable and adequate food production for a growing population is a great challenge for Bangladesh. In this context, the only way to increase our agricultural production by taking intensive agriculture that involves improving technology in agriculture. In Bangladesh, the adoption of extensive agriculture is no more possible because we already used all of our cultivable lands under cultivation. There is a lack of huge capital investment, including modern methods of cultivation for the farming activities of the poor and marginal farmers. The universal access to agricultural credit to the poor farmers may have important credibility to improve overall productivity and upgrade their livelihood.

To understand the agricultural credit and agricultural productivity relationship across the world, we reviewed some studies that have been conducted on developing economies.

Rahman et al. (2011) evaluated the lenders' performance agricultural credit and assessed the relationship between credit and farm production in Bangladesh. This study revealed a strong positive correlation between credit and production and the performance of lending institutions has been improved by various policy shifts and involving private banks to agricultural credit operation.

Saleem and Jan (2011) studied the impact of agricultural credit on agricultural GDP in a specific district of Pakistan using a linear regression model based on Cobb-Dougllass function taking information from 1990 to 2008. This study concluded that the more supply of credit can foster the agricultural production.

Alauddin and Biswas (2014) discussed the impact of agricultural credit on growth, including trends, patterns, and problems using descriptive features and concluded with recommendations that can minimize the gap of agricultural credit disbursement.

In 2014, Nepal Rastra Bank conducted a case study regarding agricultural credit and its impact on farm productivity of Kailali District in Nepal. The results of this survey indicated that agricultural credit helps to promote the agricultural productivity of the farmers in the study area.

Rahman et al. (2014) investigated the impact of credit to farmers on agricultural productivity in one commercial bank of Pakistan by employing logit regression analysis and found a positive influence of agricultural credit on the productivity of agriculture.

Narayanan (2015) examined the relationship between agricultural credit and agricultural GDP in India by using state-level data for the period of 1995-96 to 2011-12. The findings of the study suggested that an increase in agricultural credit is highly responsive to the increase in agriculture production.

Yadav and Sharma (2015) comprehensively reviewed the agricultural credit situation in developing countries considering the 110 studies on this background. This study found that the small farmers are still in vulnerable situation due limited access of institutional sources of credit and while in rural markets, the informal sources of credit are playing a dominating role.

Ayeomoni and Aladejana (2016) analyzed the association between agricultural credit and economic growth in Nigeria using the ARDL approach for the period 1986 to 2014. This

analysis showed both the short run and the long run relationships exist between the agricultural credit and economic growth.

Okosodo (2016) examined the impact of agricultural credit on the economic development of Nigeria using co-integration bound testing approach for the period of 1980 to 2014. This study suggested that disbursing more bank credit along with reducing the lending interest rate should be implemented for facilitating the agricultural sector in Nigeria.

Sarker (2018) studied to determine the role of banks in the agricultural development of Bangladesh and the results of the study show the significant role of banks in agricultural development through agricultural credit disbursement.

After comprehensively reviewing the different studies that analyzed the agricultural credit-agricultural productivity relationship around the world, this study is a modest attempt to revisit the issue of agricultural credit and development of the agriculture sector relationship in Bangladesh context. Using recent macro-level data and applying standard econometric techniques, this study will try to identify the relationship between agricultural credit and agricultural productivity as the economy of Bangladesh is primarily dominated by agricultural activities.

5. Data and Methodology

The study aims to examine the impact of agricultural credit on the productivity of agriculture sector in Bangladesh. The empirical analysis employs annual time series data of different study variables for the period of 2000 to 2019 taken from different secondary sources such as the Bangladesh Bank (BB), Ministry of Finance (MoF), Bangladesh Bureau of Statistics (BBS) and other related organizations. This paper will investigate the short run and long run relationships between agricultural productivity and agricultural credit using a modern time series co-integration technique based on autoregressive distributed lag (ARDL) bounds test method developed by Pesaran, Shin and Smith (2001) with annual time series data from 2000 to 2019.

Most of the macroeconomic time series variables could have non-stationarity problem that means violating the unit root assumption, for such cases, the variables are integrated at first order, I(1) instead of the order of integration at the level, I(0). Running regression by these non-stationary variables could give the spurious results. When the variables are stationary, I(0) then the ordinary least squares (OLS) technique is appropriate one for regression analysis. Conversely, when the variables are stationary at first difference, I(1) then the Johansen's co-integration approach is suitable one for analyzing regression. Moreover, if the variables are mixture of I(0) and I(1) then ARDL co-integration approach is proper one for estimating regression.

This ARDL bounds test approach is consistent whether the variables under consideration are stationary or not (Pesaran et al., 2001). The Johansen's co-integration approach requires that all variables must be co-integrated in the same order, but the ARDL bounds test can be used whether the variables are I(0) or I(1) or co-integrated mutually.

In macroeconomic theory, higher private sector credit growth is one of the important prerequisites for enhancing domestic investment that can foster the aggregate production. Although other factors like government expenditure, price level, and interest rate structure could have a strong influence on production growth. In line with this economic relationship, this study is conducted by considering the relationship that the agricultural gross domestic production could be influenced by the agricultural credit, government expenditure on agriculture, lending interest rate, and inflation.

The model has been used in the empirical study by the following theoretical expression

$$AGG=f(ACG, ADPAG, IR, INF) \quad (1)$$

Where AGG is the agricultural GDP growth used as the proxy of agricultural productivity, ACG is the banking sector agricultural credit disbursement growth used as the proxy of agricultural credit, ADPAG is the growth of annual development expenditure on agriculture used as the proxy of government expenditure on agriculture, IR is the banking sector weighted average lending interest rate used as the proxy of interest rate and INF is the CPI-based inflation rate used as the proxy of price change. In the economic relationship of the specified model, we can expect the sign of ACG and ADPAG are positive; conversely, the sign of IR and INF are negative.

From the above expression (1) which can be transformed into ARDL model (Pesaran et al. 2001) as follows:

$$\Delta AGG_t = \beta_0 + \beta_1 AGG_{t-1} + \beta_2 ACG_{t-1} + \beta_3 ADPAG_{t-1} + \beta_4 IR_{t-1} + \beta_5 INF_{t-1} + \Sigma \gamma_{1i} \Delta AGG_{t-i} + \Sigma \gamma_{2i} \Delta ACG_{t-i} + \Sigma \gamma_{3i} \Delta ADPAG_{t-i} + \Sigma \gamma_{4i} \Delta IR_{t-i} + \Sigma \gamma_{5i} \Delta INF_{t-i} + \varepsilon_t \tag{2}$$

Where Δ indicates the first differences of the variables. The bounds test procedure has been performed for testing co-integration. This bounds test is depending on Wald or F-statistic, which follows a non-standard distribution (Pesaran, 2001).

In this analysis, the following null hypothesis is to be considered

H₀: no co-integration between the variables

H₁: co-integration between the variables

The ARDL restricted error correction mechanism (ECM) method is defined as follows:

$$\Delta AGG_t = \beta_0 + \Sigma \gamma_{1i} \Delta AGG_{t-i} + \Sigma \gamma_{2i} \Delta ACG_{t-i} + \Sigma \gamma_{3i} \Delta ADPAG_{t-i} + \Sigma \gamma_{4i} \Delta IR_{t-i} + \Sigma \gamma_{5i} \Delta INF_{t-i} + \delta ECM_{t-1} + \varepsilon_t \tag{3}$$

The coefficients of the lagged different variables give the short run dynamics of the model, which converge into the long run equilibrium direction. Whenever it is expected, δ to be less than zero that implies the dynamic adjustment of the model. However, the speed of adjustment to the equilibrium relationship after shocking period is the coefficient of the ECM term in this model.

6. Empirical Findings and Discussions

This portion of the paper presents the descriptive statistics, analyses of ARDL bounds test, results of diagnostic tests and then analytical discussion of these outcomes.

Table 1. Descriptive Statistics

	AGG	ACG	ADPAG	IR	INF
Mean	3.577500	8.934590	15.96456	11.99450	6.512238
Median	3.445000	9.468862	13.98575	12.17500	6.449123
Maximum	7.200000	62.12837	72.33749	13.86000	12.30704
Minimum	-0.640000	-36.40340	-14.83087	9.560000	1.938702
Std. Dev.	1.939348	18.33827	20.15680	1.409384	2.594227
Skewness	0.029169	0.448826	1.048230	-0.340945	0.371210
Kurtosis	2.692749	6.163557	4.488370	1.948856	3.070089
Jarque-Bera	0.081505	9.011564	5.508660	1.308233	0.463416
Probability	0.960067	0.011045	0.063652	0.519901	0.793178
Sum	71.55000	178.6918	319.2912	239.8900	130.2448
Sum Sq. Dev.	71.46037	6389.552	7719.635	37.74089	127.8703
Observations	20	20	20	20	20

Source: Author’s estimation using the E-Views 10.

From the descriptive statistics table, based on the estimated probability of the Jarque-Bera test we can say that except for the variables ACG and ADPAG, all other variables follow the normal distribution.

It does not require in performing any stationarity test as well as the co-integration test in order to check the stationarity assumption and to find out the order of integration for determining the short run and the long run relationships in the ARDL bounds test approach. For the co-integration test in the ARDL modeling, the optimal lag length of the study variables is selected empirically using Akaike’s information Criterion (AIC) and hence, there is no serial correlation in any variables. The bounds test method for co-integration is employed using the F test in this study. The following table 2 shows the bounds test results for the co-integration of the variables.

Table 2. Bounds Test for Co-integration (F test)

F-Statistic	Critical Values (Lower Bounds)	Critical Values (Upper Bounds)	Significance
	I(0)	I(1)	
4.012612	2.20	3.09	10%
	2.56	3.49	5%
	2.88	3.87	2.5%
	3.29	4.37	1%

Source: Author’s estimation using the E-Views 10.

Theoretically, the bounds test does not necessary to test the series, which are stationary for co-integration. But if the variables are I(2) or beyond it does not exist in the ARDL model. So the decision has come up whether it is accepted or rejected depending on the variables maybe I(0) or I(1) only. Actually, it exists whenever the calculated value of the F-statistic is greater than the critical value of the upper bound. Table 2 represents co-integration between variables using the bounds test approach, which indicates that the estimated value of the F-statistic (4.01) exceeds the upper bound critical value at the 5% level of significance. Therefore, it is suggested that the co-integration is present between the variables. Finally, we can easily say that the long run relationship exists between the variables.

Table 3. Long Run Relationship of the Variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ACG	0.071745	0.051714	1.387336	0.1955
ADPAG	0.133097	0.055409	2.402077	0.0372
IR	0.401936	0.317871	1.264463	0.2347
INF	-0.338736	0.288413	-1.174482	0.2674
C	-2.027993	3.859325	-0.525479	0.6107

Source: Author’s estimation using the E-Views 10.

The long run estimations in table 3 using the ARDL approach reveal that the coefficients of agricultural credit, government expenditure on agriculture and inflation rate showed the right expected sign while only the government expenditure on agriculture is found to be statistically significant at the 5 % level. This relation indicates that a 1% increase in the growth of annual development expenditure on agriculture is associated with a 0.13% increase in agricultural GDP growth. Although the coefficient of the banking sector agricultural credit disbursement growth is not statistically significant, but the expected positive sign gives the useful insight about its true economic relationship with agricultural GDP growth substantially.

Table 4. Short Run Relationship with Error Correction of the Variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ACG)	0.021502	0.016336	1.316227	0.2175
D(ADPAG)	0.063529	0.011975	5.304971	0.0003
D(INF)	0.457574	0.194511	2.352431	0.0405
Coin-Eq.(-1)	-0.950435	0.158157	-6.009451	0.0001

Source: Author's estimation using the E-Views 10.

Note: D(ACG), D(ADPAG) and D(INF) denote the first differences of the respective variables; Coin-Eq.(-1) denotes the one period lagged error correction term.

Table 4 shows the short run estimation and the coefficient of the error correction term takes a negative sign, which is also found to be statistically significant. Such relationship focuses that the speed of adjustment from short-run disequilibrium towards long-run equilibrium is about 95% in the agricultural GDP growth equation, which means 95% of the disequilibrium in agricultural GDP growth is adjusted each year or less than a year to the long run relationship. The error has been corrected or the adjustment process has taken place significantly from short run to long run through the growth of annual development expenditure on agriculture and the inflation rate in a consistent statistical manner.

Table 5. Diagnostic Tests and Model Specification Test

Test	Test Statistics	P value
Serial Correlation	F-statistic = 2.4819	0.1450
Normality test	Jarque-Bera = 2.3978	0.3015
Heteroscedasticity	F-statistic = 5.1200	0.0096
Ramsey RESET	F-statistic = 0.1274	0.7293

Source: Author's estimation using the E-Views 10.

This study considers several diagnostic tests with model specification test for the ARDL estimators reflected in table 5. The results indicate that there is no serial correlation among the estimated disturbance terms of the ARDL model and the normality test of the model is satisfied the assumption of normally distributed estimated residuals. The homoscedastic assumption is not fulfilled that may happen when there may have other factors those have strong influences on agricultural productivity. Moreover, the Ramsey Reset test suggests the model specification is well enough for explaining the variation of agricultural productivity in Bangladesh.

7. Policy Measures

The empirical findings of the study refer to the long run integration between agricultural credit and agricultural productivity in sense of the direction of macroeconomic agent movements, although such a relationship is not significantly justified in terms of the statistical phenomenon. Conversely, the association between government expenditure on agriculture and agricultural productivity is statistically well-identified and showing a substantial level of relationship. The government development expenditure on agriculture is more influential rather than the agricultural credit to boost up the agricultural productivity in Bangladesh perspective until now. The agricultural credit facilitation is necessary in parallel with government financing for agricultural projects in fostering the productivity of the agriculture sector. The private sector credit growth through agricultural credit in the production sector will definitely ensure the timely financing needs or mitigate the financing gap by the active participation of the private sector as the government budgetary allocation for the development of the agriculture sector is limited.

Timely finance to agricultural production can increase productivity and can fulfill the huge food demand for the higher population. Although, Bangladesh Bank has tried to mobilize the timely agricultural credit disbursement to rural poor farmers by its agricultural credit policy and program, but the farmers are still facing a significant number of barriers for getting credits from formal institutional sources. The major barriers are inadequate access to finance, higher interest rate, complex institutional procedure, limited institutional source, high collateral requirement, low institutional capability, and political influence, etc. The government as well as the Bangladesh Bank should take the proper policy initiatives that could ensure the easy and timely agricultural credit facility to farmers for improving agriculture production including food security.

8. Conclusion

The purpose of this study is to estimate the impact of agricultural credit programs on agricultural productivity in Bangladesh. Recently, despite the structural transformation of Bangladesh's economy towards the service and industry sector, there is a huge importance of the agricultural sector in order to generate employment and fulfilling the increasing food demand for a rapidly growing population. Since, agricultural credit can be played a stimulating role in promoting the development of the agricultural sector, especially in food production as well as poverty alleviation. And hence it is essential to understand the proper linkage from agricultural credit to the productivity of agriculture sector through analyzing the appropriate macroeconomic behaviors.

Now a day, the access to agricultural credit has been expanded with the integrated efforts of commercial banks including NGO-MFIs. No doubt about it, the comprehensive policy initiatives of Bangladesh Bank on the agricultural credit program have fostered the credit access for poor farmers. Although, the contribution of private commercial banks and foreign banks are somewhat limited; however, their participation in agricultural financing project seemed as a surprising movement of a formal private sector contribution to agricultural financing in rural dominated Bangladesh. In fact, it is well accepted that the universal coverage of agricultural credit to poor farmers helps to promote agricultural production and their household income. The empirical measures of this study might be considerably useful in order to formulate an effective policy for the agricultural credit program. The proper policy support for credit program would definitely play a crucial role in universally credit financing to the poor rural agricultural households and that will ensure sustainable agricultural production growth, establish nationwide food security, and consequently, alleviate poverty by increasing household income level. However, it is expected that by utilizing more explanatory variables, low-frequency data with a large number of observations and applying different modern methodologies, the further study would be able to fulfill the gaps or limitations of this research work.

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