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|RESEARCH ARTICLE

Revisiting the Dynamic Linkages between the Stock Markets and the Currency Exchange Rates: Testament from the Select BRICS Economies

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Abstract

This study uses quarterly closing data of stock markets and currency exchange rates from the BRICS nations during Q3 1997 to Q2 2025, with 112 sample observations, to inspect the dynamic relationship along with co-movements between the stock market indices and currency exchange rates. Diverse econometric approaches, namely the ADF unit root test, the quantile regression model and the Wavelet Coherence analysis, are used to address the motives of the study. The dynamic relationship across different quantiles, along with the co-movements between the select stock market indices and currency exchange rates from BRICS nations, is captured as it evolves.

1. INTRODUCTION

For the past few decades, financial turmoil has ignited vigorous debates among academicians, industry, professionals, and at the government level about the dynamic linkages between the stock markets and the currency exchange rates (Dahir et al., 2018). The key setback for the worldwide investors includes recognising the relationship between the stock markets and the currency exchange rates, along with the dynamic co-movement between the stock markets and the currency exchange rates, which is difficult to recognise and also this is primarily due to the implementation of the free-floating exchange rates by several economies that are directed towards reorganising the worldwide financial arrangement and the escalation in the net capital inflows, international economic integration, and diversification strategies (Ndako, 2013; Tsai, 2012).

These play a crucial factor in explaining the dynamic linkages and designing policies in the context of global portfolios. The currency exchange rates (henceforth to be written as CER) can impact the stock markets in either a positive or a negative way, however, the negative effect is much more observed in the past studies, as demonstrated by the US subprime mortgage crisis in 2007, the worldwide financial recession in 2008, and the European debt market crisis in 2010 (Zolfaghari & Sahabi, 2017). The negative impact led to bankruptcies, leading to liquidity crises (Dahir et al., 2018). Again, the companies involved in export-related activities make a significant gain as a consequence of the currency depreciation. On the contrary, currency depreciation harms the importers and their stock prices (Bahmani-Oskooee & Saha, 2016).

However, various questions have been raised about the dynamic linkages between currency exchange rates and the stock markets, stating that there is no effect of exchange rates on the stock markets (Adeniyi & Kumeka, 2020). Under such circumstances, the present study looks forward to meticulously examining the dynamic linkages between the CER and the stock markets from the select BRICS economies.

The remaining of the study is outlined as follows: Section 2 provides the literature survey, research gaps, and the objectives of the study; Section 3 identifies the research methodology; Section 4 validates the data analysis and findings; Section 5 deals with the conclusion, policy implications, and limitations of the study.

2. UNDERPINNINGS FROM PAST STUDIES

A significant number of literatures has been reviewed minutely both from the national and international context, and the summary of the findings is outlined below:

Lefatsa et al. (2025) use the ARDL model to inspect the short-run variations and long-run steadiness between worldwide risk perception, gold prices, and interest rate disparities on exchange rate forces from South Africa. They concluded that greater global risk sentiment escalates currency depreciation, leading to the drainage of capital to comparatively safer asset categories. Sahay et al. (2025) studied the dynamic correlation as well as the volatility spillovers between the exchange rates and the stock markets from the BRICS economies during the COVID-19 pandemic and the Russia-Ukraine crisis by applying the DCC-EGARCH methodology. It was observed that both events had a negligible effect on the relationship between the exchange rate and the stock market from the BRICS nations, except for Brazil. Also, the spillover was noted across a long-run time horizon from the exchange rates to the select stock market indices. Mroua & Trabelsi (2020) introspect the causality and the versatile linkages between the exchange rates and the stock market indices from the BRICS nations by using the ARDL model. The results of their study demonstrate that there exists a noteworthy influence of exchange rates on the past and present volatility across a short and long-run time frame.

Salisu et al. (2021) designed a model for predicting the connections between the exchange rate and the stock return discrepancy between the domestic market and the foreign market along with identifying the irregular association between the stated variables. They observed that there exists a positive connection between the stock return difference and exchange rate return for the BRICS nations, namely Brazil, India and South Africa. However, China and Russia demonstrated an inverse association. Mittal et al. (2019) studied the linkages between the currencies of BRIS nations by using the ADCC-EGRARCH framework. They observed that Brazil is the net transmitting country, and Russia, India and South Africa are the net recipients of the contagion.

Dahir et al. (2018) examine the versatile association between the exchange rates and the stock returns from the BRICS nations, where they found that a positive association exists in the medium and long term, thereby confirming the connections between the exchange rates and the stock returns. The outcomes also indicate that there is a noteworthy effect on relations among the series. They opined that these have a significant inference in terms of stock returns as a result of the frequency-varying exchange rates and hence, essential strategies should be outlined to avoid any equivalent financial jeopardies.

Chkili & Nguyen (2014) apply the regime-switching model to introspect the connection between the exchange rates and the BRICS stock market returns. The study identified the low and high volatility states, along with the outcomes from the VAR model, which suggest that the effect of stock markets has a stronger impression on the exchange rates during both high and low volatility states.

Based on the findings from the past studies reviewed, several research gaps could be identified. First, most of the previous studies provide inconsistent results in terms of movement, power and consistency of the modelling. Second, the different econometric modelling, including the VAR model or a simple linear regression model that has been widely used in the past studies are not sufficient to estimate the dynamic connectedness between the variables, as there remains heterogeneity biases due to different political crises and risk structures across different countries. Finally, there is also a dearth of studies in recent times that use advanced econometric modelling to study the dynamic linkages.

Based on the lacunas in the existing studies, the following objectives could be finalised. First, to study the dynamic relationship between the selected stock market indices and the CER of the BRICS economies. Second, to study the co-movements between the stock market indices and the CER from the selected BRICS economies.

3. RESEARCH METHODOLOGY

This study considers quarterly closing return data of the select stock market indices and the CER from the BRICS economies, Bovespa (Brazil), MOEX (Russia), BSE Sensex (India), Shanghai Composite (China), and JTOPI (South Africa), along with USD/BRL (Brazil), USD/RUB (Russia), USD/INR (India), USD/CNY (China) and USD/ZAR (South Africa) during the study period from Q3 1997 to Q2 2025 with 112 sample observations. The data of select stock market indices and CER are collected from the database of investing.com.

It needs to be mentioned that the study considers Brazil, Russia, India, China, and South Africa as the BRICS member countries, which have also been widely discussed in recent times in several studies, namely Kumar et al. (2024), Afota et al. (2024), and others, since the inception of the new members into BRICS in 2024 and 2025. Very cautiously, I have not considered the new entrant countries, namely Egypt, Ethiopia, Indonesia, Russia, Saudi Arabia, and the UAE. There are several motives behind such exclusion. First, the original members had a common feature in terms of emerging nature and a budding outlook towards the manufacturing and service sectors, whereas the new entrants demonstrate expertise in resource-oriented exports, with each nation having its different economic structures (Kumar et al., 2024). Second, the conglomeration of the affiliates and the poor trade combination led to the inability of the group to impact the global trade and the worldwide monetary system. So, considering the new members in line with the old members might create an adverse impact in terms of comparability of the findings with the existing studies, along with an impact on establishing any new insights found empirically. Third, the inclusion of new members along with the existing members can also distort the theoretical groundwork established that binds the actual scenario of the BRICS hypothesis.

Also, in this context, it is again significant to discuss that Afota et al. (2024) are of the view that the enlargement of the BRICS member countries is simply an attempt to enhance the appeal for evolving and emergent countries. The author has consciously used the quarterly data for several reasons. First, quarterly data is free from the noise factor, which significantly affects the stock market and several macroeconomic indicators, like CER in our case, which is observed in daily or monthly data. Since this study considers measuring the dynamic relationship and co-movements, quarterly data does not affect the spirit of the objective in any way. However, one might consider daily or monthly data if the objective serves the motive of estimating daily volatilities and movements and so on (Pham, 2020). Second, the high-frequency daily or monthly data is vulnerable to biases connected with the bid-ask factor. Hence, this problem is also solved in the context of quarterly data usage (Pham, 2020).

To address the objectives of the study, diverse econometric approaches, namely the ADF unit root test, quantile regression model, wavelet coherence (WTC) analysis, and descriptive tests, are used. All the data are transformed into equivalent logarithmic returns to remove the intrinsic disadvantages linked with time series figures.

4 DATA ANALYSIS AND INTERPRETATIONS

Descriptive Figures

Parameters/ Variables	Bovespa	BSE Sensex	JTOPI	MOEX	Shanghai Composite	USD/ BRL	USD/ CNY	USD/ INR	USD/ RUB	USD/ ZAR
Mean	0.0243	0.0276	0.0253	0.0311	0.0100	0.0143	-0.0013	0.0079	0.0228	0.0116
Median	0.0327	0.0259	0.0255	0.0310	-0.0033	0.0022	-0.0001	0.0043	0.0077	0.0088
Maximum	0.3370	0.3179	0.2352	0.7749	0.4161	0.5269	0.0795	0.1493	0.6175	0.2771
Minimum	-0.4682	-0.3830	-0.2780	-0.7144	-0.4735	-0.1931	-0.0779	-0.0713	-0.4306	-0.2412
Std. Dev.	0.1369	0.1151	0.0879	0.1851	0.1345	0.0952	0.0202	0.0333	0.1161	0.0802
Skewness	-0.6678	-0.1594	-0.3854	-0.3631	0.2117	1.7223	0.3791	1.1432	1.5031	0.1461
Kurtosis	4.6475	3.9339	3.8376	8.6035	4.7738	10.2720	7.4685	6.1797	11.8099	4.2999
Jarque-Bera	20.8041	4.5038	5.9918	147.6616	15.3804	299.4543	95.0072	70.9363	400.7608	8.2100
Probability	0.0000*	0.1052	0.0500**	0.0000*	0.0005*	0.0000*	0.0000*	0.0000*	0.0000*	0.0165**

The above table provides the descriptive figures of the select variables, namely the stock market indices from the BRICS nations, Bovespa, BSE Sensex, JTOPI, MOEX, and Shanghai Composite, along with the CER, USD/BRL (Brazil), USD/CNY (China), USD/INR (India), USD/RUB (Russia), and USD/ZAR (South Africa) during the study period from Q3 1997 to Q2 2025 with 112 sample observations. On the basis of the p-value of the Jarque-Bera test, it is observed that, except for BSE Sensex, all other stock market indices are found to be non-normal in nature. This provides a scenario where it is observed that a mixed order of normality and non-normality exists. Here, * and ** indicate noteworthy at 1% and 5% levels.

ADF Unit Root Test

Variables/Parameters	At level		At first difference	
Bovespa	-2.31	0.43	-14.41	0.00*
MOEX	-4.35	0.00*	-7.44	0.00*
BSE Sensex	-0.45	0.98	-11.17	0.00*
Shanghai Composite	-4.89	0.00*	-7.54	0.00*
JTOPI	-2.15	0.51	-12.03	0.00*
USD/BRL	-1.62	0.78	-9.15	0.00*
USD/RUB	-3.08	0.12	-12.25	0.00*
USD/INR	-1.44	0.84	-10.06	0.00*
USD/CNY	-0.73	0.97	-10.15	0.00*
USD/ZAR	-2.29	0.44	-10.16	0.00*

The above table highlights the outcomes of the unit root test of the selected stock market indices and the CER from the BRICS economies during the study period. It is observed that, except for MOEX and Shanghai Composite, all other stock market indices and CER are found to be non-stationary at the level and stationary at the first difference. This indicates that there is no problem of unit root at the first difference for the stated indices. However, for MOEX and the Shanghai Composite, the unit root does not exist at both the level and the first difference. Here, * indicates noteworthy at 1%.

Following a mixed order of normality and stationarity, the authors conducted a quantile regression model.

Quantile Regression (QREG) Model

Dependent Variable	Independent Variables	Parameters	Q 0.25	Q 0.50	Q 0.75
Bovespa	USD/BRL	Coefficient	-0.9314	-0.7661	-0.5436
		p-value	0.0000*	0.0000*	0.0200**
MOEX	USD/RUB	Coefficient	-0.2220	-0.0871	0.2730
		p-value	0.1807	0.6788	0.0300**
BSE Sensex	USD/INR	Coefficient	-2.1366	-1.5163	-0.8215
		p-value	0.0000*	0.0200**	0.0500**
Shanghai Composite	USD/CNY	Coefficient	-0.9628	-0.9628	-1.4735
		p-value	0.0200**	0.0500**	0.0000*
Jtopi	USD/ZAR	Coefficient	-0.3383	-0.1767	-0.1088
		p-value	0.0400**	0.2139	0.3086

The equation of the above quantile regression model can be framed as:

$Y_i = \mu\ (X_i) + \sigma\ (X_i)\ \varepsilon_i$ .... (1)

Stock Market Indices$_{111}$ = μ (Currency Exchange Rates$_{111}$) + σ (X_i) ε_i ...... (2)

The above table denotes the outcomes of the quantile regression model between the selected stock market indices and the currency exchange rates from the BRICS nations, namely Brazil, Russia, India, China, and South Africa. Bovespa, BSE Sensex, and Shanghai Composite are observed to have a significant negative association along with currency exchange rates. However, the strength of the relationship gradually diminishes, which is confirmed by a lower value as we move towards a higher quantile from Q 0.25 to Q 0.75. For Russia, MOEX is observed to be insignificant at the lower quantiles, i.e., Q 0.25 and Q 0.50; however, as we reach Q 0.75, a positive and significant association is observed between MOEX and USD/RUB. At Q 0.25, Jtopi was demonstrating a significantly negative association. However, as we move towards a higher quantile, Q 0.50 and Q 0.75, we find an insignificant relationship. Here, * and ** indicate noteworthy at 1% and 5%.

The above results may have several thoughts behind such interactions. When the home currency, i.e., BRL, INR, and CNY, weakens, the stocks fall. Again, at lower quantiles, investors demonstrate increased sensitivity to macroeconomic exposures. As a result, when the currency depreciates, it demonstrates capital drainages, inflationary burden, outward vulnerability, and lowered investor self-assurance. In the BRICS nations, as the foreign institutional investor plays a pivotal factor in the context of the stock markets, a depreciating currency leads to lower returns towards the foreign investors when transformed into their own currency. This leads to a seepage of investment by the foreign investors from the stock markets under discussion. Moreover, it is also significant to mention that several companies that are listed in Bovespa, Shanghai Composite, and BSE Sensex depend on importing raw materials that are essential for production. A depreciation in currency leads to greater expenses incurred by these companies, and hence, there remains a chance of lowered profitability and corresponding low stock valuation. As the market corrects itself within a short time period, following the efficient market hypothesis (Fama, 1970), along with market resilience, domestic fundamental indicators, namely the economic evolution, augmented liquidity, policy backing, and robust investor confidence, essentially mitigate the negative outcome of the currency depreciation. At this juncture, investors look for possible expansion of the market as an outcome of the evolution in the economy, overcoming the CER risks.

On the contrary, a positive significant association only at the higher quantile for Russia can be inferred through the operational features of the Russian economy, supremacy of exports and country-specific geopolitical factors. When the Russian ruble depreciates, as a result of the export made, the exporting companies convert the foreign earnings into home currency, leading to greater ruble value in terms of profits. This induces an increase in stock prices as an outcome of greater profitability, which leads to higher stock market returns and market sentiments.

For South Africa, it is observed that Jtopi performs negatively as a result of the CER at the lower quantiles only. When the demand for commodities declines internationally, the revenues generated from exports, including precious metals like gold and platinum, along with coal and other minerals, also decline simultaneously due to rand depreciation. Based on such a backdrop, depreciation is considered to serve as a testament of economic delicateness along with the downward movement of external earnings. This results in an adverse influence on the stock market.

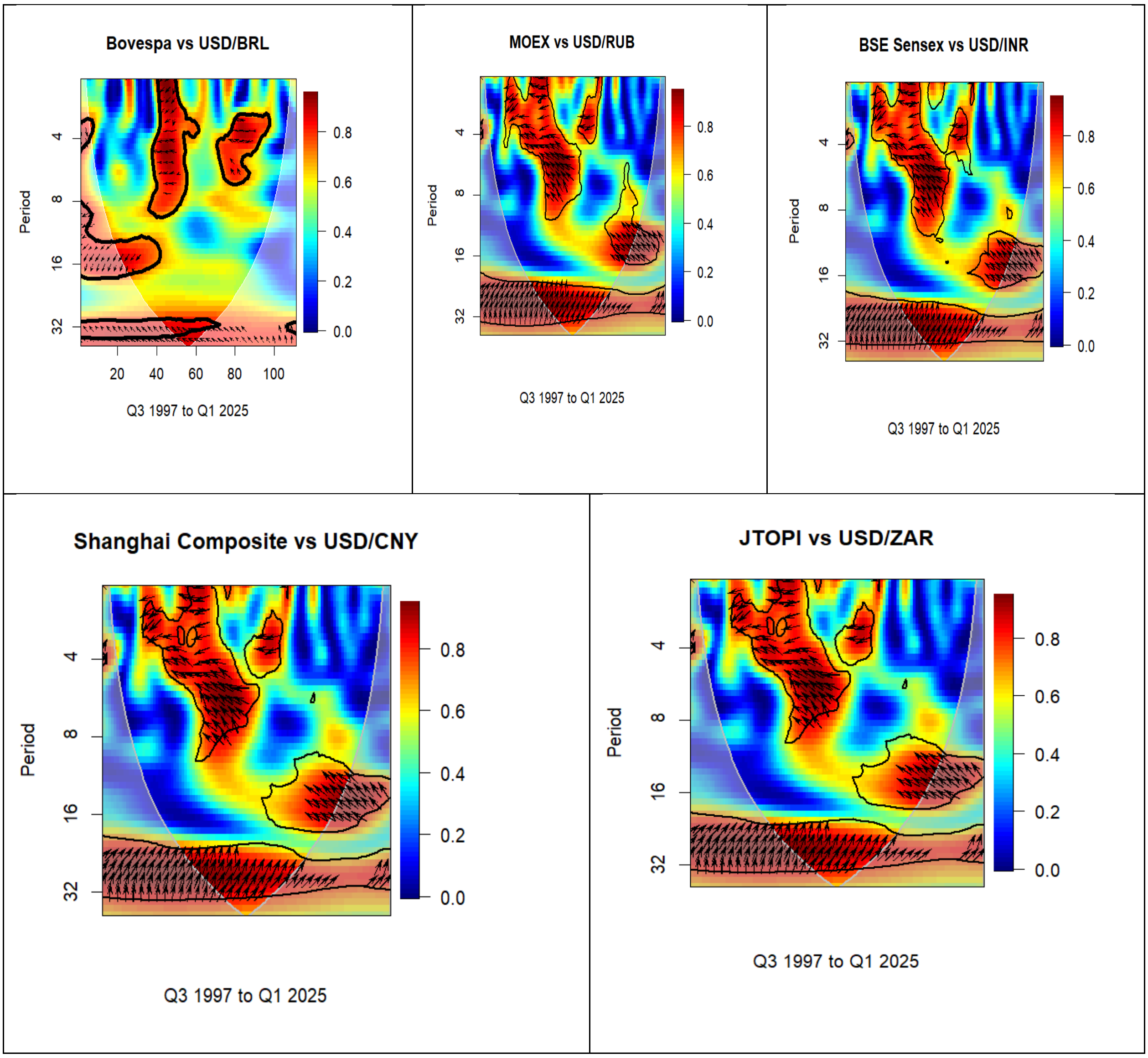
Wavelet Coherence (WTC) Analysis

The WTC analyses the existence of co-movement among a given set of variables across a time-frequency domain and phase difference. Torrence and Compo (1998) demarcated the cross-wavelet transform of two time series x(t) and y(t) as:

$$W_{xy}(u,s) = W_x(u,s)W_y^*(u,s), \quad \text{.....(3)}$$

The WTC is measured on a 2D diagram with contrast, including different colour spectrums starting from deep blue to light blue to green to yellow to red. Each colour has its own meaning and inference. A cone shape is noted within each diagram or heatmap, which is known as the cone of influence. This cone indicates the level of significance at 5 per cent. Some arrowed patches are also noted within the cone that are bounded in black, indicating the specific effects of the autonomous variable on the dependent variable. To measure the degree of association and the statistical significance, the Monte Carlo simulation methodology is used. The vertical axis measures the frequency, and the horizontal axis accounts for the time. Any colour that is cold in nature (deep blue, light blue, green) indicates lower dependency or independence or low effects, and any colour that is deep (red) indicates high effects or interdependence.

The power of co-movements gradually increases in the sequence deep blue>light blue>green>yellow>red. It is also noteworthy to mention that within the contour/heatmap, the patches bounded in black include different arrows that are rightward arrow (→), leftward arrow (←), northeast arrow (↗), northwest arrow (↖), southeast arrow (↘) and southwest arrow (↙). The arrows that are headed towards the right indicate positive association or in-phase movements, and the arrows that are headed towards the left indicate negative co-movements or anti-phase movements, i.e., an indication of lead and lag relationship or the connectedness between the variables. A northeast arrow (↗) and a northwest arrow (↖) also denote that the currency exchange rates lead stock market indices. In contrast, a southeast arrow (↘) and southwest arrow (↙) indicate that stock market leads currency exchange rates.



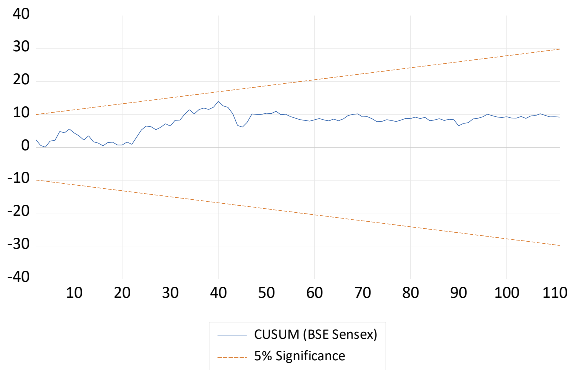
Source: Author's own computation using RStudio Package

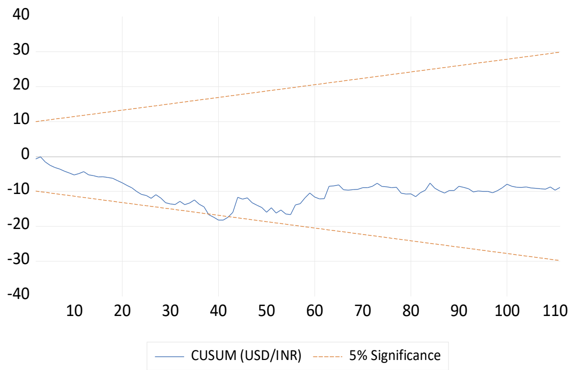
For Brazil, the effect is denoted by a leftward arrow (←), a northwest arrow (↖), and a southwest arrow (↙) bounded in black patches, indicating an anti-phase co-movement. Since Brazil is a key exporter of commodities that include agricultural products, its currency and capital market are highly affected by global market conditions. Again, as Brazil has historically experienced inflationary conditions and exchange rate fluctuations, any small change in the CER can significantly disturb investor sentiment, leading to the seepage of negative news into the capital market. In such circumstances, capital outflow may be observed from the stock markets, particularly in the context of global depositors.

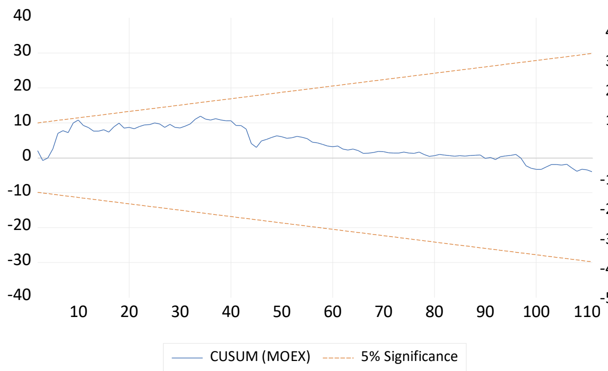
It is observed that Russia, India, China, and South Africa demonstrate mixed results, including northeast arrow (↗), northwest arrow (↖), southeast arrow (↘), and southwest arrow (↙) across the study period, which indicates these countries witness both in-phase and anti-phase scenarios. The lead-lag relationship is also diverse for the above-mentioned countries. This is primarily due to the time-varying nature of the select indices in the study. Also, the existence of both the in-phase and anti-phase movements directs towards an instability in the relationship between the select variables across a long-run time horizon. The dynamic relationship for Russia, India, China, and South Africa is highly affected by the internal economic factors of the nations, global financial dynamics, capital market instability and the capital flows within the economy.

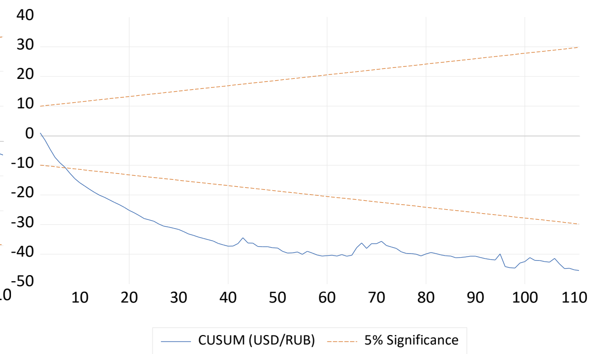
A scenario of positive co-movements simple suggests of sturdy economic indicators, greater inflows of foreign capitals, strong economic growth, foreign capital inflows, and investor confidence. On the contrary, a scenario of anti-phase dynamics suggests inferior behaviour in the investors and poor capital market conditions, invoking the shift of funds from domestic capital vehicles. In countries like South Africa and Russia, the economy is highly exposed to the global trade dynamics as a result of greater dependency on oil and mineral exports, which creates vulnerability. In the context of India and China, the dynamics of the interaction between the stock market and the CER are backed by the policies of the government and changes in monetary policies by the apex bank of the country

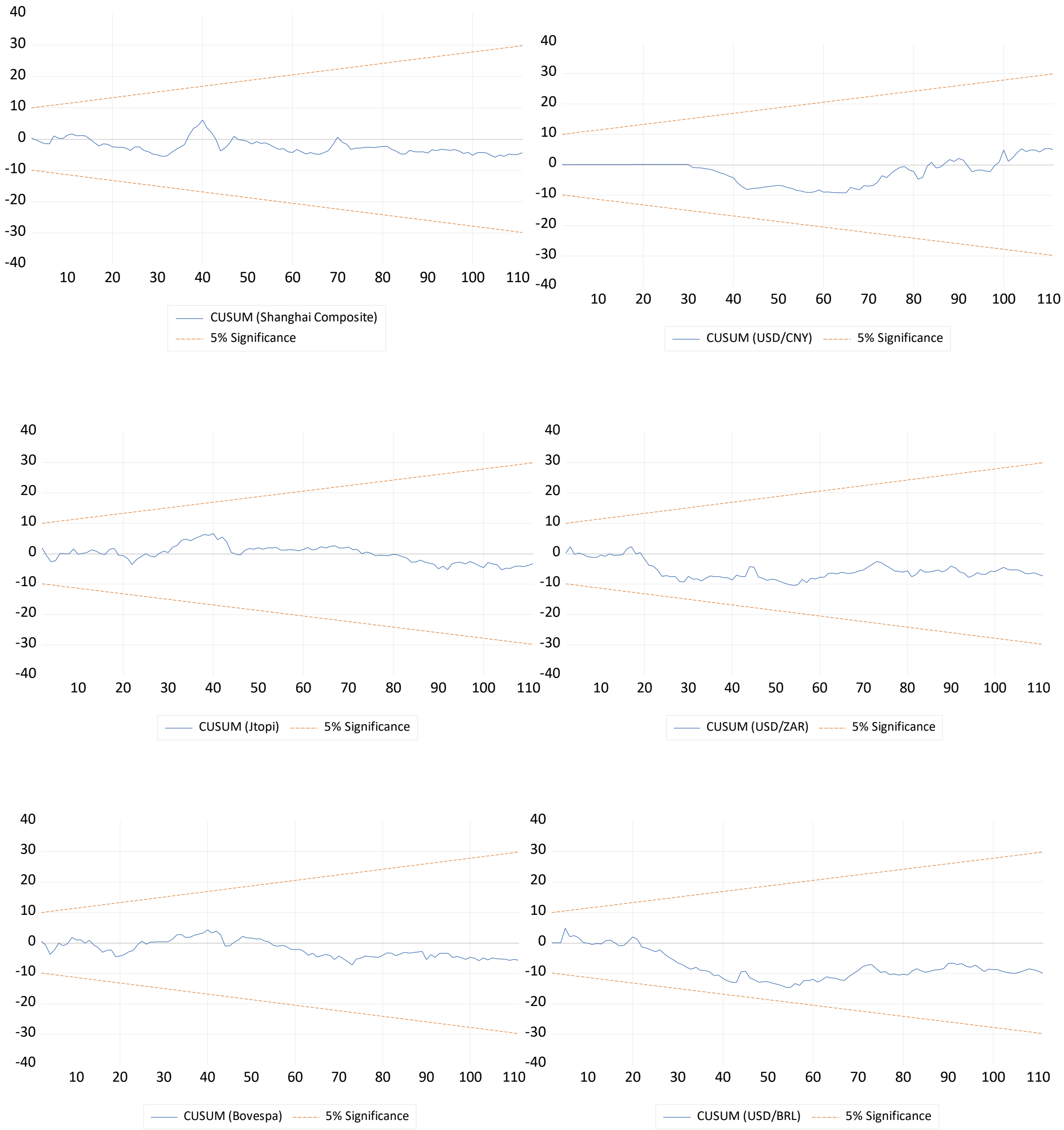
Robustness Check











Source: Author's own computation using EViews 8.0 Package

To address the issue of robustness, the CUSUM test has been applied to the selected variables to check the existence of structural changes within the variables. However, it is quite satisfactory to note that all the variables except USD/RUB were found to be within the level of significance as outlined graphically. Hence, it can be said that the variables did not shift from the existing structure. However, USD/RUB demonstrates a significant shift outside the level of significance line, confirming a structural change.

CONCLUDING OBSERVATIONS

The empirical consequences of the present study specify the reality of significant co-movements between the select stock market indices and CER from BRICS nations to a diverse extent that evolves over time. China and India display diverse lead–lag dynamics, signifying irregular phases of market amalgamation and policy-driven exchange rate management. Again, for Russia and Brazil, a robust understanding of external commodity and geopolitical factors is noted. South Africa is more financially cohesive with global markets, which reflects a greater interface during financial instability.

In the context of wavelet coherence, it is observed that short-term dynamics are highly backed by speculative buying, investor sentiment, and global risk perception, whereas long-term dependencies are related to macroeconomic essentials, trade competitiveness, and economic evolution projections. Again, the frequent changes in the in-phase and anti-phase dynamics direct towards varied aspects of the financial integration and the macroeconomic spread mechanisms.

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