Causal relationship between FDI and trade in BRICS nations: a panel data approach

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ABSTRACT - The purpose of the study is to analyze the causal relationship between foreign direct investment (FDI) and trade in BRICS nations over the period of 20 years i.e. 1997-2016. BRICS is a group of five developing economies namely Brazil, Russia, India, China and South Africa. The empirical methodology of the study consists of Augmented Dickey-Fuller (ADF) Panel Unit Root Test, Panel Co-integration Model, Granger Causality Test under VAR (vector autoregression estimates) and Wald Test at panel level. The results indicate that data of FDI and trade are non-stationary at level but after first difference it becomes stationary. No long run equilibrium relationship has been found between FDI and trade. The results of granger causality test and wald test indicate the unidirectional relationship running from trade to foreign direct investment inflows in BRICS nations. It implies that policymakers should increase the trade activities in their respective countries to stimulate and enhance FDI.

Keywords: ADF, causality, co-integration, FDI, stationary, trade.

I. INTRODUCTION

Foreign investment is the process in which residents of one nation make investment in financial assets and production processes of another nation. Foreign investment come in two forms i.e. foreign direct investment (FDI) and foreign institutional investment (FII). FDI is an investment in production processes while FII in financial markets. Looking on the other side, FDI has a long term perspective and provides risky capital, managerial skills and modern technology to the host nation. So, FDI is considered better than FII [1]. According to Committee on compilation of FDI in India (report submitted in October 2002) "FDI is the process whereby residents of one country acquire ownership of assets for the purpose of controlling the production, distribution and other activities of a firm in another country".

"FDI is an investment reflecting the long term relationship and lasting interest & control by a parent enterprise in foreign affiliates"[2]. For obtaining the controlling interest, the parent nation firm should have at least 10 percent of ordinary shares of voting power in the firm of another nation [3]. There is an important eclectic paradigm developed by Dunning, in which a parent enterprise make investment in another nation on the basis of three main advantages namely Ownership advantage (O), Location advantage (L) and Internalization advantage (I). So this is

termed as OLI model.[1]In BRICS nations, FDI has been an important source of economic development by transmission of risky capital and creation of employment opportunities. BRICS is an association of five emerging national economies i.e. Brazil, Russia, India, China and South Africa. In OLI model, parent firm should have ownership advantage of tangible and intangible assets, location advantage of cheap labour and internalization advantage of low transaction cost because of intra firm transfer in foreign affiliates [4]. In India, FDI came into existence in 1991 under Foreign Exchange Management Act (FEMA). In the present study, the causal relationship between FDI and trade in BRICS nations has been analyzed. The concept of BRIC has been introduced by chairman of Goldman Sachs Asset Management, Jim O' Neill in 2001. He coined this concept in his publication "Building Better Global Economic BRICs". Before the controversial addition of South Africa in 2010, BRICS was named as BRIC. South Africa became the member of BRIC group on 24th Dec 2010. Brazil, Russia, India, China and South Africa are the members of G-20. Ninth BRICS

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[1] Gupta, C. B. (2008). *International business*. Ramnagar, New Delhi: S. Chand.

[2]Based on Detailed benchmark definition of foreign direct investment, 3rd edition, OECD, 1996; 4th edition, OECD, 2008.

[3]International Monetary Fund, Balance of payments Manual, 5th edition, IMF, 1993.

summit was held in China on 3-5 September 2017. As per data of 2015, BRICS nations consist of 41 percent of the world population and composed of 22 percent of gross world product. The combined foreign exchange reserve of BRICS nations is approximate US $ 4 trillion [5]. In the present study, explanatory variables are FDI and Trade. "Trade is the act or process of buying, selling or exchanging commodities at either wholesale or retail within a nation or between nations"[6]. In the previous literature, long run causal relationship has been found between export, FDI and economic growth in Slovakia (Szkorupová, 2014) [21]. Further Simionescu (2014) found that there exists short run causal relationship between FDI and trade in G7 countries [20].

[2]Bidirectional relationship between FDI and trade for China while unidirectional relationship i.e. FDI cause trade for India have been found by (Sharma and Kaur, 2013) [17]. Again, unidirectional relationship in which FDI cause International trade has been found in Bangladesh (Rahman, 2011) [15]. Bidirectional relationship has been found between Trade, FDI and economic growth in Pakistan (Iqbal *et al.,* 2010) [6]. So in various nations, several studies have been conducted to detect the causal relationship between FDI and trade (Szkorupová, 2014), (Simionescu, 2014), (Sharma and Kaur, 2013), (Rahman, 2011), (Iqbal *et al.,* 2010) [21], [20], [17], [15], [6].   But there is hardly any study which is concerned with BRICS nations. So, the present study concentrates on the causal relationship between FDI and trade in BRICS nations. Figure 1 reveals that China is the largest while South Africa is the smallest recipient of FDI inflows among BRICS nations. The main cause behind the largest amount of FDI inflows in China is the lower cost of production because of lower labour wages. In Figure 2, highest amount of net trade in goods and services has been found in China. The trade of India has been found negative during the study period. It reveals that china retains the top position in terms of FDI inflows and net trade among BRICS nations. It implies that Brazil, Russia, India and South Africa should increase the trade volume in their respective countries so that more FDI can come in these nations.

II.   REVIEW OF LITERATURE

By investigating the relationship between economic freedom, FDI and GDP in BRICS nations through panel

regression analysis, Haydaroglu (2016) found that economic freedom and FDI are positive and significant determinants of GDP growth [5]. Prabakaran (2015) analyzed the impact of FDI on GDP, inflation and NSE Nifty movement through regression analysis form the period of 1991-2010 and found the positive & significant relationship between FDI and GDP while negative & significant relationship between FDI and inflation[13]. Significant determinants namely FDI inflows and trade of economic growth in BRICS nations have been found by Prabhakar *et al.* (2015) [14]. Agrawal (2015) investigated the relationship between FDI and GDP in BRICS nations from the period of 1989-2012. The co integration model found the long run relationship between FDI and GDP. The results of Granger causality test found the bidirectional relationship between FDI and GDP in BRICS nations [1]. Positive long run relationship and unidirectional relationship between FDI and GDP in which GDP is a cause of attraction of FDI inflows in Bangladesh have been found by Kaleem *et al.* (2015) [7]. Tshepo (2014) found long run relationship between FDI, GDP and employment and unidirectional relationship running from FDI to GDP and employment in South Africa [22]. Sharma and Nishant (2014) analyzed the relationship between FDI and GDP in BRICS nations from 1993-2012. Co integration model found long run co-integration between FDI and GDP in South Africa and Brazil, but not in Russia. The results of Granger causality test found the unidirectional relationship between FDI and GDP in which GDP is a cause of FDI inflows in India and China whereas FDI inflows is a cause of GDP growth in Brazil and South Africa. No cause and effect relationship has been found between FDI inflows and GDP growth in Russia [16]. Long run relationship between FDI and GDP through co integration in Pakistan has been found by Nosheen (2013) [11]. Kaur *et al.* (2013) analyzed the causal relationship between FDI and GDP per capita of India from the period of 1975-1990 to 1991-2009. Johansen co integration test found the long run co-integration between FDI inflows and GDP. The results of granger causality test found the bidirectional relationship between FDI and GDP per capita during 1991-2009 (post liberalization) period and unidirectional relationship i.e. FDI cause growth during 1975-1990 (pre liberalization period) [8]. Koojaroenprasit (2012) analyzed the impact of FDI on economic growth in South Korea by using multiple regression from the period of 1980-2009 and found the positive impact of FDI, employment, Export and human capital on South Korean economic growth [9]. By analyzing the impact of FDI on macroeconomic variables in India, Shome and Suri (2012) found high degree of correlation between FDI and investment, FDI and consumption, FDI and employment [18]. Agrawal and Khan (2011) analyzed the impact of FDI on GDP of China and India through multiple regression from the period of 1993-2009. The results found that 1 percent increase in FDI inflows would cause

[4]Dunning, J. H., & Lundan, S. M. (2008). *Multinational enterprises and the global economy*. Edward Elgar Publishing.

[5] https://en.wikipedia.org/wiki/BRICS retrieved on 06-09-2017

[6]http://www.dictionary.com/browse/trade   retrieved on 06-09-2017

in 0.07 percent increase in GDP of China and 0.02 percent increase in GDP of India [2]. By investigating the causal relationship between FDI and industrial production index in BRICS from 1996-2007 for Brazil, 1994-2007 for Russia, 1992-2007 for India, 1999-2007 for China and 1990-2007 for South Africa, Sidharan *et al.* (2009*)* found the long run relationship and bidirectional relationship between FDI and industrial production index in all countries except India and China, in which FDI is a cause of growth [19]. Krkoska (2001) investigated the relationship between FDI and gross fixed capital formation along with other sources of capital formation i.e. capital market financing, debt financing and subsidies using

annual data of 25 countries (excluding Bosnia, Herzegovina and FR Yugoslavia) from the period of 1989-2000. The empirical results of seemingly unrelated regression (SUR) found that capital formation is positively correlated with FDI, domestic debt, capital market financing but negatively correlated with stock market liquidity [10]. Zhang and Song (2000) investigated the role of FDI inflows in promotion of exports in China from the period of 1986-1997. Ordinary least squares estimation and generalized linear model had been used. The results found that FDI inflows positively promote exports in China [23].

Figure 1: FDI, net inflows (current US $) in BRICS nations
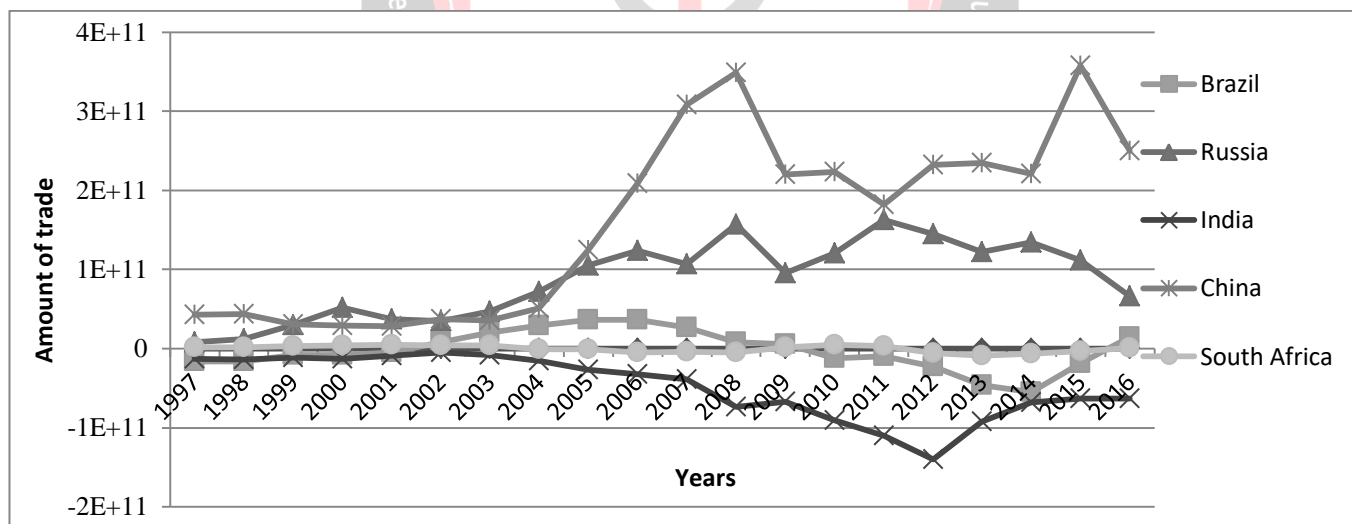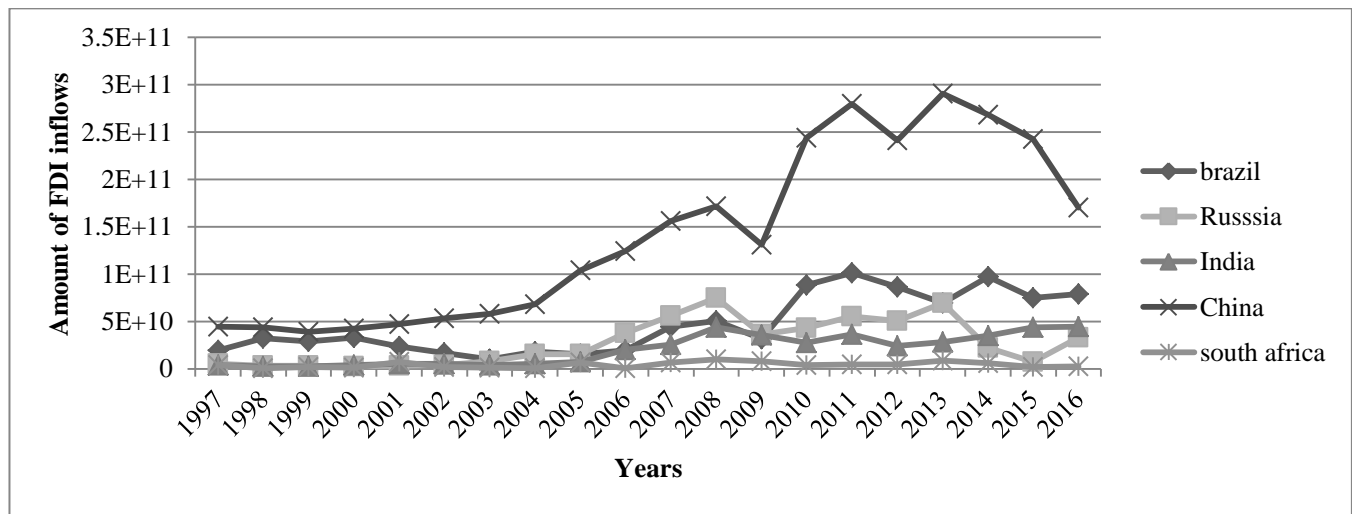
Source: World development indicators

Figure 2: Net trade in goods and services (Current US $) in BRICS nations

Source: World development indicators

III.   RESEARCH GAP

By over viewing the literature, it is implied that there are various studies regarding causal relationship between FDI and economic growth (GDP) in different nations. The

relationship varies from nation to nation. So the previous literature suggests that there should be more study on causal relationship between FDI and other macro-economic variables like trade, inflation, exchange rate and foreign exchange reserves in BRICS nations. So, the researcher attempts to fulfill the gap.

IV.   OBJECTIVE OF THE STUDY

The objectives of the present study are as following:

1. To find out the long run co-integration between foreign direct investment and trade in BRICS nations.

2. Cause & effect relationship between foreign direct investment and trade in BRICS nations.

V. HYPOTHESES OF THE STUDY

For different statistical tools, following hypotheses have been framed:

Augmented Dickey-Fuller (ADF) Panel Unit Root Test

Null Hypothesis: Presence of unit root in the series (data is not stationary).

Alternate Hypothesis: Absence of unit root in the series (data is stationary).

Pedroni's Panel Co-integration Test

Null hypothesis: Non existence of co integration (long run relationship) between FDI and trade.

Alternate hypothesis: co integration exists (long run relationship) between FDI and trade.

Granger Causality Test under VAR and Wald Test

If FDI is dependent variable:

Null hypothesis: Trade is not the cause of FDI inflows.

Alternate Hypothesis: Trade is the cause of FDI inflows.

If trade is dependent variable:

Null hypothesis: FDI inflows is not the cause of trade.

Alternate Hypothesis: FDI inflows is the cause of trade.

VI. RESEARCH METHODOLOGY

Secondary data has been used for the present study. The sample of the study consists of panel data for 20 years i.e. 1997-2016. The study has been investigated for five nations i.e. Brazil, Russia, India, China and South Africa. EViews 8 software has been used for finding out the results. The researcher contributed approximate 1 year to analyze and find out the results for the present study.

Variables	Measurements	Source
FDI	FDI, net inflows (Current US $)	World Development Indicators, UNCTAD FDI Statistics, World Economic Outlook
TRADE	Net trade in goods and services (Current US $)	World Development Indicators, World Economic Outlook

STATISTICAL TOOLS

Different statistical tools have been used for accomplishing the objective. Augmented Dickey-Fuller (ADF) panel unit root test (Dickey and fuller, 1981) has been used to check the stationarity of the data [3]. After

confirming the presence of stationarity, the next step is to search for co-integration between the variables. For this purpose panel co-integration test (Pedroni, 1999) has been applied [12]. Co-integration test is used to investigate the long term relationship between the variables. After that there is need to check the causality between the FDI and trade in BRICS nations. Granger causality test (Granger 1969) under VAR and Wald test have been used for checking the cause and effect relationship [4].

VII. RESULTS AND DISCUSSION

Augmented Dickey- Fuller (ADF) Panel Unit Root Test

Table 1 presents the results of Augmented Dickey- Fuller (ADF) panel unit root test. The results show that data of FDI and trade are non-stationary at level since probability values i.e. 0.6281 and 0.2055 respectively are greater than significance level i.e. 0.05. So, by accepting the null hypothesis, it is concluded that variables are non-stationary at level. But after first difference the probability values of FDI (0.0001) and trade (0.0209) are less than sig. level (0.05). By rejecting the null hypothesis it is found that variables are stationary after first difference.

TABLE 1: AUGMENTED DICKEY-FULLER (ADF) PANEL UNIT ROOT TEST.

VARIABLES	LEVEL		FIRST DIFFERNCE		Order of integration
	Statistics	Probability	Statistics	Probability	
FDI	8.00730	0.6281	35.9613	0.0001	1(1)
Trade	13.3356	0.2055	21.0324	0.0209	1(1)
Notes: Exogenous variables: Individual effects, User-specified lags: 1, No. of cross sections = 5. Significance level is 0.05.					

Source: Data Analysis

So the results of Augmented Dickey- Fuller (ADF) panel unit root test indicate that data of FDI and trade are non-stationary at level but after first difference it becomes stationary. It implies that variables are integrated of order 1 i.e. 1(1).

Pedroni's Panel Co-integration Model

 The results of Pedroni's panel co- integration have been presented in table 2, 3 and 4. There is an assumption of co-integration model that the variables should be stationary after first difference. After confirming the assumption of stationarity at first difference, the next step is to check the long term relationship between FDI and trade in BRICS nations through co-integration model. Pedroni's panel co-integration model has been used under three scenarios namely no deterministic trend, deterministic intercept and trend, no deterministic intercept or trend as shown in table 2, 3 and 4. Table 2 presents the results of Pedroni's Panel Co-integration test results at no deterministic trend. The

probability values are given under two dimensions i.e. within dimension and between dimension. The empirical results reveal that out of 11 probabilities the values of 6 prob. are greater than significance level i.e. 0.05. So, acceptance of null hypothesis reveals that there is no long run co-integration between FDI and trade in BRICS nations. Table 3 presents the results of Pedroni's panel cointegartion test results at deterministic intercept and trend. Seven probability values are greater than 0.05. So,

null hypothesis is accepted and it is concluded that data of FDI and trade are not co-integrated in long run. Table 4 reveals the results of Pedroni's panel cointegartion test results at no deterministic intercept or trend. The values of ten prob. are more than significance level which show that there is no long run relationship between FDI and trade. In the end, it is concluded that no long run co-integration has been found between FDI and trade in BRICS nations.

Table 2: PEDRONI'S PANEL COINTEGARTION TEST RESULTS AT NO DETERMINISTIC TREND

	Methods	Statistics	Prob.	Weighted statistics	Prob.		Methods	Statistics	Prob.
Within direction	Panel v-Statistic	0.045250	0.4820	0.620370	0.7325	Between	Group rho-Statistic	0.331772	0.3700
	Panel rho-Statistic	0.766363	0.2217	2.119317	0.0170		Group PP-Statistic	1.807723	0.0353
	Panel PP-Statistic	0.899780	0.1841	2.957589	0.0016	Direction	Group ADF-Statistic	1.552545	0.0603
	Panel ADF-Statistic	1.690308	0.0455	2.584277	0.0049				
Notes: Exogenous variables: Individual effects, User-specified lags: 1, No. of cross sections = 5. Significance level is 0.05.									

Source: Data Analysis

Table 3: PEDRONI'S PANEL COINTEGARTION TEST RESULTS AT DETERMINISTIC INTERCEPT AND TREND:

	Methods	Statistics	Prob.	Weighted statistics	Prob.		Methods	Statistics	Prob.
Within dimension	Panel v-Statistic	1.092758	0.1372	1.966898	0.9754	Between Dimension	Group rho-Statistic	0.491771	0.6886
	Panel rho-Statistic	0.330715	0.6296	1.202434	0.1146		Group PP-Statistic	2.307764	0.0105
	Panel PP-Statistic	0.448212	0.6730	3.684156	0.0001		Group ADF-Statistic	2.577047	0.0050
	Panel ADF-Statistic	-1.149201	0.1252	3.529550	0.0002				
Notes: Exogenous variables: Individual effects, User-specified lags: 1, No. of cross sections = 5. Significance level is 0.05.									

Source: Data Analysis

Table 4: PEDRONI'S PANEL COINTEGARTION TEST RESULTS AT NO DETERMINISTIC INTERCEPT OR TREND:

	Methods	Statistics	Prob.	Weighted statistics	Prob.		Methods	Statistics	Prob.
Within dimension	Panel v-Statistic	0.747452	0.2274	0.642747	0.7398	Between dimension	Group rho-Statistic	0.046238	0.4816
	Panel rho-Statistic	-1.028502	0.1519	0.403705	0.3432		Group PP-Statistic	0.281457	0.3892

Panel PP-Statistic	-1.103040	0.1350	0.658172	0.2552		Group ADF-Statistic	1.005064	0.1574
Panel ADF-Statistic	-1.848374	0.0323	0.315097	0.3763				

Notes: Exogenous variables: Individual effects, User-specified lags: 1, No. of cross sections = 5. Significance level is 0.05.

Source: Data Analysis

Granger Causality Test Under VAR (Vector Autoregression Estimates)

The concept of causality has been introduced by Granger (1969) [4]. Table 5 and 6 presents the results of granger causality test under VAR. After confirming the stationarity of variables after first difference, there is need to check the causality between the variables. As shown by table 5, rejection of null hypothesis shows that trade is the cause of FDI inflows in BRICS nations. The results of table 6 reveal that null hypothesis is accepted. So, FDI is not the cause of trade in BRICS nations. At last, it is found that there is unidirectional relationship between FDI inflows and trade in which trade is the cause of FDI inflows in BRICS nations.

Table 5: VAR GRANGER CAUSALITY/BLOCK EXOGENEITY WALD TEST

DEPENDENT VARIABLE = FDI					
Null hypothesis	Excluded	Chi- square	Df	Prob. (p)	Results
Trade is not the cause of FDI inflows.	Trade	10.33672	2	0.0057	p<0.05, Null hypothesis is rejected. So, Trade is the cause of FDI inflows.
	All	10.33672	2	0.0057	
Notes : Significance level is 0.05, lag period =2					

Source: Data Analysis

Table 6: VAR GRANGER CAUSALITY/BLOCK EXOGENEITY WALD TEST

DEPENDENT VARIABLE = TRADE					
Null hypothesis	Excluded	Chi-square	Df	Prob. (p)	Results
FDI inflows is not the cause of Trade.	FDI	3.674318	2	0.1593	p>0.05, Null hypothesis is accepted. So, FDI inflows is not the cause of trade.
	All	3.674318	2	0.1593	
Notes : Significance level is 0.05, lag period =2					

Source: Data Analysis

Table 7: SYSTEM EQUATION MODEL

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.998379	0.111723	8.936209	0.0000
C(2)	-0.078842	0.117207	-0.672679	0.5021
C(3)	-0.180525	0.072029	-2.506278	0.0131
C(4)	0.239799	0.076151	3.148986	0.0019
C(5)	4.89E+09	2.66E+09	1.836652	0.0680
C(6)	0.232307	0.183749	1.264267	0.2079
C(7)	-0.106902	0.192768	-0.554563	0.5799
C(8)	0.887434	0.118465	7.491111	0.0000
C(9)	0.015838	0.125245	0.126459	0.8995
C(10)	3.11E+08	4.38E+09	0.070917	0.9435

Source: Data Analysis

System Equation Model (OLS estimation) has been presented in table 7. There are 10 coefficients in system equation model. Following two equations have been used:

EQUATION 1:

FDI = C (1)*FDI (-1) + C (2)*FDI (-2) + C (3)*Trade (-1) + C (4)*Trade (-2) + C (5)

EQUATION 2:

Trade = C (6)*FDI (-1) + C (7)*FDI (-2) + C (8)*Trade (-1) + C (9)*Trade (-2) + C (10)

In equation 1 FDI is the dependent variable and trade (lag 1, lag 2) is the independent variable while in equation 2, trade is the dependent variable and FDI (lag 1, lag 2) is the independent variable. Further Wald test have been applied to confirm the unidirectional relationship between FDI and trade. The results of Wald test have been shown in table 8 and 9. As per table 8 and 9, it is confirmed that FDI and trade have unidirectional relationship. Trade is the cause of FDI inflows in BRICS nations.

Table 8: WALD TEST

DEPENDENT VARIABLE = FDI , INDEPENDENT VARIABLE = TRADE					
Null hypothesis	Statistics	Value	df	Prob.	Results
C(3)=C(4)=0,Trade is not the cause of FDI inflows	Chi-square	10.33672	2	0.0057	Null hypothesis is rejected. So, Trade is the cause of FDI inflows
Notes: significance level is 0.05.					

Source: Data Analysis

Table 9: WALD TEST

DEPENDENT VARIABLE = TRADE , INDEPENDENT VARIABLE = FDI					
Null hypothesis	Statistics	Value	Df	Prob.	Results
C(6)=C(7)=0, FDI inflows is not the cause of trade.	Chi-square	3.674318	2	0.1593	Null hypothesis is accepted. So, FDI inflows is not the cause of trade.
Notes: significance level is 0.05.					

Source: Data Analysis

VIII.   SCOPE FOR FUTURE RESEARCH

The present study considers the causal relationship between FDI and trade in BRICS nations. However, the results are not without any limitation. In future, further study can be done by analyzing the causal relationship of FDI with various macro-economic variables. In the previous studies, mainly the relationship between FDI and GDP has been shown. But there are many socio-economic variables like employment, inflation, exchange rate, foreign exchange reserves, labour cost, and infrastructure facilities in BRICS nations which represent the economy. Labour cost can be proxied by wage rate; infrastructure facilities can be proxied by electricity, water & telecommunications etc. The present study is restricted to only a panel of BRICS nations. In future, there is a scope for researcher to analyze the nations individually. Comparative analysis of BRICS nations regarding FDI determinants can also be studied.

IX.   CONCLUSION

The purpose of the study is to find out long run and causality relationship between FDI inflows and trade in BRICS nations. Various econometric tools have been applied for the study. The study found that China is the largest while South Africa is the smallest recipient of FDI inflows among BRICS nations. The prime cause behind the largest amount of FDI inflows in China is the low cost of production. Further, China shows the highest amount of trade in goods & services. The results of Augmented Dickey Fuller test indicate that data of FDI and trade are non-stationary at level but after first difference it becomes stationary. This implies that the variables are integrated of order 1 i.e. 1(1). After that, Pedroni's panel co-integration test at three scenarios namely no deterministic trend, deterministic intercept and trend, no deterministic intercept or trend has been applied to check the long run equilibrium relationship between FDI and trade. The results indicate the no long run co-integration between the FDI and trade in BRICS nations. The empirical results of Granger causality under VAR at panel level show that there is unidirectional relationship between FDI inflows and trade in which trade is the cause of FDI inflows in BRICS nations. Further the Wald test confirmed the unidirectional relationship running from trade to FDI inflows in BRICS nations. Finally it is concluded that in BRICS nations, trade in goods & services is the main cause of attraction of FDI inflows.

X.   RECOMMENDATION

FDI plays an important role in the economic development of a nation. In the present study, the unidirectional relationship running from trade to FDI inflows has been found. In the other way, it shows that trade attracts FDI inflows in BRICS nations. So, the study recommends the government of BRICS nations to enhance their trade activities in goods and services to stimulate more FDI in the nations respectively. The economic development of any nation can be achieved through the growth of trade. So, it is advisable for the countries to open up the export oriented units to increase the trade.

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