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Agriculture Sector Credit and Output Relationship in Nepal

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Authors' contributions

This work was carried out in collaboration between both authors. Author AKD designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author KKT managed the analyses of the study and rechecked the statistical calculations.

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ABSTRACT

Purpose: The purpose of this study is to find out the condition of priority of commercial banks to provide loans to the agricultural sector and to find the relationship and impact of agricultural loans to the agricultural GDP of Nepal.
Objectives: This study aims to compare the condition of loan disbursements in agricultural and manufacturing sectors. It further aims to compare loan percent with growth and contribution to the GDP of the agricultural and industrial sectors and tries to show the impact of agricultural loans to the agricultural GDP of Nepal.
Methods: It was based on a descriptive and analytical research design. Statistical tools standard deviation, correlation, regression, etc. are used and Excel, and EViews software are used for the statistical calculations. Statistical calculations and graphs are simultaneously used to show and compare the condition of variables.
Results: Commercial banks give higher priority to the manufacturing sector for loans than the agricultural sector. The Johansen Co-integration test indicates no long-run relationship between loans of commercial banks and agricultural output in Nepal. However, the least-squares method, it indicates that a positive causal relationship between agricultural loans and agricultural growth.
Implications: The loans of commercial banks directly stimulate the growth of agriculture but the

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amount of growth is less noticeable. Thus, it is concluded that the commercial bank's loan alone cannot affect and control the growth of the agricultural sector of the Nepalese economy therefore the government should increase its expenditure on the agricultural sector.

Keywords: Commercial banks; agricultural sector; manufacturing sector; agricultural GDP; correlation.

1. INTRODUCTION

Agriculture is the largest sector in Nepal in terms of employment, GDP, export earnings, and raw materials supply to the existing manufacturing industries and plays a vital role in the economic development of the nation. Additionally, the agricultural sector is the main source of raw materials for the domestic manufacturing sector and ultimately, for agriculturally dependent rural households [1]. Agricultural plays a significant role in Nepal's economy, employment, livelihood, contributing nearly 28% to GDP, 66% to employment, and 50% of exports [2].

In Nepal, the agricultural sector is important because it is a source of income, employment, livelihood, and environmental protection. Based on available means and resources, the agricultural sector has been accorded top priority since the fifth five years plan among the various periodic plans [3]. Nearly, 18.7% of people in Nepal live below the poverty line [4]. Poor are farmers and farmers are poor in Nepal. Agricultural productivity is low in Nepal. This is because of the fluctuation of ago-based products, small land holding, traditional culture, methods, poor irrigation facilities, low or misuse of farm technology, low productivity of land and problem of credit availability, farmers cannot invest in agriculture from their savings. Thus, credit agencies are necessary to help farmers in applying and undertaking the improved farm practices. Therefore, agricultural credit plays a major role in agricultural development. Different sources, like formal and informal are available in the agricultural credit market in Nepal [5].

Farmers need loans when their earnings or income do not meet their consumption and investment needs. There are two sources of agro-finance; the formal sector and the informal sector. Out of the total rural credit requirements, it is estimated that only about 30 percent of rural demand is fulfilled by the formal sector and rest 70 percent agro-finance is fulfilled by the informal sector [6]. There are 27 commercial banks, 23 development banks, 22 finance companies, and 89 microfinance companies in Nepal [7]. The loan is the lending of money by one or more individuals, organizations, or other entities to other individuals, organizations, etc. The recipients incur debt and are usually liable to pay interest on that debt until it is repaid as well as to repay the principal amount borrowed.

Nepalese farmers carry out their agricultural activities mostly for subsistence purposes and cereal crops have their dominance in agricultural products. Inadequate provision of irrigation facilities is one of the major causes of low production and low productivity in the agricultural sector of Nepal. Recent studies show the growth rate of that investment in agricultural sector is less than another economic sector. Agricultural financing is one of the most important factors in the development of rural areas in developing countries. In fact, the facilitation of access to credit can raise the amount of productive investment. Credit has a crucial role in the elimination of farmers' financial constraints to invest in farm activities, increasing productivity, and improving technologies. Credit accessibility is important for improving the quality and quantity of farm products.

Credit flow is still very low compared to other subsectors of the Nepalese economy [8]. Nepal's agricultural development strategy 2015-2035 is the key document that provides a roadmap for the development of agriculture in the country. In 2017, realizing the need to increase investment in the agricultural sector, the central bank of Nepal, Nepal Rastra Bank (NRB), adopted the priority sector lending programme (PSLP). This program mandates banks and financial institutions to allocate 10% of their loan portfolio to the agricultural sector at a subsidized interest rate of 5% [9]. For the development of the nation, the agricultural sector must be uplifted from subsistence levels. The question of agricultural development versus industrial development has become a false issue. Instead of the emphasis is on the inter-relationship between industry and agriculture and the contribution that one sector can make to the other. The intimate and complex relationship between agriculture and the rest sector of the economy, which goes on changing along with economic growth, has been recognized as an important factor in the development process [10].

Agricultural development is determined with respect to crops, purchase, and installation of agricultural equipment, livestock, marketing of agricultural goods, agricultural innovation and invention, fisheries, poverty alleviation, and income-generating activities [11]. This is possible if and only if the bank and financial institutions give priority to provide loans to the agricultural sector. Various banking and financial institutions have heterogeneously implemented their loan policies but ultimately it impacts positively in the field of agriculture [12]. Sectoral components of GDP, such as agriculture, industry, and services are the productive sectors. Investment in the productive sectors has been the main focus of the government thus stimulating economic growth and generating income and employment opportunities. The NRB has made mandatory provision of lending in the agriculture and productive sectors to support the economy. To achieve sustainable economic growth of the nation, NRB directed to the bank and financial institutions (BFIs) to lend in some priority sectors of the economy. Currently, directed lending is focused on the priority sector and the deprived sector [13].

Despite dismal lending demand from the growth of accelerator agriculture, a deliberate focus on the agricultural sector by both government and central bank with rapid agricultural insurance implementation helps boost lending. However, the lending idea and decisions are still in the bleak for many banks due to the lack of the nature of business and inherent risks occupied by such factors. Priority sector lending is mandatory but there are many problems under it. Banking and financial institutions are not interested to provide loans in the agricultural sector. Their decision-making practice depends on the clothing condition of the customer. Only businessmen, traders, and industrialists can earn and able to pay loan installment to the bank. The bank and financial institutions betray the government and central bank by saying no demand for loans from the priority sector of government, especially from farmers. The farmers are indeed unable to fulfill the procedure of loans and they are unable to show the source of guarantee to pay loans [14].

2. STATEMENT OF THE PROBLEM

Improving the productivity of the agricultural sector requires a greater effort either from the government, NGOs, INGOs, or commercial banks. Consequently, agricultural finance is one that could play a greater role to enhance the level of agricultural output. Despite the government of Nepal's priority and policy efforts for more than two decades, the growth rate has been very slow, which is below 3%. Commercial banks are not interested to provide loans to the agricultural sector, especially, to farmers. Main agricultural loan goes to the agro-based business, not to the agro-based production sector. Real farmers are unable to fulfill the procedures of loan and they have to tangible assets of security for loan procedure for commercial banks. Commercial banks are indirectly guided by the principle that manufacturing sectors are more productive than the agricultural sector of the economy. Although the government and central bank directed lending to commercial banks in priority sectors. But the commercial banks evade the government policy by saying no demand for loans from the government's priority sector. Various research covers the impact of agricultural loans to the recipients on economic status, earnings, effect on production function, relation on particular commodities, place, productivity and covered area of cultivable land but there nominal studies are conducted on the condition of priority of loan disbursement on agricultural sector of commercial banks, overall relation of agricultural loans to the growth rate of agricultural sector, comparison of loan growth rate and product growth rate between agricultural and manufacturing sectors. To fill this type of research gap, this research may be useful. It is claimed to be significant from a policy perspective. The present work tries to answer the following research questions:

1) What is the condition of loan disbursement in agricultural and manufacturing sectors by the commercial banks of Nepal?
2) What type of condition can be seen between loans percent and the contribution of agricultural sector to GDP?
3) What type of relationship can be found in agricultural loan and agricultural output growth in Nepal?

3. REVIEW OF LITERATURE

There are so many research studies about the importance of loan to increase the productivity and growth of the agricultural product, Similarly, research studies are conducted on the impact of formal sector loan to improve the economic status of the farmers. Among the crowds of agricultural research, some relevant literature is reviewed in this section.

Pervaiz, Khan, et al. [15] observed the condition and constraints of agricultural loans in Pakistan by using primary data from 291 respondents. From the analysis, they concluded that the majority of small farmers are deprived of getting a loan. Access to loans by small farmers was badly hampered by a lack of grantees, high rates of interest, complicated procedures, and religious reasons. The relationship between the size of loan holdings and access to loans indicates that the relationship is statistically significance at 1% ($P<0.01$). This means it rejects the null hypothesis of no relationship between loan holding and access to loans. Sarkar [11] indicates that banks play a significant role in agricultural development in Bangladesh. There is a positive association between agricultural credit and agricultural production.

Rehman et al. [16] have shown a high-level correlation (0.938 with statistical significance 1%) between agricultural credit accessibility and greater production. In addition to this food grains production, and fisheries production have a higher correlation (0.948), whereas, livestock products like milk, meat, and eggs have been found to correlate 0,772, 0.938, and 0.688 respectively, all of which statistically significant at 1% significant level. Agricultural credit has a positive impact on household income and GDP growth rate. Zuberi [17] studied the role of institutional credit based on the time series data and found lower productivity of major crops in Pakistan than in most of the less developed countries in this region, He also concluded that the availability of loans alone cannot increase the productivity of the agricultural product. The institutional complex, the productivity of loans, natural condition, religious belief, and other related facts must be considered.

Rimal [3] studied the agricultural credit flow of commercial banks and its impact on agricultural productivity in Nepal and found that a percentage change in agricultural credit flow of commercial banks will on average brings a 0.183 percentage change in agricultural GDP. The study brings to a close estimation that agricultural credit flow of commercial banks has a positive impact on agricultural production and is a significant determinant of improving agricultural gross domestic product of the agrarian country like Nepal. Sail et al. [18] present some important findings of agricultural production from institutional credit in Pakistan. The researchers observed that agricultural credit, availability of water, cropping intensity and agricultural labour force are positively and significantly related to agricultural production.

Ibrahim et al. [19] found that in Ethiopia the formal sector was the main source of credit in rural and urban areas. The study concluded that by reducing bureaucracy, transportation cost, and other barriers in the way of credit disbursement will enhance the agricultural output. Iqbal and et al. [20] found the high degree positive association between agricultural loans and agricultural products. Kohansal et al. [21] observed that the accessibility of agricultural loans increases productivity and the cultivation area. Agricultural loan increases the productive of agro-based product and decreases poverty.

Hartarska et al. [22] observed the impact of agricultural credit and economic growth in rural areas of the U.S economy. The found the positive association between agricultural lending and agricultural GDP growth per rural resident with the additional burden of loan. Kayani et al. [23] evaluated the effect of agricultural loans on productivity and income of farmers. There was a significant impact on farm productivity of loan of commercial banks if it is not used as non-productivity i.e. construction of houses, purchase of vehicles, and marriages. Temi and Olubiyo [24] found the positive impact of agricultural credit on agricultural production in Nigeria.

Medugu, Musa, & Abalis [25] observed the commercial bank's credit and agricultural product in Nigeria covering the period of 1980 to 2018. Ordinary least square method was employed to estimate the relationship among the variables and the result showed a positive and significant relationship exists between the commercial bank's credit and agricultural output in Nigeria. The same relationship also exists between expenditure made on agriculture by the government and agricultural output. R^2=0.98, which means 98% of the variation in agricultural output is explained by the expansionary variables i.e. credit of commercial banks and expenditure made by the government on agriculture. Oyelade [26] invested the impact of commercial banks' credit on agricultural output in Nigeria over the period of 1980 to 2015. This study found that the commercial bank's loan and the interest rate on commercial banks credit to agriculture determine and affect the output of the agricultural sector. Olowofeso, Adeboye et al. [27] investigate the relationship between agricultural sector credit and output relationship in Nigeria utilizing a nonlinear autoregressive distributed lag model. Results show no evidence of asymmetry in the

impact of credit to output growth in the agricultural sector in short-run but different equilibrium relationship exists in long run.

A review of studies indicates that there is a relation between loans of commercial banks and change in agricultural output in many countries of the world. From the above-reviewed literature, it is clear that researchers have not considered the relationship between the proportion of loans in agriculture and the contribution of agricultural sector to the GDP of the country. Similarly, the relationship between loan growth rate and change in the growth rate of agriculture is not considered. The comparison of the growth rate of loan and output is made in both agricultural and manufacturing sectors, so there is a vast research gap between former studies and this present study. To fill the gap, the present study is undertaken.

4. MATERIALS AND METHODS

4.1 Research Design

As per the research design, descriptive as well as analytical research design has been applied. Econometric and statistical tools and models have been used to measure the impact of agricultural loan to agricultural GDP. For analyzing and interpreting the data collected through different sources in the process of presentation and analysis quantitative methods have been applied with the help of Excel, E-views 10 software package.

4.2 Data Analysis and Tools

The data related to loans to different sectors of the economy and agriculture GDP and industrial GDP covering the period 1999-2018 is taken into consideration. As the study is time series econometrics; unit root test, Johansen test of co-integration, Granger causality test, vector error correction model are applied to test whether these variables are stationary or not, whether they have the long-run relationship between independent and dependent variables or not and whether one variable granger cause another variable or not.

4.3 Specification of the Model

The agriculture output of the economy is affected by the loan disbursement by the commercial bank, particularly to this sector. This paper focused on studying the impact on agricultural output due to commercial bank loan disbursement in the agriculture sector. Researchers assume the hypothesis that there is no relationship between loan to agriculture and the generation of agricultural output. To confirm the hypothesis let us consider linear regression equation: -

$$AGRGDP = \beta_1 + \beta_2 AGRLN + \varepsilon \quad (4.1)$$

Where AGRGDP and AGRLN represent the agriculture GDP and loan to agriculture by commercial bank at a particular time respectively while ε represents the error term, β_1 and β_2 are the intercept and slope and coefficient of regression. The coefficient of regression β_2 indicates how a unit changes in the independent variable (AGRLN) affects the dependent variable agriculture GDP. The error ε_i is incorporated in the equation to cater for other factors that may influence agriculture GDP. The validity or strength of the Ordinary Least Square method depends on the accuracy of the assumptions. In this study, the Gauss Markov assumptions are used and they include; that the dependent and independent variables are linearly correlated, the estimators (β_1 and β_2) are unbiased with an expected value of zero i: e $E(\varepsilon_i) = 0$, which implies that on average the errors cancel out each other.

4.4 Stationary versus Non-stationary of Time Series Data

The initial step for establishing the presence of a long-run relationship between variables is to determine the optimal lag length. Lag-length misspecification for the model often generates autocorrelated errors Lutkepohl [28]. Excessively short-lags may fail to capture the causality, lead to omitted variables, the bias in the remaining coefficients, and likely to produce serially corrected errors. Too many lags lead to loss of a degree of freedom and can cause multicollinearity, serial correlation in error terms, and misspecification error.

A stochastic process is said to be stationary if its mean and variance are constant over time and the value of the covariance between two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed (Gujarati, 2004). The stationary property of the data series has to be checked to prevent biased conclusions in the study. For this purpose, the Augmented Dickey-Fuller (ADF) unit root test was used to check stationarity under the

following equations Yetiz, [29]; Rahman et al., [30].

$$\Delta Y_t = \gamma Y_{t-1} + \delta_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \text{ (no trend, no intercept)} \quad (4.2)$$

$$\Delta Y_t = \alpha + \gamma Y_{t-1} + \delta_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \text{ (intercept only)} \quad (4.3)$$

$$\Delta Y_t = \alpha + \beta T + \gamma Y_{t-1} + \delta_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \text{ (trend and intercept)} \quad (4.4)$$

Where α is an intercept (constant), β is the coefficient of time trend T, γ and δ are the parameters where, $\gamma = \rho - 1$, ΔY_t is the first difference of Y_t series, m is the number of lagged first-differenced term, and ε_t is the error term. The test for a unit root is conducted on the coefficient of Y_{t-1} in the regression. The unit root test is carried out under the null hypothesis implies unit root presents.

4.5 Co-integration and Granger Causality Test

In the next step, the Johansen Cointegration test was used to determine possible cointegration relationship among data series. In this model, the cointegration relationship is shown below, and if the error term is stationary I(0), two series is concluded cointegrated.

$$Y_t = \beta X_t + \varepsilon_t \quad (4.5)$$

H_0: β=0 (series are not cointegrated)
H_A: β≠ 0 (series are cointegrated)

The rejection of null hypothesis H_0 indicates the cointegration of series, which means that the series take joint action in the long run. However, this test does not reveal the direction of the relationship. One method that can be used for this purpose is the Granger causality test. To test for Granger causality, we will estimate a VAR model as follows, in which all variables are initially considered symmetrically and endogenously Rahman et al., [30], Gaspar et al., [31].

$$Y_t = a_0 + a_1 Y_{t-1} + \cdots + a_p Y_{t-p} + b_1 X_{t-1} + \cdots + b_p X_{t-p} + \mu_t \quad (4.6)$$

$$X_t = c_0 + c_1 X_{t-1} + \cdots + c_p X_{t-p} + d_1 Y_{t-1} + \cdots + d_p Y_{t-p} + v_t \quad (4.7)$$

Here, testing H_0: $b_1 = b_2 = \ldots\ldots = b_p = 0$, against H_A: 'Not H_0', is a test that X does not Granger cause Y. Similarly, testing H_0: $d_1 = d_2 = \ldots\ldots = d_p =$ 0, against H_A: 'Not H_0', is a test that Y does not Granger-cause X. In each case, a rejection of the null implies there is Granger causality.

5. OBJECTIVES OF THE STUDY

This study represents the condition of priority of commercial banks to provide loan to the agricultural sector by comparing with the manufacturing sector. It also tries to establish the relationship between the annual growth rate of loan and production of agricultural sector. The specific objectives of the study are:

1) To compare the annual growth rate and percent of loan disbursement on agricultural and manufacturing sectors by the commercial banks of Nepal.
2) To compare loan percent with growth and contribution to the GDP of the agricultural and industrial sector
3) To show the impact of commercial bank's loan to agricultural GDP of Nepal.

6. LIMITATIONS OF THE STUDY

This study is limited to find out the condition, relation, and impact of agricultural credit to the growth rate of the agricultural product on the national level. The loan of commercial banks covers the loan provided by commercial banks, development banks, microfinance companies, and other financial institutions. It does not consider the impact of agro-finance on its clients. It is based on the secondary data collected from various economic surveys and the central bureau of statistics (CBS) of Nepal from fiscal year 1990/00 to 2018/19. This means it covers 20 years. It compares the loan percent of the total loan provided by commercial banks to the agricultural and manufacturing sectors with the annual growth rate of production and contribution to the GDP of these sectors. It also compares the condition of the priority of commercial banks to provide loans between agricultural sector and manufacturing sector of the economy of Nepal. It mainly examines the role of commercial bank's loan to the agricultural growth rate and Agricultural GDP. The analysis which is not taken in this study all is considered as the limitations of this research.

7. RESULTS AND DISCUSSION

7.1 Condition of Loan Disbursement

The solution for agricultural development problems lies in increasing the per unit

productivity of loans and labour. Agricultural development means a positive increase in aggregate agricultural production accompanied by an increase in per capita real income for the agricultural family. Low productivity of the agricultural sector is mainly responsible for the low level of PCI and the growth of the Nepalese Economy is ultimately related to the growth rate of the agricultural sector. Like other sectors of the economy, an increase in investment is essential for the increment of agricultural growth. The commercial banks play a significant role in the fulfilment of loan deficit of the farmers and other agro-based businesses and enterprises. The condition of loan disbursement in the agricultural sector by commercial banks is presented in the following Table.1.

According to Table 1, the percentage loan ranges from 2.70% to 8.91 % in the agricultural sector of the total loan disbursement of commercial banks of Nepal during 20 years from 1999/00 to 2018/19. But the loan disbursement ranges from 16.42 to 45.27 in the manufacturing sector in the same period. It shows the condition of priority in loan disbursement of commercial banks. It is concluded that agricultural sector comes under less priority in loan disbursement in the view of commercial banks. The following Figs. 1 and 2 compare the condition of loan disbursement in agricultural and manufacturing sectors by the commercial banks of Nepal.

7.1.1 Comparison of loan disbursement by sectors

The statistical measurement of the growth and percent of loans by sectors is presented in Table 2.

Table 1. Amount, percentage and annual growth rate of loan by sectors

Fiscal Year	Agriculture	%	Growth rate	Manufacturing	%	Growth rate	Total	Growth rate
1999/00	609.59	7.25	-	3806.21	45.27	-	8408.25	-
2000/01	886.37	8.91	45.40	4488.53	45.13	17.93	9945.38	18.28
2001/02	999.94	8.86	12.81	5100.89	45.20	13.64	11286.07	13.48
2002/03	373.45	3.09	-62.65	4291.05	35.54	-15.88	12075.46	6.99
2003/04	490.19	3.61	31.26	4718.15	34.79	9.95	13563.02	12.32
2004/05	441.55	2.77	-9.92	5374.42	33.73	13.91	15932.32	17.47
2005/06	457.2	2.59	3.54	5647.5	31.98	5.08	17657.81	10.83
2006/07	1388.2	5.99	203.63	6237	26.90	10.44	23184.3	31.30
2007/08	1388	4.53	-0.01	7488.98	24.43	20.07	30653.41	32.22
2008/09	1337.63	3.33	-3.63	8787.8	21.87	17.34	40177.8	31.07
2009/10	1429.09	3.04	6.84	9471.37	20.18	7.78	46933.18	16.81
2010/11	1419.2	2.70	-0.69	11518.6	21.89	21.61	52624.6	12.13
2011/12	23407.3	3.76	1549.33	143972.2	23.13	1149.91	622537.4	1082.98
2012/13	3153.1	4.16	-86.53	17666.2	23.33	-87.73	75709.1	-87.84
2013/14	4027.01	4.47	27.72	20742.82	23.02	17.42	90100.86	19.01
2014/15	6515.98	4.78	61.81	25556.56	18.76	23.21	136208.68	51.17
2015/16	7879.15	4.68	20.92	29611.12	17.61	15.87	168185.26	23.48
2016/17	9004.1	4.53	14.28	32980	16.60	11.38	198622.4	18.10
2017/18	13575.66	5.60	50.77	39785.35	16.42	20.63	242277.88	21.98
2018/19	193457.41	6.64	1325.03	478560.93	16.43	1102.86	2911896.87	1101.88

Source: Economic surveys of Nepal 2000/01, 2008/09, and 2019/20.
Note: - The percent of loan and growth rate are calculated from the available data

Table 2. Statistical measurement of growth and percent of loans by sectors

Description	Growth rate			Covered percentage		
	Mean	Standard Deviation	Coefficient of variation	Mean	Standard Deviation	Coefficient of Variation
Agriculture	167.89	270.98	161.4	4.77	1.47	30.8
Manufacturing	125.02	210.81	168.62	27.11	8.19	30.19
Total	128.09	203.02	158.5			

Note: - Statistical values are calculated by using excel 2016

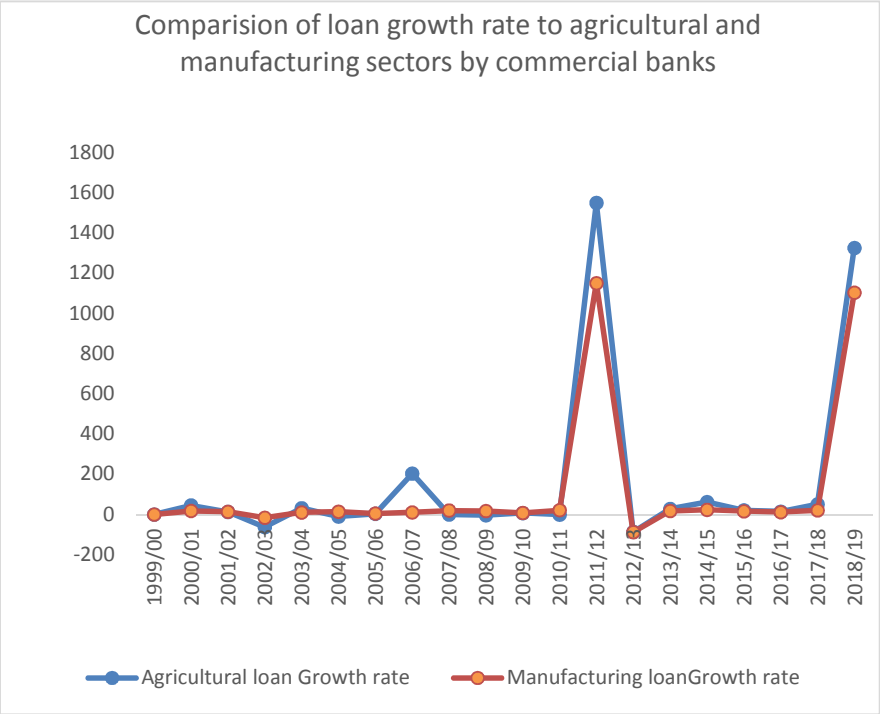

Fig. 1. comparison of loan growth rate by sectors

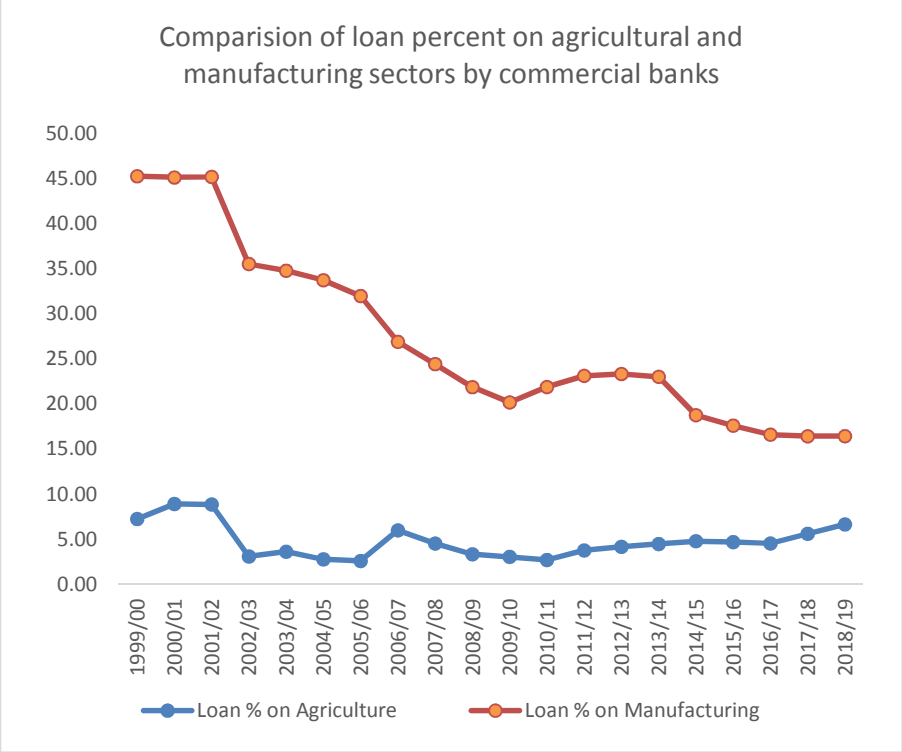

Fig. 2. Comparison of loan percent by sectors

According to Table 2, the mean of growth rate of agricultural loans is 167.69 where it is 125.02 in the manufacturing sector. The standard deviation of agricultural sector's loan growth rate (270.98) is greater than the manufacturing sector (210,81). Therefore, the mean of manufacturing is more representative. Recall that the standard deviation is used in judging the representativeness of mean. The coefficient of variation of manufacturing sector (168.62%) is more than agricultural sector (161.4%). So, the growth rate of loans of manufacturing sector is more variable than the growth rate of agricultural sector. Similarly, the average of loan percentage to agricultural sector is 4.77% of the total loan disbursement of commercial banks for 20 years whereas that average is 27.11% in manufacturing sector. The standard deviation of the percentage covered by the loan of agricultural sector (1.47) is less in comparison to manufacturing sector (8.19). So, the mean of loan percentage covered by agricultural sector is more representative. The coefficient of variation of loan percentage covered by agricultural sector is slightly more than manufacturing sector. So, the loan percentage of manufacturing sector is more consistent than agricultural sector.

7.2 Comparison of Loan Percent with Growth and Contribution to GDP

Investment is necessary for the growth of production of any sector of the economy. The loan of commercial banks plays a significant role in the fulfilment of a deficiency of capital for investment. An increase in loans automatically increases the amount of investment in the particular sector of the economy. The following Table 3 compares the loan percent of the total commercial bank's loan to the agricultural and manufacturing sector with annual growth rate of production and contribution to GDP of the respective sector.

According to Table 3, the percentage of contribution to GDP from agricultural sector is more than the manufacturing sector. The standard deviation of the annual growth rate of loans of the agricultural sector (1.47) is less than the standard deviation of manufacturing sector (2.38). So, the average of annual growth rate of loans to the agricultural sector by commercial banks is more representative than the manufacturing sector. Similarly, the standard deviation of the contribution of the manufacturing sector (0.98) is smaller than agricultural sector

Table 3. Comparison of loan percent and percent of contribution to GDP by sectors

Fiscal Year	Percentage of loan		Production growth rate			Contribution to GDP	
	Agriculture	Manufacturing	Agriculture	Manufacturing	Overall	Agriculture	Manufacturing
1999/00	7.25	45.27	4.9	6.8	6.1	36.98	8.47
2000/01	8.91	45.13	5.5	4.3	4.7	36.15	9.03
2001/02	8.86	45.2	3.01	-5.32	0.12	36.92	8.5
2002/03	3.09	35.54	3.32	0.04	3.95	36.03	8.2
2003/04	3.61	34.79	4.72	2.15	4.68	35.45	8.05
2004/05	2.77	33.73	3.45	2.62	3.48	34.71	7.92
2005/06	2.59	31.98	1.67	2	3.36	33.09	7.59
2006/07	5.99	26.9	0.94	2.55	3.34	32.04	7.48
2007/08	4.53	24.43	5.8	0.87	6.1	31.22	7.34
2008/09	3.33	21.87	2.98	-1.05	4.53	32.54	6.97
2009/10	3.04	20.18	1.99	2.96	4.82	35	6.34
2010/11	2.7	21.89	4.49	4.05	3.42	36.68	6.24
2011/12	3.76	23.13	4.58	3.63	4.78	34.82	6.34
2012/13	4.16	23.33	1.07	3.72	4.13	33.4	6.35
2013/14	4.47	23.02	4.54	6.28	5.99	32.16	6.2
2014/15	4.78	18.76	1	0.37	3.32	31.27	6.03
2015/16	4.68	17.61	0.01	-8	0.59	31.08	5.82
2016/17	4.53	16.6	5.14	9.7	8.22	29.14	5.48
2017/18	5.6	16.42	2.72	9.17	6.7	28.03	5.53
2018/19	6.64	16.43	5.05	6.82	6.99	26.98	5.65
Average			3.34	2.68	4.47	33.18	6.98
SD			1.47	2.38	1.45	2.43	0.98
CV			44.05	88.56	32.43	7.32	14.03

Source: Economic surveys of Nepal 2000/01, 2008/09, and 2019/20

(2.43). So, the average contribution of the manufacturing sector is more representative than agricultural sector. The coefficient of variation of the annual growth rate of loans of agricultural sector (44.05%) is less in comparison to manufacturing sector (88.56%). So, the loan growth rate in manufacturing sector is more variable than agricultural sector. Likewise, the coefficient of variation of the contribution to GDP from agricultural sector (7.32%) than the manufacturing sector (14.03%). So, the contribution to GDP from agricultural sector is more consistent than the manufacturing sector. The loan percentage and annual growth rate of agricultural sector are also compared in Table 3. The contribution to GDP from the agricultural sector is very high as compared to the loan percentage of commercial banks. The contribution to GDP from the manufacturing sector is comparatively low than agricultural sector but the more percentage of loans of commercial banks goes into its sector. It means that commercial banks give high priority to the manufacturing sector but less contribution to GDP is achieved. i.e. high priority to loan less contribution to GDP. The correlation coefficient between loan percentage and annual growth rate of agricultural sector is found 0.197. It means there is a low degree positive relationship between the percentage of loan to agriculture and the annual growth rate of production of the agriculture sector. The following Figs. 3 and 4 compare the loan percent, the annual growth rate of production, and contribution to GDP from the agricultural and manufacturing sectors of the Nepalese economy.

7.3 Impact of Loan to Agricultural Output

Generally, the loan increases the investment and investment increases the volume of production and growth of the product. This general conclusion may also apply to the agricultural sector. The condition of loan and agricultural product is presented in Table 4.

7.3.1 Lag selection

The Annex Table 1 shows the optimum lag structure. The results depict that majority of the selection criteria, such as the Final Prediction Error, Akaike Information Criterion, Schwarz Information Criterion, and Hannan-Quinn Information Criterion selected the optimum lag length of 1 at 5 percent level of significance. Since the star in the above table indicates lag order, all the criteria suggest selecting lag 1 for estimating the Johansen Co-integration Test and Granger Causality Test.

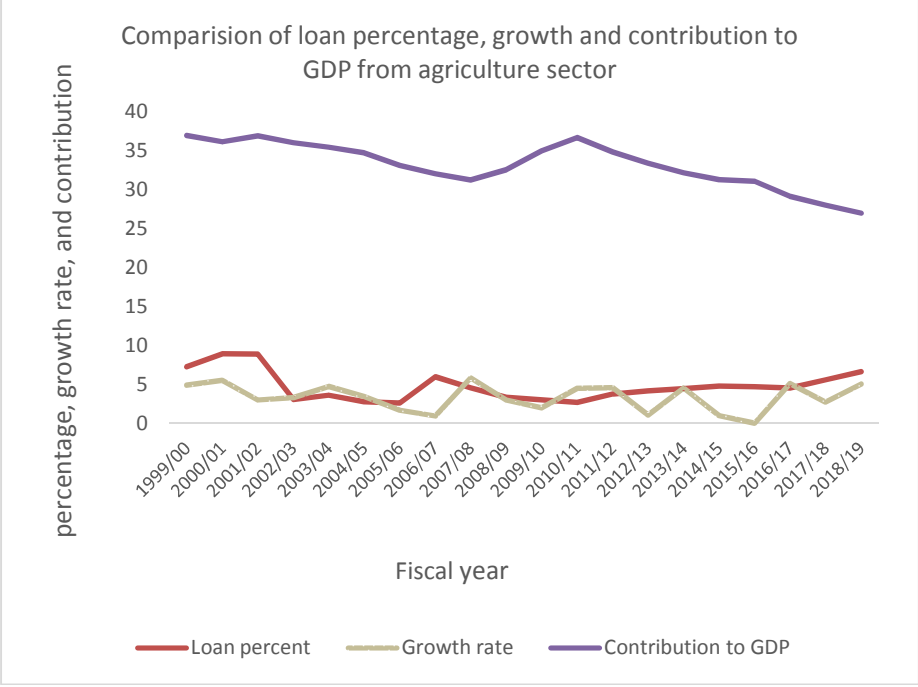

Fig. 3. Loan, growth, and contribution to GDP from agriculture

Table 4. Condition of agricultural loan and agricultural GDP

F/Y	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
AGRL	609.59	886.37	999.94	373.45	490.19	441.55	457.2	1388.2	1388	1337.63	1429.09	1419.2	23407.3	3153.1	4027.01	6515.98	7879.15	9004.1	13575.66	193457.41
TLN	8408.25	9945.38	11286.07	12075.46	13563.02	15932.32	17657.81	23184.3	30653.41	40177.8	46933.18	52624.6	622537.4	75709.1	90100.86	136208.68	168185.26	198622.4	242277.88	2911896.87
AGRGDP	13543.96	14945.46	15890.26	16585.51	17749.78	19037.91	20221.89	21665.80	23625.92	25585.26	41747.09	50139.87	53182.12	56613.37	63179.61	66609.79	70028.31	77934.73	85349.30	93318.24
TGDPN	36625.1	41342.9	43039.7	46032.5	50069.9	54848.5	61111.8	67621.1	75675.6	78627.1	119277.4	136695.4	152734.4	169501.1	196454	213015	225316.3	267449.3	304492.7	345879.3

Source: Economic surveys of Nepal 2000/01, 2008/09, and 2019/20

Where, F/Y= Fiscal Year, AGRL= Agricultural loan, TLN= Total loan issued by commercial banks, AGRGDP= Agricultural GDP, TGDPN= Total GDP of Nepal.

Based on the Table 4, the following statistical calculations are made

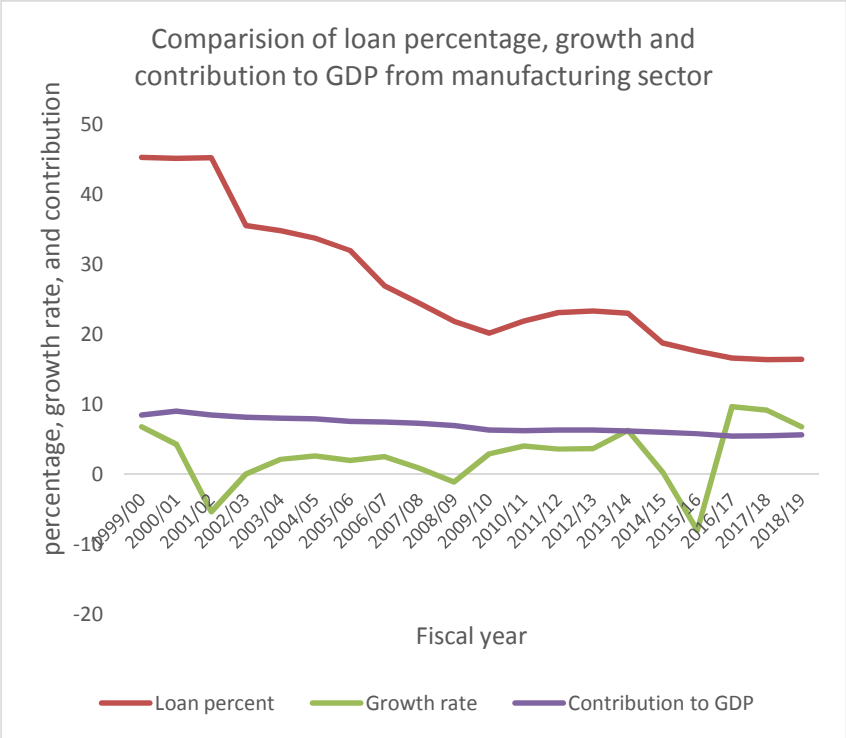

Fig. 4. Loan, growth, and contribution to GDP from manufacturing

Table 5. Johansen co-integration test

Sample (adjusted): 2001 2018				
Included observations: 18 after adjustments				
Trend assumption: Linear deterministic trend				
Series: LNAGRGDP LNAGRLN				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None	0.393827	9.070692	15.49471	0.3589
At most 1	0.003331	0.060062	3.841466	0.8064
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****
None	0.393827	9.010630	14.26460	0.2853
At most 1	0.003331	0.060062	3.841466	0.8064
Max-eigenvalue test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Authors' Estimation Results using E-views10, 2020
LNAGRGDP= Agricultural GDP taken at the constant price (taking log)
LNAGRLN= Agricultural loan by commercial bank taken in log form

7.3.2 Unit root test

The common method to test the presence of a unit root for all variables is Augmented Dickey-Fuller test (ADF test) using modified Akaike in levels and first differenced are presented in the annex number II. The annexed table shows the results of the ADF unit root test for AGRGDP and AGRLN. All the variables are non-stationary in their level forms and stationery in their first difference at a 5 percent level of significance. If the time series data are in integrated into order (1), we can proceed with the Johansen Test of Co-integration.

7.3.3 Johansen co-integration test

Having established that all variables are integrated of the same order; stationary after first differenced, we proceed with the Johansen co-integration test which allows us to test for a long-run relationship between agricultural loan by commercial bank and agricultural GDP and the results are given below.

According to Table 5, the outcome of the co-integration test employed using both trace and max-eigen test statistics indicates the absence of a long-run relationship between the agricultural loan by a commercial bank and agricultural GDP variables at 5 percent level of significance, thereby leading to the acceptance of the null hypothesis of no co-integration. From the result, it is therefore evident that agricultural GDP and loan to agriculture by the commercial bank are not co-integrated. Due to trace statistics is less than critical value and probability value is more than 5 percent, the null hypothesis is accepted meaning that no long-run relationship between AGRGDP and AGRLN. The same has happened at the result of the Maximum Eigenvalue test. Due to the negligible and flexible amount of loans in the agriculture sector in Nepal, there is no long-run relationship between these variables.

7.3.4 VAR model

After the Johansen cointegration test, it is known that all the variables are not cointegrated; the unrestricted VAR model has to use for measuring the degree of relationship. For this model, variables must be converted into first differenced since variables are non-stationary at the level.

From the help of lag selection and unit root test the following table gives the Vector Autoregressive model:

The targeted variable agricultural GDP; independent variable is positively related to its lagged values i.e. (0.177802) and negatively related to one lagged of loan to agriculture sector by the commercial bank but the coefficient is very small i.e. (-0.012605). Accordingly, the above table shows that both values are insignificant since the probability values are more than 5 percent (ANNEX-III). And again, if we assume agriculture loan as an independent variable,

Table 6. Vector autoregressive model

Vector Autoregression Estimates Sample (adjusted): 2001 2018 Included observations: 18 after adjustments Standard errors in ( ) & t-statistics in [ ]		
	D(LNAGRGDP)	**D(LNAGRLN)**
D(LNAGRGDP(-1))	0.177802	1.249755
	(0.25245)	(2.56036)
	[0.70430]	[0.48812]
D(LNAGRLN(-1))	-0.012605	-0.416657
	(0.02804)	(0.28440)
	[-0.44952]	[-1.46504]
C	0.085746	0.243228
	(0.03635)	(0.36865)
	[2.35895]	[0.65977]
R-squared	0.045574	0.139227
Adj. R-squared	-0.081683	0.024457
Sum sq. resids	0.168591	17.34132
S.E. equation	0.106016	1.075215
F-statistic	0.358123	1.213100
Log-likelihood	16.49498	-25.20538
Akaike AIC	-1.499442	3.133931
Schwarz SC	-1.351046	3.282326
Mean dependent	0.101756	0.299204
S.D. dependent	0.101935	1.088610

Source: Authors' Estimation Results using E-views10, 2020
LNAGRGDP= Agricultural GDP taken at the constant price (taking log)
LNAGRLN= Agricultural loan by commercial bank taken in log form

the loan is positively affected by one lagged of agricultural GDP but negative relation to its own one lagged value.

7.3.5 Granger causality test

The above result indicates that the probability value is more than the conventional level of the p-value, so we cannot reject the null hypothesis suggesting that agricultural loan does not Granger Cause agricultural GDP and agricultural GDP also does not Granger Cause agriculture loan. This means for the data there is no causal effect between variables taken for analysis.

Table 7. Granger causality test

Pairwise Granger Causality Tests Sample: 1999 2018 Lags: 1			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
	18		
D(LNAGRGDP) does not Granger Cause D(LNAGRLN)		0.23826	0.6325
D(LNAGRLN) does not Granger Cause D(LNAGRGDP)		0.20206	0.6595

Source: Authors' Estimation Results using E-views10, 2020
LNAGRGDP= Agricultural GDP taken at the constant price (taking log)
LNAGRLN= Agricultural loan by commercial bank taken in log form

7.3.6 Diagnostic checking

According to annex IV, due to the probability value of more than 5 percent that is 62.16 percent, we accept the null hypothesis, indicates there is no problem of serial correlation. Annex V indicates that the VAR residual heteroskedasticity whose p-value of 97.81 confirms the absence of heteroskedasticity in the model since its p-values are greater than the critical values at a 5 percent level of significance. Again, from the annex VI shows the results of the Jarque-Bera normality test with a joint probability of 0.000 indicates that residuals are not normally distributed. The different diagnostic tables presented in annex shows that there is no problem of serial correlation, absence of heteroskedasticity but residuals are not normally distributed. This all ensures the reliability of the model.

7.3.7 Ordinary least square

The results of the Ordinary Least Squares Regression are summarized in the Table 8.

The impact of the agricultural loan on agricultural growth in Nepal can be explained with the following equation which is derived from table number 8.

Regression Equation (Ordinary Least Square)

LNAGRGDP= 7.667324 + 0.357275LNAGRLN
[0.05]
(6.81)

Adjusted R-Square	F-statistics	D-w
0.70	46.40	1.16

The above equation implies that there is a positive relationship between loans to agriculture on the growth of the agriculture sector; loan directly stimulates growth in agriculture but the amount of growth is less effective. When loan increases by 100 percent agriculture GDP is enhanced by only 35.72 percent and this slope parameter is significant at a 5 percent level of significance. Value of slope coefficients (β_2) is 0.35 implies that more than 64 percent of agricultural GDP is determined or affected by other variables such as loan by local money lenders, agricultural subsidy provided by the local, provincial and federal government, irrigation facility, obtaining fertilizer in time, labor participation, etc. Due to the R^2 = 0.72, seventy-two percent defined the agriculture output (dependent variable) by loan to agriculture (independent variable) meaning that the regression line is best fitted and since Durbin-Watson statistics is greater than the value of R-squared, the regression line is not spurious with no serial correlation, no heteroskedasticity but residual are not normally distributed. Jerque-Bera normality test indicates residuals are not normally distributed. It may arise because of the low number of observations I.e. 20 and again nature of independent variable is not stable which can be seen in Kusum Test in Fig. 5 where the curve crosses the upper bound. The following figure depicts the nature of agricultural GDP.

D-W statistics is used to detect the presence of autocorrelation. If the disturbance terms in the regression model are autocorrelated, it poses a serious problem. It is because the least square estimates are no longer best, linear and unbiased estimates under the presence of autocorrelation. Due to the Durbin-Watson statistics is greater than the value of R-squared, the regression line is not spurious and it is also supported by the serial correlation test presented in annex III.

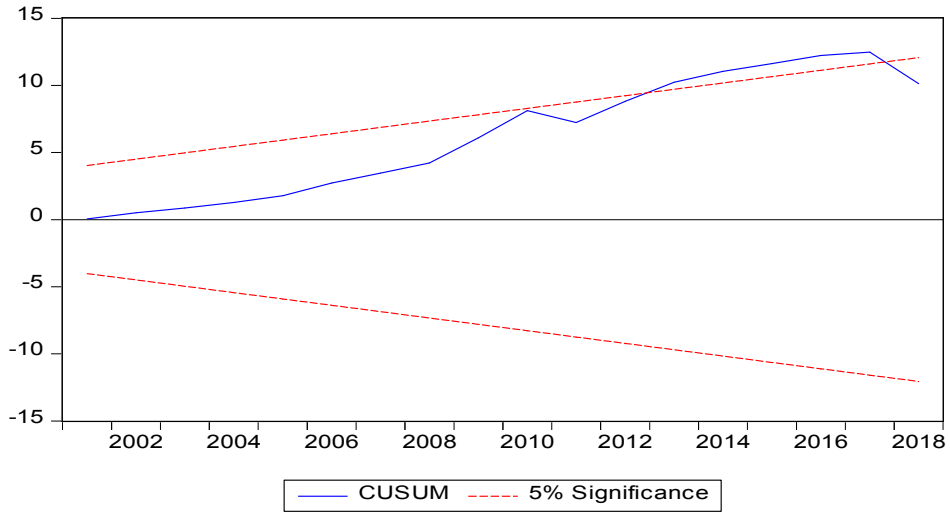

Fig. 5. Cusum test

Table 8. Ordinary least square

Dependent Variable: LNAGRGDP
Method: Least Squares
Sample: 1999 2018
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.667324	0.416174	18.42336	0.0000
LNAGRLN	0.357275	0.052449	6.811865	0.0000
R-squared	0.720503	Mean dependent var		10.44691
Adjusted R-squared	0.704976	S.D. dependent var		0.673740
S.E. of regression	0.365949	Akaike info criterion		0.921996
Sum squared resid	2.410541	Schwarz criterion		1.021569
Log-likelihood	-7.219961	Hannan-Quinn criter.		0.941434
F-statistic	46.40151	Durbin-Watson stat		1.162880
Prob(F-statistic)	0.000002			

Source: Authors' Estimation Results using E-views10, 2020
LNAGRGDP= Agricultural GDP taken at the constant price (taking log)
LNAGRLN= Agricultural loan by commercial bank taken in log form

The co-integration test shows the absence of a long-run relationship between the agricultural GDP and loan by commercial banks to agriculture. The VAR model and Ordinary Least Square method indicate that there is a positive relationship between these variables but in very less amount. There is no problem of serial correlation and heteroskedasticity.

The volume of the actual loan in agriculture is less than that in other sectors so the statistical results also achieved accordingly. Until when this weak result cannot be converted into a remarkable one, the existing scenario of low loan and its contribution to agricultural sector growth cannot be changed. For changing growth scenarios, planning of loan distribution in the agriculture sector must get priority to a greater extent providing a suitable atmosphere.

8. CONCLUSION AND POLICY IMPLICATIONS

The Nepalese commercial banks give high priority in loan disbursement to the manufacturing sector than in the agricultural sector. The minimum threshold of 10% of the central bank/ government is not also reached in the agricultural sector. There may be two reasons i.e. lesser demand of loan due to lack of banking knowledge of farmers and many hurdles to fulfil the formalities in getting loan and less priority is given to agriculture sector by commercial banks. The change in loan

percentage of manufacturing sector is more consistent than the agriculture sector. The commercial banks provide less of their loan to the largest and prominent sector of the economy. The loan growth rate of manufacturing sector is more unstable than agricultural sector. The loan growth rate and contribution to GDP from agricultural sector are more stable than the manufacturing sector. The contribution to GDP from the agricultural sector is high as compared to the loan percentage of commercial banks.

The Johansen Co-integration test indicates no long-run relationship between loans of commercial banks and agricultural output in Nepal. It is because of the negligible and flexible amount of loans in the agricultural sector. The VAR model and Ordinary Least Square method indicate that there is a positive relationship between these variables but in very less amount. Such type of controversial conclusion was also observed by Adeboye and his friends in Nigeria [27]. The result of the Least Square method indicates the positive causal relationship between agricultural loan and growth of agricultural productivity. More or less the loan of commercial banks in the agricultural sector affects the agricultural product. The loan of commercial banks directly stimulates the growth of agriculture but the amount of growth is less noticeable. So, it is concluded that the commercial bank's loan alone cannot affect and control the growth of the agricultural sector of the Nepalese economy therefore the government should increase its expenditure on the agricultural sector through budgetary and monetary system.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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ANNEXURE

ANNEX-I

LAG SELECTION CRITERIA

VAR Lag Order Selection Criteria
Endogenous variables: LNAGRGDP LNAGRLN
Exogenous variables: C
Sample: 1999 2018
Included observations: 16

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-33.93061	NA	0.306021	4.491326	4.587900	4.496271
1	-5.357909	46.4306*	0.014307*	1.41973*	1.70945*	1.434575*
2	-3.034649	3.194482	0.018258	1.629331	2.112199	1.654058
3	-1.018845	2.267780	0.025429	1.877356	2.553371	1.911973
4	5.048306	5.308757	0.023264	1.618962	2.488124	1.663470

Source: Authors' Estimation Results using E-views10, 2020
LNAGRGDP= Agricultural GDP taken at the constant price (taking log)
LNAGRLN= Agricultural loan by commercial bank taken in log form

Annex II

Unit Root Test

Variables		Level			First Differenced			Second Differenced		
		Inter-cept	Trend and inter-cept	None	Trend	Trend and Inter-cept	None	Inter-cept	Trend and Inter-cept	None
LnAGRLN	Test Critical Value	-3.040	-3.6736	-1.964	-3.040	-3.7104	-1.961	-3.0655	-3.7332	-1.9644
	Augumented Dickey-fuller Test	0.549	-2.6640	1.552	-5.120	-3.9547	-4.767	-5.2226	-5.0764	-5.3086
	P- Value	0.983	0.2598	0.964	0.000	0.032	0.004	0.0008	0.005	0.000
LnAGRGDP	Test Critical Value	-3.029	-3.6908	-1.960	-3.297	-3.6908	-1.961	-3.0521	-3.7104	-1.9628
	Augumented Dickey-fuller Test	-0.084	-2.3459	4.441	-3.043	-3.2339	-2.065	-5.4413	-5.2656	-5.6196
	P- Value	0.938	0.391	0.999	0.0287	0.1091	-0.040	0.0005	0.0031	0.000

Source: Authors' Estimation Results using E-views10, 2020

LNAGRGDP= Agricultural GDP taken at the constant price (taking log)

LNAGRLN= Agricultural loan by commercial bank taken in log form

ANNEX-III

Probability Value

Dependent Variable: D(LNAGRGDP)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Sample (adjusted): 2001 2018
Included observations: 18 after adjustments
D(LNAGRGDP) = C(1)*D(LNAGRGDP(-1)) + C(2)*D(LNAGRLN(-1)) + C(3)

	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
C(1)	0.177802	0.252451	0.704301	0.4920
C(2)	-0.012605	0.028042	-0.449516	0.6595
C(3)	0.085746	0.036349	2.358951	0.0323
R-squared	0.045574	Mean dependent var		0.101756
Adjusted R-squared	-0.081683	S.D. dependent var		0.101935
S.E. of regression	0.106016	Akaike info criterion		-1.499442
Sum squared resid	0.168591	Schwarz criterion		-1.351046
Log-likelihood	16.49498	Hannan-Quinn criter.		-1.478980
F-statistic	0.358123	Durbin-Watson stat		1.945927
Prob(F-statistic)	0.704804			

Source: Authors' Estimation Results using E-views10, 2020
LNAGRGDP= Agricultural GDP taken at the constant price (taking log)
LNAGRLN= Agricultural loan by commercial bank taken in log form

ANNEX-IV

SERIAL CORRELATION

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.192098	Prob. F(1,14)	0.6679
Obs*R-squared	0.243640	Prob. Chi-Square (1)	0.6216

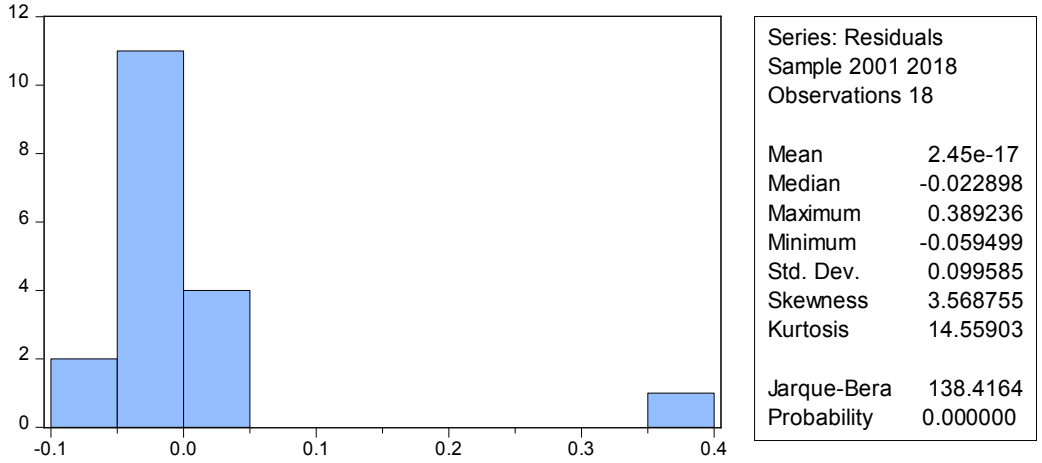
ANNEX-V

HETEROSKESTICITY

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.083612	Prob. F(4,13)	0.9860
Obs*R-squared	0.451468	Prob. Chi-Square (4)	0.9781
Scaled explained SS	2.125511	Prob. Chi-Square (4)	0.7127

ANNEX-VI

JARQUE-BERA NORMALITY



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