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Connectedness of OVX, GVZ, EVZ with the Volatility indices of BRICS nations

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Abstract
This study analyzed the long-run and short run relationship among global uncertainty indices OVX, GVZ, and EVZ with the volatility indices of BRICS nations, offering strong evidence of diverse transmission mechanisms among these rising economies. To serve the purpose of the study, daily closing prices are used for the respective Volatility Index, namely, Brazil (VXEWZ), Russia (RVI), India (IVIX), China (VHSI), and South Africa (JSAVI), Oil volatility index (OVX), Gold Volatility Index (GVZ) and Euro Volatility Index (EVZ). The findings demonstrate that OVX, GVZ, and EVZ long-run cointegration for Brazil, India, China, and South Africa at the 1% significance level, but the findings for Russia remained indeterminate. The aggregate count of observations for each series is 1033 and data has been obtained from investing.com. This study enhances the literature by illustrating that, despite their integration with global markets, BRICS economies exhibit varied responses to volatility shocks due to their distinct structural and financial connections, thus providing significant insights for policymakers, investors, and risk managers in formulating hedging and diversification strategies.

Keywords: OVX, GVZ, EVZ, VIX, BRICS, Volatility Indices

1. Introduction

In a period characterised by intensified global financial instability, the necessity to comprehend volatility transmission among asset classes and regions has been increasingly critical (Cheng *et al.*, 2024) [5]. The increasing intricacy of global markets, prompted by geopolitical conflicts, commodity price volatility, and currency fluctuations, has heightened the interdependence between developed and emerging economies (Oliinyk *et al.*, 2025) [20]. The BRICS nations, Brazil, Russia, India, China, and South Africa, have become significant actors in the global economic framework (Fan & Wang, 2024). Nonetheless, their reliance on commodity exports and foreign exchange markets makes them especially susceptible to external shocks.

Volatility indices (VIX) are essential instruments for gauging market emotion and predicting risk. The VIX reflects the psychological sentiment of investors (Lian *et al.*, 2022) [14]. The VIX is the premier indicator of fear or greed inside US and global markets (Traub *et al*, 2000; Prasad *et al.*, 2022) [28-22]. The VIX is vital to financial markets, offering essential insights to investors, traders, and policymakers (Sadat & Gormus, 2025) [25]. The concept of a volatility index was initially established by Brenner and Galai in 1989 [3]. Whaley (1993) [29] presented the VIX as a dependable measure of short-term market volatility, applicable as a benchmark for managing volatility risk in portfolios. VIX, such as the Oil Volatility Index (OVX), Gold Volatility Index (GVZ), and Euro Volatility Index (EVZ), have become essential instruments for assessing market instability and investor mood. These indices, created from options pricing, indicate anticipatory risk assessments within their respective markets. Their impact on BRICS economies is notably significant owing to structural dependencies: Russia and Brazil are prominent oil exporters, while India and China are the foremost consumers of gold; all five nations sustain substantial economic and financial connections with the Eurozone (Sezal, 2024) [26]. The OVX, based on options on crude oil futures, indicates expected variations in oil prices. Considering that Russia and Brazil are prominent oil exporters, while India and China are substantial consumers, fluctuations in oil prices directly affect their macroeconomic stability and equity markets (Naeem *et al.*, 2022;

Haase *et al*., 2016) [16, 10]. Likewise, GVZ encapsulates uncertainty in gold markets, which is especially pertinent for India and China two of the globe's foremost gold consumers (Raza *et al*., 2016) [24]. EVZ, derived from euro-dollar options, indicates currency risk and affects BRICS nations via trade and capital movements (Rai & Garg, 2022) [23].

This study examines the relationships among OVX, GVZ, and EVZ and the volatility indices of BRICS stock markets. This study seeks to enhance the literature on financial contagion, risk management, and portfolio diversification in emerging countries by examining the mechanisms and extent of volatility spillovers. The results will provide insights into the transmission of global uncertainty through commodities and currency markets into BRICS financial institutions, guiding academic research and policy development.

The rest of the study is structured as follows. Section 2 provides a literature assessment of prior empirical studies indicating the interconnectedness of financial markets. Section 3 delineates the data and methods. Section 4 presents the empirical findings accompanied by a discussion. Section 5 finishes the study and presents several research implications.

2. Literature Review

Global implied volatility indices (VIX) affect not just other stock markets but also each other (Shu & Chang, 2019). Badshah *et al*., (2013) emphasizes a unidirectional spillover from VIX to GVZ and EVZ, as well as a bidirectional spillover between GVZ and EVZ. The impact of VIX on GVZ intensified during the COVID-19 pandemic, with positive fluctuations in VIX prompting positive fluctuations in GVZ (Löwen *et al*., 2021) [15]. Ergün *et al*., (2023) [4] examined the correlation among investor risk capacity in Borsa Istanbul and highlight the impact of global uncertainty indices such as OVX, VIX, GVZ, and EVZ on investor behavior. Their findings indicate that international investors react more vigorously to changes in these volatility indices, particularly during times of increased market stress, providing insights into volatility transmission in emerging markets. Global financial uncertainty indicators (GVZ, USEPU, and UKEPU) positively affect financial market interconnectivity, but EVZ demonstrates a negative influence, and VIX and OVX are statistically negligible (Naeem *et al*., 2025) [17]. Dutta *et al*., (2020) [7] examined the nexus among OVX and volatility indices of China. They discovered that panic in the US crude oil market influenced the Chinese equity market. The GVZ and VIX have consistently served as risk connections and primary net triggers of shocks the OVX has acted as a net receiver of shocks, while the EVZ has typically maintained a neutral stance toward the net transmission of risk (Fousekis, 2024) [9]. López, (2014) [15] conducted a VAR analysis of the VIX, OVX, GVZ, EVZ, and TYVIX from 2008 to 2013, revealing that the VIX preceded all other indices, but the EVZ notably impacted commodity-related volatilities (GVZ and OVX). The intensity of cointegration was more pronounced under the high volatility-to-volatility regime, with information flowing from the VIX to the OVX. Naeem *et al*., (2021) [11] investigated the relationships between the time-frequency dynamics of the VIX and worldwide stock markets, concluding that the OVX influences the VIX interconnectedness of global stock markets, especially during periods of crisis and stress. The worldwide dynamics influencing the interconnection of green, Islamic, and conventional financial markets impart substantial diversification and safe-haven characteristics to the implied volatilities of VIX, OVX, GVZ, EVZ, and MOVE (Karim & Naeem, 2022) [11].

The majority of recently published research has been on the relationships between prominent implied volatility indices, such as the VIX, and specific commodity or currency indices, as well as on volatility transmission among equity markets in various nations. Nevertheless, no research has concurrently investigated the interrelated dynamics of OVX, GVZ, and EVZ alongside the volatility indices of a regional consortium such as the BRICS states. This creates a significant gap, as BRICS economies are particularly susceptible to swings in commodity prices and exchange rates, potentially resulting in distinctive volatility spillover patterns in contrast to developed markets. Moreover, prior studies have predominantly overlooked the implementation of sophisticated time-varying or frequency-domain techniques to elucidate the dynamic and crisis-specific characteristics of these spillovers. This study aims to furnish new data on the relationship between OVX, GVZ, EVZ, and BRICS volatility indexes, thereby yielding insights with considerable implications for risk management, portfolio diversification, and policy development in developing markets.

3. Research Methodology

3.1 Data Description

The data for this study were sourced from Investing.com and consist of daily observations of global volatility indexes from March 11, 2020, to December 31, 2024. This timeframe was intentionally selected to commence on the day the World Health Organization proclaimed COVID-19 a global pandemic, enabling the study to assess both the immediate and prolonged impacts of the pandemic on market uncertainty. The dataset includes the volatility indices for BRICS nations, as well as OVX, GVZ, and EVZ, which serve as indicators of market anxiety and instability. This research seeks to comprehend the responses of financial markets across many regions to the evolving pandemic, policy interventions, and later recovery phases through daily analysis of these indices. This data underpins the analysis of changes in investor sentiment, volatility clustering, and cross-market contagion during a notably tumultuous era in recent financial history. The aggregate count of observations for each series is 1033 and data has been obtained from investing.com.

3.2 Model and Specification

This study used both the Phillips-Perron (Phillips and Perron, 1988) and Augmented Dickey-Fuller (Dickey and Fuller, 1981) unit root tests to assess data stationarity at its level and following the first difference of the time series. The purpose of utilizing the ADF and PP tests was to ascertain if the variables remained stationary at levels I(0) or I(1). An Auto Regressive Distributed Model (ARDL), henceforth bound test is conducted after the stationary test to verify long-term cointegration. The ARDL bounds testing strategy is more adaptable than the more conventional cointegration approaches and can be used with series with a distinct order of integration. Any series with a mixed order of integration can use this method (Khan *et al*., 2019) [12]. There are two steps in the ARDL technique. In the first stage, the study examines the long-run cointegration relationship between the variables by computing joint F-statistics for the bound test. In the second stage, study estimates the short and long-run coefficients with the error correction term (ECT) after rejecting the null hypothesis under the bound test.

3.3 ARDL Equation

$$\mathrm{In}(\mathrm{Brazil})_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta \mathrm{In}(\mathrm{OVX})_{t-p} + \sum_{i=1}^{p} \alpha_2 \Delta \mathrm{In}(\mathrm{GVZ})_{t-p} + \sum_{i=1}^{p} \alpha_3 \Delta \mathrm{In}(\mathrm{EVZ})_{t-p} + \alpha_4 \mathrm{In}(\mathrm{OVX})_{t-1} + \alpha_5 \mathrm{In}(\mathrm{GVZ})_{t-1} + \alpha_6 \mathrm{In}(\mathrm{EVZ})_{t-1} + \alpha_7 \mathrm{DV} + \varepsilon_t$$

$$In(Russia)_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta In(OVX)_{t-p} + \sum_{i=1}^{p} \alpha_2 \Delta In(GVZ)_{t-p} + \sum_{i=1}^{p} \alpha_3 \Delta In(EVZ)_{t-p} + \alpha_4 In(OVX)_{t-1} + \alpha_5 In(GVZ)_{t-1} + \alpha_6 In(EVZ)_{t-1} + \alpha_7 DV + \varepsilon_t$$

$$In(India)_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta In(OVX)_{t-p} + \sum_{i=1}^{p} \alpha_2 \Delta In(GVZ)_{t-p} + \sum_{i=1}^{p} \alpha_3 \Delta In(EVZ)_{t-p} + \alpha_4 In(OVX)_{t-1} + \alpha_5 In(GVZ)_{t-1} + \alpha_6 In(EVZ)_{t-1} + \alpha_7 DV + \varepsilon_t$$

$$In(China)_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta In(OVX)_{t-p} + \sum_{i=1}^{p} \alpha_2 \Delta In(GVZ)_{t-p} + \sum_{i=1}^{p} \alpha_3 \Delta In(EVZ)_{t-p} + \alpha_4 In(OVX)_{t-1} + \alpha_5 In(GVZ)_{t-1} + \alpha_6 In(EVZ)_{t-1} + \alpha_7 DV + \varepsilon_t$$

$$\mathrm{In}(\mathrm{South\ Africa})_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta \mathrm{In}(\mathrm{OVX})_{t-p} + \sum_{i=1}^{p} \alpha_2 \Delta \mathrm{In}(\mathrm{GVZ})_{t-p} + \sum_{i=1}^{p} \alpha_3 \Delta \mathrm{In}(\mathrm{EVZ})_{t-p} + \alpha_4 \mathrm{In}(\mathrm{OVX})_{t-1} + \alpha_5 \mathrm{In}(\mathrm{GVZ})_{t-1} + \alpha_6 \mathrm{In}(\mathrm{EVZ})_{t-1} + \alpha_7 \mathrm{DV} + \varepsilon_t$$

The error term is represented as ε_t. Coefficients α_1 to α_3 signify the short-term coefficients in the model, and coefficients α_4 to α_7 represent the long-run coefficients. The null hypothesis is expressed as α_4=⋯= α_7=0, indicating the absence of cointegration among the variables and vice versa.

3.4 ECM Equation

$$\Delta In(Brazil)_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta In(OVX)_{t-p} + \sum_{i=1}^{p} \alpha_2 \Delta In(GVZ)_{t-p} + \sum_{i=1}^{p} \alpha_3 \Delta In(EVZ)_{t-p} + \alpha_4 ECT_{t-1} + \alpha_5 DV$$

$$\Delta In(Russia)_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta In(OVX)_{t-p} + \sum_{i=1}^{p} \alpha_2 \Delta In(GVZ)_{t-p} + \sum_{i=1}^{p} \alpha_3 \Delta In(EVZ)_{t-p} + \alpha_4 ECT_{t-1} + \alpha_5 DV$$

$$\Delta In(India)_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta In(OVX)_{t-p} + \sum_{i=1}^{p} \alpha_2 \Delta In(GVZ)_{t-p} + \sum_{i=1}^{p} \alpha_3 \Delta In(EVZ)_{t-p} + \alpha_4 ECT_{t-1} + \alpha_5 DV$$

$$\Delta In(China)_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta In(OVX)_{t-p} + \sum_{i=1}^{p} \alpha_2 \Delta In(GVZ)_{t-p} + \sum_{i=1}^{p} \alpha_3 \Delta In(EVZ)_{t-p} + \alpha_4 ECT_{t-1} + \alpha_5 DV$$

$$In(South\,Africa)_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1\, \Delta In(OVX)_{t-p} + \sum_{i=1}^{p} \alpha_2\, \Delta In(GVZ)_{t-p} + \sum_{i=1}^{p} \alpha_3\, \Delta In(EVZ)_{t-p} + \alpha_4 ECT_{t-1} + \alpha_5 DV$$

where ε_t denotes the error term and ECT signifies the error correction term. The short-term coefficients in the model are represented by α_1 through α_5 in the aforementioned formula.

Within the ARDL framework, the Error Correction Model (ECM) is employed to ascertain the short-run relationship and the rate of adjustment of the model. The model's robustness is assessed by the ARCH test for heteroskedasticity, the LM test for autocorrelation in the error series, and the Ramsey test to verify the right functional form of the variables.

4 Empirical Result

Tables 1, 2 and Figure 1 depict the stylised facts of all studied Volatility Indices. The graphical trends of prices and returns of volatility indices reveal frequent spikes, reflecting periods of global uncertainty and crisis-induced shocks. These changes underscore the dynamic and infectious character of volatility transmission among BRICS and global markets. It shows how VIX prices fluctuate, reflecting periods of high uncertainty and market stress. Descriptive statistics for all studied Volatility Indices (VIX) are presented in Table 1. EVZ has the lowest average, reflecting lower volatility. OVX exhibits the highest volatility, with a mean of 44.68 and extreme variations, as evidenced by a maximum value of 325.15. Elevated standard deviations across most indices indicate substantial variability in returns, while pronounced skewness and kurtosis statistics reveal asymmetry and heavy tails, aligning with volatility clustering in financial time series. The Jarque-Bera statistics decisively reject the null hypothesis of normality for all series, emphasizing the necessity for econometric models that can accommodate non-normal and fat-tailed distributions. In summary, the descriptive statistics highlight the heterogeneous and non-normal characteristics of volatility behavior across BRICS and global uncertainty indices.

Table 1: Descriptive Statistics of Volatility Indices

	Brazil	**Russia**	**India**	**China**	**South Africa**	**OVX**	**GVZ**	**EVZ**
Mean	38.76	37.20	18.35	24.84	21.44	44.68	17.59	7.92
Median	36.74	31.52	16.22	23.80	20.44	39.10	16.85	7.39
Maximum	144.42	142.66	83.61	64.80	49.04	325.15	48.98	19.31
Minimum	21.00	14.23	10.14	15.75	13.97	23.78	10.22	4.84
Std. Dev.	13.51	18.08	8.50	5.74	4.60	24.48	4.16	2.13
Skewness	3.36	2.34	3.53	2.04	2.30	5.16	2.38	1.40
Kurtosis	21.92	9.74	20.30	11.08	12.12	38.30	13.59	5.59
JB	17343.92	2893.49	15029.82	3526.24	4486.94	58239.11	5810.52	624.45
Observation	1033	1033	1033	1033	1033	1033	1033	1033

Firstly, unit root test is employed to assess the stationarity and order of integration of the time series data before to utilizing the ARDL model. Consequently, we have employed the commonly utilized ADF and PP tests to ascertain the order of integration at both the level and first difference series. The outcomes derived from the ADF and PP tests are presented in Table 2. The findings suggest that the majority of the volatility indices are non-stationary at level but achieve stationarity upon initial differencing, so demonstrating that they are integrated of order one, I(1). Although certain series, including Brazil, India, China, South Africa, OVX, and GVZ, exhibit signs of stationarity at level under specified conditions, the findings are not consistently homogeneous across both tests. Conversely, the EVZ index is non-stationary at its level and achieves stationarity solely through differencing. The findings confirm the efficacy of the ARDL limits testing approach, as it can incorporate a combination of I(0) and I(1) variables without necessitating that all series be integrated at the same order.

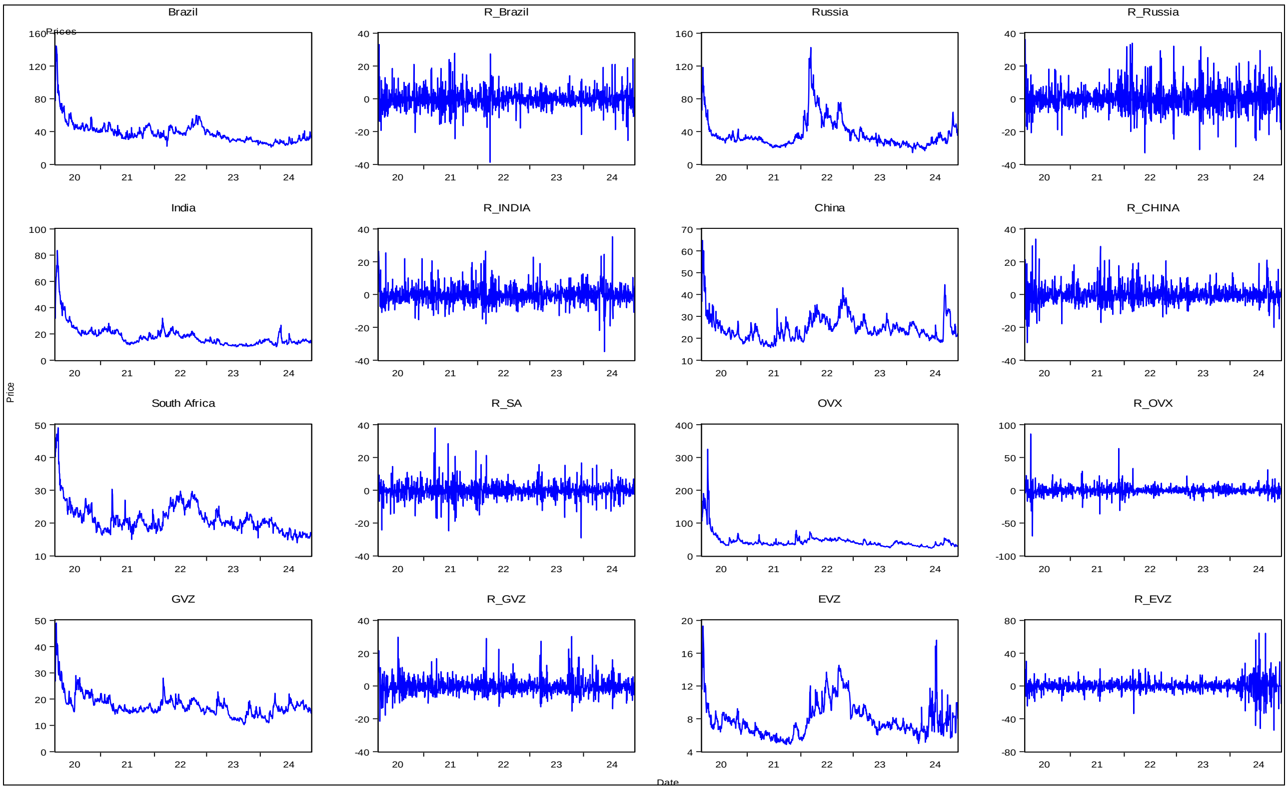

Fig 1: Graph of Prices and Returns of Volatility Indices

The ARDL bounds testing results show in Table 4 indicate long-run cointegration between BRICS volatility indices and global uncertainty measures OVX, GVZ, and EVZ for Brazil, India, China, and South Africa, all significant at the 1% level, although the case of Russia is inconclusive. Ultimately, GVZ serves as a crucial factor influencing market volatility in Brazil and India, underscoring gold's status as a safe-haven asset in both economies. Conversely, EVZ demonstrates a significant and favorable long-term impact on China and South Africa, indicating heightened susceptibility to currency and financial market disturbances. OVX, while economically significant, demonstrates comparatively weaker long-term benefits throughout the majority of BRICS markets. The short-run dynamics further substantiate that lagged effects of GVZ and EVZ considerably contribute to volatility spillovers, exhibiting country-specific variations in responsiveness. The error correction terms are negative and statistically significant for all cointegrated models, signifying consistent modifications toward long-run equilibrium. The ARDL results highlight the varied transmission mechanisms of global volatility among BRICS, influenced by their unique economic and financial frameworks.

Table 2: Unit Root Test of Volatility Prices

Countries	ADF				PP			
	At Level		At First Difference		At Level		At First Difference	
	t-Stat.	Prob.	t-Stat.	Prob.	t-Stat.	Prob.	t-Stat.	Prob.
Brazil	-6.05	0.00	-16.73	0.00	-4.59	0.00	-42.59	0.00
Russia	-2.71	0.23	-7.55	0.00	-3.45	0.05	-34.40	0.00
India	-5.97	0.00	-8.69	0.00	-4.00	0.01	-31.70	0.00
China	-5.12	0.00	-7.26	0.00	-4.69	0.00	-37.94	0.00
South Africa	-6.00	0.00	-12.93	0.00	-4.70	0.00	-39.39	0.00
OVX	-5.53	0.00	-7.60	0.00	-5.40	0.00	-35.96	0.00
GVZ	-7.59	0.00	-14.85	0.00	-4.89	0.00	-33.35	0.00
EVZ	-2.53	0.31	-8.75	0.00	-5.19	0.00	-57.38	0.00

Note: - All Assumptions with constant and trend
Source: - Authors own Compilation

Table 3: Bound Test Results

Dependent Variable	*F*-Stat	Optimum Lag Length	Remark
Brazil (OVX, GVZ, EVZ)	13.7463*	(2, 3,1,4)	Cointegrated
Russia (OVX, GVZ, EVZ)	2.9187	(3,1,1,1)	Inconclusive
India (OVX, GVZ, EVZ)	7.2899*	(4, 2, 3, 2)	Cointegrated
China (OVX, GVZ, EVZ)	12.9864*	(2, 2, 4, 1)	Cointegrated
South Africa (OVX, GVZ, EVZ)	7.4654*	(4,1, 4, 1)	Cointegrated

Note: - * denotes significance level at 1 %.
Source: - Authors own Compilation

As suggested in Table 3, the bounds test results show that the Brazil Volatility Index is co-integrated with all the selected indices. Where the Brazil Volatility Index is taken as the dependent variable in the ECM model, the results of Table 4 reveal that in Brazil, GVZ substantially influences long-term volatility, whereas short-term dynamics exhibit pronounced and enduring spillovers from EVZ and lagged effects of OVX, indicating that Brazil's financial markets are acutely susceptible to global uncertainty shocks, especially from gold and currency markets, akin to the conclusions drawn by Bouri *et al*.

Table 4: Dependent Variable Brazil

Long Run Form				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
OVX	0.07429	0.07282	1.02014	0.3079
GVZ	0.89696	0.41056	2.18473	0.0291
EVZ	0.32616	0.62546	0.52148	0.6021
C	15.3423	6.59246	2.32725	0.0201
Short Run Result				
D(BRAZIL(-1))	-0.2276	0.02598	-8.7593	0
D(OVX)	0.02915	0.00987	2.95177	0.0032
D(OVX(-1))	0.0118	0.00943	1.25161	0.211
D(OVX(-2))	-0.0273	0.00979	-2.7887	0.0054
D(GVZ)	0.3671	0.07236	5.07323	0
D(EVZ)	0.7431	0.10162	7.31276	0
D(EVZ(-1))	0.48844	0.10827	4.51128	0
D(EVZ(-2))	0.35802	0.10415	3.43765	0.0006
D(EVZ(-3))	0.41232	0.09704	4.24905	0
CointEq(-1)*	-0.0642	0.00773	-8.3068	0
Residuals Diagnostics				
LM	0			
Ramsey	0.0482			
Arch	0			
Source: - Authors own Compilation				

The Bound test clearly demonstrates the cointegration of the India volatility index with the other volatility indices studied. The India Volatility Index is regarded as a dependent variable. The steady co-integration relationship between the India VIX index and the chosen indices is evidenced by the significant and negative ECT. The results in Table 5 show that in India, GVZ exerts the most significant long-term influence, aligning with the country's historical position as one of the largest consumers of gold, which frequently serves as a safe-haven commodity during global instability (World Gold Council, 2021). The short-term outcomes underscore the significance of GVZ and EVZ, but OVX appears comparatively feeble, suggesting that India's volatility is more closely associated with precious metals than with energy disruptions.

According to Table 3 the bounds test results show that the China Volatility Index is co-integrated with all the selected indices. In China, the long-term influence of EVZ prevails, indicating the nation's increasing financial integration with global currency markets, whereas GVZ exhibits diminished effects. Short-term findings underscore the significant impact of both EVZ and lagged GVZ, aligning with the evidence of exchange-rate channel contagion in emerging economies (Diebold & Yilmaz, 2014) [6].

Table 5: Dependent Variable India

Long Run Form				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
OVX	0.06474	0.05213	1.24184	0.2146
GVZ	1.177	0.28189	4.17541	0
EVZ	-0.0782	0.42009	-0.1861	0.8524
C	-5.3466	4.06601	-1.315	0.1888
Short Run Result				
D(INDIA(-1))	-0.0507	0.03028	-1.6745	0.0943
D(INDIA(-2))	-0.0172	0.02882	-0.5983	0.5497
D(INDIA(-3))	0.11274	0.028	4.02615	0.0001
D(OVX)	-0.0008	0.00511	-0.1601	0.8728
D(OVX(-1))	0.01527	0.00508	3.00615	0.0027
D(GVZ)	0.10549	0.03931	2.68353	0.0074
D(GVZ(-1))	0.15609	0.04016	3.88666	0.0001
D(GVZ(-2))	-0.0888	0.0385	-2.3074	0.0212
D(EVZ)	0.11043	0.05517	2.00168	0.0456
D(EVZ(-1))	0.09179	0.05548	1.65464	0.0983
CointEq(-1)*	-0.0516	0.00854	-6.0493	0
Residuals Diagnostics				
Ramsey	0.2277			
ARCH	0			
LM	0			
Source: - Authors own Compilation				

Table 6: Dependent Variable China

Long Run Form				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
OVX	0.05062	0.03337	1.51711	0.1296
GVZ	-0.3113	0.20036	-1.5536	0.1206
EVZ	1.34537	0.28807	4.67032	0
C	16.9879	2.97102	5.71786	0
Short Run Result				
D(CHINA(-1))	-0.1212	0.02912	-4.1617	0
D(OVX)	0.00681	0.00635	1.07217	0.2839
D(OVX(-1))	0.0228	0.00631	3.61553	0.0003
D(GVZ)	0.11146	0.04913	2.26851	0.0235
D(GVZ(-1))	0.15063	0.04737	3.17983	0.0015
D(GVZ(-2))	-0.1053	0.04584	-2.2979	0.0218
D(GVZ(-3))	0.16516	0.04589	3.59909	0.0003
D(EVZ)	0.35152	0.06474	5.42951	0
CointEq(-1)*	-0.091	0.01127	-8.0739	0
Residuals Diagnostics				
Ramsey	0.0001			
ARCH	0			
LM	0.0337			
Source: - Authors own Compilation				

The Bound test results reveal that the South Africa volatility index is cointegrated with all the studied volatility indices. The relationship's stability is tested by the ECM model and presented in Table 7. Where the South Africa volatility index is taken as the dependent variable. The empirical results revealed that the cointegration relationship between the South Africa volatility index and selected indices is stable, as the ECT term is negative and significant. The results reveal that the impact of OVX and EVZ, reflecting the economy's vulnerability to external shocks due to its reliance on commodities exports and exchange-rate fluctuations (Zhang *et al*., 2020) [30]. The results together highlight the diverse yet systematic interrelation between BRICS volatility indices and global uncertainty metrics, influenced by distinct national economic frameworks and international market connections.

Table 7: Dependent Variable South Africa

Long Run Form				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
OVX	0.0541	0.0300	1.7994	0.0722
GVZ	0.0769	0.1810	0.4249	0.6710
EVZ	0.8002	0.2661	3.0068	0.0027
C	10.8468	2.6323	4.1206	0.0000
Short Run Result				
D(SOUTH_AFRICA(-1))	-0.1512	0.0305	-4.9494	0.0000
D(SOUTH_AFRICA(-2))	-0.0611	0.0307	-1.9900	0.0469
D(SOUTH_AFRICA(-3))	-0.1007	0.0300	-3.3566	0.0008
D(OVX)	0.0129	0.0043	3.0141	0.0026
D(GVZ)	-0.0109	0.0330	-0.3320	0.7400
D(GVZ(-1))	0.0913	0.0314	2.9073	0.0037
D(GVZ(-2))	0.0081	0.0308	0.2613	0.7939
D(GVZ(-3))	0.0761	0.0309	2.4607	0.0140
D(EVZ)	0.1236	0.0435	2.8418	0.0046
CointEq(-1)*	-0.0666	0.0109	-6.1216	0.0000
Residuals Diagnostics				
Ramsey	0.5711			
LM	0.6355			
ARCH	0.6825			
Source: - Authors own Compilation				

5. Conclusion

This study analyzed the relationship between global uncertainty indices OVX, GVZ, and EVZ with the volatility indices of BRICS nations, offering strong evidence of diverse transmission mechanisms among these rising economies. The ARDL limits testing method established long-run cointegration for Brazil, India, China, and South Africa at the 1% significance level, however the findings for Russia remained indeterminate. An analysis by country indicated that gold volatility (GVZ) serves as the primary long-term driver for Brazil and India, underscoring the traditional and financial significance of gold in these markets. In contrast, euro EVZ markedly affects China and South Africa, illustrating their susceptibility to currency and financial disturbances. OVX exerted a relatively diminished influence but, short-term dynamics suggest that OVX shocks can instigate transient volatility spillovers, especially in Brazil and South Africa. The substantial and adverse error correction terms further corroborated stable adaptations toward equilibrium in cointegrated models. These results align with previous research on volatility spillovers and safe-haven assets in emerging nations (Diebold & Yilmaz, 2014; Zhang *et al*., 2020) [6. 30], highlighting the influence of global uncertainty on domestic financial stability. This study enhances the literature by illustrating that BRICS economies, despite their integration with global markets, exhibit varied responses to volatility shocks due to their distinct structural and financial connections, thus providing significant insights for policymakers, investors, and risk managers in formulating hedging and diversification strategies.

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