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## A STUDY OF INTEGRATION OF BRICS STOCK MARKET

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### ABSTRACT

*This paper's primary objective is to examine the integration of BRICS countries' stock market indices. For foreign investors looking to diversify their portfolios overseas and for policymakers responding to changes in the aforementioned economies, the context is crucial. As a result, the focus of this article is on investigating how the BRICS nations' stock markets interact with one another. This study paper's goal is to examine the existence of both long-term Cointegration and short-term links among the BRICS markets. Utilizing Augmented Dicker-Fuller (ADF), stationarity among the chosen variables is examined. The results of Granger Causality test and Johansen Cointegration test have given robust results for BRICS nations, As long term relationship exists with various countries.*

**KEYWORDS:** BRICS nations, Integration, Augmented Dicker-Fuller (ADF), Stationarity, Cointegration

## INTRODUCTION

BRICS, an acronym for Brazil, Russia, India, China, and South Africa, represents a group of emerging economies that have garnered significant global influence and economic power over the years. Formed in 2001, the BRICS nations share a common vision of promoting cooperation and collaboration in areas such as trade, finance, technology, and development. Each member country brings its unique strengths and resources to the table, contributing to the group's collective growth and influence on the world stage. With a combined population of over 3.6 billion people and representing around 41% of the global population, the BRICS nations are a formidable force in the international arena. Their collective economic strength, abundance of natural resources, and growing consumer markets make them vital players in shaping the future of the global economy. Through regular summits and dialogues, the BRICS nations continue to foster greater political, economic, and cultural ties, aiming to bolster mutual understanding and address shared challenges while advancing their individual and collective development goals.

Stock market integration refers to the process of connecting various stock markets across the world, enabling them to interact and influence each other's performance. In recent decades, advances in technology, financial liberalization, and globalization have played a pivotal role in accelerating this integration. The seamless flow of information, capital, and investment opportunities has turned the stock market into a global marketplace, creating new challenges and opportunities for investors, governments, and financial institutions alike.

It can also be understood as Stock market integration is a process that connects various financial markets worldwide, allowing for seamless interaction and interdependence. Over the past few decades, advancements in technology, financial liberalization, and globalization have accelerated this integration. This phenomenon has transformed the stock market into a global entity, presenting both opportunities and challenges for investors, governments, and financial institutions. This essay explores the concept of stock market integration, its drivers, benefits, challenges, and implications for the global economy.

Literature includes various benefits of stock market integration such as Technological Advancements where the development of electronic trading platforms and high-speed communication networks has revolutionized financial markets. These advancements enable real-time access to market information and facilitate cross-border transactions at unprecedented speed and efficiency.

Financial Liberalization is also a benefit where many countries have embraced financial liberalization policies, allowing foreign investors to access their domestic stock markets more easily. This openness has encouraged capital flows across borders, fostering stock market integration.

Furthermore, the interconnectedness of markets can lead to increased market volatility. News and events from one market can quickly transmit to others, resulting in amplified market movements. While this interconnectedness enhances price discovery, it also makes markets more sensitive to external shocks.

The importance of stock market integration are multi-faceted. Firstly, it leads to increased market liquidity, as a larger pool of investors is now involved in trading. This liquidity, in turn, facilitates smoother price discovery and ensures that stock prices more accurately reflect market conditions.

Secondly, stock market integration enables efficient allocation of capital. With a broader range of investment options available, funds can flow to companies and industries with the most promising growth potential, fostering economic development worldwide.

Thirdly, investors can diversify their portfolios internationally, reducing risk exposure to individual markets or sectors. This diversification is essential for hedging against regional economic downturns or fluctuations in specific industries.

In this paper we have included BRICS nations to check with integration of stock market of these countries. The research paper includes various layers and steps where, firstly stationarity of data is checked followed by causality test for which granger causality test has been considered. To examine the long run relationship of BRICS nations Johanson Cointegration test has also been used. The results of the paper are extremely robust. Though the existing literature includes various studies which conducted interrelationships, interdependencies, integration, and dynamic linkages of various countries. The novality of this paper lies with the recent dataset and the analysis of long run relationship of BRICS countries stock market integration.

## 1. Brazil:

- **Stock Market:** B3 (B3 S.A. - Brasil, Bolsa, Balcão)
- Brazil's stock market is one of the largest in Latin America.
- **Key indices:** Bovespa Index (IBOVESPA), B3 Small Cap Index (SMLL), and B3 Corporate Governance Index (IGCX).
- **Major sectors:** Financials, Commodities, Energy, and Consumer Goods.

## 2. Russia:

- **Stock Market:** Moscow Exchange (MOEX)
- Russia's stock market is significant in the Eurasian region.
- **Key indices:** MOEX Russia Index (IMOEX), RTS Index (RTSI), and MICEX Index (MICEX).
- **Major sectors:** Energy, Financials, Metals & Mining, and Telecommunications.

## 3. India:

- **Stock Market:** National Stock Exchange (NSE) and Bombay Stock Exchange (BSE)
- India's stock market is one of the largest in Asia.
- **Key indices:** Nifty 50 (NSE), Sensex (BSE), and BSE 500 (BSE).
- **Major sectors:** Information Technology, Financials, Energy, and Consumer Goods.

## 4. China:

- **Stock Markets:** Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE)
- China has two primary stock exchanges.
- **Key indices:** Shanghai Composite Index (SHCOMP), Shenzhen Component Index (SZCOMP), and CSI 300 Index (CSI300).
- **Major sectors:** Technology, Financials, Consumer Discretionary, and Industrial.

## 5. South Africa:

- **Stock Market:** Johannesburg Stock Exchange (JSE)
- South Africa's stock market is the largest in Africa.
- **Key indices:** FTSE/JSE All Share Index (J203), FTSE/JSE Top 40 Index (J200), and FTSE/JSE Financial 15 Index (J580).
- **Major sectors:** Mining, Financials, Industrial, and Consumer Goods.

It is important to consider that several elements, such as the economic climate, governmental policies, global occurrences, and investor sentiment, can influence the performance and patterns of the stock market in different countries. Therefore, conducting thorough research and seeking advice from financial professionals is highly recommended before making any investment choices.

The BRICS countries have emerged as the leading emerging markets globally in recent decades. Collectively, these countries, comprising approximately 41% of the world's population, account for over 31.5% of the global GDP.

These nations stand out from other emerging markets due to their significant demographic and economic potential, positioning them to become influential and prominent economies in the 21st century. A recent projection on the future of the world's largest economies ranks four out of the five BRICS countries among the top ten by 2050 (Global Sherpa 2023a). Each BRICS member has experienced substantial growth over the past decade, with India leading as the fastest-growing economy, followed by China, Brazil, Russia, and South Africa, according to the IMF (2023). The shared characteristic of high growth rates has contributed to the formidable influence of this collaboration in the global economy today.

The financial markets within the BRICS cooperation have experienced significant growth. In Brazil, the market capitalization expanded from 4 percent to 74 percent of its GDP between 1990 and 2010. India saw its market capitalization rise from 12 percent to 93 percent, while Russia's increased from virtually nothing to 70 percent. China's market capitalization similarly grew from a minimal level to 81 percent, and South Africa more than doubled from 123 to 278 percent.

Nevertheless, these five countries exhibit notable disparities in terms of their structural characteristics, geopolitical importance, and economic policies. They also differ in their internal political structures and

cultural variations. These distinctions suggest the potential existence of diversification opportunities, making it worthwhile to explore further.

In the current globalized markets, investors must take into account the advantages of long-term diversification. However, a challenge arises as financial markets tend to become more interconnected over time, diminishing the potential benefits of long-term diversification. As a consequence, investors have become more involved in foreign capital markets in their quest for superior investments that can help mitigate portfolio risks. The progress in global financial development has facilitated cross-border investments, contributing to increased interdependence among nations. Consequently, financial markets worldwide have been progressively integrating over time.

## REVIEW OF LITERATURE

The literature on stock market integration is not that abundant specifically when BRICS nations are to be considered. However, we have collected most relevant literature of recent times.

**Routh, B. (2023)** found interesting results in their paper namely “Integration Between Stock Market Returns and Interest Rate and its Impact on Inflation: Empirical Evidence from Five Countries.”

This study delved into the influence of the equilibrium relationship between deposit interest rates and stock market returns on inflation. The researchers sought to understand how these two financial variables interacted and impacted the overall inflation levels in different countries.

**Wu, F. (2020)**. In their paper named Stock market integration in East and Southeast Asia: The role of global factors found strong results of stock market integration. Wu in this paper explores various issues and complexities of financial integration among stock markets of ASEAN economies, plus China (mainland China and Hong Kong), Japan and South Korea. Wu's paper delves into the intricacies and challenges of financial integration among the stock markets of ASEAN economies, including mainland China, Hong Kong, Japan, and South Korea.

Upon closer examination, it becomes evident that market interconnections significantly diminished when the researchers removed the influences stemming from the global stock market. This suggests that the apparent high level of cross-market correlation is predominantly driven by pervasive effects originating from the global equity market.

It can be seen that markets substantially decreased after they filter out the influences from the global stock market. This indicates that the seemingly high level of cross-market connection is largely caused by the pervasive influences from the global equity market. The methodology of the paper is relevant and hence has been included as considerable literature.

**Boțoc, C., & Anton, S. G. (2020)** in their paper New empirical evidence on CEE's stock markets integration. *The World Economy*, The primary aim of the study was to investigate how the stock markets of Central and Eastern European (CEE) countries are interconnected with those of more developed nations such as Germany, the USA, and the UK. The findings of the study have significant practical implications in various areas. Firstly, the increasing integration of these stock markets has important implications for international portfolio diversification strategies. It means that financial market operators will need to engage in timely and active portfolio management, relying on efficient and easily accessible information. As a result, the benefits of international diversification will become more apparent to skilled investors who can capitalize on these opportunities. Secondly, the study's results make a significant contribution to the research on market efficiency. The integration of stock markets is a key indicator of the efficiency of financial markets. This means that the more integrated these markets become, the more efficient they are likely to be in terms of information dissemination and price discovery.

**Habiba, U. E., Peilong, S., Zhang, W., & Hamid, K. (2020)** in their paper titled 'International stock markets Integration and dynamics of volatility spillover between the USA and South Asian markets: evidence from Global financial crisis' The main aim of this research is to offer insights to investors, fund managers, and policy-makers regarding the integration of financial markets and the transmission of volatility before, during, and after the global financial crisis.

The results indicate a lasting integration between the USA market and South Asian emerging stock markets. Additionally, the study reveals a causal relationship between the USA stock market and emerging stock markets in the short-term. Furthermore, it is observed that during financial crisis periods, returns and volatility spillover effects are more pronounced compared to non-financial crisis periods.

**Caporale, G. M., You, K., & Chen, L. (2019)** in their paper Global and regional stock market integration in Asia: A panel convergence approach found full panel convergence in differentials relative to Asia and the

US, with the speed of convergence indicating marginally faster regional (as opposed to global) convergence. The sample period has been taken from the period 1998m12–2018m3. The results are robust as Industry level convergence tests show that, despite the overall evidence of convergence at the aggregate level, 3 out of 10 industries, which are Oil & Gas, Healthcare and Technology do not exhibit full panel convergence, indicating the integration is mainly driven by other sectors while these 3 sectors are holding it back. The findings of the paper have been extremely relevant with respect to stock market integration.

The findings highlighted an intriguing pattern. In countries where no equilibrium relationship between deposit interest rates and stock market returns existed, a unidirectional causal relationship was established from the residual (the unexplained part of the relationship) to the consumer price index (CPI). Essentially, this means that fluctuations in the residual, which could result from fluctuations in interest rates or stock market returns, influenced changes in the CPI. On the other hand, in countries where an equilibrium relationship was present between deposit interest rates and stock market returns, no significant causality was found. This implies that in such cases, the equilibrium relationship might have a stabilizing effect on inflation, limiting the influence of short-term fluctuations in interest rates or stock market returns on the CPI.

#### **OBJECTIVE OF THE STUDY:**

- To Examine the Integration of BRICS Stock Market

#### **DATA AND METHODOLOGY:**

The data employed in this study are daily returns computed from daily closing price of stock market indices for India (NSE NIFTY50), Brazil (Bovespa index), Russian MOEX Russia Index (IMOEX), China, Shanghai Composite Index (SHCOMP), South Africa (FTSE/JSE) from 1 April 2021 to 31 March 2023.



**UNIT ROOT TEST****Augmented Dickey-Fuller (ADF) Test : At Level**

<b>Variable</b>	<b>T-statistics</b>	<b>p-Value</b>	<b>Outcome</b>
Bovespa index	-1.76	0.39	Non-stationary
MOEX	-0.96	.076	Non-stationary
NSE NIFTY50	-2.32	0.16	Non-stationary
SHCOMP	-1.79	0.38	Non-stationary
FTSE/JSE	-1.82	0.37	Non-stationary

**Augmented Dickey-Fuller (ADF) Test : At 1<sup>st</sup> Difference**

<b>Variable</b>	<b>T-statistics</b>	<b>p-value</b>	<b>Outcome</b>
Bovespa index	-20.52	0.00	Stationary
MOEX	-12.31	0.00	Stationary
NSE NIFTY50	-12.10	0.00	Stationary
SHCOMP	-20.5	0.00	Stationary
FTSE/JSE	-20.51	0.00	Stationary

Augmented Dickey Fuller test is applied to examine stationarity of data. For time-series analysis Unit root test is the first and important step to be done. The result shows that the data of Bovespa index is not stationary. Now Unit root is further applied at first difference.

With the help of the following result it can be inferred that the stock market data of Bovespa index is stationary at first difference because the null hypothesis is rejected here.

When Unit root test is applied on MOEX, we got the following results where probability value is greater than 0.05 significant value. Thus unit root test is further applied to check at first difference. As the probability value is 0.00 which is less than 0.05 significant value, we can infer that the data is stationary at first difference.

Augmented Dickey Fuller test is applied to examine stationarity of data of NSE NIFTY50. The result of NSE NIFTY50 stationarity test shows that the data of NSE NIFTY50 is not stationary. The probability value is 0.16 which is greater than 0.05 significant level. The unit root test is further applied at first difference to check the stationarity and it can be inferred that the data is stationary at first difference. Stationarity has been checked with the SHCOMP as well. The probability value is 0.38 which is greater than 0.05 significant value. The unit root test is further applied to examine the stationarity at first difference. With the help of the following results we can say that the data is stationary at first difference. To examine stationarity of data of FTSE/JSE Augmented Dickey Fuller test is applied. The result of FTSE/JSE stock market data's stationarity test shows that the data of FTSE/JSE is not stationary. The probability value is 0.37 which is greater than 0.05 significant level. The unit root test is further applied at first difference to check the stationarity and it can be inferred that the data is stationary at first difference.

## GRANGER CAUSE

Null Hypothesis	F-Statistics	p- Value	Conclusion
<b>NSE NIFTY50 and Bovespa</b>			
Bovespa does not Granger Cause NSE NIFTY50	0.59825	0.5503	Accept
NSE NIFTY50 does not Granger Cause Bovespa	0.30825	0.7349	Accept
<b>NSE NIFTY50 and MOEX</b>			
MOEX does not Granger Cause NSE NIFTY50	0.75504	0.4178	Accept
NSE NIFTY50 does not Granger Cause MOEX	0.13568	0.8732	Accept
<b>NSE NIFTY50 and SHCOMP</b>			
SHCOMP does not Granger Cause NSE NIFTY50	0.08703	0.9167	Accept
NSE NIFTY50 does not Granger Cause SHCOMP	0.15018	0.8606	Accept

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**NSE NIFTY50 and FTSE/JSE**


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FTSE/JSE does not Granger	NSE	1.28722	0.2772	Accept
NIFTY50				
NSE NIFTY50 does not Granger		3.42231	0.0336	Reject
Cause FTSE/JSE				

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After applying Granger Causality test on NSE NIFTY50 and Bovespa it can be inferred that both the null hypotheses are accepted as probability values are greater than 0.05 significant level. Thus we accept that Bovespa does not Granger cause NSE NIFTY50 and NSE NIFTY50 does not granger cause Bovespa. Granger Causality Test has also been applied with NSE NIFTY50 and MOEX. The probability value for the first null hypothesis is 0.55 which is greater than 0.05 significant value. Thus it can be inferred that MOEX does not Granger cause NSE NIFTY50. Causality analysis when done on NSE NIFTY50 and SHCOMP gave the similar results as the probability value for both the hypotheses are greater than 0.05 significant value. It can also be inferred that SHCOMP does not granger cause NSE NIFTY50 and also NSE NIFTY50 does not Granger cause SHCOMP. Granger Causality Test has also been applied with NSE NIFTY50 and FTSE/JSE It can be inferred that FTSE/JSE does not Granger cause NSE NIFTY50.

**COINTEGRATION**
**1. NSE NIFTY50 and Bovespa index**

$H_0$ : There is no Cointegration between NSE NIFTY50 and Bovespa index

Hypothesized	Eigen value	Trace Statistic	Critical value	p-Value
<b>No.of CE</b>				
None	0.20	160.30	15.49	0.000
At most 1	0.15	67.46	3.84	0.000

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Hypothesized No.of CE	Eigen value	Max-Eigen value	Critical value	p-Value
None	0.20	92.56	14.46	0.000
At most 1	0.15	67.46	3.84	0.000

After applying Cointegration test on NSE NIFTY50 and Bovespa index, the results show that the trace value is 160.0 which is greater than critical value 15.49. Thus the null hypothesis is rejected and it can be inferred that long run relationship exists between NSE NIFTY50 and Bovespa index. According to Maximum eigenvalue as well, the  $H_0$  is rejected and result shows Cointegration exists.

## 2. NSE NIFTY50 and MOEX

$H_0$  : There is no Cointegration between India and MOEX

Hypothesized No.of CE	Eigen value	Trace Statistic	Critical value	p-Value
None	0.16	137.96	15.49	0.000
At most 1	0.15	65.11	3.84	0.000

Hypothesized No.of CE	Eigen value	Max-Eigen value	Critical value	p-Value
None	0.166	72.85	14.26	0.000
At most 1	0.150	65.11	3.84	0.000

We tested Johansen Cointegration test with NSE NIFTY50 and MOEX as well to check with long run relationship between these two countries. As trace value is greater than critical value we tend to reject the null hypothesis which states that Cointegration exists between NSE NIFTY50 and MOEX, and it can be inferred that the long run relationship exists between NSE NIFTY50 and MOEX. According to Maximum eigen value the  $H_0$  is being rejected here.

### 3. NSE NIFTY50 and SHCOMP

$H_0$ : There is no Cointegration between NSE NIFTY50 and China

Hypothesized	Eigen value	Trace Statistic	Critical value	p-Value
<b>No.of CE</b>				
None	0.20	156.13	15.49	0.000
At most 1	0.153	66.68	3.84	0.000

Hypothesized	Eigen value	Max-Eigen value	Critical value	p-Value
<b>No.of CE</b>				
None	0.20	89.49	14.26	0.000
At most 1	0.13	66.78	3.84	0.000

Examining Cointegration on NSE NIFTY50 and SHCOMP shows that the trace value is 156.13 which is greater than critical value 15.49. Thus the null hypothesis is rejected and it can be inferred that long run relationship exists between NSE NIFTY50 and SHCOMP. According to Maximum eigenvalue as well, the  $H_0$  is rejected and result shows Cointegration exists.

### 4. NSE NIFTY50 and FTSE/JSE

$H_0$ : There is no Cointegration between NSE NIFTY50 and FTSE/JSE.

Hypothesized	Eigen value	Trace Statistic	Critical value	p-Value
<b>No.of CE</b>				
None	0.18	146.0	51.49	0.000
At most 1	0.15	65.84	3.84	0.000

Hypothesized	Eigen value	Max-Eigen value	Critical value	p-Value
<b>No.of CE</b>				
None	0.181	80.22	14.36	0.000

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At most 1	0.151	68.84	3.84	0.000
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The long run relationship can be seen between NSE NIFTY50 and FTSE/JSE as the trace statistic is greater than Critical value at 0.05 significance level. While considering maximum eigen value, the result show the similar implication as the maximum eigen value is greater than critical value. Thus it can be inferred that long run Cointegration exists between NSE NIFTY50 and FTSE/JSE because the null hypothesis is being rejected here.

## CONCLUSION

The major objective of this article was to support the BRICS nations' decision-making processes for overseas investments and the establishment or modification of policies in response to these countries' changing dynamics. For foreign investors looking to diversify their portfolios overseas and for policymakers responding to changes in the aforementioned economies, the context is crucial. As a result, the focus of this article is on investigating how the BRICS nations' stock markets interact with one another. This paper examined the existence of both long-term Cointegration and short-term links among the BRICS markets. Utilizing Augmented Dicker-Fuller (ADF), stationarity among the chosen variables is examined. This study does have a few limitations, though. Instead of using the closing index value, natural logarithmic daily returns from the chosen markets may produce more accurate findings. Additionally, the effects of the global subprime crisis, which wreaked havoc throughout this research period, were not taken into account. Future research might examine these restrictions.

Future studies could also evaluate the impact of other established nations, such as the US, UK, Germany, Japan, etc., as well as other emerging areas, such as the ASEAN-5, etc., on the BRIC stock markets using the same data set.

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