European Online Journal of Natural and Social Sciences 2019;
Vol.8, No 2 pp. 316-330
ISSN 1805-3602

Impacts of FDI Inflows on Domestic Investment, Trade, Education, Labor Forces and Energy Consumption in Bangladesh

Shapan Chandra Majumder
Department of Economics, Comilla University, Cumilla-3506, Bangladesh
Email: scmajumder_71@yahoo.com

Received for publication: 04 April 2019.
Accepted for publication: 03 June 2019.

Abstract

This study examines the impact of foreign direct investment on the domestic investment, trade, education, labor forces, and energy consumption in Bangladesh using annual time series data. It employs multivariate ordinary least square regression to find out the link between the variables. Multivariate OLS regression results show that FDI has a positive effect on the domestic investment, education, labor forces, and energy consumption in the country. It means that FDI assists the local investment, encourage education level, and energy consumption in promoting the economy. To explore the long-run relationship and cointegration between FDI and domestic investment, trade, and labor forces, the study uses Autoregressive Distributed Lag (ARDL) bound testing approach and Error Correction Model (ECM). Augmented Dickey-Fuller (ADF) test is used to check the stationarity of the variables. The ARDL model finds the long-run relation between FDI and domestic investment, trade, and labor forces in Bangladesh. So, the ARDL framework asserts that the variables move together in the long-run.

Key Words: Foreign Direct Investment, Local Investment, Openness, ARDL, ECM

Introduction

Bangladesh is a South Asian developing country which, despite being blessed with strategically significant geographical location, temperate climate, plain land, and a good volume of population, has acquired the status of a lower-middle income country in 2015. The bitter history of British colonial rule and Pakistani military autocracy still marks its sign over the country. Due to the lacks of modern technology-based education and infrastructure development especially in rural areas where almost 65% people dwell in, both natural resources and man power of the country fail to give her what they could do. However, realizing the possibilities of different resources, the nation started to reset its vision especially in the last decade of the 20th century when after numerous political assassinations and military cues the country restored democracy and opened its economy to foreign investors. The academic as well as the civil societies of the country also came forward to designing the route to development. An integrated effort of over 20 years has been able to recuperate the poverty-stricken socio-economic condition of the country to some extent which is reflected in her GDP growth that remains constant over 6.5% throughout the decade. The goal of her present government is to transform her into an upper middle-income country by 2021.

At present, the challenge of the country to meet her targeted development is capital deficiency. A recent study published by World Bank demonstrates that Bangladesh requires yearly by 7-8% growth to achieve the minimum middle-income country status by 2021. In order to reach the goal, the investment of the country has to be considerably more than 33% of GDP. In these circumstances, the country needs a huge amount of investible fund which the internal source of investment cannot meet up. Necessarily, external sources appears as the promising solution to the demand of the

country. Generally the external sources of investment comprise foreign aid (from donor countries and donor agencies), grants, loans, private foreign investment i. e., portfolio and foreign direct investment (FDI), and official development assistance (ODA). It is theoretically and empirically believed that aid, grants, loans play an important role in poverty reduction by many ways. However, these insufficient, vulnerable, and, above all, demeaning sources of capital can never be a solution. Though, nowadays, Bangladesh relies hugely on portfolio and FDI, the former one carries control over the borrowing entity, and, therefore, is not much beneficiary to the country. FDI, on the other, may not involve any direct control over the use of lending funds (Shamsuddin, 1994). The study on FDI inflows to the country, thus, emerges as a required academic endeavor playing a role to the development of the country.

The objective of this study is to examine the impact of FDI on the domestic investment, trade, education, labor forces, and technology of the country during 1972-2015. The study try to explore whether there are any cause and effect relationships between independent variables and FDI inflows. It examines the critical relationship between the variables with the help of ARDL model and Error Correction Model.

Literature Review

Table 1 presents the brief summary of the previous study of the impact of FDI inflows on domestic investment in the host country. It is seen that several studies have found the positive effect of FDI on the domestic investment such as Ang (2009), Tang *et al*. (2008), Adams (2009), Prasanna (2010), Rahman (2012), and Göçer *et al*. (2014) while some studies also have shown the negative relation between the variables (Ivanović, 2015; Eregha, 2012; and Saglam & Yalta, 2011).

Table 1. Literature Review on the Impact of the FDI on the Domestic Investment

Name of the Author	Type of Data, Country & Duration	Framework of the Study	Variables	Results
Tang et al. (2008)	Time Series Data; China; 1988-2003	VAR Framework & ECM Approach	Domestic Investment, FDI, GDP	Their empirical results demonstrate that there is a unidirectional causal relation between FDI and domestic investment in China during the study period.
Adams (2009)	Panel Data; Sub-Saharan Africa (42 Countries); 1990-2003	Pooled Time Series Cross-Section Regression Approach	Domestic Investment, Human Capital, Openness, FDI, Rate of Inflation, Government Consumption, Location, Risk of Politics	Only OLS estimation supports that FDI has a positive significant influence on domestic investment in the studied countries.

Name of the Author	Type of Data, Country & Duration	Framework of the Study	Variables	Results
Ang (2009)	Time Series; Malaysia; 1060-2003	Cointegration Approach	Private Domestic Investment, FDI, Public Investment	There is a long-run cointegration relation among the variables during the study period and FDI and public investment both are complementary to each other.
Prasanna (2010)	Time Series; India; 1996-97 to 2006-07	Multiple Regression	GDP, Domestic Investment, FDI Inflows, GDP Growth Rate, Gross Local Investment	Results demonstrate that FDI has a positive direct effect on domestic investment but in the long-run, the effect is neutral.
Saglam & Yalta (2011)	Time Series; Turkey; 1970-2009	VAR Model	FDI, Public Investment, Private Investment	VAR model shows that there is no long-run cointegration among the variables in the country.
Eregha (2012)	Panel Data; ECOWAS Economies; 1070-2008	Cointegration Approach	Domestic Investment, FDI	The fixed effect and panel ECM results assure that FDI has a negative effect on domestic investment.
Rahman (2012)	Time Series; Bangladesh; 1996-2010	OLS Regression	Domestic Investment, FDI	It shows that there is a positive and significant effect of FDI on domestic investment in Bangladesh during the study time.
Göçer et al. (2014)	Panel Data; Developing Countries (30); 1992-2010	Dynamic Panel Analysis	Domestic Investment, FDI	Their analysis illustrates that FDI has a crowding in effect in Asian, Latin American and Caribbean economies in the study period.
Kamaly (2014)	Panel Data; Emerging Countries (16); 1978-2010	Two Stage Least Square	Domestic Investment, FDI	Results show that FDI has a positive effect on domestic investment.

Name of the Author	Type of Data, Country & Duration	Framework of the Study	Variables	Results
Evren & KIZILGÖL (2015)	Time Series; Turkey & Mexico (1990-2012), Brazil (1995-2012), Russia (1995-2012), South Africa (1990-11);	GMM Technique	FDI, Domestic Investment, GDP Growth Rate	Crowding in effect exhibits in Russia. Crowding out effect shows in South Africa and Turkey.
Ivanović (2015)	Time Series; Croatia; Q1 2001 –Q4 2014	VAR Approach	Gross Fixed Capital, FDI, GDP growth Rate, Real Domestic changes in stocks	The result illustrates that negative relation between FDI inflows and domestic investment.

Source: Author's Collection

Study about the impacts of FDI on domestic investment, trade, education, labor forces and energy consumption in Bangladesh is scarce. Most of the researchers have done the research on the effects of FDI on the economic growth in Bangladesh. Some of the researchers also have examined the determinants of FDI inflows in the country. One of the researchers investigates the impact of FDI on domestic investment where he gets positive result. But as far as we know, not about of effects of FDI on trade, labor forces and energy consumption in Bangladesh is examined. The study will use the secondary data to explore the cointegration among the variables in the long-run and how the local investment will be benefited from foreign investors.

Methods of the Study

The time period of the study is 1972-2015. The variables used in this study are FDI, domestic investment, education, labor forces, trade, and technology. The annual time series data are taken from the World Development Indicators-2016 of World Bank and Bangladesh Economic Review of Ministry of Finance, Bangladesh. The sources of the data are well recognized and therefore credible. To examine the relation between the variables of the study, this section follows four steps-unit root test, lag selection process, ARDL framework and Error Correction Model (ECM). For checking the stationarity of the variables, the study applies the ADF unit root test. Without checking the stationarity of the variables, the results may give spurious regression. For the applicability of the ARDL model, the study will first check whether the variables are integrated at same order, combined or at second difference. Then it will check the optimum lag selection. Optimum lag length of the series is also an important step. The valid results of the ARDL depend on the lag length of the variables. To detect the cointegration equations of the variables, this study applies Pesaran *et al*. (2001) approach. Finally, in order to examine the short-run dynamics with long-run equilibrium, the study will use Error Correction Model (ECM).

Econometric Model Specification

To examine the impacts of FDI on the domestic investment, trade, education, labor forces, and energy consumption of the country, this study tries to find out the empirical relationships among the variables. These variables are the most influencing factors of economic growth. FDI can influence domestic investment both negatively and positively. It can encourage domestic investment by

initiating joint-ventured partnerships. Local firms can introduce projects which would otherwise be impossible without high technologies and managerial knowledge of foreign firms. In this process, FDI also contributes to developing the technological skill of the domestic labor. However, FDI can do harm to the local firms by using the limited resources of the countries i.e., highly trained manpower and financial sources. Interestingly, this negative impact eventually turns into a positive one. As the foreign firms offer a high volume of salary and search for quality manpower, they indirectly encourage the local employees into higher quality education. The impacts of FDI on these sectors of Bangladesh are shown in Table 3.

Impact on Domestic Investment

$$Domestic\ Investment = f(FDI, Savings, GDPPC, ICT, RIR) \quad (1)$$

Econometric form of the Domestic Investment Model by taking Log on both sides

$$Ln(DI)_t = \alpha_0 + \beta_1 Ln(FDI)_t + \beta_2 Ln(Savings)_t + \beta_3 Ln(GDPPC)_t + \beta_4 Ln(ICT)_t + \beta_5 Ln(RIR_t) + \mu_t \quad (2)$$

Where, DI means domestic investment (as % of GDP), FDI presents foreign direct investment (net inflows % of GDP), Savings shows gross domestic savings (% of GDP), GDPPC illustrates the per capita gross domestic product (current US$), ICT demonstrates information and communication technology (Telephone main lines per 100 people subscriptions), RIR presents real interest rate (Annual %), μ is an error term, t means 1, 2, 3, . . . , 36, the time period is from 1981 to 2016, and $\alpha_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ indicate the parameters which are to be estimated. Data are collected from the world development indicators of World Bank, Bangladesh economic review, and Bangladesh Bank.

Impact on Trade

$$Openness = f(FDI, GDP, Infra) \quad (3)$$

Econometric form of the Trade/Openness Model by taking Log on both sides

$$Ln(OP)_t = \beta_0 + \alpha_1 Ln(FDI)_t + \alpha_2 Ln(GDP)_t + \alpha_3 Ln(Infra)_t + \vartheta_t \quad (4)$$

Where, OP presents openness or trade (summation of export plus import, % of GDP), GDP means real gross domestic product (current US$), Infra refers infrastructure development (telephone lines per 100 people subscriptions), ϑ is an error term, β_0, α_1, α_2, α_3 demonstrate coefficients to be estimated, and t is a time period from 1972 to 2015.

Impact on Education

$$Education = f(FDI, Infl) \quad (5)$$

Econometric form of the model by taking Log on both sides

$$Ln(Education)_t = \gamma_0 + \theta_1 Ln(FDI)_t + \theta_2 Ln(Infl)_t + \epsilon_t \quad (6)$$

Where, $Education$ presents the government expenditure on education (as % of GDP, total), $Infl$ refers inflation (GDP deflator, annual %), ϵ is a disturbing term, γ_0, θ_1, θ_2 are coefficients parameters to be examined, and t provides the time period from 1981 to 2016.

Impact on Labor Forces

$$Labor\ Force = f(FDI, GDP, Infl, Savings, RIR, EXPORTS) \quad (7)$$

Econometric form of the model by taking Log on both sides

$$Ln(LF)_t = \vartheta_0 + \varphi_1 Ln(FDI)_t + \varphi_2 Ln(GDP)_t + \varphi_3 \ln(Infl)_t + \varphi_4 Ln(Savings)_t + \varphi_5 Ln(RIR)_t + \varphi_6 Ln(exports)_t + \omega_t \quad (8)$$

Where, LF means labor force participation rate (as % of total population ages 15 to 64), exports shows the exports of goods and services (as % of GDP), ω is a disturbing error, ϑ_0, φ_1, φ_2, φ_3, φ_4, φ_5, φ_6 are coefficients to be estimated, t presents time period from 1976 to 2016, and other variables are explained in previous equations.

Impact on Energy Consumption

$$Energy\ Consumption = f(FDI, GDPPCG, Infl, OP, HC) \quad (9)$$

Econometric form of the model by taking Log on both sides

$$Ln(EnPC)_t = \tau_0 + \omega_1 Ln(FDI)_t + \omega_2 Ln(GDPPCG)_t + \omega_3 Ln(Inf)_t + \omega_4 Ln(OP)_t + \omega_5 Ln(HC)_t + \epsilon_t \quad (10)$$

Where, $EnPC$ refers energy consumption per capita (kg of oil equivalent per capita), GDPPCG means growth of GDP per capita (annual %), HC presents the human capital (School enrollment, tertiary (% gross), ϵ is an error term, τ_0, and ω_1 to ω_5 are coefficients to be estimated, t is a time duration from 1972 to 2014 (irregular year because some data are missing in World Developing Indicators of World Bank), and other variables are explained in previous equations.

Results and Discussion

After checking the ADF unit root test, it appears that some variables are stationary at level while some others are at first difference (Table 2). As the variables are a mix of *I* (0) and *I* (1), the study estimates the ARDL bound test cointegration which is shown in Table 4. This study follows the Pesaran *et al*. (2001) ARDL framework.

Table: 2: Results of the ADF Unit Root Tests

Variables	Constant and No Trend		Constant and Trend	
	At Level	At 1st Differenced	At Level	At 1st Differenced
Ln(FDI)	0.956028	-8.715735***	-2.375696	-7.074222***
Ln(DI)	1.650111	-4.474504***	-3.039062	-5.017657***
Ln(SAVINGS)	-0.074691	-5.971739***	-3.593640*	-5.866495***
Ln(GDPPC)	9.552546***	0.684307	4.557467***	-2.532217
Ln(GDP)	8.923887*	-1.684052	5.597272*	-3.163955
Ln(Infl)	-4.991305*	-11.37429*	-5.847872*	-3.786184**
Ln(ICT)	-2.053047	-4.682368***	-1.564030	-4.785321***
Ln(RIR)	-3.764459***	-8.778450***	-3.180419	-8.733410***
Ln(Trade)	-0.427207	-7.408188***	-2.648830	-4.379983***
Ln(EXPORT)	-0.596014	-6.595783***	-2.776701	-6.559728***
Ln(LF)	0.340605	-2.719932**	-2.972011	-7.261481***

Source: Author's Envies output. (***), (**) and (*) shows significant coefficients at the 1%, 5% & 10% level respectively.

Table 3 illustrates the OLS regression results of several impacts of inward FDI on domestic investment, trade, education, labor forces, and energy consumption of the country. Column (2) shows that FDI has a positive effect on the domestic investment in Bangladesh because its *P*-value is less than 1% which is statistically highly significant. It means that FDI assists the local investment in promoting the economy. This result is supported by Adams (2009) in the study on 32 Sub-Saharan African countries, Prasanna (2010) in the study on India, and Rahman (2012) in the study on Bangladesh. Most of the coefficients of the model are also expected sign i.e., savings, real interest rate and GDP per capita are statistically significant where savings and GDP per capita are positively and the real interest rate is negatively related to the domestic investment in the country. Goodness of fit R^2 and its adjusted R^2 values are in desired level in the model. *F*-statistic is also higher and its *P*-value is almost zero meaning that all of the independent variables are presenting the domestic investment very nicely. The model is good fitted because the value of the Durbin-Watson

is higher than R^2 that means the model is free of spurious regression problem. The diagnostic tests of the model are also presented in the lower part of the Table 3. They show that the residuals of the model are normally distributed. There are no serial correlation and heteroscedasticity problem. CUSUM and CUSUMSQ tests are used to check the stability of the model. They show that the residuals of the domestic investment model are stable on the basis of their positions in the graphs which are demonstrated by green lines.

Table 4 presents the result of the ARDL bounds test for cointegration relationship of the domestic investment and its independent variables FDI, savings, GDPPC, ICT and real interest rate. The unit root tests of the variables show that some variables are stationary at level and some are stationary at first difference (Table 2) meaning that they are not integrated at same order. If the variables are integrated at different order or mix order of integration, the study uses ARDL model to estimate the long-run relation between the variables.

Table 3: Regression Results of Several Impacts of FDI Inflows in Bangladesh Economy

Variables (1)	Domestic Investment (2)	Trade (3)	Education (4)	Labor Force(5)	Energy Consumption (6)
FDI INFLOWS	1.854349 (2.982645) [0.0056]	0.845436 (0.263155) [0.7938]	0.500047 (4.817261) [0.0001]	0.805968 (1.855123) [0.0723]	14.93243 (1.921022) [0.0658]
GDP		1.10E-10 (3.441243) [0.0014]		2.23E-11 (5.666281) [0.0000]	
INFLATION			-0.049409 (-3.354204) [0.0027]	0.061313 (0.884800) [0.3825]	-0.174461 (-1.457288) [0.1570]
SAVINGS	0.542880 (9.924770) [0.0000]			0.262713 (9.077082) [0.0000]	
REAL INTEREST RATE	-0.096001 (-2.887843) [0.0071]			0.072185 (1.118565) [0.2712]	
EXPORTS				0.289121 (5.292759) [0.0000]	
GDPPC	0.003278 (3.187180) [0.0033]				
GDPPCG					0.715397 (1.628534) [0.1155]
Openness					1.148204 (2.522514) [0.0181]
ICT/Infrastructure	-1.534741 (-1.233108) [0.2271]	17.05389 (4.510338) [0.0001]			

Variables (1)	Domestic Investment (2)	Trade (3)	Education (4)	Labor Force(5)	Energy Consumption (6)
Human Capital					5.973921 (5.248092) [0.0000]
Constant	11.87554 (26.07450) [0.0000]	14.95088 (12.58485) [0.0000]	1.865645 (15.63574) [0.0000]	48.36497 (50.02192) [0.0000]	63.73760 (7.944025) [0.0000]
R^2	0.977907	0.890183	0.603088	0.986756	0.962209
Adjusted R^2	0.974225	0.881947	0.568574	0.984418	0.954942
$F-$ Statistic [P $-$ Value]	265.5788 [0.000000]	108.0811 [0.000000]	17.47370 [0.000024]	422.1899 [0.000000]	132.3997 [0.000000]
Durbin-Watson stat	1.245657	1.180483	1.169007	1.627539	0.596230
Normality (J-B, P-Value)	4.934430 [0.084821]	0.487589 [0.783649]	1.792838 [0.408028]	0.421253 [0.810077]	1.550180 [0.460662]
Serial Correlation –LM Test	0.0706		0.1293	0.6465	
Heteroscedasticity – Breusch-Pagan-Godfrey (P-Value)	0.8682	0.3626	0.4300		0.2757
Heteroscedasticity Test: ARCH	0.6533	0.0610	0.6602		0.0604
Heteroscedasticity Test: White	0.1893	0.4032	0.1382	0.0965	0.2700
CUSUM & CUSUMSQ Test	Stable	Stable	Stable	Stable	Stable

Note: ( ) means $t-$ statistic &[ ] presents $P-$ Value

Table 4: ARDL Bounds Test for Cointegration Relationship: Domestic investment, Trade & Labor Forces Equations

Model			F-statistics	
F(DI/ FDI, Savings, GDPPC, ICT, RIR)			7.236023*** (Lag 1)	
F(OP/FDI, GDP, Infra)			3.675563* (Lag 1)	
F(LF/ FDI, GDP, INF, SAVINGS, RIR, EXPORT)			4.348009** (Lag 1)	
	Pesaran et at. (2001)		Narayan (2005)	
Critical Value	Lower Bound Critical Value	Upper Bound Critical Value	Lower Bound Critical Value	Upper Bound Critical Value
1 percent	3.74	5.06	4.768	6.670
5 percent	2.86	4.01	3.354	4.774
10 percent	2.45	3.52	2.752	3.994

Note: *, ** and *** indicate significance levels at 10%, 5% and 1%, respectively.

The domestic investment of ARDL model shows that the value of the *F-statistics* of Wald-Test is 7.236023 which is significant at 1% level with Lag 1. After taking lag 2, the *F*-statistics of the model is very low which is1.327. On the basis of SIC lag selection criteria Lag 1 is appropriate for this ARDL model. This value (*F*-Statistics) is higher than the upper bound critical values of both Pesaran *et al*. (2001) and Narayan (2005). It means that there is a long-run cointegration relationship between dependent and independent variables in the model. So, the variables in the model run together in the long-run meaning that domestic investment and FDI inflows both are cointegrated. This result is supported by the study of Tang *et al*. (2008) on China, Ang (2009) on Malaysia, and Göçer *et al*. (2014) on 32 developing countries. The diagnostic tests of the ARDL model are shown in Table 5 and the Figure 1 and 2 respectively. These tests illustrate that the model is normally distributed, no serial correlation, and no problem of Heteroskedasticity. The model is also stable by checking CUSUM and CUSUMSQ tests.

Table 5: Diagnostic Test of the Residuals of the Respective ARDL Model

Model	Test Statistic	Hypothesis	LM (χ2)	Decision Rule
Domestic Investment	Serial Correlation	Ho= No serially correlated errors	0.0780	Fail to reject Ho
	Normality	Ho= Errors are normally distributed	0.890175	Fail to reject Ho
	Heteroskedasticity	Ho= Breusch-Pagan-Godfrey effect does not characterize model's errors	0.2230	Fail to reject Ho
Openness	Serial Correlation	Ho= No serially correlated errors	0.7926	Fail to reject Ho
	Normality	Ho= Errors are normally distributed	0.3920	Fail to reject Ho
	Heteroskedasticity	Ho= Breusch-Pagan-Godfrey effect does not characterize model's errors	0.1136	Fail to reject Ho
Labor Forces	Serial Correlation	Ho= No serially correlated errors	0.4729	Fail to reject Ho
	Normality	Ho= Errors are normally distributed	0.4046	Fail to reject Ho
	Heteroskedasticity	Ho= Breusch-Pagan-Godfrey effect does not characterize model's errors	0.7124	Fail to reject Ho

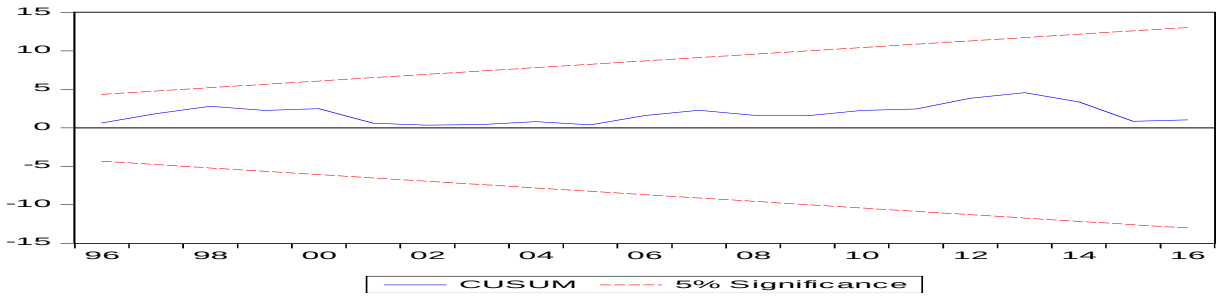

Figure 1: Stability Checking of the Residuals of the ARDL (DI) Model by CUSUM Test

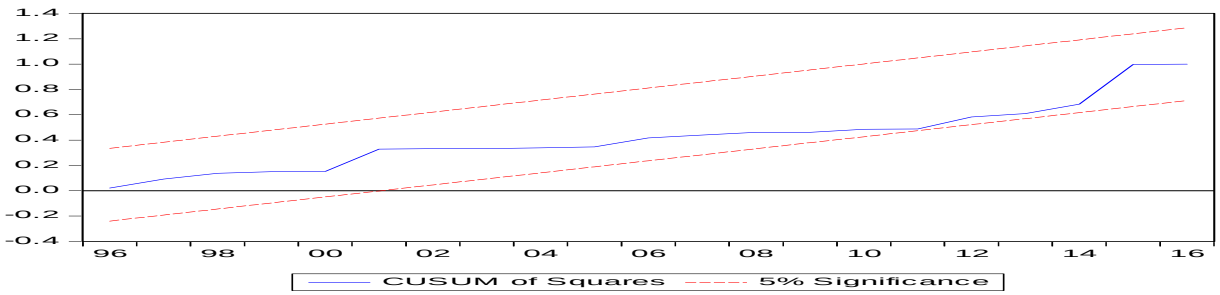

Figure 2: Stability Checking of the Residuals of the ARDL (DI) Model by CUSUMSQ Test

After getting the cointegration relation between the variables, the study estimates the ECT model which shows the speed of adjustment of the model in the long-run equilibrium. The coefficient value of the ECT is - 0.889427 and its corresponding *P*-value is 0.0009 which is significant at 1% level of significance (Table 6). The model shows that though the speed of adjustment is very high, it will readjust very quickly. This ECT model is also the best fitted and in the desired model because there are no serial correlation, no heteroskedasticity problem, and normally distributed which are presented in Table 7, and also stable model by checking CUSUM and CUSUMSQ tests respectively. So, above discussions confirm that FDI inflows and domestic investment both are positively related in the long-run in Bangladesh. Thus, Bangladesh economy can benefit by using the inward foreign direct investment and it supplements the local investment also which is a good sign for the country.

Table 6: The ECT Representation for the Domestic Investment ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.332640	0.109589	3.035336	0.0055
D(DI(-1))	0.518119	0.159654	3.245267	0.0033
D(FDI(-1))	0.413110	0.347065	1.190296	0.2451
D(SAVINGS(-1))	0.000431	0.067521	0.006378	0.9950
D(GDPPC(-1))	-0.001115	0.001933	-0.576929	0.5691
D(ICT(-1))	-6.312100	1.466859	-4.303141	0.0002
D(RIR(-1))	-0.008730	0.014676	-0.594829	0.5573
ECT(-1)	-0.889427	0.235758	-3.772623	0.0009
R-squared	0.755787	Mean dependent var		0.421273
Adjusted R-squared	0.687407	S.D. dependent var		0.585234
F-statistic	11.05280	Durbin-Watson stat		1.746408
Prob(F-statistic)	0.000003			

Table 7: Diagnostic Test of the Error Correction Term (ECT) of the Respective Model

Model	Test Statistic	Hypothesis	LM (χ2)	Decision Rule
Domestic Investment	Serial Correlation	Ho= No serially correlated errors	0.1025	Fail to reject Ho
	Normality	Ho= Errors are normally distributed	0.5057	Fail to reject Ho

Model	Test Statistic	Hypothesis	LM ($\chi 2$)	Decision Rule
	Heteroskedas-ticity	Ho= Breusch-Pagan-Godfrey effect does not characterize model's errors	0.7258	Fail to reject Ho
Openness	Serial Correla-tion	Ho= No serially correlated errors	0.0808	Fail to reject Ho
	Normality	Ho= Errors are normally distributed	0.1836	Fail to reject Ho
	Heteroskedas-ticity	Ho= Breusch-Pagan-Godfrey effect does not characterize model's errors	0.0828	Fail to reject Ho
Labor Forces	Serial Correla-tion	Ho= No serially correlated errors	0.1586	Fail to reject Ho
	Normality	Ho= Errors are normally distributed	0.4987	Fail to reject Ho
	Heteroskedas-ticity	Ho= Breusch-Pagan-Godfrey effect does not characterize model's errors	0.7819	Fail to reject Ho

Column (3) in Table 3 demonstrates the OLS results of the trade equation where the impact of FDI is positive though it is not statistically significant. Other variables, GDP, and ICT are positive and have statistically significant relationship with the dependent variable at 1% level of significance. The other criteria states that the model is drawn in a proper way on the basis of values of goodness of fit R^2 and it's adjusted R^2. The overall acceptance of the model is also good because its *F*-statistics is very high and its P-value is almost zero. There is no spurious regression problem in the model because its R^2 value (0.890183*)* is less than the Durbin-Watson value (1.180483). The diagnostic tests of the model are illustrated that the model is normally distributed, it has homoscedasticity characteristic, and finally the model is stable according to the CUSUM and CUSUMSQ tests.

The ARDL approach of the trade equation is presented in Table 4 where it is found that the model is significant at 10% level of significance on the basis of Pesaran *et al.* (2001) ARDL bounds test cointegration results. Because the *F*-statistic of the trade equation is 3.67553 which is greater only than the upper bound critical value of Pesaran *et al*. (2001). It means that there is a long-run association between foreign trade and FDI inflows in Bangladesh. So, the ARDL framework asserts that the variables move together in the long-run meaning that trade, FDI inflows, GDP, and infrastructure development are cointegrated. The diagnostic tests suggest that the ARDL model is valid and stable on the basis of J-B normality test, Breusch-Godfrey serial correlation test, Heteroskedasticity tests which are shown in Table 5 and stability of the model checking by CUSUM, and CUSUMSQ tests respectively. They confirm stable of the model.

After confirming the cointegration relationship between the variables, now the study moves to run the error correction model which is presented in Table 8. The coefficient of the ECT model must be negative and significant to get the long-run positive association between the variables. The coefficient result of the ECT model is - 0.961617 and its P-value is 0.0026 meaning that it is significant at 1% level of significance. That means the speed of adjustment of the model is nicely fitted and it will readjust very quickly. This ECT model is also valid according to the diagnostic tests which are seen in Table 7.

The OLS result of the education equation is presented in column (4), Table 3. The results show that the impact of the foreign direct investment on education in Bangladesh is positive and it is statistically significant at 1% level. It is seen in many studies that FDI encourages the local employees to achieve the quality education. Inflation has a negative relation with education in the country meaning that when macroeconomic instability or inflation rate goes up the scope of education declines. It is also expected a sign and statistically significant. The goodness of fit of the model has also attained the satisfactory level. The P-value of F-statistic is statistically highly significant which is almost zero. The Durbin-Watson of this equation is higher than the R^2 value means that there is no spurious regression problem in the model. Other diagnostic tests suggest that the model is normally distributed, no heteroskedasticity problem, and no serial correlation. According to the CUSUM and CUSUMSQ tests the model is stable because the green line remains both of the red lines.

Table 8: Error Correction Model of the Trade Equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.316372	0.664438	0.476150	0.6369
D(OP(-1))	0.461522	0.243431	1.895907	0.0663
D(FDI(-1))	1.575065	2.735771	0.575730	0.5685
D(GDP(-1))	-2.22E-13	9.57E-11	-0.002320	0.9982
D(INFRA(-1))	4.644289	11.81594	0.393053	0.6967
ECT(-1)	-0.961617	0.296828	-3.239644	0.0026
R-squared	0.274127	Mean dependent var		0.683814
Adjusted R-squared	0.170431	S.D. dependent var		3.304452
F-statistic	2.643566	Durbin-Watson stat		2.108952
Prob(F-statistic)	0.039548			

The OLS result of the labor forces equation is illustrated in column (5), Table 3. The impact of FDI on the labor forces in Bangladesh is positive and significant at 10% level. GDP, savings, and exports have also positive effects on labor forces and interestingly all are significant at 1% level. The overall probability of the model is significant at 1% level and its *F*-statistics is very high which is desired. J-B normality test suggests that the model is normally distributed. According to the Breusch-Godfrey serial correlation test, the model is free of serial correlation. The model also supports the results of other diagnostic tests which are shown in the lower portion of Table 3.

Table 4 presents the result of the ARDL bounds test for cointegration relationship of the labor forces and its independent variables FDI, GDP, inflation, savings, real interest rate, and export. The value of the *F*-statistics of Wald-Test is 4.348009 which is significant at 5% level with Lag 1. After taking lag 3, the *F*-statistic of the model is found very low (0.900435) and insignificant because it is lower than the lower bound critical values of Pesaran *et al*. (2001) and Narayan (2005). On the basis of SIC lag selection criteria Lag 1 is found appropriate for this ARDL model because at Lag 1 the value of SIC (-2.442659) is lower than the value of Lag 3 (-1.785762). This value (*F*-Statistics, 4.348009) is higher than the upper bound critical values of Pesaran *et al*. (2001) at 5% level of significance and Narayan (2005) at 10% level of significance. It means that there is a long-run cointegration relationship between labor forces and independent variables in the model. So, the variables in the model run together in the long-run meaning that labor forces and FDI inflows both are cointegrated.

The diagnostic tests of the ARDL labor forces model are shown in Table 5. These tests illustrate that the model is normally distributed, no serial correlation, and no problem of Heteroskedasticity. The model is also stable by checking CUSUM and CUSUMSQ tests. After confirming the cointegration relation between the variables, the study runs the ECT model which shows the speed of adjustment of the model in the long-run equilibrium. The coefficient value of the *ECT* is -0.554070 and its corresponding *P*-value is 0.0710which is significant at 10% level of significance (Table 9). The coefficient of *ECT* is also good and in the desired model because there are no serial correlation, normally distributed, and no heteroskedasticity problem (Table 7*)* and also stable model by checking CUSUM and CUSUMSQ tests respectively. So, above discussions confirm that FDI inflows and labor forces both are positively related in the long-run in Bangladesh. Thus, Bangladesh economy can benefit by using the inward foreign direct investment and it helps the local labor market also.

Table 9: Result of the ECT Estimation of Labor Forces Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.080145	0.030647	2.615091	0.0140
D(LF(-1))	0.812843	0.089004	9.132684	0.0000
D(FDI(-1))	-0.039829	0.042338	-0.940743	0.3546
D(GDP(-1))	4.10E-13	1.81E-12	0.226847	0.8221
D(INF(-1))	-0.019988	0.012314	-1.623138	0.1154
D(SAVINGS(-1))	-0.001218	0.007394	-0.164679	0.8703
D(RIR(-1))	-0.019748	0.013485	-1.464376	0.1538
D(EXPORT(-1))	-0.001622	0.008728	-0.185844	0.8539
ECT(-1)	-0.554070	0.295673	-1.873927	0.0710
R-squared	0.817054	Mean dependent var		0.374927
Adjusted R-squared	0.766586	S.D. dependent var		0.119387
F-statistic	16.18955	Durbin-Watson stat		1.677008
Prob(F-statistic)	0.000000			

Column (6) in Table 3 demonstrates the OLS results of the energy consumption equation where the impact of FDI is positive and it is statistically significant at 10% level. Other variables, openness, and human capital are positive and have statistically significant relationship with the dependent variable at 5% and 1% level of significance respectively. The per capita growth of GDP has positive and inflation has a negative relation with energy consumption though they are not significant. The other criteria states that the model is drawn in a proper way on the basis of values of goodness of fit R^2 and it's adjusted R^2. The overall acceptance of the model is also good because its *F*-statistics is very high and its P-value is almost zero. The diagnostic tests of the model are illustrated that the model is normally distributed, it follows the homoscedasticity characteristic, and finally the model is stable according to the CUSUM and CUSUMSQ tests.

Conclusion

Many studies demonstrate that inward FDI helps to increase national income, employment generation and export earnings, fill the shortage of savings, develop the efficiency of domestic firms through competitiveness, and enjoy modern technology and information communication facilities of the host countries. Considering the contribution of FDI to host economy, this study attempts to ex-

amine the impact of FDI inflow on domestic investment, trade, education, labor forces, and energy consumption in Bangladesh with a view to suggesting her ways to attract foreign investors.

This study examines the impact of FDI on the domestic investment, trade, education, labor forces, and energy consumption in Bangladesh using annual time series data. Data are collected from mainly World Development Indicators of World Bank, Bangladesh Bank, Bangladesh Economic Review, UNCTAD Stat, etc. It has been employed multivariate ordinary least square regression to find out the link between the independent and dependent variables. Multivariate OLS regression results show that FDI has a positive effect on the domestic investment in Bangladesh because its *P*-value is less than 1% which is statistically highly significant. It means that FDI assists the local investment in promoting the economy. This result is supported by Adams (2009) in the study on 32 Sub-Saharan African countries, Prasanna (2010) in the study on India, and Rahman (2012) in the study on Bangladesh. Most of the coefficients of the model are also expected sign i.e., savings, real interest rate and GDP per capita are statistically significant where savings and GDP per capita are positively and the real interest rate is negatively related to the domestic investment in the country.

The OLS results of the trade equation where the impact of FDI is positive though it is not statistically significant. Other variables, GDP, and ICT are positive and have statistically significant relationship with the dependent variable at 1% level of significance. Another OLS result shows that the impact of the FDI on education in Bangladesh is positive and it is statistically significant at 1% level. It is seen in many studies that FDI encourages the local employees to achieve the quality education. The impact of FDI on the labor forces in Bangladesh is positive and significant at 10% level. GDP, savings, and exports have also positive effects on labor forces and interestingly all are significant at 1% level. Energy consumption equation demonstrates that the impact of FDI is positive and it is statistically significant at 10% level. Other variables, openness, and human capital are positive and have statistically significant relationship with the dependent variable at 5% and 1% level of significance respectively.

To explore the long-run relationship and cointegration between FDI and domestic investment, trade, and labor forces, the study has been used Autoregressive Distributed Lag (ARDL) bound testing approach and Error Correction Model (ECM). Augmented Dickey-Fuller (ADF) test is used to check the stationarity of the variables. The ARDL model finds the long-run relation between FDI and domestic investment, trade, and labor forces in Bangladesh. It means that there is a long-run association between domestic investment, foreign trade, labor forces and FDI inflows in Bangladesh. So, the ARDL framework asserts that the variables move together in the long-run.

References

Adams, S. (2009). Foreign direct investment, domestic investment, and economic growth in Sub-Saharan Africa. Journal of Policy Modeling, 31(6), 939-949.

Ang, J. B. (2009). Do public investment and FDI crowd in or crowd out private domestic investment in Malaysia? Applied Economics, 41(7), 913-919.

Eregha, P. B. (2012). The dynamic linkages between foreign direct investment and domestic investment in ECOWAS countries: A panel cointegration analysis. African Development Review, 24(3), 208-220.

Evren, İ. P. E. K., & KIZILGÖL, Ö. A. (2015). The Contribution of FDI Flows to Domestic Investment: An Econometric Analysis of Developing Countries. Journal of Management and Economics, 22(2), 401-413.

Göçer, İ., Mercan, M., & Peker, O. (2014). Effect of Foreign Direct Investments on the Domestic Investments of Developing Countries: A Dynamic Panel Data Analysis. Journal of Economic and Social Studies, 4(1), 69.

Ivanović, I. (2015). Impact of foreign direct investment (FDI) on domestic investment in Republic of Croatia. Review of Innovation and Competitiveness: A Journal of Economic and Social Research, 1(1), 137-160.

Kamaly, A. (2014). Does FDI crowd in or out domestic investment? New evidence from emerging economies. Modern Economy, 5 (4), 391-400.

Narayan, P. K. (2005). The Saving and Investment Nexus for China: Evidence from Cointegration Tests. Applied Economic, 37 (17), 1979-1990.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bound Testing Approach to the Analysis of Level Relationships. Journal of Applied Econometrics, 16, 289-326.

Prasanna, N. (2010). Direct and indirect impact of foreign direct investment (FDI) on domestic investment (DI) in India. Journal of Economics, 1(2), 77-83.

Rahman, A. (2012). Foreign Direct investment in Bangladesh, Prospects and Challenges, and its Impact on the Economy. Master's Thesis. School of Management, Asian Institute of Technology, Thailand.

Saglam, B. B., & Yalta, A. Y. (2011). Dynamic linkages among foreign direct investment, public investment and private investment: Evidence from Turkey. Applied Econometrics and International Development, 11(2), 71-82.

Shamsuddin, A. F. M. (1994). Economic Determinants of Foreign Direct Investment in Least developed countries. The Pakistan Development Review, 33 (1), 41-51.

Tang, S., Selvanathan, E. A., & Selvanathan, S. (2008). Foreign direct investment, domestic investment and economic growth in China: A time series analysis. The World Economy, 31(10), 1292-1309.