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Das, Seshanwita and Das, Tapas

Galgotias Institute of Management Technology, Plot No: 1, Knowledge Park – II, Greater Noida – 201306, Uttarpradesh, India, JSS Academy of Technical Education, C-20/1, Sector-62, Noida – 201304, Uttarpradesh, India

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A Time-series Analysis of Impact of FDI on Economic Development In India during Post-reforms Era (1991-2010)

Seshanwita Das[1] and Tapas Das[2]

Abstract

This paper examines the empirical association between Foreign Direct Investment (FDI) and Economic development (GDP) in India during 20-year-period (1991-2010) in the post-reforms era. With help of time-series regression model, where GDP has been regressed on FDI, after making both the non-stationary series (FDI and GDP) stationary through 2nd differencing of Augmented Dickey-Fuller Test, it has been found that FDI had a negative impact, and that too marginally significant, on India's economic development during this period, which is contrary to the common belief. The negative impact has been substantiated by the fact the growth rate of FDI inflow into the economy during this period was greater than growth rate of GDP, which implies some unabsorbed capital remained in the economy, leading to inflationary pressure, which, in turn, caused fall in the development of the real sector further, establishing a negative impact of FDI on economic development.

Key Words: *Time Series Analysis, FDI, Economic Development*

JEL Classifications: *F 21; C 32; F 43*

[1] Corresponding Author: Assistant Professor, Galgotias Institute of Management & Technology, Plot No: 1, Knowledge Park – II, Greater Noida – 201306, Uttarpradesh, India, E-mail: seshanwitadas@yahoo.co.in

[2] Assistant Professor, Department of Management Studies, JSS Academy of Technical Education, C-20/1, Sector-62, Noida – 201304, Uttarpradesh, India, E-mail: tapasdaswb@yahoo.co.in

1. Introduction:

During the past two decades, foreign direct investment (FDI) has become of utmost importance in the developing world, with a growing number of developing countries succeeding in attracting substantial and rising amounts of inward FDI. Although the bulk of FDI continues to take place among OECD countries, the increase in FDI has been particularly pronounced in developing countries, largely reflecting the integration of large emerging economies, the so-called BRICs (Brazil, Russia, India and China), into the world economy.

The increase of FDI into developing countries has been spectacular. The share of non-OECD countries in the global stock of inward FDI has risen from 22% in 1990 to 32% in 2005. China is by far the most important non-OECD country as a recipient of FDI, accounting for about one third of FDI in non-OECD countries in 2005. However, FDI inflows also tend to be sizable in many other emerging countries. Indeed, since the mid-1990s, inward FDI has become the main source of external finance for developing countries and is more than twice as large as official development aid.

The influx of FDI has increased rapidly during the late 1980s and 1990s all over the world reassuring the positive impact of FDI on economic development through capital, skill and technology transfer, market access and export promotion. Though, theoretical literature in economics identifies a number of channels through which FDI inflows may be beneficial to the receiving economy, but empirical literature has had more trouble in identifying these advantages in practice.

The role of FDI in stimulating economic growth is one of the controversial issues in the development literature. In the traditional Solow-type growth model, FDI enables host countries to achieve investment that exceeds their own domestic saving and enhances capital formation and potential beneficial impact of FDI on output growth is confined to the short run. In the long run, given the diminishing marginal returns to physical capital, the host economy could, either converge to a steady state of growth rate, leaving no permanent impact on the growth of the economy (De Mello) or, enjoy the growth rate in so far as it generates increasing returns in production via externalities and production spillovers, as suggested by endogenous growth models (Romer, Lucas, Barro and Sala-i-Martin).

2. Literature Review:

Economic theory forwards a multitude of reasons why FDI may result in enhanced growth performance of the host country. However, there is no unanimous convergence of opinions among the empiricists regarding positive impact of FDI on economic growth. While some studies observe a positive impact of FDI on economic growth, others, such as Aitkin and Harrison (1999), Djankov and Hoekman (2000), Damijan *et al.* (2001), Konings (2001), Castellani and Zanfei (2002a, 2002b), and Zukowska-Gagemann (2002), found a negative relationship between these two variables. In a survey, Mello (1997) found that FDI may stimulate growth through, i) capital spillovers by encouraging the adoption of new technology in the production process and ii) stimulating knowledge transfers by bringing in alternative management practices in place. Both Mello and

OECD, in another study, stress the economic and technological conditions in the host country. To be specific, the host countries have to attain a certain degree of development in education and/or infrastructure, before they can enjoy the fruits of FDI. Otherwise the potential benefits of FDI remain far from being realized, establishing either a weak or an insignificant impact on economic growth. Li and Liu (2005) found a significant endogenous relationship between FDI and economic growth from the mid-1980s.

Several studies, relying on a variety of cross-country regressions, have peeped into the conditions necessary for identifying FDI's positive impact on economic growth. Surprisingly, the studies emphasize on different closely related aspects of development. Blomstrom *et al.* (1994) argue that FDI has a significant positive growth effect when a country is sufficiently rich in terms of per capita income. Balasubramanyam *et al.* (1996) observe trade openness as being crucial for realization of growth impact of FDI. Borensztein *et al.* (1998) found that FDI encourages growth only in countries where the labour force has attained a certain level of education. Alfaro *et al.* (2004) drew attention to financial markets by saying that FDI promotes economic growth in economies with sufficiently developed financial market. Bengoa and Sanchez-Robles (2003) showed that FDI is positively correlated with economic growth and the enjoyment of the benefits from long-term FDI inflows requires the FDI host countries to have human capital, economic stability and liberalized markets. Durham (2004) suggested that the effects of FDI are contingent on the 'absorptive capability' of host countries.

3. Motivation:

A considerable number of research articles have been published, which have proved a positive relationship between FDI and economic development. But, interestingly, there is no unanimous convergence of opinions among the empiricists regarding positive impact of FDI on economic growth, as some of them have obtained the positive impact of FDI on economic development contingent upon certain abiding conditions. This has made us extremely inquisitive to look into the impact of FDI on economic development during this period and concomitant plausible cause of association thereto.

4. Objective:

To see, whether or not, during the 20-year-period (1991-2010), changes in the value of FDI had significantly explained variation in the value of GDP.

5. Methodology:

FDI data collected from Department of Industrial Policy and Promotion (DIPP), Ministry of Industry and Commerce and GDP data collected from RBI Bulletin, Year 2010-11 are as below.

Table 1. FDI (Rs Crores) and GDP at market price (Rs Crores)

Year	FDI (Rs Crores)	GDP at market price (Rs Crores)
1991	375	1503337
1992	965	1,585,755

1993	1838	1,661,091
1994	4126	1,771,702
1995	7172	1,905,899
1996	10015	2,049,786
1997	13220	2,132,798
1998	10358	2,264,699
1999	9338	2,456,363
2000	18406	2,554,004
2001	29235	2,680,280
2002	24367	2,785,013
2003	19860	3,006,254
2004	27188	3,242,209
2005	39674	3,544,348
2006	103367	3,812,974
2007	140180	4,253,184
2008	173741	4,462,967
2009	179059	4,780,179
2010	138462	5,236,823

Source: *GDP data from RBI Bulletin, 2010-11 and FDI from FDI, Statistics, DIPP, Ministry of Industry & Commerce (www.dipp.nic.in/fdi_statistics/india)*

Since GDP and FDI are both time series data, in order to see the relationship between them first we have to check whether both the series are stationary or not. A series is said to be stationary if its mean, variance and covariance remain constant over time.[1] For a stationary series, an unexpected behaviour of a variable, known as 'shock', gradually dies over time. Stationarity of time series data is required because if standard regression techniques are applied to non-stationary series then it will lead to 'spurious regression', which means this kind of regression will give significant coefficient estimates along with high R^2 value but actually it is valueless. Stationarity can be checked with the help of simple graphs as well as Correlogram.

Autocorrelation Function and Correlogram[2]

One simple test of stationarity is based on the so-called autocorrelation function (ACF). The ACF at lag k, denoted by ρ_k, is defined as

$$\rho_k = {}^{\gamma_k}/_{\gamma_0}$$

$$= \frac{covariance\ at\ lag\ k}{variance}$$

Since both variance and covariance are measured in the same units of measurement, ρ_k is a unitless or pure number. It lies between -1 and +1, as any correlation coefficient does. If we plot ρ_k against k, we obtain a graph, which is known as population correlogram.

1 Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 318-320

2 Damodar N. Gujarati, Basic Econometrics, 4th Edition pages 827-832

Since in practice, we only have a realisation (i.e, sample) of a stochastic process, we can only compute the sample autocorrelation function (SAF), $\widehat{\rho_k}$. To compute this, we must first determine the sample covariance at lag k, $\widehat{\gamma_k}$, and the sample variance, $\widehat{\gamma_0}$, which are defined as;

$$\widehat{\gamma_k} = \frac{\sum(Yt - \bar{Y})(Yt + k - \bar{Y})}{n}$$

$$\widehat{\gamma_0} = \frac{\sum(Yt - \bar{Y})2}{n}$$

Where n is the sample size and $\bar{Y}$ is the sample mean.

Therefore the sample autocorrelation function at lag k is

$$\widehat{\rho_k} = \frac{\widehat{\gamma_k}}{\widehat{\gamma_0}}$$

which is simply the ratio of sample covariance (at lag k) to sample variance. A plot of $\widehat{\rho_k}$ against k is known as the sample correlogram.

To check whether a series is stationary or not we look at the sample correlogram diagram. The solid vertical line in the diagram of autocorrelation represents the zero axis, observations above the line are positive values and below the line are negative values. From both the correlogram diagrams, we see that most of the observations either lies above or below the solid line in the autocorrelation diagram and the values under AC column is not equal to zero. So we can conclude that both the series are not stationary, as shown in the following Eviews 6 output.

Correlogram of GDP

Included observations: 20

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |******|	. |******|	1	0.826	0.826	15.806	0.000
. |***** |	. | . |	2	0.669	-0.044	26.738	0.000
. |**** |	. *| . |	3	0.516	-0.078	33.629	0.000
. |*** |	. *| . |	4	0.360	-0.109	37.200	0.000
. |**. |	. | . |	5	0.231	-0.032	38.760	0.000
. |* . |	. | . |	6	0.114	-0.061	39.165	0.000
. | . |	. | . |	7	0.012	-0.055	39.170	0.000
. *| . |	. | . |	8	-0.076	-0.061	39.381	0.000
. *| . |	. | . |	9	-0.145	-0.042	40.228	0.000
.**| . |	. *| . |	10	-0.213	-0.088	42.221	0.000
.**| . |	. *| . |	11	-0.273	-0.081	45.868	0.000
.**| . |	. *| . |	12	-0.331	-0.100	51.894	0.000

Correlogram of FDI

Included observations: 20

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |******|	. |******|	1	0.866	0.866	17.362	0.000
. |**** |	****| . |	2	0.618	-0.526	26.699	0.000
. |*** |	. | . |	3	0.354	-0.039	29.942	0.000
. |* . |	. | . |	4	0.145	0.064	30.519	0.000
. | . |	. | . |	5	0.019	0.043	30.530	0.000

. | . |	. | . |	6	-0.025	0.048	30.549	0.000
. | . |	.**| . |	7	-0.057	-0.236	30.659	0.000
. *| . |	. | . |	8	-0.093	0.003	30.976	0.000
. *| . |	. | . |	9	-0.141	-0.054	31.768	0.000
. *| . |	. | . |	10	-0.185	-0.006	33.272	0.000
.**| . |	. | . |	11	-0.206	0.011	35.354	0.000
.**| . |	.**| . |	12	-0.226	-0.216	38.165	0.000

Source: *Data Analysis*

Figure 2.1

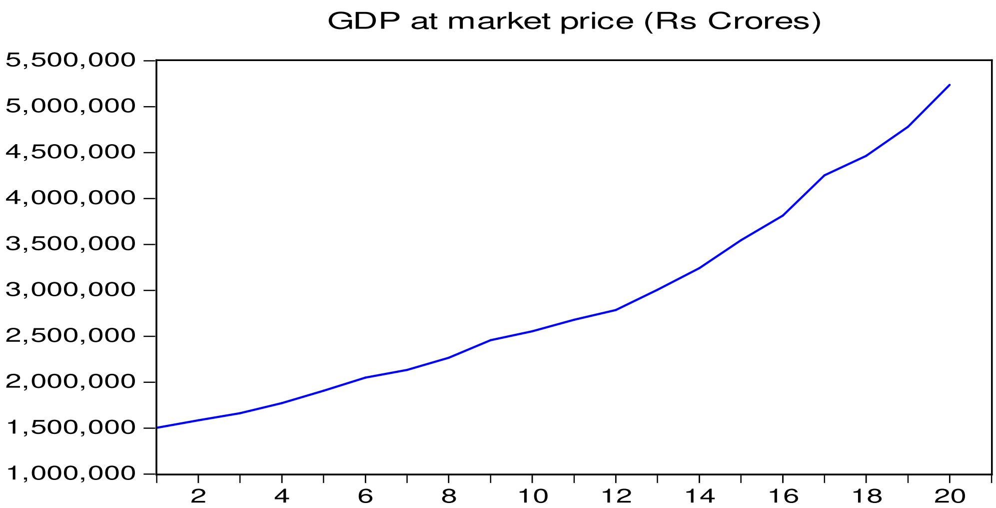
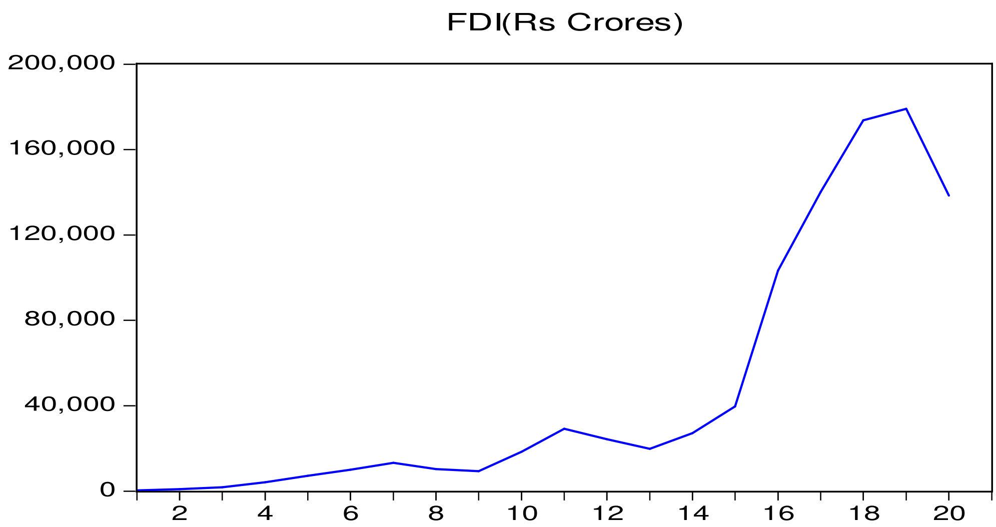


Figure 1



Source: *Data Analysis*

From the Correlograms (where we have tested, with the help of the Q-statistic, the joint significance of autocorrelation up to 12 lag order, since data is annual) as well as from the figures, we see that both the series are non-stationary. So, both of them are to be made stationary first to make a meaningful relationship between them. For checking stationarity statistically, we go in for Unit Root Test and with the help of *'Augmented Dickey Fuller Test'*, we check stationarity in the level first including an intercept in the equation, then including trend for the purpose of de-trending and at last taking 1st as well as 2nd differencing. Here, both the series, through *'Augmented Dickey Fuller Test',* become stationary after 2nd differencing, as shown below in the Eviews 6 output;

Null Hypothesis: D(FDI,2) has a unit root Lag Length: 3 (Automatic based on SIC, MAXLAG=3)		
	t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic	-3.699263	0.0201
Test critical values	1% level	-4.121990
	5% level	-3.144920
	10% level	-2.713751

Source: *Data Analysis*

Null Hypothesis: D(GDP,2) has a unit root Lag Length: 0 (Automatic based on SIC, MAXLAG=3)		
	t-Statistic	**Prob.***
Augmented Dickey-Fuller test statistic	-6.288777	0.0002
Test critical values	1% level	-3.959148
	5% level	-3.081002
	10% level	-2.681330

Source: *Data Analysis*

So, here the regression model is of the form; $\widehat{gdp2} = \alpha + \beta * fdi2 + u_t$; ....(1)

where, gdp2 = 2nd difference of the GDP series, and fdi2 = 2nd difference of the FDI series.

$$\widehat{gdp2} = 15924.95 - 2.126324*fdi2$$

$$SE = (20239.98) \quad (1.039642)$$

$$t = (0.786806) \quad (-2.045247)*$$

$$(F\text{-statistic} = 4.183037)* \quad (R^2 = 0.207255) \; (\text{D-W statistic} = 2.559821)$$

Here, in the above equation, 2nd difference of GDP has been regressed on 2nd difference of FDI. Since it is level regression, it signifies long-run relationship between FDI and GDP. From the output, we see that the value of FDI coefficient (- 2.126324) is insignificant, rather marginally significant, which implies that FDI has a negative impact on GDP, which is marginally significant. When we divide the intercept-coefficient or slope coefficient by standard error, we get the t-statistic, which if is at least equal to t=2, then t-statistic is significant. The parameter coefficient and standard error of the coefficient are calculated as follows;

$$\widehat{\beta_2} = \frac{n\sum X_iY_i - \sum X_i \sum Y_i}{n\sum X_i^2 - (\sum X_i)2}$$

$$= \frac{\sum(X_i - \bar{X})(Y_i - \bar{Y})}{\sum(X_i - \bar{X})2}$$

$$= \frac{\sum x_i y_i}{\sum x_i^2}$$

$$\overline{\beta_1} = \frac{\sum x_i^2 \sum Y_i - \sum x_i \sum x_i Y_i}{n \sum X_i^2 - (X_i)2}$$

$$= \bar{Y} - \overline{\beta_2} \bar{X}$$

$$\hat{\sigma} = \sqrt{\frac{\sum \hat{u_t^2}}{n-2}}$$

Overall fitness of the model is warranted from the significant value of F-statistic (4.183037) and 20.72% of the variation in gdp2 is explained by fdi2, which is warranted by the value of R^2. The negative impact of FDI on GDP is based on the fact that during this period the cumulative growth rate of FDI inflow into the economy was much greater than the cumulative growth rate of GDP. To absorb this higher rate FDI inflow, immediate translation of FDI into employment generation was very much needed. But, unfortunately, the growth rate employment in the economy during this period was much lesser than the growth rate of FDI. As a result, excess capital inflow into the economy remained unabsorbed, which led to inflationary pressure, which in turn, ate away the growth in the real sector, establishing a negative impact of FDI on GDP, as shown in the following table.

Table 2. Growth rate of GDP, FDI, Employment and Inflation

Year	Growth rate of GDP	Growth rate of FDI	Growth Rate of Employment	Growth Rate of Inflation
1991	-	-	-	-
1992	5.482336961	157.3333333	1.267217631	10.05774783

1993	4.750796939	90.46632124	-1.305767138	8.351552252
1994	6.658936807	124.4831338	1.130099228	12.6
1995	7.574467941	73.82452739	0.136276915	7.992895204
1996	7.549560601	39.64026771	1.878062058	4.605263158
1997	4.049788612	32.001997	4.568527919	4.402515723
1998	6.184411276	-21.64901664	2.427184466	5.948795181
1999	8.463111433	-9.8474609	0.698428536	3.269367448
2000	3.975023236	97.10858856	2.402774337	7.157604955
2001	4.944236579	58.83407584	1.596516691	3.596660244
2002	3.907539511	-16.65127416	-1.976190476	3.409795412
2003	7.943984463	-18.496327	0.534369687	5.455635492
2004	7.848804525	36.89828802	-2.246919546	6.480955088
2005	9.318924227	45.92467265	-2.743450321	4.5
2006	7.578996193	160.5409084	5.387547649	6.602870813
2007	11.54505643	35.61388064	-3.617072583	4.667863555
2008	4.932375369	23.94136111	-2.15161371	8.061749571
2009	7.107648342	3.060877974	-2.454615188	3.80952381
2010	9.552864025	-22.67241524	1.782437746	9.556574924
Cumulative Growth Rate	**129.3688635**	**890.3557398**	**7.3138139**	**120.5273707**

Source: *Data for GDP, FDI, Employment and Inflation have been collected from RBI Bulletin and growth rate and cumulative growth rate have been computed by the researcher.*

Next, we will check whether this model survives all the diagnostic tests of classical linear regression model to enjoy BLUE property or not, one by one;

β_2^* is said to be a best linear unbiased estimator of β_2 if the following points hold:[3]

1. It is linear, i.e., linear function of the dependent variable (GDP).
2. It is unbiased, i.e., its expected value, $E(\beta_2^*)$, is equal to true value of β_2
3. It has minimum variance in the class of all such linear unbiased estimators. An unbiased estimator with the minimum variance is known as an efficient estimator.

Heteroskedasticity Test: White

One of the important assumptions of classical linear regression model is that the variance of the disturbance term u_i, conditional upon the chosen values of the explanatory variables, is some constant number equal to σ^2. This is the assumption of homoscedasticity.[4] If the errors do not have a constant variance they are said to be heteroscesdastic.

There are a number of formal statistical test for heteroscesdasticity and one of the simple methods is Goldfied-Quandt (GQ) test[5]. Their approach is based on splitting the total sample of length T into two sub-samples of length T_1 and T_2. The regression model is estimated on each sub-sample and the two residual variances are calculated as respectively. The null hypothesis is that the variances of the disturbance are equal, which can be written as H_0: $\sigma_1^2 = \sigma_2^2$ against a two-sided alternative i.e., $\sigma_1^2 \neq \sigma_2^2$. The test statistics denoted by GQ, is simply the ratio of the two residual variances where the larger of the two variances must be in the numerator:

3 Damodar N. Gujarati, Basic Econometrics, 4th Edition pages 81
4 Damodar N. Gujarati, Basic Econometrics, 4th Edition pages 396
5 Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 133-135

$$GQ = \frac{s_1^2}{s_2^2}$$

The test statistics is distributed as an F (T_1-k, T_2-k), under the null hypothesis and the null of the constant variance is rejected if the test statistics exceeds the critical value. The GQ test is simple to construct but its conclusion may be contingent upon a particular and probably arbitrary, choice of where to split the sample.

A further popular test is White's (1980) general test for heteroscedasticity. The steps followed are:

1. Assume that the regression model estimated is of the standard linear form, e.g.

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + u_t^2$$

To test var (u_t) = σ^2, estimate the model above, obtaining the residual $\hat{u}t$

2. Then run the auxiliary regression

$$\hat{u}t^2 = \alpha_1 + \alpha_2 x_{2t} + \alpha_3 x_{3t} + \alpha_4 x_{2t}^2 + \alpha_5 x_{3t}^2 + \alpha_6 x_{2t} x_{3t} + v_t$$

Where v_t is a normally distributed disturbance term independent of u_t. This regression is of the squared residuals on a constant, the original explanatory variables, the squares of the explanatory variables and their cross-products. The reason that the auxiliary regression takes this form is that it is desirable to investigate whether the variance of the residuals (embodied in $\hat{u}t^2$) varies systematically with any known variable relevant to the model.

3. Given the auxiliary regression as stated above the test can be conducted using F-test and LM-test.
4. The test is one of the joint null hypothesis that $\alpha_2 = 0$ and $\alpha_3 = 0$ and $\alpha_4 = 0$ and $\alpha_5 = 0$ and $\alpha_6 = 0$

From the output of Eviews 6, for *'White's general test of heteroscedasticity'*, we get three statistics and it is evident that there is no presence of residual heteroscadasticity as no value is significant.

White's general test of heteroscedasticity	
Test Summary	**Value**
F-statistic (Wald version)	.225356
χ^2 Statistic (LM version)	.250005
Scaled Explained Sum-Square (normalised version of explained sum of square)	.488026

Source: *Data Analysis*

Breusch-Godfrey Serial Correlation LM Test:

Another important assumption of the CLRM's disturbance term is that the covariance between the error terms over time is zero i.e. the errors are uncorrelated with each other. If the errors are not uncorrelated with each other than they are said to be autocorrelated.[6]

6 *Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 139*

The various ways to test autocorrelation are Graphical Method, Runs test, Durbin-Watson d-test and Breusch-Godfrey LM test[7]. We are not using DW d-statistic because the regressand (gdp2) contains lagged values. If the DW d-statistic is used here then the test statistics would be biased towards DW=2, indicating no autocorrelation when actually it is not true. Moreover the DW test cannot be used to test all forms of autocorrelation. For example, if corr ($\hat{u}_t, \widehat{u_{t-1}}$) = 0, but corr ($\widehat{u_{t-1}}, \widehat{u_{t-2}}$) ≠0, DW will not find any autocorrelation. Therefore, it is desirable to examine a joint test for autocorrelation that will examine the relationship between $\hat{u}_t$ and several of its lagged values at the same time. The Breusch-Godfrey test is a more general test for autocorrelation up to the r[th] order. The model for the errors under this test is;

$$u_t = \rho_1 u_{t-1} + \rho_2 u_{t-2} + \rho_3 u_{t-3} + \ldots + \rho_r u_{t-r} + v_t \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where, $v_t \sim N(0, \sigma_t^2)$

The null and alternative hypotheses are:

H_0: $\rho_1 = 0$ and $\rho_2 = 0$ and ……… and $\rho_r = 0$

H_1: $\rho_1 \neq 0$ and $\rho_2 \neq 0$ and ……… and $\rho_r \neq 0$

From Eviews 6 output, we see that Breusch-Godfrey Serial Correlation test presents two statistics – F version and LM version, both of which are insignificant here, implying no residual autocorrelation.

7 *Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 148*

Breusch-Godfrey Serial Correlation LM Test		
Test Summary	**Value**	**D.f**
F statistic (F)	1.038007	(2,14)
Obs*R-squared (Chi-Square)	2.324472	(2)

Source: *Data Analysis*

Residual Normality: Jarque-Bera Test

To conduct hypothesis test it is required that the model parameters should be normally distributed, $u_{t,} \sim N(0,\sigma^2)$.[8] A normal distribution is symmetric and is said to be mesokurtic. Normal distribution is not skewed and has a coefficient of kurtosis equal to 3. Denoting the errors by u and their variance by σ^2, the coefficient of skewness and kurtosis can be expressed respectively as

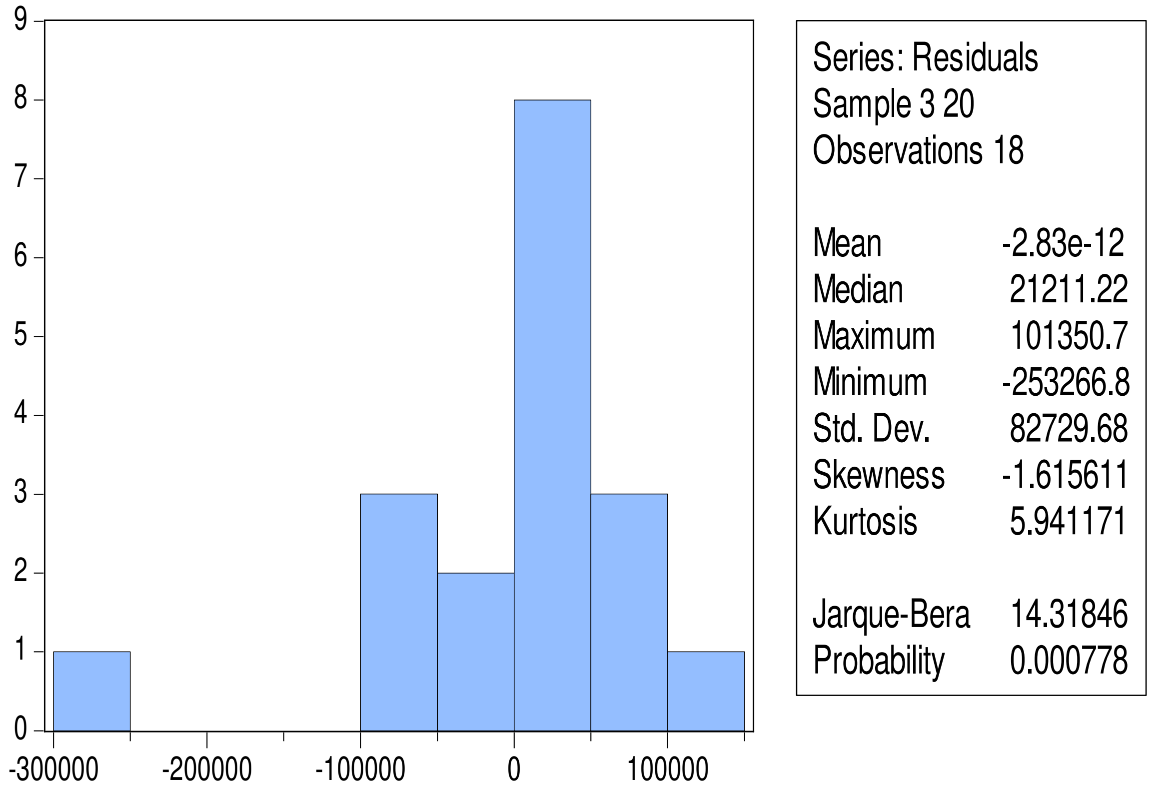
$$b_1 = \frac{E(u^3)}{(\sigma^2)^{3/2}} \quad \text{and } b_2 = \frac{E(u^4)}{(\sigma^2)^2}$$

The Jarque-Bera test statistic is given by

$$W = T\left[\frac{b_1^2}{6} + \left(\frac{b_2 - 3}{24}\right)\right] \quad \text{where T is the sample size.}$$

The test statistic asymptotically follows a $\chi^2(2)$ under the null hypothesis that the distribution of the series is symmetric and mesokurtic.

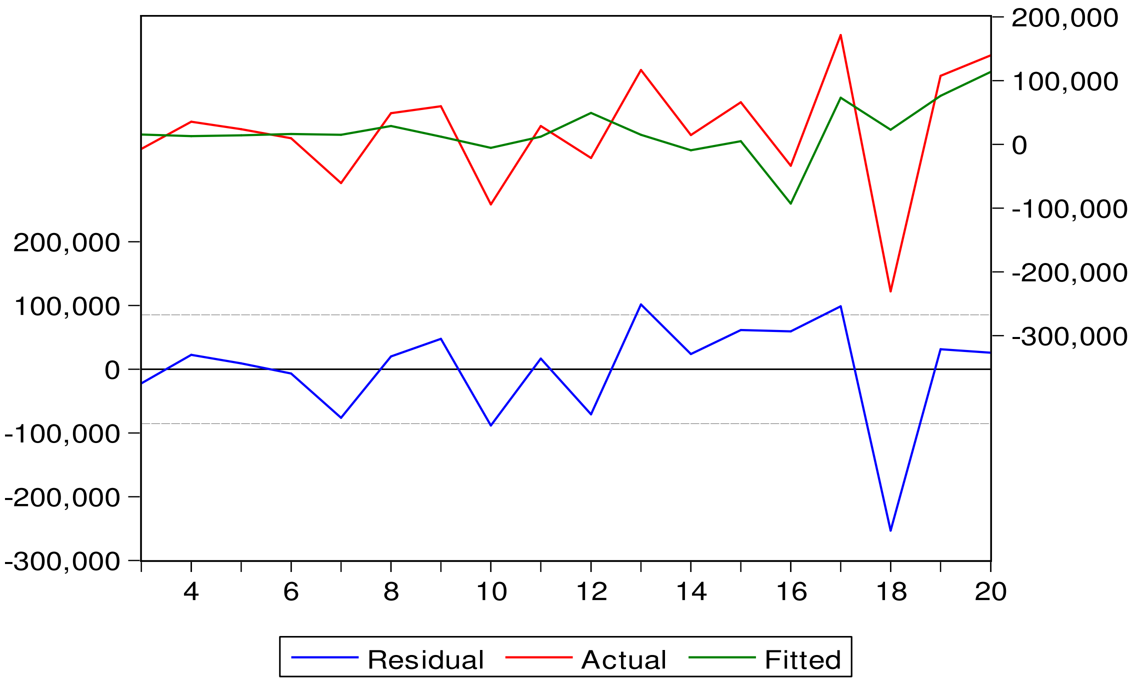
8 Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 161-163



Source: *Data Analysis*

Jarque-Bera residual normality test has been applied in Eviews 6. From the p-value of JB test, we see that the test statistic is significant and so the normality assumption is rejected. Therefore, residuals are not normally distributed in this case. Though *'Law of large numbers'* and *'Central Limit Theorem'* ensure residual normality, but if residuals are not normally distributed, in the presence of large outliers, dummy variables could have been used to cure the problem. From the *'Actual-Fitted-Residual'* graph below obtained from Eviews 6, we see that the outlier is taking place at 18^{th} observation (i.e., year 2008).

Figure 2.3: Actual-Fitted-Residual Graph of GDP-FDI Regression



Source: *Data Analysis*

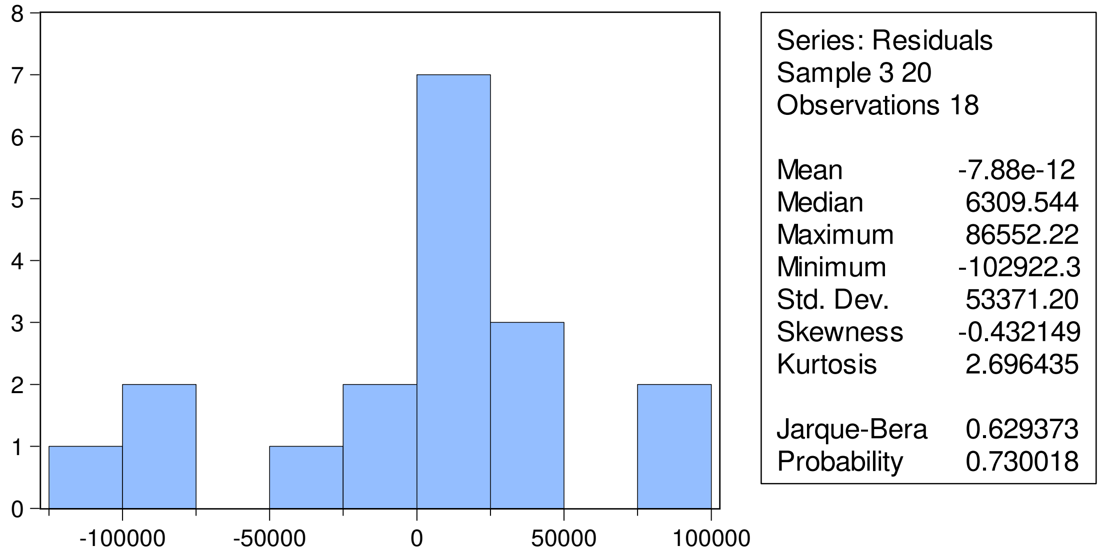
If we take the value of 18th observation equal to '1' and all other observations equal to '0', then a dummy variable is created. Now, if gdp2 is regressed on fdi2 as well as on the dummy variable, then the problem of residual non-normality may be taken care of. The Dummy Variable Regression Equation is; $\widehat{\mathbf{gdp2}} = \alpha + \beta_1 \mathbf{*fdi2} + \beta_2 \boldsymbol{*D18} + u_t$,.............(3)

where, D18 is the dummy variable. The Eviews 6 regression output as well as normality test are shown below;

$$\widehat{\mathbf{gdp2}} = 30737.26 - 2.164746 * \mathbf{fdi2} - 268204.0 \boldsymbol{*D18}$$

$$SE = (13866.82) \quad (0.692748) \quad (58469.50)$$

t = (2.216605)*** (-3.124868)*** (-4.587076)***



Source: *Data Analysis*

After taking dummy variable (D18), which considers the outlier (2008 observation) as '1' and all others as '0' and then regressing gdp2 on fdi2 as well as D18, as shown below, we see that residuals are normally distributed, which is vouched by the insignificant p-value (0.7300018) of JB test.

Ramsey RESET (Regression Specification Error) Test

An implicit assumption of the classical linear regression model is that the appropriate 'functional form' is linear.[9] This means that the appropriate model is assumed to be linear in the parameters, in this case the relationship between fdi2(x) and gdp2(y) can be represented by a straight line. Whether the model should be linear can be formally tested

9 Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 174-175 using Ramsey's RESET test (Regression Specification Error Test), which is a general test for misspecification of functional form.

Essentially the method works by using higher order terms of the fitted values (e.g. $\overline{y_t^2}$, $\overline{y_t^3}, etc.$) in an auxiliary regression. The auxiliary regression is thus one where y_t, the dependent variable from the original regression, is regressed on powers of the fitted values together with the original explanatory variables

$$y_t = \alpha_1 + \alpha_2\overline{y_t^2} + \alpha_3\overline{y_t^3} + \ldots + \alpha_p\overline{y_t^p} + \sum \beta_i x_{it} + v_t \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Higher order powers of the fitted values of y can capture a variety of non-linear relationships, since they embody higher order powers and cross-products of the original explanatory variables, e.g.

$$\overline{y_t^2} = (\overline{\beta_1} + \overline{\beta_2}\, x_{2t} + \overline{\beta_3}\, x_{3t} + \ldots + \overline{\beta_k} xkt)^2$$

The value of R^2 is obtained from the auxiliary regression and the test statistics is given by TR^2, is distributed asymptotically as a $\chi^2(p-1)$.

Ramsey's RESET (Regression Specification Error Test) test signifies whether the model specification is appropriate or not. From the Eviews 6 output given below, we have F-statistic not significant and Likelihood ratio statistic is also not significant, implying that there is no apparent non-linearity in the regression model.

Ramsey RESET (Regression Specification Error) Test		
Test Summary	**Value**	**D.f**
F-statistic	1.085934	(1, 14)
Likelihood ratio	1.344698	(1)

Source: *Data Analysis*

6. Conclusion:

FDI had a negative long-term marginally significant impact on India's economic development during the period 1991-2010. The negative impact of FDI on GDP during the study period has made it clear from the policy perspective that allowing FDI inflow into the economy only cannot warrant economic growth. Minimal level of development should be there in the economy to absorb the inflow of foreign capital, or else the inflow can act to the detriment of economic development by not translating it into capital formation, causing inflationary pressure in the economy, in turn. So, from policy perspective, it is to be kept by policy makers in mind, that FDI is not the be-all and end-all. Under-utilisation of foreign capital, in absence of absorption capacity, may turn FDI into watered capital.

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