# AGRICULTURE PRODUCTIVITY AND ECONOMIC GROWTH: A CASE OF PAKISTAN

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***ABSTRACT-****The objective of this research paper is to study the agriculture productivity and its impact on economic growth of Pakistan. The ADF test was used to check the stationarity among variables. ARDL Model was applied to determine long-run and short-run relationship between agriculture productivity and economic growth, using secondary data from1994 to 2017. Our empirical results show that GCF and inflation rate have negative relationship with economic growth while all other variables have positive relationship with economic growth in short-run and long-run. We suggest that Government should make more investment and introduce new technology in agriculture sector to improve its productivity.*

**Keywords:** Agriculture productivity, economic growth, gross capital formation, employed labor force, inflation rate.

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## 1. INTRODUCTION

### 1.1. Overview of Agriculture productivity

Agriculture productivity is a mainstay for the economy of Pakistan. This is the second biggest sector of Pakistan's economy because its share in GDP is more than 21% and it employs half of its labor force which is about 45% of total labour force. Almost 67% of population lives in rural areas depending on this sector for their survival. The purpose of agriculture progress is to minimize poverty in rural areas. Agriculture also plays key role in progress of industrial sector. This sector supplies raw material to the industrial sector and industrial sector provides machinery, fertilizer and pesticides to agriculture sector. The use of this products increase national income. Fertilizer is the most important input to improve crop yield. The use of fertilizer enhanced the fertility of land and this step increase the productivity of major and minor crops.

Agriculture sector has many roles in the progress of Pakistan's economy. First, this sector accomplishes the needs of food to all the people of nation. Second, it provides employment to the people. Third, it significantly contributes to reduce poverty. Fourth, it raises the income of people who worked in this sector. Fifth, it supplies raw material to the industrial sector. Sixth, it supports those people who migrate from rural areas to urban areas. Seventh, this agrarian sector is a big source of earnings of foreign exchange, which is used to purchase the imported goods that include machinery, capital

goods and manufacturing goods. Lastly, agriculture supplies goods and services to household, industries and to world market.

During the period of 1970's to 2017's, the role of agriculture sector has been changed. The growth rate has decreased to 2.4% in 1970's because of

structural issues. However, it went up to 5.4% during the period of 1980's because of Green Revolution. In the decade of 1990 the agriculture growth rate was about 4.3% because of shift the focus from agriculture to industry. During the period of 2000's the growth rate of agriculture productivity perpetually decreased from 3.2% to -2.2% in the 2000, 0.1% in 2001, 4.1% in the period of 2002, and 2.4% in the year of 2003, that was the lowest rate of growth due to the heavy rain that the severely affected the productivity of agriculture sector. After that during of 2004 to 2005 the growth rate of agriculture productivity was surprisingly raised to 6.4% because of timely water's supply. But it was again fell 3.5% during the period of 2006, 1.0% in the year of 2007, 4.0% in the year of 2008, 2.0% in the year of 2009, and 2.0% in the year of 2010. Later, during the period of 2011 and 2012 the growth rate was 3.6% and 2.7% respectively while it was 2.5% and 2.1 % during 2013 and 2014 and 0.2% during 2015 which was the lowest growth rate in that period, However, the growth rate was jumped to 5.28% in the year of 2016-17 which was highest during last 10 years.

## 1.1 Main Research Problem

The main research problem is to study the "the relationship between agriculture productivity and economic growth in Pakistan."

## 1.2 Objective of the Research:

Main objectives of this research paper are listed below:

• To study the causes of variations in agriculture productivity.

• To investigate long run relationship between agriculture productivity and economic growth.

• To suggest some policies to improve level of agriculture productivity

and economic growth in Pakistan to reduce poverty.

## 1.3 Significance of the research:

This research is very important for improving the productivity of food, foreign exchange earnings and job opportunities in Pakistan. It has importance for farmers, public, government, student, teachers, investors, common readers, economist and policy makers as well.

## 2. LITERATURE REVIEW:

Ahmad (2012) has studied the determinants of agriculture productivity growth in the Pakistan. ARDL model has been employed to estimate the significant impact of total factor productivity (TFP). Five variables were selected in this research for the time period of 1965-2009 which obtained from different issues of Pakistan economic surveys. The three variables like fertilizer, human capital and agriculture credit to increase the capacity of total factor productivity. The results show that cropped area was not increased significantly in the case of short run and long run. Human capital and Fertilizer had the highest influence in the long and short run elasticity of production. The study concluded that the provision of skilled labor force and food security should be assured to increase the agriculture productivity.

Alam (2015) investigated the influence of agriculture productivity on economic growth. Secondary data has been used for the year of 1972-to-2012. Autoregressive distributed lags technique was applied to determine the

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agriculture production and its influence on economic progress. The influence of inflation rate on economic growth has negative while the impact of all other variables such as GCF, trade, ELF, agriculture value added and openness has positive on economic progress. During this period, Government makes the policies to increase the agriculture productivity and economic growth through

skilled labor force, surety of trade and provision of better raw material. The result shows that there was the more contribution of agriculture productivity in economic growth.

Ali (2012) investigated the role of agrarian sector in economic development of Pakistan. Simple regression method was used to modify the importance of agriculture sub-sectors like as livestock, major crops, fisheries, minor crops and economic growth with GDP. OLS method was used to study the agriculture sub-sector and economic growth. Seven variables were used in this specification study. The consequence of empirical analysis show that the relationship between forestry and GDP was significant. While the association among GDP and all other independent variables were significant. They had positive relationship with GDP. 90% Contribution of crops and livestock in agriculture sector show robust performance while the contribution of fisheries and forestry had low contribution in overall agriculture productivity due to lack of investment.

Awan and Aslam (2014) attempted to measure the impact of agriculture and its influence on economy of Pakistan. They disclosed that Pakistan was facing many problems such as low output due to low investment, insufficient food due to over population and inefficient management due to low education system. Pakistan's products have no value in the international

market due to low output and poor quality. Pakistan should take some steps to eradicate the problems of agrarian sector. The new technologies should be introduced such as the use of mechanization, new method of irrigation and the quality of packing.

Faridi (2012) explored the contribution of agrarian exports to economic development in Pakistan. He applied the Johansen co-integration

test, using secondary data from the 1972-2008 to see the result of agriculture exports and Economic progress. The result revealed that increase in agriculture exports will decline the economic growth. Agriculture exports increases the agriculture productivity. Thus, study concludes that agriculture exports have negative impact on economic progress and significant influence on economic development but non-agriculture exports have positive influence on economic development. He recommended that Government should promote non-agriculture products and textile products.

Awan and Naseem (2018) studied the impact of government expenditures on economic development in Pakistan. They used time series data from 2005 to 2015. OLS method was applied for analysis of data and linear regression model was used to obtain results. Economic growth was taken as dependent variable and Health, education, investment and saving rate were taken as independent variables. They found that education and health have negative impact on Pakistan's GDP because educated worker (human capital) are unemployed whereas investment and saving have a slightly positive impact. They also found that skill development enhances the efficiency and productivity of human capital and consequently it enhances economic growth.

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Chandio *et al* (2016) examined the share of agrarian sector and GDP growth rate in Pakistan by using secondary data over the period of 1971 to 2015. ARDL model was used to show that the agriculture has substantial effect on every sector as well as on GDP. The results showed that the association between agriculture productivity and economic development has significant influence on GDP. They emphasized that new technologies should be

introduced in all sectors of Pakistan for the improvement of agriculture productivity. And this step would increase the economic growth of Pakistan.

Khan *et al* (2016) investigated the agriculture value added and poverty reduction in Pakistan. Improvement in agriculture production leads to the reduction in poverty. The secondary data has been applied in this research during the year of 1972-2013. Johansen co-integration model has been employed to examine the long run association among the agriculture, poverty reduction and its determinant with GDP. The study revealed that agriculture productivity like livestock and employed labor force help to minimize the poverty. Poverty has negative influence on economic development. So the result concludes that agrarian value added has positive influence on economic growth.

Muhammad (2016) evaluated the contribution of agrarian sector in the GDP growth in Pakistan. He included livestock major crops and other crops in the study and found that they are the backbone of agriculture which contributes the 23.5% share in GDP. His results indicated that there was the strong association between the agriculture and GDP annual growth rate. Because agriculture sector provides the jobs and incentives for the farmers,

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provide food supply and accessibilities of pesticides. Thus agriculture impact has significant and positive influence on economic progress.

## 3. RESEARCH METHODOLOGY:

Methodology of research is the theoretical process that is used to identify, select variables and collect data about a research topic. The researcher critically estimates the study's overall effectiveness and accuracy. The research methodology contains selection of topic, collection of data, interviews, surveys and other techniques.

## 3.1 Nature of study:

This study is quantitative in nature because secondary data has been used in it in order to determine relationship between agriculture productivity and economic growth in Pakistan.

## 3.2. Types of data and sources:

Secondary data has been used in this study. The data is collected from World Development Indicator, Pakistan Economic Survey and Hand Book of Statistics. The sampling period of the study is spread of 20 years from 1997-2017.

## 3.3 Selected Variables and their definitions

* GDP (Gross Domestic Product) _____Dependent variable
* INF (Inflation Rate) _____Independent variable
* ELF (Employed Labor Force) _____ Independent variable
* GCF (Gross Capital Formation) _____Independent variable
* FER (Fertilizer) _____ __Independent variable
* AGRI (Agriculture)_____ _Independent variable

## 3.3.1 Gross Domestic Product

The country produced all goods and services within a particular year. This is called GDP. GDP selected as dependent variable which show the economic growth. If GDP increase, then economic growth will also increase.

### 3.3.2 Inflation Rate

In economics, inflation is the rate in which shows overall increase in the prices rise of goods and services over a period of time. Inflation declines the purchasing power of a nation's currency. It has a major effect on country's whole economy and its population. Consumer price index also measures inflation rate.

### 3.3.3 Employed Labor Force

Employed labor force means the people who are working actively in different places like; firms, banks, shops and industries. Employed labor force is an essential requirement for the economic growth in a country. If country provides more employment opportunities, then it will cause high economic growth and vice versa.

### 3.3.4 Gross Capital Formation (GCF)

GCF defines as two goods fixed assets and net change in inventories. Non-liquid assets contain machinery, plant, equipment and structures, while inventory contains works in procedure. GCF helps to measure the GDP of any country.

### 3.3.5 Fertilizer:

Fertilizer is the mixture of chemical substances or solid animal waste that is applied to fertilize the soil and this use of substances enhances the productivity of plant growth. Fertilizer has three beneficial macronutrients include

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phosphorus, potassium and nitrogen. Fertilizer is the essential requirement for the improvement of agriculture productivity.

## 3.3.6 Agriculture Productivity:

Agriculture productivity is concerned with fertility of land. This reflects raising livestock, major and minor crops also. Agriculture sector is related to economic growth. If the productivity of agriculture increased the economic growth will also increase. This sector fulfills the needs of food of Pakistan.

## 3.4 Hypothesis Formulation

$H_0$ = Agriculture productivity has no positive relationship with economic
        growth in Pakistan.

$H_1$ = Agriculture productivity has positive relationship with economic growth


        in Pakistan.

## 3.5 Econometric Model:

The econometric model of this study is given below:

$$GDP = \beta_0 + \beta_1 (INF) + \beta_2 (GCF) + \beta_3 (AGRIP) + \beta_4 (ELF) + \beta_5 (FER) + \mu \quad (1)$$

Where:

GDP = Gross Domestic Product annual growth

INF = Inflation

GCF = Gross Capital Formation

AGRIP = Agriculture productivity

ELF = Employed Labor Force

FER = Fertilizer

$\beta_0$ = Intercept

$\beta_1, \beta_2, \beta_2, \beta_3, \beta_4, \beta_5$ = Slope Coefficient

$\mu$ = Error Term

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# 4. DATA ANALYSIS:

## 4.1 Descriptive Statistics:

The results of descriptive statistics are shown in Table 1: -

**Table 1:  Results of Descriptive Statistics**

|         | GDP   | INF    | GCF    | AGRI   | ELF    | FER   |
|---------|-------|--------|--------|--------|--------|-------|
| **Mean**    | 4.106 | 8.218  | 17.019 | 3.316  | 44.35  | 5.38  |
| **Median**  | 4.328 | 7.645  | 16.877 | 3.100  | 43.441 | 5.800 |
| **Maximum** | 7.667 | 20.286 | 19.546 | 11.700 | 50.056 | 6.900 |
| **Minimum** | 1.014 | 2.529  | 14.120 | -2.200 | 41.010 | 3.800 |

| Std.Dev. | 1.729 | 4.461 | 1.645 | 2.846 | 2.528 | 1.104 |
|----------|-------|-------|-------|-------|-------|-------|
| Skewness | 0.170 | 0.729 | 0.012 | 0.809 | 0.761 | -0.296 |
| Kurtosis | 2.542 | 3.239 | 1.799 | 4.546 | 2.355 | 1.570 |
| Jarque-Bera | 0.325 | 2.187 | 1.442 | 5.010 | 2.732 | 2.295 |
| Probability | 0.849 | 0.335 | 0.486 | 0.081 | 0.255 | 0.317 |

Calculated by Author through Eviews Software

The descriptive statistics indicates about median, mean, minimum, maximum, skewness standard deviation, kurtosis and jarque-bera and the probability. Time series data consist of 23 years of annual observations from 1994 to 2017.

This data in table 1 shows that the average growth of GDP is 4.106 with std. deviation of 1.72. The average inflation (INF) rate is 8.21 with the std. deviation of 4.46. The average or mean value for gross capital formation (GCF) is 17.01 with the std. deviation of 1.64. The mean value for agriculture productivity (% of GDP growth) is 3.31 with the std. deviation of 2.84. The mean value of employed labor force is 44.35 with the std. deviation of 2.52 and the mean value of fertilizer is 5.38 with the standard deviation of 1.10. All the variables include GDP, inflation, GCF, agriculture and EFF are positively skewed except fertilizer that negatively skewed. Kurtosis statistic of the variables indicate that GDP, GCF, employed labor force and fertilizer are platykurtic (lower peak or short tailed) because their value is less than 3. Variables include inflation and agriculture is Laptokurtic (long tailed or high

peak) because their value is greater than 3. The results indicate that Jarque-Bera P (Probability) value of GDP is 0.84 that is greater than 10%, therefore, we accept the null hypothesis means data is normally distributed. Jarque-Bera P value of inflation is 0.33 that is greater than 10%, we accept the null hypothesis as its means data is normally distributed. Therefore, Jarque-Bera P value of all the others variables are greater than 10%, we accept the null hypothesis because the data are normally distributed. The P-value of Jarque-Bera of fertilizer is 0.08 that is not normally distributed.

## 4.2 Correlation Analysis:

The result of correlation analysis is given in table 2.

**Table 2: Results of Correlation Matrix**

|      | GDP    | INF    | GCF    | AGRI  | ELF    | FER    |
|------|--------|--------|--------|-------|--------|--------|
| GDP  | 1      | -0.337 | 0.133  | 0.244 | -0.261 | 0.158  |
| INF  | -0.337 | 1      | 0.348  | 0.310 | 0.132  | 0.210  |
| GCF  | 0.133  | 0.348  | 1      | 0.217 | 0.461  | -0.341 |
| AGRI | 0.244  | 0.310  | 0.217  | 1     | 0.060  | -0.093 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **ELF** | -0.261 | 0.132 | 0.461 | 0.060 | 1 | -0.777 |
| **FER** | 0.158 | 0.210 | -0.341 | -0.093 | -0.777 | 1 |

Calculated by through Eviews

All the variables are significantly correlated with GDP except inflation and employed labor force. The variable gross domestic product (GDP) is

negatively correlated with INF and ELF. GCF, agriculture productivity and fertilizer are positively correlated with gross domestic product (GDP). The same variables GCF and GCF, AGRI and AGRI, ELF and ELF and fertilizer are fully depending on each other. The association between GDP and inflation is negative -0.33 because $r < |0.30|$. Degree of association between gross capital formation and employed labor force is 0.46 and correlation is moderate because $|0.30| < r < |0.70|$. Degree of association between GDP and fertilizer is 0.15 that shows correlation between them is weak.

## 4.3 ADF Test:

The results of ADF test are shown in table 3:

### Table 3: Results of ADF Test

| variables | Level | | 1st difference | | 2nd difference | | |
|---|---|---|---|---|---|---|---|
| | Intercept | Trend & intercept | Intercept | Trend & intercept | Intercept | Trend & intercept | Decision |
| GDP | -2.24 0.19* | -2.24 0.44* | -4.46 0.00* | -4.40 0.07* | -7.01 0.00* | -6.82 0.00* | I(1) |
| INF | -2.08 0.25* | -2.03 0.55* | -5.87 0.00* | -5.72 0.00* | -6.08 0.00* | -4.83 0.00* | I(1) |

| GCF | -2.02 0.27* | -2.08 0.52* | -4.81 0.00* | -4.71 0,00* | -4.81 0.00* | -4.71 0.00* | I(1) |
|-----|------|------|------|------|------|------|------|
| AGRI | -4.70 0.00* | -4.78 0.00* | -4.76 0.00* | -4.62 0.00* | -5.62 0.00* | -5.44 0.00* | I(0) |
| ELF | -2.64 0.09* | -3.43 0.07* | -3.43 0.02* | -3.96 0.03* | -3.81 0.01 | -3.56 0.00* | I(0) |
| FER | -1.66 0.43* | -1.44 0.81* | -3,82 0.03* | -3.81 0.03* | -4.28 0.004* | -3.64 0.58* | I (1) |

Calculated by through Eviews

Table 3 show that the stationary and non-stationary of the individual variables. The stationary of time series data is compulsory for averting spurious regression analysis because it is impracticable to get good results and making predicting with a non-stationary series. Augmented Dickey-Fuller test showed that some variables are stationary at level and other variables are stationary at 1st difference. This results in indicates that GDP is integrated at 1st difference

and the t-statistic value is-4.46 with 0.002 probability value. The inflation is also stationary at 1st difference with the t-statistic value is -5.87 with probability value is 0.00. The gross capital formation (GCF) is integrated at 1st difference with the t-statistic value is -4.81 with 0.00 probability value. The agriculture productivity is stationary at level with the t-statistic value is -4.07 with the probability value is 0.00. The employed labor force (ELF) is stationary at level where the t-statistics value is -2.64 with the probability value is 0.09. The fertilizer is stationer at 1st difference where the T-statistic value is -3.81 with probability value is 0.03. Time series analysis shows that

all the variables are integrated at different orders thus there is no co-integration exists among variables and we can use ARDL model.

## 4.4 Autoregressive Distributed Lag Model:

ARDL approach is used to analyze the agriculture productivity and economic growth in Pakistan. ARDL bound testing process developed by Pesaran et al (1996), Pesaran and Ship (1990) and Pesaran et al. (2001) is elastic and it requires that variables exist in the model specification can be either integrated at order 0 or 1, that is I (0) or I (1). This model of estimation gives efficient consequences even for small samples. Variables can be attributed different lag length in the model. The ARDL equation is as follows:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + .. + \beta_q Y_{t-p} + \alpha_0 x_t + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + + \alpha_k x_{t-k} + \mu_t \quad (2)$$

Whereas, unrestricted vector error model is given below.

$$\Delta(GDP)_t = \alpha_0 + \Sigma^p_{i=1} \alpha_1(GDP)_{t-i} + \Sigma^p_{i=0} \alpha_2(INF)_{t-i} + \Sigma^p_{i=0} \alpha_3(GCF) + \Sigma^p_{i=0}$$

$$\alpha_4(AGRI) + \Sigma^p_{i=o} \alpha_5(ELF)_{t-1} + \alpha_6(GDP)_{t-1} + \alpha_7(INF)_{t-1} + \alpha_8(GCF)_{t-1} +$$

$$\alpha_9(AGRI)_{t-1} + \alpha_{10}(ELF)_{t-1} + \mu_t \qquad (3)$$

Equation (3) is the ARDL model which indicates the long run and short run association between the dependent and independent variables. $\alpha_0$ is the

intercept term. Short run co-efficient of variables are $\alpha_1$, $\alpha_2$, $\alpha_3$, $\alpha_4$, $\alpha_5$, explanatory variables while the long run co-efficient of variables are $\alpha_6$, $\alpha_7$, $\alpha_8$, $\alpha_9$, $\alpha_{10}$ whereas, $\mu_t$ is the stochastic error and it contains all omitted variables in the equation.

## 4.5 Bound Test:

Bound test for co-integration indicates the long run association between the variables. The results are shown in Table 4.

### Table 4:  Results of Bound Test

| Test statistics | Value | Signif. | I(0) | I(1) |
|---|---|---|---|---|
| | | | **Asymptotic n=1000** | |
| **F-statistic** | 12.48 | 10% | 2.08 | 3 |
| **K** | 5 | 5% | 2.39 | 3.38 |
| | 2.5% | 2.7 | 3.73 | |
| | 1% | 3.06 | 4.15 | |

Calculated by Author through Eviews

The above table shows the critical values of the upper and lower-bound I(1) and I(0) respectively. The observed F-Statistic value is 14.00 that is greater than the upper-bound of F-Statistics we reject null hypothesis and accept alternative hypothesis, which describes that there is long run association among the variables.

## 4.6 Long Run Relationship of ARDL Model

The long run association between the dependent and independent variables is given in the form of equation.

$$\Delta(GDP)_t = \Upsilon_0 + \Sigma^p_{i=1} \Upsilon_1(GDP)_{t-i} + \Sigma^p_{i=0} \Upsilon_2(INF)_{t-i} + \Sigma^p_{i=0} \Upsilon_3(TRD)_{t-i} + \Sigma^p_{i=0} \Upsilon_4(GCF)_{t-i} + \Sigma^p_{i=0} \Upsilon_5(AGRI)_{t-i} + \Sigma^p_{i=0} \Upsilon_6(ELF)_{t-i} + \mu_t \qquad (4)$$

In which $\Upsilon$'s is coefficient of the lagged X term. The long run relationship is given in Table 5:

Table 5    Results of long-run relationship between variables

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| INF | -0.429903 | 0.094071 | -4.569968 | 0.0006 |
| GCF | -0.229769 | 0.262625 | -0.874896 | 0.3988 |
| AGRI | 0.979530 | 0.218939 | 4.473983 | 0.0008 |
| ELF | 0.014598 | 0.210592 | 0.069319 | 0.9459 |
| FER | 0.958357 | 0.462495 | 2.072147 | 0.0605 |
| C | 2.630021 | 10.56091 | 0.249033 | 0.8075 |

Author's calculation through Eviews

Table 5 shows the results of ARDL model which indicate that the co-efficient value of inflation in the long run is significant. It reflects negative association with GDP annual growth rate, meaning if one-unit increase in inflation rate the GDP annual growth rate will likely to fall by 0.42 percent. The co-efficient value of gross capital formation (GCF) is statistically insignificant and negatively related to GDP annual growth in the long run.  The reason for insignificant and negative relation in the long run is that the lack of investment due to the shortage of electricity, therefore, there is the negative affect of GCF on GDP. The co-efficient value of agriculture in the long run is positive and statistically significant. The significant share of agriculture increases economic growth [Alam (2015)]. The coefficient of employed labor force is

statistically insignificant in the long run but it reveals positive association with GDP annual growth rate. The coefficient value of fertilizer is statistically significant and has positive relationship with GDP. It means that use of best quality fertilizer enhances the agriculture productivity.

## 4.7 Error Correction Model: Short Run Relationship:

This technique is employed to determine the short run association between the gross domestic product and other independent variables. The short run error correction equation is given below:

$$\Delta(GDP)_t = \eta_0 + \Sigma^p_{i=1} \eta_{1i}(GDP)_{t-i} + \Sigma^p_{i=0} \eta_{2i}(INF)_{t-i} + \Sigma^p_{i=0} \eta_{3i}(TRD)_{t-i} + \Sigma^p_{i=0} \eta_{4i}(GCF)_{t-i} + \Sigma^p_{i=0} \eta_{5i}(AGRI)_{i=0} + \Sigma^p_{i=0} \eta_{6i}(ELF)_{t-i} + \lambda(ECM)_{t-i} + \mu_t \qquad (6)$$

$(ECM_{t-i})$ ECM indicates the short run impact on x and y variables and speed of adjustment.

$$\Delta Y_t = \eta + \delta_{t-i} + \lambda(ECM_{T-I}) + \mu_t \qquad (7)$$

In equation $\delta$ indicates the short run affect and $\lambda$ indicates the adjustment speed. The results of ECM are shown in table 6.

**Table 6: Results of ECM** (ECM of selected variables (1,0,0,0,1,1)

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(INF) | -0.185331 | 0.034827 | -5.321531 | 0.0002 |
| D(AGRI) | 0.278425 | 0.039082 | 7.124110 | 0.0000 |
| D(ELF) | 0.169953 | 0.069081 | 2.460194 | 0.0300 |
| CointEq(-1)* | -0.665725 | 0.058139 | -11.45063 | 0.0000 |
| R-squared | 0.899439 | Mean dependent var | | 0.081333 |
| Adjusted R-squared | 0.882678 | S.D. dependent var | | 1.630247 |
| S.E. of regression | 0.558396 | Akaike info criterion | | 1.835470 |
| Sum squared resid | 5.612517 | Schwarz criterion | | 2.033842 |
| Log likelihood | -16.19017 | Hannan-Quinn criter. | | 1.882201 |
| Durbin-Watson stat | 2.512273 | | | |

Author's calculations through eviews

The above table shows that agriculture productivity is the most important variable in the long run and short-run. The value of ECM co-efficient is -0.66 which is negative and significant. This negative and significant coefficient of

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error correction model indicates the presence of long-run causal relationship. The value of ECM indicates the speed of adjustment from disequilibrium to equilibrium. The value of adjusted R2 is 0.88 which reveals that there is 88% variation in GDP (Dependent variable) due to the change in independent variables. The probability of F-statistic is also statistically significant at 5% level of significance, which justify that the model is goodness of fit.

## 4.8 Stability of the Model:

Cumulative sum of recursive residuals (CUSUM) tells about the stability of the model with respect to short-run and long-run relationship between variables. The graph of cumulative sum of recursive residuals is given below.

**Figure 1: Result of CUSUM of recursive residual**
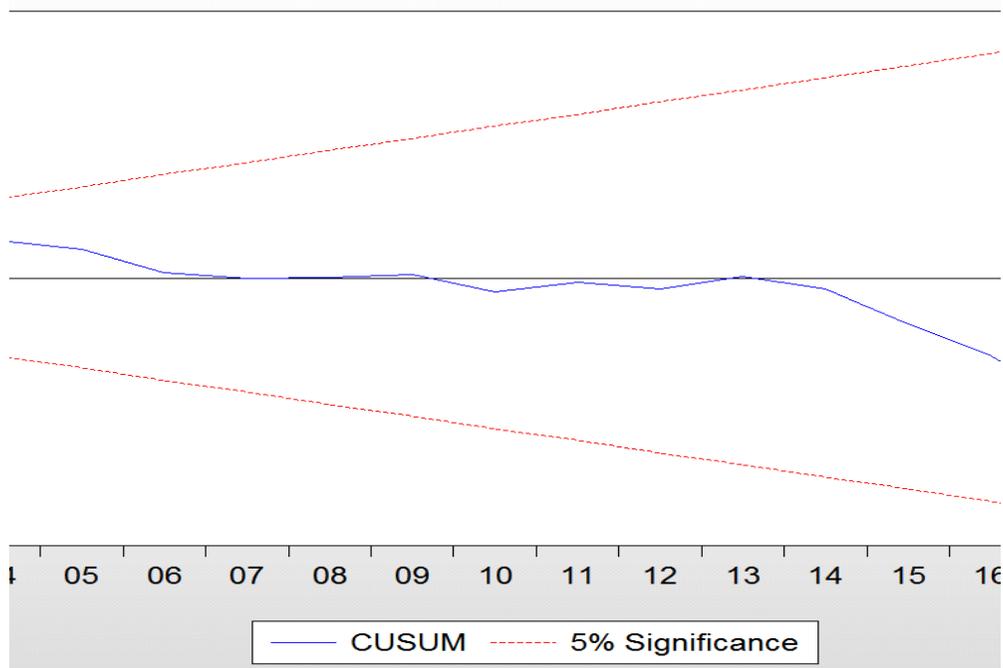


Source: Author's calculation through Eviews

CUSUM Test takes the time series on horizontal axis and residual along vertical axis to check the stability of the model. Figure1 shows that CUSUM is within the range 5% critical lines. This critical boundary is not crossed by the graph. So, we can conclude that the model is stable and there is no major gap. This correct specification model accepts the null hypothesis at the 5% significance level.

## 5. Findings of the Study:

Key findings of the study are given in the following: -

First of all, we discuss the impact of explanatory variables on economic growth that is called GDP. The results of ARDL model shows that all the independent variables include agriculture, employed labor force and fertilizer

in the long run as well as in the short-run are significantly and positive related with the economic growth of Pakistan except inflation and GCF that has negative effect on economic growth. In the study, the value of R-square shows Independent variable has significant impact on dependent variable and the model of the study is goodness of fit.

## 6. Conclusion:

Pakistan is an agricultural country, so agricultural productivity growth is vital the economic development in Pakistan. Increased in agricultural productivity not only fulfills domestic needs but it also creates surplus goods for exports and earn hard needed foreign exchange. The advancement in agriculture sector and the better use of land resources are essential for reducing food scarcity and poverty. The results of our research show the negative affect of inflation and gross capital formation on economic growth of Pakistan. Due

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to high inflation rate and existence of feudalism in our country, majority of farmers are poor and incapable to purchase quality seeds, advanced

machineries and high quality fertilizer to make effective use of their soil. Inflation is adversely affecting the agricultural productivity, which ultimately leads to the negative effect on the economic growth of agro-based country like Pakistan. Further, GCF is showing the negative affect on the economic growth, as Pakistan is underdeveloped country. Thus, it is focusing more on the advancement of industrial sector than agricultural. As more investments are being made on the formation of infrastructures relating to trade sector, transport sector and education sector, but small resources have always been allocated to the projects related to agricultural productivity.

## 7. Policy Recommendations:

We would like to make the following recommendations: -

- Government of Pakistan should discourage the existence of feudalism and should provide subsidies to the poor farmers that would be helpful for them to purchase fertilizers, equipment and quality seeds.
- Government should make more investment in the infrastructures relating to agricultural sector that may enhance economic growth.
- The government should make investment in the development of dams to create water reservoirs in order to reduce shortage irrigated water.
- Pakistan's government should increase ELF by improving the quality of education in agriculture sector and industrial sector also.
- The government of Pakistan should invest and use modern technology to overwhelm the issue of agriculture.

- Government should develop and expand irrigation system to deliver water at tail end.

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## CONTRIBUTION OF AUTHORS AND CONFLICT OF INTEREST

This research work was carried out in collaboration between two authors.

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