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## THE EFFECT OF TRADE LIBERALIZATION ON AGRICULTURE GROWTH IN PAKISTAN

Hazrat Ali<sup>1</sup>, Abdur Rehman<sup>2,\*</sup>, Umme Ruqia Saddat<sup>3</sup>, Abdul Manan<sup>1</sup> and Imran Qureshi<sup>4</sup>

<sup>1</sup>Department of Economics, Faculty of Arts and Social Sciences, Gomal University, Dera Ismail Khan, KPK-Pakistan

<sup>2</sup>Department of Agricultural Economics, Faculty of Agriculture, Gomal University, Dera Ismail Khan, KPK-Pakistan

<sup>3</sup>Department of Management Sciences, Faculty of Law and Administrative Sciences, Gomal University, Dera Ismail Khan, KPK-Pakistan

<sup>4</sup>Department of Commerce, Faculty of Law and Administrative Sciences, Gomal University, Dera Ismail Khan, KPK-Pakistan

### ABSTRACT

Trade liberalization plays a vital role in the growth of any economy. However, the role of trade liberalization in the growth of Pakistan is not yet investigated. The main purpose of the current study is to evaluate the effect of trade liberalization on the enhancement of agricultural development in Pakistan. The secondary data for the 45 years from 1972 to 2016 have been drawn from the World Development Indicator and Pakistan Economic survey. The unit root tests, i.e., the Augmented Dicky Fuller (ADF) and Phillips Perron (PP) tests, were used to check the stationary level of the concerned variables. The ARDL framework was used to detect the short-run and long-run relationship of the variables. The study concluded that the reality of estimation exists for the long interval, which indicates that long-run correlations are present. The study further concluded that in the short and long run, trade liberalization, the consumer price index, and the numbers of tractors have a positive and significant impact on the growth of agriculture in the Pakistan economy. The diagnosis tests of different models show that the models are correct and stable.

*Keywords: Agricultural growth; ARDL; CPI; Trade liberalization; Trade openness; Pakistan.*

\* Email: [drrehmanagec@gu.edu.pk](mailto:drrehmanagec@gu.edu.pk)

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### INTRODUCTION

Trade liberalization can be defined as “The removal of the trade restrictions, i.e., the tariff on imports and exports, import quotas, trade barriers, etc., by the government to expand the country's trade volume.” In trade liberalization, there are no trade hurdles such as government interference in matters of business, and all countries are involved in the free transaction of goods and services with each other. In free trade, if some of the customs duties are implemented by the government of any country, it does not mean that the relevant country uses the revenue to protect domestic industries. This phenomenon first started in the 19th century, when most economists recommended the idea of free trade to be implemented by countries because they knew that there were large benefits than trade loss. Most of the famous organizations, such as transitional cooperation, world trade organization, followed the free trade policies and gave suggestions to the member countries for free trade. Before 1995, the trade liberalization phenomena were not famous, and most of the nations followed different types of policies, but after the Uruguay round, all the countries felt the advantages of the free trade policies, and more than 150 countries signed the membership of world trade organization (Akyuz, 2005). As compared to the developed countries, the third world countries gain more benefits in the matters of free trade policies because due to protected trade policies, there are some

problems created in the countries such as lack of modern equipment for manufacturing, lack of foreign investment, state of the art technology and non a viability of skilful labours. The poor countries of Asia, such as Pakistan, India, Sri Lanka, etc., adopted the free trade liberalized policies due to some aspects of the relevant countries' progress, i.e., Pakistan takes the latest technology for textile manufacturing, India in the production of tea, etc. Due to the liberalization of trade, countries make significant progress in various fields of the economy, i.e., agriculture sectors, industrial sectors, etc. Trade liberalization converted the strict rules of trade into the simplest shape and encouraged the traders to improve the activities of imports and exports. As a result, the industrial sector, as well as the agricultural sectors of the economy, increased. Through liberalized trade policies, the economies of south Asian countries such as Taiwan, South Korea, Singapore, and Hong Kong are rapidly growing.

In recent years, the condition of the growth of Pakistan's economy has been fruitful, regardless of the reality that the economic background of Pakistan was very weak. The average growth in actual GDP is 6 percent annually throughout the last thirty years, whereas the overall contribution of the agro sector to the gross domestic product was 38 percent per annum. This is a reality that the contribution of the agro sector of the economy reduced by 60 percent between 1960-1970. After all, the share of agriculture further decreased by 24 percent, while the share of industry increased continuously. It is also a reality that the sector of agriculture is the backbone of Pakistan's economy. If we see the drawback of the Pakistan economy, we will find out that 50 percent of job opportunities will be provided by the agriculture sector. It also brings two-thirds of revenue from abroad to export agricultural products, i.e., wheat, sugar, tobacco, cotton, fruit, etc. It is a reality that 70 percent population of the country lives in rural areas, where most people work or are employed in agriculture, which plays a significant role in national income. In the economy of Pakistan, the contribution of livestock and fisheries increases over time. Nowadays, Pakistan exports a large number of dairy products along with fisheries products to earn valuable foreign reserves to reduce the balance of payment. Bringing state-of-the-art technology and high-quality seeds of different agricultural products, i.e., rice, grams, wheat, cotton, and rice, along with modern irrigation facilities and using modern technology, i.e., tractors, etc., puts a positive and significant impact on the agriculture sector of Pakistan.

Previous studies employed different variables and methods to assess the benefits of trade liberalization with different time series data sets (years), but this study is unique from the rest regarding the period of data set and techniques. The present study will consist of 45 years of data from 1972-2016. The present study will be using two tests for making the data stationary, such as ADF and PP tests. Test of co-integration would be used to find the original drawback that either long-term integration present between the variables. For this purpose, we will be used ARDL bound test to investigate whether long-term co-integration exists between the study, including variables. For short-term relationships among the variables, we will use ARDL short run form to conclude the results of the included observation variable. The main research gap of this study is to evaluate the contribution of trade deregulation or trade openness to agricultural growth with the combination of other economic indicators like the Consumer Price Index (CPI) and Tractor (TRA) in Pakistan.

It is the basic question of different researchers what degree of association existed between the two macroeconomic terms, i.e., Trade liberalization and Agriculture growth conducting different research processes. In some cases, it shows positive and significant results, proving that trade liberalization played an active role in the development of the agriculture sector. While on the other side, some cases show that the studies' consequences are negative, meaning trade liberalization plays a negative role in agriculture growth. In most studies, it proves that with more liberalized trade policies, country increases their exports and are able to bring state-of-the-art technology that further increases the rate of GDP. If modern technologies are available for any country's agriculture sector, it will lead to prosperity and increase the per capita income of the people. Trade liberalization also has some positive changes in the labour sector to make skilful labour that makes their efficiency better.

Recent observations would be fruitful to evaluate the analysis of contextual trade reforms to Pakistan's agriculture sector. Present investigating would be fruitful for various researchers getting a share of the literature on the deregulation of trade in Pakistan's economy. Current observation would be fruitful to help thinkers find out the role of trade reforms and their impacts on Pakistan's agriculture improvement.

The objectives of the study are: the examination of the trade openness to overall the agriculture growth of Pakistan's economy, to check out the short-term and long-term co-integration between liberalization of trade on growth of agriculture, to find out the relationship between the agriculture growth with the included variables of study, and to draw Policy implications and suggestions for the policy and decision-makers.

### **International Trade Liberalization Effect on Agriculture Production**

In the 18<sup>th</sup> and 19<sup>th</sup> centuries, the trade liberalization phenomenon started because more economists were in favour of this theory. The reasons were that they experienced gaining more benefits as compared to the loss. Such trade liberalization has a fruitful effect on economic growth in such a way that it also affects any economy's agriculture sector. Due to the liberalization process, modern agriculture technology, such as tractors, fertilizer etc., are helpful for more production of crops. It is concluded that developing countries expand their exports quickly due to trade liberalization (Vos, 2007).

By observing the studies of various researchers, it is clearly indicated that more liberalized policies certainly enhanced international trade, i.e. mobilizing goods, capital, services and labor across borders. International trade advancement has a significant effect on employment, investment and wages. As a result, more agriculture production is received at a high rate, and overall, agriculture sector shares are increased in the economy. In 1977 the policy of trade liberalization introduced increased the goods and services available for consumers and also expanded the agricultural sector opportunities, increasing investments, higher rate of output and productivity in the agricultural sector and market competition enhancement. The main objective of economic growth is received at that time when the Gross Domestic Product (GDP) has continuously increased at a higher rate for a long period. Continuous growth in real GDP is an indicator of economic development and capital accumulation; entrepreneurial abilities, manpower, technology and natural resources perform a significant role in real GDP increase. The agricultural sector also increased the real GDP, simultaneously increasing the agricultural output and finally the agriculture as a surplus. As a result, surplus labor shifted into the agriculture sector, which increased agricultural production and stable the economy of the country. Trade policy reforms further motivate and encourage trade liberalization, which tends to ultimately increase derived welfare from domestic resources with efficient allocation in the agriculture sectors.

Anwar et al. (2010) analyzed the research study "Effects of Trade Reforms on Agriculture Exportation of Pakistan's Economy. This study observes 1971 to 2008 to see the original picture of the economy and what situation was created with different periods of time. The author of the study indicated that trade liberalization brought competition in markets and increased the volume of trade along with the exportation of agricultural products. The study examined the data of cotton, sugarcane, maize, barley and wheat that with the passage of time, the country applied more liberalized policies that increased the growth rate of agriculture production with the help of modern techniques and technology. Fabiosa (2008) made research work on a study of liberalized trade over the growth of the agrarian economy of underdeveloped countries and populations all over the world. For the study, first, the free trade impact on the agriculture sector, especially for food consumption, is changed due to prices and income. In the study, it is estimated that free trade raised economic growth in both developed and underdeveloped countries. Since lower-income households' food consumption was more responsive to income changes, under the trade liberalization regime, their consumption of foods increased; the second arguments are the expectation of the trade liberalization to increase the price of the commodities internationally. Generally, with protected policies, the price of the goods is more expensive than the free trade policies because the price of imports or exports of the

commodities were low with the imposition of low tariffs. Therefore, it is necessary for low-income nations to reduce the price of consumption goods, which they increase at a fast speed. For underdeveloped countries and households, the importance is that these are the main source of income for those households to pay or consume for main expenditure items, i.e. food products. Empirical estimation of the study shows that if there is a risk for the small producers in the importing country, it was neither widespread nor large in scale because the net income dominates from the substitution effects of the lower domestic prices.

Gingrich et al. (2010) made an observation on the liberalized trade policies impact on the two underdeveloped countries Costa Rica and El Salvador. The study indicated that both countries have a high economic crisis, and they have a high rate of the burden of debt. It shows that when both countries applied liberalized trade policies in the 1980's they gained a lot of benefits from them. The study also shows that trade liberalization positively and significantly impacts both economies to produce agricultural crops that increase the export of both countries to earn valuable foreign reserves. With the growth of the agricultural sector, trade liberalization also positively and significantly impacts the prices of various commodities, the exchange rate as well as the rate of employment. The main suggestion of the study is to reduce the rate of non-developmental funds, improve the rate of energy and more liberalized policies adoption.

Hertel (2007) did a research study on the topic of the liberalization effects of the WTO reforms on agriculture sectors of both underdeveloped and developed nations of the world. The study used panel time series data for observation. The study pointed out that in the US, the government subsidized the farmer to grow more and increased the export of agricultural products that affected and were harmful to the other 15 developing countries' households of the study, which have not able to increase the export that created a serious problem for free liberalized trade. In such circumstances, the gap between the poverty line increased in both developed and developing countries. Agriculture trade policies of reform basically became popular in Doha round that created many advantages for developing countries, but most of the benefits were received by US farmers because the subsidies by the government made the agricultural sector strong. Eventually, the study concluded that underdeveloped countries have more benefits if they are seriously thinking about agricultural sector improvement and trade liberalization policies along with the removal of subsidies policies of the US government for equaling opportunities among all the citizens of the relevant countries.

Huang et al. (2015) tried to investigate stabilization regarding prices increase of trade reforms in agriculture product markets of the South East Asian countries. For investigation, the author observed the framework of partial equilibrium in requisites of rice that indicated that due to liberalization, rice production has been increased with the quality standard along with stabilizing price to trade among the South East Asian countries, i.e. Indonesia, Philippines and Malaysia. The observation also shows that with this circumstance, the member countries decreased their domestic prices by 34 percent while they brought an increase of 20 percent in exportation to other countries, helping to countries' balance of payment. For future forecasting, it is possible that by 2020 the liberalized trade policies will help them to increase the production of rice to 4.5 million tons which would reduce rice prices and enlarge the exports to other countries by the members' countries Thailand, Vietnam, Malaysia, Philippines and Indonesia.

Malik (2007) concluded the study of trade reforms on Pakistan's agricultural export sector performance. The basic aims of the study were to find out all those external demands and internal supplies that put positive impacts on the efficiency of agriculture exports performance. For the said analysis agenda of four points' are trade openness, competitiveness, international demand and diversification of the agriculture manufacturing process. The conclusion of the study shows that external demand and internal supply affected the agriculture sector positively both in the long run as well as short-run using the Johnson co-integration and VCM framework. The study suggests that trade openness has a significant and affirmative effect on the agriculture sector to sustain a high standard of living, per capita income and growth of the economy.

Mahmood et al. (2010) made an observation on the study of the same topic that showed the original drawback of the study in the case of Pakistan. The observation was mostly theoretical and used cross-sectional data collected by questionnaires. The study indicated that there is a positive association between the liberalization of trade and the productivity of the agricultural sector. Overall it can be realized that there is some difference between size, income and standard of living among the citizen. The study also shows that liberalized policies bring modern technology, skills, and investment, reduce the unemployment rate & increase the rate of growth in agriculture production.

Shaheen (2013) analyzed the same study of agriculture growth and trade liberalization in Pakistan using secondary data from 1975 to 2013. They included the variables such as Gross Fixed Capital Formation (GFCF), agriculture growth (FDI), labor in the agriculture sector etc., for cointegration to find a long-run relationship-bound test to be used. For short-run relationships, ECM is used with pairwise causality to check out the association of the explanatory variables with explained variable. The consequences show that gross fixed capital formation positively impacts agriculture growth while the remaining variables have a negative relationship with agriculture growth.

Walkenhorst (2005) structured analysis of the study 'Impacts of Trade Deregulations on Textiles Industry of the Developing Countries. The observation indicated the shifts in the manufacturing sector along with commerce expanded the production efficiency of the underdeveloped Asian countries and contracting economies of developed countries. Most of the later studies indicated the increase in production and growth from liberalized trade policies, but a large push can be shown between projected gaining and distribution.

International trade is considered an engine of growth that facilitates enhanced free trade reforms to make trade simple and easier. Domestic resource efficient allocation means reducing the import substitution production and raising the quantity of exportable commodities; as a result, eventually, the agricultural sector's total production will be increased. On the other side, efficient allocation of resources and adjusting exports generate comparative advantages, as a result gaining higher surpluses production from the agricultural sector. Trade liberalization is fruitful in increasing the consumer's welfare with a low price of imported goods and substitutes.

### **Trade Liberalization and Agriculture in Pakistan**

After independence, the economy of Pakistan has been characterized by a weak base of industry, economic and political instability, agriculture sector dominance and the lack of well-organized infrastructure. After this harsh experiment, it has been realized by the government took progressive steps for a non-liberalized trade system and implemented huge tariffs and non-tariff restrictions for the protection of local industry (Anwar, 2002). The first five-year plan is organized to develop and reorganize the industrial laws. As a result, industrial manufacturing is expanded. In this period, the more protected trade regime remained effective. In contrast, some beneficial trade policies were introduced for the exports of industrial goods to other countries, i.e. export bonuses, erasers access for credit from the bank, automatic renewal of licenses of imports and overvalued exchange rate etc. Still, unfortunately, the success of industrial progress is not continued to the next decade of the political crises. Although Bhutto's regime nationalized various types of industries which discouraged investors from investing in Pakistan, as a result, the ability of the industry reduced. The government of that time introduced three types of liberalization policies, i.e. (1) devolution of local currency in 1972 by 57%. (2) Discontinuation of the restrictive licensing scheme. (3) Removal of the export bonus scheme. As a result, exports, especially of manufactured products, are stimulated. Nowadays, most under-developed countries, such as Pakistan, have followed the policies of liberalization to expand their volume of trade. It is observed in most underdeveloped countries that liberalized policies rise the production of agriculture growth as well as the employment rate of the country. In 1970, the Pakistan liberalization policies framework's main aims were to increase the goods and services available for the consumers, expand the agricultural sector employment rate, market competition enhancement, and

increase investments while improving the production of the country's agriculture sector. It is obvious that free trade policies increased the welfare of the nation by declining or removing the trade barriers, i.e. taxes, quotas and subsidies. While in the other hand, the net welfare effects of liberalized trade have been debated over the course of time (Abbasi, 2008). Figure 1 shows the original picture of the openness of trade on the development of the agriculture sector in Pakistan.

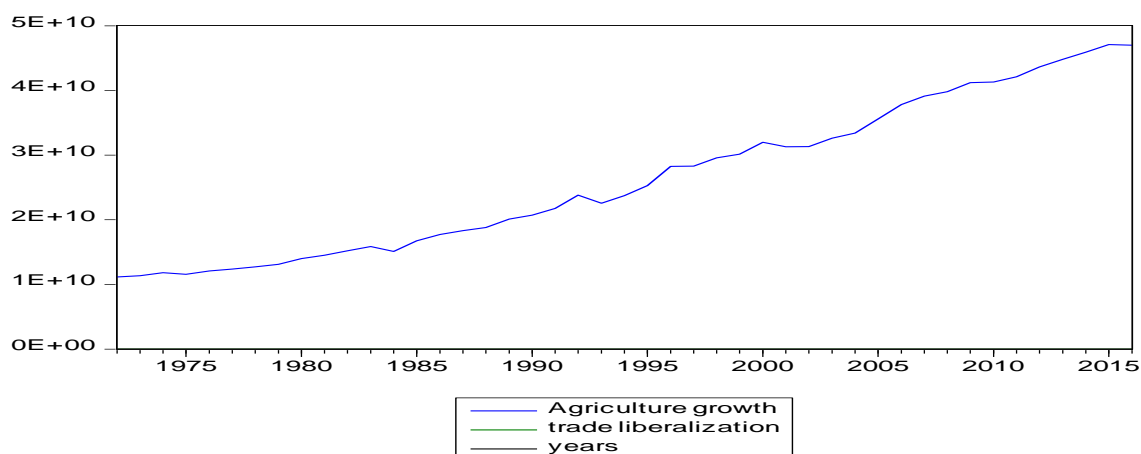


Figure 1. Impact of trade openness on the growth of the agricultural sector of Pakistan's economy.

In figure 1, we see that before the slow rate of trade liberalization, our agriculture growth increased slowly. When the rate of liberalization of trade increases, i.e. removal of trade barriers and other restrictions, the speed of agriculture growth also increases. In 1972 the rate of agricultural productivity was low due to constraints on the economy because there was a lack of liberalization. In the course of time, the government of Pakistan realized the importance of liberalization and their benefits also. In 1995, the government suddenly decreased the rate of tariff, which dramatically increased the production of agricultural productivity; as a result, the unemployment rate decreased.

Suppose we see the other side of the picture. In that case, it shows a different argument because, in some studies, it is proved that trade liberalization has little effect or no effect on accelerating the production of agriculture growth. Some analyses empirically show that the link between agricultural production growth and trade liberalization exists. Moreover, in the point of research, the productivity of agriculture and liberalization of trade may feed each other. Production of agriculture can be achieved from the openness of trade, along with free trade policies, as agriculture products need to be more competitive to take expected production levels of agriculture (Angela & Lee, 2011).

### **Hypothesis testing**

The following are the important hypotheses of the study.

- H<sub>0</sub>: Trade Liberalization has no effect on the growth of the agriculture sector.
- H<sub>1</sub>: Trade Liberalization has an effect on the growth of the agriculture sector.
- H<sub>0</sub>: Tractors as heavy agriculture machines do not affect the agriculture sectors.
- H<sub>1</sub>: Tractor has positively affected the agriculture sectors.
- H<sub>0</sub>: The consumer price index has not affected the agriculture sectors of Pakistan.
- H<sub>1</sub>: The consumer price index has affirmative impacts on the agriculture sectors of the Pakistan economy.

### **METHODOLOGY**

#### **Data Sources and Data Analysis**

The overall study is conducted in Pakistan. And the data used for the purpose of analysis are secondary and time series data and these data are taken from the world development indicators along with the Economic

Survey of Pakistan from 1972 to 2016. The software Eviews 9 is used for the purpose of analysis and used to check the consequences of the variables, i.e., agricultural growth, number of tractors (TRA) used, trade openness (TON), and consumer price index (CPI) of Pakistan's economy.

### **Data Analysis**

For data analysis, various kinds of econometric tools, i.e., unit root test, pp test, ARDL bound test, and various diagnostic tests, are to be applied to gain the results of the current study that are selected for the observation.

### **Model of the Study**

Following is the econometric model of the study.

$$Y = f(X_1) + \varepsilon_t \quad (1)$$

Putting the explanatory variables of the current study in equation 1.

$$\text{AGRO GDP} = f(\text{CPI}, \text{TON}, \text{TRA}) + \varepsilon_t$$

$$\text{Or } (\text{AGRO GDP}) = \beta_0 + \beta_1(\text{CPI}) + \beta_2(\text{TON}) + \beta_3(\text{TRA}) + \varepsilon_t \quad (2)$$

For the linearity of data of the included variables, the model is taken in doubles logs form. It could be written in the following shape.

$$\text{Log AGRO GDP} = \beta_0 + \beta_1 \text{Log (CPI)} + \beta_2 \text{Log (TON)} + \beta_3 \text{Log (TRA)} + \varepsilon_t \quad (3)$$

While,

AGRO GDP: AGRO GDP is nominated for the agriculture growth rate.

CPI: indicated for the inflation rate.

TON: it is denoted for trade openness. It means that TON occurred when we calculated imports plus export divided by a gap.

TRA: number of tractors that are used in the agriculture sector case study of Pakistan.

$\varepsilon_t$ : is the error term.

Following is the description of the variables that are explained as under.

### **Agriculture growth**

Before explanation of agricultural growth, we want to define GDP or growth. "All those commodities which are manufactured in the fixed time period". So agricultural growth rate means occupation or science that is used to cultivate or rearing the production of crops and livestock, i.e. husbandry and farming etc. so agricultural growth means all the agricultural commodities and services that are produced in one year in a country's national boundary are called agriculture growth. We take Agriculture GDP as a proxy for agriculture increase. The data were taken from WDI at the constant rate in 2010 is US \$.

### **Trade liberalization**

Trade restrictions, i.e. trade barriers, import quotas and custom duty etc., reduction or removal of tariffs between the two countries that are making the transaction of goods and services with each other. Alternatively, in short, we can define it as  $\text{IMP} + \text{EXP} / \text{GDP}$ . Such type of trade that erases the trade hurdles promotes the free trade concept that is very beneficial for both countries. For the current study, we take trade openness (TON) as a proxy. The data of trade openness are taken by WDI as constant rate 2010 at US \$.

### **Consumer price index (CPI)**

CPI measures the level of prices of different commodities and services of the consumer by different households of market baskets due to changes. In other words, we can define it as "Consumer price levels of various goods" and services of market basket changes of various households are measured with a scale, that scale called CPI. It is one of the few indices of the price that are calculated by mostly national agencies of

statistics. Yearly percentage variations in the consumer price index are used for the measurement of inflation. CPI could be taken (adjusted effect of inflation), salaries, wages real values, and pensions, due to regulating price and for monetary magnitudes deflating to show variation in real values. Time series data of the CPI are taken from WDI.

**Tractors**

Such types of powerful machines have powerful diesel motors or gasoline, heavily treaded rear tires and large shapes that are commonly used especially for pulling or cultivation of crops with scientific methods to gain more production than traditional methods of cultivation. Before the tractor, most of the crops were cultivated with the help of bulls or other animals. Tractors cultivated the crops with limited time and an appropriate arrangement. The data on the tractor are collected by economic surveys of Pakistan from 1972 to 2016.

**Estimation**

Estimation means finding out the results of different variables using econometric tools. For the checking of stationary test of unit root has applied, while for finding results of long run relationship ARDL bound approach is used among the variables of both the sides of the model. To check out the consequences of the short run, the error correction shape of the ARDL has been used. The first step of the estimation is checking the variables' stationary stander using the unit root test.

**Unit Root Test**

This test is used to find out the stationarity of the variable at 1<sup>st</sup> difference. The first step in the case of secondary data is to check the non-stationarity problem whether exists or not. The problem of non-stationarity gives us spurious results (Harris, 1995). The basic purpose of using this test is that either the included variables are stationary or not. ADF or augmented ducky fuller tests (1979) are used for the recent observation to find out the stationary results of the study that which variables are at level and which one at 1<sup>st</sup> difference. Following are the equation of the ADF test.

$$\Delta Y = \Omega Y_{t-1} + \varepsilon_t \tag{4}$$

$$\Delta Y = \beta_0 + \Omega Y_{t-1} + \varepsilon_t \tag{5}$$

$$\Delta Y = \beta_0 + \Omega_{1i} + \Omega Y_{t-1} + \varepsilon_t \tag{6}$$

For the parametric value “ $\Omega$ ” all the above equations are tested; if the worth of the “ $\Omega$ ” is non-zero, then it indicates that the variable is stationary; if the value of “ $\Omega$ ” is zero, it means that the set of the data of the variable is not stationary. The above equitations are made on the basis of the assumption that the terms of error are not correlated. If they are correlated Augmented Ducky Fuller test (1981) is to be used as follows.

$$\Delta Y_t = \beta_0 + \beta_{1i} + \Omega Y_{t-1} + \sum \beta_i Y_{t-i} + \varepsilon_t \tag{7}$$

It means that if the equation-4 critical values are greater than the t-statistics or Mackinnon that  $H_0$  accepted if the value of  $\Omega$  lays outside the critical region, the variable is stationary.

**ARDL Bound Test Approach**

For investigation of long-term correlation among Agriculture Growth and Trade Liberalization along with the other factors, it is essential to focus on an advanced approach instead focusing on traditional approaches of co-integration, i.e. Engel and Granger (1987) and Johansen and Juselius (1990) approaches of co-integration. In such circumstances we applied modern approach (ARDL) bounds test framework created by Pesaran et al. (2001) to find out either the association long term are present or not related. This test approach has various benefits i.e. the approach can be applied if the variables of the model are purely at level I(0) or purely at first difference I(1) or some of the variables are at level I(0) or some or I(1) it can be used. In traditional approaches, it is not possible. According to (Haug, 2002) the Bound approach of ARDL



test is more beneficial and provides better results for small sample. Parameters of short term along with long term of the study are simultaneously estimated. In equation-1 the model can be used as.

$$\Delta \text{TON}_t = \lambda_0 + \lambda_1 \text{TON}_{t-1} + \lambda_2 \text{Agro.GDP}_{t-1} + \lambda_3 \text{CPI}_{t-1} + \lambda_4 \text{TRA}_{t-1} + \sum_{i=1}^n \Delta \varepsilon_i \text{TON}_{t-i} + \sum_{i=0}^n \Delta \varepsilon_i \text{Agro.GDP}_{t-i} + \sum_{i=1}^n \Delta \varepsilon_i \text{CPI}_{t-i} + \sum_{i=1}^n \Delta \varepsilon_i \text{TRA}_{t-i} + \eta \text{ECM}_{t-1} + \varepsilon_t \quad (8)$$

In the above model,  $\Delta$  is the 1<sup>st</sup> difference operator that means a change. As shows the  $\beta$ 's or coefficients of long term along with short term. Numbers of hypothesis deals with no co integration  $H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$  &  $H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq 0$  are the co-integration of alternative hypothesis.

After that other pace is to cheek the calculated values of F-statistic with values of critical from the Pesaran (2001) that was created for small scale observation between 30 and 80. Therefore our sample sizes of the study are 42 than it is best. One set of the equation argued that all the included variables of the model that are at  $I_{(0)}$  and the other set of the equation indicated to assumes they are all at  $I_{(1)}$ . If the calculated F-statistic is greater than the critical value of upper bounds, then we will be rejected  $H_0$ . If the value of F-statistic decreased in to the bounds then the test became inconclusive. On the other hand if the value of F-statistic is lower than the below value of critical bounds, it indicated the absence of co-association between explanatory variables.

For the short run analyses to see the altitudes of the explanatory variables, we use ARDL error correction shape. The model is as follows.

$$\Delta \text{TON}_t = \psi_0 + i_1 \Delta \text{TON}_{t-1} + i_2 \Delta \text{Agro. GDP}_{t-1} + i_3 \Delta \text{CPI}_{t-1} + i_4 \Delta \text{TRA}_{t-1} + \eta \text{ECM}_{t-1} + \varepsilon_t \quad (9)$$

Here  $\Delta$  indicates change in the difference operator while ECM occurred from the co-integration of long term relationship commencing the particular shape of ARDL. In the above equation,  $\eta$  must show a positive and considerable mark for causality that is present in the long run. For the finding consequences of model stability two tests i.e. CUSUM or cumulative sum of recursive residuals, and CUSUMSQ or cumulative sum of squares of recursive residuals are used to test the original drawback of the model.

### **Appropriate Software and Statistical Package**

EViews is a contemporary econometric, statistics, and forecasting package that provides powerful analytical tools in a flexible, user-friendly interface.

E-Views allows you to manage your data quickly and efficiently, perform econometric and statistical analysis, generate forecasts or model simulations, and generate high-quality graphs and tables for publication or inclusion in other applications. Therefore, the current study use E-views 9 for data analysis.

### **Diagnostic Tests**

To relax the data from various kinds of crisis like Auto correlation, serial Correlation, various kinds of tests i.e. Breush Godfray serial correlation test. Ramsey RESET test etc. is used to detect the problem in time secondary data. In current study, different diagnostic tests are applied for detection of the problem.

## **RESULTS AND DISCUSSIONS**

### **Descriptive Statistics**

Nowadays, most researchers use descriptive statistics commonly in the modern research process. In descriptive statistics, we find the values of the mean, median, minimum, maximum, and Standard Deviation of the explanatory variables. Liberalization is used to enhance the trade of the country and has a positive effect on agriculture growth. Consumer price index also plays a positive role in agriculture growth, but tractor has an insignificant impact on agriculture production both in the long and short run. Below are the original pictures of the variables.

Table 1. Results of the descriptive statistics.

Stat.	Agro GDP	CPI	TON	TRA
Mean	2.4300	43.2344	0.2782	292283.5
Median	2.3800	27.0000	0.2859	295000.0
Maximum	4.7100	150.7535	0.3918	601786.0
Minimum	1.1100	3.1353	0.1923	30165.0
Std. Dev	1.1700	42.9474	0.0599	174591.1
Skewness	0.3158	1.2631	0.1396	0.0869
Kurtosis	1.7601	3.4366	1.6631	1.9027
Jarque-Bera	3.6305	12.3243	3.4971	2.3142
Probability	0.1627	0.0021	0.1740	0.3143
Sum	1.1800	1945.55	12.5203	13152
Sum Sq.Dev	6.0400	81157.44	0.1583	1.3400

Source: Author’s calculation.

In Table 1, we see that we take 42 years of annual data from 1972 to 2016 in Pakistan. The results of Mean, Median and St. Deviation of all the explanatory variables of the study. Trade openness has 0.2782, 0.2859 and 0.0599, which indicate that trade liberalization has positive effects on agriculture growth.

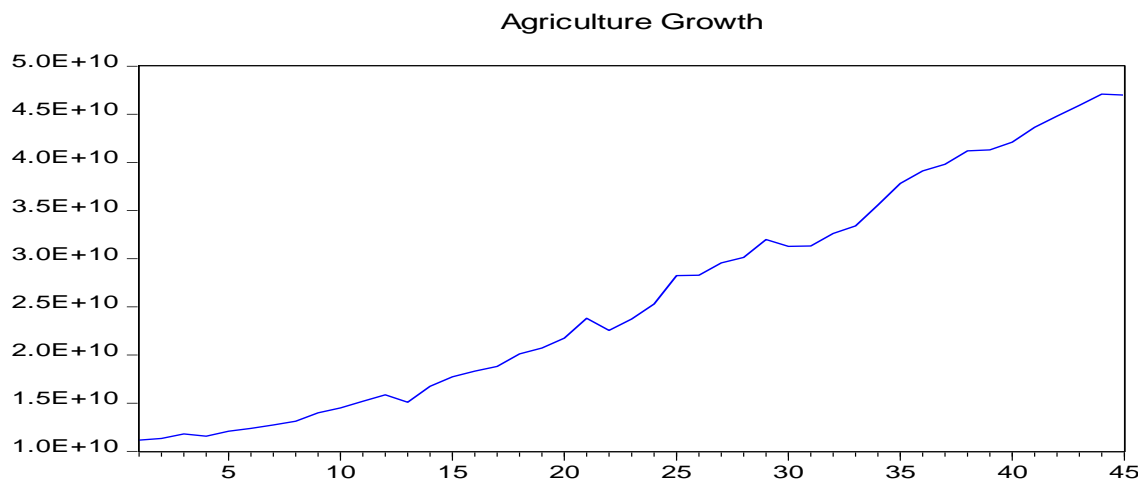


Figure 2. Log of agriculture (GDP) in Pakistan.

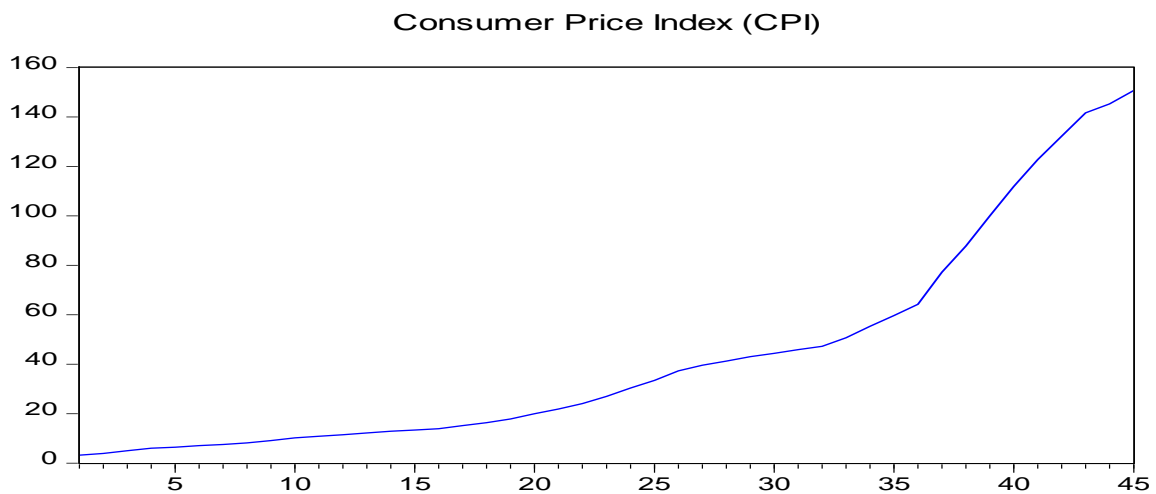


Figure 3. Log of Consumer Price Index (CPI) case study of Pakistan.

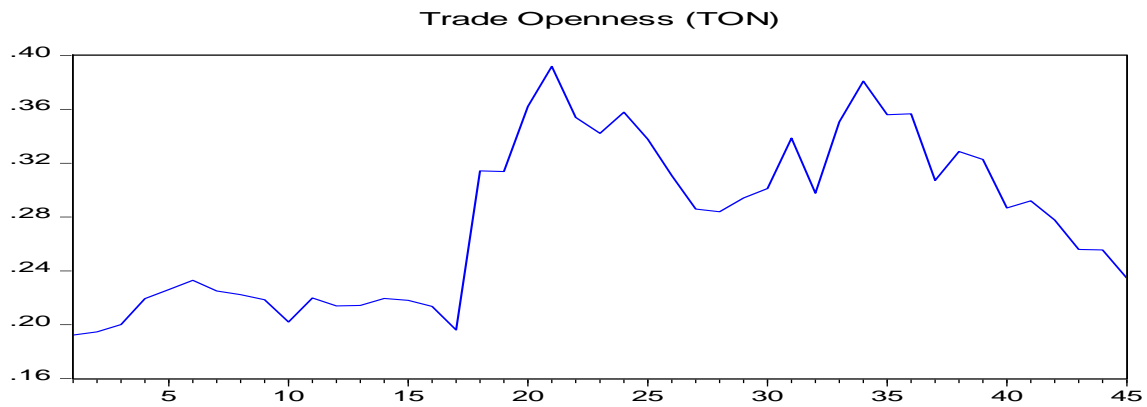


Figure 4. Trade openness (TON) in Pakistan.

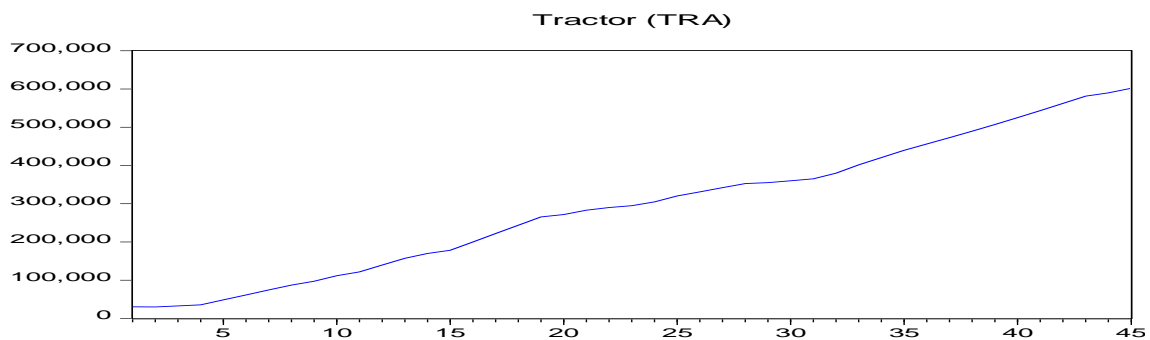


Figure 5. Log of tractor (TRA) in Pakistan.

In the Figure 5, we see that agriculture growth increased with the passage of time due to trade liberalization. Now the next step is to analyse the relevant data, whether it is linear or not. For checking the level of linearity of the data, we used two tests, i.e. ADF and PP test, to find out the results of the Unit Root.

**Consequences of Unit Root**

Current observation used secondary data from 1972 to 2016. As the method of the research process, firstly, we observed the states of the explanatory variable that either they are at level or at 1<sup>st</sup> difference level. We can find unit root results with a different tests such as the ADF test, PP test etc. In the current study, we used two tests for data stationary as ADF & PP test. Unit root test tell us that econometric techniques are suitable for estimation. Following are the table of the results of unit root by Augmented Ducky Fuller test.

Table 2. Results of unit root test with the help of ADF test.

Variables	At level	At 1 <sup>st</sup> Difference	Conclusion	Order of Co-integration
Agriculture GDP	-0.873521 (0.7871)	-5.322895*** (0.0001)	The conclusions indicate that the variables are stationary at 1 <sup>st</sup> difference.	I(1)
Consumer Price Index (CPI)	-0.570034 (0.8666)	-4.165837** (0.0021)	The conclusion indicated the stationary at 1 <sup>st</sup> difference.	I(1)
Trade Openness (TON)	-1.787432 (0.3816)	-4.177280** (0.0020)	The conclusion indicated the stationary at 1 <sup>st</sup> difference.	I(1)
Tractor (TRA)	-5.248250*** (0.0001)	-1.875190 (0.3404)	The result shows the stationary at level difference.	I(0)

Note: natural log has been taken of all the variables; \*\*\*level of significance at 1%, \*\* at 5% \* at 10%. All values are taken by intercept scale.

According to the Table 2, it is seen that the three variables Agriculture GDP, (CPI) and (TON) are linear at 1<sup>st</sup> difference I<sub>(1)</sub> with intercept and the remaining variable Tractor is at level I<sub>(0)</sub>. We also see that Agriculture GDP is stationary at a 1% level of significant. On the other hand, the Consumer price index (CPI) is at a 5% level of significant, Trade Openness is significant at 5% and Tractor is significant at a 1% level. Now we used Phillips Perron (PP) test for data stationary as shown in Table 3.

Table 3. Unit Root test with the help of PP test.

Variables	At level	At 1 <sup>st</sup> Difference	Conclusion	Order of Integration
Agriculture GDP	-0.869205 (0.7887)	-8.435956*** (0.0000)	The result shows the stationary at 1st difference.	I(1)
Consumer Price Index (CPI)	-1.587168 (0.4806)	-3.257464* (0.0233)	The conclusion indicated the stationary at 1st difference.	I(1)
Trade Openness (TON)	1.957741 (0.3038)	-7.262365*** (0.0000)	The conclusion indicated the stationary at 1st difference.	I(1)
Tractor (TRA)	-4.928724*** (0.0002)	-2.880717* (0.0559)	The result shows the stationary at level difference.	I(0)

Note: Natural log has been taken of all the variables; \*\*\*significance level at 1%,\*\*at 5%,\*at 10%. All the values are taken by intercept scale.

The results of Phillips Peron show that three variables, including Agriculture GDP, (CPI) and Openness of trade, are stationary at the first difference at 1%, 10% and 5%, respectively while Tractor (TRA) are linear at level and also at 1<sup>st</sup> difference at the level of 1% and 10%. All the results of variables in unit root tests are significant. Now the next step is taken for the estimation. We see that three variables are at 1<sup>st</sup> difference and one variable are at level; then we know that if a few explanatory variables are at 1<sup>st</sup> few are at level, then we used ARDL framework.

Following are the consequences of ARDL framework that are used. The bound test tells us whether a long-term association is present among the various variables of the model. Before proceeding to the ARDL bound test approach for the cointegration, suitable order lags of variables be determined (Pesaran et al. 2001).

Table 4. ARDL bound test for cointegration.

Variables	F-statistics	Co-integration
F(AGRO GDP/CPI. TON. TRA)	4.502409**	Co integration exist
Critical Values	Lower Bound Values	Upper Bound Values
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Notes: \*\*\* Statistical significance at 1% level; \*\* Statistical significance at 5% level; \* Statistical significance at 10% level. The lag length k=0 was selected based on the Schwarz criterion (SC). Critical values are obtained from Pesaran et al. (2001) case III for 42 observations.

The consequences of ARDL bound test of the co-integration point out the result of the F-statistic is 4.50, which means greater than the upper bound critical value of 4.35 at 5%, that means the co-integration association ship present among the growth of Agriculture growth and liberalization of trade in Pakistan.

Table 5. Short run relationships.

Repressors	Coefficient	Std. Error	t-statistic	Probability
Δ Log (CPI)	0.080530	0.041189	1.955146	0.0578*
Δ Log(TON)	0.066313	0.033983	1.951369	0.0582*
Δ Log (TRA)	0.021056	0.017805	2.87761	0.0087*
ECT (-1)	-0.239112	0.091116	-2.624242	0.0123

$$\text{Cointeg} = \text{Log (GDP)} - (0.3368 * \text{Log (CPI)} + 0.2773 * \text{Log (TON)} + 0.0881 * \text{Log (TRA)} + 22.1668$$

The short-run ARDL estimation explores the consequences of the short-run effect of the related variables on the growth of agriculture. In Table 5, we show all the expected signs of the variables in the study. First, we see that the consumer price index (CPI) has a significant and positive effect on agriculture growth in the short run, which means a 1% change in the consumer price index brings a positive change of 0.08% in agriculture growth in the case of Pakistan. In the same manner, a one percent increase in trade openness (TON) brings 0.06% positive change in the agriculture growth of Pakistan, as well as tractor (TRA), which has a positive and significant association with agriculture growth. The value of (ECT) tells us about short-run deviation or adjustment of speed from the equilibrium of the long run. The coefficient values must be negative and indicate the adjustment of speed between the long run and short term. In Table 5, we see that the worth of ECT is considerable and inversely related, which shows that the model of the study grasps convergence belongings and it will be return in the short run. In short, we say that trade deregulation has affirmative impacts on agriculture ripeness which imply a positive role in agriculture production.

Once it has been found that there are long-term associations of co-integration exist, equation (8) is estimated applied the specification of the below ARDL (1, 0, 0, 0). The consequences are procured by normalizing agriculture GDP(Y) in the long run.

Table 6. Long run relationships.

Variables	Coefficient	Std. Error	t-statistic	Probability
C	22.166790	0.880078	25.187292	0.0000
Log (CPI)	0.336789	0.064773	5.199506	0.0000
Log (TON)	0.277330	0.131899	2.102599	0.0420
Log (TRA)	0.088058	0.082112	2.024262	0.0547

Note: \*\* (\*) denotes 1% (10) significance level. Results obtained from eviews 9.0.

The long-run coefficients of the variables show that openness of trade has a significant impact on agriculture GDP (agriculture growth). According to the Table 6, a one percent change in trade liberalization brings a 0.2 percent change in agriculture GDP. The sign of the Tractor has positive and significant. The consumer price index (CPI) has a positive sign and is highly significant means that due to 1% change brings 0.3% increase in agriculture production. The consequences disclosed that trade deregulation has an affirmative impact on agriculture growth in Pakistan; however, the impact is highly significant.

The Table 7 shows the results of the model selection, with the view toward showing their similarities. It gives advised that a few difficulties removed by sequence tests of a hypothesis might be more expeditiously treated by the application of criteria model selection. This process shows us which model is good for estimation. For those criteria, we must select the best ARDL model for analysis. According to Table 7, the model ARDL (1, 0, 0, 0) is best because AIC: -4.028129, BIC: -3.823338, HQ: -3.952608, which are greater than all other ARDL models. Here we used the first 20 ARDL models based on Akaike info criterion that shows that ARDL (1, 0, 0, 0) model is best. Following are the top 20 ARDL models that show with the help of Figure 6.

Table 7. Model selection criteria.

Model	Log L	AIC*	BIC	HQ	Adj.R-sq	Specification
1	91.604764	-4.028129	-3.823338	-3.952608	0.995470	ARDL(1,0,0,0)
2	92.586021	-4.027257	-3.781508	-3.936632	0.995555	ARDL(2,0,0,0)
3	93.007109	-4.000331	-3.713624	-3.894602	0.995520	ARDL(1,0,0,2)
4	91.746874	-3.988287	-3.742478	-3.897602	0.995378	ARDL(1,0,1,0)
5	92.641322	-3.983317	-3.696610	-3.877589	0.995443	ARDL(2,0,1,0)
6	91.640740	-3.983290	-3.737541	-3.892666	0.995355	ARDL(1,0,0,1)
7	92.628508	-3.982721	-3.696014	-3.876993	0.995440	ARDL(2,1,0,0)
8	92.621323	-3.982410	-3.695703	-3.876682	0.995439	ARDL(2,0,0,1)
9	91.613233	-3.982011	-3.736262	-3.891386	0.995349	ARDL(1,1,0,0)
10	93.607793	-3.981758	-3.654093	-3.860925	0.995519	ARDL(2,0,0,2)
11	93.197922	-3.962694	-3.635029	-3.841861	0.995432	ARDL(1,0,1,2)
12	93.011250	-3.954012	-3.626347	-3.833179	0.995393	ARDL(1,1,0,2)
13	91.778509	-3.943186	-3.656479	-3.837458	0.995256	ARDL(1,0,1,1)
14	92.774786	-3.943013	-3.615348	-3.822181	0.995342	ARDL(2,2,0,2)
15	91.773722	-3.942964	-3.656257	-3.837235	0.995255	ARDL(1,0,1,1)
16	91.755997	-3.942139	-3.655432	-3.836411	0.995251	ARDL(1,1,1,0)
17	91.720615	-3.940494	-3.653787	-3.834765	0.995244	ARDL(1,0,2,0)
18	93.708247	-3.939918	-3.571295	-3.803982	0.995408	ARDL(1,2,0,0)
19	92.703623	-3.939703	-3.612038	-3.818871	0.995326	ARDL(2,0,1,2)
20	92.676241	-3.938430	-3.610765	-3.817597	0.995320	ARDL(2,1,1,0)

Source: Author's calculation.

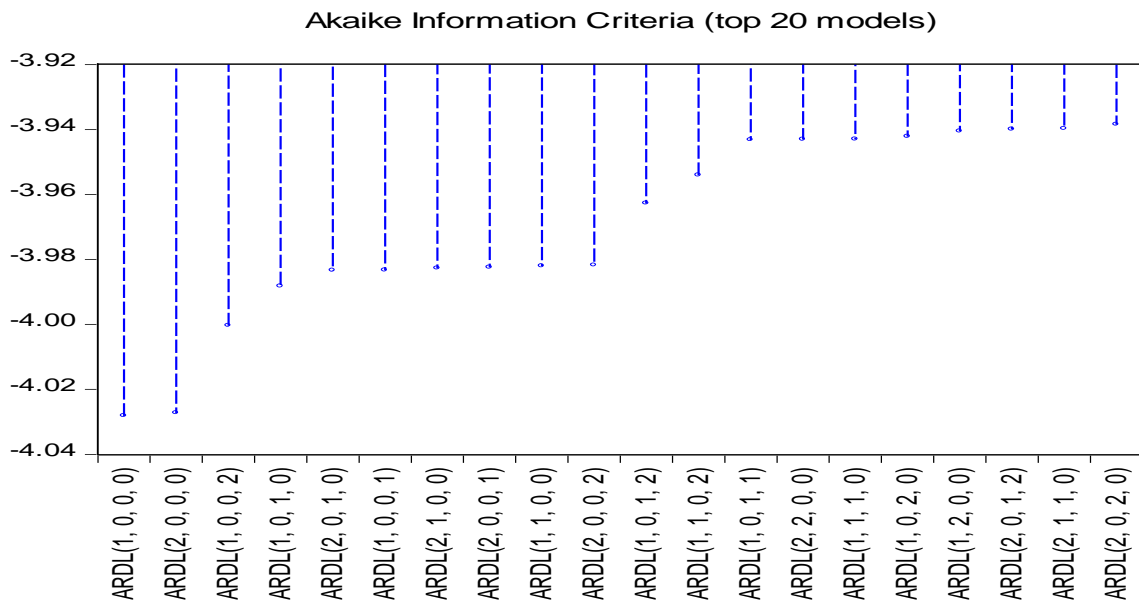


Figure 6. Model selection criteria for the first 20 model.

Figure 6 shows the real picture of the first 20 ARDL models, which the first model of the study is ARDL (1, 0, 0, 0), are the best. For the detection of autocorrelation and hetroskadasiy problem, two tests are used, such as Breusch-Godfrey serial correlation and ARCH test are used. Following are the results of the diagnostic test as under Table 8.

Table 8. Results of diagnostic test.

Test	F- statistics	Probability
Ramsey RESET Test (log likelihood ratio)	0.328486	0.7443
Breusch-Godfrey Serial Correlation test	1.684903	0.1994
ARCH test	0.131913	0.7183

Source: Author’s calculation.

In Table 8, we see that the F-statistics of the Breusch-Godfrey Serial Correlation test and ARCH test are 1.684903 and 0.131913, respectively, and their probability is 0.1994 and 0.7183 that indicated the results are insignificant shows that no problem of autocorrelation and hetroskadasy are exist in the model. Ramsey RESET Test shows whether their non-linear relationship is existed or not. According our results there are no non-linier relationship exist because the values of the F-statistics is 0.328486 and their probability is 0.7443 that means insignificancy. If there is insignificance, it means that a non-linear relationship is not found and the model is a linear regression model.

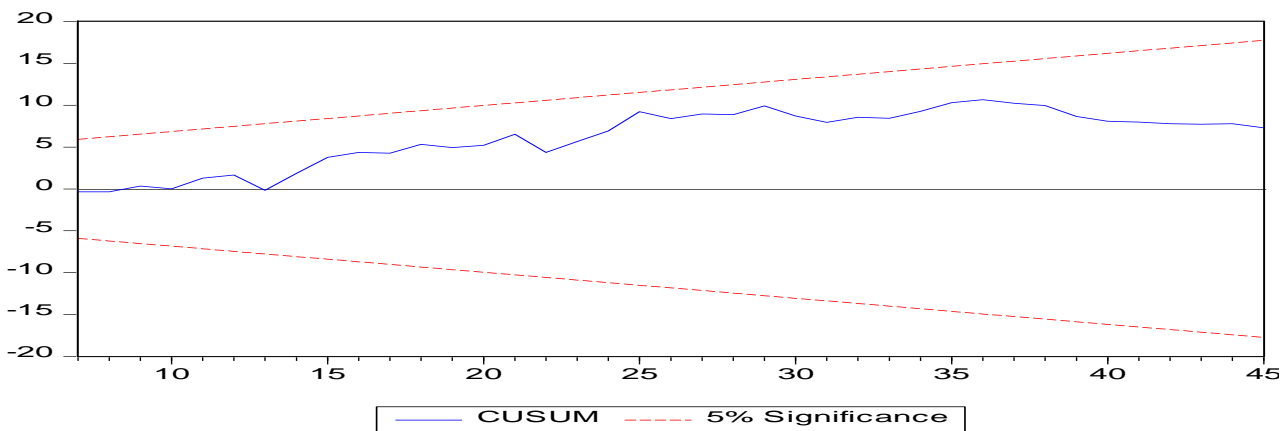


Figure 7. Cumulative sums (CUSUM) test for model stability plot.

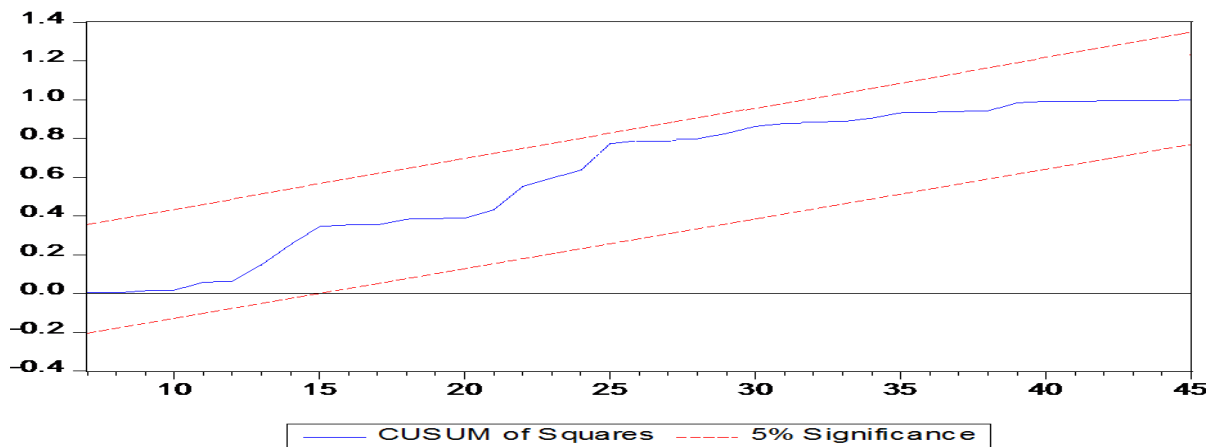


Figure 8. Cumulative sum of squares (CUSUMSQ) test for stability plot.

For finding results of regression model stability, two types of test are used, i.e. cumulative sum and cumulative sum of the square. Figure 7 and 8 indicate the consequences that there is no instability of coefficient in the CUSUM or cumulative sum plot, and the plot of CUSUMSQ dropped in the inner area, which indicates that the model is established.

**CONCLUSIONS AND RECOMMENDATIONS**

The ranks of Pakistan have the fifth most populous country in the world that faces numerous challenges to the constant growth of its population. Nowadays, the population of Pakistan has stood up to 202 million as

per the population census 2018 and is estimated to rise to 350 million by the mid of 2050. Demand for agriculture and livestock production would have increased due to the fast rate of population growth. More modern and favourable experiences would be required to meet the demand for food production with limited resources. Consequently, such experiences would be overexploited of God-gifted resources that may decline sustainable agriculture. The main object of the current observation has to investigate the fundamental association between the liberalization of trade and agricultural expansion in Pakistan by using secondary data from 1972 to 2016. The current study employed the ARDL bound test to investigate the estimation of the long-run co-integration, strength and direction of the association between trade liberalization and agriculture growth. Prior to testing the ARDL framework of co-integration, the current study used two tests, ADF and PP, for stationarity. The consequence shows that the consumer price index (CPI), trade liberalization (TON) and the number of tractors have a positive and significant impact on agriculture growth in the same way in the short run and long run. It also shows the liberalization of trade importance, enhancing the country's agriculture sector. The study's consequences recommend that Pakistan go to liberalize its trade policies to extend the rate of growth and prosperity. The inflation rate has put affirmative impacts on the agriculture growth case study of Pakistan in both the short term and long term; the study results mean that as people of the country expand their expenditure on food items, it gives benefits to the agricultural sector of the country to expand the rate of growth. All the discussion pointed out that liberalization of trade puts a significant positive effect on the rate of agriculture growth; Pakistan should focus on modern infrastructure, capital accumulation, creating entrepreneurship, establishing a secure macroeconomic framework and steps that are fruitful for investment. This entire step will help speed up agriculture's growth for Pakistan's economy.

Pakistan is an agricultural country. The big parts of the GDP consist of agriculture production. The most opportunity for employment is available in the agriculture sector. Pakistan should improve the efficiency of its economy to increase the rate of agricultural growth to improve the technology standard, research facilities, skilful labour etc. Pakistan is a developing country, and the main share of GDP consists mostly of agriculture production. It indicates that agriculture is the engine of growth. The government should remove hurdles or restrictions for free trade to boost trade. As a result, many macroeconomic indicators like foreign direct investment (FDI) and the volume of export and import will be expanding will further expand our agriculture sector, creating new employment opportunities and decreasing unemployment rates. The government should encourage a free and friendly investment environment to expand the agricultural growth rate. For this purpose, country laws should be made conducive and attracting foreign investors. Further research is necessary in this regard that leads the agriculture sectors fatherly. Consequently, the speed of economic growth would be improved. In order to boost the efficiency of the economy, simultaneous coordination is required on various fronts, i.e. security, technology, industry, human development, agriculture growth rate and inflation.

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