Home Country Effect of FDI Outflows from the BRIC Countries: Study of Domestic Investment

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Abstract

The recent phenomenon of rising outward foreign direct investment (OFDI) flows has raised serious policy concerns about its effects on the domestic investment and capital formation in the source countries. Does OFDI stimulate domestic investment or does it crowd it out? The concern arises because OFDI activities could shift not only some of the production activities from home to foreign destinations but also could possibly threaten the availability of scarce financial resources at home by allocating resources abroad. All this have the potential to reduce domestic investment, thus lowering the long run economic growth and employment of the home economies. The central goal of this paper is to empirically explore the evidence of the macroeconomic relationship between OFDI and levels of domestic capital formation in the BRIC economies. Our study reveals that OFDI has both short run and long run positive causality with domestic investment and thus figures out to be a significant factor affecting domestic investment in the BRIC nations. It becomes imperative, therefore, that the BRIC countries make special effort to promote their OFDI through the designing of appropriate OFDI policies that would help stimulate their domestic investment and economic growth now and in the future.

Key Words & Concepts
Domestic Investment, FDI Outflows, BRIC Nations, Dynamic OLS, Granger Causality

JEL Classifications
C22, F21, F23, O16

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The phenomenon of rising foreign direct investment (FDI)[1] outflows has raised serious policy concerns about its effects on the domestic investment in the source/home countries. Policy concerns become especially pronounced when outward FDI (OFDI) tends to substitute those domestic investments that could have sustained and enhanced home productivity. The argument is that if overseas relocation of domestic production takes place because of reduced investment opportunities at home, then, such OFDI activities may not only shift some of the production activities from home to foreign destinations but also possibly threaten the availability of scarce financial resources at home by allocating resources abroad (Stevens and Lipsey, 1992). This has the potential to reduce the domestic productivity of home firms in the long run by lowering their rate of accumulation of physical capital, thereby impairing their domestic investment. This in turn affects the long run rate of economic growth and employment of the country (Al-Sadig, 2013). On the other hand, it is also recognized that OFDI can actually be instrumental in fostering positive linkages with the source economy through the employment of domestic inputs and promotion of domestic investment in the manufacturing and service (information technology, management etc.) sectors by producing outputs in the host country. Such an increase in OFDI activities by home country multinationals may promote higher domestic investment and output, leading to long run economic growth (Desai, Foley and Hines, 2005)[2].

A review of the available theoretical and empirical literature on the association between domestic investment and OFDI provides two distinct economic views regarding the effect of OFDI on the home country investment – substitutability and complementarity, each of which has its own implications on domestic economic growth. In view of the controversies existing in the relevant theoretical and empirical literature about the potential impact of OFDI on domestic investment, the study of the direction of causality between these two macroeconomic variables becomes theoretically important and practically relevant because of the inherent growth and developmental implications of OFDI for the home countries and also for the rest of the world.
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[1] Foreign direct investment are the net flows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments (World Bank, 2012).

[2] The current deceleration in the growth of the emerging economies has once again made this question relevant. While the emerging markets as a group was growing at about 7 per cent before the crisis (2003-08), their post crisis growth rate fell to about 5 per cent by the next 5 years. Such synchronized deceleration has raised concern among the economists of the emerging nations as well as those of the developed countries because of the potential adverse spillover effects through trade and finance at the global level and eventual spillbacks on the original source economies themselves (Blanchard, Faruqee, Das, 2010; Harding, 2014).

The existing economic literature on OFDI-domestic investment nexus has been directed predominantly towards the developed countries such as the U.S., Sweden, Germany and Japan presumably because of the sheer volume of their foreign investment that have attracted wide research (Kim, S., 2000). On the other hand, seemingly because of the newness of this phenomenon in emerging economies and consequently, relatively lesser volume of OFDI activities in these countries, not much relevant literature could develop for these emerging nations. The OFDI-domestic investment literature for the advanced economies of the world may not be generally relevant for the emerging countries because the consequences of outward FDI may vary, for example, between capital-rich and capital-scarce OFDI-making countries[3]. Al-Sadig (2013) has recently accomplished a generic panel study on the relationship of OFDI with the domestic investment of 121 developing countries. However, OFDI, like any other macroeconomic variable, shows substantial cross country differences depending on the prevailing socioeconomic and political environment. There exists doubts therefore, as to whether the results of such generic studies which apply to the average country in the sample, are applicable to specific regions or nations. This research aims to fill the void by choosing to concentrate only on a small group of emerging economies[4] -- the BRIC[5] (Brazil, Russia, India and China) countries and explore the role of OFDI as stimulating or impairing their domestic investment for a period of 22 years from 1992 through 2013.

Why BRIC is Important

The four prominent emerging countries comprising BRIC, as a group, have become increasingly important economic players and have attracted the attention of the academia, politicians and media, largely because of their distinguished characteristics. These countries have been grouped as one entity presumably because each of them seems to be at a similar stage of economic development. The common elements shared by these economies are large population, cheap labor markets and vast amount of natural resources. Overall, the four BRIC countries cover over 25 percent of the world's land, contain about 40 percent of the world's population and account for about 17 percent of the world economy[6]. Since the middle of the 1990s, the per capita real annual growth rates of the BRIC countries have been much higher than those of the European Union and the US. Figure 1 shows that not only the BRIC as a whole, but also each individual BRIC nation has demonstrated rapid growth rate in the late 1990s and in the 2000s, far beyond the EU and the US. This sustained high growth rate for nearly two decades indicates that these countries are catching up to the developed countries and possess vast potential of further growth. The importance of BRIC is further accentuated since the implementation of their outward looking development strategies from the mid-nineties. China completed the first phase of its reforms, ex-Soviet enterprises were privatized and Brazil and India gradually liberalized their

[3] This is because, OFDI outflows transfer part of private domestic savings abroad (Al-Sadig, 2013).

[4] The emerging countries are considered to be those nations with social or business activity in the process of rapid growth, restructuring and industrialization along market-oriented lines to offer a wealth of opportunities in trade, technology transfers, and FDI. For additional information, read Li (2010), Sauvant (2005), Grant (2010).

[5] Jim O'Neil, then of Goldman Sachs, coined the acronym "BRIC" in 2001 (The Economist, 2013)

[6] Los Angeles Research Group (LARG).
http://www.laresearchgroup.com/brazil-russia-india-china-bric-nations-gdp.html

economies in the 1990s. The growing geo-political and economic importance of the BRIC is finally emphasized by the BRIC(S) countries' (the BRIC bloc and South Africa) approval in March 2013, during their meeting in Durban, of the creation of a new Development Bank to finance investment in infrastructure and more sustainable development in BRIC(S) and other emerging and developing countries (Griffith-Jones, 2014). Further agreements and deliberations in this direction have taken place at the meeting in Brazil in 2014.

Figure 1 about here

Design of the study

This study is a balanced panel analysis of short run and long run causality between OFDI and domestic investment for the four BRIC countries over 1992-2013. The remainder of this paper is organized as follows. While Section 1 presents the introduction, section 2 documents the statistics of OFDI and domestic investment for the BRIC economies. Section 3 delivers a review of the existing economic literature on this issue. In Section 4, we provide the data, postulate the methodology, perform the panel data analysis and analyze the empirical results. Section 4 which concludes the paper bears a summary of the findings and the policy prescriptions. We will try to keep all the technical discussions limited to the bare necessities for explaining the paper and instead provide the relevant references.

2. BRIC Nations –OFDI Flows and Domestic Capital Formation

OFDI

The BRIC countries together have demonstrated an amazing rise in OFDI flows as a group and also relative to the global FDI outflows. While rising economic prosperity and global aspirations of domestic firms have fuelled outward FDI to an extent in BRIC countries, high costs and lack of investment opportunities at home are also cited to be some of the other factors contributing to the surge in outbound FDI.

In some cases, FDI outflow from BRICs has begun to resemble a capital flight. For instance, 2011 saw $10 billion worth of Russian capital flow into property in EU countries. In Brazil, outward FDI has exceeded the value of inbound FDI. One of India's largest conglomerates, the Tata Group, has publicly acknowledged that there are better investment opportunities outside India. A survey conducted last year indicated that 60 percent of Chinese millionaires would consider immigrating abroad due to uncertainties over government policies (Mazumdar, 2014).

Table 1 reveals that global OFDI has increased 7 times from $204 billion in 1992 till it reached $1411 billion in 2013. Over the same period, the OFDI from the BRIC countries have displayed a spectacular increase of a factor of 34, from $5.7 billion in 1992 to $194 billion in 2013. Thus, outward FDI by BRICs has grown even more rapidly than that from the world, with the BRIC/World OFDI ratio rising by 11 percentage points over 1992-2013.

Table 1 about here

It is evident from Table 1 and Figure 2a that up to the year 2000, all the four countries showed similar modest FDI outflows. And so did the world. However, outward FDI by BRICs and also the overall global FDI outflows gained a momentum from 2000. While the world OFDI nearly doubled from $1.24 trillion to a peak at $2.27 trillion in 2007, the OFDI from the BRIC countries increased nearly 22 times from $7 billion in 2000 to $153 billion in 2008. In sync with the global recession, the world OFDI showed a decline over 2008-2009 after which it picked up once again, with occasional tremors but has not yet attained the 2007 level. Similarly, the OFDI from BRIC showed a temporary fall in 2009, and then went on a rapid growth path reaching an unprecedented height of $194 billion in 2013. This trend is aligned with BRICs' national policies to encourage domestic firms to invest globally.

Figure 2a about here

As observed in Table 1, China and Russia have been the leaders in OFDI outflows from the BRIC, alternating the lead position between themselves. From 1997 through 2007, the share of Russia in BRIC OFDI outflows dominated that of China. After 2007, China is observed to be the interrupted BRIC leader in OFDI. Presumably, due to the decline in Russia's political image globally, its OFDI fell drastically to about $8 billion in 2012, dropping its rank to 4 among the 4 BRIC nations. Russia seems to have recovered and has raised its OFDI flows to $95 billion in 2013. FDI outflows from Brazil and India remained consistently lower than those from China and Russia, barring occasional reversal of positions till 2007 from when Indian OFDI outflows have steadily exceeded those from Brazil. The Indian OFDI flows, alternating between the third and fourth positions among the BRIC nations, over the period, showed a remarkable rise of up to $21 billion in 2008, after which it has shown a steady deceleration till 2013. Brazilian FDI outflows have shown a very irregular pattern and even fell to negative values in 1996, 2001, 2009 and then from 2011 till 2013, up to where data is recorded for this paper.

China has been increasingly engaged in resource seeking OFDI in many resource-abundant countries of Africa, Central Asia and Latin America, driven by its rising demand for natural resources, particularly oil. Its banks also have made foray into the financial sectors of the developed economies. 80 to 90 percent of Chinese OFDI is driven by state-owned enterprises (SOEs). The prominent role of SOEs in the Chinese economy and the country's OFDI, allows the government a degree of direct influence, impossible for most other national policy makers. Until recently, China showed an inclination towards South-South OFDI -- Chinese OFDI mainly directed towards other developing economies. Only recently has it shown some deviation from its geographical direction of capital outflows. China has the most well-defined and sophisticated OFDI policy among the BRIC countries – its "Going Global" policy framework adopted in 2000, explicitly fosters OFDI (Sauvant, Maschek, McAllister, 2009).

OFDI from Russia has been rising from 2001 and went undeterred even during the recession, reaching nearly $67 billion in 2011. Russian firms have predominantly engaged in resource seeking FDI projects in pursuit of raw materials and access to strategic commodities. The role of government has been large and growing in Russia since 1999. SOEs account for 26 percent of all foreign assets held. Russia has demonstrated a preference to buy assets in developed countries mainly in USA and western Europe (Sauvant, Maschek, McAllister, 2009).

Liberalization of the OFDI regime from regulatory protection and supportive industrial and technology policies, in the early 1990s played significant role in facilitating OFDI from India. However, even now, OFDI flows from India are small, relative to that from Russia and China, partially reflecting its skepticism of allowing outward FDI on a larger scale. Nonetheless, as per the India Brand Equity Foundation (IBEF) report of June 2014, OFDI from India has more than doubled to $5.23 billion in March 2014 as compared to $2.16 billion in March 2013, according to the Reserve Bank of India (RBI) data[7]. Recent acquisition of foreign firms by prominent Indian business houses such as the Tatas, Wipro, Infosys, etc. have ignited economic, political and academic interest on the nature of Indian OFDI flows. Indian companies have focused their attention to mergers and acquisitions on high technology based knowledge intensive industries such as pharmaceuticals and information technology services. Majority of India OFDI is in the developed world such as USA, Western Europe, Japan and Australia (Sauvant, Maschek, McAllister, 2009).

OFDI flows from Brazil had been rising because of the internationalization plans of its firms in natural resources such as oil and gas, metals and mining, steel and also in cement and food and beverage industries. Appreciation of its currency also helped its internationalization process. Brazil has a preference of making OFDI to buy assets in developed countries mainly in USA and western Europe – a trend that is similar to that of Russia and India (Sauvant, Maschek, McAllister, 2009).

Domestic Investment

We now take a look at the domestic investment in the BRIC countries over 1992 through 2013 as represented by the ratio of gross fixed capital formation to GDP (used interchangeably with domestic investment) as shown in Figure 2b. Data reveals that China has been the leader in domestic investment over the whole period. Even with the credit crunch and the global recession in 2009, domestic investment in China shows signs of uninterrupted growth. India also demonstrated significant rise in domestic investment, following China. While Russia occupied the lead position, alternating with China in OFDI flows from the BRIC countries, it has been a laggard in domestic investment, consistently occupying the third position slightly higher than Brazil. Brazil has taken the fourth position in domestic investment all through in our sample. We also checked the OFDI-Domestic Investment ratios for the BRIC countries in Figure 2c. The ranking of such ratios show that Russia with a significantly high OFDI and consistently low domestic investment, has the largest ratio, somewhat followed by Brazil. On the other hand, China with substantially large values for both OFDI flows and GFCF, has, on an average, very low OFDI-Domestic Investment ratios. Otherwise, no clear trend for China and India is observable. They have conspicuously exchanged their positions from time to time.

Figures 2b and 2c about here

The inquiry into the domestic investment scenario of the BRIC nations is important because the economic literature (discussed in Section 3 below) reveals that eventual effect of OFDI on home country growth depends on the degree of complementarity and substitutability between its domestic investment and FDI outflows. Casual journalistic empiricism portrays that the

[7] "Indian Investment Abroad – Overseas Direct Investment by Indian Companies", www.ibef.org.

phenomenal rise in the BRIC/World OFDI ratio in Table 1 is attributable, not only to the rising economic prosperity and global aspirations of domestic firms but also to the high costs and lack of domestic investment opportunities (Mazumdar, 2014). We intend to check this hypothesis.

3. Literature Review

Given the pattern of OFDI flows and domestic investments in each of the BRIC nations, we once again address the questions about the impact of OFDI on the economic development for the BRIC economies. Does a fast growth of capital outflow in the form of OFDI imply that the domestic investment is losing attractiveness to the home country investors so that resources and consequently the economic activities are diverted abroad? Or whether the OFDI is actually a catalyst to domestic investment? The process of answering these questions leads us to a survey of the existing economic literature that points towards two opposite strands of thought in explaining the association between domestic investment and OFDI of the source economies – substitutability and complementarity. Rest of this section will explore the substitution and complementary association between the two variables both from the theoretical and empirical perspectives.

3.1 Substitution

Theoretical Literature

Economic literature predominantly indicates a relation of substitutability between OFDI and domestic investment and the resultant crowding out of investment in the home countries. This can happen in many ways. First, the domestic production of goods[8] could be shifted overseas due to the lower cost of capital abroad, the preferential tax treatment to foreign profits of home country corporations and other fiscal incentives (Stevens and Lipsey, 1992; Feldstein, 1995; Desai Foley and Hines, 2005 and Herzer and Schrooten, 2007). If the firms making such overseas investment partly self-finance the OFDI, there occurs a foreign transfer of at least a part of their domestic savings. This raises the domestic interest rate and crowds out domestic investment thus deterring the creation of new capital in the home economy. Thus, whether OFDI crowds out domestic investment also depends on how that FDI outflow was financed (Kim, 2000).

Second, when a firm builds a production base in a foreign country with low labor costs, there exists a possibility that it will in future continue to devote resources and create jobs in these foreign outlets to enjoy the advantages of low wage cost coupled with market penetration. This would in turn have unfavorable effects on home country investment, employment, growth and development.

Next, the segmentation of financial markets due to capital controls may also crowd out domestic investment. For example, in India, the capital control policies create a wedge between the capital cost of domestic versus foreign expansion because it is cheaper for Indian firms to secure debt for creation of foreign assets rather than domestic investment (Girma, Patnaik, Shah, 2010). This encourages shifting of domestic production overseas. Also, when capital market constraints do

[8] OFDI in services would have either neutral or positive effects on the rate of domestic investment because such FDI would not substitute exports (Al Sadig, 2013).

not allow firms to bring cheaper capital back to invest at home, gains from overseas production activity cannot be brought back to the home country and the growth in domestic investment could be slower (Girma, Patnaik, Shah, 2010).

Fourth, such crowding out might also become visible when domestic firms engage in offshore production with the primary objective of exporting back to home markets. Thus, foreign production through OFDI flows replaces the home country exports of that very product, leading to the crowding out of domestic investment through its export-replacing effect (Kim, 2000). Desai, Foley and Hines (2005) have argued that in the case of horizontal OFDI there is a possibility of the diversion of domestic investment provided the domestic production have been substituted by overseas production by the home country firms. However, in latter stages after the accomplishment of the initial horizontal cross-border investment, if the foreign operations utilize their domestic set-up, OFDI and domestic investments could become complementary to each other.

Also, substitutability could arise later in vertical OFDI when stages of the production process that were previously undertaken in the home country are now shifted to overseas locations. However, in such cases, where on the one hand, outward FDI displaces exports of finished products and on the other hand, promote exports of intermediate products from the parent or from other domestic firms in the home country to the firm's foreign affiliate, the net impact becomes unclear (Al-Sadig, 2013).

Empirical Findings

Feldstein (1995) derived robust results on substitutability from aggregate cross country data of major OECD countries during the 1970s and 1980s. He found a roughly one-to-one negative correlation[9] between OFDI and domestic investment indicating that outward investment and domestic investment are at least partial substitutes. One-to-one negative relation between OFDI and domestic investment has also been confirmed by Sauramo (2008) in his macroeconomic study for Finland over 1965–2006. Desai, Foley, and Hines (2005a) have also supported negative association between OFDI and domestic investment for OECD-countries for the 1980s and 1990s in line with Feldstein but with a larger sample set of OECD economies. Such substituting relationship, although less than dollar to dollar negative association was also confirmed by Andersen and Hainaut (1998), employing data for the United States (US), Japan, Germany, and the United Kingdom (UK) spanning from the 1960s until the 1990s. That the OFDI by Swedish multinationals had a negative effect on the size of their home country's capital stock has been established by Svensson (1993). Herzer and Schrooten (2007) conducted a similar analysis for the US and Germany. They distinguished between the short-run and long-run effects of outward FDI on domestic investment in Germany and found that the long-run effect was negative for Germany.

3.2 Complements

Theoretical Literature

Positive or complementary association between OFDI and domestic investment could happen in situations of efficiency-seeking OFDI where the home and overseas production activities are

[9] This means that every dollar amount of OFDI causes one dollar to be less invested at home thus indicating a perfect substitutability between the two variables.

deliberately combined by the investing firms to exploit the economies of scale, reduce costs and enhance the efficiency in domestic production and investment efforts. While foreign production through OFDI flows can replace the possibility of home country exports of that very product, such production could also be export-supporting in that it could generate demand for the tangible and intangible resources, such as capital goods or intermediate goods and services available to the domestic counterpart of the capital exporting firms. In other words, the internationally operating domestic firms may import significant amounts of inputs and technology (machinery and other capital equipment, domestically manufactured production inputs and specialized services, software, technical and managerial consultancy) from their parent companies as conduits of the initial FDI made from the home country. These products that may be provided by other parts of the parent company, its suppliers, or independent firms at home would possibly complement domestic investment (Kim, 2000) and thus generate increased economic activity and employment, as well as tax revenues, exports and also the spillover of imported technologies to the domestic firms. Such FDI where the production process is partly relocated to the home country, thus complementing exports of capital and intermediate goods and services are vertical (Braunerhjelm, Oxelheim and Thulin, 2006) and thus do not immediately reduce home country production (Al-Sadig, 2013).

Empirical Findings

Desai, Foley and Hines (2005) have suggested positive relationship between OFDI and domestic investment. Using time-series data on capital expenditures of US multinational companies they found a direct association between their capital expenditure abroad and their domestic capital spending, thus establishing the complementarity between OFDI and domestic investment of these US firms. Strong positive association has also been found by Stevens and Lipsey (1992) who have employed firm-level data involving the domestic and foreign operations of seven US MNEs for a period of 16 to 20 years. Complementarity is established in Faeth (2006) for Australian balance of payments data.

4. Data, Methodology, Analysis

4.1 Data

The study considers a comprehensive set of six relevant economic variables that could be expected to explain domestic investment. While gross fixed capital formation (GFCF) representing domestic investment is the dependent variable, we consider five macroeconomic variables as the determinants of GFCF – OFDI, growth of per capita GDP (GGDPPC), overall trade in the economy (TR)[10], broad money supply (M2) and real rate of interest (R). GFCF, OFDI, M2 and TR are measured as ratios to GDP[11]; the interest rate and economic growth rate are used as is. While, we are actually interested in the relation between OFDI and domestic investment, the other variables are the control variables of the model. These control variables are

[10] Export + Import as a percentage of GDP.

[11] Differences in the size of the BRIC countries can generate biasness which can be eliminated by using the variables as ratios of GDP of the respective countries.

chosen from the literature on the determinants of domestic investment[12] (Luca and Spatafora, 2012; Lim, 2013). The nature and direction of expected relationships of the control variables with GFCF are presented in Table 2.

Table 2 about here

Data Source

All data are secondary. Data on OFDI are obtained from *UNCTAD Statistics*. The rest of the data are acquired from the World Bank's *World Development Indicators*. Because some of our data have negative values, we chose not to transform the data into natural logarithms. Notwithstanding the merits of natural logs, the transformation of the negative values into positive ones to accommodate natural logs would bring in artificiality in the data that is feared to vitiate the results. Definitions of the variables as provided by the World Bank and UNCTAD are presented in Table 2 above.

Empirical Framework

We have employed a balanced panel of four countries – Brazil, Russia, India and China over the period of 22 years from 1992 through 2013. In order to empirically investigate the relationship between domestic investment and outward FDI flows for the four BRIC countries using other variables mentioned above, that might jointly influence domestic investment. In the light of the above discussion, we propose the following model for estimation and analysis:

$$GFCF_{it}=\alpha_i+\beta_1 OFDI_{it}+\beta_2 GGDPPC_{it}+\beta_3 TR_{it}+\beta_4 R_{it}+\beta_5 M2_{it}+\varepsilon_{it} \qquad (1)$$
$$(+) \quad (+) \quad (-/+) \quad (+) \quad (-)$$

where ε is the stochastic disturbance term with a mean of zero and the subscripts *t* and *i* are indices for the years and countries respectively. The signs below each variable indicate its expected relation with GFCF.

If OFDI directly raises capital formation in the home countries, then the BRIC countries should adopt appropriate policies to ease and strengthen the flow of overseas FDI. However, if domestic investment rises because of other factors such as policies related to trade, real interest rate, broad money supply or per capita GDP growth, then economic policies should be focused on those the promotion of those variables with the purpose of boosting domestic investment. On the other hand, if OFDI reduces domestic investment, then the BRIC countries ought to desist from encouraging capital outflows in the form of overseas FDI flows.

4.2 Methodology, Data Analysis

Given the longitudinal nature of the dataset, panel data analysis techniques will be used. In this study we retain the standard assumption of the independence of the disturbance terms or error terms across cross-sectional units. However, we acknowledge the possibility of the economic or financial situation of one country affecting other countries through international trade and rise in

[12] Economic literature on the determinants of domestic investment contains many other factors from which we selected a few, given the limited nature of the cross section and time series dimensions of our panel data on the BRIC countries.

economic and financial integration, arising due to spatial or spillover effects, or due to unobservable common factors. This implies that the error terms may in fact, have cross-sectional dependence. According to Baltagi (2008), cross-sectional dependence is specially a problem in macro panels with long time series, say, over 20-30 years. Controlling for cross-sectional dependence is of vital importance in the panel unit root and cointegration literature because the presence of cross-sectional dependence is likely to cause substantial size distortions (Banerjee, 1999; Pesaran, 2007) increasing with the number of cross sections (Banerjee, Marcellino and Osbat, 2004; 2005). In that case, the second generation panel tests yield a more consistent, efficient and powerful estimation (Bayar, 2014) in the face of cross section dependence. But as mentioned in Baltagi and Banerjee, Marcellino and Osbat above, application of second generation tests require more time series and cross section units to generate effective results[13]. With 22 years in time series and 4 countries as cross section units, our data set poses a borderline case, as per the above thresholds. We therefore choose to pursue the first generation standard panel tests, based on cross section independence, in the rest of the paper. Extending the number of years and expanding the set of cross section units could have solved the econometric dilemma. But, the inclusion of an increased number of years is not feasible in this particular study because OFDI is a new phenomenon for the BRIC countries, starting predominantly in the 1990s. Adding more cross section units is not possible either, as the focus of this study is strictly the four BRIC nations as a bloc.

We have performed the panel test for causality between the variables in the BRIC countries in three steps. First, as part of the data analysis, we will need to test for presence of stationarity/the order of integration of the values of the relevant time series variables in order to provide valid empirical evidence on the relationship between the variables. This is essential because if the variables are not stationary, the direct application of ordinary least squares (OLS) or generalized least squares (GLS) regression analysis will generate spurious results making the test statistics invalid or misleading. These regressions would produce inflated performance statistics, such as high R^2's and t-statistics, which often lead investigators to commit a high frequency of Type I errors (Granger and Newbold, 1974). Next, having established the order of integration in the series, we carry out heterogeneous panel cointegration[14] test for the long run relationships between the variables of interest. In other words, we need to determine whether or not there exists at least one linear combination of the non-stationary variables that is cointegrated (integrated of order zero). If the variables share a common stochastic trend and their first difference is stationary, then they can be cointegrated. Finally, dynamic heterogeneous panel causality will be used to assess the short run cointegration. The direction of causality between the two variables is then inspected using heterogeneous panel causality tests. We will always assume balanced panels and lag orders (P) identical for all cross-units, respecting the condition $T > 5 + 2P$, which are important to guarantee the validity of the proposed tests (Hurlin, 2004).

Panel Unit Root Tests

In order to estimate the economic long run cointegrating relationships between the variables and to test Granger causality we must first check the order of integration by performing unit root

[13] For example, the cointegration tests are very sensitive to the size and fail to generate results with fewer data.

[14] Granger (1980) first introduced the concept of co integration into the literature.

tests. The number of observations in our panel (4 countries x 22 annual observations) does not lend itself to the application of single-unit root tests for time series. Therefore, we opt to use panel unit root tests in potentially nonstationary time series in order to avoid possible spurious regression. The use of panel-based tests is necessary because the power of standard time-series unit root tests may be quite low given the small sample sizes and relatively short time span employed in this exercise (Christopoulos and Tsionas, 2004). These panel tests not only increase the power of unit root tests due to the span of the observations, but also minimize the risks of structural breaks. When all the variables are stationary, we can apply the traditional estimation methods to estimate the (causal) relationship among variables. In case, at least one of the series is non-stationary we need to provide greater care.

A number of panel unit root tests such as those by Levin, Lin and Chu (LLC; 2002), Im, Pesaran and Shin (IPS; 2003, 2007), Maddala and Wu (1999) and Hadri (1999) have been developed for balanced panel data set in recent years. In this study, we have employed the LLC and IPS panel unit root tests, because they give better results in small samples. LLC and IPS use nonstationarity as the null hypothesis. Furthermore, LLC and IPS tests are a generalization of the ADF test from single time series to panel data series to panel data against the alternative of non-stationarity of the series (Baltagi, 2008). These tests have demonstrated that panel unit root tests are more powerful (less likely to commit a Type II error) than unit root tests applied to individual series because of increased sample size and the inclusion of heterogeneous cross-sectional information which is not available in univariate time series data (Baltagi, 2008). In addition, in contrast to individual unit root tests which have complicated limiting distributions, panel unit root tests lead to statistics with a normal distribution in the limit (Baltagi, 2008). LLC test assumes general unit root process in determining stationary of series. Different from LLC test, IPS test considers unit root process concerning each cross section. However, in recognition of the possibility of cross-sectional dependence in error terms, we also use the Cross-Sectionally Augmented IPS Panel Unit Root Test (CIPS)[15] – the second generation unit root test proposed by Pesaran (2007) designed specifically for exploring unit root in variables with cross section dependence in error terms. To define the approach of these tests (except CIPS), we consider the following AR(1) process:

$$Y_{it}=\rho_i Y_{it-1}+\delta_i X_{it}+\xi_{it} \quad .(2)$$

where i=1,2, …., N shows cross section series and *t=1,…,T* shows time series observations.

Xit shows exogenous variables. *ρi* values show autoregressive coefficients, *εit* values show error terms. If $|\rho i| < 1$, values are trend stationary. On the other hand, if $|\rho i|=1$, then *Yi* series has unit root. There are two assumptions in panel unit root tests. First assumption is parameters for all cross section variables are same ($\rho i=\rho$). The LLC test use this assumption in their tests. The second assumption is that *ρi* is changeable for all cross section data. The IPS test considers this assumption.

[15] The CIPS test is a panel fixed effects test allowing for parameter heterogeneity and serial correlation between the cross-sections, correcting their dependency. CIPS test is based on the IPS test and uses a common factor structure to account for cross-sectional dependence.

All the tests have been carried out in level and in first difference with both intercept and trend at 5 percent level of significance. The results are indicated in Table 3. The results support the conclusion that the series are stationary only after being differenced once for the first generation unit root tests as well as for the second generation (CIPS) test.

Table 3 about here

Cointegration Test

Having established that all the variables are stationary that is, integrated of order one, based on the results of LLC, IPS and CIPS unit root tests, we now apply panel cointegration method to test whether the involved economic variables have a stable and non-spurious, long run (cointegrating) relationship among themselves over the relevant time span[16] (Granger, 1980). Cointegrated variables are expected to move together over time so that short-term disturbances get corrected in the long-run. If the series are not cointegrated, they may wander arbitrarily far away from each other (Dickey, Jansen and Thornton, 1991). The heterogeneous panel cointegration test developed by Pedroni (1999, 2004) allows for cross-sectional interdependency among different individual effects by allowing for heterogeneity in the intercepts and slopes of the co integrating equation. Being based on panel data, Pedroni's test also overcomes the problem of small samples.

Pedroni's method includes a number of different statistics for the test of the null of no cointegration in heterogeneous panels[17]. The first group of tests is termed "within dimension". It includes the panel-v, panel rho(r), which is similar to the Phillips and Perron (1988) test, panel non-parametric (PP) and panel parametric (ADF) statistics. The panel non-parametric statistic and the panel parametric statistic are analogous to the single-equation ADF-test. The other group of tests is called "between dimensions". It is comparable to the group mean panel tests of Im, Pesaran, Shin (2003). The "between dimensions" tests include four tests: group-rho, group-pp, and group-ADF statistics. We carried out 2 tests shown in Table 4 – one with no deterministic trend and the other with deterministic intercept and trend. In each of the tests, majority of the results were significant. So we reject the null hypothesis of no cointegration and accept the presence of long run association among the variables. It transpires therefore, that when we consider all the BRIC countries together in panel data we find that there is cointegration among these variables indicating the presence of a long run relation.

Table 4 about here

Panel Dynamic OLS Test

When there is long run association among variables, we can run the Dynamic OLS (DOLS) procedure of Stock and Watson (1993) to estimate the long run coefficients. DOLS is a

[16] Granger (1980) showed that when the series becomes stationary only after being differenced once (integrated of order one), they might have linear combinations that are stationary without differencing. In the literature, such series are called "co integrated". If integration of order one is implied, the next step is to use co integration analysis in order to establish whether there exists a long-run relationship among the set of the integrated variables in question.

[17] Details and mathematical representation of the tests are found in Pedroni (2004).

framework for estimating and testing hypothesis for homogeneous cointegrating vectors (Kao and Chiang, 2000; Mark and Sul, 2003). It is believed to provide unbiased and asymptotically efficient estimates of the long run relation even in the presence of endogenous regressors. DOLS estimates have better small sample properties and works better than OLS by coping with small sample sources of bias. It provides superior approximation to normal distribution.

Table 5 presents DOLS estimates of our variables with the maximum lag length for the model, based on the unrestricted VAR estimation using the Akaike Information Criteria (AIC). The lag and lead terms are included in DOLS regression with the purpose of making its stochastic error term independent of all past innovations in stochastic regressors. The coefficient of OFDI is positive which implies that an increase in OFDI would raise domestic investment. This signifies complementary relation between the two variables. The coefficient is 1.94, which implies that a one unit increase in OFDI leads to a rise in home country investment by about 1.94. Thus, the impact of FDI outflows is nearly double on home country investment. The result is significant since the probability value is less than 5 percent. This means that for the BRIC countries as a whole, OFDI has influence on domestic investment.

Table 5 about here

Real rate of interest and broad money supply also have positive, substantial and probabilistically significant impact on domestic investment in the BRIC nations. Usually, a high interest rate level raises the real cost of capital and therefore dampens the private investment level. However, the positive association between R and GFCF is possible when an increase in interest rates leads to an increase in the volume of financial savings through financial intermediaries and this increase raises investible funds, a phenomenon that McKinnon (1973) calls the "conduit effect". The positive relation between M2 and GFCF is expected. It signifies financial deepening, indicating a favorable level of financial development. The impact of per capita GDP and trade openness do not show significant effects on domestic investment.

Granger Causality Tests

Having confirmed the existence of long run association between OFDI and GFCF, we now proceed to explore the short run relation between these two variables, that is, whether OFDI causes GFCF in the short run. Following the seminal work of Granger (1969) on time series causality, we say that OFDI *causes* GFCF if we are able to better predict *GFCF* using all available information than in the case where the information set used does not include *OFDI*. To investigate this phenomenon, we test for cross-causality between the variables running the new panel pairwise Granger causality test, proposed by Dumitrescu and Hurlin (2012).

In order to allow for the property of heterogeneity in the panel data framework, Dumitrescu and Hurlin propose extending the Granger causality approach by adding cross-sectional units to the time series dimension. This is a simple test of Granger non-causality for heterogeneous panel data and can be used in the case when N>T or T>N or N grows and T fixed in a balanced panel. This test allows all coefficients to be different across cross-section and run a Granger causality test for each cross section individually and take the average of the test statistics across the cross-sectional units. Hence, it develops a test of no causality which accounts for Homogenous Non-Causality (HNC), i.e., no causal relation for any of the units of the panel) under the null. Under

the alternative, it specifies the heterogenous hypothesis defined as the cross-sectional average of the Wald statistics associated with the individual Granger causality tests. Two subgroups of cross-sectional units are therefore defined: one characterized by causal relations from the independent variable to the dependent variable and another subgroup for which there is no causal relation.

We consider pair-wise Dumitrescu and Hurlin model of panel causality test for OFDI and GFCF which may be represented as follows:

$$GFCF_{it}=\alpha_i+\sum_{p=1}^{P}\beta_i^{(p)}GFCF_{i,t-p}+\sum_{p=1}^{P}\gamma_i^{(p)}OFDI_{i,t-p}+\varepsilon_{it}\ \ i=1,2,\ldots\ldots,N\ and\ t=1,2,\ldots,T. \quad (3)$$

where the variables are stationary, for N countries in T periods. The lag orders P are assumed to be identical for all cross-section units in the panel. The intercept denote the autoregressive parameter and other parameters are the parameters of the regression coefficients. These are assumed to be different across countries. Similar with the bivariate Granger causality tests, in this test also, *OFDI* causes GFCF if and only if the past values of *OFDI* observed on the i^{th} country improve the forecast of GFCF. The direction of the causality is tested under the null hypothesis of HNC or OFDI does not homogenously cause GFCF for all countries, against the alternative hypothesis that causality exist at least one country in the sample. Technically, the null and alternative hypothesis[18] can be written as follows:

H_0: $\gamma_i=0$ for all i=1, 2, …, N where $\gamma_i=(\gamma_i^{(1)},\gamma_i^{(1)},\ldots.,\gamma_i^{(1)})'$

H_1: $\gamma_i=0$ for all i=1, 2, …, N_1
and $\gamma_i\neq0$ for all i=N_1+1, N_1+2,…..,N.

where N_1 is unknown but satisfies the condition $0\leq N_1/N< 1$. This means that there can be non-causality for some of the countries under the alternative (the causal relationships may be heterogeneous across countries).

The panel test statistic is calculated as the average of individual Wald statistics defined to test the Granger non causality hypothesis for each country. Under the assumptions above the panel statistic sequentially converges under the HNC hypothesis to a normal distribution, when T tends to infinity first and then N tends to infinity. Using a standardized statistic $Z_{N,T}^{HNC}$, the HNC hypothesis is rejected if $Z_{N,T}^{HNC}$ is larger in absolute value than the corresponding normal critical value for a given level of significance. Dumitrescu and Hurlin show that the small sample power properties of their test exceed that of time series Granger causality tests even for small values of T (e.g. around 10).

Starting values for OFDI and GFCF are assumed to be observed. The individual effects α_i are assumed to be fixed. We allow for heterogeneity of the model since $\beta_i^{(p)}$ and $\gamma_i^{(p)}$ may differ

[18] The hypotheses are as follows:
H0: There is Homogeneous Non Causal (HNC) Relationship from OFDI to GFCF
H1: There is at least one Causal Relationship from OFDI to GFCF within the Sample

across cross-section units. The error terms ε_{it} are assumed to be iid $(0,\sigma_i^2)$ and independently distributed across units. The Pairwise Dumitrescu Hurlin Panel Causality Test is carried out in Table 6, on all six variables to upto 4 lags. The results show short run causality running from OFDI to GFCF in all the lags except 2. Thus, in our model, the past values of *OFDI* observed on the i^{th} country improve the forecast of GFCF.

Table 6 about here

5. Conclusion and Policy Implications

5.1 Findings of the Panel Analysis

The Unit Root tests indicate that our variables are nonstationary at level but stationary at first difference. Given the stationarity of the variables, we applied the Pedroni test of panel cointegration. We found the variable to be cointegrated amongst themselves, that is, they have long run relationship among themselves. Our DOLS results show that OFDI has positive and substantial and statistically significant effect on domestic investment in the BRIC countries indicating complementarity between the two variables. We examine the presence of the short run association, and to look into specific causality of pairs of variables, we have used the Pairwise Dumitrescu Hurlin Panel Causality Test. It clearly shows pairwise causality between OFDI and domestic investment in most of the cases. This means that for the BRIC countries as a whole, OFDI has influence on domestic investment both in the long-run as well as in the short run. Moreover the impact of OFDI on home country investment is positive, signifying complementarity between the two variables. Economic literature has identified that growth in domestic investment raises domestic growth rate[19]. So we can expect that OFDI-induced increase in domestic investment would boost economic growth in these countries in the long run.

We refer back to Figure 1 that shows the GDP growth rates for the BRIC countries. Comparing the investment levels of Figure 2 and the growth rates in Figure 1, we find that China has been leading both in domestic capital formation and economic growth. Similarly India was in the second position in domestic investment and also maintained predominantly the second position in growth rate. Thus, some of the BRIC countries display a correspondence between home country investment and economic growth, upholding the Harrod-Domar growth theories and the latter endogenous growth models that high investment rates could be instrumental in raing the growth rates of the countries.

[19] The early growth models of Harrod (1939) and Domar (1946) assumed that output was proportional to capital and thus growth rate of output would be proportionally related to the growth rate of capital that is investment. Later on, the endogenous growth models of Romer (1986), Lucas (1988) etc. based on the Harrod-Domar assumptions of constant returns to capital, also conclude that higher investment rates lead to a higher growth rate of output (Agarwal, Sahoo, Dash, 2007).

5.2 Policy Implications

Exploring the role of OFDI in boosting domestic investment and long run economic growth acquires even more importance in the current global scenario when the BRIC countries are showing a remarkable decline in their growth rates since 2011. Table 7 reveals that the growth rates of the BRIC countries reached unprecedented heights in 2007 after which it started falling for 2008 and 2009. The rates showed some signs of recovery in 2010. But it is from 2011, that the rates have plummeted steadily.

Table 7 about here

The plunge in the growth rates in BRIC since 2007 can be attributed to the current financial crisis in the world, which had also affected the ability of most of the BRIC countries to invest abroad. For example, Indian firms had great difficulty in financing their foreign expansion largely through credits, in the face of the credit crunch. Table 1 shows that Brazil, Russia and India experienced a fall in OFDI in 2009 after which Brazil and India could revert back to rising OFDI once again. But it is evident from our data that China had never to face falling OFDI after the crisis in 2008. This is because of a stable currency value and the availability of domestic liquidity in China. The appreciation of the Renminbi vis-à-vis the dollar and euro has helped Chinese firms to acquire dollar and euro denominated assets. Chinese domestic liquidity is partly fuelled by an immense foreign reserves pool, part of which is under the management of several Chinese sovereign wealth funds (SWFs)[20]. However, SWFs for example from China, have reduced their investments abroad because of various reasons such as poor performance by earlier investments, fall in the growth of their resources and also because of skepticism surrounding the FDI outflows made by the SWFs (Sauvant, Maschek, McAllister, 2009). Also, there exists a popular sentiment that the emerging economies, in general, should abstain from promoting OFDI activities when economic growth rates are falling, because the outflow of capital diminishes net external finance for domestic investments and this could have further negative repercussions on the economic growth rate. Such concern naturally got aggravated with the global economic crisis in 2008 when the BRIC economies, like other emerging nations, experienced acute capital withdrawal (Rajan, 2009).

This study, engaged in the investigation of the impact of OFDI on domestic investment in the BRIC nations for the period 1992-2013, has empirically established the long run and short run effects of OFDI on domestic investment, using the panel methods of co-integration and causality. The observed complementarity between OFDI and domestic investment implies that OFDI can actually be instrumental in promoting domestic investment in the manufacturing and service sectors of the BRIC countries that would lead to the rise in employment of domestic inputs and eventually lead to long run economic growth. To promote growth enhancing OFDI, the governments of the BRIC countries, in collaboration and engagement with their private sectors need to promote OFDI that would raise and sustain domestic investment and consequently their economic growth. This in turn would generate more employment, improve living standards and help alleviate poverty[21]. Some of the policy recommendations could be the following:

[20] SWFs are government asset management agencies that invest domestic resources in foreign assets.

[21] During the last three decades, economic activity in the BRIC countries have made considerable contributions in reductions of absolute poverty, particularly in Brazil and China, which together account for 25 percent of the

- The BRIC countries need to engage more intensely in natural resource seeking OFDI that would access raw materials such as oil, minerals and metals to be exported back to the country for further processing and use in domestic production. This would help raise GDP and growth rate.
- These countries should also access superior technology in advanced countries which could be used at home to further domestic investment and growth.
- The multinational companies of these countries need to be incentivized to remit their profits from their overseas investment and reinvest their remittances at home to stimulate economic growth.
- Improved access to domestic finance is necessary to keep the BRIC firms to expand international operations through OFDI. This requires the further development of private capital markets.
- While fostering OFDI that would crowd-in domestic investment, the nations have to carefully monitor that their OFDI activities do not crowd-out domestic investment.
- To motivate more OFDI from the BRIC nations, the governments should further simplify the approval process, raise the threshold value of projects for which approval is required, disseminate information on investment projects and on problems previously experienced and develop more succinct guidelines. This would provide a policy framework of increased guidance and support.
- To achieve and sustain a balance between the benefits of overseas investments and the need for domestic capital formation, economic growth and employment, all stakeholders – the government, central bank, professional and industry bodies and domestic firms of each country should constantly review the policies, procedures and Home Country measures.

The set of policy prescriptions suggested in the study is envisaged to enable the individual nations in the BRIC bloc to reap the benefits of capital outflows in the form of OFDI, while preserving the national interests of higher domestic investment and economic growth and thus attain and sustain their macro-economic stability. We hope and expect that the results and the recommendations of this research will make important contribution towards the FDI literature and towards effective policy decision making regarding overseas FDI flows from the BRIC economies.

world's population. Fall in the poverty rate of India was not as pronounced. Headcount poverty rate is the highest in India – with about 42 percent of its population living in extreme poverty on less than $1.25 a day. Taking this measurement as standard, Russia virtually eradicated absolute poverty since 2009, although its national level of subsistence is widely contested, and by some measurements, 12.8 percent of Russian population lives below it (Ivins, 2013).

Graphs and Tables

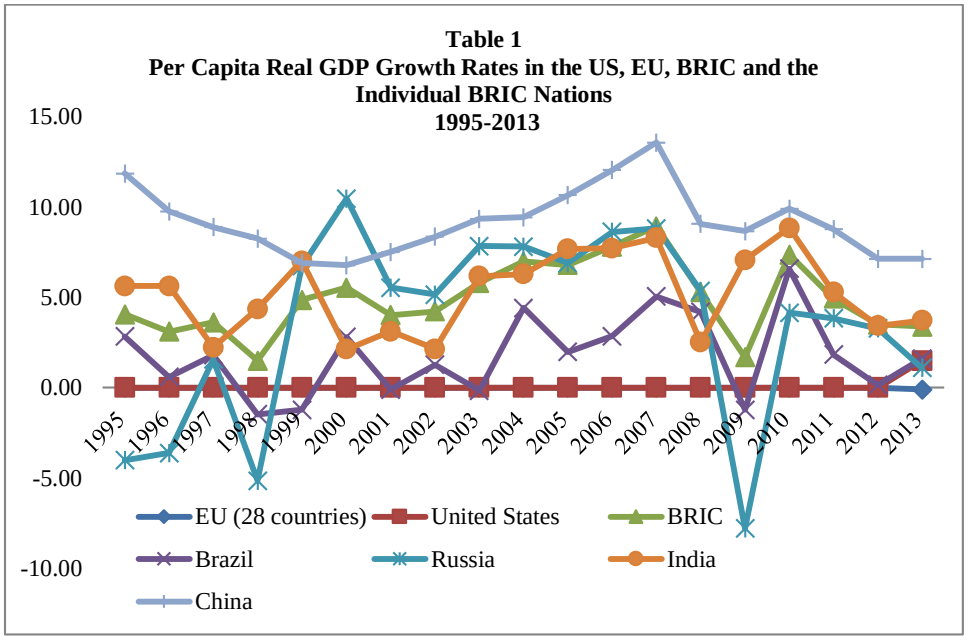

Table 1
OFDI from the BRIC and the World
1992-2013

	OFDI ($bn.)										
Year	**Brazil**	**Russia**	**India**	**China**	**BRIC**	**World**	**BRIC/ World**	**Brazil/ BRIC**	**Russia/ BRIC**	**India/ BRIC**	**China/ BRIC**
1992	0.14	1.57	0.02	4	5.73	204.05	0.03	0.02	0.27	0	0.7
1993	0.49	1.02	4E-04	4.4	5.92	242.77	0.02	0.08	0.17	0	0.74
1994	0.69	0.28	0.08	2	3.05	286.87	0.01	0.23	0.09	0.03	0.66
1995	1.10	0.61	0.12	2	3.82	361.94	0.01	0.29	0.16	0.03	0.52
1996	-0.47	0.92	0.24	2.11	2.81	394.79	0.01	-0.17	0.33	0.09	0.75
1997	1.12	3.18	0.11	2.56	6.98	475.91	0.02	0.16	0.46	0.02	0.37
1998	2.85	1.27	0.05	2.63	6.81	689.37	0.01	0.42	0.19	0.01	0.39
1999	1.69	2.21	0.08	1.77	5.75	1091.90	0.01	0.29	0.38	0.01	0.31
2000	2.28	3.18	0.51	0.92	6.89	1241.22	0.01	0.33	0.46	0.08	0.13
2001	-2.26	2.53	1.40	6.89	8.56	758.82	0.01	-0.26	0.30	0.16	0.81
2002	2.48	3.53	1.68	2.52	10.21	528.11	0.02	0.24	0.35	0.16	0.25
2003	0.25	9.73	1.88	2.86	14.71	580.69	0.03	0.02	0.66	0.13	0.19
2004	9.81	13.78	2.18	5.50	31.26	919.76	0.03	0.31	0.44	0.07	0.18
2005	2.52	17.88	2.99	12.26	35.64	904.27	0.04	0.07	0.50	0.08	0.34
2006	28.20	29.99	14.28	21.16	93.64	1425.32	0.07	0.30	0.32	0.15	0.23
2007	7.07	44.8	17.23	26.51	95.61	2267.16	0.04	0.07	0.47	0.18	0.28
2008	20.46	55.66	21.15	55.91	153.18	1999.33	0.08	0.13	0.36	0.14	0.37
2009	-10.08	43.28	16.03	56.53	105.76	1171.24	0.09	-0.10	0.41	0.15	0.53
2010	11.59	52.62	15.93	68.81	148.95	1467.58	0.10	0.08	0.35	0.11	0.46
2011	-1.03	66.85	12.46	74.65	152.93	1711.65	0.09	-0.01	0.44	0.08	0.49
2012	-2.82	48.82	8.49	87.8	142.29	1346.67	0.11	-0.02	0.34	0.06	0.62
2013	-3.50	94.91	1.679	101	194.09	1410.81	0.14	-0.02	0.49	0.01	0.52

Source: UNCTAD FDI Statistics
The ratios are computed by the author.

Table 2a
OFDI for the BRIC Countries ($bn), 1992-2013

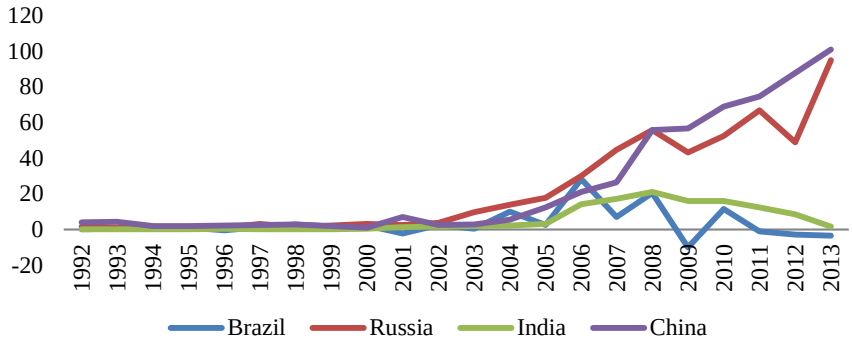

Table 2b
GFCF in the BRIC Countries ($bn), 1992-2013

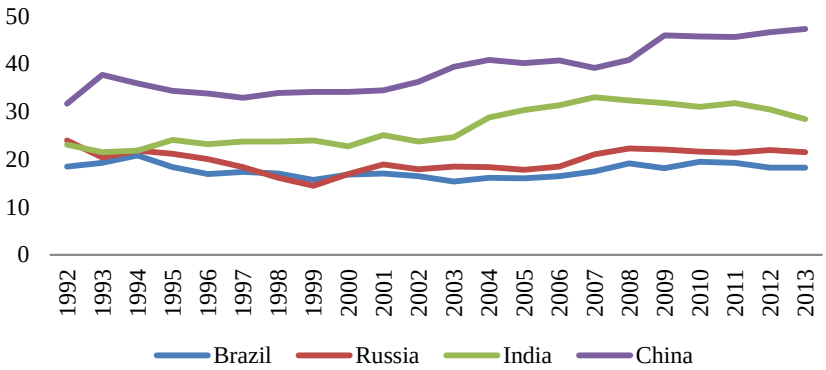

Table 2c
OFDI/GFCF for the BRIC countries, 1992-2013

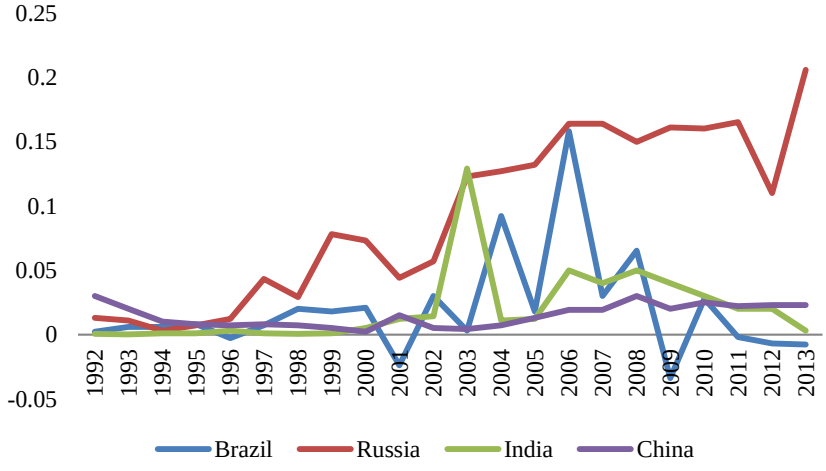

Table 2
Variables in the Study

Dependent Variable	**Definition**	
Gross Fixed Capital Formation (GFCF)	Gross fixed capital formation (formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. It is divided by GDP.	
Independent Variables	**Definition**	**Expected Direction of Relationship with GFCF**
Outward FDI Flows (OFDI)	Outflows of investment from the reporting economy to the rest of the world and is divided by GDP.	Economic Openness (>0, <0)
GDP per capita growth (annual percent) (GGDPPC)	Annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2005 U.S. dollars. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.	Change in aggregate demand for output based on the principle of acceleration (>0) (Blomstrom, Lipsey and Zejan, 1996; De Long and Summers, 1991)
Real Rate of Interest (R)	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator. The terms and conditions attached to lending rates differ by country, however, limiting their comparability.	Cost of borrowing (<0) Reward for saving (>0) through conduit effect on GFCF (McKinnon, 1973)
Trade (TR)	Trade is the sum of exports and imports of goods and services measured as a share of GDP.	Trade liberalization coefficient as an indicator of trade openness (>0) through technology and knowledge spillovers. An economy highly integrated to the world is expected to attract investments in tradable sectors in order to increase productivity and competitiveness (Balasubramanyam, Salisu and Sapsford, 1996). (<0) if consumers prefer imported products (Ndikumana, 2000).
Money and quasi money (M2)	Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. It is measured as a share of GDP.	Financial deepening/intermediation indicating the level of financial development – the liquidity available to finance investment (>0)

Source: World Development Indicators, World Bank; UNCTAD FDI Statistics.

Table 3
Panel Unit Root Tests for BRIC Countries

Variable	Unit Root Methods		Level		First Difference		Decision*
			Intercept	Intercept & Trend	Individual Intercept	Individual Intercept & Trend	
GFCF	LLC	t Statistic	0.25	1.1	5.27	2.94	
		Probability	0.4	0.14	0	0	I(1)
	IPS	W Statistic	0.56	0.23	4.86	2.97	
		Probability	0.71	0.59	0	0	I(1)
	CIPS	Zt-bar	-1.23	-0.65	-1.82	-3.37	
		Probability	0.1	0.26	0.03	0	I(1)
OFDI	LLC	t Statistic	0.45	0.11	12.36	11.13	
		Probability	0.67	0.46	0	0	I(1)
	IPS	W Statistic	0.7	0.22	11.57	10.84	
		Probability	0.76	0.41	0	0	I(1)
	CIPS	Zt-bar	0.7	0.68	-1.98	-3.68	
		Probability	0.76	0.75	0.02	0	I(1)
GGDPPC	LLC	t Statistic	4.12	3.79	9.67	8.64	
		Probability	0	0	0	0	I(1)
	IPS	W Statistic	4.02	2.66	9.42	8.24	
		Probability	0	0	0	0	I(1)
	CIPS	Zt-bar	-1.75	0.38	-1.59	-2.85	
		Probability	0.04	0.65	0.06	0	I(1)

Source: Computed by author.

Table 3(contd.)
Panel Unit Root Tests for BRIC Countries

Variable	Unit Root Methods		Level		First Difference		Decision*
			Intercept	Intercept & Trend	Individual Intercept	Individual Intercept & Trend	
TR	LLC	t Statistic	0.31	2.4	3.57	5.5	I(1)
		Probability	0.62	0.99	0	0	
	IPS	W Statistic	0.25	1.92	5.61	2.6	I(1)
		Probability	0.6	0.03	0	0	
	CIPS	Zt-bar	-1.55	1.43	-2.29	-8.02	I(1)
		Probability	0.06	0.92	0.01*	0	
R	LLC	t Statistic	0.9	1.94	8.61	5.97	I(1)
		Probability	0.18	0.03	0	0	
	IPS	W Statistic	0.55	2.39	7.42	6.16	I(1)
		Probability	0.29	0.009	0	0	
	CIPS	Zt-bar	0.42	2.11	-5	-2.07	I(1)
		Probability	0.66	0.98	0*	0.02	
M2	LLC	t Statistic	0.51	-2.56	-7.59	-6.84	I(1)
		Probability	0.69	0.005	0	0	
	IPS	W Statistic	2.32	-0.78	-6.99	-6.18	I(1)
		Probability	0.99	0.22	0	0	
	CIPS	Zt-bar	0.97	2.24	-3.8	-3.04	I(1)
		Probability	0.83	0.99	0*	0	

Source: Computed by author.

Table 4
Pedroni Cointegration Test

Pedroni Residual Cointegration Test					
Series: GFCF OFDI GGDPPC TR R M2					
Sample: 1992 2013					
Included observations: 88					
Cross-sections included: 4					
Null Hypothesis: No cointegration					
Trend assumption: No deterministic trend					
Automatic lag length selection based on SIC with a max lag of 3					
Newey-West automatic bandwidth selection and Bartlett kernel					
Trend Assumption: No deterministic Trend					
Alternative hypothesis: common AR coefs. (within-dimension)					
				Weighted	
		Statistic	Prob.	Statistic	Prob.
Panel v-Statistic		0.320406	0.3743	-0.239301	0.5946
Panel rho-Statistic		0.781352	0.7827	0.584716	0.7206
Panel PP-Statistic		-3.452312	0.0003	-5.593966	0.0000
Panel ADF-Statistic		-4.083730	0.0000	-5.240200	0.0000
Alternative hypothesis: individual AR coefs. (between-dimension)					
		Statistic	Prob.		
Group rho-Statistic		1.390497	0.9178		
Group PP-Statistic		-6.590131	0.0000		
Group ADF-Statistic		-5.550594	0.0000		
Trend Assumption: Deterministic Intercept and Trend					
Alternative hypothesis: common AR coefs. (within-dimension)					
				Weighted	
		Statistic	Prob.	Statistic	Prob.
Panel v-Statistic		-0.745660	0.7721	-1.244986	0.8934
Panel rho-Statistic		1.577734	0.9427	1.401331	0.9194
Panel PP-Statistic		-3.061241	0.0011	-5.116212	0.0000
Panel ADF-Statistic		-3.764067	0.0001	-4.873588	0.0000
Alternative hypothesis: individual AR coefs. (between-dimension)					
		Statistic	Prob.		
Group rho-Statistic		2.128512	0.9834		
Group PP-Statistic		-5.338680	0.0000		
Group ADF-Statistic		-4.796179	0.0000		

Source: Computed by author.

Table 5
Panel Dynamic OLS Estimation

Panel Dynamic OLS Test
Dependent Variable: GFCF
Method: Panel Dynamic Least Squares (DOLS)
Sample (adjusted): 1994 2012
Periods included: 19
Cross-sections included: 4
Total panel (balanced) observations: 76
Panel method: Pooled estimation
Cointegrating equation deterministics: C
Fixed leads and lags specification (lead=1, lag=1)
Coefficient covariance computed using default method
Long-run variance (Bartlett kernel, Newey-West fixed bandwidth) used for coefficient covariances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OFDI	1.941807	0.778448	2.494458	0.0413
TR	-0.039069	0.109247	-0.357620	0.7312
R	0.163749	0.041575	3.938654	0.0056
M2	0.200422	0.034810	5.757573	0.0007
GGDPPC	1.273145	0.614117	2.073129	0.0769
R-squared	0.998899	Mean dependent var		25.67148
Adjusted R-squared	0.988202	S.D. dependent var		9.015106
S.E. of regression	0.979198	Sum squared resid		6.711795
Long-run variance	0.068154			

Source: Computed by the author.

Table 6
Panel Causality Tests

Pairwise Dumitrescu Hurlin Panel Causality Tests			
Sample: 1992 2013			
Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
Lags: 1			
OFDI does not homogeneously cause GFCF	3.76218	3.00844	0.0026
GFCF does not homogeneously cause OFDI	3.02898	2.17202	0.0299
TR does not homogeneously cause GFCF	0.26646	-0.97940	0.3274
GFCF does not homogeneously cause TR	6.23417	5.82844	6.E-09
R does not homogeneously cause GFCF	1.05809	-0.07632	0.9392
GFCF does not homogeneously cause R	1.97959	0.97490	0.3296
GGDPPC does not homogeneously cause GFCF	2.73398	1.83549	0.0664
GFCF does not homogeneously cause GGDPPC	1.66431	0.61524	0.5384
M2 does not homogeneously cause GFCF	5.47736	4.96509	7.E-07
GFCF does not homogeneously cause M2	0.52251	-0.68731	0.4919
Lags: 2			
OFDI does not homogeneously cause GFCF	2.83424	0.39079	0.6960
GFCF does not homogeneously cause OFDI	4.41212	1.56184	0.1183
TR does not homogeneously cause GFCF	3.31722	0.74924	0.4537
GFCF does not homogeneously cause TR	8.27566	4.42924	9.E-06
R does not homogeneously cause GFCF	2.83221	0.38928	0.6971
GFCF does not homogeneously cause R	5.24589	2.18064	0.0292
GGDPPC does not homogeneously cause GFCF	2.39462	0.06452	0.9486
GFCF does not homogeneously cause GGDPPC	2.78536	0.35451	0.7230
M2 does not homogeneously cause GFCF	6.70548	3.26390	0.0011
GFCF does not homogeneously cause M2	1.36225	-0.70167	0.4829
Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.

Source: Computed by author.

Table 6 (contd.)
Panel Causality Tests

Pairwise Dumitrescu Hurlin Panel Causality Tests			
Sample: 1992 2013			
Lags: 3			
OFDI does not homogeneously cause GFCF	11.9646	4.46467	8.E-06
GFCF does not homogeneously cause OFDI	5.31641	0.91615	0.3596
TR does not homogeneously cause GFCF	2.86318	-0.39329	0.6941
GFCF does not homogeneously cause TR	7.88358	2.28641	0.0222
R does not homogeneously cause GFCF	6.88837	1.75520	0.0792
GFCF does not homogeneously cause R	13.1610	5.10329	3.E-07
GGDPPC does not homogeneously cause GFCF	4.02976	0.22939	0.8186
GFCF does not homogeneously cause GGDPPC	5.17129	0.83869	0.4016
M2 does not homogeneously cause GFCF	6.22413	1.40066	0.1613
GFCF does not homogeneously cause M2	3.73705	0.07315	0.9417
Lags: 4			
OFDI does not homogeneously cause GFCF	11.7037	2.43270	0.0150
GFCF does not homogeneously cause OFDI	6.91393	0.65670	0.5114
TR does not homogeneously cause GFCF	3.09458	-0.75948	0.4476
GFCF does not homogeneously cause TR	11.7932	2.46587	0.0137
R does not homogeneously cause GFCF	6.99203	0.68566	0.4929
GFCF does not homogeneously cause R	12.9403	2.89124	0.0038
GGDPPC does not homogeneously cause GFCF	8.03889	1.07382	0.2829
GFCF does not homogeneously cause GGDPPC	8.45339	1.22752	0.2196
M2 does not homogeneously cause GFCF	7.69834	0.94755	0.3434
GFCF does not homogeneously cause M2	4.13224	-0.37473	0.7079

Source: Computed by author.

Table 7
Per Capita Real GDP Growth Rates in the BRIC Countries
1992-2013

Year	Brazil	Russia	India	China	BRIC
1992	-2.0407	-14.5684	3.451423	7.849075	-1.33
1993	3.056524	-8.56461	2.77679	12.93489	2.55
1994	3.734336	-12.4613	4.687593	12.68347	2.16
1995	2.831524	-4.01735	5.62157	11.8587	4.07
1996	0.595554	-3.61244	5.632798	9.768401	3.1
1997	1.806261	1.567785	2.231102	8.888383	3.62
1998	-1.46786	-5.14314	4.362977	8.25329	1.5
1999	-1.22138	6.729578	7.01206	6.903701	4.86
2000	2.812311	10.46365	2.12266	6.775171	5.54
2001	-0.09536	5.538623	3.118376	7.516496	4.02
2002	1.267974	5.153142	2.145277	8.353662	4.23
2003	-0.16615	7.845111	6.175988	9.342204	5.8
2004	4.41708	7.806581	6.286606	9.433147	6.99
2005	1.974775	6.901941	7.683345	10.65731	6.8
2006	2.854765	8.629065	7.720913	12.04913	7.81
2007	5.055334	8.819454	8.304064	13.56771	8.94
2008	4.199357	5.365463	2.514154	9.074351	5.29
2009	-1.21702	-7.79087	7.069188	8.672337	1.68
2010	6.586558	4.154159	8.843644	9.914861	7.37
2011	1.832662	3.847771	5.282049	8.777427	4.93
2012	0.156602	3.275499	3.420993	7.129312	3.5
2013	1.619382	1.09144	3.720962	7.140918	3.39

Source: World Development Indicators
The growth rates for the BRIC nations are computed by the author.

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