

Determinants of Innovation leading to sustainable Growth : BRICS Nations

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Abstract— Panel data analysis of factors influencing innovation of a country has been a focus of several studies. While several factors including country level variables like real exchange rate and inflation were included, variables that define the business environment and corruption were not included in the studies, to the best of our knowledge. Further there are studies that have been done using different modeling methods like simple regression analysis to complex time series ARMA modelling for individual countries. What the present study intends to do is to analyze the impact of business environment and corruption on innovation in a set of emerging economies BRICS nations. BRICS nations include Brazil, Russia, India, China and South Africa. Using panel data estimation method of random effects modeling the study finds that ease of doing business and corruption prevailing in an economy has a significant impact on FDI inflows indicator of innovation for an economy for the period of 2004 to 2015.

Keywords- Innovation; Ease of Doing Business; Corruption Perception Index; Panel Analysis Random Effects

I. INTRODUCTION

Innovation helps in the development as well as growth of a country. To cater to the growing demand, there is a need of frugal innovation which would lead to sustainable growth [13]. In the emerging economies, there are various factors such as rapid increase in population and unemployment which hinder innovation and economic growth. The importance of innovation is seen to extend beyond borders [15]. The prime focus of the study is to find the determinants which are leading to FDI inflow, which is an indicator of innovation in BRICS countries. The exports of the BRICS nations has doubled in the past Years from 8 percent to 16 percent. During the period of 2001 to 2011, the total exports of these nations grew above 500%. On the other hand the total global exports went up by 195% during the similar period. The period from 2002 to 2012, BRICS experienced an increase in trade between themselves by US \$27 to 276 billion, while trade with others rose from US\$ 4.7 to 6.1 trillion dollars. They comprise of almost 43 percent of the world population, with a World Gross Domestic Product (GDP) of 30 percent and a share of 17 percent in trade as per the data provided by BRICS [17]. BRICS countries has

emerged as one of the major destinations which are innovating.

As per the latest statistics of World bank Fig (1) China as shown has the highest GDP of \$ 11.008 trillion followed by India \$2.095 trillion, Brazil \$1.775 trillion, Russia \$1.331 trillion and South Africa \$314.572 billion. And when it comes to the inflow of FDI in china it has the highest FDI inflow of 289 billion US Dollars followed by Brazil \$75 billion, India \$44 billion, Russia \$6.47 billion.

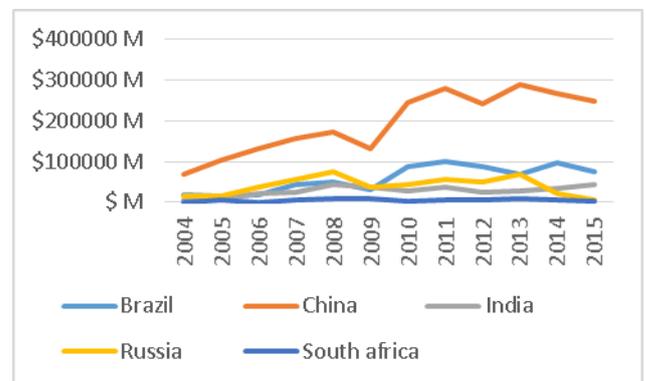


Fig 1.Foreign Direct Investment Inflow: BRICS Countries (World bank)

II. LITERATURE REVIEW & HYPOTHESIS DEVELOPMENT

Finding the determinants which affect the foreign direct investment in a country started from the research work of [1] & [2]. The eclectic paradigm helped in providing a concrete framework which can help us to explain FDI [3]. Empirical studies which are built on aggregate econometric method inspects the determining factors of FDI inflow in East and South Asian Countries in the period ranging from 1960 to 1987[4].

The study conducted by [5] on the impact of macroeconomic factors on FDI inflows for Norway over the study period of 1986 to 2009 finds that the co-integration coefficients for income variables, such as real GDP and GDP of all the three sectors, real exchange rate, and trade openness are significant thus supporting the

hypothesis that macroeconomic variables impact FDI inflows.

[6] focuses on the relationship between FDI developing countries taking corporate tax rates into consideration. Using the data of the location choices of Japanese firms during 1990 to 2000, the study finds differences between the developed and developing countries. The research finds that developed countries provide a better working condition as compared to the developing countries which offer less promising conditions to foreign multi-nationals. Further study finds that corporate tax rates help modify the attractiveness of a country in foreign investor's perspective. While studies have found several important determinants of FDI inflow, two factors that have not been explored are ease of doing business and corruption prevailing in the host country. Our study aims to do this for BRICS nations.

Ease of Doing business

Ease of doing business measures the extent of costs, time taken and difficulty which a mid-sized firm have to face to start its business. Ease of doing business is significant factor which helps in driving FDI inflow [7]. The lesser the period needed to start a new venture in the parent country, more attractive would be the country for attracting FDI inflow. Hence the study hypothesises that

H1: *The relationship of Ease of doing business is negatively related with FDI inflow in BRICS Countries.*

Corruption perception index

The corruption rank of the countries is decided on the basis of Corruption Perception Index (CPI). Corruption Perception Index defines corruption as the use of Political power for our own economic benefit. Study conducted by [8] to study the impact of various policies on FDI in 49 less developed economies found that there is a significant impact of corruption on FDI inflow. Hence the present study hypothesises that

H2: *The relationship of Corruption perception Index is Positive with FDI Inflow in BRICS Countries.*

Control Variables

A. Real Exchange Rate

There are two ways in which the change in exchange rates has an effect on FDI. One is the wealth effect channel and the other one is the relative production cost channel [9]. According to the wealth effect, foreign investor's wealth in comparison with the wealth of domestic investor's increases as the host country's currency depreciates. Also the purchasing power of the investors in terms of the foreign currency increases which leads to the positive relationship between exchange rate and FDI Inflow [10]. The study hypothesises that

H3: *The relationship between depreciation in the currency of the host country and FDI Inflow is negative in BRICS Countries.*

B. Inflation

Inflation rates helps to understand the economic stability or position of a country. Excessive inflation also known as hyperinflation negatively impacts the economy. The same happens in the case of deflation. Higher inflation is seen to reduce the real value of money earned by the foreign investors in local currency [11]. The study hypothesises that

H4: *The relationship between FDI Inflow and Inflation is Negative in BRICS Countries.*

C. Real Interest Rates

[12] In the analysis done, lower interest rate was found to be a major determinant factor to decide locations to set up a manufacturing sector in EU nations. The location having competitive interest rates are preferable as compared to other locations. The study hypothesises that

H5: *The relationship between Real interest rates and FDI inflows will be positive in BRICS Countries.*

D. Tax Rates

Studies have shown that tariffs and FDI Inflow are related with each other [8]. The Tax rates of the host country act as a major determinant for the investors. Higher the tax rate lesser will be the returns as compared with the countries with lower tax rates. The study hypothesises that

H6: *The relationship between Tax rates and FDI Inflows is negative in BRICS Countries.*

E. Unemployment

Studies have shown that mobility of capital i.e. FDI has a link with unemployment. The study observes that unemployment and FDI inflow are negatively related [16]. It shows that when unemployment increases in a country investors think that environment is unfavorable for doing business. The study hypothesises that

H7: *The relationship between unemployment and FDI inflow is negative in BRICS Countries.*

III. DATA SOURCE AND RESEARCH METHODOLOGY

A. Data Description

The data set comprises of yearly observations of Brazil, Russia, India, China and South Africa from a period of 2004 to 2015. The data has been sourced from World Bank database. The study aims to analyze the determinants of FDI inflow for all BRICS countries in a single framework. Variables used for analysis are defined in Table I.

TABLE I. VARIABLE DEFINITION

Variables	Definition
Foreign Direct Investment	Amount of money invested by non-resident investors in a country
Ease of Doing Business	Overall Time required to complete all measures officially required to make the business registered and operational.

Corruption Perception Index	A composite index which measures the amount of Corruption prevailing in a country.
GDP per capita	GDP/Total Population
Unemployment	Proportion of Unemployed people
Exchange Rate (Real)	Nominal Exchange Rate multiplied by the Ratio of Domestic Price Level and Foreign Price Level
Inflation	[(CPI of Year two – CPI of Year one)/CPI of Year one] * 100
Interest rates (Real)	Nominal Interest rate less Inflation(Expected or Actual)
Tax Rate	(Actual Tax Payable/ Commercial Profit) * 100

Further data for all variables were unavailable for all years across countries like data for unemployment does not include the data for the year 2015 due to the unavailability of data. Also the data of total tax rate includes the rates for only 2005 to 2015.

B. Methodology

The study estimates two model random effects model and fixed effects model. Panel data is a dataset which involves Multi-Dimensional data involving measurements overtime. Stata 13.0 was used for the analysis. The following is the general model used for the study. The model supposes that there is a latent variable.

$$Y_{it}^* = \beta_0 + \beta_1 X_{it} + \beta_2 Z_{it} + u_{it} \quad (1)$$

Where $i = 1, 2, \dots, 5$; $t = 1, 2, 3, \dots, 12$

Y_{it} is the latent dependent variable.

X_{it} are the variable the study is specifically looking at.

Z_{it} are the other control variables.

Similar methodology has been used by [11]. The model estimated

$$FDI = \beta_0 + \beta_1 \text{Easeofdoingbusiness} + \beta_2 \text{Corruption} + \beta_3 \text{GDP} + \beta_4 \text{Inflation} + \beta_5 \text{Int Rate} + \beta_6 \text{Tax rates} + \beta_7 \text{Unemployment} + \beta_8 \text{exch rate} + u_{it} \quad (2)$$

Where FDI= Foreign Direct investment received by a country, Easeofdoingbusiness = Number of days taken to start a business in a country, Corruption = Corruption Perception Index of a country, GDP = GDP per capita of a country, Inflation = Inflation rate, Int Rate = Real interest rates, Tax rates = Total tax rates (% of commercial profits), Unemployment = unemployment rate, Exch rate = Real exchange rates.

IV. ESTIMATION

A. Panel Analysis

The Model, as given in eq(2) is estimated using Panel analysis of random effects and fixed effect. Hausman specification test proved that random effects would be a better model over fixed effects model. The hypothesis tested was that fixed effects model is a better model. But the results of Hausman test (p value < 0.00) indicates that we can reject the null. Hence we select the random effects model is a better model.

II. PANEL ESTIMATE RESULTS FOR DETERMINANTS OF FDI

Independent Variable	Coefficients	
	REM	FEM
Easeofdoingbusiness	-810 ^{***}	21
Corruption	2900 ^{**}	3420 [*]
GDP	-0.226	12 ^{***}
Unemployment	-10600 ^{***}	14700 ^{**}
Exch rate	-3370 ^{***}	-3180 ^{**}
Inflation	-2560	5400 ^{***}
Int rate	-955	320
Tax rates	107	394
Cons	193000	-258000

Note: All the figures are in Million US Dollars (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$)

B. Random Effects Model

As seen in Table II, Ease of doing Business indicator has a negative significant impact at 1% level of significance. The results indicates that in country where it takes more times for a business to set up then it attracts lesser FDI as compared to a country which takes lesser time to set up a business. Corruption perception index which looks at perceived levels of corruption has a positive significant impact on Foreign Direct Investment inflow in BRICS nations at 5% level of significance. The results pertaining to corruption shows that a country where large amount of corruption persists the inflow of FDI is lesser as compared to countries low on corruption. Inflation and Real Interest rates has a negative relationship with FDI inflow as stated in the study [6]. Tax rates does not play a significant role in attracting FDI. Unemployment has a negative and a significant impact on Foreign Direct Investment inflow at 1% level of significance [15]. Real Exchange rates have a negative impact on FDI inflow at a 1% level of significance [6].

V. CONCLUSION

Ease of doing business and corruption prevailing in a country has significant impact on the foreign direct investment in BRICS countries which is a factor of innovation. Ease of doing business attracts foreign investors as it makes environment more favorable for innovation. In order to study the relationship and the impact of ease of doing business and corruption perception on foreign direct investment inflow, this study used Panel analysis random effects model. The results show that a negative relation exists in number of days to start a business with the FDI inflow in BRICS. They also prove that there is a positive relationship between corruption perception index and FDI inflow which means that when a country improves in CPI, FDI inflow increases. Other control variable such as Unemployment and Real exchange rates also have a negative but significant impact on FDI inflow.

VI. LIMITATIONS

The current study has a lot of limitations which provides a scope of further research. The data is collected from only 2004 to 2015. Further studies can be conducted to take other factors which depicts ease of doing business in an economy. The study can also be extended to specific sectors such as retail sector to understand what factors in retail sector has an impact on FDI inflow.

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