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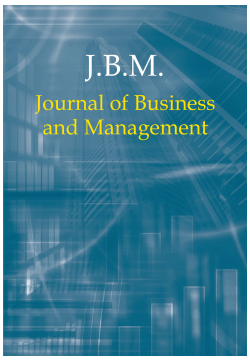

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The COVID-19 pandemic effects on FDI in select emerging economies

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Abstract: This paper explores the relationship between stock markets and foreign direct investment (FDI) inflows in four major emerging markets: Brazil, Russia, India, and South Africa. Using quarterly data from 1997Q1 to 2020Q3, including the COVID-19 period, we analyse the influence of stock market levels and returns on FDI using various statistical models. Our findings show that stock market performance is a key determinant of FDI decisions, with changes in FDI inflows occurring gradually in response to stock market shifts. The first quarter of 2020, marked by COVID-19 and a sharp market decline, significantly disrupted FDI patterns. Additionally, macroeconomic factors such as GDP growth, exchange rates, and interest rates also impact FDI. By incorporating financial variables often omitted in existing research, this study adds to the ongoing debate on FDI determinants, particularly under global uncertainty. This is the first panel data study focusing on the stock market-FDI nexus in these four emerging economies.

Keywords: stock returns; foreign direct investment; FDI decisions; supply chains; M&A; emerging markets; BRICS.

JEL codes: G11, G15, C58, F21, F23.

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1 Introduction

The decade-old debate on foreign direct investment (FDI) determinants remains unresolved. Despite the extensive research regarding FDI, most studies have concentrated on the links between FDI and economic factors. Until recently, most research studies

have ignored the link between FDI and the financial markets (Al Samman and Jamil, 2018). Some researchers have established a link between FDI and financial markets in Ghana (Adam and Tweneboah, 2008), the Gulf Cooperation Council (GCC) (Al Samman and Jamil, 2018), Pakistan (Bilal, 2018), Greece (Tsagkanos et al., 2019), USA (Yavas and Malladi, 2020), Vietnam (Vo, 2021), and Africa (Makoni, 2021).

This paper expands the determinants of FDI inflows, FDI received over a given period, to a selected sample of emerging markets (BRIS: Brazil, Russia, India, and South Africa). China is excluded in this study mainly for the following reasons: among the BRICS countries, the Chinese economy is an order of magnitude larger than those of Brazil, Russia, and South Africa. So, if included, the results get skewed or dominated by China. Moreover, a quick search on Google Scholar reveals more than 2,300 published papers specifically addressing FDI in China. Given the extensive existing research, we aimed to avoid potential criticism that this study lacks novelty by focusing on the relatively underexplored BRIS economies. Nonetheless, future studies should explore including China separately or within sub-panels to compare dynamics explicitly, thus strengthening the robustness and generalisability of findings.

The BRIS countries collectively account for approximately 18% of global GDP and 40% of the world's population, underscoring their economic and demographic significance. Brazil is a top agricultural exporter, producing nearly 20% of the global soybean supply, while Russia contributes over 17% of global natural gas production. India, with a GDP of $3.7 trillion (2024 est.) and a population exceeding 1.4 billion, is the world's fastest-growing large economy, with a growth rate projected at 6.3% in 2024. South Africa, though smaller in size, serves as a gateway to Africa's $3.5 trillion market. These figures highlight the collective influence of BRIS nations in trade, resources, and global consumption patterns.

FDI to BRICS countries accounted for approximately 23% of inflows to developing economies and 10% of global inflows in 2019. Over the analysis period from January 1, 1997, to December 10, 2020, Brazil recorded the highest median quarterly FDI inflows at $10 billion, followed by Russia with $5.28 billion, India with $4.6 billion, and South Africa with $583 million. During the same period, median quarterly returns in local stock markets mirrored this order, with Brazil at 2.7%, Russia at 1.2%, India at 1.1%, and South Africa at 1.0%.

Our primary hypothesis in this paper is that stock market variables are among the key determinants of FDI inflows. We contribute to and expand upon the literature on the linkages between FDI and financial variables along the lines of Puck and Filatotchev (2018) and Yavas and Malladi (2020). The secondary objective is to observe FDI trends in these BRIS countries during the COVID-19 pandemic. These twin objectives are carried out by introducing financial variables, (i.e., returns and levels of the emerging stock markets) along with the traditional factors (GDP growth, exchange rates, and inflation rates) frequently found in FDI literature.

The paper's contribution is fourfold:

1 We include the long-ignored financial variables from four unexplored emerging markets to study incoming FDI. Other studies focus mostly on economic variables.

2 Most studies use annual data, while we use quarterly data. Some events, such as the stock market crash of COVID-19, are not observable in annual data.

3 Quantify the impact of COVID-19 on FDI inflows in BRIS countries.

4 Panel data methods and vector autoregression (VAR) deployed in this study combine cross-section and time series, thus less collinearity among variables, more degrees of freedom, and more efficiency (Baltagi, 1995).

Among the key findings, we document that the stock market levels and returns, GDP growth, exchange rates, and interest rates are among the key determinants of FDI decisions. FDI inflows appear to follow and slowly adjust to stock market changes. We also show that 2020Q1 (the start of COVID-19 along with plunging stock markets) is the most significant breakpoint in FDI analysis.

The rest of the paper is organised as follows: the next section reviews FDI literature regarding FDI motivations and identifies gaps in the literature. The section on data explains several data sources used in this paper. Next, the statistical methods and analysis section elaborates on the three methods deployed in this paper, followed by each method's results. The final section summarises the results, presents conclusions, and identifies the scope for further research.

2 Literature review of FDI, financial markets, and linkages

The determinants of FDI have been extensively studied through both 'micro' and 'macro' approaches. Models that take a 'micro' approach explore firm-specific factors such variables as firm size, technical skills, and management expertise (Dunning, 1973), the industrial-organisational theory (Caves, 1971; Hymer, 1983), the appropriability theory (Magee, 1981), market internalisation theory (Rugman, 1985), the eclectic theory (Dunning, 1977, 2003; Verbeke, 2003) and the risk diversification theory (Agmon and Lessard, 1977; Grubel, 1968).

The 'macro' approach models investigate broader economic variables and include the currency premium theory (Aliber, 1970), the comparative advantage theory (Kojima, 1973), and the development stage theory (Dunning, 1981). Both micro and macro approaches utilise exogenous as well as endogenous variables. Exogenous variables widely considered in the literature include market size, cost of inputs, and market imperfections – all of which may give rise to locational advantages for undertaking FDI in a host country (Bergstrand and Egger, 2007; Buckley and Casson, 1976; Carr et al., 2001; Markusen, 1984).

In the context of emerging markets, additional factors often manifest differently due to unique challenges such as institutional quality, trade barriers, and financial volatility. The emerging-market FDI determinants were investigated, leading to the identification of factors such as external interest rates (Koepke, 2019) and tariff barriers (Paul and Jadhav, 2019) in Brazil (Junior and Eid, 2017), Russia (Ledyaeva, 2009), India (Singhania and Gupta, 2011), and South Africa (Wilson and Vencatachellum, 2019).

In search of a cohesive theoretical FDI model, some researchers explored the stock market's influence on FDI inflows. Baker et al. (2009) provide a foundational model linking stock markets and FDI inflows through two key hypotheses. First, the cheap financial capital hypothesis posits that FDI is higher when financial capital in the source country is unusually cheap, as reflected by elevated stock market valuations, which lower the cost of raising capital for outward investments. Second, the cheap host country assets hypothesis suggests that FDI increases when assets in the host country are undervalued, indicated by depressed stock market returns, creating attractive acquisition opportunities

for foreign investors. In our study, these hypotheses are tested using country-level stock market variables – levels and returns – as proxies for financial and asset 'cheapness.' The significant results in our models align with these theoretical predictions, emphasising the importance of stock market conditions in driving FDI flows. Klein and Rosengren (1994) studied the effect of stock market returns and GDP on incoming FDI.

The relationship between financial markets and FDI is particularly significant in emerging economies, where stock markets serve as indicators of economic stability and investor confidence. Examples include Barro (1990), who argued that stock market valuations in the home country have significant explanatory power for US investments abroad; Baker et al. (2009) confirmed a strong association between home stock market valuations and FDI; Feridun et al. (2009) found a causal relationship between stock prices and FDI. Besides the stock markets, other financial variables, notably exchange rate and bank lending rates (BLR), are essential in FDI studies since the real exchange rate depreciation would lower capital costs and increase incoming FDI (Blonigen, 1997). Majeed and Ahmad (2008) and Durham (2003) modelled the BLR effects on FDI.

The COVID-19 pandemic has severely hurt the FDI inflows. In 2020, global FDI flows fell by 35% to $1 trillion or 20% below the low point reached after the 2008 global financial crisis (UNCTAD, 2021). Two strands of research on the current pandemic have emerged: the impact of the pandemic on the financial markets (Haldar and Sethi, 2020; Liu et al., 2020; Mazur et al., 2021) and the impact of the pandemic on FDI (Makoni, 2021; Padhan and Prabheesh, 2021; Sharma and Sha, 2020; Vo, 2021; Zhang et al., 2021).

Previous literature extensively covers the relationship between stock markets and FDI (e.g., Baker et al., 2009; Makoni, 2021). However, this study extends the analysis uniquely by leveraging high-frequency quarterly data and incorporating the COVID-19 pandemic as a distinct structural breakpoint, which allows capturing dynamic short-term shocks and long-term adjustments more precisely than prior research. We add to the existing literature through our methodological approach (by adding financial variables, deploying panel data/VAR methods), country selection (four emerging markets at once), data frequency (quarterly as opposed to annual to capture more details), and COVID-19 impact.

3 Data

FDI data are obtained from the TradingEconomics[1] (TE) website, which aggregates data from official central banks for BRIS countries: Banco Central do Brasil (Brazil), Central Bank of Russia, Reserve Bank of India, and South African Reserve Bank. These sources are widely recognised for their accuracy and reliability in reporting macroeconomic data.

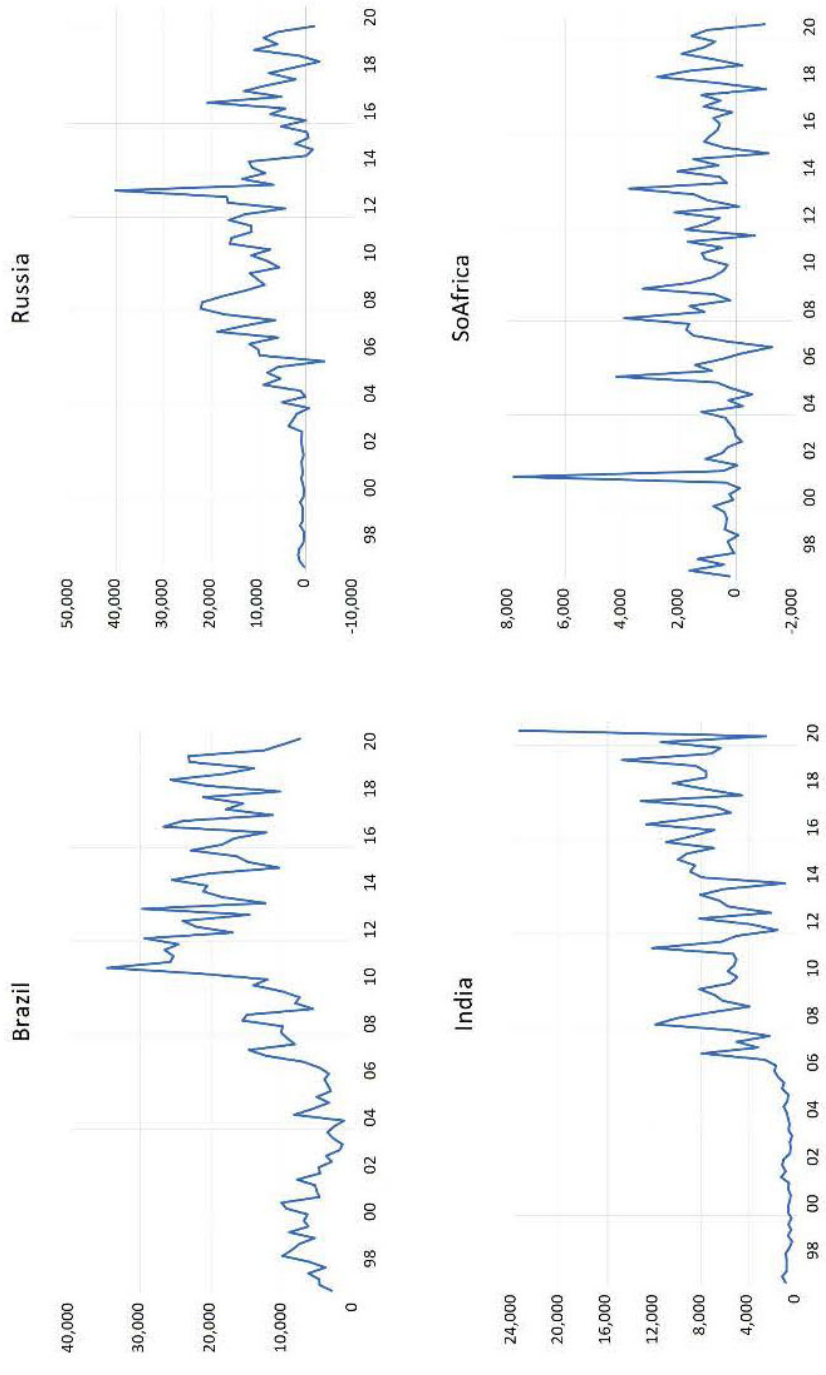
All variables in this study are of quarterly frequency, allowing for a more granular analysis compared to annual data, and are reported in nominal US dollars (USD). The use of quarterly data ensures that short-term dynamics in FDI and stock market linkages are captured effectively. Our data window begins on 1997Q1 (the earliest data point available) and ends on 2020Q4 (December 10, 2020, when we started this paper). The quarterly inward FDI flow in Figure 1 is in millions of USD. Figure 2 shows the market share of BRIS FDI flows as a percentage of the developing and all the economies. Brazil has the largest FDI by size, followed by India, Russia, and South Africa.

Table 1 Economic or financial indicators, data variables, data sources, and notes

Indicator	*Variable*	*Source*	*Notes*
FDI net inflow	FDI_Brazil	TE	Monthly series summed to QTR
FDI net inflow	FDI_Russia	TE	Quarterly series
FDI net inflow	FDI_India	TE	Monthly series summed to QTR
FDI net inflow	FDI_SA	TE	Quarterly series
FX to USD	FX_India	FRED[1]	Value of local currency for 1 USD, QTR
FX to USD	FX_Brazil	FRED	Value of local currency for 1 USD, QTR
FX to USD	FX_Russia	FRED	Value of local currency for 1 USD, QTR
FX to USD	FX_SA	TE	Value of local currency for 1 USD, QTR
Inflation rate	INF_R_Brazil	TE	Converted MONTH to QTR using [(1 + r1)*(1 + r2)*(1 + r3)]^(1/3) – 1
Inflation rate	INF_R_Russia	TE	Converted MONTH to QTR using [(1 + r1)*(1 + r2)*(1 + r3)]^(1/3) – 1
Inflation rate	INF_R_India	World Bank[2]	Converted Yearly to quarterly using (1 + r)^(1/4) – 1
Inflation rate	INF_R_SA	TE	Converted MONTH to QTR using [(1 + r1)*(1 + r2)*(1 + r3)]^(1/3) – 1
Stock index return	STK_R_Brazil	FRED	Quarterly series
Stock index return	STK_R_India	FRED	Quarterly series
Stock index return	STK_R_Russia	FRED	Quarterly series
Stock index return	STK_R_SA	FRED	Quarterly series
GDP (real rate)	GDP_R_Brazil	TE	Quarterly series
GDP (real rate)	GDP_R_Russia	TE	Quarterly series
GDP (real rate)	GDP_R_India	TE	Quarterly series
GDP (real rate)	GDP_R_SA	TE	Quarterly series
Bank lending rates	BLR_R_Brazil	TE	Monthly series averaged to QTR
Bank lending rates	BLR_R_Russia	TE	Monthly series averaged to QTR
Bank lending rates	BLR_R_India	TE	Monthly series averaged to QTR
Bank lending rates	BLR_R_SA	TE	Monthly series averaged to QTR
Stock index level	STK_LVL_Brazil	Yahoo Finance	Stock market level as of QTR end
Stock index level	STK_LVL_Russia	Moscow Exchange[3]	Moscow exchange indices (MOEX Russia index and RTS index)
Stock index level	STK_LVL_India	Yahoo Finance[4]	Stock market level as of QTR end
Stock index level	STK_LVL_SA	TE	Stock market level as of QTR end

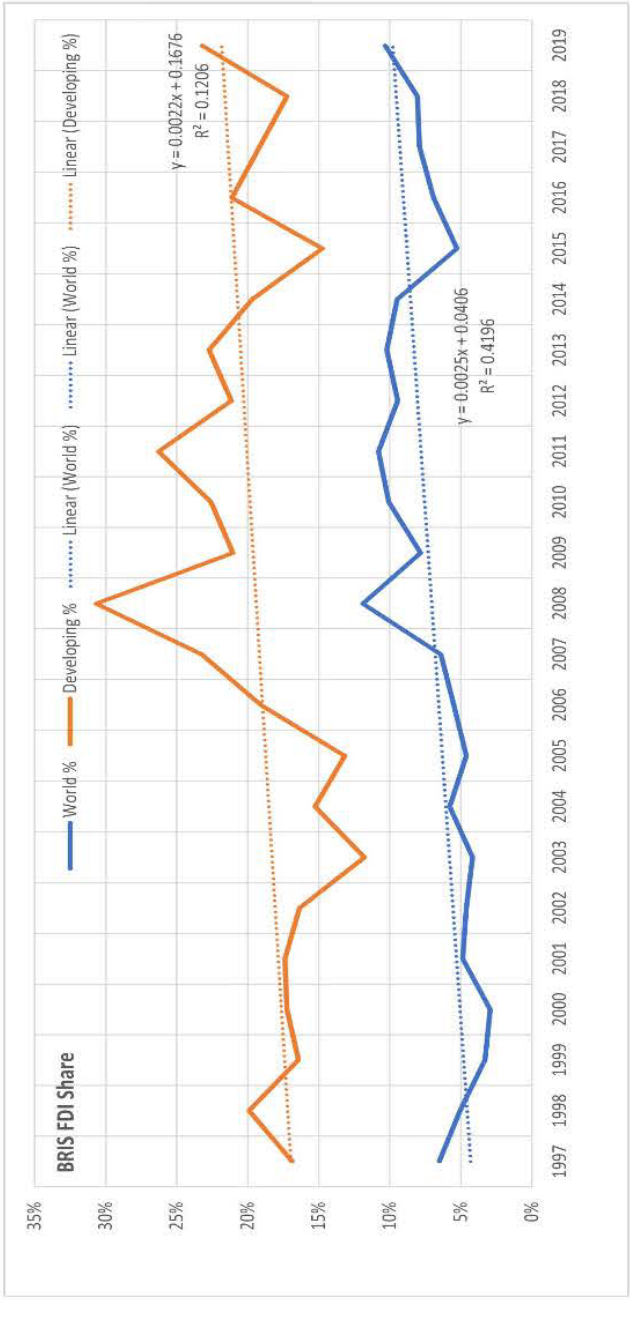
Notes: [1]FRED Economic Data from St. Louis Fed: https://fred.stlouisfed.org/
[2]World Bank Data: https://data.worldbank.org/
[3]Moscow Exchange: https://www.moex.com/
[4]Yahoo Finance, World Indices: https://finance.yahoo.com/world-indices.

Figure 1 FDI quarterly inflows (see online version for colours)



Notes: The quarterly FDI inflows to BRIS economies are shown in millions of USD. Please note that FDI flows can be negative, so a log operation is impossible. Data window: from 01/01/1997 to 12/10/2020.

Figure 2 Share of BRIS country FDI inflows (see online version for colours)



Notes: The top line shows the BRIS FDI share of developing economies. The bottom line shows the BRIS FDI share of all economies. FDI to BRIS countries accounted for approximately 23% of the developing economies and 10% of the global economies in 2019. Data window: from 01/01/1997 to 12/10/2020.

Baker et al. (2009) and Klein and Rosengren (1994) studied the effect of stock market returns and GDP on incoming FDI. Froot and Stein (1991) and Blonigen (1997) included exchange rates and found them to influence the US incoming FDI. Finally, the effects of lending rates on FDI are studied by Majeed and Ahmad (2008) and Durham (2003). Our primary hypothesis in this paper is that stock market variables are among the key determinants of FDI inflows. So, we collect all possible factors (FDI, GDP, stock market, foreign exchange, inflation, and lending rates) from five sources, as shown in Table 1. Each variable (source and how it is computed) is explained below.

The dependent variable in our analysis is incoming FDI. The independent variables are selected from the literature discussed in the previous paragraph for comparison. The most commonly used FDI determinants (GDP growth rate, inflation rate, foreign exchange rate, bank lending rate) are augmented with stock market level and return. Each of these variables is explained below in detail.

a Incoming FDI (*FDI*): it is measured in millions of USD in nominal terms. We chose 01/01/1997 as the starting date due to the availability of quarterly data.

b Currency index (*FX*): currencies are converted to USD using a quarter-end exchange rate.

c Inflation rate (*INF_R*): the national inflation rate measurements without adjustments as reported by the official agencies in Brazil[2], Russia[3], India[4], and South Africa[5].

d Stock index level (*STK_LVL*): the end-of-quarter index levels used for computations are BOVESPA, MOEX Russia Index, SENSEX, and JALSH-All Share.

e Stock return (*STK_R*): the quarterly stock return is computed using $[(1+r_1)*(1+r_2)*(1+r_3)]^{\left(\frac{1}{3}\right)}-1$ formula, where *r* is a monthly stock return compiled by the FRED as the 'total share prices for all shares' series and derived from the OECD. The respective variables used are SPASTT01BRQ657N (Brazil), SPASTT01RUQ657N (Russia), SPASTT01INQ657N (India), and SPASTT01ZAM657N (South Africa).

f Real GDP growth rate (*GDP_R*): percent change from the previous quarter, seasonally adjusted. This quarterly data series is obtained from the TE.

g Bank lending rate (*BLR_R*): the BLR is computed as follows: weighted average interest rate charged on commercial loans (Brazil); average interest rate charged on loans for up to one year by commercial banks to companies (Russia); the prime lending rate (India); the average interest rate charged on loans by five major banks (South Africa). This quarterly data series is obtained from the TE.

h COVID-19 (*covid*): a binary control variable is included to identify structural breakpoints and assess the impact of the pandemic. Its inclusion highlights the significant disruption caused by COVID-19 in 2020.

Table 2 Summary statistics for BRIS countries

	Brazil							*Russia*						
	FDI	*STK_LVL*	*STK_R*	*FX*	*BLR_R*	*GDP_R*	*INF_R*	*FDI*	*STK_LVL*	*STK_R*	*FX*	*BLR_R*	*GDP_R*	*INF_R*
Mean	12,358	45,394	0.029	2.52	0.637	0.005	0.061	6,568	1,222	0.014	36.69	0.151	0.004	0.145
Median	10,008	48,234	0.027	2.28	0.561	0.006	0.058	5,281	1,370	0.012	30.26	0.115	0.008	0.096
Maximum	34,662	113,761	0.212	5.74	1.318	0.077	0.169	40,140	3,046	0.259	78.71	0.472	0.041	1.168
Minimum	1,312	7,047	(0.163)	1.07	0.390	(0.096)	0.018	(3,922)	27	(0.246)	5.77	0.063	(0.320)	0.023
Std.Dev.	8,070	27,611	0.078	0.96	0.224	0.017	0.027	7,164	815	0.072	17.65	0.095	0.037	0.190
Skewness	0.66	0.31	0.16	1.01	1.47	(1.68)	1.51	1.47	0.15	0.16	0.73	2.04	(7.27)	4.01
Kurtosis	2.39	2.25	2.78	4.10	4.60	17.61	6.69	6.71	2.08	6.61	2.70	6.33	64.06	19.45
Jarque-Bera(p)	0.016	0.153	0.754	0.000	0.000	0.000	0.000	0.000	0.161	0.000	0.012	0.000	0.000	0.000
#Quarters	95	95	94	94	94	94	94	93	93	93	95	95	95	95
			India							*South Africa*				
	FDI	*STK_LVL*	*STK_R*	*FX*	*BLR_R*	*GDP_R*	*INF_R*	*FDI*	*STK_LVL*	*STK_R*	*FX*	*BLR_R*	*GDP_R*	*INF_R*
Mean	4,707	16,072	0.009	52.29	0.111	0.016	0.018	858	28,592	0.008	9.19	0.130	0.701	0.057
Median	4,605	15,455	0.011	47.30	0.108	0.016	0.015	583	27,666	0.010	8.03	0.105	0.037	0.055
Maximum	23,418	41,254	0.104	76.40	0.142	0.219	0.069	7,827	59,505	0.086	18.46	0.742	5.200	0.124
Minimum	348	2,812	(0.095)	35.81	0.083	(0.252)	0.004	(1,251)	4,791	(0.093)	4.42	0.070	(0.517)	0.003
Std.Dev.	4,291	11,399	0.039	10.81	0.014	0.036	0.012	1,213	18,370	0.031	3.32	0.074	1.350	0.023
Skewness	1.19	0.50	(0.18)	0.66	0.30	(2.49)	2.36	2.47	0.24	(0.64)	0.80	6.19	1.77	0.45
Kurtosis	5.26	2.08	2.92	2.07	2.02	44.18	10.33	13.84	1.57	4.29	2.59	51.02	4.67	3.54
Jarque-Bera(p)	0.000	0.025	0.766	0.006	0.073	0.000	0.000	0.000	0.011	0.001	0.005	0.000	0.000	0.110
#Quarters	95	95	95	95	95	95	95	95	95	95	95	95	95	95

Notes: The quarterly FDI inflows to BRIS economies, stock market levels, stock returns, value of local currency per one USD, bank lending rates, GDP growth rates, and inflation rates are summarised in this table. Negative numbers are shown in (). Most variables have data for all 95 quarters. Brazil has the largest median FDI, followed by Russia, India, and S. Africa. FDIs exhibit a positive skew. The Jarque-Bera test assesses whether a series follows a normal distribution. A low (p) value results in rejecting the null hypothesis of a normal distribution. Data window: from 01/01/1997 to 12/10/2020.

4 Methodology and results analysis

Summary statistics of economic and financial variables in this study are shown in Table 2. The correlation analysis is provided in Table 3a for each country and Table 3b for all countries.

We follow a three-step approach described in Gujarati and Porter (2009) to study incoming FDI. In the first step, we study the variables that explain a country's FDI using the pooled OLS regression, neglecting the time series and cross-sectional effects. In the second step, we utilise two panel data regression models:

a the fixed-effect model (FEM)

b the random-effect model (REM).

We uncover simultaneity with VAR methodology and separate short-and long-run effects with a dynamic regression model in the third and final step.

Below, we explain all three methods employed in detail. Before proceeding with the methodology, we want to address a reader's common concerns. We conducted stationarity tests on the panel and ensured the stationarity of variables. A difference operation is performed when a variable is non-stationary to ensure stationarity. Log operation is not possible since the incoming FDI can be negative in some quarters. Collinearity is less likely in a panel since the country cross-section adds variability (Baltagi, 1995; Ranjan and Agrawal, 2011).

4.1 Pooled OLS regressions

A balanced panel data is created by the country variable as the cross-section and the quarter as frequency. Baltagi (1995) lists four advantages of using panel data methods over a cross-section or time series data:

1 Panel data estimation methods allow for heterogeneity into account by allowing for individual-specific variables.

2 By combining cross-section and time series, panel data has less collinearity among variables, more degrees of freedom, and more efficiency.

3 By studying the repeated cross-section of observations, panel data are better suited to study the dynamics of change.

4 Panel data can better detect and measure effects that cannot be observed in pure cross-section or pure time-series data.

In short, panel data can enrich empirical analysis in ways that may not be possible if we use only cross-section or time-series data.

Table 3a Correlations among BRIS individual country variables (see online version for colours)

Brazil								*Russia*							
	FDI	*FX*	*INF_R*	*STK_LVL*	*STK_R*	*GDP_R*	*BLR_R*		*FDI*	*FX*	*INF_R*	*STK_LVL*	*STK_R*	*GDP_R*	*BLR_R*
FDI	1.00							FDI	1.00						
FX	0.16	1.00						FX	(0.11)	1.00					
INF_R	(0.21)	0.08	1.00					INF_R	(0.26)	(0.26)	1.00				
STK_LVL	0.66	0.46	(0.42)	1.00				STK_LVL	0.37	0.72	(0.50)	1.00			
STK_R	(0.26)	(0.08)	0.13	0.03	1.00			STK_R	(0.15)	0.02	0.37	(0.08)	1.00		
GDP_R	(0.05)	(0.41)	(0.03)	(0.13)	0.28	1.00		GDP_R	0.01	(0.22)	0.30	(0.12)	0.30	1.00	
BLR_R	(0.45)	(0.28)	0.11	(0.69)	0.03	(0.07)	1.00	BLR_R	(0.39)	(0.41)	0.69	(0.65)	0.09	(0.11)	1.00

India								*South Africa*							
	FDI	*FX*	*INF_R*	*STK_LVL*	*STK_R*	*GDP_R*	*BLR_R*		*FDI*	*FX*	*INF_R*	*STK_LVL*	*STK_R*	*GDP_R*	*BLR_R*
FDI	1.00							FDI	1.00						
FX	0.65	1.00						FX	0.01	1.00					
INF_R	0.35	0.22	1.00					INF_R	0.10	(0.12)	1.00				
STK_LVL	0.77	0.87	0.25	1.00				STK_LVL	0.08	0.81	(0.18)	1.00			
STK_R	(0.13)	(0.07)	(0.11)	0.02	1.00			STK_R	0.01	(0.13)	(0.29)	(0.04)	1.00		
GDP_R	0.31	(0.07)	(0.07)	(0.00)	0.02	1.00		GDP_R	(0.01)	(0.26)	0.25	(0.55)	(0.05)	1.00	
BLR_R	(0.51)	(0.77)	(0.12)	(0.74)	(0.10)	(0.01)	1.00	BLR_R	(0.04)	(0.04)	0.13	(0.23)	0.03	0.18	1.00

Notes: Correlations above 0.5 are highlighted. There is no consistent (across-panel) correlation among the independent variables. Data window: from 01/01/1997 to 12/10/2020.

Table 3b Full panel correlations (see online version for colours)

	TOTAL panel						
	FDI	*FX*	*INF_R*	*STK_LVL*	*STK_R*	*GDP_R*	*BLR_R*
FDI	1.00						
FX	0.53	1.00					
INF_R	(0.13)	(0.15)	1.00				
STK_LVL	0.01	(0.37)	(0.05)	1.00			
STK_R	(0.07)	(0.08)	0.19	0.09	1.00		
GDP_R	(0.13)	(0.15)	0.03	(0.07)	(0.02)	1.00	
BLR_R	(0.04)	(0.43)	0.19	0.40	0.15	(0.04)	1.00

Notes: Correlations above 0.5 are highlighted. High correlations present in country-specific data (as shown in Table 3a) disappear in the full panel. Data window: from 01/01/1997 to 12/10/2020.

There are 95 quarters (time-series) between 01/01/1997 and 12/10/2020, and four countries (cross-section), a 95 × 4 balanced panel, are created in this paper. The theoretical FDI models (Dunning, 1981, 2003) are implemented in several empirical studies (Adam and Tweneboah, 2008; Asiamah et al., 2019; Vo, 2021), to name a few. The pooled OLS regression equation to be estimated, characterised by two FDI subscripts (i and t), is shown in equation (1).

$$FDI_{it} = \beta_0 + \beta_1 STK\_LVL_{it} + \beta_2 STK\_R_{it} + \beta_3 FX_{it} + \beta_4 BLR\_R_{it} + \beta_5 GDP\_R_{it} + \beta_6 INF\_R_{it} + \mu_{it} \quad (1)$$

where FDI_{it}, the dependent variable is the incoming quarterly FDI to a country i in quarter t. i = 1, 2, 3, 4 and t = 0, 1, 2, …., 95. *STK_LVL*: stock market level, *STK_R*: stock market return, *FX*: exchange rate with USD, *BLR_R*: bank lending rate, *GDP_R*: real gross domestic product growth rate, and *INF_R*: inflation rate. It is assumed that the regressors are non-stochastic, or if stochastic, are uncorrelated with the error term, and the error term follows the assumption $E(\mu_{it}) \sim N(0, \sigma^2)$. β_0 is the intercept and β_1 to β_6 are the regression equation coefficients. Please refer to Table 1 for more details on variable definitions.

Based on equation (1), pooled OLS regression results are provided in Table 4 for all four countries together. Panel (a) shows significant variables in the same quarter, whereas panel (b) shows significant variables in the current and two lagged quarters. The stepwise least squares method is used for regressor selection.

The findings in Table 4 (panels a and b) indicate that higher local stock market levels, higher local BLR, cheaper local currency, and negative stock returns in the current quarter are significant determinants of FDI inflows to BRIS countries. COVID-19 has a significant and negative effect on incoming FDI. Interestingly, the GDP growth rate does not figure in the FDI determinants when stock market variables are added. Higher stock market levels and BLR correspond to higher incoming FDI – both conditions signal investor confidence and make emerging markets attractive to foreign investors. In addition, the depreciating local currency, (i.e., higher FX) and negative stock return in the current quarter make acquiring target companies for M&A cheaper for foreign investors (i.e., buying the dip).

Table 4 COVID effect on FDI using pooled OLS

(a) Dependent variable: FDI (BRIS, in USD millions, no lags)			*(b) Dependent variable: FDI (BRIS, in USD millions, two lags)*		
Variables	*Coefficient (significance)*	*t-Stat*	*Variables*	*Coefficient (significance)*	*t-Stat*
STK_LVL	0.13***	10.34	STK_LVL(–1)	0.13***	10.27
BLR_R	7,953.33***	6.95	BLR_R	8,092.68***	6.95
FX	62.20***	6.18	FX(–1)	63.75***	6.26
STK_R	–16,916.71***	(3.12)	STK_R	–14,446.85***	(2.67)
COVID	–4,381.59**	(2.06)	COVID	–4,716.77**	(2.22)

Notes: Results are derived from equation (1) with incoming FDI as a dependent variable. Only significant variables are shown. (–1) denotes a previous quarter. Data window: from 01/01/1997 to 12/10/2020, $N = 375$. Asterisks denote the statistical significance at the 0.1 (*), 0.05 (**), and 0.01 (***) levels. The COVID-19 effect (starting from 2020Q1) on FDI inflows is significant and negative at a 5% level.

For robustness check, we evaluate individual contributions of significant variables to explain the dependent variable (FDI) by removing one variable at a time. For example, when we remove economic variables (such as the GDP growth rate), the adjusted R-square drops slightly from 28.0% to 27.5%. However, if we remove the model's stock market levels, the adjusted R-square drops almost by half to 14.1% from 28.0%. So, stock market variables appear to do a better job of explaining FDI inflows than other variables. Our results are similar to prior studies:

a changes in stock prices have substantial explanatory power for US investment (Barro, 1990)

b FDI flows are very strongly positively related to source-country stock market valuations (Baker et al., 2009)

c US stock market level explains the current quarter incoming FDI (Yavas and Malladi, 2020).

We perform a structural break test on results in Table 4 to examine if the model parameters are stable across various subsamples of data. The Quandt-Andrews breakpoint test at the 10% level shows that the maximum LR F-statistic (41.85) occurs in 2020Q1 (beginning of COVID-19), the most likely breakpoint location. A second multiple breakpoint analysis (Bai and Perron, 1998, 2003) confirms that 2020Q1 was the most significant breakpoint in FDI analysis. Results also show that COVID-19 has a significant negative effect on incoming FDI in the panel, Brazil, and Russia. However, further differentiation between short-term disruptions and potential long-term structural shifts due to pandemic-induced changes in global value chains, investment behaviour, and policy responses needs deeper exploration, warranting future longitudinal studies.

Blonigen and Wang (2004) find that the underlying factors determining FDI activity vary systematically across countries. So, we conduct country-specific tests on FDI inflows and summarise the results in Table 5. For three out of four BRIS countries (except S.A.), stock market levels and/or returns are crucial in explaining the incoming FDI. Interestingly, the GDP growth rate appears only once among the eleven significant variables. Also, it is not significant in the aggregate panel.

Table 5 COVID effect on country-specific FDI using OLS

(a) Brazil FDI (in USD millions)			*(b) Russia FDI (in USD millions)*		
Variables	*Coefficient (significance)*	*t-Stat*	*Variables*	*Coefficient (significance)*	*t-Stat*
STK_LVL(–1)	0.3***	12.90	STK_LVL(–1)	10.83***	8.38
COVID	–10,477.75***	–2.97	FX	–261.48***	–4.83
STK_R(–1)	–31,174.45***	–4.54	BLR_R(–1)	21,293.15***	*3.77*
INF_R(–1)	*61,805***	*2.94*	COVID	–15,649.89**	*–2.55*
FX(–1)	*–2,452.02***	*–3.10*			
BLR_R	3,986.81***	2.21			
(c) India FDI (in USD millions)			*(d) S. Africa FDI (in USD millions)*		
Variables	*Coefficient (significance)*	*t-Stat*	*Variables*	*Coefficient (significance)*	*t-Stat*
STK_LVL(–1)	0.29***	21.36	Constant	1,279.19***	5.05
GDP_R	25,899.77***	3.83	BLR_R(–1)	–3,161.7*	–1.87
GDP_R(–1)	–25,263.41***	–3.12			

Notes: Only significant variables are shown. One panel is allocated per country. Data window: from 01/01/1997 to 12/10/2020, 95 quarters × 4 countries. Asterisks denote the statistical significance at the 0.1 (*), 0.05 (**), and 0.01 (***) levels. The COVID-19 effect (starting from 2020Q1) on FDI inflows is significant in Brazil and Russia at a 5% level and is negative.

4.2 Fixed and random effect model regressions

We capture the heterogeneity that may exist among the BRIS countries with the help of a one-way fixed-effects regression model (FEM) of Baltagi (1995) and Gujarati and Porter (2009). In a FEM model, each country, i is allowed to have its own time-invariant (hence, the name fixed effect) intercept (β_{0i} instead of β_0) while assuming that the slope coefficients are constant across firms. The FEM equation is shown below:

$$FDI_{it} = \beta_{0i} + \beta_1 STK\_LVL_{it} + \beta_2 STK\_R_{it} + \beta_3 FX_{it} + \beta_4 BLR\_R_{it} + \beta_5 GDP\_R_{it} + \beta_6 INF\_R_{it} + \mu_{it} \tag{2}$$

If we relax the assumption that β_{0i} is time-invariant and substitute it with a random variable with a mean value of β_0 (no i subscript) such that

$$\beta_{0i} = \beta_0 + \varepsilon_i \tag{3}$$

where ε_i is a random error term with mean 0 and variance, σ_ϵ^2. The resulting method is called the one-way REM, also called the error components model (ECM), because the composite error term, wit, consists of two (or more) error components.

$$FDI_{it} = \beta_0 + \beta_1 STK\_LVL_{it} + \beta_2 STK\_R_{it} + \beta_3 FX_{it} + \beta_4 BLR\_R_{it} + \beta_5 GDP\_R_{it} + \beta_6 INF\_R_{it} + w_{it} \tag{4}$$

where $w_{it} = \varepsilon_i + \mu_{it}$. The composite error term wit has two components: ε_i, the individual-specific error component, and $\mu_{i,t}$, the combined time series and cross-section error component.

We present the results from the FEM in Table 6, using equation (2). FEM results in Table 6 (panel b) show that stock levels, stock returns, BLR, and GDP growth rates are significant determinants of BRIS countries' FDI inflows. All significant variables have their expected signs. Higher stock market levels and high GDP growth rates signal an emerging market's strength to foreign investors. When the stock market level is high, a negative stock return in the current quarter signals a buying opportunity. It makes acquiring target companies for M&A cheaper for foreign investors (i.e., buy the dip). A negative BLR coefficient implies that FDI inflows increase as it becomes cheaper to finance acquisitions domestically.

Note that two out of three significant determinants of FDI inflows, (i.e., stock levels and stock returns), as shown in panel (b), are related to the local country's stock market, confirming that stock markets play a key role in determining FDI inflows. Our findings align with the results of Yavas and Malladi (2020) that stock market variables are key FDI determinants in the USA. The adjusted R-square for the combined FEM model is 52.2%, significantly higher than the adjusted R-square in the pooled OLS of 30.1% (of Table 4b) – validating that panel data estimators perform well in forecast performance mostly due to their simplicity, parsimonious representation, and the stability of the parameter estimates (Baltagi, 2008). The introduction of lags does not improve the FEM model significantly, so the lags are not included in the table.

Implicit in the FEM estimation is the assumption that the errors for different cross-sectional units are uncorrelated. For robustness, we use the residual cross-section dependence test. The asymptotically standard normal Pesaran CD test fails to reject (p-value of 0.62) the null hypothesis of no cross-section dependence (correlation) in residuals. It means that shocks to FDI do not occur simultaneously in multiple BRIS countries. Panel data methods to study FDI have previously been used without stock market variables (Ranjan and Agrawal, 2011).

Table 6 FEM results for BRIS countries

(a) FDI (in USD millions, FEM, all variables, BRIS)			*(b) FDI (in USD millions, FEM, significant variables only, BRIS)*		
Variable	*Coefficient*	*t-Statistic*	*Variable*	*Coefficient*	*t-Statistic*
C	5,665.89***	4.97	C	4,867.95***	5.01
STK_LVL	0.15***	7.89	STK_LVL	0.14***	7.64
STK_R	–17,006.48***	(3.81)	STK_R	–18,685.58***	(4.28)
FX	–38.83	(1.42)	BLR_R	–7,138.97***	(2.95)
BLR_R	–6,004.94**	(2.40)	GDP_R	1,119.44***	2.81
GDP_R	1,175.39***	2.95			
INF_R	–5,078.27*	(1.77)			

Notes: Panel (a) shows all variables, and panel (b) contains significant-only variables.
Data window: from 01/01/1997 to 12/10/2020, 95 quarters × 4 countries.
Asterisks denote the statistical significance at the 0.1 (*), 0.05 (**), and 0.01 (***) levels.

Table 7 REM results for BRIS countries

(a) FDI (BRIS, in USD millions, REM, significant variables only)		
Variable	*Coefficient*	*t-Statistic*
C	2,198.68***	5.32
STK_LVL	0.12***	10.28
STK_R	*–15,369.86***	(3.49)
BLR_R	*5,881.51***	5.55
(b) Hausman test for the selection of FEM or REM		
Cross-section random effects test comparisons:		
Variable	*Fixed*	*Random*	*Significance*
STK_LVL	0.1235	0.1165	
STK_R	(18,704.84)	(15,369.86)	***
BLR_R	(8,021.36)	5,881.51	***
Test summary		Chi-Sq. statistic	Chi-Sq. d.f.
Cross-section random		218.78	3

Notes: Swamy and Arora (1972) estimator of component variances are used. All variables are in panel (a), and significant-only variables are in panel (b). Data window: from 01/01/1997 to 12/10/2020, 95 quarters × 4 countries. Asterisks denote the statistical significance at the 0.1 (*), 0.05 (**), and 0.01 (***) levels.

We next turn to the REM to allow for slope coefficient differences. Researchers routinely deploy both (FEM and REM) models for estimation and select one of the two based on the Hausman (1978) test. We use equation (4) to explore REM on BRIS FDI and present the results in Table 7. Since the REM estimation requires the number of cross-sections (four, in this case, one for each country) to be greater than the number of coefficients, we could not run REM for all variables and instead show the three most significant regressors. REM results in Table 7 also identify that stock market levels and returns are key determinants of FDI inflows. Using the REM, other researchers find a similarly positive and statistically significant relationship between FDI and stock markets in African countries (Makoni, 2021).

Next, we use the Hausman test to decide whether FEM or REM is a more appropriate model for this study. The Hausman test's null hypothesis states that the FEM and REM estimators do not differ substantially, while the alternative hypothesis is that they differ. The test statistic developed by Hausman has an asymptotic $\chi 2$ distribution. If the null hypothesis is rejected, the conclusion is that the REM is not appropriate because the random effects are probably correlated with one or more regressors. The Hausman test results in Table 7b reject the null hypothesis. The estimated $\chi 2$ value for three degrees of freedom is highly significant, so we prefer FEM results.

4.3 Vector autoregression

It is common in research to have models where some variables are explanatory and dependent simultaneously. In these cases, we turn to simultaneous equation models. Sims (1980) argued that there should be no distinction between endogenous and exogenous variables, and all variables should be treated as endogenous. This means that each equation has the same regressors in its general reduced form, which leads to the

development of a vector autoregressive and vector error correction model (VAR/VECM) introduced by Engle and Granger (1987). In this paper, we use the P^{th} order VAR model of Asteriou and Hall (2011) with p-lagged values. A P^{th} order VAR, denoted by $FDI_t(p)$, is shown in equations (5) and (6).

$$FDI_t(p) = \alpha + \sum_{j=1}^{p} \beta_j FDI_{t-j} + \sum_{j=1}^{p} \gamma_j X_{t-j} + \delta_{1t} \tag{5}$$

$$X_t(p) = \alpha' + \sum_{j=1}^{p} \theta_j FDI_{t-j} + \sum_{j=1}^{p} \varphi_j X_{t-j} + \delta_{2t} \tag{6}$$

where X_t is a regressor at time t, δ are stochastic error terms called impulses, innovations, or shocks. $E(\delta_t) = 0$, $E(\delta_t, \delta_{t-k}) = 0$ for any non-zero k.

As described in Maddala and Wu (1999), the Johansen-Fisher panel cointegration test in Table 8 shows that three out of seven variables are cointegrated, or there is a long-term or equilibrium relationship (Gujarati and Porter, 2009). We used a VECM model for lag selection and identified that the lag length of one produces the best model, as specified by the Akaike information criterion. To address causality between FDI and other variables, we use the Granger (1969) causality test – other researchers have deployed this test to find causality in FDI flows (Coondoo and Dinda, 2002; Hoffmann et al., 2005). This test's basic premise is straightforward: in a bi-variate framework, the first variable is said to cause the second variable in the Granger sense if the forecast for the second variable improves when lagged variables for the first variable are considered (Granger, 1969). The results from the VECM tests using equations (5) and (6) for BRIS countries are presented in Table 9.

Table 8 Panel cointegration test results

Johansen Fisher panel cointegration test results (1997Q1 to 2019Q4)				
Series: FDI, STK_LVL, STK_R, FX, BLR_R, GDP_R, INF_R. Total observations: 552				
No. of cointegrations (hypothesised)	*Fisher stat. (trace test)*	*p-value*	*Fisher stat. (max eigen test)*	*p-value*
None	294.5	0.0000	275.9	0.0000
At most 1	183.5	0.0000	122.8	0.0000
At most 2	85.3	0.0000	66.0	0.0000
At most 3	*32.6*	*0.0011*	*28.2*	*0.0052*
At most 4	13.4	0.3398	9.5	0.6640
At most 5	11.3	0.5026	7.7	0.8045

Notes: Both trace and maximum eigen tests indicate that, at most, three variables are cointegrated in the panel. The presence of cointegrated variables suggests using VECM instead of VAR to unveil relationships among the variables.

We highlight two key results from the Granger causality tests:

1 The stock market level is the most significant Granger-cause variable, followed by the bank lending rate and change in the local currency, on incoming FDI – higher stock market level, a signal of emerging market's strength to foreign firms and investors, attracts new incoming FDI.

2 FDI flows Granger-cause stock market returns – higher incoming FDI, typically headline news in emerging markets, leads to higher stock market returns.

Table 9 Granger causality test results

Granger cause	*Effect*	*Chi-square*	*Significance*	*Granger cause*	*Effect*	*Chi-square*	*Significance*
STK_LVL	***FDI***	11.5	***	STK_R	FX	5.1	**
BLR_R	***FDI***	5.1	**	STK_R	BLR_R	4.0	**
FX	***FDI***	3.8	*	FX	BLR_R	2.8	*
D(FX)	***FDI***	3.3	*	D(STK_LVL)	BLR_R	11.0	***
FDI	STK_R	4.2	**	STK_LVL	INF_R	6.6	**
INF_R	STK_R	3.9	**	FX	INF_R	6.9	***
BLR_R	STK_R	6.8	***	D(STK_R)	INF_R	15.4	***
D(FX)	STK_R	4.8	**	D(BLR_R)	GDP_R	7.6	***
D(BLR_R)	STK_R	11.9	***				

Notes: Only significant variables are shown. FDI is highlighted in bold italics. Data window: from 01/01/1997 to 12/10/2020, 95 quarters × 4 countries.

In a similar study, Al Samman and Jamil (2018) found a positive long-term relationship between stock markets and FDI in GCC countries. The VECM results also support the central hypothesis that a local stock market is key in incoming FDI. The Granger causality test results in Table 5 show that a rising stock market proceeds higher FDI inflow.

4.4 Short-and long-run effects of stock levels on FDI

The permanent income hypothesis of Friedman (1957) illustrated that the dependent variable *Y*'s current value is affected by the current and lagged values of the explanatory variable *X*. Several models have expanded the original model to separate short-and long-term effects. Having established that the stock market is a key determinant of FDI, it is logical to separate the stock market's short-and long-term effects on FDI. The finite order distributed lag model (Gujarati and Porter, 2009), as shown in equation (7), serves this purpose. A simplified equation using the Koyck method is shown in equation (8). Model results are shown in Table 10.

$$FDI_t = \alpha + \sum_{j=0}^{1} \beta_j STK_{t-j} + \mu_t \tag{7}$$

$$FDI_t = A(1-\lambda) + \beta_0 STK_t + \lambda FDI_{t-1} + \upsilon_t \tag{8}$$

where $\beta_k = \beta_0 \lambda^k$, $k = 0.1, \ldots; 0 < \lambda < 1$; $\upsilon_t = \mu_t - \lambda\mu_{t-1}$. λ is the rate of decay.

The short-run effect of stock levels on FDI is 3.58%, and the long-run effect is 13.0%. They indicate that if the stock market goes up by 100%, FDI inflows will increase by 3.58% in the short run and 13.0% in the long run. Moreover, a value of λ close to 1 suggests that β declines slowly and indicates a long-term memory effect. The decay rate in FDI, λ is 0.726 and closer to 1. It means that the speed of adjustment, $(1 - \lambda)$ is 27.4%. So, FDI inflows slowly adjust to stock level changes. We support the findings of a significant and positive correlation between FDI and stock markets in India and Pakistan (Bilal, 2018; Sultana and Pardhasaradhi, 2012). Finally, a robustness check of results in Table 10 uses the residual cross-section dependence diagnostic test. The Breusch and Pagan (1980) LM test fails to reject (p-value of 0.48) the null hypothesis of no cross-section dependence (correlation) in residuals. It means that shocks to FDI do not occur simultaneously in multiple BRIS countries.

Table 10 Finite order distributed lagged model

Distributed lagged model: FDI (BRIS, in USD millions)		
Variables	*Coefficient*	*t-Statistic*
C	913.73***	2.64
STK_LVL	0.0358***	3.31
FDI(–1)	*0.726***	*19.93*

Notes: Data window: from 01/01/1997 to 12/10/2020, 95 quarters × 4 countries.
Short-run effect of stock level on FDI, β_0 is 3.58%. The long-run effect of stock level on FDI, $\beta_0/(1 - \lambda)$, is $0.0358/(1 - 0.726) = 13.0\%$.

5 Conclusions and policy implications

This paper investigates the relationship between local stock markets and FDI inflows for four emerging markets: Brazil, Russia, India, and South Africa. Our results indicate the importance of the financial variables in all three specifications of the statistical models: pooled OLS regression (panel), FEM, and random effect model. Of the six variables included in the model, the two financial variables (stock market levels and returns) were consistently significant in all three models, supporting our contention that it is vital to include them as variables among FDI determinants. FDI inflows slowly adjust to stock market changes. We also show that 2020Q1 (the start of COVID-19 along with plunging stock markets) is the most significant breakpoint in FDI analysis, and COVID-19 hurts incoming FDI.

To enhance the alignment of policy implications with the role of local stock markets, we propose the following:

1 Stabilise and strengthen stock markets: policymakers should implement measures to reduce market volatility and enhance the transparency and efficiency of equity markets. For example, Brazil could focus on reducing transactional costs in its stock exchange, while India could strengthen disclosure norms and corporate governance practices on the NSE and BSE.

2 Enhance market liquidity: increasing market liquidity through regulatory reforms and incentives for domestic and foreign participation can attract sustained FDI. South Africa, for instance, could benefit from expanding financial instruments that cater to foreign investors.

3 Integrate forward-looking financial metrics: although this paper could not include forward-looking volatility metrics like the VIX due to data limitations, future policies could explore the development of similar indices for emerging markets to better assess market risk and its implications for FDI.

4 Leverage cross-country learnings: emerging markets could benefit from studying successful policies in other countries. For instance, Russia could explore how advanced economies have used financial market reforms to attract technology-driven FDI, while India could examine strategies to incentivise FDI in greenfield investments.

To build on the findings of this study, future research could focus on:

a Testing the hypothesis, (i.e., the stock market is a key determinant of FDI) in a broader sample of emerging markets.

b Incorporating additional financial variables, such as interest rate spreads or exchange rate volatilities.

c Examining the impact of forward-looking volatility measures on FDI flows, once such datasets become available for emerging markets.

By bridging the gap between financial market performance and FDI policy, these recommendations and future research directions can contribute to a more nuanced understanding of the determinants of FDI and inform evidence-based policymaking in emerging economies.

Declarations

Authors do not have any conflicts of interest associated with this article.

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Notes

1 Trading Economics (TE) FDI data (available by subscription): https://data.tradingeconomics.com.

2 Instituto Brasileiro de Geografia e Estatística: https://www.ibge.gov.br/

3 Federal State Statistics Service: https://eng.gks.ru/

4 Ministry of Statistics and Programme Implementation: http://www.mospi.gov.in/

5 Statistics South Africa: http://www.statssa.gov.za/