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Measuring the Dependence of Economic Growth in terms of GDP on Foreign Direct Investment: The Case of Bangladesh and India

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ABSTRACT: *This paper aims to test the dependence of economic growth measured by gross domestic product on the foreign direct investment in a country. An appropriate regression model is developed to measure the relationship. The countries selected for this analysis are Bangladesh and India. The data of Foreign Direct Investment (FDI) and Gross Domestic Product (GDP) is collected for both the countries for 24 years, i.e. from 1991 to 2014. The results reveal that there exists a relationship between FDI and economic growth and that the FDI of Bangladesh has more significant impact on its economic growth (measured by GDP) while the FDI of India has less significant impact on its economic growth.*

Keywords: Foreign Direct Investment, Economic Growth, Gross Domestic Product,

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It is widely said that there exists a direct relationship between FDI (Foreign Direct Investment) and the economic growth (Taiwo & Olayemi, 2015; Chakraborty & Mukherjee, 2012; Shahbaz & Rahman, 2012, Li & Liu, 2005; Hermes & Lensink, 2003; Carkovic, & Levine, 2002; Zhang, 2001; De Mello, 1999; Borensztein, Gregorio & Lee, 1998; Barrell & Pain, 1997; Balasubramanyam, Salisu, & Sapsford, 1996; etc.). The purpose of this paper is to test this claim statistically by conducting a case study of two countries. An appropriate regression model is developed to measure the relationship between FDI (Foreign Direct Investment) and the GDP (Gross Domestic Product, which represents economic growth). The countries selected for this analysis are Bangladesh and India. In this analysis, there is one dependent variable and one independent variable. The dependent variable is GDP (Gross Domestic Product) and independent variable is FDI (Foreign Direct Investment) because the objective is to check the impact of FDI on GDP of these countries. For this analysis, data of Foreign Direct Investment (FDI) and Gross Domestic Product (GDP) is collected for 24 years, i.e. from 1991 to 2014. The analysis for both the countries is carried out separately and then compared for final interpretation and conclusion.

Literature Review

Foreign Direct Investment, commonly called as FDI refers to the investment made by a company or entity in foreign country into another country for the sake of long term economic interest, influence, or control through various means like joint ventures, merger or acquisition, or fully owned business operational setup (Carbaugh, 2014; Froot, 1993; Moran & Institute for International Economics, U.S., 1999). The foreign investors may be individuals, entities, groups of entities, governmental bodies, or combination of them (Carbaugh, 2014). Foreign direct investment has direct relationship with the economic growth of a country since it promotes commercial and production activities, brings technological advancements, sets up new units, and brings opportunities for human development (Rāzîn & Tsadḳah, 2007; Faeth, 2010).

Various researchers have measured the relationship between economic growth and foreign direct investment taking different measures, e.g. Carkovic, & Levine (2002) & Barrell & Pain (1997) have used transfer of technology as the measure of economic growth; Balasubramanyam, Salisu, & Sapsford (1996) have tried to measure the impact of exogenous component of FDI on economic growth in a country; Borensztein, Gregorio & Lee (1998) have found that foreign direct investment is a vital to boost up economic growth in a country. They have used regression framework for a cross country analysis to measure this dependence of economic growth on foreign direct investment (Borensztein, Gregorio & Lee, 1998). Hermes & Lensink (2003) strongly argue that the soundness of the financial system of a country contributes to the inflow of foreign direct investment which eventually boosts up economic growth of that country. Zhang (2001) believe that the relationship between economic growth and foreign direct investment depends upon various country specific characteristics, which mainly include education system, trade regime, human development, focus on exports, and overall macroeconomic conditions. Similarly, Taiwo & Olayemi (2015), Chakraborty & Mukherjee (2012), Shahbaz & Rahman (2012), and Li & Liu (2005) also believe that there exists a strong relationship between economic growth and foreign direct investment in a country.

Findings and Discussion

To test the relationship between economic growth and foreign direct investment, a regression model is developed for both the countries separately. Before conducting a regression analysis, it is necessary to satisfy its assumptions; which include Normality, Multicollinearity, Auto- correlation and Heteroscedasticity.

Bangladesh

Normality: Almost all statistical tests necessitate that data should be normal. So in data analysis, our first step is to check the normality of the data. In order to satisfy the normality assumption, we test the normality of residuals. We performed the Shapiro-Wilk test to check that either normality exists or not.

Table 1.1 Tests of Normality

	Shapiro-Wilk	
	Df	Sig.
Unstandardized Residual	21	.435

Before remedial measures, the significance value is .435 as shown in table 1.1 which indicates that data is from normal distribution because for normal distribution the p value should be more than 5%. It indicates that there are apparently no unusual observations which are affecting the normality of the data. A look at the normal Q-Q plot shows that there are some points on the scatter plot which are away from the regression line (as shown in figure 1.1 a and b) but they cannot be considered unusual observations or outliers because the significance value shows normal distribution.

Figure 1.1 (a)

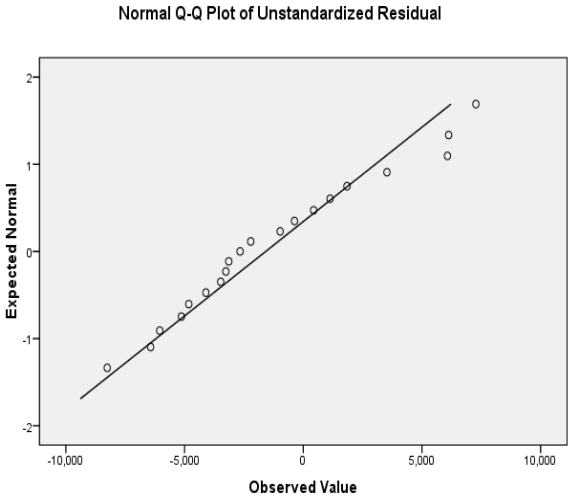
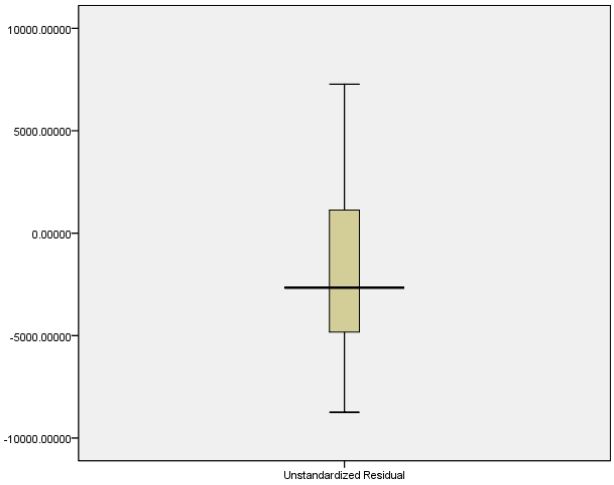


Figure 1.1 (b)



Multicollinearity: It is applicable for multiple regressions and not for simple regression. It means correlation among independent variables. In our model there is only one independent variable. So this assumption is not applicable for this particular analysis.

Auto-Correlation: Auto correlation tells about the effect of one observation on another observation and there should be no auto-correlation in regression analysis. It increases the significant value in co-efficient table. If this value is greater than .05 the regression co-efficient becomes insignificant and not generalizable. Durbin-Watson test is used to check the auto correlation of the data. Before remedial measure the Durbin-Watson value was not in the ignorable limit which is 1.7-2.3 so there was a need to perform remedial measures. In these measures, first of all we calculated the value of Rho (ρ) by following formula: ρ= 1- Durbin-Watson/2

After creating time series and computing new variables, we again performed the Durbin-Watson test and its value become 2.026 as shown in table 1.2.

Table 1.2

Model	R	R Square	**Durbin-Watson**
1	.985[a]	.970	2.026

Durbin-Watson value becomes 2.026 as shown in table 1.2 which falls within the ignorable range (1.7-2.3).

Heteroscedasticity: Many researchers are of the view that when the first three assumptions of regression are fulfilled then the assumption of Heteroscedasticity is automatically fulfilled.
The value of R^2 is .970 which indicates strong regression and also it fulfills the linearity assumption because its value is not in the range of 0-0.02. This value of R^2 also indicates that this model explains the relationship between FDI and GDP by 97.0% as shown in table 1.3.

Table 1.3

Model	R	R Square	Adjusted R Square
1	.985[a]	.970	.968

The significance of the model can be seen in ANOVA Table (Table 1.4) which shows that the model is significant (sig = 0.000). It clearly indicates that these results are not by chance or due to repeatability, however, these results are generalizable and applicable to whole population.

Table 1.4 ANOVA[b]

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1.338E10	1	1.338E10	609.118	.000[a]
Residual	4.173E8	19	2.196E7		
Total	1.380E10	20			

India

The steps in regression analysis for Bangladesh are also carried out for India to measure the same relationship. i.e. between FDI and GDP where FDI is independent variable and GDP is dependent variable. Similarly, the Normality, Multicollinearity, Auto- correlation and Heteroscedasticity assumptions of regression analysis are also satisfied for this country.

Normality: In this first step, the normality of the data is checked, i.e. we tested the normality of residuals. We performed the Shapiro-Wilk test to check that either normality exists or not.

Table 2.1 Tests of Normality		
	Shapiro-Wilk	
	Df	Sig.
Unstandardized Residual	23	.000

Before remedial measures, the significance value is .000 as shown in table 2.1 which indicates that data is not from normal distribution because for normal distribution the p value should be more than 5%. It indicates that there are some unusual observations which are affecting the normality of the data. In order to identify that which unusual observations affecting the normality of the data we checked the normal Q-Q plot. Here the points on the scatter plot that are vertically far away from the regression line are the unusual observations or outliers as shown in figure 2.1 (a) & (b).

Figure 2.1 (a)

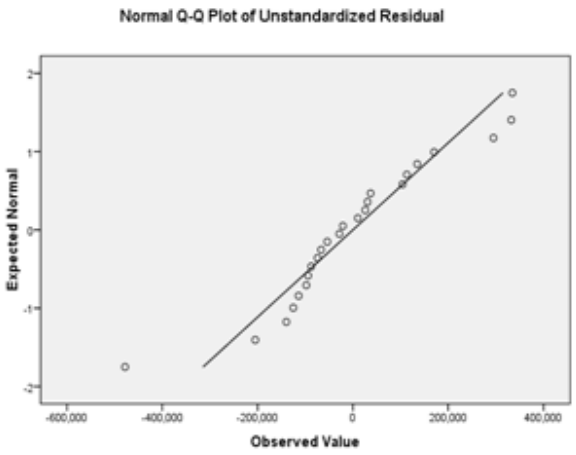
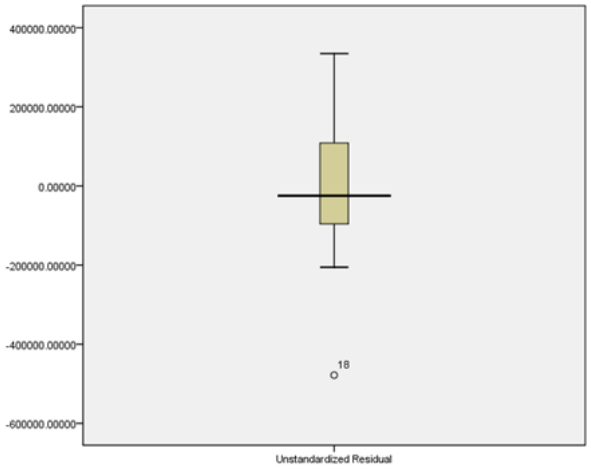


Figure 2.1 (b)



After taking remedial measures and deleting the outliers, the significance value in Shapiro-Wilk test become .168 which is greater than 5% level of significance as shown in table 2.2. So the data becomes normal due to this remedial measure.

Table 2.2 Tests of Normality			
	Shapiro-Wilk		
	Statistic	df	Sig.
Unstandardized Residual	.937	22	.168

Multicollinearity: It is applicable for multiple regressions and not for simple regression. It means correlation among independent variables. In our model there is only one independent variable. So this assumption is not applicable for this particular analysis.

Auto-Correlation: Auto correlation tells about the effect of one observation on another observation and there should be no auto-correlation in regression analysis. It increases the significant value in co-efficient table. If this value is greater than .05 the regression co-efficient becomes insignificant and not generalizable. Durbin-Watson test is used to check the auto correlation of the data. Before remedial measure the Durbin-Watson value is 0.864 and it is not in the ignorable limit which is 1.7-2.3 as shown in the table 2.3. So it increased the regression co-efficient value and makes it insignificant.

Model Summary[b]				
R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.881[a]	.777	.765	1.566194E5	.864

In corrective measures first of all we calculated the value of Rho (ρ) by following formula and its value is 0.568 by this formula. ρ= 1- Durbin-Watson/2
This 0.568 is the value which trickles down from first observation to the second observation and so on. After creating time series and computing new variables, we again performed the Durbin-Watson test and its value become 1.189 as shown in table 2.4.

Table 2.4			
Model	R	R Square	Durbin-Watson
1	.708[a]	.501	1.189

Durbin-Watson value becomes 1.189 as shown in table 2.4 which still does not fall within the ignorable range (1.7-2.3). Durbin-Watson value basically evaluates the impact of one observation on the other. In this data, the Durbin-Watson value is beyond the ignorable range which means there lies an impact of observations on other observations. This can be due to various reasons. For example, this model is only measuring FDI vs. GDP relationship. There might be some other factors, outliers, influential points, or clusters in the data which are

affecting data in the time series. These factors might include governmental policies, behavior of the Government towards foreign direct investments, economic situation, political stability, etc.

The value of R^2 is .501 which indicates moderate regression and also it fulfills the linearity assumption because its value is not in the range of 0-0.02. This value of R^2 also indicates that this model explains the relationship between FDI and GDP by 50.1% as shown in table 2.5.

Table 2.5			
Model	R	R Square	Adjusted R Square
1	.708[a]	.501	.475

The significance of the model can be seen in ANOVA Table (Table 2.6) which shows that the overall model is significant (sig = 0.000). It clearly indicates that these results are not by chance or due to repeatability, however, these results are generalizable and applicable to whole population.

Table 2.6						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.331E11	1	1.331E11	19.092	.000[a]
	Residual	1.324E11	19	6.971E9		
	Total	2.655E11	20			

Conclusion

After conducting regression analysis for both Bangladesh and India, it is found that there exists a relationship between FDI (Foreign Direct Investment) and GDP (Gross Domestic Product). The regression carried out on the data of last 24 years shows that the FDI of Bangladesh has more significant impact on its GDP as compared to that of India. That is, the value of R^2 for regression analysis for Bangladesh is .970 which indicates strong regression. This value of R^2 also indicates that this model explains the relationship between FDI and GDP by 97.0%. On the other hand, the value of R^2 for the regression analysis for India is .501 which indicates moderate regression. This value of R^2 indicates that this model explains the relationship between FDI and GDP by 50.1%. If both relationships are compared with each other, it is revealed that the FDI of Bangladesh has more significant impact on its economic growth (measured by GDP) while the FDI of India has less significant impact on its economic growth. This difference in the impacts of their FDIs on the economic growth is due to the economic policies and behaviors of these Governments towards foreign direct investments.

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