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Causal Relationship between Foreign Direct Investment and Growth: Evidence from BRICS Countries

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Abstract

In this paper we examine the causal relationship between Foreign Direct Investment (FDI) and Growth of the BRICS countries. We employed Industrial Production Index (IPI) as a measure of Economic Growth. The stationarity of the data series are checked using Augmented Dickey Fuller (ADF) Test and tested for the existence of co-integration. Johansen Co-integration model found that the Brazil alone co-integrated among the selected countries at levels. The Vector Error Correction Model (VECM) employed to trace the existence of long run relationship. The results of VECM found that Growth leads FDI bi-directionally for Brazil, Russia and South Africa and FDI leads Growth uni-directionally for India and China respectively.

Keywords: Foreign Direct Investment, Growth, Stationarity, Vector Error Correction.

JEL Classification Code: F21, O57

1. Introduction

The growth of international production is driven by economic and technological factors. Liberalization of Trade Policies and FDI facilitate this growth. In this context, Globalization offers an unprecedented opportunity for developing countries to achieve faster Economic Growth through Trade and Investment. During the 1970s, International Trade grew more rapidly than FDI, and thus International Trade was the most important International Economic activity. This situation changed dramatically during 1980s, when world FDI flow started to increase sharply. In this period, the world FDI has increased its importance by transferring technologies and establishing marketing and procuring networks for efficient production and sales, internationally (Shujiro Urata, 1998). While, foreign investors benefit by utilizing their assets and resources efficiently through FDI, the recipients benefit by acquiring technologies and by getting involved in international production and trade networks.

There are several studies which examine the channels of transmission between FDI and Growth. Econometric models of endogenous growth were combined with studies of Diffusion of Technology in an attempt to show the effect of FDI on the Economic Growth of several economies (Lucas, 1988; Barro, 1990). In these models, Technology plays an important role in Economic Development. The factors contributing to the mobility of capital and technology have been the single most reason for low income countries to grow at a higher rate. The volatility of FDI and requirement for macroeconomic and financial adjustments has been identified as a contributing factor for Economic Growth of developing nations. De Gregrio and Guidotti (1995) indicated that financial liberalization and stabilization must be undertaken in the host countries before any increases in FDI become feasible. FDI has been seen as an effective channel to transfer technology and foster growth in developing countries, within the framework of the neoclassical models (Solow, 1956).

This study is organized into five sections including the present one. The empirical relationships exist between FDI and Economic Growth is described in section 2. The data and their sources are given section 3. The methodological issues and the empirical result are discussed in section 4. Summary and concluding remarks are given in section 5.

2. Relationship between FDI and Economic Growth

The notion of 'Investment led Economic Development' has put forward the idea that the outward and inward FDI position of a country is related to its Economic Development relative to the rest of the world. It suggests that the countries changes through five different stages of development. These stages are being classified according to the propensity of the countries to the outward and/or inward investors (Dunning and Narula, 1994). This propensity, in turn, depends on the extent and pattern of the ownership-specific advantages of domestic firms, its location advantages and the degree of utilization of the ownership-specific advantages by the domestic and foreign firms in the internationalization of markets.

The impact of FDI on growth rate of output was constrained by the existence of diminishing returns of physical capital. Therefore FDI could only exert an effect on the level of output per capita, but not on the growth rate. In other words, it was unable to alter the growth of output in the long run. In the context of the new theory of Economic Growth, FDI is considered as an engine of growth of mainstream economies. As noted by the World Bank (2002), several recent studies concluded that FDI can promote the Economic Development of the Host Country by promoting productivity growth and export. However, the exact relationship between Foreign Multinational Corporations and their host countries varies considerably between countries and among industries. The characteristics of the Host Country and the policy environment are important determinants of net benefit of FDI.

The role of FDI in the growth process has been a topic of discussion in several countries. These discussions have provided rich insights into the relationship between FDI and Growth. Although several studies on FDI and Growth in Developing Economies exist, however, few studies on this subject have been done on BRICS (Brazil, Russia, India, China and South Africa) countries. Moreover, most of the studies provide a descriptive discussion of FDI and Economic Growth. The available studies have employed cross section regression methodologies but recent time series studies do not support the FDI led Economic Growth hypotheses. A large body of literature explores the direct and indirect relationship between Foreign Direct Investment (FDI) and Growth, with substantial number of evidences that highlight the apparent relationship between Foreign Direct Investment and Trade. Recent empirical evidences are rather mixed. Some found no causality between FDI and Economic Growth (Jung and Marshall, 1985) others found unidirectional relationship. Chow (1995) reported bidirectional relationship between FDI and Economic Growth. The heterogeneity that observed in the previous study results may be due to adoption of different testing procedures, different lag structure specifications and the different filtering techniques used in the methodologies. Thus, the general objective of this study is to examine the causal relationship between FDI and Economic Growth in BRICS. Specifically, this study examines whether:

i) Economic Growth of a country drives the FDI inflow

ii) FDI-leads the Economic Growth of a country

iii) The two way causal link between them

The most interesting economic scenario suggests a two-way causal link between FDI and Host Country's Economic Growth. Countries with fast Economic Growth generate more demand for FDI and offer opportunities for making profits. On the other hand, inward FDI flows may enhance growth through positive direct and indirect effects on variables that affect growth. Thus, the study expects a bi-directional causality between FDI and Growth.

3. Data

This study analyses the causal nexus between FDI inflows and the growth of selected countries Brazil, Russia, India, China and South Africa (BRICS). The growth of any economy can be substituted by Gross Domestic Product (GDP), Per-capita Income and Industrial Production Index (IPI). However, this study employs IPI as the measure of growth in the analysis using available quarterly data set from 1996 to 2007 for Brazil, 1994 to 2007 for Russia, 1992 to 2007 for India, 1999 to 2007 for China and 1990 to 2007 for South Africa. Similarly, FDI flows are also used in-terms of US$ for above matching period for the selected countries. The quarterly data set is obtained from IMF International Financial Statistics Year Books.

4. Empirical Models and Results

The methodology involves constructing an econometric estimation model to investigate the impact of FDI on the growth of BRICS countries. In the first step of the estimation process, the study examines the stationarity properties of the data series. In stationarity time series, shocks will be temporary and over the time their effects will be eliminated as the series revert to their long run mean values. On the other hand, non-stationarity series will contain permanent components (Asteriou, 2006). In fact, most of the economic variables show a trend and therefore most cases are non stationery. These non stationary time series can easily lead the Ordinary Least Square (OLS) regression to incorrect or spurious conclusions. Thus, a key way to test for non- stationarity is to test for the existence of unit root. The present study employs the Augmented Dickey –Fuller (ADF) Test for unit roots. The ADF Test includes extra lagged terms of the dependent variables in order to eliminate autocorrelation. The lag length on these extract term is determined by the Akaike Information Criterion (AIC) and Schwartz Criterion (SC). The ADF Test is given in the following regression equation.

$$\Delta Y_{t-1} = \alpha_0 + \gamma Y_{t-1} + \alpha_2 t + \sum_{i=1}^{\rho} \beta_i \Delta Y_{t-1} + \varepsilon_t \qquad (1)$$

The ADF regression test for the existence of unit root of Y_t, is in the logarithm format for the variables FDI and IPI at time t. The variable ΔY_{t-1} expresses the first differences with p lags and the ε_t is the variable that adjusts the errors of autocorrelations. The coefficients and α_i are being estimated. The null and the alternative hypothesis for the existence of unit root in variable Y_t is:

$H_0 : \delta_2 = 0 \quad H_\varepsilon : \delta_2 < 0$

The results of the ADF Test for the variables FDI and IPI for the alternative models of constant and constant with trend for their logarithmic levels and their differences are presented in the Table 1. The results for the selected countries indicate that the series is non- stationary when the variables are defined at levels with constant, except IPI series of China. Where, the FDI and IPI series of India and China for the constant and constant with trend is stationary at levels. While, the first differencing of series removes the non- stationary components in all cases (constant and constant with trend) and the null hypothesis of non- stationarity is clearly rejected at the 5% significance level and it confirms that the FDI and IPI are integrated in order one. Thus, the robustness of the result allows this study to treat the variables as I (1) to proceed with Co-integration analysis.

4.1. Co-integration and Johansen Test

The study confirms that the variables under examination are integrated in order one. However, the co-integration test is performed to determine the nature of the long run relationship. The testing of hypothesis is null for non co-integration against the alternative hypothesis, which mean the existence of co-integration. The pioneering work on co-integration analysis was done by Engle and Granger (1987). After this, the researchers like Stock and Watson (1988) and Johansen (1988) tried to extend the work. This study tests the presence of co-integrating relationship between FDI and IPI using the Johansen (1988) Maximum Likelihood Method within a Vector Auto Regressive (VAR) framework. This procedure has superior properties to other methods of testing co-integration (Gonzalo, (1994). A brief outline of the Johansen (1988) procedure is given below:

The notation Z_t denote a p × 1 vector of variables which are not integrated in order higher than one, then Z_t can be formulated as a VAR model of order k:

$$Z_t = \prod_1 Z_{t-1} + \prod_2 Z_{t-2} + \Lambda + \prod_k Z_{t-k} + \text{deterministic components} + \varepsilon_{1t}$$

Where ε_{1t} is independently and normally distributed and $\prod_1$, $\prod_2$, Λ, $\prod_{t-k}$ are coefficient matrices. The model can be reparameterized to yield a Vector Correction Model in the form of $\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Lambda + \Gamma_{k-1} \Delta Z_{t-(k-1)} + \Gamma Z_{t-1} +$ deterministic components $+ \varepsilon_{2t}$

Where ε_{2t}, is independently and normally distributed and Γ_1, Γ_2, $\Lambda, \Gamma_{1-(k-1)}$ and Γ are coefficient matrices. Let r = rank (Γ), then if $0 < r < p$ the matrix Γ can be portioned into p x r matrices α and β such that $\prod = \Gamma\beta'$ and β' is I (0) (Johansen and Juselius,1990). r is the number of co- integrating relationships and β in each column is the co- integrating vector. In this study we used Johansen (1995) Trace Tests to determine the number of co-integrating relationships between the variables in the bi-variate model.

The results of Co-integration Test based on Johansen's approach are presented in table 2. The results of the Trace Test rejects the null hypothesis at 0.95 critical value level for the selected countries under our study, expect for Brazil, where no co-integration exist and fails to reject the hypothesis at the stationarity level on linear combination.

4.2. Error Correction Model

The study confirms that the variables under examination are co-integrated and estimate the VAR model, in which the study includes Vector Error Correction Model. The Error Correction Model detects the Long run co-integration relationship in the following form:

$$\Delta\gamma_t = \alpha_0 + \beta_1 \Delta\chi_t - \pi \hat{e}_{t-1} + \varepsilon_t \tag{2}$$

This model will include both long run and short run information where β_1 is the impact multiplier (the short run effect) and π is the feed back effect (adjustment effect and shows number of disequilibrium being corrected). The β_2 in the equation $\hat{e}_{t-1} = \gamma_{t-1} - \hat{\beta}_1 - \hat{\beta}_2 \chi_{t-1}$ however includes the long run response.

The coefficient of Error Correction Model includes information about whether the past values of variables affect the current value of the variables under study. The size and statistical significance of the co-efficients of the Error Correction Model measures the tendencies of each variable to return to equilibrium. For example π in equation (2) is statistically significant means that y_t responds to disequilibrium in its relation with erogenous variables. According to Choudry (1995), even if the co-efficients of the lagged charges of the independent variables are not statisticaly significant, Granger Causality can still exist as long as π is significantly different from zero. The shot run dynamics are captured through individual co-efficients of the different terms. We carefully chose the appropriate lag length of each regessor based on Schwartz criterion. The results of the Error Correction Model for FDI and IPI are presented as panel A and panel B respectively in Table 3. The Error Correction term for FDI shows a negative sign for BRICS countries and it significantly explores the existence of long run relationship for Brazil, Russia and South Africa. In the short run, growth leads FDI, for India and South Africa which exhibits bidirectional relationship. The same result was also confirmed for India by Bhatt, Sundari and Durairaj (2005). The Error Correction Model results for IPI does not explain the existence of long run relationship with FDI for BRICS countries, whereas in the short run it exhibits unidirectional relationship for India and China explaining that FDI leads Growth at lag length of one.

5. Summary and Conclusion

Our study examined the causal nexus between FDI and Economic Growth of the BRICS countries using quarterly data set for Brazil from 1996 to 2007, Russia from1994 to 2007, India from 1992 to 2007, China from 1999 to 2007 and South Africa from 1999 to 2007 respectively. The study employed Industrial Production Index (IPI) as a measure of Economic Growth. The data series are checked for the stationarity using Augmented Dickey Fuller (ADF) Test and employed the Johansen Co-integration to find out the level of consistence of co-integration, where Brazil alone was co-integrated among the selected countries. However, using Vector Error Correction Model, the existence of long run relationship was traced and the test result revealed that the growth leads FDI bi-directionally for Brazil, Russia and South Africa and FDI leads growth uni-directionally for India and China respectively.

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Table 1.Unit Root Test

Augmented Dickey Fuller Test Results

Foreign Direct Investment

	Level		Difference	
Country	**C**	**C&T**	**C**	**C&T**
Brazil	-0.491*	-0.491*	-1.771*	-1.768*
	(-4.000)	(-3.960)	(-7.079)	(6.998)
Russia	-0.133	-0.528	-2.313*	-2.315*
	(-1.288)	(-2.706)	(-6.421)	(-6.361)
India	-0.102	-0.257*	-1.230*	-1.297*
	(-3.058)	(-4.114)	(-6.217)	(-6.353)
China	0.282	-0.338	-1.843*	-1.855*
	(-1.540)	(-1.761)	(-5.567)	(-5.540)
South Africa	-0.224	-0.567	-1.879*	-1.883*
	(-1.840)	(-3.332)	(-6.017)	(-5.988)

Industrial Production Index

Brazil	-0.0251	-0.161	-0.960*	-0.966*
	(-0.489)	(-1.445)	(-6.387)	(-6.377)
Russia	-0.128	-0.275	-1.086*	-1.092*
	(-1.753)	(-2.988)	(-7.907)	(-7.863)
India	-0.237	-0.309	-1.101*	-1.122*
	(-2.721)	(-3.446)	(-8.262)	(-8.381)
China	-0.848*	-0.892*	-1.190*	-1.190 *
	(-4.952)	(-5.089)	(7.020)	(-6.920)
South Africa	-0.019	-0.134	-1.184*	-1.226*
	(-0.458)	(-2.3270	(-9.878)	(-10.308)

Notes: a. FDI is the foreign direct investment and
b. IPI is the industrial production index
c. C is the constant C & T is the C constant and trend
d. Figures in the parenthesis are t-statistics and *denotes significant at 5% level which is the rejection of the null hypothesis of non- stationary. A critical value at 5% level of significance for constend is -2.90 and constant and trend is -3.47.

Table 2. Co-integration Test Results Based on Johansen Approach

Country	H_o	H_a	λ_{max} rank Value (0.95)	λ_{max} CV Value(0.95)	λ_{Trace} rank	λ_{Trace} CV
Brazil	r=0	r=1	6.387	14.26	6.513	15.49
	r≤1	r=2	0.126	3.84	0.126	3.84
Russia	r=0	r=1	28.970*	14.26	31.019*	15.49
	r≤1	r=2	2.049	3.84	2.049	3.84
India	r=0	r=1	22.999*	14.26	23.673*	15.49
	r≤1	r=2	0.674	3.84	0.674	3.84
China	r=0	r=1	34.853*	14.26	37.052*	15.49
	r≤1	r=2	2.199	3.84	2.199	3.84
South Africa	r=0	r=1	37.322*	14.26	55.685*	15.49
	r≤1	r=2	18.362*	3.84	18.632*	3.84

Note: r is the co-integrating vector, CV is the critical value at 5% level
* denotes rejection of the null hypothesis at 5% level of significant

Table 3. Vector Error Correction Model

Panel – A: Foreign Direction Investment

Panel – A: Foreign Direction Investment

	Countries				
Variables	**Brazil**	**Russia**	**India**	**China**	**South Africa**
CointEq1	-0.348*	-0.436*	-0.020	-0.348	-0.487*
	(-2.291)	(-2.356)	(0.490)	(-1.806)	(-2.886)
FDI[-1]	-0.289	-0.359*	-0.917*	-0.466*	-0.228
	(-1.628)	(-2.061)	(-6.960)	(-2.033)	(-1.438)
FDI[-2]	-0.143	-0.242	-0.441*	-0.033	-0.169
	(-0.918)	(-1.702)	(-3.264)	(-0.177)	(-1.380)
IPI[-1]	-2.66	-1.951	-0.512	-2.426	12.155*
	(0.962)	(-0.853)	(0.555)	(-1.304)	(2.149)
IPI[-2]	-1.198	-0.684	1.240	-1.826	4.342
	(-0.434)	(-0.329)	(1.960)**	(-1.252)	(0.738)
C	0.015	0.065	0.009	0.024	0.011
	(0.509)	(1.355)	(0.468)	(0.558)	(0.179)
R^2	0.335	0.309	0.557	0.490	0.404
Adj R^2	0.250	0.325	0.513	0.396	0.357
S.E.equation	0.186	0.343	0.152	0.243	0.512
F-statistic	3.932	6.017	12.576	5.191	8.560
Log likelihood	15.129	-15.315	29.322	3.128	-49.628

Note: FDI is the Foreign Direct Investment , Figures in paranthesis are t-Statistic,
* and ** denotes the rejection of null hypothesis at 5% and 10% level of significance

Panel – B: Industrial Production Index

	Countries			
Variables	**Russia**	**India**	**China**	**South Africa**
CointEq1	0.032	0.042	0.121	0.009
	(2.548)	(5.157)	(4.791)	(2.512)
FDI[-1]	-0.010	-0.079*	-0.063*	-0.003
	(-0.863)	(-3.027)	(-2.106)	(-0.782)
FDI[-2]	-0.006	-0.043	-0.016	0.002
	(-0.597)	(-1.606)	(-0.639)	(0.661)
IPI[-1]	0.073	0.141	0.715	-0.206
	(0.466)	(0.769)	(2.930)	(-1.764)
IPI[-2]	0.046	0.125	0.189	-0.113
	(0.321)	(0.989)	(0.988)	(-0.932)
C	0.002	0.002	0.000	0.001
	(0.704)	(0.620)	(0.044)	(1.063)
R^2	0.157	0.635	0.642	0.187
Adj R^2	0.067	0.599	0.575	0.122
S.E.equation	0.024	0.030	0.032	0.010
F-statistic	1.750	17.443	9.680	2.904
Log likelihood	126.430	119.519	70.157	218.029

Note: IPI is the Industrial Production Index, Figures in parenthesis are t-Statistic
* denotes the rejection of null hypothesis at 5% level of significance