



# BRICS Nations: A Financial Dynamics of International Trade of India with Human Capital and Labor Markets

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**Abstract.** In this research paper, authors have been examined the causal relationship between human capital and economic factors in BRICS Nations. The authors have used data from 1997 to 2020 and a panel vector autoregressive model from the BRICS Nations. The gross domestic product (GDP), imports, exports, and foreign direct investment (FDI) are among the economic elements taken into account. Using a vector autoregressive (VAR) model, the study compares Russia, India, China, Brazil and South Africa. In China, the results show a bidirectional causal relationship between FDI and human capital, whereas in Brazil, there is a unidirectional relationship between FDI and human capital. Furthermore, in South Africa, Brazil, Russia, and India, there is a one-way causal relationship between GDP and human capital. By concentrating on economic growth, foreign direct investment, and trade, policymakers should guarantee ongoing investment in human capital.

**Keywords:** Human Capital; COVID-19; BRICS Nations; VAR; Labor force; International trade.

## 1 Introduction

A nation's capacity to both create new ideas and adapt old ones is greatly influenced by the level of education of its labor force and the amount of human capital that it accumulates. The endogenous economic growth theory states that knowledge, innovation, and human capital investments are important sources of economic growth. Beyond its immediate economic effects, international technical spillovers from human capital such as FDI and international trade increase local productivity. Advanced science and technology are introduced to the host nation through FDI, and foreign companies can make a major direct or indirect contribution to the inventive activities of the host nation.

International trade in manufactured goods, capital equipment, and tangible intermediate inputs all contribute to the effective use of home resources and raise domestic

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productivity at the same time. Moreover, it promotes "cross-border" learning about foreign technology, industrial methods, and materials by facilitating open communication among trading partners, which supports economic progress. Consequently, economic progress can lead to the expansion of exports, knowledge spillovers, and other externalities, resulting in positive feedback loops of cumulative causation. In particular, continued economic expansion creates new demands that cannot be satisfied by home production, which raises the quantity of imports even more. There has been a lot of discussion over the economic value of human capital. Numerous correlations, including long-term ones [1,2], dynamic links [3,4], and between human capital and economic growth are suggested by prior research and one-way or two-way causal relationships [5,6]. Some research concentrate on how human capital affects foreign direct investment or trade [7-9]. Meanwhile, some studies look into whether foreign commerce or FDI promotes the accumulation of human capital [10-14]. There are also some researches that show a causal relationship in both directions between human capital and foreign direct investment or trade [15-17]. Interestingly, the BRICS nations account for almost 25% of global gross domestic product (GDP) and 40% of the world's population and 17% of world trade. It is expected that in the next years, their share of the global GDP would increase considerably.

***The objectives of the research is to evaluate the impact of bilateral trade and growth of Human Capital in BRICS Nations.***

Understanding how to strengthen the economic function of human capital in the BRICS countries becomes essential to achieving sustainable economic development. A synopsis of the body of research is given in Section 2, along with the theories. The methods and data are described in Section 3. Our empirical findings are discussed in Section 4. Section 5 concludes with the study's of final conclusions.

## **2. Literature Review**

Several studies have emphasized the beneficial effects of human capital on foreign direct investment (FDI). Miyamoto [18] and Noorbakhsh [19] emphasized the importance of human capital in drawing foreign direct investment. Both Thangavelu and Narjoko [20] and Dorożyn'ska et al. [21], using data from Poland, and the Association of Southeast Asian Nations (ASEAN) from 2000 to 2009, examined data, verified the beneficial impact of human capital on foreign direct investment. Using a range of human capital variables, Cleeve et al. [22] discovered that, in Sub-Saharan African nations, from 1980 to 2012, human capital had a positive impact on foreign direct investment (FDI) regardless of educational attainment. Using data on bilateral FDI and foreign students from 63 countries between 1963 and 1998, Kim et al. [23] showed that the workforce of a host nation with foreign education had a positive impact on FDI inflows. Based on data from 55 developing countries from 1980 to 2011, Kheng et al. [15] found a positive bidirectional causal relationship between FDI and human capital. On the other hand, a few research have looked into how FDI affects the accumulation of human capital. Using

state-level data from the United States between 1997 and 2004, Wang [13] discovered that whereas manufacturing FDI has the reverse effect, informational FDI boosts human capital. Zhuang [14] found that while FDI has a negative correlation with post secondary education, it has a beneficial effect on secondary education in East Asia. Studies have acknowledged the significance of human capital in relative benefits and export outcomes. Anderson and Johansson [7] came to the conclusion that the spatial distribution of human capital affects both the quantity and unit price of exported goods based on firm-level data from Sweden. By utilizing data from Chinese firms, Zhao et al. [9] discovered that export performance is positively impacted by investments in the human capital of salespeople. On the other hand, studies have demonstrated that trade affects human capital as well. Evidence suggests that the use of foreign intermediate goods in production causes skill-based technical innovations, widening pay disparity, and raising the need for skilled labor (Lee and Wie, [24] ; Kasahara et al., [12]). The impact of shifting trade patterns on the accumulation of human capital has recently been studied by academics. The findings of Blanchard and Olney [25], Li et al. [26] support the idea that while expansion in agricultural and unskilled-and Hou and Karayalcin [11] intensive exports reduce the development of human capital, an increase in skill-intensive export volume increases investment in human capital. Numerous academics agree that because human capital increases labor productivity and makes new technology easier to implement, it has a favorable impact on economic growth. Through innovative activity and technological spillovers, human capital has a favorable impact on economic growth both directly and indirectly, according to research by Fleisher et al. [27] on China. The beneficial economic impact of human capital was further supported by the works of Ahmad and Khan [3], Matousek and Tzeremes [29] and Ha and Manh [28]. Based on data from China and 29 African nations, respectively, Tsen [17] and Anoruo and Elike [5] found a bidirectionally positive association between economic growth and human capital from a causality perspective. However, in their analysis of the United Arab Emirates (UAE), Kalaitzi [30] found a unidirectional causal relationship between human capital and economic growth. There has been interest in the impact of foreign technology absorption and transfers on productivity. Employing imports as a conduit for the spread of foreign technology, Teixeira and Fortuna [2] discovered that imports and human capital are crucial for enhancing productivity. Utilizing data from 14 European Union countries, Soukiazis and Antunes [31] demonstrated a positive direct and interaction effect of labor and human capital on economic growth. Studies by Alietal [32], Agbola [1], Su and Liu [33], and others further bolstered the notion that an adequate human capital stock amplifies the favorable economic impact of foreign direct investment (FDI) through cross-border technical spillovers. In order to better understand global economic variables and gender gaps in labor markets, this paper looks into the effects of digitalization, ICT, cross-border e-commerce and mobile technology. It turns out that while digitalization has a negative effect on the gender gap in low- and middle-income countries, it has a beneficial effect in high-income countries. ICT and mobile technology are very important for promoting economic growth, especially in developing nations. The study also reveals a significant favorable impact of cross-border e-commerce on trade in services. The results highlight

how crucial it is to put technology-related policies into place in order to promote gender equality and economic growth [13, 34–36].

According to the authors (Kumar & Kumar [42] in the published research article entitled “Brics New Currency: An Investigation of Trade Dynamics to De-Dollarizing Intra-Brics Trade with the Reference of Indian Bilateral Trade Contracts”, Studies conducted during the first quarter of 2021 revealed that the Russian ruble appreciated together with the South African Rand, Chinese Yuan, and Indian Rupee. Possible contributing element to this recovery: returned portfolio flows. Uneven vaccination rates, rising bond yields in AEs, and the COVID-19 pandemic may all put more pressure on the BRICS currencies in the future. The inflation rate in Brazil was 5.25 percent in 2020, however it broke beyond this threshold in July and March of 2021. India, Brazil, and Russia have higher rates of core inflation since 2020 and 2021 saw relatively low levels of inflation. After doing assessments, China and South Africa were compelled to put the relevant government regulations into place on foreign direct investment (Kumar Ravindra. et al., 2024, p.1379).

### 3. Research Methodology

Annual time series data from 1990 to 2020 from India, Brazil, China, Russia and South Africa are used in this study. Our variables include GDP per capita, FDI, human capital, and international trade, which includes imports and exports. The Human Development Report is the source of our data, and we utilize average years of schooling to quantify human capital in accordance with Blanchard and Olney [25] and Li et al. [26]. The purpose of this selection of the average years spent in school as an indicator is to provide a quantitative picture of the level of education in each nation. Because it can be found in worldwide datasets and reflects the quantity of education, this measure is frequently used in empirical research and cross-national comparisons. The United Nations Conference on Trade and Development (UNCTAD) data set is the source of the FDI inflow data, which is calculated as a proportion of GDP.

### 4. Data Analysis and Interpretations

This research uses a vector autoregressive (VAR) model to explore the relationship between human capital and economic determinants in the BRICS countries. FDI, import, export, and GDP are some of the economic factors. A common tool for analyzing the dynamics and causal relationship on economic issues is the VAR model [34,37–40]. Five VAR models from the previous research can be developed in order to explore the connections between human capital, import, export, FDI and GDP:

**Model(1):**

$$g(HC)_{i,t} = \alpha_1 + \sum_{k=1}^p \beta_{1,k} g(HC)_{i,t-k} + \sum_{k=1}^p \gamma_{1,k} g(FDI)_{i,t-k} + \sum_{k=1}^p \delta_{1,k} g(IM)_{i,t-k} + \sum_{k=1}^p \theta_{1,k} g(EX)_{i,t-k} + \sum_{k=1}^p \mu_{1,k} g(GDP)_{i,t-k} + \varepsilon_{1,t}$$

Model 1 uses GDP (GDP), FDI (FDI), import (IM), export (EX), and human capital (HC) as independent variables and human capital (HC) as the dependent variable.

**Model(2):**

$$g(FDI)_{i,t} = \alpha_2 + \sum \beta_{2,t} g(HC)_{i,t-k} + \sum \gamma_{2,t} g(FDI)_{i,t-k} + \sum \delta_{2,t} g(IM)_{i,t-k} + \sum \theta_{2,t} g(EX)_{i,t-k} + \sum \mu_{2,t} g(GDP)_{i,t-k} + \varepsilon_{2i,t}$$

In (Model 2), authors have used FDI (FDI) as the dependent variable and GDP (GDP), import (IM), export (EX), and human capital (HC) as the independent variables.

**Model (3):**

$$g(GDP)_{i,t} = \alpha_5 + \sum \beta_{5,t} g(HC)_{i,t-k} + \sum \gamma_{5,t} g(FDI)_{i,t-k} + \sum \delta_{5,t} g(IM)_{i,t-k} + \sum \theta_{5,t} g(EX)_{i,t-k} + \sum \mu_{5,t} g(GDP)_{i,t-k} + \varepsilon_{5i,t}$$

In Model 3, independent variables are import (IM), export (EX), human capital (HC), and foreign direct investment (FDI). The dependent variable is GDP (GDP).

There are a few things to do before using a VAR model. First, stationary variables are required. Consequently, it is necessary to perform a stationary analysis. Direct application of the unconstrained VAR model is possible if the variables are stationary. For estimate, the stationary forms have been utilized if the variables are not stationary. Then, taking into account the information criterion, the ideal lag length (P) have been calculated beforehand.

The descriptive data are shown in Table 1.

**Table 1.0. BRICS results of descriptive statistics.**

Variables	Mean	Median	Max	Min	Std.Dev	Obs.
HC	0.834	0.835	1.069	0.481	0.163	137
FDI	0.076	0.225	0.767	-2.579	0.529	137
IM	1.276	1.323	1.694	0.853	0.162	137
EX	1.287	1.349	1.785	0.838	0.213	137
GDP	3.439	3.489	4.214	2.489	0.483	137

## 5. Results and Discussion

### 5.1 Panel Unit Root Tests

The authors have been used the panel unit root tests of Im, Pesaran, and Shin (IPS) and Levin, Lin, and Chu (LLC) to verify the stationarity of the variables. There is a unit

root (non-stationary), according to the null hypothesis of these two panel unit root tests. The findings of the unit root tests for level variables are shown in **Table 2.0**. The null hypothesis for level variables with a 1% significant level can be rejected for all of our variables. This indicates that all variable, I (0), are stationary.

**Table 2.0; BRICS Panel unit root tests Results**

Variables	LLC Test Level		IPS Test Level	
	Statistics	pValue	Statistics	pValue
g(HC)	-8.76067	0.0000***	-10.2439	0.0000***
g(FDI)	-6.29389	0.0000***	-7.76192	0.0000***
g(IM)	-9.16016	0.0000***	-9.33210	0.0000***
g(EX)	-11.5780	0.0000***	-11.0723	0.0000***
g(GDP)	-6.81058	0.0000***	-5.79060	0.0000***

Note:\*\*\*:significantat1%.

Source of Data: Authors Calculations

### 5.2 Optimal Lag Order Analysis

Finding the number of ideal lags beforehand is the next stage. In order to achieve this, we apply the Likelihood Ratio Criterion (LR), Akaike Information Criterion (AIC), and Hannan–Quinn Information Criterion (HQ) for the best possible lag selection and Final Prediction Error Criterion (FPE). Since one lag in our VAR model appears to be the most plausible based on the majority of the criteria (LR, FPE, AIC, and HQ), as Table 3 illustrates, we utilize VAR(1) for estimations.

**Table 3.0; BRICS VAR Lag Order Results**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	923.5354	NA	$5.17 \times 10^{-14}$	-16.30420	-16.38284 *	-16.45496
1	967.8566	83.79369*	$3.66 \times 10^{-14}$ *	-16.64922 *	-16.12105	-16.35378 *
2	983.1912	27.19649	$4.38 \times 10^{-14}$	-16.47306	-15.13808	-16.13142
3	1003.945	35.67775	$4.76 \times 10^{-14}$	-16.59723	-14.65545	-15.60939
4	1016.251	20.42288	$6.02 \times 10^{-14}$	-16.17413	-13.82554	-15.34009

Note:\*indicates lag order selected by the criteria.

Source of Data: Authors Calculations

The dependent variable in **Model 1** is human capital. At the one percent significance level, foreign direct investment (FDI) has a beneficial effect on human capital. In the one-period lag term, a 1% increase in FDI can specifically result in a 0.007% growth in human capital. Human capital is unaffected by global trade and GDP with a one-period lag.

FDI is the dependent variable in Model 2. Positively affecting FDI at a 5% significance

level, imports lag by one period: a 1% increase in imports leads FDI to increase by 2.11%. Furthermore, in the one-period lag term, there is no relationship between FDI, exports, and GDP.

The dependent variable in Model 3 is GDP. A 10% significance level indicates a negative relationship between imports and GDP, with a one-period lag of 1% causing a 0.315% GDP decline for every 1% increase in import volume. There is no correlation between GDP and exports, FDI, human capital, or GDP, with a one-period lag. The aforementioned findings lead to the following conclusions: (1) FDI to human capital has a unidirectional causal relationship in the one-period lag term. An increase in FDI inflows will boost human capital. Second, a one-period lag term reveals a unidirectional link between exports and human capital, suggesting that a rise in human capital will result in a fall in export volume. Furthermore, there are unidirectional causal relationships between economic variables, such as the relationship between imports and GDP and FDI.

**Table 4.0: BRICS causality direction results**

	Dependent Variable:	Dependent Variable:	Dependent Variable:	Dependent Variable:	Dependent Variable:
	HC	FDI	IM	EX	GDP
			Causality direction		
Brazil	FDI→HC	EX→FDI	-	-	HC→GDP
Russia	-	-	FDI→IM	IM→EX	HC→GDP
India	-	-	GDP→IM	FDI→EX	HC→GDP
China	FDI→HC	HC→FDI	-	GDP→EX	-
South Africa	-	-	HC→IM GDP→IM	HC→EX	HC→GDP

Source of Data; Authors Calculations

According to the Kumar, Ravindra and Kumar ,Pavnesh(2024)., [29] “ BRICS FDI Policies: An Empirical Analysis of Foreign Direct Investment of India with BRICS Economies in COVID-19” in the published research article investigated that although other regions contribute significantly less, the main source of inward FDI is its own region. Furthermore, Latin America makes a significant contribution. There may be issues with data quality as indicated by the fact that the FDI numbers for India are not entirely clear in certain categories. This makes logical given the previously indicated facts, as East Asia accounts for a sizable portion. For the same reason, political considerations probably account for India's low share in South Asia. Although over 30% of the world's surface area is in Africa, equally large portions are found in North America and Europe. As per the current status of the BRICS economy and the potential impact of financial transactions that channel capital through an African hub such as Mauritius. However, when considering India's total inward foreign direct investment, the other BRICS

nations only make up about 2% of the total still not much, but more than in Brazil or the Russian Federation (Kumar, Ravindra. et al., 2024, p.3697).

## 6. Conclusion

Using a VAR technique, this study carefully looked at the causal links between GDP, FDI, imports, exports, human capital, and each of the BRICS countries between 1990 and 2020. The overall results showed a clear unidirectional causal relationship between FDI and human capital as well as between exports and human capital among the BRICS countries. China and FDI showed a bidirectional causal relationship, whereas Brazil showed a unidirectional causal relationship between FDI and human capital. Moreover, in South Africa, Russia, and India, a unidirectional causal relationship was found between GDP and human capital. A unidirectional causal relationship between human capital and foreign trade has been noted in South Africa.

These results have significant policy ramifications. First off, encouraging FDI inflows can have a big impact on the accumulation of human capital in the BRICS nations, particularly in China and Brazil. To ensure the greatest possible social benefits, policies that link FDI with human capital plans are necessary, as demonstrated by the detrimental effect of human capital on FDI in China. Second, the strong positive unidirectional causal relationship between economic growth and human capital in South Africa and Brazil highlights the critical role that human capital plays in promoting long-term economic progress.

It is advised to reallocate funds, especially those allocated to education. In contrast, complementary measures addressing institutional issues and regional development are required in Russia and India due to the negative link between human capital and economic growth. Thirdly, there is a clear need to advance technical advancement given the documented detrimental effects of human capital on South Africa's import and export figures. Economic growth and competitiveness can be improved by fostering technology adoption, boosting exports, and enhancing healthy competition. The primary significance of human capital in forming economic dynamics is highlighted by this research. The sustained growth of the BRICS countries is dependent on deliberate investments in human capital, even after the first economic effects. It is recommended that policymakers give careful consideration to how best to improve education, knowledge, and skills in order to create an atmosphere that will support foreign trade, foreign direct investment, and economic growth.

Furthermore, the clear unidirectional causal relationship between exports and human capital underscores the significance of coordinating human capital development with tactics that boost sustainability and global competitiveness. Human capital-rich nations should take advantage of this significance results and analysis to promote sustainable trade and responsible economic growth, while also making beneficial contributions to the global economy in the 21st century.



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