# A STATISTICAL ANALYSIS: EXPLORING THE NEXUS BETWEEN AGRICULTURAL CREDIT, AGRICULTURAL TECHNOLOGY UPTAKE AND AGRICULTURAL GROWTH IN PAKISTAN

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**Abstract**
*Agricultural credit is considered as the life line of agrarian sector of any nation in the world. Many farmers who are financially starved need external support in the form of bank or informal loans to run their farm operations. This is needed mostly by the farmers in developing countries including Pakistan. Agriculture is now becoming more capital intensive due to innovation but small scale farmers are unable to use technology due to less availability of finance and credit facilities. So, agricultural credit has a key role in agricultural development of a country.*

## INTRODUCTION
Being an agricultural economy, agriculture is the biggest sector in economy of Pakistan and noticeably affects the socio-economic status of people as it employed about 35.89% of labor force including 62% of rural population and contributing about 19.3% to GDP of Pakistan. It also contributes about 60% to foreign exchange earnings of Pakistan. It is not only the source of food and fiber but it provides raw material to all manufacturing sector as during 2019-2020 overall this sector recorded a positive growth of 2.67% but it not performed well in year2020 because of certain challenges due to COVID-19 and another challenge that agriculture of Pakistan had to face was locust attack (GOP, 2020).

Total cropped area in Pakistan is about 22 million hectares. From total copped area about 9.18 million hectares are under wheat cultivation. 2.96 million hectares are reserved for cotton crop cultivation while 1.13-million-hectare area is used for maize cultivation and about 1.14-million-hectare area are cultivated for sugarcane crop. So out of total cropped area about 17.30 areas are utilized by these major five crops and only 4.70 million hectare area are just utilized by other crops. Growth in agriculture sector in Pakistan is low as compared to other emerging economies

For rural economic development and agricultural growth agricultural credit is very important as Pakistan is an Agricultural country. Agricultural development and modernization includes technology, better human resource, sustainable environment and management of natural resources. For adoption of modern technology and better quality inputs

like use of good quality seeds, fertilizers, financial assistance of farmers is very important in terms of credit facilities (Chandio *et al.*, 2021).

Pakistan is blessed with versatile climatic conditions and soil but still the agriculture of Pakistan is lagging behind as compared to other developed countries due to certain challenges in terms of credit as rising prices of major agricultural commodities like inputs, seeds, fertilizers, pesticides, shortage of power supply in form of electricity, lack of water availability. Due to lack of finance and less credit availability farmers of small scale are facing more problems in accepting and adopting new technologies to increase their agricultural produce. In Pakistan, the main sources of agricultural credit which include Formal and informal sources ZTBL, Commercial bank, cooperative, many domestic and private banks are included in formal sources while friends, family members and all other money lenders are included in non-institutional sources (Abdullah *et al.,* 2015). Large scale farmers have easy approach to credit facilities from formal sources while small scale farmers face difficulty in obtaining credit because of lack of collateral and complex process of documentation ( Jan *et al.*, 2012).

With this background and limited work on the subject, this study will try to answer the basic question of linkages between farm credit, farm-level uptake of technology and agricultural growth in Pakistan taking into account a reasonably long period of time given the data availability. Through better productivity agriculture could play important role in Economic development, increased livelihood, food security and poverty alleviation but agriculture of Pakistan faces many issues like water stress, agronomic, institutional and non-institutional challenges which have severe effects on agriculture.

**Types and sources of agricultural credit:**
In Pakistan agricultural credit is being credited from two main sources.
❖ Formal sources
❖ In-formal sources

**Agricultural credit Types:**
Institutional sources of credit provide three types of credit in Pakistan.
❖ Short term credit for the time period of 1 year to 18 months (for buying farm inputs like fertilizer, pesticides and seeds etc.)
❖ Medium term credit for the time period of 1-5 years ( for purchase of animals like cattle and for buying improved implements)
Long term credit for time period of 5-7 years ( for purchase of farm machinery, suitable land etc
**In-formal sources of credit:**
Non-institutional or in-formal sources of credit are playing important role in providing credit facilities to farmers in rural area of Pakistan. In-formal sources of credit include money-lenders, landlords and commission agents. They provide credit for production and consumption purpose and in return force small farmer to sell their product back to them generally at low rate as compared to market price
**Institutional sources of credit:**
To develop agriculture sector and for increase in agricultural productivity many formal sources of credit are working in Pakistan. To provide agricultural facility about 26 banks are working with five different commercial banks like Allied Bank Limited (ABL), Habib Bank Limited (HBL), National Bank of Pakistan (NBP), Union Bank Limited (UBL), Muslim

Commercial Bank (MCB), ZTBL and Cooperative bank Limited. Fourteen domestic private banks, five micro credit banks are working to provide credit to farmers for cultivation of crop, livestock, poultry farming and for other agricultural activities. ZTBL provide different loan programs like development loan,
production loan, agricultural loan and off-farm income generating loan to facilitate farmers to buy improved implements and modern inputs in order to increase productivity.

**Current scenario of Agricultural Credit in Pakistan:**

Need of credit has been rising with passage of time due to increasing prices of inputs like prices of seeds, fertilizers, pesticides. State bank of Pakistan allocated agricultural credit distribution target of Rs 1500 billion for FY2021, 23.5% more than previous year's distribution of credit Rs 1215 Billion. About 50 different agricultural credit providing institutions provide credit to farmers including two specialized banks (ZTBL and PPCBL), 5 commercial banks, 11 microfinance bank, 14 domestic private banks.

Agricultural performance remained encouraging as during FY 2021, Rs 953.7 billion credits is disbursed by lending sources which is 63.3% of annual target and 4.6% heigher than last year. The Portfolio of agricultural loan has increased by Rs 29.7 billion i.e from Rs 572.2 billion to Rs 601.8 billion or 5.2% in 2021. Number of borrowers has also increased as they reached about 3.5 million in March 2021. Sectorial analysis indicates that from total Rs 953.7 billion, only Rs 507.9 billion has been delivered to farming sector and Rs 445.8 billion has received by non-farm sector during March, FY2021. Landholdings data of farm credit indicates that amount Rs 150.0 billion credit was allocated to subsistence farm size and Rs 56.2 billion to above economic farm size and Rs 301.7 billion to above economic farm size. In non- farm sector lending institution provides Rs 102. 1 billion to small farms with negative growth due to less credit offtake particularly in poultry sector while Rs 343.7 billion credit has been allotted to large scale farms with positive growth of 3%. Sector wise performance of agricultural credit shows growth by 5% in terms of production loans and 93.7% increase in development loans in FY2021. Livestock sectors including meat and dairy shows growth by 5.6% while poultry sector recorded a decline of 11.2% during the year 2021.

**Agricultural credit role in increasing productivity:**

Productivity can be increased by availability of credit as timely availability of credit to farmers makes them to buy required farm inputs and machinery for farm operations. The one window operation was started in 1997 by ZTBL which facilitated farmers in meeting their farm requirements. By introducing capital into agriculture, rate of agricultural development can be increased because it is main factor in overcoming agricultural stagnation as credit for production generally more in amount as compared to credit for development. Problems of Disbursed credit:

❖ Lack of efficiency in agricultural credit disbursement.
❖ Complex process of documentation in getting credit from formal sources.
❖ No timely availability of credit.
❖ Demand of collateral from institutional sources at time of issuance of credit while most of farmers are of small scale
❖ Risk associated with lending to farm sector because of uncertainties and chances of default.
❖ High interest rate.

❖ Expensive financial support.

## OBJECTIVES

The objectives of this study include:
- ❖ To evaluate the linkages between agricultural credit disbursements, agricultural technology uptake and the growth of agriculture sector of Pakistan.
- ❖ To find the major determinants of agricultural growth in Pakistan during the study period.
- ❖ To evaluate trends of farm credit disbursement, technological growth in agricultural sector and agricultural GDP of Pakistan

## REVIEW OF LITERATURE

Ayeomoni and Aladejana (2016) conducted a study to see the impact of Agricultural credit on financial growth in Nigeria. Autoregressive Distributed Lag (ARDL) technique was used to test the research variables. The results revealed that there was a linkage between agricultural credit and economic growth as both affected each other in short-run and in long-run. Beside these there are some other variables which affect the economic growth as Exchange rate, private and domestic investments also affected directly to economic growth while rate of inflation had negative impact on economic growth in this model. So, it is recommended that efforts should be made to increase the supply of credit which ultimately enhances the economic growth.

Sihem (2017) studied the relationship between agricultural productivity growth and agricultural insurance markets and factors which affect this relationship. Panel data for 23 countries in two continents during 2000-2015 was collected. It was found that advancement of insurance markets in agriculture had positive impact on growth of agriculture as many other conditions like availability of agricultural credit, farmer's education and risk management strategies could affect positively in development of agricultural insurance markets.

Asghar and Salman (2018) emphasized on the necessity of Agricultural credit on food production and evaluated the role of financial intermediation in food security as Pakistan is one of food insecure country. Zarai Traqiati Bank Limited is one of the main financial sources providing credit to meet all requirements of agriculture. District Bahawalnaghar was selected as sample and survey was done to collect data through structured questionnaire from borrowers or non- borrowers. T-test was used to analyze data and findings revealed that credit availability enhanced production of borrowers as they used better technologies and quality inputs. So it was cleared that by ensuring timely availability of credit, strengthening credit markets  and by removing financial constraints, agricultural production can be enhanced and can reduce food insecurity.

Hacievliyagil and Eksi (2019) analyzed the relationship between lending of bank and the performance of industrial sector especially manufacturing sector. The industrial production index was used as method to measure the dependent variable. The autoregressive distribution lag (ARDL) -restricted cointegration test index supported the following theory: Bank lending was more effective than the lending rate in the industrial production of subsectors. In addition, the increased in bank lending had led to an increase in industrial production in all subsectors excluding machinery.

Chandio *et al* .(2020) conducted a study in Pakistan to know the combine impact of agricultural credit and climate change on agricultural productivity in short run and in long run.

The study also included some controlled variables like Technology factors ( Tube wells, Tractors), Energy consumption (EC)  in case of Electricity and participating labor force (LF). Annual data covering the period of 1983-2016 was used in study and Autoregressive distributed Lag (ARDL) approach was applied to determine the correlation among study variables. Granger causality Test was applied under Vector Error correction model (VECM) to check the direction of causality in variables. Long term relationship was found between formal credit, technology factors, energy consumption, labor force and agricultural production.

Afolabi et al. (2021) investigated the effects of agricultural finance on economic growth in Nigeria for period of 1981-2017. Data was collected from Central bank of Nigeria, statistical Bulletin (CBN) and World Development Indicators (WDI). The aim of research was to examine the effect of agricultural credit guarantee scheme fund (ACGSF) and deposit money bank credit to agricultural sector (DMBCA) on Nigeria's economic growth. Stationarity of data was checked by employing ARDL of variables at levels and first difference. Results showed that in long run, DMBCA was significant and a direct relationship was found only in short run but ACGSF was non-significant in both short and long run but still had direct relation in short run. Inverse relationship was found in long run.

## METHODOLOGY

Use of appropriate methodology is very much important for correct outcomes of scientific research as its importance cannot be denied at any cost. Appropriate research methodology involves every step regarding data collection to final results.  Selection of appropriate variables, collection of data regarding variables from authentic sources, exact model specification, use of appropriate model and application of all appropriate analytical techniques over data to determine results. Then use of software was made according to feasibility of data. Methodology of this study is provided as under.

**Model, data and Estimation:**

The study has employed secondary Times Series Data from 1995-2020. Statistical supplements of economic survey of Pakistan, various publications of State Bank of Pakistan (SBP), Ministry of Finance Division, Ministry of Food and Agriculture are major sources of data. Institutional credit in agricultural sector has included all types of agricultural credit disbursed from different institutions Commercial Banks, Private Domestic Banks, Zari Taraqaiti Bank, Micro Finance Banks, Provincial Banks and Islamic Banks. In the present study Agricultural output is considered as dependent variable while agricultural credit, cropped area, water availability, fertilizer off-take, number of tractors, number of tube wells  indicated as independent variables. Following are dependent and independent variables of study.

**Variables of study:**

$Y_t$ = Agricultural Output in terms of Agricultural GDP in Pakistani billion rupee.

$CD_t$ = Agricultural Credit at time t in Pakistani million rupee

CA = Cropped Area at time t in million hectares

WA = Water Availability at time t in MFA

FOT = Fertilizer off-take N/T

ISD = improved seed distribution in Tones

Formal finance is assumed to be very important to meet financial constraints of inputs like improved seeds, fertilizer, pesticides, irrigation and improved mechanization. Cropped area has considered as very important in overall agricultural output.

**Methodology:**

Secondary data is used in this study but Time series data often have the issue of non-stationarity so there are generally two techniques to determine for stationarity of data.

- ❖ Traditional approach
- ❖ Modern approach

Traditional approach includes the use of Correlogram to find stationarity of data while many different tests are included in modern approach as use of (ADF) Augmented Ducky Fuller test and (PP) Philips Perron test).The purpose of provision of credit is to financially support farmers to buy expensive inputs like tractors, tube wells, seeds, fertilizers etc. therefore it is required to  see the long run influence and causality of  agricultural credit, cropped area, fertilizer off take, availability of water, number of tractors, number of tube wells with agricultural GDP.

**Analysis of general trend of variables:**

The purpose of graph is to join all the required points of data under study to provide understandable and meaningful information in form of picture. Graphs were designed for all variables i.e. Gross domestic product of agriculture (GDPA), credit disbursement by taking them along y-axis. Time intervals on X-axis were taken to feasibly plot the graph for data of 25 years. These graphs show the hidden facts of data. More over a researcher can explain the increase and decrease of data feasibly via pictorial aid of graph.

**Variables of study**

Y = Agricultural Output in terms of Agricultural GDP in Pakistani billion rupee.

CD = Agricultural Credit at time t in Pakistani million rupee

CA = Cropped Area at time t in million hectares

WA = Water Availability at time t in MFA

FOT = Fertilizer off-take N/T

ISD = improved seed distribution in Tones

NOT= Number of tubewells

NOTR= Number of tractors

Formal credit is considered as major source to meet financial deficiencies of inputs improved seeds, fertilizer, pesticides, irrigation and improved mechanization. Cropped area has considered as very important in overall agricultural output

**Specification of model**

Gross domestic product of agriculture, a proxy variable for agricultural production (GDPA) is taken as dependent variable while water availability (WA), agricultural credit (AC), Cropped Area (CA), Number of Tractors (NOTR), Number of tube wells (NOTU), improved seeds(ISD) , fertilizer off take (FOT) are considered as independent variables. All variables are treated in real terms. According to above description model displaying the influence of formal credit on  growth  of agriculture and technology uptake, the following model has been developed as:

$Yt = f (AC_t, CA_t, AW_t, NOTR_t, NOTU_t,) + \mu_t\ldots1$

t = 1995,1996………………………..2020.

**Analytical Techniques:**

Analytical techniques are selected according to requirements of research.  Trends of selected variables over the period of time are demonstrated by graphs. Augmented Dickey Fuller

(ADF) test is used to check the unit root, use of Autoregressive distributed lag (ARDL) approach to co-integration, to estimate the long-run relationships and application of error correction model (ECM) for short-run relationships. Pair wise Granger causality test is used to find the presence of bidirectional linkage among dependent and independent variables.

**Unit Root test:**

To analyze the Time series data, it is necessary to check whether it has constant mean and variance over time. As its co-variance does not depend on actual time period but upon the lag between two periods. If it satisfy this criteria of mean, variance and of co-variance then it is known to be stationary. For assurance of stationarity variables are differenced. No of difference are equal to presence of unit root in data.

In RWM model;

$Yt = pY_{t-1} + U_t$

$-1 \leq p \leq 1$

If p = 1 it means problem of unit root exist

If p < 1 then $Y_t$ is stationary

Ut is considered to be white noise

$E(Y_t) = 0$ and $Var(Y_t) = 1/(I-p^2)$

**The D.W test:**

DW or Durbin-Watson –value is determined as

DW = 2 (I-ρ) where Yt is random Walk , DW calculated from $1^{st}$ order equation of autocorrelation is as

$Yt = Y_{t-1} + V_t$

DW test is limited by hypothesis that $Y_t$ is random walk variable and it is not fit for integrated variables.

**Test for long-run relationship**

Autoregressive distributed lag approach was used to estimate long-run coefficients of the study. There are many reasons given as below to select this technique:

- ❖ This technique produce consistent results of the facts whether variables used in study are I(0) or I(1) or mutually co-integrated. It does not have any prior conditions to include only those variables which are stationary at same level.
- ❖ The t-statistics from ARDL are valid and results are unbiased even if study includes endogenous variables. It is also useful to obtain consistent results even in the presence of endogenity bias if we include dynamics in mode (Pesaran and Pesaran, 1997).
- ❖ This technique gives valid result even for small sample size as compared to other conventional co-integration approaches.
- ❖ Error correction model can be derived from ARDL model, after some simple transformations. This ECM is used for establishing short run relationship among variables.
  - o $\Delta lnGDPt = \alpha_o + \sum \alpha i \Delta ln(CD)_{t-1} + \sum \alpha i \Delta ln(CA)_{t-1} + \sum \alpha i \Delta ln(ISD)_{t-1} +$
    - . $\sum \alpha i \Delta ln(FOT)_{t-1} + \sum \alpha i \Delta ln(NOTU)_{t-1} + \sum \alpha i \Delta ln(NOTR)_{t-1}$
      - • $_+ \sum \alpha i \Delta ln(WA)_{t-1}$

**Test for the short-run relationship**:

In order to estimate the short-run model i.e error correction model was derived through simple transformation in ARDL model. Therefore it was possible to estimate short-run model as under, allowing EC term to show the speed of adjustment from disequilibrium to equilibrium. This methodology avoids spurious regression arid the results obtained are valid and consistent. Moreover the coefficient of ECM if significant is proof of existence of long-run relationship. It is considered as more efficient way of checking the existence of co-integration. The existence of an error-correction term among number of co-integrated variable implies that the changes in dependent variable are function of both the levels of disequilibrium in the co-integration relationship and changes in other explanatory variables

**Granger Causality test (T-Y test):**

To determine the casual directions or pairwise association among variables either one way or two or both pairwise granger causality test is used. Causality can be classified as unidirectional, bidirectional or no causality. Basically there are two basis for employing this test.

1) This test can be applied to mixed integrated order of variables and to variables which are not integrated.
2) This test can also be used to check the result of ARDL bound test as if in autoregressive distributed lag model with null hypothesis of no cointegration is not accepted then it means there is one way causality exists.

## RESULTS AND DISCUSSION

This chapter describes the assessments of all the desired tests essential for drawing any results about Agricultural GDP and its relationship with Agricultural credit and technology over time and their short and long past trend in total and individual in two parts. First portion critically analyzes the empirical estimation, application of unit root results i.e for test of stationary of all data series. Secondly ARDL results over different series of data. All the calculations reported in this chapter are carried out by using Eviews 10 crack version software.

**Critical Review of Agricultural credit disbursed to GDPA Ratio in Pakistan**

The research was designed to study the role of agricultural credit in agricultural growth of Pakistan. About 50 different agricultural credit providing institutions provide credit to farmers including two specialized banks (ZTBL and PPCBL), 5 commercial banks, 11 microfinance bank, 14 domestic private banks. Agricultural performance remained encouraging as during FY 2021, Rs 953.7 billion credit is disbursed by lending sources which is 63.3% of annual target and 4.6% higher than last year. Landholdings data of farm credit indicates that amount Rs 150.0 billion credit was allocated to subsistence farm size and Rs 56.2 billion to above economic farm size and Rs 301.7 billion to above economic farm size. In non- farm sector lending institution provides Rs 102. 1 billion to small farms with negative growth due to less credit offtake particularly in poultry sector while Rs 343.7 billion credit has been allotted to large scale farms with positive growth of 3%. Sector wise performance of agricultural credit shows growth by 5% in terms of production loans and 93.7% increase in development loans in FY2021. Livestock sectors including meat and dairy shows growth by 5.6% while poultry sector recorded a decline of 11.2% during the year 2021.

**Result from Time Series Analysis**

Mostly the time series data show trends (i.e. where the series are time variant) and is known as non-stationary. If the 1st difference of Time series data is stationary then it has a unit

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root. In critical analysis of time series, the 1$^{st}$ step is to check for the presence of unit roots to avoid spurious regression. Integration of each variable in a model to find whether it has unit root and how many times it need to be differ to attain a stationary series.

Agricultural Output in terms of Agricultural GDP in Pakistani billion rupee (Y), Agricultural Credit at time t in Pakistani million rupee (CD), Cropped Area at time t in million hectares (CA), Water Availability at time t in MFA (WA), Fertilizer off-take N/T (FOT), Improved seed distribution in Tones (ISD) in logarithm were tested for unit root using ADF test with and without linear trend and results are presented below:

**Results of ADF involving trend and intercept:**

In the present study Augmented Ducky Fuller (ADF) test was applied to test the stationarity of data series. The result of unit root test indicated that all variables did not get stationarity at their level form 1 (0) but all series of data got stationarity at their 1$^{st}$ difference as indicating the values of t-statistics in  augmented ducky fuller as t values were greater than critical values of 5% level of significance and we considered t values in absolute term so negative sign was con counted.

**ADF-Unit Root Result CA in Level Form**

| CA | Test Statistics | P-Value | Level of Significance | Critical Values |
|---|---|---|---|---|
| ADF Test Statistics (without trend) | -2.384751 | 0.1558 | 1% | -3.724070 |
| | | | 5% | 2.986225 |
| | | | 10% | 2.632604 |
| ADF Test Statistics (with trend) | -3.652982 | 0.0471 | 1% | 4.416345 |
| | | | 5% | 3.622033 |
| | | | 10% | 3.248592 |

Source: Author's own calculations

Null hypothesis regarding cropped area was that it had unit root so we applied ADF test to check the presence of unit root in level form. First we did not include trend and checked for stationarity but it was found that CA was not stationary in level form as at 5 percent level of significance. Test statistics in non-trend model was not stationary because the value of t-statistics 2.384751is less 2.986225 while for stationarity of data the t-statistics must be greater  than 5 % level of significance. But it was found stationary with trend as the value of t-statistics 3.652982 was greater than 3.622033 at 5% level of significance and p value was also significant at 5%.

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### ADF-Unit Root Result CA at First Difference Form

| CA | Test Statistics | p-value | Level of Significance | Critical Values |
|---|---|---|---|---|
| ADF Test Statistics (without trend) | -5.377868 | 0.0002 | 1% | -3.737853 |
| | | | 5% | -2.991878 |
| | | | 10% | -2.635542 |
| ADF Test Statistics (with trend) | -5.249321 | 0.0015 | 1% | -4.394309 |
| | | | 5% | -3.612199 |
| | | | 10% | -3.243079 |

Source: Author's own calculations

To check the presence of non stationarity we again applied ADF test to CA but at 1st difference. 1st we did not include trend and found that CA was stationary at 1st difference without trend as p-value 0.0002 was found significant at 5% level of significance moreover its value of t-statistics was also significant as at test statistics 5.377868 was well above the 5 percent critical value which was 2.9918
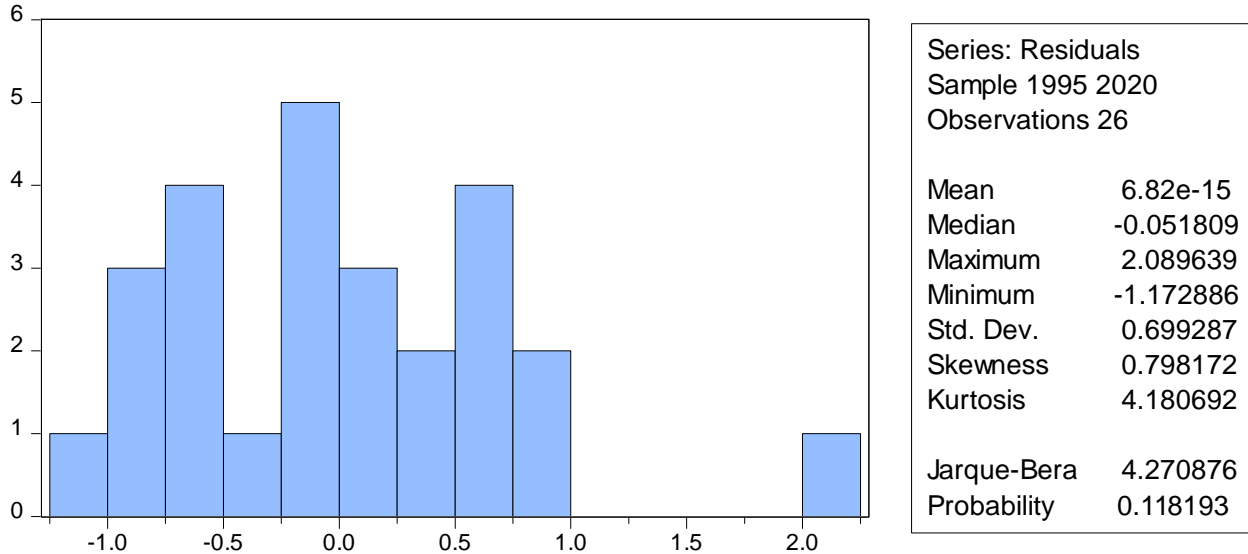
### ADF-Unit Root Result of CD in its Level Form

| CD | Test Statistics | P-value | Level of Significance | Critical Values |
|---|---|---|---|---|
| ADF Test Statistics (without trend) | 3.243410 | 1.0000 | 1% | -3.724070 |
| | | | 5% | -2.986225 |
| | | | 10% | 2.632604 |
| ADF Test Statistics (with trend) | -0.529908 | 0.9747 | 1% | -4.374307 |
| | | | 5% | -3.603202 |
| | | | 10% | -3.238054 |

Source: Author's own calculation

Stationarity for data series of Credit disbursed was also checked by employing ADF test. 1st ADF test was carried without including trend and it was found non-stationary as p-value which was 1.000 > 0.005 non- significant. Then by adding Trend we gain carried Augment dickey filler test and it was found non-stationary again as p-value was 0.9747 greater than 0.05% level of significance.



Series: Residuals
Sample 1995 2020
Observations 26

| | |
|---|---|
| Mean | 6.82e-15 |
| Median | -0.051809 |
| Maximum | 2.089639 |
| Minimum | -1.172886 |
| Std. Dev. | 0.699287 |
| Skewness | 0.798172 |
| Kurtosis | 4.180692 |
| Jarque-Bera | 4.270876 |
| Probability | 0.118193 |

No auto-correlation was found by employing D.W test which showed that data was free from the problem of Hetroscedasticity

| Variables | Coefficient | t-Statistic |
|---|---|---|
| L FOT | -0.005948 | -1.027002 |
| L CD | 9.21E-06 | 1.252477 |
| L CA | -1.313796 | -0.990280 |
| L ISD | -0.002260 | -0.210896 |
| L NOTR | 0.000118 | 1.088737 |
| L NOTU | -0.004977 | -0.641579 |
| L WA | 0.295209 | 1.375615 |
| C | 32.59791 | 0.624204 |
| $R^2$ | 0.772 | |
| F-Statistics | 17.35 | |
| P-Value | 0.000078 | |

Source: Author's own calculations
1,5,10 % Significance Level

The long run elasticity for the CD was 9.21E-06. Its t calculated value was 1.25. It showed negative relationship between CD and GDPA. It showed that 1 percent increase in FOT rate decreases gross domestic product (GDPA) by 0.5 percent in the long run. CD was significant 1% level of significance. It means that high and increasing CD reduce economic growth, by creating strong disincentives rate of personal income growth of people in Pakistan do respond

negatively to change in CD. This tended to be negatively associated with long-term economic growth and this negative relationship between CD and GDPA was justified by result. This is long run elasticity was an indicative of long run adjustment of CD.

**Result of ECM for short run**

| Variables | Coefficient | t-Statistics |
|-----------|-------------|--------------|
| C | -0.046 | -0.205 |
| D(CA) | -0.302 | -0.864 |
| D(CD) | -1.86E-06 | -0.938 |
| D(FOT) | 2.17E-05 | 0.047 |
| D(ISD) | -0.0022 | -0.659 |
| D(NOTR) | 1.35E-05 | 0.646 |
| D(NOTU) | -0.002 | -0.638 |
| D(WA) | -0.009 | -0.214 |
| ECM(-1) | -0.627 | -2.859 |

| | |
|---|---|
| $R^2$ | 0.359 |
| F-Statistics | 1.125 |
| P-Value | 0.05 |

Source: Author's own calculations

In short run CD was non-significant and has negative relationship with GDPA. Their coefficient showed that 1% increase in CD by 0.04 percent. T statistics value of taxes was 0.86 which was not significant at any level of significance.

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