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Article

Analyzing financial interdependencies: The cointegration of Jordan and BRIC stock markets

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Abstract: This study examines the financial integration between Jordan and the BRIC economies (Brazil, Russia, India, and China) to determine whether long-term equilibrium relationships exist and to assess implications for portfolio diversification and policy. Drawing on daily stock index data from 01 January 2014, to 31 August 2024, the study employs econometric techniques, including Granger Causality tests, Johansen Cointegration, and Vector Autoregression (VAR). The stationarity of stock indices at the first difference level is confirmed through unit root testing. Results indicate minimal long-term cointegration between Jordan and BRIC markets, pointing to low integration and potential diversification benefits for institutional investors. However, short-term causal links—particularly between Jordan and the Russian and Indian markets—highlight these countries' influence on Jordan's stock fluctuations. The findings suggest that, in the absence of long-term cointegration, investors may mitigate risk by investing in less correlated markets, such as Jordan, while leveraging short-term partnerships with Russia and India. Additionally, the study provides valuable insights for business leaders considering strategic alliances with BRIC counterparts in sectors like technology, agriculture, and energy, and calls for future research into factors like regulatory frameworks and geopolitical stability that may limit long-term financial integration. These results have significant implications for institutional investors, business executives, and policymakers, suggesting targeted strategies for financial stability, risk mitigation, and economic collaboration.

Keywords: cointegration; emerging markets; BRIC nations; portfolio diversification; vector autoregression

1. Introduction

Over the years, Jordan, which is at the center of the Middle East, has overcome major geopolitical and economic obstacles. With just over 10 million people living in a small country with few natural resources, Jordan has shown incredible tenacity in upholding economic stability and implementing growth-oriented reforms (Schuetze and Hussein, 2023). Due to its advantageous location at the crossroads of three continents—Africa, Europe, and Asia—the nation is a major force in regional politics and trade (Fakoussa and Kabis-Kechrid, 2020). But Jordan has also been subjected to the turbulence of regional conflicts as a result of its location, especially with its neighbors, Syria and Iraq (Fawcett, 2023; Ahram, 2020). Jordan has had to bear the financial burden of housing more than 1.3 million Syrian refugees over the last ten years, placing a strain on its social services and public resources (Al-Mahaidi, 2021).

Following the Arab Spring in 2011, Jordan's economic growth, which had previously hit remarkable levels with an 8% GDP growth rate between 1999 and 2008, dramatically decreased. This period of regional unrest disrupted trade routes, impacted foreign investment, and slowed the inflow of tourism, a key sector for the Jordanian

economy (Winckler, 2022). Despite these obstacles, Jordan has maintained its upper-middle-income status by implementing a number of economic reforms and forming strategic alliances with global institutions such as the International Monetary Fund (IMF) and World Bank (World Health Organization, 2021).

With a GDP of roughly US $50.85 billion in 2023, Jordan had the 89th largest economy in the world (Worldbank, 2024). Phosphates, potash, and their derivatives, as well as the expanding technology and pharmaceutical industries, are the main exports from the nation (Saleh et al., 2023). Jordan's position in international markets has been strengthened by its industrial diversification and emphasis on free trade agreements, particularly those with the US, Canada, and the EU (Khwaileh, 2020). However, the nation's economic expansion is still susceptible to outside shocks like shifts in the price of commodities globally and unrest in the surrounding areas (Al Khouri and Silcock, 2021).

The Economic Modernization Agenda, a comprehensive reform program intended to promote long-term sustainable growth, raise living standards, and expand employment possibilities, particularly for women and young people, was introduced by the Jordanian government in 2021 in response to these difficulties. This project aspires to quadruple Jordan's growth rate and create one million new jobs over the next decade, all while promoting sustainability by greening public and private investment frameworks (Worldbank, 2024).

1.1. Jordan and the BRIC countries: Emerging connections

Jordan has been working to strengthen its economic connections with the BRIC countries—Brazil, Russia, India, and China—all of which are significant emerging economies, in recent years. With a combined GDP larger than many wealthy nations, the BRIC countries account for a sizeable share of the global population and economic production (Bindu et al., 2022). Although previously operating in distinct economic domains, Jordan has been more closely collaborating with the BRIC nations due to the increasing significance of emerging markets (Özekin and Sune, 2023).

Brazil and Jordan are primarily interested in agricultural exports and food security from an economic standpoint. Brazil, a significant supplier of agricultural goods, has been supplying Jordan with more and more necessities including chicken, sugar, and soybeans. Jordan has endeavored to draw in Brazilian investments in exchange, namely in domains like energy and infrastructure (Nsour, 2020).

Jordan is part of the region that Russia, a major actor in the Middle East, has political and economic interests in (Jomehzadeh et al. 2021). The two countries have worked together in fields such as energy, and they have talked about working together on nuclear energy projects in the future. With its high reliance on energy imports, Jordan places special emphasis on Russia's role as a global energy producer (Mills, 2020). The two nations have also looked into measures to improve bilateral commerce, especially in the construction, defense, and pharmaceutical industries.

India has become a major trading partner for Jordan, supported by its rapidly growing economy. In 2022, India's exports to Jordan amounted to $1.8 billion, with key products being refined petroleum ($833 million), rice ($115 million), and unglazed ceramics ($68.6 million). Over the past five years, these exports have seen a

27% annual growth, rising from $545 million in 2017. India imports phosphates and fertilizers from Jordan, which are critical for its agriculture sector, while Jordan imports technology, textiles, and pharmaceuticals from India (OEC report, 2024). Collaborative efforts in technology transfers and educational exchanges further reinforce the economic ties between the two nations. Jordan stands to gain from India's increasing regional influence and its vast market potential (Ghaith, 2022).

China, the second-biggest economy in the world, will be important to Jordan's future economic plans. In an effort to encourage investment in energy, telecommunications, and infrastructure, Jordan has inked a number of agreements with China. Jordan is ideally situated to gain from China's Belt and Road Initiative (BRI), which aims to increase connectivity and trade throughout Asia. China has already invested in important infrastructure projects in Jordan, such as the creation of transportation networks and renewable energy initiatives (Zoppolato and Jiang, 2023).

There is potential for increased financial and economic cooperation as a result of the rising interdependence between Jordan and the BRIC countries, which is a reflection of the larger trend of developing market integration. These collaborations offer significant chances for trade diversification, foreign direct investment (FDI), and technology transfer as Jordan looks to broaden its economic base and overcome structural obstacles (Mugableh, 2020).

1.2. Financial cointegration between Jordan and the BRIC nations

The idea of financial cointegration becomes especially important given the growing economic ties between Jordan and the BRIC nations (Iltas, 2020; Mugableh, 2020). The phrase "financial cointegration" describes the long-term relationship—whereby the financial markets of many nations move in unison over time as a result of similar economic fundamentals or increasing interconnectedness (Nagina, 2022). It is imperative for investors, politicians, and economic planners to comprehend the financial cointegration that exists between Jordan and the BRIC nations.

The Introduction of this study is grounded in recent research underscoring the interconnectedness of natural resource management, financial integration, and sustainable economic development in emerging and developed economies. Research highlights the importance of robust policy and technological advancements to leverage resource wealth, countering traditional "resource curse" models (Lynch et al., 2022). For instance, Natural Resource-Driven Prosperity: Unveiling the Catalysts of Sustainable Economic Development in the United States illustrates how sustainable growth can be supported by policy frameworks that transform resource abundance into economic resilience (Smith et al., 2023). Likewise, in examining energy usage and natural resource wealth, From Resource Curse to Green Growth emphasizes the economic gains achieved through green energy investments and energy efficiency practices, which are essential in reducing resource dependency (Johnson and Lee, 2023).

Regional partnerships also play a crucial role in economic and industrial growth, as highlighted by Effect of Regional Factor Productivity on Manufacturing Sector: The Case of Sino-Pak Economic Ties, which demonstrates how strategic ties between China and Pakistan have improved manufacturing productivity, thus contributing to

resilience in the manufacturing sector (Ahmed and Zhang, 2022). Additionally, research on The Implications of the Ecological Footprint and Renewable Energy Usage on the Financial Stability of South Asian Countries underscores the stabilizing effect of renewable energy adoption on regional economies, advocating for cross-border environmental initiatives to ensure both ecological and economic stability (Patel et al., 2023).

Furthermore, studies on technological innovation and environmental impact, such as Innovate, Conserve, Grow: A Comprehensive Analysis of Technological Innovation, Energy Utilization, and Carbon Emission in BRICS, provide insights into how BRICS nations manage growth through policy-driven innovation. This work demonstrates that energy-efficient practices, alongside innovations in emissions reduction, contribute to sustainable development, offering valuable lessons for understanding emerging market interactions (Wu and Fernandes, 2023). These studies together lay a foundation for investigating the financial interconnections between Jordan and the BRIC nations, emphasizing the need for sustainability-oriented financial integration strategies that support diversification and economic stability.

Researchers can determine whether the financial markets of two or more nations show a long-term equilibrium link, despite short-term changes, in the context of financial markets by using cointegration analysis (Chen et al., 2022). This is especially beneficial for nations like Jordan and the BRICs, whose trade, investment, and diplomatic connections are strengthening their economic ties. One can ascertain the level of integration between Jordan's financial markets and those of the BRIC nations by looking at financial cointegration (Sayed and Charteris, 2024). This can assist in forecasting how Jordan's financial stability may be impacted by external shocks in the BRIC countries and vice versa.

For individual and institutional investors, understanding financial cointegration is crucial for portfolio diversification and risk management. If the financial markets of Jordan and BRIC countries are strongly cointegrated, it implies that these markets move together in the long run, reducing the benefits of diversifying investments across these countries. On the other hand, weak or no cointegration might indicate that these markets operate independently, providing more opportunities for diversification and reducing risk exposure.

The exploration of financial cointegration between Jordan and BRIC nations is crucial for a range of stakeholders. For investors, especially institutional ones like pension funds and mutual funds, it provides valuable insights into optimizing investment strategies by revealing how Jordan's financial markets interact with those of BRIC countries, enabling better portfolio diversification, risk management, and hedging. Policymakers can use the findings to anticipate the impact of external economic shocks, such as commodity price fluctuations or BRIC monetary policies, on Jordan's financial stability, thereby enhancing fiscal and monetary decisions. Additionally, economic planners and business leaders can leverage this understanding to identify areas for deeper economic collaboration—such as joint ventures and trade partnerships—capitalizing on Jordan's strategic position and its agreements with these emerging markets to foster long-term growth.

The relevance of examining financial integration between Jordan and BRIC economies, given the potential for diversification and strategic insights in a complex

global market. The study's novelty lies in its exploration of both long-term and short-term market relationships, uncovering unique diversification opportunities for institutional investors and offering valuable policy implications for economic collaboration. The choice of sample—daily stock index data from Jordan and BRIC markets from 2014 to 2024—aligns with recent economic shifts and highlights the importance of understanding market connections amid geopolitical uncertainty. The methodology, which includes Granger Causality, Johansen Cointegration, and Vector Autoregression (VAR) tests, is appropriate for capturing both equilibrium and dynamic relationships within these economies.

This study also contributes to literature on emerging markets' financial integration, challenging traditional models that assume inherent interconnectedness among such markets. It addresses recent findings, including research on how geopolitical, economic, and institutional factors—such as China's environmental management responses amid the Russia-Ukraine conflict—affect market stability and risk. The study's limitations include its focus on specific stock market indices and the exclusion of alternative financial instruments. The paper's structure follows: introduction, literature review, methodology, results, discussion, policy implications, and conclusion.

2. Literature review

The topic of financial market integration has drawn significant attention from both researchers and policymakers, especially in light of increasing global economic interdependence. The level of integration between markets across various countries influences market behavior, stock price correlations, and investment strategies, while also shaping risk mitigation through diversification. As globalization and financial liberalization advance, markets have become more aligned, raising concerns about the diminishing advantages of diversification. Gaining insights into the interactions between different economies, particularly emerging markets like Jordan and BRIC nations, is essential for developing informed investment strategies and policy frameworks.

2.1. Introduction to financial market integration

The concept of financial market integration has garnered significant attention in economic and financial research due to its implications for investment strategies and portfolio diversification. Integration refers to the extent to which financial markets across different countries move in unison due to global and regional economic forces (Sahabuddin et al., 2022). This phenomenon is critical for investors who seek international diversification to mitigate risk. However, high integration levels among global markets often limit diversification benefits, as integrated markets tend to respond similarly to global shocks, reducing the ability of investors to hedge against risks by investing in different markets (Wang et al., 2024). The integration of global stock markets has been widely studied in the context of both developed and emerging economies (Xia et al., 2022). Studies have shown that increased market integration is influenced by various factors, including trade relations, financial ties, and shared macroeconomic characteristics such as inflation, interest rates, and market liquidity

(Haddad, 2023; Patel et al., 2022). This review will focus on the integration between the Jordanian stock market and the BRIC (Brazil, Russia, India, and China) nations, aiming to understand the extent to which these markets are cointegrated and the implications for investors in these regions.

2.2. Theoretical background of market cointegration

The theoretical framework in this study centers on financial integration theories, which suggest that fully integrated markets are characterized by intertwined global and local risks, limiting the effectiveness of portfolio diversification in mitigating risk exposure (Haddad, 2023; Patel et al., 2022). For emerging markets like those in the BRIC nations, the literature typically categorizes these economies as partially integrated, reflecting a blend of local and global influences on stock prices and risk factors (Choudhry et al., 2020; Nagina, 2022). In such markets, expected returns are influenced by both global and local risk components, underscoring the distinct investment dynamics in partially integrated economies (Gopane, 2023).

Historically, pre-1990s stock markets displayed low correlations, particularly between developed and emerging economies, creating opportunities for investors seeking to diversify across borders. However, with the onset of globalization and capital market liberalization, there has been a marked increase in stock market cointegration, especially during times of financial crisis, reducing the potential for risk diversification (Ahmad et al., 2022).

The conceptual design of this study should build on this theoretical foundation by clearly articulating the chosen methodology, particularly in the context of empirical research on financial integration. It is essential to justify the model estimation in light of relevant literature to solidify its applicability to the Jordanian and BRIC markets. Additionally, data definitions must be detailed exhaustively, specifying the series used, measurement units, any transformations applied, and the data sources, complete with links. This level of clarity will enhance the robustness and transparency of the study's analytical framework.

2.3. Global financial crises and market cointegration

The global financial crisis (GFC) of 2008 was a pivotal event that led to heightened cointegration between global stock markets, as investors globally responded to the crisis by fleeing to safer assets, resulting in increased market correlations (Mensi et al., 2022). Research shows that during periods of crisis, financial markets tend to exhibit higher levels of integration as global shocks affect markets simultaneously, reducing the scope for portfolio diversification (Lehkonen and Heimonen, 2014). Similarly, the COVID-19 pandemic further exacerbated global market integration, particularly among the BRICS nations (Dsouza et al., 2024).

2.4. Empirical evidence of BRICS market integration

Several studies have investigated the cointegration relationships among the BRICS markets (Nagina, 2022; Ouattara, 2017; Sayed and Charteris, 2024; Wang and You, 2023). Early studies found significant correlations between the stock markets of the U.S. and BRICS countries, with Brazil showing the strongest correlation and China

and Russia the weakest (Khan, 2023). These findings indicate that BRICS markets do not form a homogeneous bloc in terms of financial integration, and their market movements are influenced by both regional and global factors (Batondo and Uwilingiye, 2022).

Research by Sayed and Charteris (2024) demonstrated that BRICS nations are more integrated within their respective regions than globally, with India being the most integrated both regionally and globally, while China remains the most segmented. This is supported by the work of Graham et al. (2012), who found that the degree of integration among BRICS markets varies over time and is most prominent during periods of crisis (Mensi et al., 2016). More recently, studies have examined the impact of economic policy uncertainty and geopolitical risk on the integration of BRICS markets, finding that China tends to be a net recipient of volatility spillovers from other BRICS markets (Li et al., 2024).

2.5. Jordanian stock market and its relationship with global markets

In contrast to the BRICS nations, the Jordanian stock market has been less studied in terms of its integration with global markets. However, existing literature suggests that Jordan, like other emerging markets, exhibits low levels of integration with developed markets. For instance, Baumöhl and Lyócsa (2014) found that Jordan, along with other Middle Eastern markets such as Kuwait and Oman, remains largely segregated from global financial markets. This segregation offers potential opportunities for investors seeking to diversify their portfolios by investing in Middle Eastern markets, which are less influenced by global shocks.

The study by Iltas (2020), Iram and Amin (2020) and Marashdeh (2005) explored the cointegration between the stock markets of Jordan, Turkey, Egypt, and Morocco, finding that while there was co-movement among these emerging markets, they did not exhibit long-term relationships with developed markets such as the U.S. and Germany. This suggests that Jordanian stock markets may offer portfolio diversification benefits when paired with more integrated markets like those in the BRICS nations.

2.6. Comparative analysis of BRICS and Jordanian markets

While the BRICS nations represent some of the largest and most dynamic emerging markets globally, Jordan represents a smaller, more segmented market with unique characteristics. Studies show that while BRICS markets have become increasingly integrated with global markets, particularly following crises, Jordan has maintained a degree of independence from global financial trends ((Sayed and Charteris, 2024). This divergence can be attributed to several factors, including the size and liquidity of the Jordanian market, as well as the relative isolation of its economy from global trade and financial networks (Mahfouz, 2021). Additionally, Jordan's stock market is influenced more by regional political and economic factors, such as instability in neighboring countries, than by global financial trends (Jarrar, 2021).

2.7. Implications for investors

The cointegration of the BRICS markets with global financial markets has important implications for investors. Increased integration reduces the potential for portfolio diversification, as global shocks tend to affect all markets simultaneously (Bhutto et al., 2020). However, the relative segmentation of Jordan's stock market offers a unique opportunity for investors seeking to diversify their portfolios by including assets that are less correlated with global markets (Moh'd AL-Tamimi, 2012).

Investors looking to capitalize on the differences in market integration between Jordan and the BRICS nations may consider combining investments in these markets to optimize their risk-return profiles (Mugableh, 2020). The BRICS markets, while offering significant growth potential, are more susceptible to global economic shocks, as evidenced by the increased integration during the GFC and COVID-19 pandemic (Mishra and Mishra, 2022). In contrast, Jordan's market offers potential for risk mitigation due to its lower correlation with global trends, making it an attractive option for diversification (Khaki et al., 2022; Zurub, 2024)

2.8. Research gap and study contribution

Although significant research has been conducted on the cointegration of BRIC markets and their interactions with global economies, there is a noticeable gap in the literature concerning the cointegration of the Jordanian stock market with BRIC economies. Previous studies have largely focused on the internal dynamics of BRIC markets or their relationship with developed markets such as the U.S. and Europe. Moreover, research that explores the impact of recent global events, such as the COVID-19 pandemic, on the integration of Jordanian and BRIC stock markets is sparse. While studies like those of Marashdeh (2005) and Baumöhl and Lyócsa (2014) have examined Jordan's financial market in relation to regional and global markets, little is known about its integration with BRIC economies post-pandemic.

This study seeks to fill this gap by investigating the short- and long-term cointegration between the Jordanian stock market and BRIC nations' stock markets. By analyzing more recent data through econometric models, this study will contribute to the existing literature by providing a deeper understanding of the dynamic relationships between these markets. The findings will not only enhance theoretical knowledge but will also offer practical insights for investors looking to optimize their portfolios by leveraging the unique characteristics of Jordanian and BRIC stock markets.

Hypotheses

This study explores the cointegration and causal linkages between the stock markets of Jordan and the BRIC nations by examining five key hypotheses. Among these, Ha2 and Ha4 are considered central to achieving the research goals, while Ha1 and Ha3 serve as supplementary hypotheses:

Ha1: The data series is stationary and does not exhibit a unit root.

Ha2: The stock markets of Jordan and the BRIC countries display at least one meaningful long-term cointegration relationship.

Ha3: There is significant serial correlation in the residuals at lag h.

Ha4: A significant causal relationship exists between pairs of stock markets in Jordan and the BRIC countries.

3. Research methodology

3.1. Data

The daily closing values of the stock market benchmark indices for Jordan and BRIC economies are used for this study. Specifically, the ASE General Index (ASEGI) for Jordan, BOVESPA for Brazil, MOEX for Russia, NIFTY 50 for India, and the Shanghai Composite for China. The study covers the period from 01 January 2014, to 30 August 2024, to analyze the cointegration and causal relationships among these markets.

3.2. Sampling technique

The closing values of benchmark indices for Jordan and BRIC countries are selected to meet the objectives of this study, using a purposive sampling technique.

3.3. Data analysis and estimation techniques

The study employs unit root tests, the Johansen Cointegration test, along with Vector Error Correction Model (VECM)/Vector Autoregressive (VAR) models, and Granger Causality tests for data analysis. These methods have been widely utilized in similar research, as evidenced by previous studies (Nagina, 2022; Patel, 2022; Syed et al., 2024), supporting the robustness of the selected methodology.

Unit root tests are performed to determine the integration order of the selected indices. Covariance analysis is utilized to assess whether there are positive or negative correlations among the stock markets of Jordan and the BRIC economies. The Johansen Cointegration test is applied to evaluate the existing relationships between these markets. Based on the outcomes of the cointegration test, a Vector Autoregression (VAR) model is employed to examine the short-term equilibrium dynamics between the chosen indices. Additionally, the VAR Granger causality test is used to explore causal relationships between these markets.

Jordan is a smaller, developing economy compared to the BRIC nations, with a GDP of approximately $48 billion in 2023 (World Economies, 2023). In contrast, Brazil, Russia, India, and China have significantly larger economies, with GDPs of around $2.08 trillion, $2.06 trillion, $3.73 trillion, and $17.72 trillion respectively (Bajpai, 2023). This stark difference makes it essential to analyze whether the financial markets of these larger economies influence Jordan's stock market. By calculating and analyzing quantitative data, the study seeks to determine the extent of integration between these stock indices over the analysis period. Thus, the study adopts a descriptive research design to assess the potential impact of these major economies on Jordan's financial market.

4. Data analysis and results

4.1. Graphical representation of selected indices

Figure 1 provides a graphical representation of the closing values of the stock indices from Jordan and the BRIC economies during the study period. The financial markets of these countries show some degree of integration. However, the Brazilian stock market, represented by the BOVESPA index, exhibits a distinct movement pattern compared to the other BRIC and Jordanian markets. Therefore, econometric techniques will be applied to confirm the extent of integration among these markets.

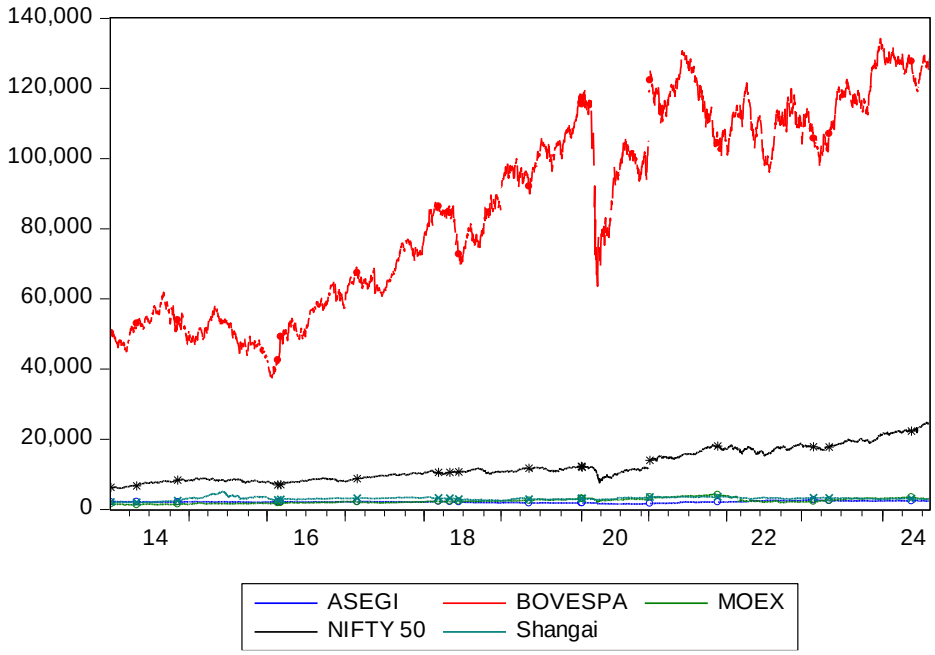

Figure 1. Jordan and BRIC indices.

(Source: Authors work).

Table 1 presents the descriptive statistics for the selected stock indices. The indices exhibit varying mean values, with Jordan at 7.653024, Brazil at 11.31383, Russia at 7.757386, India at 9.365160, and China at 8.029559. The standard deviations indicate greater volatility in the markets of Brazil, Russia, and India compared to those of Jordan and China. The positive skewness reflects a slight rightward skew in the data, while the kurtosis values suggest leptokurtic distributions. The Jarque-Bera test reveals significant deviations from normality across all indices.

Table 1. Selected stock markets' descriptive.

	JORDAN	BRAZIL	RUSSIA	INDIA	CHINA
Mean	7.653024	11.31383	7.757386	9.365160	8.029559
Median	7.661963	11.42228	7.741425	9.292777	8.046359
Maximum	7.917478	11.80704	8.363464	10.12468	8.549922
Minimum	7.335213	10.53202	7.123423	8.699665	7.596518
Std. Dev.	0.121436	0.345657	0.285538	0.354082	0.147810
Skewness	−0.504481	−0.378319	−0.014321	0.327195	−0.740016
Kurtosis	3.141251	1.714411	2.228343	1.930212	5.078628
Jarque-Bera	110.7153	237.3591	63.60259	167.7517	694.5266
Probability	0.000000	0.000000	0.000000	0.000000	0.000000

Table 1. (*Continued*).

	JORDAN	BRAZIL	RUSSIA	INDIA	CHINA
Sum	19,591.74	28,963.41	19,858.91	23,974.81	20,555.67
Sum Sq. Dev.	37.73705	305.7455	208.6400	320.8331	55.90821
Observations	2560	2560	2560	2560	2560

(Source: Authors work).

Table 2 illustrates the results of the Covariance and Correlation Analysis among the selected stock indices. A low correlation coefficient indicates a segmentation characteristic of the stock markets, enabling investors to achieve risk diversification through portfolio management. Conversely, high correlation coefficients suggest strong interdependencies among the markets, which may deter investors from diversifying their portfolio holdings across these markets. The correlation analysis for the Jordan and BRIC stock markets reveals a strong positive relationship between most of the market pairs of the selected economies during the study period. This high correlation among the indices reduces the potential benefits of portfolio diversification for investors. However, a negative correlation is observed between the Jordanian and Russian stock markets, suggesting the possibility of achieving higher returns through diversification. Additionally, low correlation values between China and the other selected indices also present opportunities for investors to generate returns.

Table 2. Covariance and correlation analysis among selected indices.

Covariance					
Correlation	**ASEGI**	**BOVESPA**	**MOEX**	**NIFTY_50**	**SHANGAI**
ASEGI	62,879.00				
	1.000000				
BOVESPA	946,722.5	7.62E + 08			
	0.136783	1.000000			
MOEX	−23,060.51	16,208,806	483,254.9		
	−0.132290	**0.844747**	1.000000		
NIFTY_50	565,412.5	1.12E + 08	2,285,400.	21,225,523	
	0.489422	**0.878413**	**0.713584**	1.000000	
SHANGAI	1970.389	2,203,315.	92,563.22	413,038.6	195,076.1
	0.017791	**0.180733**	**0.301473**	**0.202983**	1.000000

(Source: Authors work).

Furthermore, if cointegration is found among these stock markets, it would eliminate the prospects for portfolio diversification. Therefore, conducting a cointegration analysis is essential to provide investors with clear insights.

4.2. Unit root test (augmented dickey-fuller)

H01: The data series is stationary and does not exhibit a unit root.

Ha1: The data series is non-stationary and does exhibit a unit root.

Table 3 presents the results of the unit root test statistics. Based on these statistics, the null hypothesis (H01) is rejected for the indices at I (1) at a 5%

significance level, indicating that all daily data series for the selected indices are stationary at I (1) during the study period. Consequently, it is appropriate to proceed with the Johansen Cointegration test (Syed et al., 2024).

Table 3. Unit root test.

Indices	Original Series			Adjusted Series (Variable in First Difference)		
	***t*-Statistic**	**Probability**	**Result**	***t*-Statistic**	**Probability**	**Result**
Jordan-ASEGI	−0.972348	0.7650	Non-Stationary	−42.43440	0.0000*	Stationary
Brazil–BOVESPA	−0.969101	0.7661	Non-Stationary	−55.35065	0.0001*	Stationary
Russia–MOEX	−1.696836	0.4328	Non-Stationary	−53.26499	0.0001*	Stationary
India–NIFTY 50	1.190394	0.9982	Non-Stationary	−51.52642	0.0001*	Stationary
China-Shangai	−3.24952	0.0174	Non-Stationary	−23.24936	0.0000*	Stationary

(Source: Authors work). Note: *Significant at 5% significance level.

Table 4 presents the VAR Lag Order Test Statistics. Based on the findings from the VAR lag order analysis and guided by the Akaike Information Criterion, lag 3 is selected for the subsequent steps in the cointegration analysis.

4.3. Optimum lag order selection

Table 4. VAR lag order test statistics.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	6558.008	NA	$4.08\ 10^{-9}$	−5.127550	−5.116113	−5.123402
1	39416.77	65563.25	$2.84\ 10^{-20}$	−30.81907	−30.75045*	−30.79418
2	39504.46	174.6331	$2.70\ 10^{-20}$	−30.86812	−30.74232	−30.82250*
3	39551.55	93.59313	$2.66\ 10^{-20}$*	−30.88541*	−30.70243	−30.81905
4	39574.45	45.42049*	$2.66\ 10^{-20}$	−30.88376	−30.64360	−30.79667

(Source: Authors work). Note: * Optimum lag orders as per the respective criterion.

4.4. Johansen cointegration test

H02: The selected stock markets do not exhibit significant long-run cointegration relationships.

Ha2: The selected stock markets exhibit at least one significant long-run cointegration relationship.

Table 5 presents the Trace statistics, while **Table 6** displays the Maximum Eigen statistics derived from the Johansen Cointegration test. The null hypothesis (Ha2) is rejected at the 5% significance level, indicating that there is no significant long-run cointegration relationship among the stock markets of Jordan and the BRIC nations during the study period, as evidenced by both statistics. This finding suggests that no cointegrating vectors exist among the variables analyzed. These results carry important implications for global investors, highlighting potential long-term diversification opportunities between Jordan's stock market and those of the BRIC countries. In the absence of a cointegration relationship, the VAR framework can be utilized to investigate short-term causation (Goyal and Bansal, 2019; Syed et al., 2024). After meeting all prerequisites for the application of VAR, including

confirming the stationarity of the data series outlined in **Table 3**, transforming the series to stationary at I (1), and determining the optimal lag order based on the VAR lag selection results in **Table 4**, VAR at lag 3 is computed to examine short-term causation among the stock markets of Jordan and the BRIC countries as follows:

Table 5. Johansen cointegration (unrestricted rank test) trace statistics (lag 3).

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.009289	58.36263	69.81889	0.2891
At most 1	0.006976	34.50819	47.85613	0.4742
At most 2	0.005207	16.61380	29.79707	0.6684
At most 3	0.001047	3.269528	15.49471	0.9533
At most 4	0.000232	0.593002	3.841466	0.4413
Trace test indicates no cointegration at the 0.05 level				

**: 0.05.
(Source: Authors work).

Table 6. Johansen cointegration (unrestricted rank test) maximum eigen statistics (lag 3).

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.009289	23.85445	33.87687	0.4662
At most 1	0.006976	17.89439	27.58434	0.5039
At most 2	0.005207	13.34427	21.13162	0.4210
At most 3	0.001047	2.676526	14.26460	0.9659
At most 4	0.000232	0.593002	3.841466	0.4413

**: .05.
(Source: Authors work).

Table 7 displays the VAR model constructed using lag 3 to examine the cointegration among the stock markets of Jordan and the BRIC nations. The VAR estimates indicate the relationships between these markets at this lag. Each equation incorporates the stock indices of Jordan and the BRIC countries, including three lagged values along with a constant term. The results from the VAR model highlight how the lagged values of both dependent and independent variables influence the dependent variable. The analysis is performed by treating each stock market, including Jordan's, as the dependent variable in a column-wise format.

The significance of the findings is assessed by evaluating the *t*-statistics, where a value greater than 1.96 indicates that the corresponding variable significantly affects the lagged value of the dependent variable. Significant values are marked bold in **Table 7**. It is to be noted that Jordan stock market own value at lag 1 and Indian stock market value at lag 1 are significantly influencing the Jordan stock market movement. Notably, the R-squared value for the Jordanian stock market as the dependent variable is high, suggesting that the lagged values of the BRIC markets significantly determine the movement of the Jordanian stock market. This result underscores the validity of the VAR model and the appropriateness of the chosen variables. Similarly, the R-squared values for the BRIC nations' stock markets also affirm the reliability of the VAR model and the relevance of the selected variables when analyzing them as dependent variables.

Table 7. Vector Autoregression estimates VAR at lag 3.

	JORDAN	**BRAZIL**	**RUSSIA**	**INDIA**	**CHINA**
	1.173304	0.071334	−0.058973	0.054976	−0.080972
JORDAN (-1)	(0.01981)	(0.06571)	(0.06591)	(0.04511)	(0.05362)
	[59.2417]	[1.08551]	[−0.89470]	[1.21858]	[−1.51007]
	−0.148689	−0.060583	0.198777	0.057429	0.132451
JORDAN (-2)	(0.03044)	(0.10100)	(0.10131)	(0.06934)	(0.08242)
	[−4.88455]	[−0.59981]	**[1.96210]**	[0.82822]	[1.60711]
	−0.027112	−0.019103	−0.150214	−0.104070	−0.056085
JORDAN (-3)	(0.01982)	(0.06575)	(0.06595)	(0.04514)	(0.05365)
	[−1.36820]	[−0.29054]	**[−2.27777]**	**[−2.30559]**	[−1.04540]
	−0.001403	0.894194	0.039986	−0.007234	0.048735
BRAZIL (-1)	(0.00602)	(0.01998)	(0.02004)	(0.01372)	(0.01630)
	[−0.23304]	**[44.7512]**	**[1.99514]**	[−0.52737]	**[2.98910]**
	0.009380	0.138920	0.030282	0.037241	−0.018967
BRAZIL (-2)	(0.00801)	(0.02658)	(0.02666)	(0.01825)	(0.02169)
	[1.17082]	**[5.22599]**	[1.13574]	**[2.04069**]	[−0.87443]
	−0.007989	−0.040973	−0.066819	−0.022280	−0.030199
BRAZIL (-3)	(0.00603)	(0.02002)	(0.02008)	(0.01374)	(0.01634)
	[−1.32401]	**[−2.04655]**	**[−3.32742]**	[−1.62100]	[−1.84858]
	0.002262	0.040293	0.924315	0.002736	−0.017878
RUSSIA (-1)	(0.00598)	(0.01984)	(0.01990)	(0.01362)	(0.01619)
	[0.37824]	**[2.03065]**	**[46.4426]**	[0.20088]	[−1.10419]
	0.013070	−0.033633	0.072131	0.055586	−0.006016
RUSSIA (-2)	(0.00810)	(0.02688)	(0.02696)	(0.01845)	(0.02193)
	[1.61348]	[−1.25136]	**[2.67564]**	**[3.01249]**	[−0.27432]
	−0.016472	−0.005404	−0.006627	−0.056921	0.022057
RUSSIA (-3)	(0.00597)	(0.01981)	(0.01987)	(0.01360)	(0.01617)
	[−2.75827]	[−0.27274]	[−0.33347]	**[−4.18451**]	[1.36427]
	0.017362	0.073168	−0.048071	0.975480	0.007156
INDIA (-1)	(0.00871)	(0.02889)	(0.02898)	(0.01984)	(0.02358)
	[1.99366]	**[2.53222]**	[−1.65865]	**[49.1751]**	**[0.30351]**
	0.005900	−0.088647	0.170007	0.017548	0.019749
INDIA (-2)	(0.01216)	(0.04036)	(0.04048)	(0.02771)	(0.03293)
	[0.48506]	**[−2.19661]**	**[4.19993]**	[0.63338]	[0.59972]
	−0.022013	0.022448	−0.118564	−0.002057	−0.025029
INDIA (-3)	(0.00869)	(0.02885)	(0.02893)	(0.01980)	(0.02354)
	[−2.53204]	[0.77817]	**[−4.09778]**	[−0.10385]	[−1.06336]
	0.005666	0.036628	0.020284	−0.017455	1.037819
CHINA (-1)	(0.00732)	(0.02428)	(0.02435)	(0.01667)	(0.01981)
	[0.77432]	[1.50867]	[0.83295]	[−1.04727]	**[52.3876]**

Table 7. (*Continued*).

	JORDAN	**BRAZIL**	**RUSSIA**	**INDIA**	**CHINA**
CHINA (-2)	0.001096	−0.034836	−0.008327	0.014416	−0.068826
	(0.01054)	(0.03496)	(0.03507)	(0.02400)	(0.02853)
	[0.10403]	[−0.99646]	[−0.23747]	[0.60064]	**[−2.41273]**
CHINA (-3)	−0.005793	−0.005226	−0.008527	0.003653	0.026107
	(0.00731)	(0.02426)	(0.02433)	(0.01665)	(0.01979)
	[−0.79246]	[−0.21544]	[−0.35049]	[0.21937]	[1.31906]
C	0.008636	0.105752	0.060708	−0.081927	0.076259
	(0.01349)	(0.04477)	(0.04491)	(0.03074)	(0.03653)
	[0.64005]	**[2.36209**]	[1.35190]	**[−2.66552]**	**[2.08749]**
R-squared	0.998489	0.997942	0.996962	0.999074	0.992460
Adj. *R*-squared	0.998480	0.997929	0.996945	0.999069	0.992416
Sum sq. resids	0.057038	0.627950	0.631753	0.295960	0.418097
S.E. equation	0.004738	0.015720	0.015768	0.010792	0.012827
F-statistic	111906.2	82124.66	55599.53	182794.4	22297.79
Log likelihood	10065.30	6998.518	6990.800	7960.254	7518.545
Akaike AIC	−7.860228	−5.461492	−5.455456	−6.213730	−5.868240
Schwarz SC	−7.823644	−5.424908	−5.418872	−6.177146	−5.831656
Mean dependent	7.653023	11.31439	7.757935	9.365894	8.030017
S.D. dependent	0.121507	0.345470	0.285255	0.353640	0.147291

(Source: Authors work). Note: Standard errors are shown in (), and *t*-statistics are given in [] in **Table 7**.

4.5. Stability and residual diagnostics of VAR model

In this study, the accuracy of the model's specification is assessed by applying a robustness test using the Vector Autoregression (VAR) framework. A mis-specified model could lead to biased estimates and incorrect interpretations. To ensure model stability, the AR roots graph method is employed, with the results presented in **Figure 2**. The stability of the VAR model is confirmed by the fact that all characteristic roots lie within the unit circle, as shown in **Figure 2**, indicating the model's robustness.

Figure 3 provides evidence of the absence of autocorrelation among the residuals, as most of the values are contained within the two standard error bounds. This indicates that the residuals are not serially correlated, further validating the reliability of the model's estimates.

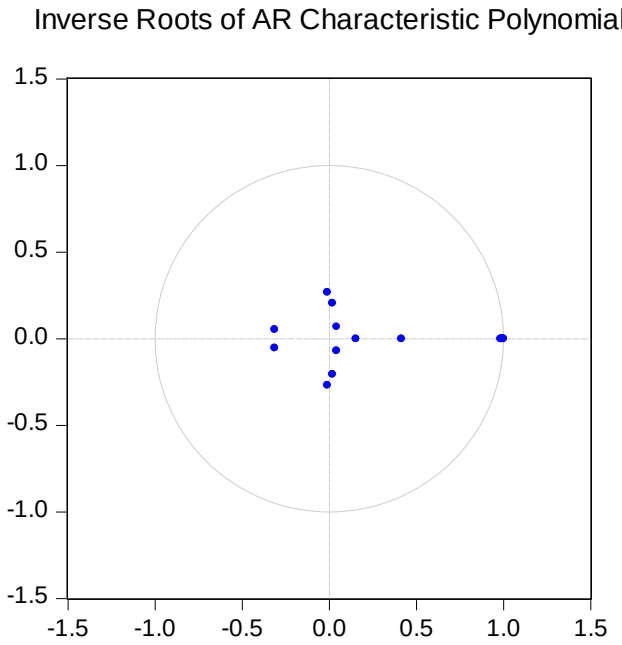

Figure 2. VAR model: The characteristics root distribution.

(Source: Authors work). Note: Dots are representing characteristic roots.

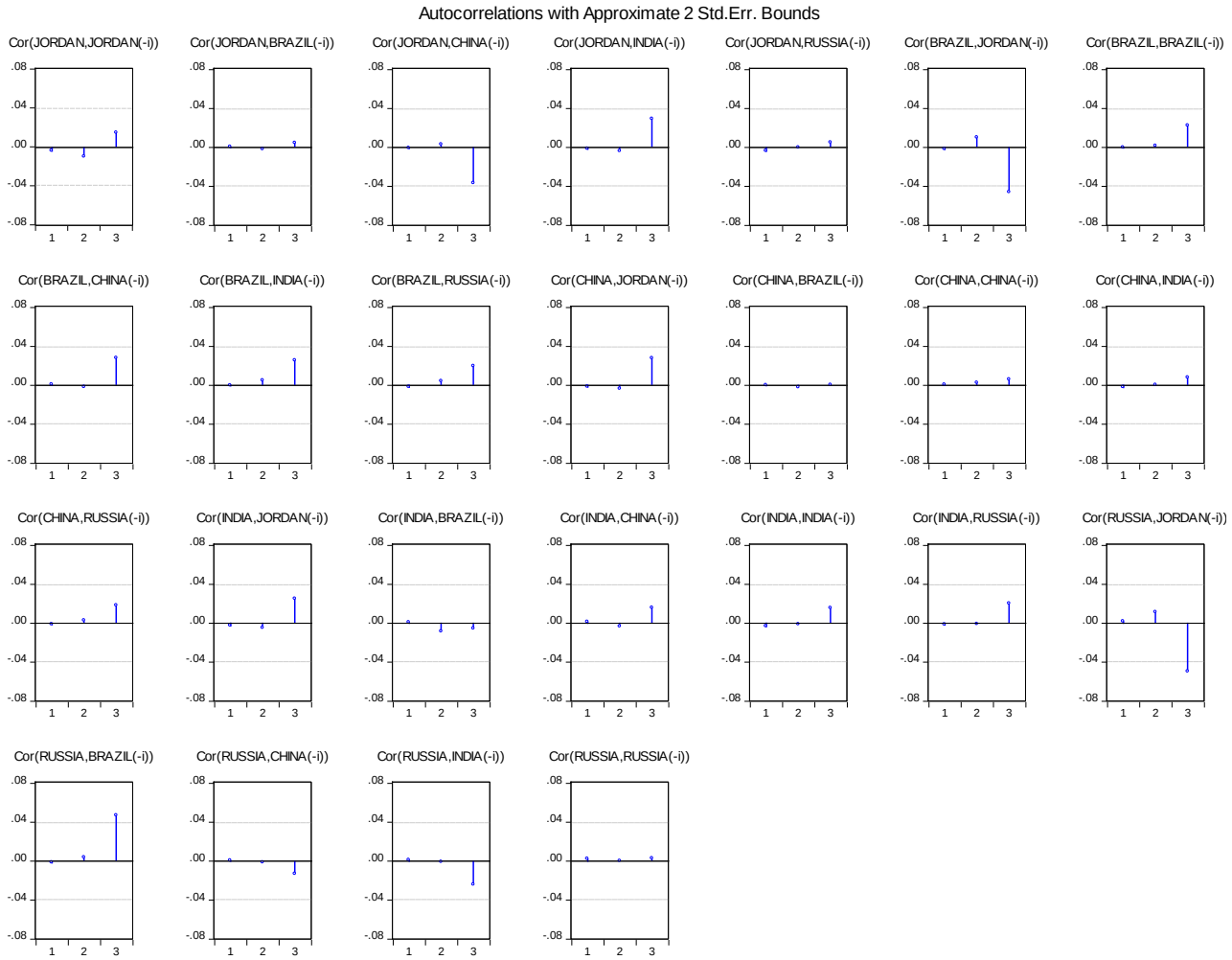

Figure 3. Autocorrelations analysis for residual diagnostics.

(Source: Authors work).

The VAR Residual Serial Correlation LM Tests are conducted to assess the presence of serial correlation in the residuals. The null hypothesis (H03) states that no serial correlation exists in the residuals at lag *h*, while the alternative hypothesis (Ha3) posits that significant serial correlation exists in the residuals at lag *h*. The results of these tests determine whether the model's residuals are independent across different time lags, further validating its accuracy.

Table 8 presents the statistics from the VAR Residual Serial Correlation LM Tests. The results indicate the absence of serial correlation in the residuals of the VAR model at lag 3, as evidenced by the *p*-value of 0.1001. Since this *p*-value exceeds the 5% significance level, the alternative hypothesis (Ha3) is rejected, confirming that no significant serial correlation exists in the residuals at this lag.

Table 8. LM tests.

Lag	LRE* stat	Df	Prob.	Rao F-stat	df	Prob.
1	39.15567	25	0.0355	1.567570	(25, 9407.5)	0.0355
2	48.68051	25	0.0031	1.949878	(25, 9407.5)	0.0031
3	34.37813	25	0.1001	1.375956	(25, 9407.5)	**0.1001**
4	60.29625	25	0.0001	2.416632	(25, 9407.5)	0.0001

(Source: Authors work).

4.6. Granger Causality test

The Granger Causality test is employed to examine the causal relationships between stock market pairs of the Quad nations. The null hypothesis (H05) asserts that no significant causal association exists among the stock market pairs, whereas the alternative hypothesis (Ha5) suggests that a significant causal association is present. The test results will determine whether changes in one stock market can predict future changes in another, highlighting potential interdependencies among these markets.

The Granger Causality test statistics mentioned in **Table 9** reveal several significant relationships between the stock markets of Jordan and the BRIC nations. Jordan's stock market is significantly influenced by Russia ($p = 0.0296$) and India ($p = 0.0097$), with the overall *p*-value (0.0042) indicating that the BRIC nations collectively have a significant causal impact on Jordan's market. Brazil's stock market shows a significant causal link from India ($p = 0.0179$), and the overall *p*-value (0.0327) confirms that the BRIC nations and Jordan together influence Brazil's market.

Table 9. Block exogeneity wald tests/ VAR Granger Causality.

Dependent variable: JORDAN			
Excluded	Chi-sq	df	Prob.
BRAZIL	1.910924	3	0.5911
RUSSIA	8.977567	3	**0.0296**
INDIA	11.40919	3	**0.0097**
CHINA	3.088274	3	0.3782
All	28.84107	12	**0.0042**

Table 9. (*Continued*).

Dependent variable: BRAZIL			
Excluded	Chi-sq	df	Prob.
JORDAN	4.346263	3	0.2264
RUSSIA	4.229259	3	0.2377
INDIA	10.07937	3	**0.0179**
CHINA	4.574793	3	0.2057
All	22.46090	12	**0.0327**
Dependent variable: RUSSIA			
Excluded	Chi-sq	df	Prob.
JORDAN	9.300669	3	**0.0255**
BRAZIL	15.53313	3	**0.0014**
INDIA	21.30133	3	**0.0001**
CHINA	2.811112	3	0.4217
All	55.48071	12	**0.0000**
Dependent variable: INDIA			
Excluded	Chi-sq	df	Prob.
JORDAN	14.76489	3	**0.0020**
BRAZIL	18.35876	3	**0.0004**
RUSSIA	18.48700	3	**0.0003**
CHINA	1.335069	3	0.7208
All	53.42953	12	**0.0000**
Dependent variable: CHINA			
Excluded	Chi-sq	df	Prob.
JORDAN	4.014890	3	0.2599
BRAZIL	11.33457	3	**0.0100**
RUSSIA	3.506022	3	0.3200
INDIA	1.651691	3	0.6477
All	18.91046	12	0.0907

(Source: Authors Work).

Russia's stock market is significantly affected by Jordan (p = 0.0255), Brazil (p = 0.0014), and India (p = 0.0001), with the overall p-value (0.0000) strongly indicating that Jordan and the BRIC nations collectively have a substantial influence on Russia's market. India's stock market is significantly impacted by Jordan (p = 0.0020), Brazil (p = 0.0004), and Russia (p = 0.0003), and the overall p-value (0.0000) shows a strong collective influence from the BRIC nations and Jordan.

In contrast, China's stock market exhibits a significant causal relationship only with Brazil (p = 0.0100), and the overall p-value (0.0907) suggests that, collectively, Jordan and the BRIC nations do not have a significant impact on China's market.

Overall, the BRIC nations and Jordan exhibit notable interdependencies, with Russia and India playing central roles in these relationships, while China's market remains less influenced by the group as a whole. The collective influence of the BRIC

nations is particularly evident in their impact on the stock markets of Jordan, Brazil, Russia, and India, but not as significant for China.

5. Discussion

The analysis of the VAR model results (**Table 7**) reveals critical insights into the dynamics of the stock markets in Jordan, Brazil, Russia, India, and China, underscoring the significance of lagged effects in determining market behavior. For Jordan's stock market, the first lag coefficient of 1.173304 (t = 59.2417) demonstrates a significant positive influence from its past performance, indicating that recent market trends are pivotal in shaping current values. In contrast, Jordan (-2) presents a negative coefficient of −0.148689 (t = −4.88455), reflecting a diminishing but still significant influence. The negligible effect of Jordan (-3) (coefficient of −0.027112, t = −1.36820) suggests that older performance data have less impact, reinforcing the notion that immediate past performance is the most critical factor.

Brazil's market also exhibits strong self-reliance, as evidenced by Brazil (-1) with a coefficient of 0.894194 (t = 44.7512), indicating its substantial role in determining current conditions. Brazil (-2) further supports this with a significant coefficient of 0.138920 (t = 5.22599), while Brazil (-3) presents a negative impact of −0.040973 (t = −2.04655), suggesting a complex interplay of influences over different time lags.

Similarly, Russia's stock market is heavily influenced by its recent past, with Russia (-1) showing a significant positive effect (coefficient of 0.924315, t = 46.4426), while the influence from Russia (-2) is also significant (coefficient of 0.072131, t = 2.67564). The minimal impact from Russia (-3) further emphasizes the importance of recent performance.

In India's case, the coefficient for India (-1) is notably strong at 0.975480 (t = 49.1751), indicating a robust persistence in market performance, although the effects diminish in the second and third lags, with coefficients of 0.170007 (t = 4.19993) and −0.118564 (t = −4.09778), respectively.

China's stock market reflects a similar pattern, with a significant coefficient of 1.037819 (t = 52.3876) for China (-1), indicating responsiveness to immediate past performance, while earlier lags do not show significant effects.

The results of the Granger Causality Test further illuminate the interactions between Jordan and the BRIC nations. Specifically, Jordan exhibits significant causal relationships from Russia (p = 0.0296) and India (p = 0.0097), while there is no significant causal relationship from Brazil (p = 0.5911) or China (p = 0.3782). Collectively, the BRIC nations significantly impact Jordan's stock market (overall p = 0.0042).

Conversely, Brazil's market is significantly influenced by India (p = 0.0179), while it shows no significant causal relationships with Jordan (p = 0.2264), Russia (p = 0.2377), or China (p = 0.2057), indicating a unique dependency. For Russia, significant causal relationships are found with Jordan (p = 0.0255), Brazil (p = 0.0014), and India (p = 0.0001), but not with China (p = 0.4217). India's market similarly shows strong influences from Jordan (p = 0.0020), Brazil (p = 0.0004), and Russia (p = 0.0003), while China shows only a significant relationship from Brazil (p = 0.0100), with no significant causal relationships from Jordan, Russia, or India.

Overall, the high R-squared values (ranging from 0.992 to 0.998) confirm that the model explains a substantial portion of the variance in stock prices across all markets, and the significant F-statistics further validate the robustness of the model. The log-likelihood values and information criteria (AIC and SBC) suggest an appropriate specification for the data. These findings underscore the interconnectedness of the stock markets among these nations, with the most substantial influences stemming from recent performance and significant causal relationships.

In the context of investment strategies and portfolio diversification, these results highlight the importance of understanding the relationships between these markets. Investors may benefit from considering the Granger causality results when constructing international portfolios, as they indicate potential predictive relationships that can enhance returns and reduce risks. For instance, the significant influences of Jordan's market from India and Russia suggest that investors might strategically allocate funds into these markets to capitalize on expected movements. Furthermore, the lack of significant causation from certain markets (such as China to others) suggests opportunities for diversification, allowing investors to mitigate risks associated with reliance on single markets. Overall, these insights can inform international investment decisions and strategies, providing a framework for enhanced portfolio performance through strategic asset allocation.

6. Conclusion

This study analyzed the cointegration and causal relationships between the stock markets of Jordan and BRIC nations, focusing on long-term financial interdependencies. The Johansen Cointegration test revealed no statistically significant cointegration between these markets, supporting the research findings. Investors can benefit from diversification as a result of this lack of long-term equilibrium, which suggests that the markets in Jordan and the other BRIC countries do not move in tandem over time. The results imply that the direct influence of external shocks on Jordan's financial market stability may be restricted in the BRIC countries due to factors like fluctuations in political unrest or changes in commodities prices. The VAR model showed the short-term dynamics between Jordan and the BRIC countries—especially with Russia and India, which have a big impact on Jordan's stock market fluctuations. This emphasizes how crucial these markets are to risk management and short-term investment strategies. Granger Causality studies revealed that although China's market showed little connection with Jordan, Russia and India have a considerable impact on Jordan's market. These results imply that Jordan's market presents special benefits for investors in terms of diversification because of its limited long-term integration with the larger BRIC markets. In order to promote economic growth and stability, Jordanian policymakers should think about utilizing these insights to fortify trade, investment, and financial cooperation relationships with the BRIC nations. In general, the findings highlight how crucial it is to comprehend the various levels of financial integration across emerging nations in order to effectively plan investments and formulate policy.

7. Implications

7.1. Policy implications

The lack of long-term financial cointegration between Jordan and BRIC nations suggests that Jordan's policymakers should prioritize bilateral economic cooperation, especially with India and Russia, where short-term interactions are more prominent. Jordan's government can focus on enhancing trade agreements and investment opportunities with these nations to capitalize on the short-term market influences identified in the study. Policymakers should also be mindful of the need to safeguard Jordan's financial market from excessive external shocks by maintaining robust economic policies that encourage market independence. The findings imply a window for Jordan to diversify its economic relationships and leverage emerging market opportunities in sectors such as energy, agriculture, and technology, particularly with India and Russia.

7.2. Managerial implications

Institutional investors, including mutual funds and pension funds, might benefit from portfolio diversification options provided by the lack of long-term cointegration between the Jordanian and BRIC economies. Investing in Jordan's stock market allows managers to lower their exposure to risk because of its low connection with the BRIC economies, which provides options for hedging against market downturns and global financial crises. Short-term partnerships with markets such as Russia and India should be emphasized in investment strategies because they have shown to have considerable causal influences on Jordan's financial movements. Furthermore, the results imply that investing in the Chinese market would not be as useful for controlling Jordan-related short-term risks.

Business executives can use the insights on short-term market interactions to inform decisions about mergers, acquisitions, and joint ventures with BRIC rivals. This is especially true for individuals who work in global environments. Companies in Jordan should look to benefit from trade and financial connections with the BRIC countries, particularly by focusing on industries with robust market connections including technology, agriculture, and energy.

7.3. Theoretical implications

From a theoretical perspective, this study contributes to the literature on financial market integration by demonstrating that emerging markets do not always exhibit long-term cointegration, even when significant short-term relationships exist. The lack of cointegration between Jordan and BRIC economies challenges traditional models that assume greater integration among emerging markets, highlighting the need to explore market-specific factors that inhibit long-term equilibrium. Additionally, this research emphasizes the significance of short-term interactions, suggesting that emerging markets may experience sporadic and dynamic relationships that are influenced by geopolitical events, trade policies, and economic reforms. Future research should investigate the causes of the limited long-term integration between

these markets and explore the impact of geopolitical stability, regulatory frameworks, and market liberalization on financial cointegration.

This paper enriches the scientific community's understanding of financial integration by providing insights into the dynamics between Jordan's stock market and the BRIC economies (Brazil, Russia, India, and China). By focusing on these specific emerging markets, the study adds to the growing literature on partial integration among developing economies, challenging traditional assumptions that emerging markets are either fully integrated or entirely isolated from global influences. This nuanced perspective supports a better understanding of how regional markets interact under different economic, political, and market conditions, highlighting unique patterns of short-term causality and limited long-term equilibrium.

Additionally, this study's empirical approach—utilizing Granger Causality tests, Johansen Cointegration, and Vector Autoregression (VAR)—provides a methodological contribution, particularly in the context of examining emerging markets where such sophisticated econometric techniques are less frequently applied. This enriches the methodological toolkit for future research, allowing scholars to better assess the extent and nature of financial interdependence in similar contexts.

Finally, by linking the findings to practical implications for investors and policymakers, the paper bridges theoretical knowledge and real-world application. This is particularly valuable for institutional investors and policymakers who aim to design risk mitigation and economic policies tailored to unique market conditions. In doing so, the paper not only advances academic knowledge but also contributes actionable insights, helping to inform strategic economic cooperation and diversification practices that are critical for financial stability in emerging markets.

7.4. Limitations and future scope

This study's main limitations are that it relies on daily stock market data and only looks at a small window of time (2014–2024), which may not fully capture the wide range of economic relationships between Jordan and the BRIC countries. To have a deeper understanding of the wider economic integration, future research should lengthen the study period and include other macroeconomic factors including interest rates, inflation, and foreign direct investment. Further understanding of the dynamic links between Jordan and the BRIC nations may also come from examining the effects of international events such as COVID-19 on market interactions.

Conflict of interest: The author declares no conflict of interest.

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