Trends and Determinants of FDI with Implications of COVID-19 in BRICS

Arup Kumar Chattopadhyay¹, Debdas Rakshit², Payel Chatterjee³ and Ananya Paul²

Abstract
Foreign direct investment (FDI) movement to any country is recognized as an important criterion for economic strength and potentiality. Hence, the present study analyzes the motives of FDI inflows through the determinants and channels, namely horizontal or vertical FDIs and the impact of COVID-19 on FDI Inflows in BRICS countries during the period 1990–2020. The Kinked Exponential (deterministic) trend, and Zivot and Andrew’s trend equations are applied for the growth analysis of FDI inflows. Regarding the estimation of channels of FDI inflows in terms of horizontal, vertical, and hybrid motivations, dynamic panel data analysis using GMM for BRICS economies together and ARDL-PMG for individual countries is made. The findings show significantly positive growth in FDI inflows in all BRICS countries except India during the first decade of the present century. After that, these countries have experienced either significantly or insignificantly declining trends, except India, where the trend has significantly increased during this later period. From the overall analysis, we see that both horizontal and vertical motivations play a dominant role in determining FDI inflows for the BRICS countries. However, from country-wise estimations, it is observed that both horizontal and vertical motives are dominant factors for FDI inflows to India and Russia. In contrast, the horizontal motive of it is significant for China. For Brazil and South Africa, no motive behind FDI inflows appears significant. The pandemic situation significantly impacts attracting FDI in Brazil, while it remains insensitive in the rest of the BRICS countries. The findings reveal that FDI determinants are country-specific. So, the BRICS countries can design proper FDI policy and adopt more reforms in attracting FDI that may help improve their economic situation.

Keywords
FDI inflow, BRICS, COVID-19, channels of FDI

¹ Department of Economics, The University of Burdwan, East Burdwan, West Bengal, India
² Department of Commerce, The University of Burdwan, East Burdwan, West Bengal, India
³ Finance & Control Department, Indian Institute of Management, Kolkata, West Bengal, India

Corresponding author:
Debdas Rakshit, Department of Commerce, The University of Burdwan, East Burdwan, West Bengal 713104, India
E-mail: drakshit@com.buruniv.ac.in
Introduction

BRICS is an association of five leading emerging economies of the world, each distinguished by rapid economic growth and industrialization, fast-growing middle-class population having considerable impact on the regional and world economy. The influence of these developing nations in the global economy representing around 41.42 percent of the global population in 2019 has enhanced considerably over the recent decades. As per the World Development Indicators, the BRICS countries have realized an annual average growth rate of about 5 percent during the period 2000–2018 compared to the world at about 2.9 percent in the same period. In the past few decades, the share of the BRICS countries in the global Gross Domestic Product (GDP) has almost tripled, from about 8.1 percent in 2000 to about 24.04 percent in 2019. However, the developing nations often experience a dearth of capital that is evident from their export–import and savings–investment gaps. They are unequipped to finance their investment needs due to absence of adequate domestic savings or funds. To bridge the gaps, developing countries depend on external sources of financing. Hence, foreign capital needs to be channeled from the industrially developed nations in the form of FDI to expedite industrialization, minimize the level of unemployment and foster sustained economic growth (Hussain & Haque, 2016). FDI is an important source of foreign capital for the much-needed economic growth, industrialization, and restructuring in a developing nation (Madhavan et al., 2020; Nistor, 2015).

The BRICS nations have sprouted as a potential bloc in the developing nations that collectively attract major foreign capital from the developed nations. The trend of FDI inflows to the BRICS nations has increased substantially over the past few decades from almost 5.25 percent of the global FDI in 2000 to around 19.51 percent in 2019. FDI brings several opportunities for the host nations. It helps lessen their dependency on foreign aid and provides a unique combination of technology, technical know-how, long-term finance, marketing networks, managerial expertise, and training. The pattern of FDI inflows varies from country to country. This is mainly due to the difference in economic, social, and political infrastructure across the nations (Adhikary, 2017). Several important domestic factors determine the attractiveness of FDI to facilitate an economy. Most researchers agree that the main factors determining FDI inflows to a country are market size, infrastructure, human capital, trade openness, inflation rate, and exchange rate (Asongu et al., 2018; Ergano & Rambabu, 2020; Kisto, 2017; Kumari & Sharma, 2017). However, being an extremely important financial decision, the investors seek solid reasons for deciding whether investment should be made in a host country.

Extant literature on FDI put forth two main motives for FDI: efficiency-seeking, that is, taking benefit of lower input costs in the foreign country, and market-seeking, that is, serving foreign markets (Markusen, 2013; Nguyen et al., 2019). This gives rise to two major types of FDI, namely vertical and horizontal FDI. Vertical FDI occurs when multinational enterprises fragment their value chain and production process vertically between the host and source countries, intending to reduce production costs. On the other hand, horizontal FDI occurs when multinational companies produce roughly the same products and services in the host country as in the source country to expand their markets. Until 2002 when Markusen developed an integrated framework embedding vertical and horizontal FDI components into a general equilibrium model, these two FDI components were treated as two distinct strands in the FDI literature. Markusen (2002) called this unified framework as the Knowledge-Capital model (K-C model). However, Carr et al. (2001) first introduced the K-C model and explained real sales of multinational enterprises. However, soon it was applied for explaining bilateral FDI flows following Markusen (2002). Presently, this model is considered the most general theory of multinational companies that permits vertical and horizontal multinationals and national firms to develop endogenously in the equilibrium based on several combinations of the host and source country attributes.
For over a year, the entire world has been grappling with Novel Coronavirus (COVID-19), which has affected human life and annihilated the global economic infrastructure, disrupting trade and commerce (Rakshit & Paul, 2020). The economic system suffered a major setback as most parts of the world were forced into a complete lockdown due to the ongoing fatal contagion, causing a major decline in employment, output, and trade. Also, both demand and supply experienced sudden shocks owing to such action. The containment measures taken by the governments of different countries to address the issue of the COVID-19 pandemic resulted in economic disruption, uprooting globalization which eventually affected the FDI decisions of the multinational enterprises. As per the UN Conference on Trade and Development (UNCTAD) report 2020, global FDI flows is expected to decline around 30–40 percent during 2020–21. It is expected that FDI flows to developing countries would drop even more than the developed countries since the primary and manufacturing sectors are severely affected by the crisis, which accounts for a major share of FDI inflows in the developing countries (OECD, 2020). Moreover, most of the BRICS countries are among the worst affected nations from the pandemic, though many are now on the path to recovery. FDI also played a significant role in supporting the economies throughout and especially after the crisis period by helping the governments to address the pandemic, supporting their affiliates, and forming linkages with the local enterprises (Alfaro & Chen, 2012).

The present study analyzes the patterns of growth in FDI inflows, the motives, determinants, and channels of FDI inflows, and the impact of COVID-19 on FDI inflows to the BRICS countries during the period 1990–2020. The contribution of this article is threefold. First, the article examines the extent of FDI inflows as a percentage of GDP to the BRICS economies during the study period. Second, the article uses K-C model to identify motives of FDI inflows through determinants focusing on the types of FDI, that is, horizontal or vertical. Moreover, the factors determining vertical and horizontal FDI have been considered in a single empirical setting to evaluate their relative significance. The K-C model helps identify the FDI determinants based on several combinations of the host and source country attributes. For defining motivation related variables, unlike earlier studies where OECD countries were taken as source one, the present study takes G7 countries together as the source country. The reason being that major share of FDI inflows to BRICS countries originate from G7 countries and this share has been increasing since the global crisis. In addition, some other variables as put forth in the existing literature affecting FDI inflows have been included in the analysis as control variables. Further, we have analyzed whether the determinants responded in similar manner for all the BRICS countries. Third, the impact of COVID-19 on FDI inflows is examined for the BRICS countries both collectively and separately. The severity of the ongoing crisis has led to exploring its impact on FDI inflows.

**Literature Review**

**Survey of Prior Studies**

Extant literature on the trend and determinants of FDI inflows to an economy provides mixed empirical evidence. In the context of Asian developing countries, market size, human capital, interest rate, and trade openness are found to be the key determinants of FDI inflows. (Adhikary, 2017; Kumari & Sharma, 2017). Similarly, market size, trade openness, labor quality, and infrastructure level are important determinants of FDI inflows to China (Na & Lightfoot, 2006). However, Zhang (2011) found that at the regional level, labour cost, tax rate, market size, and geography attracted FDI while at the sectoral level, wage rate, employment, degree of state ownership, market size, and exchange rate attracted FDI in China. Like China, tax rate and market size favorably influence FDI inflows to Russia whereas trade
barriers constraints its FDI inflows (Gurshev, 2019). For Brazilian economy, trade liberalization and domestic market dimensions were major factors attracting FDI inflows (Castro et al., 2013). Moreover, Brazilian productivity growth enhances FDI inflows in Brazil while U.S. productivity growth deters the same (Dias et al., 2014). In the context of BRICS economies, the significant determinants of FDI inflows were found to be market size, infrastructure facilities, labor cost, gross capital formation, exchange rate, trade openness, GDP growth rate, and macroeconomic stability (Asongu et al., 2018; Maryam & Mittal, 2020; Shah & Ali, 2016; Vijayakumar et al., 2010). However, economic, social, and financial factors accounted for most of the change in net FDI inflows to BRICS countries (Elfakhani & Mackie, 2015; Jadhav, 2012). Based on the analysis of FDI growth rate in BRICS countries, Malik and Savadatti (2018) have noted that China is the leading destination of inward FDI followed by India and Brazil while South Africa is the least attractive destination for inward FDI and the growth rate of FDI inflows to Russia has been stagnant during the period 1992–2016.

Several studies have examined the FDI determinants based on the two distinct FDI motives, viz., horizontal and vertical, using the K-C model. Nguyen and Cieslik (2020) claims that total earnings and similarity in market size between Europe and Asia promoted horizontal FDI in Asia while disparity in skilled labor availability between the two countries encourages vertical FDI in Asia. In contrast, commonly spoken language, GDP difference between home and host country, trade cost to both countries, and distance were found as the significant determinants of FDI inflows to Asian countries (Nguyen et al., 2019). For transition economies, market potential and low labor costs attract FDI and provide horizontal and vertical FDI in this region (Anghel, 2007). On the contrary, human capital endowment, physical capital endowment, and market size encourages FDI inflow to Poland from OECD nations while investment cost discourages inward FDI (Cieslik, 2020). Most studies focus on FDI inflows, while Cieslik and Tran (2019) analyzed FDI outflows from emerging countries and presented that geographical distance, skilled labor abundance, trade cost, investment cost, and market size were significant factors explaining such FDI outflows. The outflow of vertical and horizontal FDI from US to other countries were mainly determined by skilled labor abundance and market size (Xiaolong & Shuhui, 2016). Some prior studies put forth that the impact of FDI on the host country depends on FDI type. As documented by Beugelsdijk et al. (2008), the favorable impact of horizontal FDI on the economic growth of host countries is superior to vertical FDI. In contrast, the rise in vertical and horizontal FDI in Southeast Asian countries enhanced credit constraints for domestic companies (Bun, 2021). However, Sohn (2016), based on country-pair data for China and ASEAN countries with OECD nations, demonstrated that China’s rise in FDI induced a strong synergic impact on FDI flows to ASEAN countries from OECD nations.

A long line of literature explores the impact of various economic crises on FDI. The global crisis of 2008 had a strong adverse impact on both horizontal and vertical FDI, inward FDI and cross-border merger and acquisition activities in emerging economies (Stoddard & Noy, 2015). Similarly, the currency crisis and the banking crisis significantly reduced the value of FDI stocks, FDI inflows, and Greenfield FDI activities (Liu, 2012). Contrarily, there is little impact of the inflation crisis on FDI activities. Moon et al. (2011) showed that both inward and outward FDI had a stabilizing impact on the nation's economic growth during the Asian financial crisis and recovery period, leading to a gradual recovery rather than an immediate upturn in Asian economies. Foreign investors’ investment strategy in Korea changed from passive to active in understanding the risk associated with exchange rate volatility following the Korean crisis (Min, 2010). Studies addressing the impact of any crises on FDI inflows to BRICS nations are limited in literature. Gupta (2018) observed an upsurge in FDI inflows to China, India, and Brazil during the post-2008 global economic crisis compared to the precrisis period, whereas, in South Africa and Russia, FDI inflows were adversely affected by the crisis. Conversely, India was the only country that
had not bounced back concerning FDI inflows and outflows after the 2008 global crisis (Nandi, 2012). Molano (2009) believed that economic recovery of BRIC countries after the global financial crisis, to some extent, hinged upon the economic recovery of Western European countries and the US.

COVID-19, being a current issue, draws less attention in regard to analyzing its impact on FDI. Gujrati and Uygun (2020) theoretically studied the steps taken by the U.S., UK, Australia, and European Union countries to develop foreign investment in light of the COVID-19 crisis. The FDI inflows to India fell by 59 percent in the first quarter of the financial year 2020 due to the adverse impact of COVID-19 on all economic activities (Aggarwal, 2020). After the revision of FDI policies and the adoption of the self-reliance scheme, FDI inflows increased by 16 percent in the following months. Chaudhary et al. (2020) demonstrated that the COVID-19 pandemic had reduced FDI funds in Nepal. Further, they revealed that other barriers to FDI inflows in Nepal were poor infrastructure, weak governance, poor business environment, natural calamities, political transitions, tax slabs, diverse geography, climate change, and lack of skilled human resources.

Research Gap

The extant FDI literature has been reviewed to figure out the areas that have remained unexplored in prior studies. A review of the earlier literature discloses several studies on BRICS economies, but most of them have focused only on FDI determinants. Only a few studies are based on FDI inflows and the impact of any crisis on the FDI inflows to the BRICS countries. Moreover, hardly any study exists based on the use of the K-C model for examining FDI determinants to explore the FDI motive (horizontal or vertical) in BRICS countries. Further, COVID-19 crisis, being a recent phenomenon, finds hardly any study that has analyzed its impact on FDI inflows. Also, this aspect has not been addressed in the context of BRICS countries. Moreover, to the best of our knowledge, factors determining the type of FDI, that is, horizontal or vertical FDI, have not been studied in the BRICS context so far.

Objectives of the Study

The study mainly aims to examine the patterns of growth in FDI inflows, the motives, determinants, and channels of FDI inflows, and the impact of COVID-19 on FDI inflows for the BRICS countries during the period 1990 to 2020 using secondary level data.

Thus, the specific objectives of the study can be segregated as follows:

- To examine FDI inflows as a percentage of GDP from 1990 to 2019.
- To identify the motives of FDI inflows to BRICS countries after analyzing the determinants and channels of FDI inflows, namely, horizontal or vertical.
- To measure the impact of COVID-19 on FDI inflows.

Hypotheses of the Study

Based on the literature survey, the study develops the following hypotheses regarding the determinants of FDI inflows and assessing the impact of COVID-19 on it in BRICS economies.
Based on the K-C (Knowledge-Capital) model put forth by Carr et al. (2001) and modified by Markusen (2002), the study considers certain factors influencing vertical and horizontal FDI inflows to BRICS economies. First, the sum of GDPs of the source country and host countries are taken together (GDP$_{\text{sum}}$) as an essential determinant of FDI inflows. GDP$_{\text{sum}}$ captures the joint market size or economic size of the host and source countries. With its positive coefficient, the K-C model expects a horizontal movement/expansion in investment due to rise in their market size. In other words, this variable represents the horizontal motivation of FDI since the motive of horizontal FDI is to further serve the host country’s market with its increasing size. Thus, GDP$_{\text{sum}}$ is expected to positively associate FDI for its horizontal inflows (Carr et al., 2001; Kristjansdottir, 2010; Sohn, 2016):

**H1:** There is a positive association between GDP$_{\text{sum}}$ and FDI inflows representing horizontal motivation.

The squared difference of GDPs of the host and home countries (GDP$_{\text{diff}}$) is identified as another important determinant of FDI inflows. GDP$_{\text{diff}}$ represents the squared difference in relative market sizes between the host country and source countries taken together. This variable also captures the horizontal motivation of FDI in a reverse way as per the K-C model, which presupposes that horizontal FDI diminishes as the host and home countries become dissimilar in size. Moreover, the K-C model predicts that FDI inflows have an inverted U-shaped relationship to country size differences. Therefore, for emerging economies, it may be postulated that GDP$_{\text{diff}}$ is negatively related to FDI inflows (Carr et al., 2001; Markusen & Maskus, 2002; Sohn, 2016):

**H2:** There is a negative relationship between GDP$_{\text{diff}}$ and FDI inflows for establishing horizontal motivation.

Empirically this relation may also be positive representing vertical motivation of FDI inflows (Cieslik, 2020).

The human capital index (HCI) is also identified as an important determinant of FDI inflows. HCI indicates the difference in skilled labor abundance between the host and source countries. It captures the vertical motivation of FDI since a significant difference in skilled labor between the source countries and host country attracts vertical FDI as multinational enterprises tend to operate in countries with skilled labor abundance (Anghel, 2007; Sohn, 2016). Also, the K-C model predicts that an increase in the skilled-labor difference between the host and source countries attracts more vertical FDI (Markusen, 2013). Thus, it is presumed that HCI is positively associated with FDI inflows:

**H3:** There is a positive association between human capital and FDI inflows representing the vertical movement of FDI.

Distance is taken as another determinant of FDI inflows. Distance measures the geographic distance between the source and the host country. It is included to control the impact of costs related to distance and reflects proximity to customers. The theory does not put forth any clear prediction regarding the impact of distance on FDI inflows to the host country. Moreover, the variable impacts trade and investment, so the sign of its coefficient is ambiguous (Sohn, 2016). However, prior empirical studies suggest an adverse impact of distance on FDI inflows (Cieslik, 2020; Kristjansdottir, 2010; Nguyen et al., 2019). Hence, the study here assumes a negative relationship between distance and FDI inflows:

**H4:** There is a negative relationship between distance and FDI inflows.

In addition to these four variables, some other factors having a probable impact on FDI inflows, as shown by prior empirical studies, hence are included as control variables.
Physical capital endowment (physical capital_{diff}) is expected to influence FDI inflows to a country as its determinant. Physical capital endowment measures the difference in physical capital per worker between the host and home countries. Previous studies argue that multinational enterprises tend to be physical-capital intensive and skilled-labor intensive, so they are likely to operate in physical-capital abundant countries (Bernard et al., 2005; Helpman, 2006). Also, prior empirical studies evidence a positive association between physical capital and FDI inflows (Bergstrand & Egger, 2013; Cieslik, 2020):

H5: There is a positive relationship between physical capital and FDI inflows.

Trade openness is also considered an important determinant of FDI inflows since it minimizes the transaction costs related to investment by augmenting the unrestricted flow of goods and services (Boateng et al., 2015; Hunady & Orviska, 2014). Most researchers have observed a favorable association between trade openness and FDI inflows (Adhikary, 2017; Asongu et al., 2018; Kumari & Sharma, 2017; Maryam & Mittal, 2020; Na & Lightfoot, 2006; Shah & Ali, 2016):

H6: There is a positive relationship between trade openness and FDI inflows.

The Control of Corruption Index measures the level of corruption in the host country. It is used as a proxy for the investment environment in the host nation. Previous studies argue that the stock of international investment in the host nation is adversely affected by corruption (Bun, 2021; Cieslik, 2020; Cieslik & Goczek, 2018). Hence, it is expected that the Corruption Index is negatively associated with FDI inflows, hypothesized as follows:

H7: There is a significant negative relationship between Corruption Index and FDI inflows.

During any economic crisis, the movement of international capital becomes slow mainly due to a fall in the level of economic activities and growth (Liu, 2012; Mariana, 2011; Stoddard & Noy, 2015). This study analyzes the impact of the COVID-19 crisis on FDI inflows to BRICS countries using quarterly data. Thus, it is postulated as follows:

H8: There exists a negative relationship between COVID-19 and FDI inflows.

Database and Methodology

The present study is based on the time series secondary data, mainly taken from database of the World Bank, OECD Economic Outlook, and PENN World Table. The data series measured annually has been taken from 1990 to 2020 for the purpose of our study. The quarterly data have also been taken for analyzing the impact of COVID-19 on FDI inflows. The choice of the period of study depends purely on the availability of a complete current data series with respect to all variables. For consistency, all data of the variables are taken in million U.S. Dollars. The data collected from different such sources have been classified, tabulated and analyzed by Econometric tools such as time series analysis and panel data regression analysis through EVIEWS, STATA, and SPSS software. Table 1 presents the names of the related variables, as per the aforementioned hypotheses, and the data sources.

The methodology used in the study is discussed sequentially as follows:
Structural Break Test

The structural break test was initially performed to find the jerk or sudden upward/downward jump in the movement of time series data on FDI inflow as a percentage of GDP, using Quandt-Andrews unknown (endogenous) breakpoint test. Later on, to confirm those breakpoints obtained from Quandt-Andrews test we have also applied Chow Exogenous Breakpoint Test, the results of which are presented in Table 2. The estimated results of Table 2 shows a significant single break in the said time series for each country, but in different years for different countries, as confirmed by both the Quandt-Andrews test and Chow test. Structural breaks are identified to estimate growth patterns in FDI inflows.

Stationarity Test and Conditional—Unconditional Growth Rates

The Phillips–Perron (PP) nonparametric unit root test has been used to measure the stationarity of the time series, FDI inflow as a percentage of GDP. In structural break, parametric tests including Augmented Dickey–Fuller unit root test do not give the robust result. The estimated results of the PP test are also presented in Table 2, which demonstrates that series under consideration is stationary in China and South Africa. However, in the other three countries, the series of FDI inflow as a percentage of GDP is found to be nonstationary. In this connection, it is to be noted that for the Dynamic Panel Data Analysis Levin-Lin-Chu (2002) panel unit root test is used to check the stationarity of the variables selected for the purpose.

If the series is stationary, we have applied the conventional trend analysis by estimating the kinked exponential (deterministic) trend: \( \ln y_t = \alpha + \beta_1 d_{it} + \beta_2 d_t + \epsilon_t \). Here, \( d_{it} = 1 \) for \( i \)th subperiod and 0 for other subperiod; the origin of time \( t \) is shifted to the breakpoint. For this trend equation, which is free from any discontinuity bias, the first and second subperiods annual growth rates in \( y_t \) are respectively the estimated values of \( \beta_1 \) and \( \beta_2 \), each multiplied by 100. However, in the presence of unit root with a single break in the series, we have estimated the changes in levels and trend over subperiods using the following Zivot and Andrews trend equation:

\[
\Delta \ln y_t = \alpha + \beta r + \beta_1 d_{i-1} + \beta_2 d_{i-1} + \gamma y_{t-1} + \sum_{i=1}^{4} \theta \Delta \ln y_{t-i} + \epsilon_t,
\]
where, as before, the origin of time $t$ is shifted to the breakpoint; $d_u$ is 0 for the first subperiod and 1 for the second subperiod; $d_t$ is again zero for the first subperiod and takes respective values of $t$ for the second subperiod. The change in the level of $y_t$ over subperiods is represented by the estimated value of $\beta_1$ and the trend in $y_t$ over subperiods is represented by the estimated value of $\beta_2$.

### Dynamic Panel Analysis

As the study deals with multiple factors determining FDI inflow across countries and across time, the occurrence of heterogeneity is obvious. The method of Panel Regression Analysis is used to capture this heterogeneity across units by permitting for country-specific variations over time. The Panel Data Regression Analysis mainly uses techniques, such as Fixed-Effects Model, Random-Effects Model, and Generalized Method of Moments (GMM). The Hausman Specification test is applied for selection between Fixed-Effects Model and Random-Effects Model. Further, the method of Dynamic Panel Analysis is used to control this heterogeneity across country-specific units. Endogeneity problem in regressors with serial correlation problem is evident in such regression. Keeping all these in mind, we also selected GMM to estimate parameters of the Dynamic Panel Analysis where explanatory variables are used additionally in lagged forms to make them predetermined ones and one lagged value of explained variable as an instrumental variable. Indeed, GMM cannot solve the endogeneity problem, but its appropriate modelling helps avoid such problems. The dynamic panel data regression is estimated with I(0) variables applying one-step system GMM as prescribed by Arellano-Bover/Blundell-Bond, which is found to be most suitable in our case among one-step/two-step difference GMM and one-step/two-step system GMM. To derive the classified country-wise dynamic panel regression results, we also estimated Autoregressive Distributed Lag (ARDL) model by the Pooled Mean Group (PMG) method of estimation, in which both I(0) and I(1) variables can be included and is a suitable technique for $N < T$ like ours (where $N = 5$ and $T = 10$).

The following is the general model specification to test the hypotheses relating to the determinants of FDI flows:

$$ Y_t = \alpha + \gamma Y_{t-1} + \beta_1 X_t + \epsilon_t, $$
**Table 3. Variable Description**

| Variables         | Description                                                                 | Expected Sign |
|-------------------|-----------------------------------------------------------------------------|---------------|
| **Dependent variable** |                                                                             |               |
| lnFDI             | Logarithm of inward FDI for each of BRICS                                   |               |
| **Explanatory variables** |                                                                             |               |
| ln GDP_sum        | Logarithm of sum of average of G7 countries’ and each of BRICS countries’ GDP | +             |
| ln GDP_diff       | Logarithm of squared difference between average of G7 countries’ and each of BRICS countries’ GDP | –             |
| **Control variables** |                                                                             |               |
| lnHuman capital   | Logarithm of proportion of each of BRICS HCI with respect to average value of G7 countries | +             |
| lnPhysical capital| Logarithm of difference between average of G7 countries’ and each of BRICS countries’ physical capital per person engaged | +             |
| lnDistance        | Logarithm of weighted distance between capital cities of G7 countries and BRICS | –             |
| lnTrade openness  | Logarithm of proportion of import and export with respect to GDP for each of BRICS | +             |
| Control of corruption | Control of Corruption Index for each of BRICS                              | +             |

**Source**: Authors’ computation.

**Note**: #Weight is the outward FDI.

As classified data for source or home countries is not available, we have taken average of G7 countries’ data as a proxy on the presumption that G7 countries are the dominant suppliers of FDI.

Where $Y_t$ is the dependent variable measured by FDI Inflows impact analysis, $Y_{t-1}$ is the lagged dependent variable, $X_t$ are set of explanatory variables, such as GDP$_{sum}$, GDP$_{diff}$, human capital, physical capital, distance, trade openness, control of corruption as stated in Table 3.

**Analysis and Findings**

**Growth**

From Table 4 (to be read with Table 2), we see significant positive conditional growth of FDI inflows as percentage of GDP over time for Brazil (33.8%) and Russia (13.8 %) but there is a significant decrease of the same at level as well as in trend for Brazil (71.3% and 30.6 %). On the other hand, India (81.4 %) and Russia (79.4%) show significant growth at levels but with decreasing trend of 7.8 percent and 26.4 percent in the second subperiod.

The unconditional growth rates for China (39.4%) and South Africa (36.6%) are found to be positively significant during the first subperiod, but China (5.1%) reports a significant decrease during the second subperiod.
Table 5 reports the results of the Levin-Lin-Chu panel unit root test for each of the explanatory variables. The table confirms the stationarity of the explanatory variables at I(0) except for control of corruption in which I(2) is excluded from the model.

For the panel data, the result of Hausman test is found to be significant, so the Fixed Effects Model is chosen. The estimated results obtained from Fixed Effect Model and also one step system GMM estimators are presented in Table 5. In case of Fixed Effect model, the estimates of GDP sum, physical capital, distance, and trade openness are found to be statistically significant but in case of GMM, the majority of the estimated coefficients of explanatory variables are statistically significant and also displays the expected sign that favor both horizontal and the vertical motives of FDI inflows. We focus here on the robust GMM estimates (devoid of endogeneity problem) obtained from dynamic panel data regression analysis.

The horizontal motive predicts positive relation between GDP sum and FDI inflows of the host countries. We also observe here the significant positive coefficient of joint economic size of each of BRICS countries and G7 establishing horizontal motive of FDI inflow. The significant negative relationship between differences in the country size and the amount of inward FDI in the host countries also shows horizontal motivation to access the host country’s market. The negative and statistically significant coefficient of differences in physical capital variable shows motive of cost minimization hence, vertical one. The human capital proportion (not difference like physical capital) expectedly shows significant positive coefficient depicting more FDI inflows to that host country whose human resource is more developed. But regarding the control variables, we get startling results. Contrary to the popular

### Table 4. Estimated Statistics for Conditional and Unconditional Growth on FDI

|         | | β    | β₁    | β₂    |
|---------|-----------------|-----------------|-----------------|
| Brazil  | Coefficient     | 0.338864        | -0.713294       | -0.306377       |
| t-Statistic#  | 2.422621**     | (-1.798175*)   | (-2.242308**)   |
| India   | Coefficient     | 0.058744        | 0.814695        | -0.078768       |
| t-Statistic#  | 1.329941       | 3.279563***    | (-1.863718*)    |
| Russian Federation | Coefficient | 0.138742        | 0.79428         | -0.264995       |
| t-Statistic#  | 1.953109**     | 1.899892*       | (-2.697964**)   |
| China    | Coefficient     |                      | 0.394311        | -0.051758       |
| t-Statistic#  |                      | 7.70819***      | (-7.444207****) |
| South Africa | Coefficient |                      | 0.366349        | -0.038783       |
| t-Statistic#  |                      | 4.269241***     | (-0.81825)      |

Source: Authors’ calculation.

Note: t-statistic is considered based on lowest AIC up to lag 4, for Brazil and Russia it is lag 4 and for India it is lag 2.
Table 5. Levin-Lin-Chu Statistic for Stationarity and Estimates of Fixed Effect and One Step System GMM Model

| Variables             | Levin-Lin-Chu Statistic for Stationarity | Fixed Effect | GMM                   |
|-----------------------|------------------------------------------|--------------|-----------------------|
|                       |                                          | Coefficient  | t                     | Coefficient  | t               |
| FDI inflow: L1.       |                                           |              |                       | 0.247446     | 2.07***        |
| GDP<sub>sum</sub>     | (–4.7510***<sup>**</sup>)                | 1.9578       | 4.12*                 | 1.4378       | 4.18***        |
| GDP<sub>diff</sub>    | (–9.3017***<sup>**</sup>)                | –0.0023      | –0.05                 | –0.1301      | –1.96*         |
| Human capital         | (–7.9119***<sup>**</sup>)                | 1.0417       | 1.06                  | 0.9516       | 2.00**         |
| Physical capital      | (–2.1872**<sup>**</sup>)                 | –1.5189      | –3.08*                | –0.9114      | –2.34**        |
| Distance              | (–3.6189**<sup>**</sup>)                 | –2.6180      | –2.56**               | 1.2307       | 2.08**         |
| Trade openness        | (–3.5784***<sup>**</sup>)                | 0.9717       | 3.62*                 | 0.9869       | 5.72***        |
| Control of corruption | (–1.2501)                                |              |                       |              |                |

Source: Authors’ calculation.

Note: “1(0) represent stationarity at level,” at trend of the underlying panel by using Levin-Lin-Chu panel unit root tests for stationarity. The dependent variable is FDI inflow and the independent variables are represented as GDP<sub>sum</sub>, GDP<sub>diff</sub>, human capital, physical capital, distance, and trade openness.

belief, the distance variable shows a positive significant relation while the trade openness establishes significantly negative relation with the FDI inflow. These two peculiar empirical results could probably be avoided either by enlarging the sample size or by redefining the variables concerned, for which the present study accepts its limitations of not obtaining classified data for a longer period.

The PMG estimates of ARDL model for country specific analysis is presented in Table 6. In estimating country wise ARDL by PMG we do not get any concave function (i.e., maximization of the function) by incorporating any of the control variables in the model, probably because of the small value of units (i.e., countries) compared to time period (i.e., number of years). Thus, PMG is ran with only explanatory variables (i.e., GDP<sub>sum</sub> and GDP<sub>diff</sub>), where we do get concave function. The estimated results of GDP<sub>sum</sub> for China, India and Russia reflect significantly positive coefficient whereas the coefficient of GDP<sub>diff</sub> for China is significantly negative and for India and Russia it is significantly positive. Thus, empirically it is established that both horizontal and vertical motives are dominant factors for FDI inflows to India and Russia, whereas the horizontal motive of it significantly leads to have access to China’s market. For Brazil and South Africa, motives behind FDI remain insignificant.

Impact of COVID-19

To analyze the impact of COVID-19 on FDI inflows, we collected quarterly data from 2018 to 2020. As per the availability of the quarterly data we used GDP<sub>sum</sub> and GDP<sub>diff</sub> as the only independent variables. The stationarity of all the dependent variables is checked and reported in Table 7.

Table 7 shows the estimates of Random Effect Model and one step system GMM. The result of Hausman’s test being insignificant establishes the selection of the Random Effects Model. The estimates of Random Effect Model are found to be insignificant, whereas it is statistically significant and positive coefficient exclusively for GDP<sub>sum</sub> in case of GMM estimation, which shows that the horizontal motive of FDI inflow persists in the BRICS economies.
Table 6. Estimates of Pooled Mean Group

| Country | GDP_{sum} (t) | GDP_{diff} (t) |
|---------|--------------|---------------|
| Brazil# | 31.32541     | 0.6882597     |
| China   | 3.244468     | -0.198833     |
| India   | 27.47338     | 0.7741301     |
| Russia  | 24.59091     | 0.7469491     |
| South Africa | -53.59249 | 25.52483 |

Source: Authors’ calculation.

Note: #All estimated results, being insignificant for Brazil, have not generated. The dependent variable is FDI inflow and the independent variables are represented as GDP_{sum}, GDP_{diff}. A few values of S.E. and t statistic are not generated due to their, respective, very large and small values.

Table 7. Statistic for Stationarity of the Exploratory Variables and Estimates of Random Effect and One Step System GMM

| Variables          | Levin-Lin-Chu Statistic for Stationarity | Random Effect | GMM |
|--------------------|------------------------------------------|---------------|-----|
|                    | Coefficient | z            | Coefficient | t   |
| FDI inflow. L1.    | -0.149723   | (-1.15)      | -0.149723   | (-1.15) |
| GDP_{sum}           | -3.7443***  | 3.6697       | 1.19        | 8.305859 | 2.02** |
| GDP_{diff}          | -3.2582***  | -0.3937      | -0.44       | 0.4932429 | 0.60 |
| COVID period*      | -2.999***   | -0.3718      | -0.61       | 0.4924345 | 0.76 |

Source: Authors’ calculation.

Note: All variables are found to be I(0) at 1% level when “I(0)” represents stationarity at level, at trend of the underlying panel by using Levin-Lin-Chu panel unit root tests for stationarity. The exploratory variables GDP_{sum}, GDP_{diff} and dummy variable for COVID period (1 for COVID period and 0 otherwise).
The PMG estimates of ARDL presented in Table 8 show that the time dummy representing COVID-19 is insignificant for all BRICS nations. It is indeed too early to analyze the impact from such a short frame of data. However, even in this short data frame, Brazil represents significantly negative GDP sum and significantly positive GDP diff with FDI inflows depicting its vertical model of market access motivation during this challenging time.

### Table 8. Estimates of Pooled Mean Group

| Country | Coefficient | t |
|---------|-------------|---|
| Brazil | GDP<sub>sum</sub> | -89.12698 | (-6.89***) |
|         | GDP<sub>diff</sub> | 36.79919 | 6.46*** |
|         | Time dummy | -0.8712533 | (-1.15) |
| China  | GDP<sub>sum</sub> | 6.7710 | 1.71* |
|         | GDP<sub>diff</sub> | -1.0415 | (-1.54) |
|         | Time dummy | 0.4316 | 0.31 |
| India# | GDP<sub>sum</sub> | -19.7534 | . |
|         | GDP<sub>diff</sub> | 2.7901 | . |
|         | Time dummy | 0.1559 | 0.05 |
| Russia# | GDP<sub>sum</sub> | 13.8726 | 0.10 |
|         | GDP<sub>diff</sub> | -0.7174 | (-0.05) |
|         | Time dummy | 0.3809 | . |
| South Africa | GDP<sub>sum</sub> | -17.0730 | (-0.05) |
|         | GDP<sub>diff</sub> | 7.4994 | 0.04 |
|         | Time dummy | -0.0099 | 0.00 |

**Source:** Authors’ calculation.

**Note:** *All estimated results, being insignificant for India and Russia, have not generated. A few values of S.E. and t statistic are not generated due to their, respective, very large and small values.*

The PMG estimates of ARDL presented in Table 8 show that the time dummy representing COVID-19 is insignificant for all BRICS nations. It is indeed too early to analyze the impact from such a short frame of data. However, even in this short data frame, Brazil represents significantly negative GDP<sub>sum</sub> and significantly positive GDP<sub>diff</sub> with FDI inflows depicting its vertical model of market access motivation during this challenging time.

### Conclusions

As reported by Goldman Sachs in *Is this the BRICS decade?* BRICS have been identified as the emerging economies that can reshape the world economy. But shortly after the financial crisis, external factors combined with serious internal turmoil indicate it to be an exaggeration for the group. While China and India have grown steadily, Russia and Brazil have moved in the opposite direction with no perceptible growth in South Africa. The S&P Global Ratings in a note said, “The diverging long-term economic
trajectory of the five countries weakens the analytical value of viewing the BRICS as a coherent economic grouping.” India and China have exceeded the rating of firm’s growth predictions since the turn of the century, while Russia and South Africa have failed to meet them since about 2005, and Brazil since 2010.

In this backdrop, our study dealing with the extent, growth, and causes of FDI inflows in these select five counties, examines whether their past glory has been revived and restored to or not. FDI movement to any country is recognized as a yardstick for measuring its economic strength as well as its potential, especially for developing countries suffering from capital scarcity as postulated by Chenery’s Two Gap theory. Initially, up to the middle of the first decade of the present century, there was significant positive growth in FDI inflows in all BRICS countries except India. Since then these countries have been experiencing either significant or insignificant declining trend and/or level, again except India where the only level has significantly increased during this period, perhaps due to its lower base in the initial period. These findings on growth analysis corroborate the earlier mentioned opinion of the S&P Global Ratings.

To the estimation of channels of FDI inflows in terms of horizontal, vertical, and hybrid motivations, we have applied dynamic panel data analysis using GMM for BRICS economies together and ARDL-PMG for individual countries. From the empirical estimations, we see that both horizontal and vertical motivations have a dominant role in determining FDI inflows for the BRICS countries. But from country-wise estimations, it is observed that both horizontal and vertical motives are dominant factors for FDI inflows to India and Russia, whereas its horizontal motive is significant for China. For Brazil and South Africa, no motive behind FDI appears significant.

An important motivation for undertaking the present study is to examine the impact of COVID-19 on FDI inflows in BRICS. The period under pandemic situation is taken as a dummy variable along with other control variables. From the analysis, we can see that the pandemic has a significant impact on attracting FDI in Brazil, while it remains insensitive in the rest of the BRICS countries.

The general policy prescription derived from the study is to adopt more reforms in attracting FDI inflows by the BRICS countries that help improve their economic situation. Like other empirical studies in this field, the present study also suffers from inherent limitations. Its findings being heavily dependent on the present available data set should not be generalized with certainty. For generalization more such studies need to be undertaken.

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