

Vijayakumar, Narayanamurthy; Sridharan, Perumal; Rao, Kode Chandra Sekhara

Article

Determinants of FDI in BRICS countries: A panel analysis

International Journal of Business Science & Applied Management (IJBSAM)

Provided in Cooperation with:

International Journal of Business Science & Applied Management (IJBSAM)

Suggested Citation: Vijayakumar, Narayanamurthy; Sridharan, Perumal; Rao, Kode Chandra Sekhara (2010) : Determinants of FDI in BRICS countries: A panel analysis, International Journal of Business Science & Applied Management (IJBSAM), ISSN 1753-0296, International Journal of Business Science & Applied Management, s.l., Vol. 5, Iss. 3, pp. 1-13

This Version is available at:

<https://hdl.handle.net/10419/190616>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/2.0/uk/>

Determinants of FDI in BRICS Countries: A panel analysis

Narayanamurthy Vijayakumar

Department of Banking Technology, School of Management, Pondicherry University,

Puducherry- 14., India

Tel: +91-94433-82134

Email: nvkvijay@gmail.com

Perumal Sridharan

Department of International Business, School of Management, Pondicherry University

Puducherry- 14, India

Tel: + 91-98940-23571

Email: psdn@rediffmail.com

Kode Chandra Sekhara Rao

Department of Banking Technology, School of Management, Pondicherry University

Puducherry- 14, India

Tel: +91-98942-55526

Email: kcsrao.btm@pondiuni.edu.in

Abstract

This study examines the factors determining FDI inflows of BRICS countries using annual dataset from the period 1975 to 2007 (for Russia required data set is available from 1990 onwards). The study employs Panel data analysis and finds that the selected variables Market size, Labour cost, Infrastructure, Currency value and Gross Capital formation as the potential determinants of FDI inflows of BRICS countries. The Economic Stability and Growth prospects (measured by inflation rate and Industrial production respectively), Trade openness (measured by the ratio of total trade to GDP) are seems to be the insignificant determinant of FDI inflows of the BRICS countries. The empirical results are robust in general for alternative variables determining FDI flows.

Keywords: foreign direct investment, panel data, economic stability

1 INTRODUCTION

The world has experienced a massive transformation in terms of geopolitics, economics and in organisation and distribution of production. For several reasons, emerging economies of Brazil, Russia, India and China (BRIC) have acquired important role in the world economy as producers of goods and services. BRICS countries prominently attract larger capital because of their larger potential consumer market having the common characteristic of large population. The BRIC countries are listed as emerging economies but these countries as a whole do not have any trade or integrated economic union. Brazil, Russia, India and China have emerged as major destination for Foreign Direct Investment (FDI) inflows, resulting in BRIC - a strong constructive term which was prominently coined by the 'Goldman Sachs Investment Bank' (Wilson and Purushothaman, 2003) to represent Brazil, Russia, India, and China as an economic Block.

Global competition for FDI had given the bargaining power to Multi-National Corporations (MNCs) and their allies (Boros Torstila, 1999). Competition forced the countries to lower their entry regulations, taxes, environmental clearances, and stipulations on working conditions for attracting FDI. Goldman Sachs predicted that China and India are likely to emerge as dominant global suppliers of manufactured goods and services while Brazil and Russia to dominate in supply of raw materials.

While Asian, European and Latin American continents are represented in the profile, absence of Africa would undermine the importance of the 'Developing World' in the Global economy. Hence, it is interesting and important to look beyond BRIC. The potential of Africa, and particularly South Africa, the largest economy in the region, is also poised to play an important part in Global economic growth and development, similar to BRIC. The study by Goldman Sachs showed that South Africa could achieve five per cent growth over the next decade if the right policies were put in place. This projected growth rate was based on the similar conditions set for the similar growth rate for the BRIC. Therefore, this study includes South Africa and coins a new term *BRICS (Brazil, Russia, India, China and South Africa)* to represent the four continents of the World, which are of economic significance, in the process of Globalization.

The role played by FDI in Economic growth of an economy and living experience of BRIC economies drew the attention of researchers and policy makers to explore the FDI led growth linkage and identify the push and pull factors of FDI destinations.

The Goldman Sachs investment report (2003) pointed out not only the importance of South Africa as the biggest economy in the African continent but also as an emerging economy in the World. Although, South Africa- an emerging economy does not possess the characteristics of BRIC countries in terms of territorial extension and the size of the population, yet it has certain desirable features like:

- an enormous potential consumer market with larger middle-income group
- abundant supply of natural resources
- well developed financial parameters
- good communication and network
- effective energy and transport sectors and
- sound legal system and modern infrastructure supporting an efficient distribution of goods and services

Also, it plays an important economic and political role in the African continent.

In the recent days BRIC as emerging economies, exhibit economic strength in the face of the US credit turmoil and growth slowdown. BRICS countries characterise a cyclical component of strong domestic demand growth. There are also structural factors at work that bode well for the medium-term growth prospects. Such factors can be captured in a simple growth accounting framework. Generally, economic growth of an economy can be measured through several components, namely, changes in labour and capital inputs, and total factor productivity. The total factor productivity captures technological progress and/ or efficiency gains and residual remain unexplained due to changes in labour and capital inputs. Growth accounting provides an analytical framework to assess medium-term economic growth dynamics. However, the BRICS economies differ greatly in terms of their growth prospects.

The demographic trends, labour supply dynamics and/or low urbanisation ratios seem to remain favourable for Brazil, India and South Africa. In Brazil, India and South Africa the working age population continues to expand until the middle of the current century, while in China it may decline after 2015 and in Russia it is at the risk of collapsing (UN projects Russia's working age population to decline from 97 million in the year 2005 to 47 million by the year 2050). A low urbanisation ratio of 40 per cent in China may help to counteract the projected decline in the working age of the population by

allowing the transfer of labour from the countryside into the more productive urban economy. In Brazil, not much should be expected from further urbanisation, as the country is already more highly urbanised than many of the developed countries in the world. However, the demographic profile of Brazil is relatively favourable and benefitable from a 20 per cent increase in the population of working age between the year 2005 and 2025. The Russian population of working age is already in decline and little help will come from 'surplus rural labour' due to a high urbanisation ratio. From a purely demographic point of view, India and South Africa face the most promising prospects, combining solid population growth and a lower degree of urbanisation. Though this situation may pose challenges of its own (in terms of urban development and infrastructure), but definitely be supportive for growth dynamics. The recent capital accumulation trends favour China and India. Assuming that investment ratios do not change dramatically over the next few years, China and India face much brighter prospects than Brazil, Russia and South Africa. Currently domestic investment ratios are around 40 per cent and 30 per cent of GDP in China and India, respectively, where as an investment ratio of Brazil, Russia and South Africa account to 20 per cent to 23 per cent of GDP. Russia and South Africa probably increase its investment ratio because of large savings generated by the commodity boom. Brazil, having a more modest increase their domestic savings may drive a moderate up-tick in investment ratio. It seems that Chinese and Indian capital accumulation will proceed at a much faster pace than Brazil and Russia.

The relative and absolute economic importance of BRICS is expected to continue to rise for the foreseeable future. In terms of economic growth, China has been outperforming the other four countries by a wide margin over the past thirty years. Over the past decade, real GDP growth averaged 10 per cent in China, 7 per cent both in India and Russia, 4.6 per cent in South Africa and 3.3 per cent in Brazil. In general, high savings rate, low level of urbanisation, low per capita income, higher export-orientation, manufacturing-based development strategy underpinned by strong investment in infrastructure and education will combine to sustain BRICS countries as superior economies of world. Thus, BRICS may become the largest economies of the world in the upcoming decades.

The BRICS countries have been the predominant recipients of FDI during the last decades. However, the evolution of FDI inflow shows very distinct trajectories for the five countries. Until 1984, Brazil was the major FDI recipient country among the BRICs, overtaken by China in 1985 and since then China continues to be a major destiny of FDI, especially in the automotive and consumer durables sectors. China became the world major recipient of FDI in the 1990s, matching with country's efforts to integrate with the world economy. Many Multinational Companies have moved their operations to China to take advantage of its low labor costs and huge domestic market. South Africa and India received an almost constant and small part of the world total FDI flows during last two decades. India has many restrictions to FDI inflows, where, public enterprises dominate in many key sectors. Equally, the low and constant inflow applies to the Russian Federation since 1990. It is also worth of pointing out that the type of FDI received by each country has been significantly different and that the type depends on policies of the recipient countries. For instance, some of BRICS countries like Brazil, Russian Federation and South Africa liberalized their economies in more unconditional way and received more portfolios of FDI. For these countries, FDI was directed to the productive sectors, mostly by way of acquisitions of local firms. China and India have not liberalised the Capital account, where the FDI flows seem to be concentrated on 'Green Field Investments' in new production capacity.

Thus, the BRICS countries appear to have prosperity of economic and social development in the forth coming decades, if these countries form a formal union like European Union, ASEAN, G6 and G8 etc, and pool their resources. The economic growth will be tremendous and can throw competition and challenges towards the developed countries.

However, the current flow of FDI into BRICS is extremely complex and subject to various factors related to the competitive environment in the home and host countries. In this context, this study intends to examine the major determinants of FDI flows into BRICS countries. There are several studies contributing to the economic literature on the determinants of FDI.

The existing literature includes a number of Surveys, Case studies (see: Lankes and Venables, 1996; Meyer, 1998; Boros-Torstila, 1999; Resmini, 2000) and econometric studies (see: Lansbury et al., 1996; Wang and Swain, 1995; Hollond and Pain, 1998; Wood ward et al., 1997). There are some empirical studies formulated cross sectional analysis and found a set of explanatory variables that determine FDI flows (see: Agarwal, 1980; Gastanaga et al, 1998; Markusen and Maskus, 1999; Love and Hidalgo, 2000; Lipsey, 2000; Chakraborti, 2001; Moosa, 2002; Beven and Estrin, 2000; Singh and Jun, 1995; Sahoo, 2006; and Nunes et al., 2006 etc).

However, the above mentioned studies are investigated for the transition economies and developing economies as well as for groups like ASEAN and European Union using short time series of data. In all the above, presently available research literature pertaining to BRICS countries is still

limited. In this context, our study intends to examine the factors that determine the FDI flows to BRICS countries by employing long recent data. This study is expected to contribute its empirical results for BRICS countries along with existing economic literature.

The Panel data analysis is conducted to overcome the problems of endogeneity, heteroscedasticity and non stationarity in the regression models. However, our analysis establishes empirical evidences that the determinants of FDI inflows to BRICS countries are Market size, Labor cost, Currency value, Infrastructure and Gross capital formation. The significant effect of Gross capital formation in relation to FDI indicates that the privatization and ownership changes do not affect Capital formation of BRICS countries.

This study is organised as follows: section 1 is the present one and section 2 provides the theoretical literature relating to determinants of FDI. In section 3 we discuss the potential variables that are expected to attract FDI flows. We provide data and model specification in Section 4. We discuss empirical results in Section 5 and Summary and Conclusion in Section 6.

2 REVIEW OF LITERATURE

In this section, we provide brief literature reviews which investigate the determinants of FDI inflows across various economies.

The classical model for determinants of FDI begins from the earlier research work of Dunning (1973, 1981) which provide a comprehensive analysis based on ownership, location and the internationalization (OLI) paradigm. The empirical studies based on aggregate econometric approach are made by Agarwal (1980), Schneider et al (1985). Later on Lucas (1993) examines the determinants of FDI inflows for select East and South Asian economies during 1960 to 1987 by using a model based on a traditional derived-factor of a multiple product monopolist. The study finds that FDI inflows are more elastic with respect to cost of capital than wages and also more elastic with respect to aggregate demand in exports than domestic demand.

Loree and Guisinger (1995) study the determinants of FDI by United States towards developed nations from 1977 to 1982. The study concludes that the Host country policy related variables are significant in developed countries and infrastructure seems to be an important determinant for all the regions. Applying the qualitative economic variables Sing and Jun (1995) find a positive relationship between taxes on international transactions and FDI inflows to developing countries, where the export related variables strongly explain pulling of FDI to a country. Duran (1999) uses the Panel data and time series techniques to find out the drivers of FDI for the period 1970-1995. The study indicates that the size, growth, domestic savings, country's solvency, trade openness and macroeconomic stability variables are the catalysts of FDI. Beven and Estrin (2000) establish the determinants of FDI inflows to transition economies (Central and Eastern Europe) by taking determinant factors as country risk, labour cost, host market size and gravity factors from 1994 to 1998. The study observes that country risks are influenced by private sector development, Industrial development, the government balance, reserves and corruption. A dummy variable employed for capturing the key announcements of progress in EU accession seems to be directly influencing the FDI receipts. Lipsey (2000) captures a positive effect of FDI on growth and has a strong interaction with the level of schooling in the host country.

Levy-yeyati et al (2002) examine the extent of business cycles and interest rate cycles of developed countries impact on FDI flows to developing countries for the period 1980 to 1990. They consider the determinants of bilateral FDI using a gravity model. They find that FDI flows from US and Europe move counter cyclical to the business cycle in the source country, as well as, the interest rate cycles are the important determinants of FDI inflows. Aguilar and Vallejo (2002) study the forces behind the bilateral FDI due to the regional integration agreement for Latin America. They use gravity model and find that the size and development of both the domestic and foreign economies, the distance between them and the common language existence are the major determinants of bilateral FDI flows.

Garibaldi et al (2002) analyse the FDI and Portfolio investment flows to 26 transition economies in Eastern Europe including the former Soviet Union from 1990 to 1999. The regression estimation indicates that the FDI flows are well explained by standard economic fundamentals such as market size, fiscal deficit, inflation and exchange rate regime, risk analysis, economic reforms, trade openness, availability of natural resources, barriers to investments and bureaucracy. However, the portfolio flows are poorly explained by the fundamentals. The study of Nonnenberg and Mendonca (2004) finds that the factors such as the market size measured by GNP, growth rate of the product, the availability of skilled labour, the receptivity of foreign capital, the country risk rating and stock market behaviour seem to be the important determinants of FDI flows for developing countries comprising of 33 countries from 1975 through 2000. In the context of Latin American countries, Nunes et al (2006) find the variables such as market size, openness of the economy, infrastructure, macroeconomic stability

(inflation), wages, human capital and natural resources as the determinants of FDI flows during the period 1991 to 1998. The study observes that the market size, infrastructure and inflation are positively influencing and wage rate is negatively influencing the FDI flows. Similarly, by estimating the panel co-integration test, Sahoo (2006) finds that the market size, labour force growth, infrastructure index, and trade openness are the important determinants of the FDI flows in South Asian countries.

Thus, the reviews help us in choosing the factors or alternatives that may gauge the FDI inflows of BRICS countries.

3 POTENTIAL VARIABLES DETERMINING FDI INFLOWS

Based on the discussed literature review, our study gauges a set of potential determinant variables that influence the FDI flows and we classify the variables into seven broad categories, viz., Market size, Economic stability and Growth prospects, Trade openness, Currency value, Infrastructure facilities, Labour cost and Gross capital formation.

Market size

Larger market size should receive more inflows than that of smaller countries having lesser market size. Market size is generally measured by Gross Domestic Product (GDP), GDP per capita income and size of the middle class population. It is expected to be a positive and significant determinant of FDI flows (see: Lankes and Venables, 1996; Resmini, 2000; Duran, 1999; Garibaldi, 2002; Bevan and Estrin, 2000; Nunes et al., 2006; Sahoo, 2006). In contrast, Holland and Pain (1998) and Asiedu (2002) capture growth and market size as insignificant determinants of FDI flow.

Economic stability and growth prospects

A country which has a stable macroeconomic condition with high and sustained growth rates will receive more FDI inflows than a more volatile economy. The proxies measuring growth rate are: GDP growth rates, Industrial production index, Interest rates, Inflation rates (see: Duran, 1999; Dassgupta and Ratha, 2000). Contradictingly, when inflation is taken as proxy for the level of economic stability, then the classic symptoms of fiscal or monetary control will result in unbridled inflation. In connection with this, investors prefer to invest in more stable economies that reflect a lesser degree of uncertainty (see: Nonnenberg and Mendonca, 2004). Therefore, it is expected that GDP growth rate, Industrial production index, Interest rates would influence FDI flows positively and the Inflation rate would influence positively or negatively.

Labour cost

Higher labour cost would result in higher cost of production and is expected to limit the FDI inflows; therefore, we expect the negative and significant relationship between labour cost and FDI. Labour cost can be proxied by wage rate (see: Lankes and Venables, 1996; Nunes et al 2006). There are few studies which find labour force determining FDI flows positively, (see: Wheeler and Mody, 1992; Kumar, 1994; Sahoo, 2006). However, Resmini (2000) did not confirm the significance of wages, perhaps because of using wages that are uncontrolled for productivity and exchange rates (Bevan and Estrin, 2004).

Infrastructure facilities

The well established and quality infrastructure is an important determinant of FDI flows. On the other hand, a country which has opportunity to attract FDI flows will stimulate a country to equip with good Infrastructure facilities. Therefore, we expect positively significant relationship between FDI and Infrastructure. The previous studies of Wheeler and Mody (1992), Kumar (1994), Loree and Guisinger (1995) and Asiedu (2002) also support our expected hypothesis. The availability of quality Infrastructure can be constructed by considering Electricity, Water, Transportation and Telecommunications (see: Sahoo, 2006). Whereas, Nunes et al. (2006) consider public expenditure on capital to acquire fixed capital assets, land, intangible assets and non-financial and non- military assets for Infrastructure.

Trade openness

Trade openness is considered to be a key determinant of FDI as represented in the previous literature; much of FDI is export oriented and may also require the import of complementary, intermediate and capital goods. In either case, volume of trade is enhanced and thus trade openness is generally expected to be a positive and significant determinant of FDI (see: Lankes and Venables,

1996; Holland and Pain, 1998; Asiedu, 2002; Sahoo, 2006). Trade openness is proxied as the ratio of the Export plus Import divided by GDP (Nunes et al. 2006; and Sahoo, 2006).

Currency valuation

The strength of a currency (Exchange rate) is used as proxy for level of inflation and the purchasing power of the investing firm. Devaluation of a currency would result in reduced exchange rate risk. As a currency depreciates, the purchasing power of the investors in foreign currency terms is enhanced, thus we expect a positive and significant relationship between the currency value and FDI inflows. The currency value can be proxied by the Real Exchange Rate, Real Effective Exchange Rate (REER) and Nominal Effective Exchange Rate (NEER).

Gross Capital Formation

In a transition economy, improvements in the investment climate help to attract higher FDI inflows. It translates into higher Gross capital formation which in turn leads to greater economic growth. Libor Krkoska (2001) and Lipsey (2000) find little evidence of FDI having an impact on capital formation in developed countries and observe that the most important aspect of FDI in the selected sample of countries is related to ownership change. The relationship between FDI and Capital Formation is not simple (Libor Krkoska, 2001). In the case of certain privatization, it may not lead to increase at all or even result in reduction. Thus, the unclear relation between FDI and capital formation may also hold in a transition economy. However, a positive or negative and significant relationship between FDI and Capital Formation is expected.

4 DATA AND MODEL SPECIFICATION

The data set consists of yearly observations for the period 1975 - 2007 for the five fast developing countries namely Brazil, Russia (the data set is available from 1990 onwards), India, China and South Africa (BRICS countries). The required data set for the selected countries were obtained from 'World Development Indicators (WDI) CD-ROM- 2008', except for Industrial Production index and Exchange rate. The Industrial Production index is obtained from Center for Monitoring Indian Economy (CMIE)'s 'International Economic Indicators' and Exchange rate is obtained from *The Federal Reserve Board Statistics* (Releases and Historical data).

The dependent variables in our study is the Log of FDI inflow in current USD (LFDI) and the independent variables that are expected to determine FDI flows are carefully chosen, based on previous literature and availability of dataset for the selected period. The independent variables in our estimation generally include Gross Domestic Product, Industrial production index, Inflation rate, Wage rate, Infrastructure Index, Trade Openness, Exchange Rate and Gross capital formation. The Infrastructure index (INFRAI) is constructed by indexing Electric Power Consumption (kwh per capita), Energy use (kg of oil equivalent per capita) and Fixed line mobile phone subscribers (per 100 people). We ignore Air freight transport variable due to non availability of data for selected countries for the study period. The variable Currency value, Exchange Rate is substituted with Real Effective Exchange Rate Index (REER) because latter variable seems to be robust in the estimation than the former variable.

In connection with discussions of the previous section, we propose an estimation model as follows, where the selected variables are expected to determine the FDI inflows:

$$LFDI_{it} = \alpha + \beta_1 LGDP_{it} + \beta_2 IPI_{it} + \beta_3 IFLA_{it} + \beta_4 WAG_{it} + \beta_5 INFI_{it} + \beta_6 TRDO_{it} + \beta_7 REER_{it} + \beta_8 GCFN_{it} + e_{it} \quad (1)$$

Where,

$LFDI_{it}$ is the log of Foreign Direct Investment in current US\$ for country i at time t.

$LGDP_{it}$ is the log of Gross Domestic Product in current US\$ for country i at time t and is the measure of market size

IPI_{it} is the Industrial Production Index and $IFLA_{it}$ is the Inflation Rate (Annual percent) for country i at time t, which are the measures of Economic Stability and Growth prospectus of a country

WAG_{it} is the log of workers remittances and compensation of employees received in US \$ for country i at time t and is the measure of Labour cost

$INFI_{it}$ is the Infrastructure Index for country i at time t . The simple Infrastructure index is constructed for the selected countries as:

$$Y_{jt} = \frac{X_{jt}}{X_{jt-1}} \times 100 \quad (2)$$

X_{jt} is the value of j^{th} indicator at time t for each country.

Y_{jt} is the transformed value (index in percent) of the j^{th} indicator at time t for each country. Then the above Y_{jt} is summed up and divided by three to arrive at the Infrastructure index in percent for each country i ($INFRAI_i$), which is presented as:

$$INFRAI_{it} = \sum_j^3 Y_{jt} / 3 \quad (3)$$

$TRDO_{it}$ is the Trade Openness for country i at time t and is computed as ratio of Import of Goods and Services plus Export of Goods and Services divided by GDP

$REER_{it}$ is the Real Effective Exchange Rate for country i at time t and is the measure of currency value. Real Effective Exchange is the currency index i.e. the weighted average of a country's currency selective to an index or basket of major currencies adjusted for the effect of Inflation and is the measure of currency valuation

$GCFN_{it}$ is the Log of Gross Capital Formation to the percent of GDP for the country i at time t and

e_{it} is the error term over the time t

This study analyses the fast developing countries in the context of BRICS. However, the study does not analyze how the selected determinant variables influence the FDI inflow on each country, but in general BRICS as a whole. The panel data estimation is employed in the study to capture the dynamic behaviour of the parameters and to provide more efficient estimation and information of the parameters. The ordinary least square method can provide consistent and efficient estimates of α and β . In practice, the advantage with panel data is that they allow us to test and relax some of the assumptions, and allow for greater flexibility in modeling differences in behavior across individuals (Ho. C. H, 2004). The dynamic approach offers advantages to Ordinary Least Squares (OLS) and also improves efforts to examine the FDI growth links using panel procedures (Carkovic and Levine, 2002). In addition to this, the study also tests dynamic panel models so as to incorporate maximum information of the yearly FDI inflow and its selected determinant variables of the BRICS countries. The panel data analysis is a pooled cross section and time series data which allows us to exploit the time series nature of the relationship between FDI and its determinant variables for selected countries (our panel procedure control for specific effects).

The Panel data model includes three different methods: (a) Common constant, (b) Fixed effects, (c) Random effects. The study estimates all these three methods so as to incorporate the best fit of the estimation. The Common constant method (also called as pooled OLS method) of estimation presents result under the principal assumption that there are no differences among the data matrices of the cross-sectional dimension (N). In other words the model estimates a Common constant for all Cross-sections (Common constant for countries). Practically, the Common constant method implies that there are no differences between the estimated cross-sections and it is useful under the hypothesis that the data set is a *priori* homogeneous. However, this case is quite restrictive and case of more interest involves the inclusion of Fixed and Random effects in the method of estimation (Asterious, 2006).

The Fixed effects method treats the constant as group (section)-specific, i.e. it allows for different constants for each group (section). The Fixed effects also called as the Least Squares Dummy Variables (LSDV) estimators, because it allows for different constants for each group and it includes a dummy variable for each group. To understand this, consider the following model:

$$Y_{it} = a_i + \beta_1 X_{1i} + \beta_2 X_{2it} + \dots + \beta_k X_{kit} + \mu_{it} \quad (4)$$

Where, the dummy variable is the one that allows us to take different group-specific estimates for each of the constants for every different section.

However, while using Fixed effects method, we need to apply tests to check whether Fixed effects (i.e., different constants for each group) should indeed be included in the model. To do this the standard F-test can be used to check Fixed effects against the simple Common constant OLS method. The null hypothesis is that all the constants are the same (homogeneous), and thus therefore the Common constant method is applicable:

$$H_0: \alpha_1 = \alpha_2 = \dots = \alpha_N \quad (5)$$

The F statistics is:

$$F = \frac{(R^2_{FE} - R^2_{CC}) / (N - 1)}{(1 - R^2_{FE}) / (NT - N - k)} \sim F(N-1, NT - N - k) \quad (6)$$

Where R^2_{FE} is the coefficient of determination of the Fixed effects model and R^2_{CC} is the coefficient of determination of the Common constant model, if F-statistical is bigger than the F-critical then we reject the null hypothesis.

Therefore, while using Fixed effects one should care about the validity of estimation even the F-test suggests to do so. The significant disadvantages of the Fixed effects method suggests for using the Random effects method presented in the next section.

The Random effects method is an alternative method of estimation which handles the constants for each section as random parameters rather than fixed. Hence the variability of the constant for each section comes from the fact that:

$$a_i = a + v_i \quad (7)$$

Where v_i is a zero mean standard random variable.

The Random effects model therefore takes the following from:

$$\gamma_{it} = (\alpha + v_i) + \beta_1 X_{1it} + \beta_2 X_{2it} + \dots + \beta_k X_{kit} + u_{it} \quad (8)$$

$$\gamma_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \dots + \beta_k X_{kit} + (v_i + u_{it}) \quad (9)$$

One obvious disadvantage of the Random effects approach is that one need to make specific assumptions about the distribution of the random component. Also, if the unobserved group-specific effects are correlated with the explanatory variable, then the estimates will be biased and inconsistent. However, the Random effects model has the advantage:

- that, there are fewer parameters to estimate compared to the Fixed effects method and
- it allows for additional explanatory variable that have equal value for all observations within a group (i.e., it allow us to use dummies).

Thus the use of Random effects method in the estimation requires lot of care and must be employed only if it is necessary and meaningful in comparison to Fixed effect method. Generally in the panel data analysis, the Fixed effects model assumes that each country differs in its intercept term, whereas the Random effects model assumes that each country differs in its error term. When the Panel is balanced (i.e., contains all existing cross sectional data), one might expect Fixed effects model to work well. Otherwise, the Random effect method will be more appropriate when the sample contains limited observations of the existing cross-sectional units. However, the Hausman specification test (1978) guides us to choose the appropriate Panel data model either Fixed effects method or Random effects model.

However, this study performs all the above three methods of panel data model to analyse the robustness of parameter co-efficient in explaining the factors that determine the FDI inflows to the BRICS countries. The Fixed effect method is rejected in the analysis based on the Hausman specification test (1978), a test that assists in making choice between the Random effects. However, we

present both the results in Table-1, but will not consider for the interpretations. We show Random effects instead of Common constant method because the results of latter observed to be similar with the former. Moreover, the Random effects method has more estimation advantages than the Common constant method, since the data classification seems to be a *priori* homogeneous. The estimation ensures homogeneity by choosing the sample countries which are assumed to be the most emerging economies of the world in terms of their growth and market potentials.

Hausman (1978) adopts this based on the idea that under the hypothesis of no correlation, both Ordinary Least Square (OLS) and Generalised Least Square (GLS) are consistent but OLS is inefficient, while under the alternative OLS is consistent but GLS is not. More specifically, Hausman assumed that there are two estimators $\bar{\beta}_0$ and $\bar{\beta}_1$ of the parameter vector β and he added two hypothesis-testing procedures. Under H_0 , both estimators are consistent, but $\bar{\beta}_0$ is inefficient, and under H_1 , $\bar{\beta}_0$ is consistent and efficient but β_1 is inconsistent.

According to Ahn and Moon (2001), the Hausman statistic is viewed as a distance measure between the Fixed effects and the Random effects estimators. Thus we actually test H_0 , that Random effects are consistent and efficient, versus H_1 , that Random effects are inconsistent (as the Fixed effects will be always consistent). The Hausman test uses the following test statistic:

$$H = (\bar{\beta}^{FE} - \bar{\beta}^{RE}) [Var(\bar{\beta}^{FE}) - Var(\bar{\beta}^{RE})]^{-1} (\bar{\beta}^{FE} - \bar{\beta}^{RE}) \sim X^2(k) \quad (10)$$

If the value of the statistic is large, then the difference between the estimates is significant, so we reject the null hypothesis that the Random effects model is consistent and we use the Fixed effects estimators. In contrast, a small value of the Hausman statistic implies that the Random effect is more appropriate estimator.

5 EMPIRICAL RESULTS

The descriptive statistics and correlation results for the selected variables for BRCIS countries are given in Table-1 and 2 respectively. The REER value observation in the estimation is 82 and other variables are having 120 to 130 observations. The IFLA has highest mean and standard deviation of 120.581 and 43.829 respectively in the data distribution. The independent variable LGDP is highly correlated with IPI, WAG, INFI, and GCFN. The variable WAG is highly correlated with GCFN and INFI and IPI highly correlated with TRDO. The existence of high correlation among the independent variables will lead to the problem of multicollinearity in the estimation. Still we consider these variables because of advantageousness of the panel data estimation which takes care of the collinearity problems.

We estimate Panel data analysis including OLS pooled regression (Common constant method), Fixed effects method and Random effects method for the selected study period. The robustness of parameter coefficients are used to explain the relationship between LFDI inflows and the selected independent variables. Since, the results of OLS pooled regression and Random effects parameter coefficients sign and their significance levels are almost similar, we choose Random effects model to check the robustness with Fixed effects model. The Fixed effects model is rejected in the analysis based on Hausman specification test (1978). The estimation results of both Fixed effects and Random effects model are given in Table- 3. However, we show both results but we discuss only the results of Random effects model.

Our study also analyses an alternative econometric approach to the normal panel data so as to use a dynamic Panel data framework of Arellano and Bond (1991) model including lags of dependent and independent variables in the estimation. The result of Dynamic Panel data estimation observed to be inconsistent and the Sargan test rejected the validity of the instrumental variables as well as auto correlation problem deducted at first and second order. Therefore, it is not represented and discussed in the present study.

Table-3 showing the results of Random effects model confirms the significance of Market size (LGDP), Labor Cost (WAG), Currency value (REER) at 1 percent level of significance. The Infrastructure and Gross capital formation are significant at 10 percent level. The co-efficient signs for each of these variables are as expected, positive for Market size and Infrastructure and negative for labour cost. We find significantly negative relationship between LFDI and Currency value (REER), which is a contradictory result as expected. Therefore, the study substitutes REER with Exchange rate currency per US \$ in the estimation to check the change in sign and significance. The result changed

positively insignificant with low coefficients. Hence, the study keeps the estimation results of REER and this observed result may be due to the stability of REER in BRICS countries.

The negative and statistically significant effect of Gross capital formation in relation to LFDI indicates that the privatization and ownership changes do not affect Gross capital formation of BRICS countries. The Economic Stability and Growth Prospects measured by Inflation and Industrial production are negatively insignificant in determining the LFDI inflows while the trade openness measured by the ratio of total trade to GDP is positively insignificant. Thus, the empirical results on determinants of FDI in BRICS countries are quite similar to those studies of developing countries.

Table 1: Descriptive Statistics of Variables in the study

	Obs	Mean	Std. dev	Min	Max
LFDI	129	9.218	0.997	4.093	10.898
LGDP	130	11.508	0.331	10.826	12.421
IPI	120	82.826	19.925	44.200	126.80
IFLA	130	120.581	43.829	0.192	273.50
WAG	128	77.752	5.500	65.157	87.627
INFI	128	107.371	6.445	93.675	145.37
TRDO	130	35.027	18.295	12.351	110.577
REER	82	106.752	20.277	73.940	166.297
GCFN	130	24.811	8.202	14.313	44.624

Table 2: Correlation of Variables in the study

	LFDI	LGDP	IPI	IFLA	WAG	INFI	TRDO	REER	GCFN
LFDI	1								
LGDP	0.736	1							
IPI	0.489	0.422	1						
IFLA	-0.015	0.093	0.054	1					
WAG	0.378	0.456	0.011	-0.134	1				
INFI	0.562	0.529	0.214	-0.258	0.435	1			
TRDO	0.270	0.065	0.592	-0.050	0.207	0.129	1		
REER	-0.101	-0.020	-0.135	0.076	-0.265	-0.150	0.023	1	
GCFN	0.286	0.442	-0.140	-0.062	0.841	0.434	0.180	-0.303	1

Table 3: Determinants of FDI inflows: Panel Data Estimation results based on Fixed Effects (FE) and Random Effects (RE) Models

Explanatory Variables	FE		RE	
LGDP	0.497	(0.71)	2.116*	(8.83)
IPI	0.003	(0.66)	-0.003	(-0.78)
IFLA	-0.000**	(-1.69)	-0.000	(-1.59)
WAG	-0.024	(-0.68)	-0.046*	(-3.94)
INFI	0.016	(1.47)	0.016**	(1.81)
TRDO	0.009	(1.12)	0.004	(1.16)
REER	0.001	(0.39)	-0.006*	(-2.75)
GCFN	-0.021	(-1.07)	-0.015**	(-1.78)
Adj. R ²	0.05		0.84	
Hausman test (prob> chi ²)	11.23 (0.129)			

Notes:

a) Figures in the parenthesis represent t- value

b) * denote Significant at 1 percent level, ** denote Significant at 10 percent level

c) A constant term is included but not reported

6 SUMMARY AND CONCLUSION

In recent days, BRICS- the fast developing economies of the world having larger market potentials are expected to attract larger inflow of FDI. However, the factors attracting the FDI inflows towards these countries are relatively less researched. This study made an attempt to identify the factors determining the FDI inflows of BRICS countries from the period 1975 to 2007. The determinant factors include: Market size, Economic Stability and Growth Prospects, Cost of Labour, Infrastructure Facilities, Trade Openness, Currency value and Gross capital formation. The study finds that other than Economic Stability and Growth prospects (measured by inflation rate and Industrial production respectively), Trade openness (measured by the ratio of total trade to GDP) all other factors seem to be the potential determinants of FDI inflows in BRICS countries. The empirical results are robust in general for alternative variables determining FDI flows.

The empirical analysis has some policy implications towards the improvement of investment climate to attract higher FDI inflows into BRICS countries that are expected to facilitate their economy in enhancement of Market potential, Infrastructural development and Capital Formation. Inflation (the Economic stability variable) and the Industrial production (the Growth Perspective variable) are critical factors in attracting FDI, which helps to make appropriate policies for improving the performance of domestic economy. Therefore, it is an important object to maintain the stability of the currency of the host country to attract increased FDI. The benefit of trade openness in terms of their impact on FDI is not validated in this study. Thus, BRICS countries as developing nations have to involve themselves in the path of economic reform and liberalisation activities. As expected, the negatively significance of wage rate seems to validate the study as the determinant of FDI.

The tag of fast-paced economic growth notwithstanding, Brazil, Russia, India, China and South Africa (BRICS), will have to tackle the challenge of ensuring and achieving growth without sacrificing equity, and by utilizing the benefits of innovation to address the issues of inequality of economies. The challenge is to have an innovation policy that will ensure growth accompanied by equity, for which they must have necessary institutional mechanisms in place. Thus, BRICS nations should face the challenges, ranging from gradual deterioration of demographics and questions about environmental sustainability to potential international trade frictions. The economic growth should be maintained at least at current levels instead of slow down. The BRICS countries' short and medium-term outlook remains favourable in relation to the advanced economies. Investment ratios in Brazil remain very low. Russia is highly dependent on hydrocarbons and therefore it faces very adverse demographic developments. India will have to overcome domestic opposition to growth-enhancing and growth-sustaining economic reforms. South Africa has to make initiation in promoting investment flows. Overall, the emergence of the BRICS nations have to be seen in the context of the innovation system that could evolve a proper understanding of the dynamics of innovation in these countries under globalization which would be of immense policy relevance not only for each of these countries but also for the BRICS as a group and other less developed countries that are aspiring to catch up. Thus, the

BRICS nations have to figure out that the engine of growth and development including for heavily indebted countries lies in the execution of major infrastructure projects, investment, and technological innovations carried out in an environmentally conscious fashion.

The future studies can focus on the variables relating to the regional competency of the nations as well as equivalent to home countries of the foreign investors. Such variables should include: Relative Market Share and Relative Growth of the economy, Relative Corporate Rate, Risk Factors and Corporate Governance. Sectoral analysis also expected to enhance the understanding of industry specific FDI flows and its associated determinants. Thus, the overall significance of the model specified in this study would contribute to a greater understanding of the FDI determinants in the emerging markets, as well as, the findings of this study would also lay emphasis on the importance of liberalisation and economic policy reforms.

REFERENCES

- Agarwal, J.P. (1980) 'Determinants of foreign direct investment: a survey', *Weltwirtschaftliches Archiv*, No.116, pp. 739-77.
- Aguliar and Vallejo, H. (2002) '*Integración económica y atracción de inversión extranjera directa: el caso de América Latina*', Universidad de los Andes – CEDE Working paper.
- Arellano, M. and Bond, S. (1991) 'Some tests of specification for panel data: monte carlo evidence and an application to employment equations', *Review of Economic Studies*, Vol. 58, pp. 277-297.
- Asiedu, E. (2002) 'On the determinants of foreign direct investment developing counties: is Africa different?', *World Development*, Vol. 30 (1), pp.107-119.
- Asterious, D. (2006) '*Applied econometrics: a modern approach using Eviews and Microfit*', Palgrave Macmillan, pp: 369- 378.
- Baniak, A., Cukrowski, J. and Herczynski, J. (2002) '*On determinants of foreign direct investment in transition economies*', CERGE-EI Working paper Series.
- Bevan, A.A. and Estrin, S. (2000) 'Patterns of foreign direct investment and trade in central and eastern europe', *mimeo*.
- Bevan, A.A. and Estrin, S. (2004) 'The determinants of foreign direct investment into European transition economies', *Journal of Comparative Economics*, Vol.32, pp.775-787.
- Boros-Torstila, J. (1999) '*The determinants of foreign direct investment operations of finnish MNCs in transition economies*', Helsinki: ETLA, The Research Institute of Finnish Economy, A 28 Series.
- Carkovic, M.V., and Levine, R. (2002) '*Does Foreign Direct Investment Accelerate Economic Growth?*', University of Minnesota Department of Finance Working Paper.
- Chakrabarti, A. (2001) 'The determinants of foreign direct investment: sensitivity analyses of cross-country regressions', *KYKLOS*, Vol.54 (1), pp. 89-114.
- Dasgupta, D. and Ratha. D. (2000) 'The role of short-term debt in recent crises', *Finance and Development*, Vol. 37, pp. 54-57.
- Dunning, J.H. (1973) 'The determinants of international production', *Oxford Economic Papers*, Vol. 25.
- Dunning, J.H. (1981) '*International production and multinational enterprise*', Allen & Unwin, London.
- Dunning, J.H. (1993) '*Multinational Enterprises and the Global Economy*', Wokingham, England: Addison- Wesley.
- Durán, J.E. (1999) '*Los determinantes de la ied en los países de américa latina y el caribe: su impacto sobre el comercio y la integración regional*', ECLAC, Mimeo.
- Garibaldi, P., Mora. N., Sahay. R. and Zettelmeyer. J. (2002) '*What moves capital to transition economies?*', IMF working paper WP/02/64.
- Gastanaga, V., Nugent, J. B. and Pashamova. B. (1998) 'Host country reforms & FDI inflows: how much difference do they make?', *Word Development*, Vol. 26(7), pp.1299-1314.
- Hausman, J. A. (1978) 'Specification tests in econometrics', *Econometrica*, Vol. 46, pp1251- 71.

- Holland, D. and Pain, N. (1998) '*The diffusion of innovations in central and eastern europe: a study of the determinants and impact of foreign direct investment*', NIESR Discussion Paper No.137, National Institute of Social and Economic Research, London.
- Ho, C. H. (2004) '*Determinants of Foreign Direct Investment in China*', 16th Annual Conference of the Association for Chinese Economics Studies, Australia (ACESA), Brisbane, QLD, 19- 20 July 2004.
- Kumar, N. (1994) '*Multinational Enterprises and Industrial Organization*', Sage Publications, New Delhi.
- Lankes, H.P. and Venables, A.J. (1996) 'Foreign Direct Investment in Economic Transition: The Changing Pattern of Investments', *Economics of Transition*, Vol.4, pp.331-347.
- Lansbury, M., Pain, N. and Smidkova, K. (1996) 'Foreign Direct Investment in Central Europe Since 1990: An Econometric Study', *National Institute Economic Review*, No.156, pp.104-113.
- Levy – Yeyati., UgoPanizza. E. and Stein. E. (2002) '*The cyclical nature of north South FDI flows*', IADB Working paper, Inter- American Development Bank.
- Libor Krkoska (2001) '*Foreign direct investment financing of capital formation in Central and Eastern Europe*', European Bank for Reconstruction and Development Working paper No. 67.
- Lipsey, R. E. (2000) '*Interpreting developed countries' foreign direct investment*', NBER Working paper No. 7810.
- Loree, D.W. and Guisinger, S.E. (1995) 'Policy and non policy determinants of U.S equity foreign direct investment', *Journal of International Business Studies*, Second Quarter, pp. 281- 299.
- Love, J. H. and Lage-Hidalgo.F. (2000) 'Analyzing the determinants of US direct investment in Mexico', *Applied Economics*, Vol.32, pp.1259-67.
- Lucas, R.E. (1993) 'On the determinants direct foreign investment: evidence from East and South East Asia', *World Development*, Vol. 21(3), pp 391- 406.
- Markusen, J. and Maskus. K. (1999) '*Discriminating among alternative theories of the multinational enterprises*', NBER Working paper 7164.
- Meyer, K. (1998) '*Direct Investment in Economies in Transition*', Edward Elgar
- Moosa, I.A. (2002) '*Foreign Direct Investment: Theory, Evidence and Practice*', London: Palgrave.
- Nonnenberg and Mendonça. (2004) '*The determinants of direct foreign investment in developing countries*', IPEA Working paper.
- Nunes, C.L., Oscategui. J. and Peschiera. J. (2006) '*Determinants of FDI in Latin America*', Documento De Trabajo 252.
- Resmini, L. (2000) 'The determinants of foreign direct investment into the CEECs: new evidence from sectoral patterns', *Economics of Transition*, Vol. 8(3), pp. 665- 689.
- Rugman, A. (1998) '*Forty years of Dunning and the theory of multinational enterprise*', Paper presented at the Academy of International Business Annual Meetings in Vienna, October 1988.
- Sahoo, P. (2006) '*Foreign Direct Investment in South Asia: Policy, Trends, Impact and Determinants*', ADB Institute Discussion paper No. 56.
- Schneider, Friedrich and Frey, B.S. (1985) 'Economic and Political Determinants of Foreign Direct Investment', *World Development*, Vol 13(2), 161-175.
- Singh, H. and Jun, K.W. (1995) '*Some new evidence on determinants of foreign direct investment in developing countries*', Policy Research Working paper No.1531, The World Bank.
- Wang, Z.Q. and Swain, N.J. (1995) 'The determinants of foreign direct investment in transforming economies: evidence from Hungary and China', *Weltwirtschaftliches Archiv*, Vol. 131, pp. 359-382.
- Wheeler, D. and Mody, A. (1992) 'International investment location decisions: the case of US firms', *Journal of International Economics*, Vol.33, pp.57-76.
- Wilson, D. and Purushothaman, R. (2003) '*DreamingWith BRICs: The Path to 2050*', Global Economics Paper No: 99, <http://www2.goldmansachs.com/ideas/brics/book/99-dreaming.pdf>
- Woodward, D., Rolfe, R.J., Guimarães, P. and Doupnik, T. (1997) '*Taxation and the location of foreign direct investment in central Europe*', University of Southern Carolina Working paper.