FDI as an Opportunity for Economic growth of Bangladesh: A VECM Analysis.

Asaduzzaman, Md

Dept. of Economics, Ministry of Education, Bangladesh Civil Service.

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Md Asaduzzaman[1]

Abstract

This study investigates the empirical relationship between economic growth (GDP) and Foreign Direct Investment (FDI) as well as the Real Effective Exchange Rate (REER) and Trade Openness (TOP) of Bangladesh over the period from 1973 to 2017 by using Johansen cointegration test and VECM analysis. The empirical findings exhibit that there are a distinctive short-run and long-run relationship that exists between economic growth and foreign direct investment in Bangladesh. While the Error Correction Term (ECT) result exhibits that real effective exchange rate and trade openness are causing economic growth in the long-run. This study highly suggests that fully utilizing foreign direct investment and trade openness is one of the best chances of Bangladesh to develop its economy. Therefore, the policymaker should have more foresight to influence foreign direct investment and trade openness on the long term basis, especially to facilitate investment in the special economic zone (such as EPZ) and export more manufacturing goods and services and importing capital goods through maintaining the trade balance.

Key words: Gross Domestic Product (GDP) growth; Foreign Direct Investment (FDI), Real Effective Exchange Rate (REER); Trade Openness (TOP); Vector Error Correction Model (VECM) Model; Bangladesh Economy.

[1] Postgraduate Student of Applied Economics, Northwestern Polytechnical University (NPU), Xi'an, China
Email: asadju34@gmail.com

1.0 Introduction:

Foreign direct investment (FDI) inflows and outflows have substantial impact on the world economy, and are important for both developed and developing countries (e.g., Temiz & Gokmen, 2014). Foreign investments are generally assumed to have positive impacts on a country's economy, and to be among the principal factors supporting accelerated economic growth (Okamoto & Sjoholm, 2005). In the literature, among the most-cited reasons for Asia's strong economic growth in the recent era has been the inflow of FDI into the region. This inward FDI has also proven to be an effective means through which Asian countries are integrated with rest of the world (and vice-versa) (Vadlamannati, Tamazian, & Irala, 2009). Today, most countries are inclined to attract FDI, due to the expected favorable effects on income generation from capital inflows, advanced technology, management skills, and market know-how. In developing countries, such as China and India, the attraction of foreign capital is considered to be a necessary means for economic growth (Choong & Lam, 2010; Kurtishi-Kastrati, 2013). It is widely recognized that FDI provides economic benefits to recipient countries by providing capital, foreign exchange, and technology, and by increasing both competition and access to foreign markets (e.g., Romer, 1993; World Bank, 1999; Crespo & Fontoura, 2007).

Since early 1990, after joining World Trade Organization (WTO), a new dimension has been emerged with possibilities and challenges for Bangladesh economic growth. From the last 45 years the country economic growth was more or less average 5% whereas, from early 1980 to 1989 GDP growth of Bangladesh was in average below 4%, from 1990 to 1999 it was below 5% but gradually it was tends to increase from 2000 to 2009 which is around 6% and finally last couple of years (2010 - 2016) it grew continuously around in an average 7% (World Bank Indicator, 2018). After got Independence lack of infrastructures we had experience huge trade deficit but in 80's some government initiative change the picture of the pattern of economy. Establishing special economic zone, tax provision, availability of labor and other utilities facilities as well as bank incentives promote for the export-oriented industrial countries to encourage the investment in Bangladesh. Nowadays Bangladesh reached world 5th largest exporter country and 2nd largest readymade garments (RMG) exporters in the European Union (EU) countries and USA market after china. According to Monetary Fund (IMF), Bangladesh is in emerging market and developing economies in recent years as well as the fastest growing economy in the world. Some researchers (Balassa 1971; Bhagwati and Srinivasan, 1979; Helpman and Krugeman, 1985; Frankel et al. 1996; Awokuse, 2003) argued that trade (exports) expansion continuously contributes a positive economic growth by enhancing productivity through increased trade competition. According to the theory of Adam Smith, "Trade is the engine of economic growth." Expansion of trade is just not only increased the Balance of Payment (BoP) but also the inflow of new technology, capital as well as expert management system which increased the host country highly productive, compatibility and overall competitiveness.

Most of the study in the past used either time series simple regression or Vector Error Correction Model (VECM) for examine the relationship between FDI and economic growth. Therefore in this study first time we used the non-recursive VAR model for measuring the efficiency of the relationship with FDI, GDP growth, Trade Openness (TOP) and Real Effective Exchange Rate (REER). None of this studies reviewed here have used a structural form of VAR model. A structural form of VAR model offers to impose theoretically motivated restrictions on the

potential relationship between the endogenous variables. This modeling fretwork follows a structural VAR model. We also used the Real Effective Exchange Rate endogenous variable for the first time for examine the responsiveness of FDI and other variables.
The remaining part of this paper proceeds as follows: Section 2 discusses the review of the literature regarding FDI and economic growth around the world. In Section 3 the study presents the data sources and empirical methodology. Section 4 describes the findings and discussions of the empirical estimations along with robustness check. Finally, we conclude the major findings and the policy implications in Section 5.

2.0 Literature Review

There have been numerous empirical studies examining the effect of FDI on economic growth of developing countries. Some papers (Ramirez, 2000, 2006; Zhang, 2001; Alguacil et al., 2002; Chakraborty and Basu, 2002, Kohpaiboon, 2003) shows that FDI inflows on economic growth will effects differs depending on the countries. FDI can contribute to growth through several feeds. Directly it can affect growth throughout capital formation. Alfaro (2003) demonstrates that the growth benefits of FDI to a great extent across primary, secondary (manufacturing), and tertiary sectors.

Khawar, M. (2007); Flexner, N. (2000); Hansen, H. & Rand, J. (2006); Lensink and Marrissey (2001); Visansack, K. E. et al. (2017); Hussain, M. E. et al. (2016); Rayhan, M. A. (2014); and Quarder, S. M. (2009) examine that the relationship between FDI and Economic growth has a positively related, that means FDI has an impact on economic growth. Whereas Bianaca, M. (2012); Hammed, O. M. et al. (2017) estimated that FDI and economic growth has a negative relation with each other. That mean FDI does not cause GDP growth. Finally Dritsaki et al. (2004); Najaf, A. & Mingqu, Y (2018); Hossain, A et al. (2012); Moses, J. S. & Shen, Shen, Y. (2013) demonstrate that there was another empirical finding that we found, FDI and economic growth does not have any statistically significance relation. Khawar, M (2007); examined the Foreign Direct Investment and Economic Growth: A Cross-Country Analysis from 1970-1992 by using ordinary least squares (OLS) method finding that FDI and Economic growth has significantly and positively correlated with growth as well as domestic investment. The population growth rate, initial GDP and political instability variables were negatively correlated with growth. The human capital measure was not significant in the analysis. Flexner. N (2000); estimated the Foreign Direct Investment and Economic Growth in Bolivia in 1990- 1998. His estimated result shows that FDI has a statistically significant impact.
Hansen, H. and J. Rand (2006) examined the Causal Links between FDI and Growth in 31 Developing Countries by using heterogeneous panel data. He showed that unidirectional causality from FDI to GDP implying that FDI causes growth. Borensztein et al. (1998) demonstrate that FDI is more productive than domestic investment only when the host country has a minimum threshold stock. Dritsaki, et al. (2004) examined a Causal Relationship between FDI and economic growth in Greece from 1960-2002. They found that there is a long run equilibrium relationship between FDI and growth. Chowdhury and Mavrotas (2003) examined

the FDI and growth in Chile, Malaysia and Thailand finding the positive relation between FDI and growth. Lensink and Marrissey (2001) examine FDI has a positive effect on growth whereas volatility of FDI has a negative impact in Developing countries. Bianca Maria (2012) estimated A VAR analysis of the connection between FDI and economic growth in Romania from 1991-2009. She found that FDI volume does not initiate growth; and that economic growth is an important factor in terms of attracting FDI in Romania. Najaf Ali & Ye Mingqu (2018) examine FDI and economic growth from Asian Developing countries in between 1990-2014 by using VECM test. They showed that in short run there are no evidence of causality from FDI to GDP and vice versa, whereas the long run results show that there is a positive impact of FDI and other variables to the GDP but not significant, and from GDP and other variables to FDI there is a negative interrelationship but significant. The findings show the confusing interrelationship between FDI and economic growth. Anowar Hossain et al. (2012) empirically examined the Relationship between Foreign Direct Investment and Economic Output in South Asian Countries: A Study on Bangladesh, Pakistan and India over the period of 1972-2008 by using VECM test. Their result shows that there is no co-integration between FDI and GDP in the both long and short run in Bangladesh and India. Grainger Causality results suggest that there is no causality relationship between GDP and FDI for Bangladesh. Hammed Oluwaseyi Musibau et al. (2017) using Two-Gap model and using ECM method to examine The Impact of Foreign Capital Inflows, Infrastructure and Role of Institutions on Economic Growth in ECOWAS members over the period 1980 to 2016 found that there was Negative relationship between FDI, Infrastructure and real growth while ODA, corruption, political stability have positive impact on real growth among ECOWAS members. Visansack KHAMPHENGVONG et al. (2017) using time series data from 1990 to 2015 estimate the relationship among FDI, Trade Openness and economic Growth: Empirical Evidence from Lao PDR. This study exposes the positive sign on FDI and trade openness on economic growth in the long run. VECM model also implies the unilateral direction in short run between FDI, labor force, capital investment and economic growth. Sultanuzzaman, M. R et al. (2018) examine Trade (Exports) as an Opportunity for Bangladesh using VECM Analysis during the period 1986- 2016. The study demonstrates that there is a unique long-run equilibrium relationship between trade (exports) and economic growth of Bangladesh. The study suggests that exports are the locomotive of Growth in Bangladesh. Adhikary, B. K (2011) examine the FDI, Trade Openness, Capital Formation, and Economic Growth in Bangladesh by using VECM method during 1986-2008. This study found that FDI and capital structure level are noteworthy positive effect on changes in real GDP. Moses Joseph Shawa & Yao Shen (2013) estimate the Causality Relationship between Foreign Direct Investment, GDP Growth and Export for Tanzania during the year 1980 to 2012 reveals that there is existence of a long run association among the variables and unidirectional running from FDI to export. Rayhan, M. A. (2014) examine the Contribution of Foreign Direct Investment to Economic Growth in Bangladesh using multivariate regression framework during the years from 1975 to 2012. The study examine the positive relationship between FDI and Economic growth. Quarder, S. M (2009), using OLS method to investigate the relation between FDI and economic

growth of Bangladesh from 1990-2006. The results reveal that wage, trade openness, net export, GDP growth and tax rate have robust result. Also two years lagged values of FDI found to have a positive effect on economic growth. Mian and Alam (2006) uncover that FDI residue a factor of economic growth in Bangladesh. But lack of good governance, corruption, political instability and existing rule and regulations, and failure to increase substantial and structural policy infrastructure are the major fact for constrained FDI inflows to Bangladesh. Bhattacharaya (2004) has examined that in Bangladesh a 10% (percent) increase in FDI outcome in a 3.7% (percent) increase in the GDP. He also calculated that 13% per Annam growth in FDI will result 1% decreased in poverty level in Bangladesh. Ahmed (1975) found that in developing countries, FDI acting a significant function in the progression of industrialization and economic growth. Since 1980s, this has lead to a remarkable change in the outlook of developing countries towards FDI. Zhang (2000; 2001) stated that tends of FDI encourage GDP growth if the host countries take on a laissez-faire trade system. In addition, advance in education and human capital is a prerequisite for FDI-led growth. He pointed out that the host country should encourage export-oriented FDI and focus on macroeconomic stability. On the other hand, Zhang (2000) , argues that GDP growth leads to FDI growth. Rapid economic growth in the host country increases aggregate demand which stimulates FDI. According to neoclassical and endogenous growth models FDI is consider as a growth hypothesis of a country economy. The neoclassical growth models assume that FDI is required because of country shortage of physical and financial capital which, in turn stimulate the marginal productivity of capital. Adams (2009) argued that basic principle of neoclassical economics is capital investment in the structure of long-term assurance. Blomstorm et al. (1994), Borenzstein et al. (1995), Balasubramanyam et al. (1996), Lipsey (1999), Moosa (2002), Moosa & Cardak (2006) demonstrated that in the view of neoclassical economists, FDI is more dependable and less impulsive sources of capital for the developing economies. While, the endogenous growth models state that the growth of a country in the long-run is not only manipulated by the quantity of substantial investment but also on the effectiveness of employing investment. That's why Romer (1986), Lucas (1988), Mankiw et al. (1992), Pugel (2007) stated that FDI often brought endogenously in the incorporating organizational, managerial, technical and human skills, innovation and technological progress, and accumulation of knowledge. The study of the United Nations Conference on Trade and Development (UNCTAD) in 1992 examine that in developing economies for China and Taiwan, FDI generates a positive result on employment, human skills and international trade. Zhang (2001) reports that in Asian countries the trend of FDI stimulates economic growth than in Latin Americas. McLean & Shrestha (2002) stated that FDI effects significant impact on economic growth in developing economies than in the developed economies. Adhikary & Mengistu (2008) estimate that in developing economies, a 1 per cent increase in FDI resulting approximately on an average 0.5 per cent can increase GDP per capita growth rates. Nath (2009) reports that FDI plays a two-fold function: (1) contributes to capital accumulation and (2) increases the total productivity of investment. In spite of this positive relation between FDI and economic growth, some empirical evidence also exposes negative association between them. This view led to the

dependency theorists. The dependency theories argue that foreign gigantic investors may create negative effect on the host countries domestic firms in the long-run as they have large quantity of capital, advanced technologies, superior market access, advanced marketing networks and better managerial and human skills (Marksun & Venables 1997, Agosin & Mayer 2000, Kumar & Pradhan 2002). Musila and Sigue (2006) examined in the view of the dependency theories; they argued that FDI can have an adverse impact on employment, income distribution, national sovereignty and autonomy of a country. Thus, dependency theories argue that FDI is not an aid to the development rather it undermines the process of development (Razin et al. 1999). According to the endogenous growth theory, Romer (1989); Solow (1957) reports that trade openness can create a scope for technological progress and efficiency. Grossman & Helpman (1991), and Barro & Sala-I-Martin (1995) mention that a country with a higher degree of openness has a greater ability to absorb technological developments generated in the leading nations. World Bank (2001) reports in its global development finance edition for the success of FDI in Malaysia and Taiwan. Similarly, Acemoglu & Zilibotti (1997) explain that the economically backward countries can accelerate convergence process to catch richer economies by opening up their capital markets. However, negative arguments between trade openness and economic growth can also be found in some empirical literature. For instance, Rodrik (1992) informed that economic openness may bring macroeconomic instability by increasing inflation, devaluing exchange rates. Similarly, Levine & Renelt (1992), and Andriamananjara & Nash (1997) account that a high degree of trade openness may increase inflation and lower the real exchange rates which may create negative impact on domestic investment.

3.0 The Relationship between FDI and other three endogenous variables (GDP growth, trade openness and Real Effective Exchange rate): The Trend analysis

The Bangladesh economy has been able to continue sustained economic growth. In Fiscal Year (FY) 2016-17 the economy grew at a rate of 7.28 percent, which was 7.11 percent in FY2015-16. The per capita national income reached US$1,610 in FY2016-17, where a year earlier by US$145. Continue declining the inflation 5.92 to 5.44in respect with last year. Exports registered a growth of 1.72 percent while import grew by 9.00 percent in FY2016-17, of which capital machinery import increased by 7.35 percent.

From the empirical data we have figure 1, figure 2 and figure 3 respectively with GDP and other 3 variables. From figure 1 we see that in before the year of 1985 there was nothing to mention about FDI in Bangladesh economy. In addition GDP growth was not stable either. But after the year of 1985 FDI was gradually increase along with GDP growth rate. So before the analysis we see that the time series data shows a positive relation with FDI and GDP growth in Bangladesh economy.

Figure-1: GDP and FDI growth

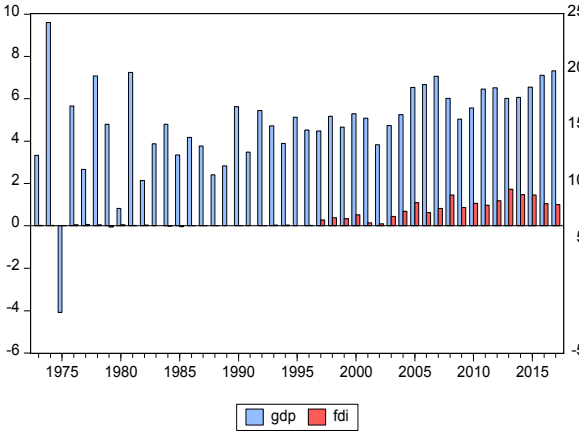

Figure-2: GDP and REER

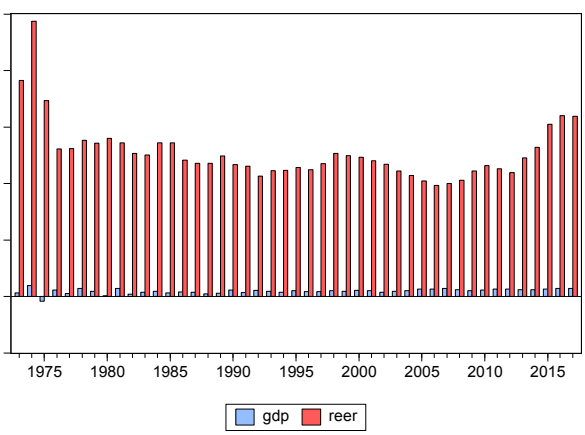

Figure-3: GDP and Trade Openness (TOP)

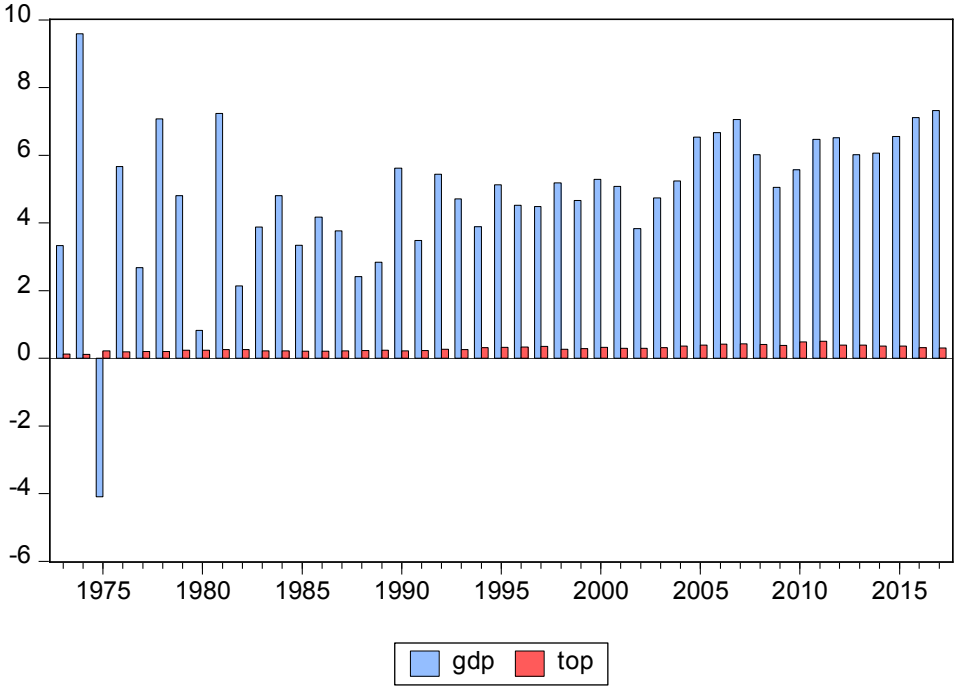

Figure 2 the empirical data shows that GDP is not sensitive with the REER in Bangladesh economy. Although it may not be the same scenario for others countries too. Therefore the empirical data initially indicate that there is a significance relationship between GDP and REER. Finally from the Figure 3 shows that GDP is relatively less sensitive with TOP.

3.1 Descriptive Statistics Analysis

Table 1: Descriptive Statistics Analysis

	GDP	FDI	REER	TOP
Mean	4.860110	0.404253	127.5570	0.292117
Median	5.077288	0.057974	120.6240	0.282826
Maximum	9.591956	1.735419	243.5372	0.502402
Minimum	-4.088214	-0.051460	98.33784	0.111260
Std. Dev.	2.132382	0.523768	25.92873	0.087098
Skewness	-1.547217	1.025868	2.460368	0.360474
Kurtosis	8.452004	2.685673	10.66395	2.730040
Jarque-Bera	73.68724	8.078284	155.5308	1.111206
Probability	0.000000	0.017613	0.000000	0.573726
Sum	218.7050	18.19141	5740.065	13.14525
Sum Sq. Dev.	200.0703	12.07066	29581.15	0.333789
Observations	45	45	45	45

The descriptive statistics shows that the over the study period, GDP growth averaged about 5%, which can be considered as a moderate figure for Bangladesh. On the other hand, FDI is on an averaged 0.4% over the study period. This implies that the country FDI growth rate is quite satisfactory for the growing economy. The REER is on an average 127.55% which is sensible with as an exporting country. While the TOP growth rate 0.29% which is comparatively lower than the rational for the open economic behavior. It indicates that there are some drawbacks of this sector. The maximum GDP rate is 9.59% while the minimum is -4.09%. The maximum growth rate of FDI is 1.74%, whiles the minimum is -0.05%. The maximum REER is 243.54%, whiles the minimum is 98.33%. The maximum TOP growth rate is 0.5%, whiles the minimum is 0.11%. The skewness of GDP growth of -1.54 implies that low levels of GDP dominated high levels. The skewness of FDI growth of 1.02 implies that high levels of FDI dominated. The positively skewed, meaning that FDI growth into the country has gradually increasing. The positively skewed of REER (2.46), meaning that REER into the country has been fairly increasing. The positively skewness of TOP (0.36) implies that high levels of TOP dominated. The Jarque-Bera for GDP, FDI, REER and TOP demonstrated that the data was not normally distributed; that is, the null hypothesis that the variables are not normally distributed was rejected.

4.0 Methodology

In this study firstly it will check whether the data series are stationary or non-stationary since its use annual time series data. For this purpose, this study will use Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) unit root test because by using these it can be able to know whether time series are stationary or non stationary. Then, will use Johansen cointegration test to examine the cointegration between the variables (GDP growth, Foreign Direct Investment, Trade Openness and Real Effective Exchange Rate). Then examine the VECM methodology. Finally, to justify the robustness of the VECM model its will use stationary of VECM model, autocorrelation test for residuals, the normality and homoscedasticity of residual errors and stability tests of the model. The variables in this model, GDP growth rate is calculated on the market prices. FDI and Trade Openness (TOP) are calculated as a share of GDP. Real Effective Exchange is calculated domestic currency against US dollar. The data was collected from World Bank, Bangladesh Bank, World Economic Indicator and Bangladesh Bureau of Statistics.

4.1 Basic steps to estimating a VECM:

Step 1: all the series must be stationary at I(1) and not I(2).
Step 2: Determine the optimal Lag length (p) for the model.
Step 3: Perform Johansen cointegration test with (p) lag.
Step 4: If there is no cointegration, then estimate the unrestricted VAR model.
Step 5: If there is cointegration, then specify the VECM with (p-1) lags.
Step 6: Finally Performs some diagnostic tests.

4.2 Model Specification

The VAR model can be specified as follows:

$$Y_t = A(L)Y_t + \varepsilon_t \quad (1)$$

Where Y_t is the vector of endogenous variables and ε_t white noise which is independently and identically distributed (iid).
To examine the relationship between economic growth and Foreign Direct Investment (FDI) in Bangladesh, I will use recursive VAR model which can be expressed in the following dynamic structural model.

$$A(L)Y_t = \vartheta_t \quad (2)$$

Where $A(L)$ is n×n matrix polynomial in the lag operator, Y_t is n×1 vector of endogenous variables, ϑ_t is the n×1 vector of structural disturbance term with E(ϑ_t) and var(ϑ_t) = I_n, Where I_n represents diagonal matrix representing structural disturbances. In this case we assume that structural disturbances are mutually uncorrelated to each other.
Equation (2) can be expressed as reduced form of VAR as follows;

$$Y_t = G(L)Y_{t-1} + u_t \quad (3)$$

Where $G(L)$ is the matrix polynomial of VAR lag operator and $u_t = A^{-1}v_t$ to shows the relation between forecast and errors and the VAR residual with $E(u_t)$ = 0, and variance is constant var(u^t) = $\sum$
Bernank and Mihov (1998), Blanchard and Perotti (2002) and others authors and EViews use a more general way of relating errors and shocks in structural VARs. So the model can be expressed by the following equations:

$$Au_t = Bv_t \quad (4)$$

B is the new matrix form which has both errors and shocks. So to get the system response to shocks one need to have;

$$u_t = A^{-1}Bv_t \quad \text{or } u_t = Fv_t \quad (5)$$

Here $F = A^{-1}B$ is the contemporaneous coefficient matrix.
The endogenous variables in our model can be expressed as follows;

$$Y_t = [gdp_{t-i}\ , fdi_{t-i}\ , reer_{t-i}\ , top_{t-i}] \quad (6)$$

Here, Y_t is the Real Gross Domestic Product growth. Since we use recursive VAR model, the ordering of recursive VAR model can be shown as follows: (1) GDP growth Rate (gdpgr), (2) Real Effective Exchange Rate (reer), (3) Trade Openness (topn) and (4) Foreign Direct Investment (fdi). The recursive VAR model consists of four endogenous VAR equations. The first equation shows that GDP growth is the dependent variable and the lags of all four variables are the explanatory variables. The second equation states that Foreign Direct Investment (FDI) is the dependent variable and the lags of all four variables plus the current value of the GDP growth rate are the explanatory variables. The third equation shows that trade openness is the dependent variable and the lags of all four variables plus the current value of the GDP growth and the current value of the FDI are the explanatory variables. The fourth equation shows that Exchange rate growth is the dependent variable and lags of all four variables plus the current value of the GDP growth, the current value of the FDI and current value of trade openness are the explanatory variables. Stock and Watson (2001), stated that changing the order of the variables, changes the VAR equations, coefficients and residuals also. They estimated recursive VAR model depends on the ordering of the variables. In the present study, changing the order of the variables changes the result of VAR model insignificantly. Therefore, in this study we order the recursive VAR model as follows: firstly GDP growth is the dependent variable, and then the main explanatory variable is FDI, then trade openness and lastly Exchange rate growth rate.

4.3 VECM model Identification

In this study we used Cholesky approach because it is a unique case of exactly identified of VAR model. The reduced form of recursive VAR covariance matrix can be expressed as follows:

$$\begin{bmatrix} v_t^{gdp} \\ v_t^{fdi} \\ v_t^{reer} \\ v_t^{top} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 \\ a_{41} & a_{42} & a_{43} & 1 \end{bmatrix} \begin{bmatrix} u_t^{gdp} \\ u_t^{fdi} \\ u_t^{reer} \\ u_t^{top} \end{bmatrix} \quad (7)$$

In equation (7) we assume that first two variables such as GDP growth and FDI are exogenous to all other variables contemporaneously. In the first equation structural VAR model reveals no contemporaneous relationship between real GDP growth and other nominal variables. In the second equation we assume that FDI has no immediate effect on GDP growth contemporaneously while GDP growth will affect FDI contemporaneously but not to real effective exchange rate (REER) and TOP. In the third equation we assume that REER has no immediate effect on FDI while REER has contemporaneously affected by GDP growth and FDI. And finally, in the fourth equation we assume that TOP has no immediate effect on FDI while FDI has contemporaneously affected by GDP growth, then FDI and then REER.

If there is cointegration among the variables, then specify the VECM with (p-1) lags. So the equation (7) can be written as;

$$ECT_{t-1} = GDP_{t-1} + FDI_{t-1} + REER_{t-1} + TOP_{t-1} \quad (8)$$

5.0 Empirical Analysis and Results

To investigate the stationary property of the particular data series we used Augmented Dickey-Fuller and Phillips-Perron Unit Root Test. The study indicates that except GDP growth rate (gdpgr) all variables are not stationeries at level in both unit root test. When these series (topn, reer, fdi) are converted to the first difference, then they become to be stationary and also integrated at Order of Integration/Stationary of, *I* (0). These (ADF and PP Unit Root Test) results will overlay for running lag selection criterion.

5.1 Stationary Test

In order to check the stationarity of the four variables we used ADF tests. The hypothesis of ADF test can be formulated as follows (e.g.):

H_0: Variable has a unit root. (Null hypothesis)
H_1: Variable has no unit root (Alternative hypothesis)

If we reject the null hypothesis at 1% or 5% or 10% level of significance, we can say that the variable has no unit root i.e. the variable is stationary at 1% or 5% or 10% level of significance. But if we fail to reject the null hypothesis then we can say that the variable has a unit root. When the variable has a unit root, we can transform the non-stationary variables into stationary variable by taking first difference of the variables. The summary results of ADF test of four variables can be shown in Table 1. The results show that GDP growth (gdp), foreign direct investment (fdi), real effective exchange rate (reer) and trade openness (top) has no unit root at level at 1% or 5% or 10% level of significance.

Table 2: Unit root test with Trend and Intercept

variables	ADF Test			PP Test		
	t-Statistic	Prob.*	Order of Integration/ Stationary	t-Statistic	Prob.*	Order of Integration/ Stationary
gdp	-11.04613	0*	I(O)	-12.2104	0*	I(0)
fdi	-2.960062	0.1548	I(1)	-2.877747	0.1793	I(1)
Δfdi	-3.904874	0.0215*	I(0)	-9.461292	0*	I(0)
reer	-2.283608	0.4337	I(1)	-1.826568	0.6747	I(1)
Δreer	-8.971476	0*	I(0)	-8.424541	0*	I(0)
top	-2.366559	0.3912	I(1)	-2.324014	0.4128	I(1)
Δtop	-7.557798	0*	I(0)	-7.672208	0*	I(0)

Notes: Δ denotes first differences. Significant at * 1% level and ** 5% level; ADF Test is determined by the Mackinnon (1966) formula.
Source: Authors calculations by using EViews 10.0

5.2 Lag selection criteria

One of the important responsibilities in VAR model is lag selection because Johansen co-integration tests are sensitive to the lags used. This criterion method is used throughout

unrestricted VAR. Therefore, optimal lag length order is definite by the Akaike information criterion (AIC). Table 2 shows, most of the criteria suggest lag 2. So, the order of optimal lag is 2 for this series. We use this lag order for estimating Johansen cointegration and VECM tests. The optimal lag order is so sensitive for both techniques

Table 3: Lag selection criterion

VAR Lag Order Selection Criteria
Endogenous variables: GDP FDI REER TOP
Exogenous variables: C
Date: 11/11/19 Time: 15:59
Sample: 1973 2017
Included observations: 43

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-219.5142	NA	0.384633	10.39601	10.55984	10.45643
1	-123.0520	170.4914	0.009153	6.653580	7.472743*	6.955662*
2	-105.2131	28.21023*	0.008580*	6.568053*	8.042547	7.111801

* 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

Source: Authors calculations by using EViews 10.0

If we run on exogenous variables in the VAR then the count of the lag would be started at 1 but in here we selected the constant that's why the lag count started at 0. According to the theory the lag selection criteria is to minimize the prediction error of the estimated model. In this study, we use a small sample of annual data. Usually for annual data series the lag length should be 1 or 2. So selecting more lags would reduce the degree of lack of restrictions. According to Johansen and Juselius (1990) they stated that for the well-organized results for small samples the best lags should be in between 1 and 2. Therefore the optimum lags selected in this model is 2 which have already written in Table 3.

5.3 Johansen Cointegration test

In turn to demonstrate the long run correlation along with the four variables, we have to apply the Johansen multivariate conintegration test.
Null hypothesis (H0): No Cointegration in equation.

Rejecting the null hypothesis means that the equation has cointegration.
By applying the Trace test under flock, we uncover that there is a full rank i.e. n=4. While n=4 and our number of variables are 4, we can run VAR model at the level forms. For that reason, we develop VAR model taking into account all the variables are stationary at level form.

Table 4: Co-integration Rank Test:

Date: 11/11/19 Time: 19:28
Sample (adjusted): 1975 2017
Included observations: 43 after adjustments
Trend assumption: Linear deterministic trend
Series: GDP FDI REER TOP
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.808319	117.9625	47.85613	0.0000
At most 1 *	0.433078	46.92991	29.79707	0.0002
At most 2 *	0.364664	22.52597	15.49471	0.0037
At most 3	0.067847	3.021087	3.841466	0.0822

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.808319	71.03263	27.58434	0.0000
At most 1 *	0.433078	24.40393	21.13162	0.0167
At most 2 *	0.364664	19.50489	14.26460	0.0068
At most 3	0.067847	3.021087	3.841466	0.0822

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source: Authors calculations by using EViews 10.0

The Johansen cointegration of unrestricted Cointegration Rank Test (Trace) shows that there is a 3 cointgration between the variables. (*) indicate that there is rejecting the null hypothesis means that there is a cointegration among the variables. And the unrestricted Cointegration Rank Test (Maximum Eigenvalue) are shows that 3 cointegration equation exists among the variables. Both results indicate 3 cointegrating eqn(s) at the 0.05 level of significance. The Johansen (1988) cointegration rank tests (Trace and Maximum Eigenvalue) verify the long-run equilibrium

cointegration among the variables in Table 4. It indicates that the intended cointegrating rank can apply to estimate the long-run belongings of VECM inferences. The investigation discloses that in the arrangement, there is a long-run relationship consecutively from GDP to FDI, REER and TOP. The model also has prior year residuals, so moving to VECM estimation in the long-run demonstrations (Engle and Granger, 1987).

5.4 Johansen normalization Interpretation

Table 5: Johansen normalization Test.

1 Cointegrating Equation(s): Log likelihood -128.6781

Normalized cointegrating coefficients (standard error in parentheses)

GDP	FDI	REER	TOP
1.000000	-4.125908	0.099217	15.94765
	(0.66106)	(0.01034)	(4.64100)

Adjustment coefficients (standard error in parentheses)

D(GDP)	-0.625456
	(0.11605)
D(FDI)	0.008695
	(0.01740)
D(REER)	-5.483517
	(0.63183)
D(TOP)	0.001466
	(0.00292)

2 Cointegrating Equation(s): Log likelihood -116.4761

Normalized cointegrating coefficients (standard error in parentheses)

GDP	FDI	REER	TOP
1.000000	0.000000	-0.064172	-11.73112
		(0.01182)	(3.25417)
0.000000	1.000000	-0.039601	-6.708529
		(0.00400)	(1.10076)

Adjustment coefficients (standard error in parentheses)

D(GDP)	-1.563060	3.608612
	(0.25979)	(0.48191)
D(FDI)	0.071746	-0.105006
	(0.04488)	(0.08325)
D(REER)	-2.368076	19.20855
	(1.58605)	(2.94210)
D(TOP)	0.004013	-0.008841
	(0.00775)	(0.01437)

3 Cointegrating Equation(s): Log likelihood -106.7237

Normalized cointegrating coefficients (standard error in parentheses)

GDP	FDI	REER	TOP
1.000000	0.000000	0.000000	-14.63801
			(1.92627)
0.000000	1.000000	0.000000	-8.502372

			(1.04884)
0.000000	0.000000	1.000000	-45.29801
			(40.2647)
Adjustment coefficients (standard error in parentheses)			
D(GDP)	-1.670816	2.682218	-0.033023
	(0.25885)	(0.72573)	(0.01200)
D(FDI)	0.040303	-0.375320	0.002348
	(0.04151)	(0.11638)	(0.00192)
D(REER)	-2.763660	15.80765	-0.573556
	(1.61754)	(4.53502)	(0.07496)
D(TOP)	0.008140	0.026643	-0.000274
	(0.00753)	(0.02112)	(0.00035)

Source: Authors calculations by using EViews 10.0

Johnson Cointegration of equation 1 shows that GDP is positioned as the dependent variable. Note that, the sign of the coefficient are reverse in the long run. Therefore, in the long-run, FDI has positive impact on GDP while REER and TOP has a negative impact on GDP, on average, ceteris paribus. The coefficients are statisticallysignificance at the 1% level. So in conclusion, the null hypothesis of no cointegration is rejected against the alternative of a cointegrating relationship in the model.

Johnson Cointegration of equation 2 shows that GDP is positioned as the dependent variable. In the long-run, TOP has positive impact on GDP, on average, ceteris paribus. Johnson Cointegration of equation 3 shows that GDP is positioned as the dependent variable. In the long-run, REER and TOP has positive impact on GDP, on average, ceteris paribus.

5.5 Estimate VECM model

Table 6: VECM long-run representations: GDP as a dependent variable

Vector Error Correction Estimates
Date: 11/11/19 Time: 20:10
Sample (adjusted): 1975 2017
Included observations: 43 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	CointEq2	CointEq3
GDP(-1)	1.000000	0.000000	0.000000
FDI(-1)	0.000000	1.000000	0.000000
REER(-1)	0.000000	0.000000	1.000000
TOP(-1)	-14.63801	-8.502372	-45.29801
	(1.98054)	(1.07839)	(41.3991)
	[-7.39090]	[-7.88432]	[-1.09418]

C	-0.510659	2.115042	-111.9392	

Error Correction:	D(GDP)	D(FDI)	D(REER)	D(TOP)
CointEq1	-1.670816	0.040303	-2.763660	0.008140
	(0.26614)	(0.04268)	(1.66311)	(0.00774)
	[-6.27785]	[0.94433]	[-1.66174]	[1.05118]
CointEq2	2.682218	-0.375320	15.80765	0.026643
	(0.74618)	(0.11966)	(4.66279)	(0.02171)
	[3.59460]	[-3.13660]	[3.39017]	[1.22720]
CointEq3	-0.033023	0.002348	-0.573556	-0.000274
	(0.01233)	(0.00198)	(0.07707)	(0.00036)
	[-2.67751]	[1.18743]	[-7.44201]	[-0.76411]
D(GDP(-1))	0.117715	-0.019598	1.065580	-0.001682
	(0.13525)	(0.02169)	(0.84516)	(0.00394)
	[0.87035]	[-0.90357]	[1.26080]	[-0.42733]
D(FDI(-1))	-1.840507	-0.092053	-11.84045	-0.042029
	(0.96367)	(0.15454)	(6.02185)	(0.02804)
	[-1.90990]	[-0.59568]	[-1.96625]	[-1.49899]
D(REER(-1))	0.010235	-0.004528	0.209008	0.000234
	(0.01639)	(0.00263)	(0.10239)	(0.00048)
	[0.62460]	[-1.72335]	[2.04124]	[0.49147]
D(TOP(-1))	1.032867	-2.417408	-36.21022	0.192506
	(6.60829)	(1.05972)	(41.2945)	(0.19227)
	[0.15630]	[-2.28118]	[-0.87688]	[1.00122]
C	-0.016560	0.033811	-1.462379	0.004907
	(0.19789)	(0.03173)	(1.23661)	(0.00576)
	[-0.08368]	[1.06545]	[-1.18257]	[0.85220]
R-squared	0.868426	0.327818	0.734222	0.237384
Adj. R-squared	0.842111	0.193381	0.681066	0.084861
Sum sq. resids	57.40565	1.476236	2241.614	0.048596
S.E. equation	1.280688	0.205373	8.002882	0.037262
F-statistic	33.00147	2.438456	13.81268	1.556382
Log likelihood	-67.22662	11.47729	-146.0200	84.87188
Akaike AIC	3.498913	-0.161734	7.163721	-3.575436
Schwarz SC	3.826578	0.165931	7.491387	-3.247771
Mean dependent	-0.052987	0.023084	-1.950859	0.004393
S.D. dependent	3.223056	0.228670	14.17086	0.038952

Determinant resid covariance (dof adj.)	0.003833
Determinant resid covariance	0.001682
Log likelihood	-106.7237
Akaike information criterion	7.010404
Schwarz criterion	8.812563
Number of coefficients	44

Significant at * 1% level and ** 5% level. Source: Authors calculations by using EViews 10.0

Therefore, the ECT equation can be written as;

$$ECT_{t-1} = 1.000GDP_{t-1} + 1.000FDI_{t-1} + 1.000REER_{t-1} - 45.29801TOP_{t-1} - 111.9392$$

Table 7: VECM long-run representations: GDP as a dependent variable

	Coefficient	Std. Error	t-Statistics	Probability value
ECT	-1.67082	0.26614	-6.27785	0.0000*

Significant at * 1% level and ** 5% level.
Source: Authors calculations by using EViews 10.0

The above results is the estimating VECM in Table 7 indicates that ECT is negative (-1.67082) and the probability is 0.0000 % which is significant in 1% level. The result implies that the null hypothesis that GDP do not causes FDI growth, whereas the alternative hypothesis, FDI cause GDP growth. So, the null hypothesis is rejected. The study discloses that there is strong long-run equilibrium causality successively from FDI and GDP as well as other explanatory variables. Therefore, it can be said that a unidirectional correlation running from FDI, REER and TOP to GDP. Love and Chandra (2004) recommended similar result for Pakistan and India case. However the outcome involves that in the long-run both FDI and TOP are serving to boost up GDP growth of Bangladesh.
The coefficient of the Error Correction Term (ECT) is -1.67082, implies that the previous deviation from long-run equilibrium is corrected in the current period as an adjustment at a speed of 167.08 percent, i.e., the speed of adjustment from disequilibrium to equilibrium is extremely fast. In other words, it can be said that in the long-run, the economy is corrected around 167.08% of the previous year's disequilibrium.

Table 8: VECM short-run representations: Wald Test

Variables	Test Statistic	Value	Probability Value
GDP	Chi-square	0.757516	0.3841
FDI	Chi-square	3.647725	0.0561
REER	Chi-square	0.390129	0.5322
TOP	Chi-square	0.024429	0.8758

Significant at * 1% level and ** 5% level
Source: Source: Authors calculations by using EViews 10.0

Wald statistics (table 8) shows that there is short-run causality running from FDI to GDP. While no short-run causality running from REER and TOP to GDP. The probability value of FDI shows that its significant at 5% significant level which implies that there is a short-run relationship between FDI and economic growth.

5.6 Robustness check of the Model (post-estimation)

The study performs the robustness check during the post-estimation method of the model. The R^2 (0.868426) and adjusted R^2 (0.842111) of the OLS model throughout the VECM bound of this research are relatively high. While R^2 is more than 60%, considering that the model is in best of fit. The F-statistic (33.00147) of the model is as well as positive and large enough with corresponding probability value (0.0000) which is significant at 1% level demonstrates that all the independent variables have together influenced the dependent variable GDP. The Durbin-Watson statistic is (1.630433) which is lies in the range of 1.5-2.5 implies that, the model is not suffering any autocorrelation problem and the series is stationary in nature too. For that reason, the investigation carries outs the serial correlation test, the normality test of the residuals and the stability test of the coefficient.

Table 9: Diagnostic test:

	Jarque-Bera	F-statistic	Probability*
Normality	0.221078		0.895352
Serial Correlation		2.074102	0.1417
Heteroscedasticity		1.702485	0.1337

R-squared	Adjusted R-squared	Durbin-Watson statistic
0.868426	0.842111	1.630433

Source: Authors calculations by using EViews 10.0

Therefore, table 9 shows, Breusch-Godfrey LM test (Breusch, 1978; Godfrey, 1978) and Breusch and Pagan heteroscedasticity tests (Breusch and Pagan, 1979) results that the model is not suffering any serial correlation and heteroscedasticity problem. In addition, Jarque-Bera test authenticates that the residuals are the normality distributed (Hendry and Juselius 2001). Finally, I have examined the stability of the long-run parameters together with the short-run dynamics for the equations. For the test, I relied on cumulative sum (CUSUM) and cumulative sum square (CUSUMSQ) tests proposed by Borensztein et al. (1998). Pesaran et al. (1997), and Moshen et al. (2002) has been utilized this same procedure to test the stability of the long-run coefficients. The test applied to the residuals of the ECM model (Brown et al., 1975).

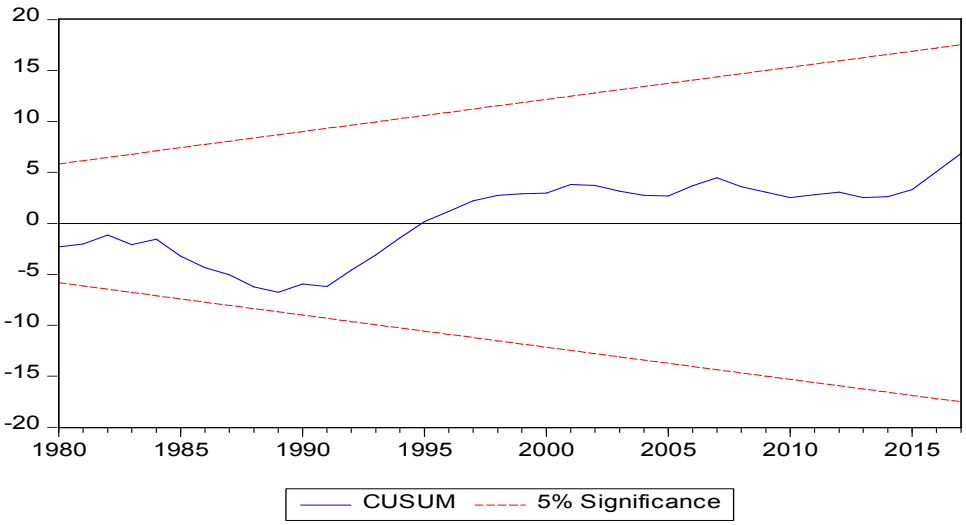

Figure 2: CUSUM Test.

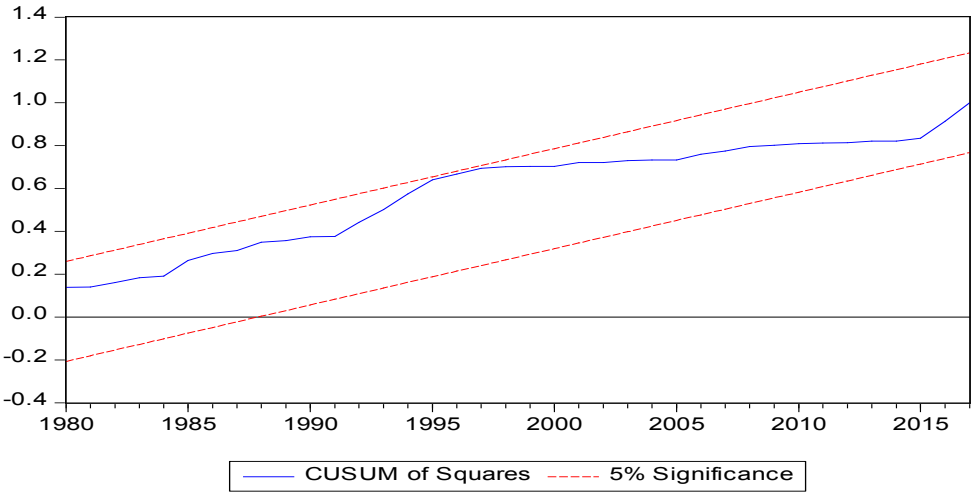

Figure 3: CUSUMSQ Test.

Figure (2) and figure (3) plot the CUSUM and CUSUMSQ for equation (8). It can be seen from figure that the plot of CUSUM stays within the critical 5% bounds that confirms the long-run relationships among variables and thus shows the stability of coefficient. If we can see the result that the plot of the CUSUM and CUSUMSQ stays within the 5% critical bounds that we accept the null hypothesis the long-run relationship among the variables and thus shows the stability of coefficient. But if the CUSUM and CUSUMSQ exceed the 5% critical bounds we can confirm instability of the coefficient. However, the CUSUM and CUSUMSQ test shows that the model is lies within 5% critical bounds of parameter stability, which shows the stability of coefficient and thus implies the long-run relationships among the variables. Afterward, the inverse roots of the characteristic polynomial are all inside the unit circle, implication that model is stable. Thus all the diagnostic results recommend that model is robust and good fit for examining the effects of GDP and FDI growth of Bangladesh.

6.0 Conclusion and Policy Recommendation

This study examines the special effects of economic growth on FD, REER and TOP of Bangladesh over the period (1983–2018) by using Johansen cointegration test and Vector Error Correction Model (VECM) approach. With the purpose of disclose the best outcome of the model; have used four major variables in this study such as GDP annual growth rate (GDP), Foreign Direct Investment (FDI), Real Effective Exchange Rate (REER) and Trade Openess (TOP). Furthermore, this study used dummy of GDP because of structural. After estimating Johansen cointegration test, the study discovers that there is a long-run relationship among the variables. Then the study deploys the VECM test as Granger representation theorem. The VECM investigation demonstrates that there is a long-run relationship running from FDI, REER and TOP to GDP growth. While, Wald test demonstrate that in the short-run only causal relationship running from FDI to GDP growth. The main objective of this study was to find out the causal relationship between economic growth and other variables of Bangladesh both in the short-run and long-run. The empirical study also recommended that FDI has a significantly impact on economic growth in both short-run as well as long-run of Bangladesh. This study highly suggests that fully utilizing FDI and TOP is one of the best chances of Bangladesh to develop its economy. This study also influenced as Love and Chandra (2004) and Sultanuzzaman, M. R et al. (2018). The limitation of this study is limited samples size. I hope in future, modifying this empirical study and transform the variables as well as use long period data might get the better results on Bangladesh. On the other hand, technological innovation and transfer, energy intensity, green investments in industries and infrastructure, strong stock market, less corruption, good governance, potential monetary policy, well decorated customs laws as well as human resources are potential requirements for enhancing GDP which leads to sustainable economic growth.

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