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The Impact of Trade Openness on Economic Growth in Pakistan; ARDL Bounds Testing Approach to Co-integration

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Abstract

This paper's main objective was to investigate the impact of trade openness on economic growth in Pakistan. We have employed the Johansen and Autoregressive Distributed Lag (ARDL) Co-integration together with ECM Techniques for the period 1975-2016. The empirical estimated results are the sound evidence that there exists a short-run and long-run positive and stable cointegration among the variables. Our empirical findings show that trade openness and foreign direct investment significantly impact Pakistan's economic growth. Moreover, the Granger causality test also confirms the bidirectional causality between trade openness and economic growth. It is, therefore, concluded that trade openness can play a vital role as the economic growth of Pakistan is concerned.

Keywords: Economic Growth, Trade Openness, ARDL, Causality, Pakistan.

JEL Classification: E01, F13, F21.

1. Introduction

Today we see that most of the developed and developing nations of the world are on the path of Economic growth and development only because of multilateral trade. Trade Openness is beneficial to a developing country like Pakistan to not only foster foreign investment and technology transfer but also to reduce poverty and child labor and to encourage human capital accumulation. There is considerable research work that has been concluded that trade openness has been

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played a pivotal and key role in promoting the economic growth of all those nations who have been recognized the importance of international trade and have also been involved in multilateral trade. A substantial number of Economists have been declared that trade liberalization and openness have been put the nations on the way of economic progress and growth, among them (Yanikkaya, 2003) believed that trade openness is an important indicator of economic growth of a country. Trade openness has been a prominent component of policy advice to developing countries for the last few decades. Trade openness is considered an important element of globalization, which has been mostly described as the increasing interaction, or integration of national economic systems with the help of growth in international trade and other socio-economic variables. It is connected with the growing internationalization of production, marketing of goods and services, and the associated growing production and commercial activities. Trade openness involves the dismantling of all forms of tariff structures like import and export duties, quotas and tariffs, and other restrictions to the free flow of goods and services across countries (Faiza, 2014).

Trade liberalization is a system that minimizes the hedges to make the mobility of goods and services across the globe easy and more comfortable. Trade liberalization transforms the world into a global village by reducing the obstructions, which gives birth to dynamic changes in the economic activities at national and international level; ultimately, the meaning of distance and living standard has been changed among the people of nations (Zafar et al., 2015).

The relationship between trade openness and economic growth has been a key debate in the development literature for most of the second half of the twentieth century. In the post-world war period, many economists have concluded that protective trade policies stimulated growth and, therefore, import substitution policies were widely adopted by developing countries.

From 1980 and thereafter the results of empirical studies had demonstrated the failure of the import substitution approach and consequently, the export-oriented policies were widely adapted (Gorgi and Alipourian, 2008). The debate relating to the import substitution and export promotion is found in development economic literature pros and cons have been argued on it. The big push theory, import substitution theory, and protection of domestic industry were the challenging issues in the 1950s and 1960s as important factors of economic growth and development (Muhammad et al., 2012).

After taking into consideration the importance of the trade openness for the promotion of economic growth of particularly, developing nations, I decided to research the impact of trade openness on the economic growth in case of Pakistan, therefore, rest of the research paper is designed as follows: Section 2 will discuss the literature review, in section 3 data and specification of the model is described, section 4 explains the methodology, section 5 provides the Estimation and Interpretation of Empirical Results and finally, Conclusion and policy implications will end up the paper in section 6.

2. Literature Review

Wacziarg (2001) investigated the relationship between trade policy and Economic Growth. He took 57 nations and used the data for the period from 1970 to 1989. He adopted a fully specified empirical model with the help of three trade policy variables namely, tariff barriers and a dummy variable of liberalization, he developed an openness index. He concluded that trade openness affects growth mainly by raising the ratio of domestic investment to GDP and by FDI.

Afzal (2009) investigated the impact of trade openness on Economic Growth in the case of Pakistan, using the data over the period 1960 – 2009. He applied the Johnson co-integration approach and concluded that there exists a positive association among the trade openness, financial integration, and financial growth variables.

Atif et al. (2010) investigated the impact of financial development and trade openness on GDP growth in Pakistan using annual data over the period 1980 – 2009. They employed the bounds testing approach to co-integration and confirmed the validity of trade-led growth and financial growth hypothesis in Pakistan. Aco-integration relationship between economic growth, trade openness, and financial development was noticed in both the long-run and short-run. Further, the analysis showed that trade openness and financial development Granger-Cause Economic growth in the period of study.

Muhammad et al. (2012) investigated the relationship between openness and Economic growth in case of Pakistan using data over the period 1970 to 2012. Export, import, and foreign direct investment were taken as variables that show a border sense of openness. The result of the study showed that there is a long-run relationship between openness and Economic growth regarding Pakistan. Further, the study found the proofs of the export-led growth hypothesis in the case of Pakistan.

Shaheen et al. (2013) investigated the impact of trade liberalization on economic growth in case of Pakistan. The Johansen co-integration technique was adopted to know the impact of trade liberalization, gross fixed capital formation, foreign direct investment, and inflation on the economic growth using the data for the period from 1975 – 2010. The study concluded that trade liberalization and gross fixed capital formation has a positive impact on economic growth. However, the study also showed the negative effect of foreign direct investment and inflation on economic growth.

Zafar et al. (2015) analyzed the impact of trade openness and external debt on economic growth. Through panel regression analysis for the data over the period 1980 to 2012, they found a positive relationship between trade openness and growth. The study concluded, that external debt has a significant and negative impact on economic growth and debt is being considered by the nations as an obligation and ultimate burden on the economy

3. Data and Specification of the Model

This study uses annual time series data for the period 1975-2016 for Pakistan, which is taken from Pakistan Economic survey various issues and State Bank of Pakistan's annual reports. To investigate the impact of Trade Openness and Foreign Direct Investment on Economic Growth of Pakistan the following Econometric model is developed.

$$\mathbf{lnGDP_t = \beta_0 + \beta_1 lnTO_t + \beta_2 lnFDI_t + \varepsilon_t} \quad (1)$$

where $\boldsymbol{\beta_1}$>0 and $\boldsymbol{\beta_2}$>0

GDP (Gross Domestic Product) is a dependent variable and serves as a proxy for Economic Growth, while TO [Trade Openness=(X+M/GDP*100)] and FDI (Foreign Direct Investment) are independent variables. All variables are in natural logs.
where X stands for Exports and M stands for
Imports.
$\boldsymbol{\beta_0}$ **is the constant and** $\boldsymbol{\beta_1}$**and** $\boldsymbol{\beta_2}$ **are the parameters**, $\boldsymbol{\varepsilon_t}$ is the white noise error term, ln= natural logarithm, and t = time.

4. Methodology

We will apply both the Johnson and Autoregressive Distributed Lag approach to co-integration. Equation (1) represents only the long-run equilibrium relationship and may form a cointegration set provided all the variables are integrated of order 1(1) in the case of Johansen technique and 0 and 1, i.e. I(0) and I(1) for ARDL approach.

4.1 Unit Root Test

Almost all time - series data are found to be non-stationary and due to this issue, we have to face the problem of spurious regression. A time-series which have a unit root is said to be non-stationary. Therefore, to conduct a meaningful statistical analysis one should assess the stationary of the involved time series. A non-stationary time series y_t that is stationary in the first difference is said to be integrated of order one and is denoted by$y_t \sim$ I(1). In general, if a non-stationary series must be differenced d times before becoming stationary the series is said to be integrated of order d and is denoted by I(d). If the series is stationary at level e.g. y_t (non-differenced) it is denoted by$y_t \sim$ I(0) (Brooks, 2014).To test the time series data for stationary a common method is to apply an Augmented Dickey-Fuller test (ADF) (Dickey & Fuller, 1979) to test for a unit root. Keeping in view the error term which is found to be white noise, Dickey and Fuller made some modifications in their test procedure and introduced an augmented version of the test, to overcome the problem of autocorrelation in the test equation by including the extra lagged terms of the dependent variable hence, this test is now known as ADF test. We, therefore, apply the ADF test to test the unit root in time series data. The ADF test examines the null hypothesis that a series $Y_t$is non-stationary by calculating a t-statistic for $\delta = 0$ in the following regression.

$$\Delta Y_t = \alpha + \gamma T + \delta Y_{t-1} + \sum_{i=1}^{p} \beta i \Delta Y_{t-i} + u_t.$$

where α and γT are the deterministic elements, Y_t is a variable at time t, and $u_t$is the disturbance term.

4.2 Johansen Approach to cointegration

Johansen (1988) and Johansen and Juselius (1990) have been introduced a new co-integration technique for the long run and short-run correlations for the multivariate equation. They proposed 4 steps for reliable results which are as follows.

1- In the first step, we have to test the order of integration of all variables.
2- In the second step, we should set the appropriate lag length of the model.
3- Selection of the appropriate model keeping in view the deterministic components in the multivariate system.
4- In the final step, the researcher should determine the rank of Πor the number of cointegrating vectors. We use the eigenvalue statistics and trace statistics in step four (4) to find out the number of cointegrating equations and relationships as well as for the values of coefficients and standard errors for the econometric model. If we come to know that variables are integrated of order one i.e. I(1) then, we will run the Johansen cointegration test. Moreover, if we will also find that the variables under study (GDP, TO and FDI) are cointegrated, then, we will be in a position to run the VECM to examine both the short-run as well as the long-run dynamics of the series.

The conventional ECM for cointegrated series is as follows:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta Y_{t-i} + \sum_{i=0}^{n} \gamma_i \Delta X_{t-i} + \varphi Z_{t-1} + u_t.$$

where Z is the ECT and is the OLS (ordinary least square) residuals from the following long-run cointegrating regression:

$\mathbf{Y_t = \beta_{0t} + \beta_1 X_{t-1} + \varepsilon_t}$ … … .. and is defined as:
$\mathbf{Z_{t-1} = ECT_{t-1} = Y_{t-1} - \beta_0 - \beta_1 X_{t-1}}$

As the coefficient of ECT φ measures the speed of adjustment, at which Y returns to equilibrium after a change in X, therefore, it is, known as the speed of adjustment.

4.3 Specifications of the ARDL Model

To empirically investigate the long-run co-integration and dynamic interactions among the variables under consideration, we employ the most recently introduced autoregressive distributed lag (ARDL) approach to cointegration, developed by Pesaran et al. (2001). This procedure is adopted for the following three reasons. Firstly, the bounds test procedure is simple. As opposed to other multivariate cointegration techniques such as Johanson and Juelius (1990), it allows the cointegration relationship to be estimated by OLS once the lag order of the model is identified. Secondly, the bounds testing procedure does not require the pre-testing of the variables included in the model for unit roots unlike other techniques such as the Johansen approach. It is applicable irrespective of whether the underlying regressors in the model are purely 1(0), 1(1), or fractionally/mutually cointegrated. Thirdly, the test is relatively more efficient in small or finite sample data sizes as is the case in this study. The procedure will however crash in the presence of 1(2) series (Fosu and Magnus, 2006: 2080).

The ARDL bounds testing approach is given as follows:

$$\mathbf{\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \sum_{i=1}^{p^1} \beta_i \Delta Y_{t-i} + \sum_{j=0}^{q} \gamma_j \Delta Y_{t-j} + \varepsilon_t} \qquad (2)$$

where α_0 is the drift component and ε_t are white noise errors.

Based on equation (2), unres tricted error correction version of the ARDL model is given by:

1. **Note**: p describes the lag of dependent variable, while q demonstrates the lag of independent variables.

$$\Delta \mathbf{lnGDP_t} = \boldsymbol{\varphi} + \boldsymbol{\lambda_1} \mathbf{lnGDP_{t-1}} + \boldsymbol{\lambda_2} \mathbf{TO_{t-1}} + \boldsymbol{\lambda_3} \mathbf{lnFDI_{t-1}} + \sum_{i=1}^{p} \boldsymbol{\alpha} \Delta \mathbf{lnGDP_{t-i}} + \sum_{i=0}^{q_1} \boldsymbol{\beta} \Delta \mathbf{TO_{t-i}} + \sum_{i=0}^{q_2} \boldsymbol{\gamma} \Delta \mathbf{lnFDI_{t-i}} + \boldsymbol{\varepsilon_t} \quad (3)$$

The long-run dynamics of the model are revealed in the first part. where the short-run effects/relationships are shown in the second part with summation sign; while Δ is the first difference operator; where λ_i is the long-run multipliers, φ is the Drift, and ε_t are white noise errors.

4.4 Bounds Testing Procedure

According to (Fosu and Magnus, 2006: 2081)The first step in the ARDL bounds testing approach is to estimate equation (3) by ordinary least squares (OLS) to test for the existence of a long-run relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables, i.e., $H_{0:}$ $\lambda_1 = \lambda_2 = \lambda_3 = 0$ (no long-run relationship) against the alternative H_1: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq 0$(long-run relationship exists). We denote the test which normalizes GDP by F_{GDP}(GDP \TO, FDI). Two asymptotic critical values bounds provide a cointegration test when the independent variable is I(d) (where $0 \leq d \geq 1$): a lower value assuming the regressors are I(0), and an upper value assuming purely I(1) regressors. If the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship can be rejected irrespective of the order of integration for the time series. Conversely, if the test statistic falls below the lower critical value the null hypothesis cannot be rejected. Finally, if the statistic falls between the lower and upper critical values, the result is inconclusive. The approximate critical values for the F and t-tests were obtained from Pesaran et al. (2001).

In the next step, once cointegration is estimated, the conditional ARDL (p, q_1, q_2) long-run model derives from the following equation:

$$\boldsymbol{\Delta \ln GDP_t = \varphi + \sum_{i=1}^{p} \alpha \Delta \ln GDP_{t-i} + \sum_{i=0}^{q_1} \beta \Delta TO^{1}{}_{t-i} + \sum_{i=0}^{q_2} \gamma \Delta \ln FDI_{t-i} + \varepsilon_t} \quad (4)$$

where all variables under consideration have already been explained and defined. We use the Akaike information criteria (AIC) to select the order of the ARDL (p, q_1, q_2,) model in the three variables. In the third and final step, to get the short-run dynamic parameters we estimate the error correction model. We specify it as under:

$$\Delta lnGDP_t = \varphi + \sum_{i=1}^{p} \alpha \Delta lnGDP_{t-i} + \sum_{i=0}^{q_1} \beta \Delta TO_{t-i} + \sum_{i=0}^{q_2} \gamma \Delta lnFDI_{t-i} + \eta ECM_{t-i} + \varepsilon_t \quad (5)$$

Here α, β, $and\ \gamma$ are the short-run dynamic coefficients of the model's convergence to equilibrium and $\boldsymbol{\eta}$ is the speed of adjustment, where ECM is the error correction term and is defined as:

$$\mathrm{ECM}_t = \Delta\mathrm{lnGDP_t} - \varphi - \sum_{i=1}^{p} \alpha\Delta\mathrm{lnGDP}_{t-i} - \sum_{i=0}^{q_2} \beta\Delta\mathrm{TO}_{t-i} - \sum_{i=0}^{q_2} \gamma\Delta\mathrm{lnFDI}_{t-i} \ldots \quad (6)$$

4.5 Granger Causality Test

To ascertain the direction of causation between the series, we use the Granger Causality test proposed by Granger (1969, 1988). The Granger Causality equations are specified as follows:

$$\boldsymbol{GDP_t = \delta_0 + \sum_{i=1}^{k} \delta_i GDP_{t-i} + \sum_{j=1}^{k} \lambda_j TO_{t-j} + \varepsilon_1 t} \quad (7)$$

$$\boldsymbol{TO_t = \beta_0 + \sum_{i=1}^{k} \beta_i TO_{t-i} + \sum_{j=1}^{k} \gamma_j GDP_{t-j} + \varepsilon_2 t} \quad (8)$$

1. **Note**: In ARDL approach, the log of TO is not taken.

where it is assumed that both $\varepsilon_1 t$ and $\varepsilon_2 t$ are uncorrelated white noise error terms.

$$\text{If} \sum_{j=1}^{k} \lambda_j = 0 \ \text{and} \sum_{j=1}^{k} \gamma_j = 0,$$

Then trade openness (TO) does not Granger cause Economic Growth /(GDP) in equation (7), and Economic growth (GDP) does not Granger cause Trade Openness (TO) in equation (8). It then follows that Trade Openness (TO) and (GDP) / Economic growth are independent, otherwise both series could be interpreted as a cause to each other.

5. Interpretation of Estimated Empirical Results

To conduct co-integration analysis, first of all, we have to check the presence of a unit root in variables under study. Therefore, to examine the unit root properties of the time-series data, we first use the ADF test statistics for the purpose. We can see in table 1 the results of the ADF tests regarding the level as well as for the first-difference of the involved variables. On the bases of these results of the ADF test, it is stated that all variables are non-stationary at levels. However, they have become stationary in their first differences. This implies that all the series are integrated of order one i.e. I (1).

Augmented Dickey-Fuller (ADF) Test for Unit Roots.

Table 1: Result of ADF Tests

Variables	Level					
	Constant			Constant & Trend		
	C.V	T. Stat	Prob	C.V	T.Stat	Prob
DlnGDP						
1% Level	-3.600987	-0.186115	0.9322	-4.198503	-2.942450	0.1605
5% Level	-2.935001			-3.523623		
10% Level	-2.605836			-3.192902		
DlnTO						

Variables	Level					
	Constant			Constant & Trend		
	C.V	T. Stat	Prob	C.V	T.Stat	Prob
1% Level	-3.600987	-0.046905	0.9484	-4.198503	-2.666513	0.2551
5% Level	-2.93500			-3.523623		
10% Level	-2.605836			-3.192902		
DlnFDI						
1% Level	-3.600987	-1.768131	0.3906	-4.198503	-2.007237	0.5801
5% Level	-2.935001			-3.523623		
10% Level	-2.605836			-3.192902		
Variables	**First Difference**					
	Constant			**Constant & Trend**		
	C.V	**T.Stat**	**Prob**	**C.V**	**T.Stat**	**Prob**
DlnGDP						
1% Level	-3.605593	-6.316443	0.0000	-4.205004	-6.242977	0.0000
5% Level	-2.936942			-3.526609		
10% Level	-2.606857			-3.194611		
DlnTO						
1% Level	-3.605593	-5.226404	0.0001	-4.205004	-5.285597	0.0005
5% Level	-2.936942			-3.526609		
10% Level	-2.606857			-3.194611		
DlnFDI						
1% Level	-3.605593	-7.230589	0.0000	-4.205004	-7.327092	0.0000
5% Level	-2.936942			-3.526609		
10% Level	-2.60685			-3.194611		

Source: Research findings and calculations (Eviews 9).

Lag Length Selection Process

To follow the Johansen cointegration approach, we have to determine the appropriate lag length. So in the second step, we do the selection of appropriate lag length by using different well-known information criteria. The results are reported in Table 2.

Table 2: VAR (Vector Regression) Lag Order Selection Criteria

Endogenous variables: D(lnGDP)
Exogenous variables: C D(lnTO) D(lnFDI)
Sample: 1975 – 2016
Included observations: 33

Lag	LogL	LR	FPE	AIC	SC	HQ
0	29.61994	NA	0.011670	-1.613329	-1.477283*	-1.567554
1	29.70788	0.154574	0.012342	-1.558054	-1.376659	-1.497020
2	30.24906	0.918361	0.012705	-1.530246	-1.303503	-1.453954
3	30.29403	0.073590	0.013485	-1.472366	-1.200273	-1.380815
4	30.88899	0.937507	0.013854	-1.447817	-1.130376	-1.341008
5	30.95231	0.095937	0.014712	-1.391049	-1.028259	-1.268981
6	37.52814	9.564846*	0.010539*	-1.728978*	-1.320840	-1.591652*
7	37.56257	0.047990	0.011235	-1.670459	-1.216971	-1.517874
8	37.56295	0.000512	0.012019	-1.609876	-1.111040	-1.442033

Source: Research findings and calculations (Eviews 9).
Notes: * indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Johansen's Cointegration Analysis

Johansen's test in table 3 reports and indicates that there exists one co-integration relation among Economic Growth (GDP), Trade Openness (TO), and Foreign Direct Investment (FDI). Since the trace statistic shown in table 3 is greater than the five percent critical value (50.89> 42.91) so the null hypothesis of no cointegration is rejected. However, we cannot reject the null hypothesis which describes that there is at most one cointegrating vector because (23.80 < 25.87).

Table 3: Unrestricted Cointegration Rank Test, Trace, and Maximum Eigenvalue Statistics

Hypothesized No. of	Eigen value	Trace Statistic	Max-Eigen Statistic	0.05Critical Value Trace	0.05 Critical Value Max-	Prob.** Trace Statistic	Prob.** Max-Eigen
None*	0.538802	50.89038	27.08746	42.91525	25.82321	0.0066	0.0339
At most 1	0.346913	23.80292	14.91155	25.87211	19.38704	0.0885	0.1985
At most 2	0.224338	8.891364	8.891364	12.51798	12.51798	0.1871	0.1871

Source: Research findings and calculations (Eviews 9).

Notes:

There are six lags in the VAR model. Both tests indicate 1 cointegrating equation at the 0.05 level.

*denotes rejection of the null hypothesis at the 0.05 level.

**MacKinnon-Haug-Michelis (1999) p-values.

The maximum eigenvalue test is shown in table 3 also reports the same result and confirms the existence of the only one cointegration relationship among the variables under study. Thus the null hypothesis of no co-integration is once again rejected on the bases of the fact that the maximum eigenvalue statistic is greater than 5% critical value (27.0874 >25.8232). However, the null hypothesis, which describes that there is at most one co-integration vector is not rejected because (14.9115 < 19.3870).

Table 4: Cointegrating Equation / (Long–run Model)

Sample (adjusted): 1982 –2016
Included observations: 35 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq	CointEq1
lnGDP(-1)	1.000000
lnTO(-1)	0.695367
	(0.48703)
	[1.42777]
lnFDI(-1)	0.315998
	(0.19288)
	[1.63831]
@TREND(75)	-0.127326
	(0.04313)
	[-2.95241]
C	-13.50627

Source: Research findings and calculations (Eviews 9).

Table 5: Vector Error Correction Estimates/Model

Error Correction:	**D(lnGDP)**	**D(lnTO)**	**D(lnFDI)**
CointEq1	-0.422713	0.353814	-0.598824
	(0.10128)	(0.18562)	(0.50834)
	[-4.17390]	[1.90614]	[-1.17801]
D(lnGDP(-1))	-0.264030	0.567665	1.942103
	(0.21985)	(0.40295)	(1.10352)
	[-1.20094]	[1.40878]	[1.75991]
D(lnGDP(-2))	-0.241968	0.314295	1.602652
	(0.21609)	(0.39606)	(1.08465)
	[-1.11974]	[0.79356]	[1.47757]
D(lnGDP(-3))	0.279585	-0.008865	1.404417
	(0.20672)	(0.37888)	(1.03760)
	[1.35249]	[-0.02340]	[1.35353]
D(lnGDP(-4))	0.469146	-0.613672	-1.579342
	(0.21932)	(0.40198)	(1.10086)
	[2.13907]	[-1.52664]	[-1.43465]

Error Correction:	**D(lnGDP)**	**D(lnTO)**	**D(lnFDI)**
D(lnGDP(-5))	0.716970	-0.648577	0.508937
	(0.23276)	(0.42660)	(1.16828)
	[3.08036]	[-1.52035]	[0.43563]
D(lnGDP(-6))	0.306130	-1.143148	-1.880475
	(0.24283)	(0.44505)	(1.21884)
	[1.26069]	[-2.56856]	[-1.54285]
D(lnTO(-1))	-0.083959	0.177501	1.476782
	(0.17133)	(0.31401)	(0.85995)
	[-0.49005]	[0.56527]	[1.71728]
D(lnTO(-2))	0.135226	-0.037942	0.426647
	(0.17835)	(0.32688)	(0.89520)
	[0.75821]	[-0.11607]	[0.47659]
D(lnTO(-3))	0.401112	-0.038745	1.262118
	(0.17909)	(0.32824)	(0.89892)
	[2.23972]	[-0.11804]	[1.40404]
D(lnTO(-4))	0.363774	-0.737984	-1.702031
	(0.18823)	(0.34500)	(0.94481)
	[1.93257]	[-2.13911]	[-1.80145]
D(lnTO(-5))	0.429774	-0.483400	0.262186
	(0.19986)	(0.36630)	(1.00316)
	[2.15040]	[-1.31968]	[0.26136]
D(lnTO(-6))	0.541848	-1.226322	-1.673755
	(0.21010)	(0.38508)	(1.05459)
	[2.57894]	[-3.18458]	[-1.58711]
D(lnFDI(-1))	0.130967	0.027828	0.125291
	(0.05587)	(0.10241)	(0.28045)
	[2.34399]	[0.27174]	[0.44675]
D(lnFDI(-2))	0.129793	-0.203137	-0.157894
	(0.04121)	(0.07553)	(0.20684)
	[3.14969]	[-2.68961]	[-0.76337]
D(lnFDI(-3))	-0.032034	-0.024692	0.190488
	(0.04199)	(0.07696)	(0.21076)
	[-0.76292]	[-0.32086]	[0.90384]

Error Correction:	D(lnGDP)	D(lnTO)	D(lnFDI)
D(lnFDI(-4))	0.087942	-0.007741	0.166255
	(0.04500)	(0.08248)	(0.22588)
	[1.95424]	[-0.09386]	[0.73604]
D(lnFDI(-5))	0.080896	0.038316	-0.200595
	(0.04132)	(0.07574)	(0.20742)
	[1.95762]	[0.50590]	[-0.96711]
D(lnFDI(-6))	0.098546	0.065254	0.226771
	(0.04245)	(0.07780)	(0.21307)
	[2.32143]	[0.83870]	[1.06428]
C	0.044883	-0.037508	-0.242977
	(0.06797)	(0.12457)	(0.34115)
	[0.66037]	[-0.30110]	[-0.71224]
R-squared	0.904968	0.776757	0.732548
Adj. R-squared	0.784593	0.493982	0.393776
Sum sq. resids	0.077407	0.260023	1.950180
S.E. equation	0.071836	0.131662	0.360572
F-statistic	7.517943	2.746907	2.162364

Source: Research findings and calculations (Eviews 9).

Estimated VECM with GDP as Target Variable

$\Delta GDP = -0.422\ ECT_{t-1} - 0.264\ GDP_{t-1} - 0.241\ GDP_{t-2} + 0.279 GDP_{t-3} + 0.469\ GDP_{t-4} + 0.716\ GDP_{t-5} + 0.306\ GDP_{t-6} - 0.0839\ TO_{t-1} + 0.1352\ TO_{t-2} + 0.4011\ TO_{t-3} + 0.363\ TO_{t-4} + 0.429 TO_{t-5} + 0.541\ TO_{t-6} + 0.130\ FDI +_{t-1} + 0.129\ FDI_{t-2} - 0.032\ FDI_{t-3} + 0.087\ FDI_{t-4} + 0.080\ FDI_{t-5} + 0.098\ FDI_{t-6} + 0.0448.$

Cointegrating Equation: Since the variables are cointegrated, the estimated long-run cointegrating equation using Vector Error Correction is presented below.

$Z_{t-1} = ECT_{t-1} = y_{t-1} - \beta_o - \beta_1 X_{t-1}$ (Long-run Model)

$\therefore ECT_{t-1} = 1.000000 \ln GDP_{t-1} + 0.695367 \mathrm{In} TO_{t-1} + 0.315998 \ln\ FDI_{t-1} - 0.127326$

The above long-run model estimates have been proved a positive long-run stable correlation among the variables under study. Though the estimated coefficient for TO is not statistically highly significant, it is positive. The positive coefficient of TO indicates that a 1% increase in TO will cause the GDP to increase by 0.695%. The estimated coefficient of FDI is also positive indicating that a unit increase in FDI will lead to a 0.315% increase in Economic Growth in Pakistan. The results are consistent with earlier findings of (Anorou and Ahmad 1999) investigated the relationship between trade openness and economic growth for five Asian countries and found the evidence of long-run cointegration between openness and economic growth for all the nations under consideration.

Wald Test of Short-run Causality

On the bases of VECM, we have three (3) error correction models. So out of these three, I shall choose the 1st one D(lnGDP) to perform the Wald test, because in table 5 D(lnGDP) [D(lnGDP) = C (1)* (Error correction model for GDP)] is my target variable. The following is my error correction model in table 6, while GDP is the dependent variable. As C(1)* is the coefficient of the Co-integrating model /equation and from this cointegrating equation, I am taking the residuals and after taking those residuals that will be error correction term so, that is under C(1)* coefficient[1].

1. C(1)* = C(1)*(lnGDP(-1) + 0.695366710747*LNTO(-1) +0.315997889218*lnFDI(-1) - 0.127326436528*@TREND(75) -13.506274853) see table 6.

Notes: In Table 5 we can see that all three models have no p-value,so in order to know the p-value for each variable I have been used the system equation .Now, we can see the p - value of each variable and p-value of F-statistic in table 6.
System equation= D(LNGDP) = C(1)*(LNGDP(-1) + 0.695366710747*LNTO(-1) + 0.315997889218*LNFDI(-1) - 0.127326436528*@TREND(75) - 13.506274853) + C(2)*D(LNGDP(-1)) + C(3)*D(LNTO(-1)) + C(4)*D(LNFDI(-1)) + C(5)*D(LNGDP(-2)) + C(6)*D(LNTO(-2)) + C(7)*D(LNFDI(-2)) + C(8)*D(LNGDP(-3)) + C(9)*D(LNTO(-3)) + C(10)*D(LNFDI(-3)) + C(11)*D(LNGDP(-4)) + C(12)*D(LNTO(-4)) + C(13)*D(LNFDI(-4)) + C(14)*D(LNGDP(-5)) + C(15)*D(LNTO(-5)) + C(16)*D(LNFDI(-5)) + C(17)*D(LNGDP(-6)) + C(18)*D(LNTO(-6)) + C(19)*D(LNFDI(-6)) + C(20)

Table6: Error Correction Model

Dependent Variable: D(lnGDP)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Sample (adjusted): 1982 – 2016
Included observations: 35 after adjustments
D(lnGDP) = C(1)*(lnGDP(-1) + 0.695366710747*LNTO(-1) + 0.315997889218*lnFDI(-1) - 0.127326436528*@TREND(75) - 13.506274853) + C(2)*D(lnGDP(-1)) + C(3)*D(lnTO(-1)) + C(4) *D(lnFDI(-1)) + C(5)*D(lnGDP(-2)) + C(6)*D(lnTO(-2)) + C(7) *D(lnFDI(-2)) + C(8)*D(lnGDP(-3)) + C(9)*D(lnTO(-3)) + C(10) *D(lnFDI(-3)) + C(11)*D(lnGDP(-4)) + C(12)*D(lnTO(-4)) + C(13)*D(lnFDI(-4)) + C(14)*D(lnGDP(-5)) + C(15)*D(lnTO(-5)) + C(16)*D(lnFDI(-5)) + C(17)*D(lnGDP(-6)) + C(18)*D(lnTO(-6)) + C(19)*D(lnFDI(-6)) + C(20)]

	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
C(1)	-0.422713	0.101275	-4.173898	0.0008
C(2)	-0.264030	0.219853	-1.200938	0.2484
C(3)	-0.083959	0.171327	-0.490049	0.6312
C(4)	0.130967	0.055874	2.343989	0.0333
C(5)	-0.241968	0.216093	-1.119738	0.2804
C(6)	0.135226	0.178350	0.758207	0.4601
C(7)	0.129793	0.041208	3.149688	0.0066
C(8)	0.279585	0.206719	1.352491	0.1963
C(9)	0.401112	0.179091	2.239716	0.0407
C(10)	-0.032034	0.041989	-0.762919	0.4573
C(11)	0.469146	0.219322	2.139068	0.0493
C(12)	0.363774	0.188233	1.932572	0.0724
C(13)	0.087942	0.045001	1.954235	0.0696
C(14)	0.716970	0.232755	3.080355	0.0076
C(15)	0.429774	0.199857	2.150403	0.0482
C(16)	0.080896	0.041323	1.957620	0.0691
C(17)	0.306130	0.242827	1.260694	0.2267
C(18)	0.541848	0.210105	2.578944	0.0210
C(19)	0.098546	0.042451	2.321433	0.0348
C(20)	0.044883	0.067966	0.660370	0.5190
R-squared	0.904968			
Adj R-squared	0.784593			
F-statistic	7.517943			
Prob (F-Statistic)	0.000129			

Source: Research Findings and calculations (Eviews 9).

C(1) -0.422 is the residual of the one-period lag residual of the cointegrating vector among the GDP, TO, FDI. The C(1) - 0.422 is negative and it is also highly significant because P-value (0.0008) is less than a 5% level of significance. It means that TO and FDI have a long-run causality on GDP.

Short Run Causality

To check the short-run causality from TO and FDI to GDP, I shall use the chi-square value of Wald statistics. We know, that the coefficient from C(3) to C(18) are the coefficients of Trade openness. We, therefore, first Check that whether or not the coefficients [C(3) to C(18) for TO] and [C(4) to C(19) for FDI] jointly influence the GDP. From Table 7, It is concluded that the chi-square probability is less than a 5% level of significance on the bases of which I reject the Null hypothesis and conclude that there is a short-run causality from TO and FDI to GDP.

Table 7: Short-run Causality between Trade Openness (TO) and GDP

Short Run Causality between Trade Openness (TO) and (GDP)

Wald Test:

Test Statistic	**Value**	**Df**	**Probability**
F-statistic	2.669760	(6, 15)	0.0575
Chi-square	16.01856	6	0.0137

Null Hypothesis: C(3)=C(6)=C(9)=C(12)=C(15)=C(18)=0

Null Hypothesis Summary:

Normalized Restriction (= 0)	**Value**	**Std. Err.**
C(3)	-0.083959	0.171327
C(6)	0.135226	0.178350
C(9)	0.401112	0.179091
C(12)	0.363774	0.188233
C(15)	0.429774	0.199857
C(18)	0.541848	0.210105

Short-run Causality between Foreign Direct Investment (FDI) and GDP

Wald Test:

Test Statistic	**Value**	**Df**	**Probability**
F-statistic	4.490569	(6, 15)	0.0085
Chi-square	26.94342	6	0.0001

Null Hypothesis: C(4)=C(7)=C(10)=C(13)=C(16)=C(19)=0

Null Hypothesis Summary:

Normalized Restriction (= 0)	**Value**	**Std. Err.**
C(4)	0.130967	0.055874
C(7)	0.129793	0.041208
C(10)	-0.032034	0.041989
C(13)	0.087942	0.045001
C(16)	0.080896	0.041323
C(19)	0.098546	0.042451

Source: Research findings and calculations (Eviews 9).

Estimated Result Based on ARDL (6, 6, 5) Model

Where the ARDL model approach allows us to proceed, irrespective of whether the underlying regressors are I(1), I(0), or fractionally integrated, it also imposes some restrictions that the series must not be integrated of order two i.e., I(2). Therefore, to confirm that variables are not integrated of order two, we have already been used the Augmented Dickey-Fuller test (See Table 1) with maximum lag and found that all the variables are integrated of order one i.e. 1(1). Then, since neither of our series is 1(2) we can now apply the Autoregressive Distributed Lag (ARDL) bounds testing approach to estimate the impact of TO and FDI on the Economic growth of Pakistan.

Furthermore, before the adoption of (ARDL) bounds test to co-integration, we have been selected the appropriate lag length by using Akaike information criteria [(AIC=-2(1/T)+2(K/T)].

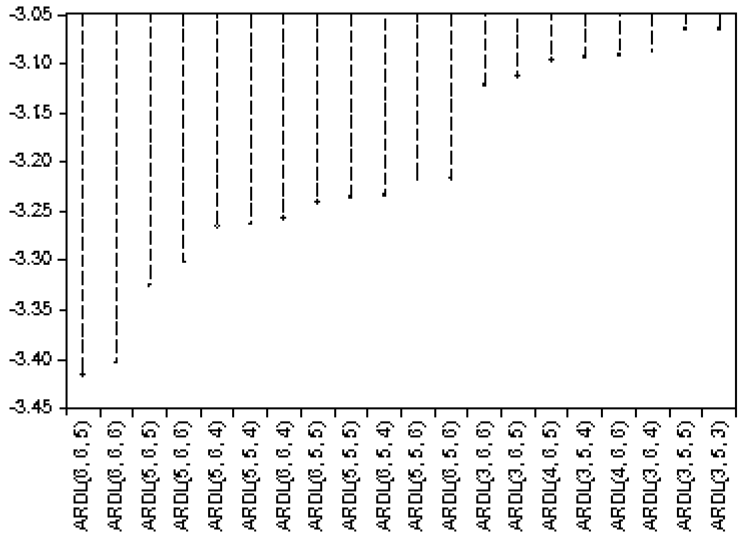

Figure 1: Akaike Information Criteria (Top 20 Models)
Source: Research estimations and plotting (Eviews 9).

Figure 1 depicts that the ARDL (6, 6, 5) model is our appropriate model.

According to the bounds test shown in table 8, the computed F-statistics (7.342579) is greater than the upper bound of 3.5, 3.87, 4.38, and 5 at 10%, 5%, 2.5%, and 1% respectively. We, therefore, reject the null hypothesis that there exist no long-run relationships. Rather, we accept the alternative hypothesis that there exists a long-run co-integration relation among economic growth (GDP), Trade openness (TO), and (FDI) in the case of Pakistan. Therefore, it has been confirmed that there exists a cointegration among the variables under consideration and study.

Table 8: Autoregressive Distributed Lag Bounds Test; Using ARDL (6, 6, 5) Model

Null Hypothesis: No Long-run Relationships Exist		
Test Statistic	**Value**	**K**
F-statistic	7.342579	2

Critical Value Bounds

AwqSignificance	Lower Bound	Upper Bound
10%	2.63	3.35
5%	3.1	3.87
2.5%	3.55	4.38
1%	4.13	5

Source: Research findings and calculations (Eviews 9).

Table 9 reveals that the estimated long-run coefficients of the selected ARDL (6, 6, 5) model are significant at a 5% level of significance possessing expected signs.

The coefficient of trade openness (TO) is positive and significant at a 5% level of significance, thus supporting the contention that trade openness (TO) carries a perceptible influence on the economic growth in Pakistan. The positive coefficient of TO of 0.368 indicates that in long run a unit increase in trade openness will lead to a 37 percent increase in economic growth/GDP, all things being the same. Moreover, the coefficient of foreign direct investment is also positive and highly significant at a five percent level of significance demonstrating that in the long-run, a unit increase in FDI will bring an increase of 168 percent in the economic growth of Pakistan. Our results are consistent with those of Afzal(2009), Darrat (1999), Jawaid (2014), Piazolo (1995), Shabbir 2006), Shaheen and Kauser (2013), Siddiqui 2005) and Wacziarg (2001) They found a positive relationship between trade openness and economic growth.

Table 9: Estimated Long-run Coefficients; Using ARDL (6, 6, 5) Model

Dependent Variable: ln GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TO	0.368803	0.145732	2.530697	0.0223
LnFDI	1.682512	0.161301	10.430873	0.0000
C	7.865287	0.703995	11.172369	0.0000

Source: Research findings and calculations (Eviews 9).

The short-run dynamics coefficients of the estimated ARDL (6, 6, 5) model are being shown in table 10, where the lag is selected by Akaike information criteria.

Ttable10 shows that the estimated lagged error correction term ECM(-1)/$EC_{t-1,}$ is -0.135943 which is highly significant at 5% level of significance and negative (ranges between zero and one) as was expected having probability value less than 5%, level of significance which is 0.0000. These results support the short-run relationship / co-integration among the variables represented by Equation 1. The feedback coefficient is -0.135943, which suggests that approximately13.5% disequilibrium from the previous year's shocks in Equation 5 converge back to the long-run equilibrium and is corrected in the current year.

Table10: Error Correction Estimation for Estimated ARDL (6, 6, 5) Model

Dependent Variable: lnGDP

Selected Model: ARDL(6, 6, 5)

Sample: 1975– 2016

Included observations: 36

Cointegrating Form

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(lnGDP(-1))	-0.549173	0.210313	-2.611224	0.0189
D(lnGDP(-2))	-1.088791	0.164353	-6.624726	0.0000
D(lnGDP(-3))	-0.730450	0.244326	-2.989647	0.0087
D(lnGDP(-4))	-0.485372	0.130549	-3.717920	0.0019
D(lnGDP(-5))	-0.263182	0.138361	-1.902138	0.0753
D(TO)	-0.155489	0.021593	-7.200909	0.0000
D(TO(-1))	-0.101315	0.051451	-1.969149	0.0665
D(TO(-2))	-0.201054	0.039633	-5.072948	0.0001
D(TO(-3))	-0.129927	0.050685	-2.563409	0.0208
D(TO(-4))	-0.115068	0.028741	-4.003613	0.0010
D(TO(-5))	-0.076906	0.033061	-2.326207	0.0335
D(lnFDI)	0.076901	0.017156	4.482423	0.0004
D(lnFDI(-1))	-0.171859	0.030695	-5.599011	0.0000
D(lnFDI(-2))	-0.122338	0.032862	-3.722772	0.0019
D(lnFDI(-3))	-0.129707	0.027575	-4.703883	0.0002
D(lnFDI(-4))	-0.062381	0.025305	-2.465150	0.0254
ECM (-1)	-0.135943	0.023019	-5.905697	0.0000

ECM=lnGDP-(0.3688* TO +1.6825* lnFDI + 7.8653			
R-squared	0.999744	Akaike info criterion	-3.415329
Adjusted R-squared	0.999440	Schwarz criterion	-2.535596
F-statistic	32.91029	Hannan-Quinn criterion	-3.108279
Prob(F-statistic)	0.000000	Durbin-Watson statistic	1.949467

Source: Research findings and calculations (Eviews 9).

Stability and Diagnostic Tests of ARDL (6, 6, 5) Model

Tables 11, 12, 13, and 14 generally pass several diagnostic tests for ARDL (6, 6, 5) model. These tests reveal that the model has achieved desire econometric properties and the model has the best goodness of fit of the ARDL (6, 6, 5) model and valid for reliable interpretation. Breusch – Godfrey (1978) serial correlation LM test which is used to test for the presence of Serial Autocorrelation indicates that the residuals are not serially correlated as we can see in table 10 that the P-Value is greater than 5% level of significance so we cannot reject the null hypothesis (there is no serial correlation) and conclude that the model has no serial correlation. White's test (White 1980) for Heteroscedasticity (ARCH test) shows that the residuals have not heteroscedasticity problem as the P-Value is greater than five percent level of significance, the null hypothesis(There is no ARCH effect) is not rejected and we have been known that this model does not have any ARCH effect. Similarly, the Regression Specification Error Test (RESET) (Ramsey 1969) for functional form also confirms no miss-specification and we cannot reject the null hypothesis(No power in non-linear combinations - No miss-specification) as the p-value is greater than 5% level of significance. According to (Brooks 2014) non- normality may cause problems regarding statistical inference of the coefficient estimates such as significance tests and for confidence intervals that rely on the normality assumption. We, therefore, use the Jarque-Bera test to know that the residuals are normal or not. Figure 2 shows the Jarque – Bera normality test, because, the P-Value is greater than the five percent level of significance we, therefore, cannot reject the null hypothesis (that residuals are normally distributed). In the light of all these tests it is, therefore, concluded that in this model there is no serial correlation, no ARCH effect, and the residuals are normally distributed.

Table 11: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.823918	Prob. F(2m14)	0.4589
Obs*R-squared	3.791072	Prob. Chi-Square (2)	0.1502

Source: Research findings and calculations (Eviews 9).

Table12: Ramsey RESET Test

	Value	Df	Probability
T-statistic	1.226488	15	0.2389
F-statistic	1.504272	(1, 15)	0.2389

Source: Research findings and calculations (Eviews 9).

Table13: Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.129425	Prob. F(19,16)	0.4068
Obs*R-squared	20.62322	Prob. Chi-Square (19)	0.3580
Scaled explained SS	3.933894	Prob. Chi-Square (19)	0.9999

Source: Research findings and calculations (Eviews 9).

Table14: Heteroscedasticity Test; ARCH

F-statistic	1.803996	Prob. F(19,16)	0.1815
Obs*R-squared	3.544607	Prob. Chi-Square (2)	0.1699

Source: Research findings and calculations (Eviews 9).

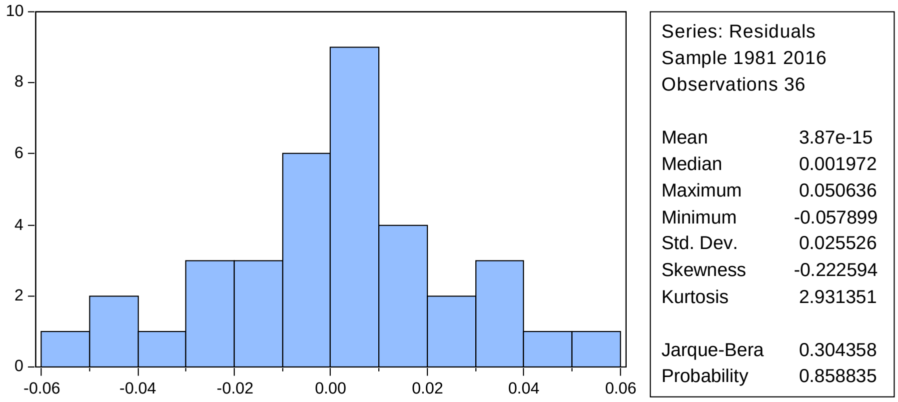

Figure 2: The Jarque – Bera Normality Test
Source: Research estimations and plotting (Eviews 9).

Granger Causality Tests

The Granger Causality test is given in the following Table 15 shows that there is bidirectional causality between Trade Openness and GDP/Economic growth. Results further depict that there exist unidirectional causality, from FDI to GDP and TO, but not the other way. Our results are consistent with (Atif et al., 2010) as their study reported that trade openness Granger- Cause Economic growth in the period of study from 1980-2009.

Table 15: Pairwise Granger Causality Tests

Sample: 1975 – 2016

Lags: 4

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
lnTO does not Granger Cause lnGDP	38	2.60971	0.0560
lnGDP does not Granger Cause lnTO		3.97967	0.0108
lnFDI does not Granger Cause lnGDP	38	3.25548	0.0254
lnGDP does not Granger Cause lnFDI		1.45535	0.2413
lnFDI does not Granger Cause lnTO	38	4.54216	0.0057
lnTO does not Granger Cause lnFDI		1.51171	0.2247

Source: Research findings and calculations (Eviews 9).

To check the stability of our finding based on ARDL (6, 6, 5) model both for long-run and short-run parameters, following Pesaran and Pesaran (1997) we apply a level of stability tests, also known as the cumulative (CUSUM) and cumulative sum of squares (CUSUMQ) proposed by Brawn et al. (1975). The CUSUM and CUSUMQ statistics are updated recursively and plotted against the breakpoints. If the plotted points for the CUSUM and CUSUMQ statistics stay within the critical bounds of a 5% level of significance, the null hypotheses for all coefficients in the given regression are stable and cannot be rejected. Accordingly, the CUSUM and CUSUMQ plotted points to check the stability of the short-run and long-run coefficients in the ARDL error correction model are given below in Figure3 and 4 respectively depicts that both statistics CUSUM and CUSUMQ remains within the critical bound of the five percent significance level; indicating that all coefficients in the ARDL error correction model are stable. Therefore, the null hypothesis that all the coefficients are stable cannot be rejected.

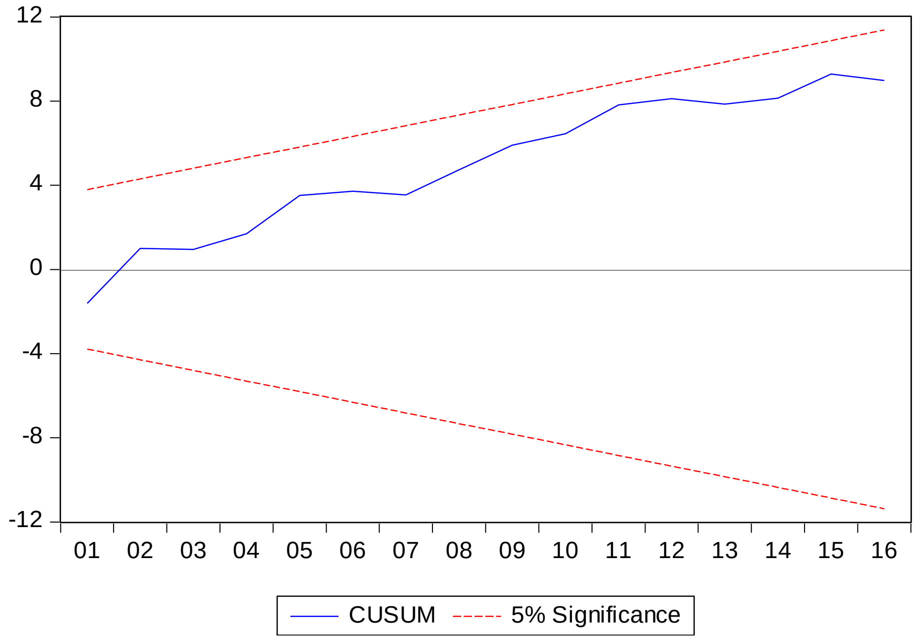

Figure 3: Plot of Cumulative Sum of Recursive Residuals

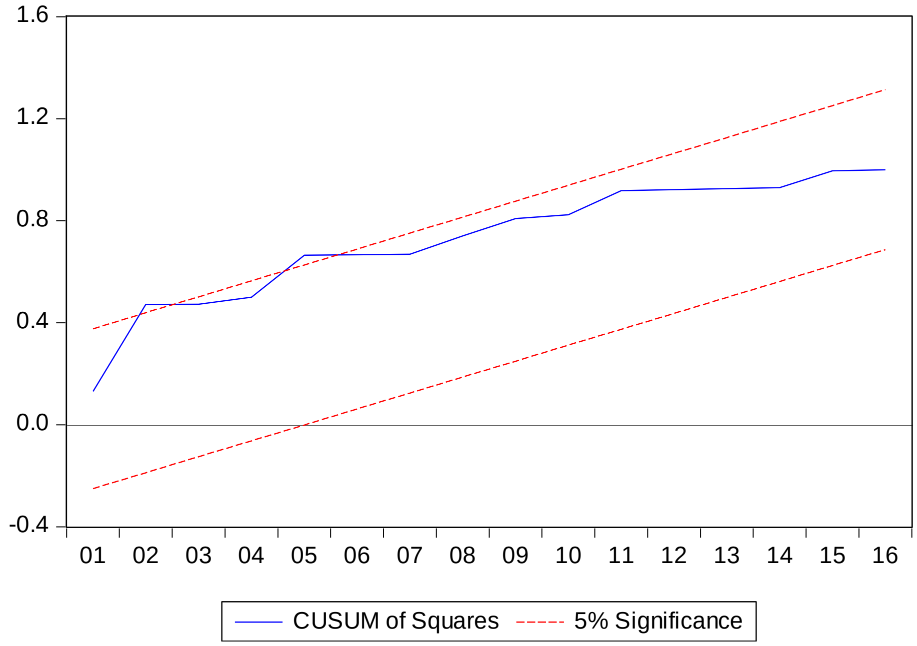

Figure 4: Plot of Cumulative Sum of Squares of Recursive Residuals

6. Conclusion and Policy Implications

The main objective of this study was the investigation of the impact of the trade openness on economic growth in Pakistan. This study has been empirically examined the impact of trade openness on the economic growth of Pakistan using annual time series data for the period 1975 – 2016. We have been employed both the Johensen and Autoregressive Distributed Lag (ARDL) approach to cointegration. The empirical estimated results are the sound evidence that there exists a short-run and long-run positive and stable cointegration among the variables. Our empirical findings further depict that trade openness and foreign direct investment has a significant positive impact on economic growth in Pakistan. Moreover, the Granger causality test also confirms the bidirectional causality between trade openness and economic growth. It is, therefore, concluded that trade openness can play a key role as the economic growth of Pakistan is concerned.

This study has some important policy implications, the government should take some appropriate measures that are proved conducive to enhance international trade, through which we can get a comparative advantage. The following steps are suggested which the government must adopt.

1- The government should support entrepreneurship
2- The government should make and ensure the optimal use of natural resources.
3- Trade development authority of Pakistan must also undertake various export promotion activities through trade exhibitions to enhance the trade.
4- The government should do a regional trade agreement and strategic trade policy framework.
5- The government should ensure the diversification of products and markets. 6- Pakistan should move towards higher value-added in exports and must establish export-processing zones.

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