



Determinants of Innovation leading to sustainable Growth : BRICS Nations

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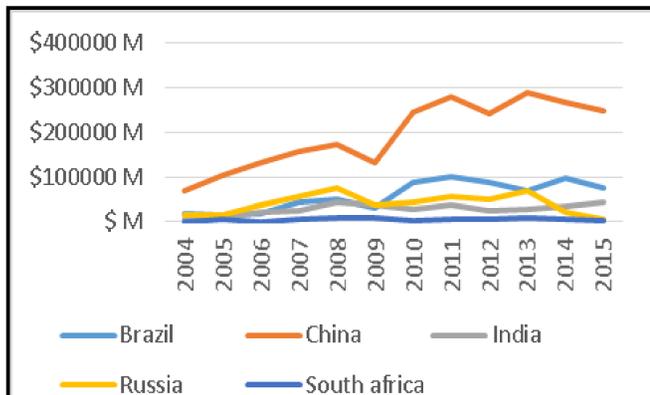
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Abstract

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.**

Introduction

Innovation helps in the growth and development of a country in rural as well as urban aspect. To cater to the growing demand, there is a need of frugal innovation which would lead to sustainable growth. Brazil, Russia, India, China and South Africa are few of the emerging economies who collectively play an important role as producers of goods and services in the world. In these 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. The main aim 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, growth in primary, secondary and tertiary sector of economy. 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 during 2010-2012, BRICS 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 Gross Domestic Product (GDP) of 30 percent of the world GDP and a share of 17 percent in trade as per the data provided by BRICS. BRICS countries has emerged as one of the major destinations which are innovating.



Source: World Bank

As per the latest statistics of World bank China 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 foreign direct investment china has the highest FDI inflow of 289 Billion US Dollars followed by Brazil \$75 Billion, India \$44Billion, Russia \$6.47 Billion.

Hypothesis

H1: There is a negative relationship between the Ease of doing business and FDI inflow in BRICS Countries.

H2: Corruption perception Index has a Positive Relationship with FDI Inflow in BRICS Countries.

H3: A depreciation in the currency of the host country leads to Increase in FDI Inflow in BRICS Countries.

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

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

H6: There is a negative relationship between Tax rates and FDI Inflows in BRICS Countries.

H7: There is a negative relationship between unemployment and FDI inflow in BRICS Countries.

Research Methodology

Panel data has been used in the study to find the impact of different Variables and to extract more effective estimations and information about the variables.

Panel data is a dataset which involves Multi-Dimensional data involving measurements overtime. Panel Data has three different models (i) Common Constant (ii) Fixed Effects (iii) Random Effects. The study estimates only fixed effects and random Effects model 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.

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

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.

The model estimates in analyzing is

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

Data Source & Description

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 |
| Real Exchange Rate | Nominal Exchange Rate * (Domestic Price Level/Foreign Price Level) |
| Inflation | [(CPI of Year 2 – CPI of Year 1)/CPI of Year 1] * 100 |
| Real Interest rates | Nominal Interest rate – Inflation (Expected or Actual) |
| Tax Rate | (Actual Tax Payable/ Commercial Profit) * 100 |

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 extracted from World Banks. 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.

Estimation

The Model, as given above is estimated using Panel analysis (Fixed effects and Random effects). Both Random effects and fixed effect were conducted. Hausman specification test proved that Random effects model is better than the fixed effects model. The results for the estimation are tabulated in Table III. The hypothesis tested was that fixed effects model is a better model. But the results of Hausman test ($p \text{ value} < 0.00$) indicates that we can reject the null. Which proves that random effects model is a better model.

II. Hausman specification test

| | (b) | (B) | (b-B) | Sqrt(diag(V b-V B)) |
|------------------------|-----------|-----------|----------|---------------------|
| | Fixed | Random | Diff. | S.E. |
| Ease of doing business | 2.14E+07 | -8.10E+08 | 8.31E+08 | 1.78E+08 |
| Corruption | 3.42E+09 | 2.90E+09 | 5.16E+08 | 1.70E+09 |
| GDP | 1.16E+07 | -2.26E+05 | 1.18E+07 | 1737434 |
| Unemployment | 1.47E+10 | -1.06E+10 | 2.53E+10 | 5.84E+09 |
| Exch rate | -3.18E+09 | -3.37E+09 | 1.89E+08 | 1.20E+09 |
| Inflation | 5.40E+09 | -2.56E+09 | 7.96E+09 | 1.25E+09 |
| Int rate | 3.20E+08 | -9.55E+08 | 1.28E+09 | 5.78E+08 |
| Tax rates | 3.94E+08 | 1.07E+08 | 2.88E+08 | 2.18E+08 |

Results

III. Panel Estimate results for determinants of FDI

| Independent Variable | Coefficients | |
|------------------------|--------------|---------|
| | REM | FEM |
| Ease of doing business | -810*** | 21 |
| Corruption Index | 2900** | 3420* |
| GDP | -0.226 | 12*** |
| Unemployment | -10600*** | 14700** |
| Exchange rate | -3370*** | -3180** |
| Inflation | -2560 | 5400*** |
| Interest 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

As seen in Table III, 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 and a significant impact on FDI 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. Tax rates does not play a significant role in attracting FDI. Unemployment has a negative and a significant impact on FDI inflow at 1% level of significance. Real Exchange rates have a negative impact on FDI inflow at a 1% level of significance.

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.