

## Panel Cointegration and Granger Causality Approach to Foreign Direct Investment and Economic Growth in BRICS Countries.

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**Abstract:** The aim of this study is to investigate the relationship between foreign direct investment and economic growth in BRICS countries. *Past empirical studies have failed to examine the long run relationship between FDI, growth rate and economic growth in these countries, which has created a gap in the literature.* Data was collected from the United Nations Conference on Trade and Development and World Bank Indicator from 1990– 2017 and the *Johansen Fisher Panel Cointegration and Pairwise Dumitrescu Hurlin Panel Causality Tests* were employed to estimate the model. In the model, RGDP is used to proxy economic growth meanwhile Foreign Direct Investment and the Growth Rate as proxies for other macroeconomic variables. Consequently, the empirical results show that foreign direct investment, growth rate and economic growth *have a long run equilibrium relationship. Also, there is an existence of unidirectional causality which runs from FDI to economic growth.* Based on these findings, this paper recommends that *the policy makers in BRICS countries should embark on more foreign investment oriented policies that would boost further attraction of FDI inflows into their economies. This will in the long run ensure the sustainable growth rate of BRICS economies.*

**Keywords:** FDI; GDP; Growth Rate; Long Run Relationship

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## 1. Introduction

In the last three decades, the world has undergone various economic, political and social metamorphosis. Various countries have come together to form alliance and coalition in order to pursue economic prosperity, political affiliation and social interaction. This scenario has given birth to several economic blocks like the European Union, ASEAN, ECOWAS, AU, etc.

Meanwhile, the advent of sporadic inflows of FDI into some distinctive emerging economies in the last two decades made the ‘Goldman Sachs Investment Bank’ to carve out Brazil, Russia, India, China as BRIC Economic Block (Wilson & Purushothaman, 2003). The outstanding performance of South African Economy in the African continent orchestrated the emergency of South Africa in 2010 to become part of the newly carved economic block called BRICS economies.

However, several factors have been identified in the literature as the catalyst that facilitates continuous FDI inflows in these economies. Apart from South Africa, the BRICS countries possess huge population that creates competitive domestic market. It is paramount to state here that a well-developed financial institution, low labour cost, efficient energy and transport facilities, effective communication and network, and uncompromising legal system alongside massive infrastructural development and efficient distribution of goods and services have made BRICS countries to be the prominent FDI inflows destination in the world. Other important variable that worth mentioning is the rate at which these economies are growing.

**Table 1. Annual GDP growth rate in emerging economies in the last decade**

Year/Country	China	India	Brazil	South Africa	Russia
2007	14.2	9.8	6.1	5.4	8.2
2008	9.7	3.7	5.1	3.2	5.2
2009	9.4	8.5	-0.1	-1.5	-7.8
2010	10.6	10.3	7.5	3.0	4.5
2011	9.5	6.6	4.0	3.3	5.3
2012	7.9	5.5	1.9	2.2	3.7
2013	7.8	6.4	3.0	2.5	1.8
2014	7.3	7.4	0.5	1.8	0.7
2015	6.9	8.2	-3.5	1.3	-2.8
2016	6.7	7.1	-3.5	0.6	-0.2
2017	6.3	6.6	1.0	1.3	1.5
Average	8.8	7.3	2.0	2.1	1.8

*Source: World Development Indicator, 2018*

The average growth rate of China and India in the last ten years has been reported to surpass those of developed countries. Among these countries, China has stood out in

terms of growth rate of its GDP and FDI inflows. Currently, China is the second largest economy and second highest recipient of FDI inflows in the world simultaneously. Prior 1985, Brazilian economy happened to be the major player in FDI inflows among BRICS economies. In the same vein, India, Russia and South Africa have been attracting small but constant quantum of world percentage of FDI inflows since early 1990. In 2000s, Chinese low labour cost and large domestic market have motivated a large number of Multinational enterprises to relocate their operational activities to China. The unconditional liberalization of Brazilian, Russian and South African economies have made these countries to attract cross border capital in the recent time.

Consequently, the indispensable role in which FDI inflows is playing in the BRICS countries has drawn the attention of scholars and policy makers in different quarters to embark on various empirical investigations about the linkage between FDI inflows and economic growth in these countries. Despite the fact that there are several empirical studies in the past about FDI inflows in BRICS countries. Bulk of these studies focus on the determinants of FDI inflows into these countries. See Nonnenberg and Mendonca (2004), Sahoo (2006), Jadhav (2012), Vijayakumar et al. (2010), Jadhav and Katti (2012). These studies have failed to examine the long run relationship between FDI inflows and economic growth in BRICS countries. Therefore, this study will move the frontiers of knowledge in that regard.

## **2. Literature Review**

This section provides the account of recent studies on FDI and economic growth in developed, emerging and developing countries. Hudea and Stancu (2012) utilize a panel data analysis to examine the link between foreign direct investments, technology transfer and economic growth in seven East European countries between 1993 and 2009. The results that emerged from the study posited that FDI has a positive impact on economic growth in both short run and long run in the countries under investigation. In the same vein, Acaravci and Ozturk (2012) estimate the nexus between FDI, export and economic growth in new European Union countries using ARDL bounds testing approach. It was discovered that a long-run relationship exists among the variables of interest. Also both long-run and short-run causal relationship exists between export, FDI and economic growth in four out of the ten countries the study considered.

Tiwari (2011) investigates the effectiveness of foreign aid, foreign direct investment, and economic freedom in 28 Asian economies. The author concludes that a rise in the financial freedom, fiscal freedom and domestic capital stock are the significant factors that directly affect growth of the economy. Meanwhile, freedom from corruption, FDI inflows and foreign aid are identified as the significant factors that inversely affect economic growth.

Similarly, Azman-Saini, Baharumshah, and Law (2010) evaluates the systemic nexus between foreign direct investment, economic freedom and economic growth. The findings from the study show that foreign direct investment has indirect positive effect on economic growth, but the impact of FDI is contingent on the level of economic freedom in the host nations. This implies that the countries with higher level of economic freedom get higher benefits from the inflows of cross border capital.

Consequently, Broadman and Recanatini (2001), Pradhan (2009) and Zafar (2013) independently examine the impact of market size, education level, local investment, cost of labour, transportation and infrastructure variables on the regional and total FDI in Russia, BRICS countries and India, Pakistan and Bangladesh. All the studies submit that a strong and direct relationship exists between FDI inflows and economic growth.

In the same vein, Janicki and Wunnava (2004) discovers that economic growth, political risk, trade openness and labor cost are the major variables that caused FDI inflows to Central and Eastern European nations.

While investigating the determinants of FDI inflows in both developing and developed countries, Kyrkilis and Pantelidis (2003) discover that effective exchange rate, real GNP, and human capital were the key determinants of FDI flows in those countries. However, Mahmood et al., (2010) examines the relationship between economic freedom and economic growth in SAARC Member Countries. The authors discover that government size has an inverse correlation with growth, but financial, trade, investment, business, property rights, and freedom from corruption show a positive relationship with growth. Similarly, Pearson et. al. (2012) critically examine the link between economic freedom, state growth and FDI of fifty states in the United States of America with the aid of panel data analysis. It was discovered by the researchers that both economic freedom and growth rate of the each state have positive and significant impact on the inflow of FDI. Also, Vijayakumar et al. (2010), adopts panel analysis to examine the factors propelling FDI inflows to BRICS

countries. The researchers find out among others that market size, labor cost, infrastructure, and gross capital formation are the significant positive variables that are causing FDI inflows in BRICS countries, while trade openness and inflation are identified to be insignificant.

While investigating institutional and political determinants of foreign direct investment in BRICS countries, Jadhav (2012) concludes that openness to trade, market size, and rule of law play strategic roles in attracting FDI to BRICS economies, but the availability of natural resources show an inverse effect. This implies that the flows of FDI to BRICS countries is largely market-oriented. Furthermore, Jadhav and Katti (2012), assert that efficient governance and quality of regulatory show a positive impact on FDI inflow in BRICS economies, but the reverse is the case for political instability, voice, accountability, and control of corruption.

While conducting a study about the factors that determine FDI inflows in United States of America from period of 1977 to 1982, Loree and Guisinger (1995) submit that the policy of host economy and infrastructure are significant factors that determine the FDI inflows in the US economy. However, Sahoo (2006) employs a panel co-integration test to confirm the market size, the growth of labour force, infrastructure index, and openness of economies as the key determinants of FDI inflows in South Asian countries. Also, Sing and Jun (1995) submit that there exists a direct relationship between taxes payment on international transactions and flows of FDI to developing nations with aid of a qualitative economic variables. Similarly, Nunes et al (2006) conclude that the degree of openness of the economy, infrastructural facilities, macroeconomic stability, size of the economy, wages, human capital and availability of natural resources are the key determinants of FDI flows in Latin America between 1991 to 1998.

In the same vein, Duran (1999) combines Panel data and time series data to estimate the factors that drive FDI inflows in Latin America between 1970 and 1995. The study finds out that the major determinants of FDI inflows in the economy are: trade openness, domestic savings, the size of economy, macroeconomic stability, growth and solvency of country.

Furthermore, Lucas (1993) uses a model of traditional derived-factor of a multiple product monopolist to argue that the determining factors of FDI inflows in some selected East and South Asian countries during the period of 1960 to 1987 show

higher degree of responsiveness to aggregate demand of exports than domestic exports, and similarly higher degree of responsiveness to interest rate than wages.

Conversely, Aguilar and Vallejo (2002) conduct a study with the aid of gravity model in order to establish the driving force behind the bilateral FDI as a result of the regional integration agreement in Latin America. The finding from the study establishes that the principal determinants of FDI inflows in this region are development of domestic and foreign economies, common language existence and the size of the economies.

While employing fixed effect panel model, Asiedu (2004), establishes that infrastructural development, natural resources, human capital, market size, host countries' investment policies, reliability of legal system and stability of political climate promote FDI flows in Africa, but reverse is the case for corruption, political instability.

In addition, Asiedu and Lien (2011) use GMM estimator; and regression technique to estimate the nexus between democracy and FDI, and if availability of natural resources has an impact on relationship of the host countries. The finding of the paper concludes among others that democracy promotes FDI inflows if the percentage of the country's oil and minerals in the total exports is less than its critical value. Chakraborty and Basu (2002) adopt a structural cointegration model alongside with vector error correction mechanism to investigate the relationship between FDI and Growth in India. The authors submit that a unidirectional causality runs from GDP to FDI

In summary, from the empirical literature reviewed, it is clear that there was no consensus regarding the way FDI inflows affect economic growth in all countries of the world. Hence, the relevance of this study.

### **3. Data and Methodology**

This study utilizes secondary data of BRICS countries from 1990 to 2017. Data on FDI were extracted from UNCTAD database published by World Bank. Meanwhile data on GDP and growth were sourced from World Bank Indicator. E-Views software was employed for the running of the data.

#### **3.1. Model Specification**

The model for this study can be specified in the general form as follows:

In order to examine the long run equilibrium relationship among the variables, the study follows Johansen and Juselius (1990) whose Trace statistics and Maximum eigenvalue statistics can be estimated from the eigenvalues of the coefficient matrix. The null hypothesis of the Trace statistics is that there are at most  $r$  cointegrating vectors while the alternative is that there are more than  $r$  cointegrating vectors, and the maximum eigenvalue statistics test the null that there are  $r$  cointegrating vectors against the alternative that there are  $r + 1$  cointegration relationship.

However, in order to examine the causal relationship between the variables, this paper adopts a recently-developed panel causality test; called Dumitrescu and Hurlin (DH) causality test. This test was pioneered by Dumitrescu and Hurlin (2012). The linear panel causality equation can be modified thus:

$$GDP_{it} = \alpha_0 + \sum_{i=0}^p \alpha_1 FDI_{it-1} + \sum_{i=0}^p \alpha_2 GRT_{it-1} + \sum_{i=0}^p \alpha_3 GDP_{it-1} + \varepsilon_{1it} \quad 1$$

$$FDI_{it} = \beta_0 + \sum_{i=0}^p \beta_1 FDI_{it-1} + \sum_{i=0}^p \beta_2 GRT_{it-1} + \sum_{i=0}^p \beta_3 GDP_{it-1} + \varepsilon_{2it} \quad 2$$

$$GRT_{it} = \gamma_0 + \sum_{i=0}^p \gamma_1 FDI_{it-1} + \sum_{i=0}^p \gamma_2 GRT_{it-1} + \sum_{i=0}^p \gamma_3 GDP_{it-1} + \varepsilon_{3it} \quad 3$$

Where  $GDP_t$ ,  $GRT_t$  and  $FDI_t$  are the stationary time series for GDP, GRT and FDI concurrently.  $\varepsilon_{1t}$ ,  $\varepsilon_{2t}$  and  $\varepsilon_{3t}$  denote error terms.  $p$  is the lag length. While  $i = 1 \dots 5$  and  $t = 1990 \dots 2017$ .

Explicitly, GDP is used to proxy economic growth, FDI connotes foreign direct investment and GRT represents the growth rate of the economy. 5 BRICS countries namely Brazil, Russia, India China and South Africa were sampled in the study between 1990 and 2017.

#### 4. Results and Discussion

**Table 2. Panel Unit Root Test**

Variables	Panel ADF Test			Panel PP Test		
	@Level	@First Difference	Remarks	@Level	@First Difference	Remarks
LRGDP	2.4011	0.80671	I (1)	4.9006	31.4736	I (1)
GRT Rate	26.8089	-----	I (0)	32.9402	-----	I (0)
LFDI	1.73270	63.2555	I (1)	1.34597	113.525	I (1)

Source: Authour`s Computatio, 2018

The table 2 shows the results of panel unit root test of GDP, growth rate and FDI. Both GDP and FDI possessed unit roots using both Panel Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The variables are said to be I (1) variables, but became stationary after first differencing. Meanwhile, growth rate did not possess a unit root. In order to examine the long run equilibrium relationship between these variables, cointegration test was performed.

**Table 3. Johansen Fisher Panel Cointegration Test**

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	150.4	0.0000	92.10	0.0000
At most 1	21.72	0.0166	25.19	0.0050
At most 2	2.853	0.9847	2.853	0.9847

\* Probabilities are computed using asymptotic Chi-square distribution.

Individual cross section results

Cross Section	Trace Test Statistics	Prob.**	Max-Eigen Test Statistics	Prob.**
<b>Hypothesis of no cointegration</b>				
1	116.5576	0.0000	103.5352	0.0001
2	116.5576	0.0000	103.5352	0.0001
3	116.5576	0.0000	103.5352	0.0001
4	116.5576	0.0000	103.5352	0.0001
5	116.5576	0.0000	103.5352	0.0001
<b>Hypothesis of at most 1 cointegration relationship</b>				
1	13.0224	0.1140	12.9223	0.0806
2	13.0224	0.1140	12.9223	0.0806
3	13.0224	0.1140	12.9223	0.0806
4	13.0224	0.1140	12.9223	0.0806
5	13.0224	0.1140	12.9223	0.0806
<b>Hypothesis of at most 2 cointegration relationship</b>				
1	0.1001	0.7518	0.1001	0.7518
2	0.1001	0.7518	0.1001	0.7518
3	0.1001	0.7518	0.1001	0.7518
4	0.1001	0.7518	0.1001	0.7518
5	0.1001	0.7518	0.1001	0.7518

\*\*MacKinnon-Haug-Michelis (1999) p-values

Source: Authors` Computation, (2018)



The panel multivariate cointegration mechanism put forward by Johansen Fisher (1990) was adopted to examine the long run equilibrium relationships between the variables of FDI, GDP and growth rate, since FDI and GDP variables in the systems were I(1), and it is possible they have some kind of a long run equilibrium relationship. The panel test results reported in tables 3 indicates the existence of two cointegrating vectors in the systems. From the trace statistics, it could be established from the results that there are two cointegrating vectors in the model (at a lag interval of 1 to 1. In the same vein, the maximal eigenvalue statistics in the above table shows the existence of two cointegrating vectors. Consequently, this proves that the variables in the system have a long run equilibrium relationship with one another, and perhaps adjust to short run disequilibrium through the same channel. This study confirmed the submission of Gaurav (2015), Hudea and Stancu (2012) despite the fact that different methodology was adopted.

**Table 4. Pairwise Dumitrescu Hurlin Panel Causality Tests**

Sample: 1990 2017

Lags: 2

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
DFDI does not homogeneously cause DRGDP	5.42077	2.92174	0.0035
DRGDP does not homogeneously cause DFDI	1.88679	-0.29464	0.7683
GRT_RATE does not homogeneously cause DRGDP	8.57347	5.79111	7.0009
DRGDP does not homogeneously cause GRT_RATE	7.11276	4.46168	8.0006
GRT_RATE does not homogeneously cause DFDI	36.4965	31.2048	0.0000
DFDI does not homogeneously cause GRT_RATE	2.87940	0.60877	0.5427

*Source: Authors` computation (2018)*

The panel Granger causality test was carried out with a view to determining the direction of causality among FDI, growth rate and economic growth in BRICS countries, the above table shows that causality runs from FDI to economic growth with Zbar-Stat value of 2.92174 and p-value of 0.0035, thus the null hypothesis of no causality was rejected, while economic growth does not granger cause FDI, This implies there is an existence of unidirectional causality from FDI inflows to economic growth. This study upheld the propositions of Harrod-Domar and Solow growth models, which both submitted that investment is necessary condition for economic growth in any economy. However, this finding contradicts the submission of Chakraborty and Basu (2002) who posited that a unidirectional causality runs from GDP to FDI in India and Hudea and Stancu (2012) who discovered a bi-directional causality between GDP and FDI in Eastern European countries. Similarly, there is one way causality that runs from growth rate of economy to FDI

inflows. However, the results from the above table shows that there is no field back relationship between growth rate and economic growth.

## 5. Conclusion and Recommendation

This paper examined the long run equilibrium relationship between FDI, growth rate and economic growth in BRICS countries over the period of 1990 to 2017 with the adoption of Johansen Fisher Panel Cointegration and Pairwise Dumitrescu Hurlin Panel Causality Tests. The study hereby establishes among others, that long run equilibrium relationship exists among FDI, growth rate of economy and economic growth in BRICS countries within the studied period. This implies that these three important economic variables have the high propensity to converge in the nearest future. FDI inflows have catalyzed the expansion of productive sectors of the BRICS economies in particular and economic growth in general over time. Similarly, the growth rate of the BRICS economies is the principal factor that is causing the sporadic inflows of FDI in the past two decades As FDI is growing in these countries, the rate of growth expands and consequently leads to overall economic growth in the long run. In addition, there is an existence of unidirectional causality running from FDI to economic growth, and there is one way feedback effect from growth rate of economy to FDI inflows. The implication of this result is that when economic growth is the target of policy makers, manipulating the rate of economic growth will induce an increase in FDI inflows, and FDI will propel economic growth in the long run.

However, it is important to draw a vital policy recommendations for policy makers, investors, financial institutions regulators and future researchers from the findings that emerged in this study.

The paper suggests that policy makers in BRICS countries should come up with adequate strategic policy that will ensure a sustainable growth rate of the economies. Also, conducive business environment that would boost further attraction of FDI inflows into all sectors of their economies should be embarked upon: Some of the policies suggested include:

1. The government should possess a political goodwill to sustain the growth rate of the economy

2. The policies that will create a conducive environment for foreign investment to thrive should be vigorously put in place. This will encourage foreign investors to invest in these countries.

3. Foreign policies that will create a platform for these countries to have a diplomatic relations with the rest of the world should be implemented.

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