Understanding the Impact of COVID-19 on the Volatility Dynamism of Brics Stock Market

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Abstract

The current study is aimed at examining the impact of COVID-19 on the volatility of stock market returns in the BRICS economies known as trading partners. Due to the pandemic situation all over the world, it had influence on the working of the stock markets as the investors were vigilant of their investment position. Since the World Bank declared the first confirmed case of covid-19 on 31st December 2019, hence the daily data of the stock indices of the each of the BRICS economies has been fetch ranging from 1st January 2020 to 31st march2021. The impact of Covid-19 has been studied by taking the number of daily Covid-19 cases in the respective economies. The study employed GARCH family of models such as GARCH(1,1), EGARCH(1,1) and MGARCH(1,1) in order to understand the nature and dynamics of volatility of the stock markets of BRICS economies so that investors can make decisions regarding portfolio management while investing in such economies acting as global trading partners. The study found that except China and South Africa, the rising number of cases has significant impact on BRICS economies volatility. The level of persistence is found to be high, revealing that it takes time to volatility to wipe out from the market, indicating that the BRICS stock market remained volatile for a longer period of time due to the arrival of Covid news.

Keywords: volatility, Covid -19, risk and return, BRICS economies
JEL codes: **G10, G11, G15,G17, D81**

Introduction

Investors around the globe are cautious of their investment position due to sudden eruption of the covid19 news in the stock markets. The stock market reacts quickly to any information or news that has tendency to affect the sentiments of the market in a positive or negative manner. The outbreak of disease and thereby the spread of number of increased cases created an alarming situation among the stock markets of the world. The decline in the stock market returns was more severe during 40-60 days of the news of spread of virus (Ashraf, 2020). The one-third of the economies around the globe had to face partial or full lockdown of economic activities (Hoof, 2020). Investors react quickly to the negative news as compared to the positive news. The arrival of Covid-19 and the sudden announcements of the lockdowns of various economic activities created a turmoil situation in the financial world. This was followed by the immediate measures taken by the governments of the nations including imposing restrictions on travel, guiding measures for social distancing, lockdowns, restricted economic activities such as only bare essentials services were allowed to operate. This led to the reduction in the movements of goods and people thereby curbing trade and activities. World bank declared Covid-19 as pandemic on March12, 2020. This announcement came as

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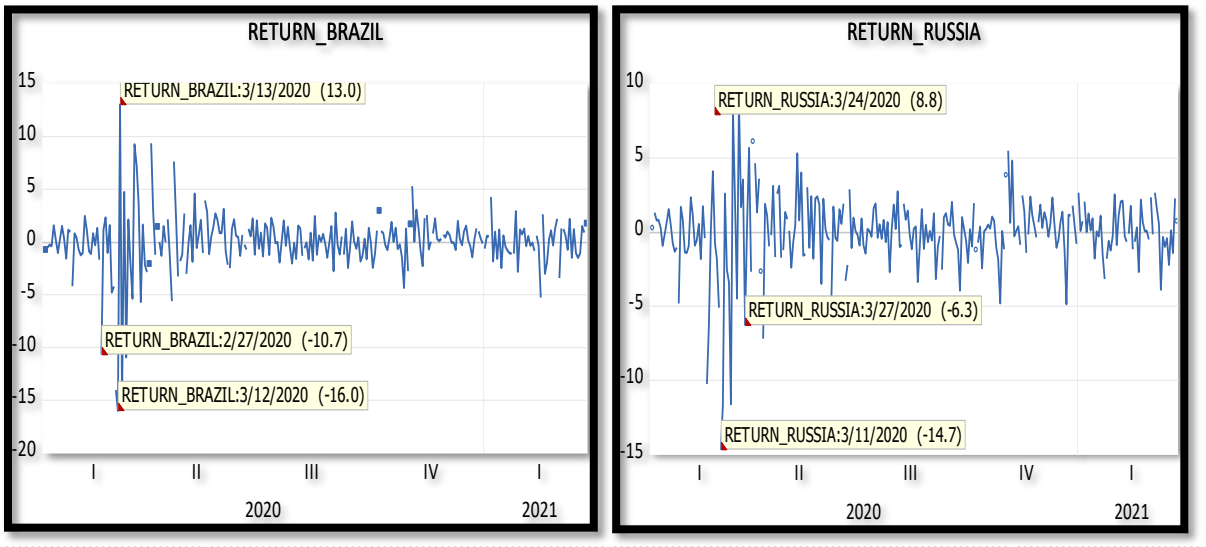
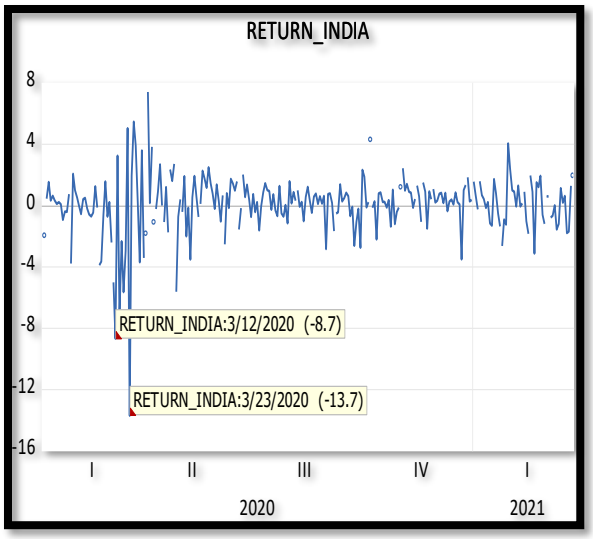
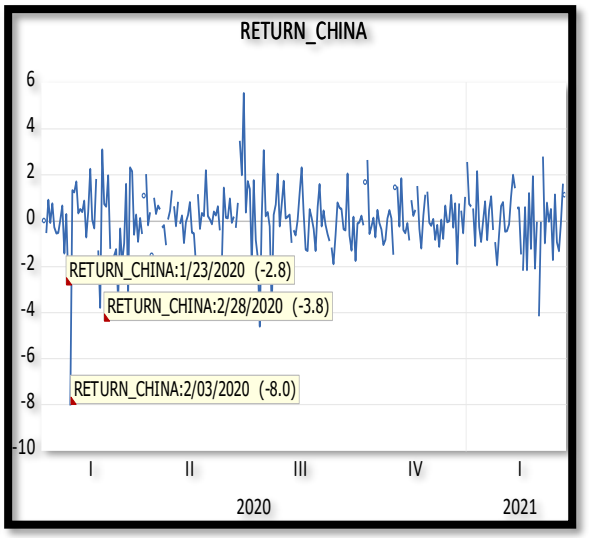
havoc in the stock market. This greatly impacted the world economy. (BBC news, 2020). This led to increase in volatility of returns in the asset prices. Volatility refers to the dynamic nature of the returns to change suddenly due to any news, information or event. The stock markets had to see unprecedented changes owing to Covid-19 (Zhang,2020). Owing to the arrival of third wave of Covid-19 in Japan and the consequent restrictions on business activities, it had impact on the consecutive falling down of stocks in Japan. As a repercussion, the economy of Japan saw a highest fall of 20% in stock prices on feb2020 as compared with the December 2019 period.US too noticed a turmoil situation when within a week; the stock market had to apply the circuit breaker in order to correct the price mechanisms in about four events. BRICS economies too had unexpected movements. On 12th march, 2020, the price of FTSE index fell down for more than 10% since 1987(BBC, 2020). The Russian financial market too had to declare march 10th, 2020 as black Monday, following which the share prices of Russian firms crashed by 20% (the Moscow Times, 2020). Although most of the stock markets have tend to follow the route of recovering, still the uncertainty hovers over the stock markets until the pandemic stays.

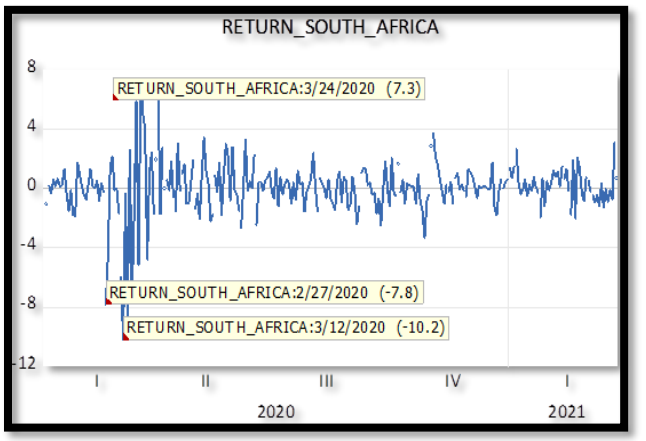
The current study holds importance due to several reasons. Firstly, the study endeavours to understand the volatility of BRICS stock market by increasing the time span as compared with previous studies having short time span. Secondly, very few studies exist to bring into light the comprehensive view of dynamics of volatility such as size & sign effect of the news, level of persistence and impact of shock using GARCH extension models. Also this study attempts to understand contribution of the variance in affecting the total returns in the BRICS stock market.

Fig.1: Graphs showing the volatility of returns









High return spikes have been observed during the arrival of the news of the COVID in the BRICS economies. In case of China, the turmoil situation in the stock market has been observed at first during January,2020 among the BRICS economies, as China saw the first mark of Covid-19 virus. After china, an increased volatility of returns has been seen during feb2020 in Brazil, Russia, South Africa. Amongst all, India saw the increase in return spikes in march2020 due to rise in the number of cases. Negative lowest spikes have been observed on 27th feb as this day marked the biggest fall in Dow Jones Industrial average when the fear of spread of Covid -19 increased outside china. On 12th march also, negative returns have been observed in the stock markets as WHO acknowledged the pandemic on 11th march 2020. On 30th January 2020, marked as the event date of declaration of Covid-19 as public health emergency (Rahman et al. 2020). This led to multiple drops in world's stock market.

Review of literature

The research world is full of investigations concerning the influence of Covid-19 on the functioning of stock markets in recent months. Some of the studies focussed on evaluating the impact of rise in number of Covid 19 cases, impact of arrival of Covid news as pandemic, calibrated lockdowns, announcement of policy changes to curb the spread restricting economic activities of the countries. These have bearing on the functioning of financial markets. Some of the past studies on volatility dynamisms conducted in several nations are as follows.

Table 1: Snapshot of previous literature:-

Author(s)	Nation(s)	Timeline	Tools	Conclusion
1. Akhtaruzzaman et al.(2021)	China and G7 countries	January 1st , 2013 to December 30, 2019 and December 31, 2019 to March 20, 2020	VARMA (1,1) DCC-GARCH model	intensity of increase in conditional correlations is comparatively higher for financial firms as compared with non financial firms
2. Kotishwar (2020)	Spain, France, USA, China, Italy and India	March 11th to April of 2020	VECM	Negative relationship among the countries indices in the long run.
3. Awadhi et al. (2020)	China	January 10th , 2020 to March 16th , 2020	Panel regressions	Rising cases led to negative stock returns
4. Onali (2020)	US	8th april,2019 to 9th april,2020	GARCH (1,1) model	The Dow jones saw increase in conditional heteroscedasticity with the rise in the cases and number of deaths.
5. Harjoto et al. (2020)	Developed Countries, emerging markets, US Firms	March 13th 2019 to April 23 rd 2020	Event study	Greater impact on emerging countries and firms with small capitalisation in US.
6. Anh and Gan (2020)	Vietnam	30 January 2020 - 30 May 2020	Panel data regression	Negative impact on stock returns, financial sector worst hit
7. Orhan (2020)	75 countries together	January-April 2020	Panel data regressions	Rising cases have adverse influence on stock returns, while the pandemic led to increase in volatility .
8. Ashraf (2020)	64 nations together	January 22, 2020 to April 17, 2020	panel data regressions	The decline in the stock market returns during initial 40-60days
9. Liu et al. (2020)	21 nations including Singapore Japan, , , the USA, Germany, Korea	21 February, 2019 to 18 March, 2020.	Event study	Stock markets of Asian nations suffered negative abnormal returns.

	Italy, and the UK			
10. Duttilo et al. (2021)	Euro area countries	4 January 2016 to 31 December 2020	GARCH (1,1)-in-Mean mode	Significant impact on volatility
11. Rahman et al.(2020)	Australia	Negative event dates - January 30th ,2020 and March 11th , 2020. Positive event dates – march 22,2020 and april8th 2020	Event study	The market reacted negatively to Covid news, while the stimulus package news announcement of the government has positive impacts.
12. Gao et al.(2021)	China and US	March to May 2020	GARCH (1, 1) model & Wavelet analysis	US stock market showed stronger impact on volatility during outbreak as compared with china, though remained sensitive with the daily increase in cases.
13. Lee et al.(2020)	Malaysia	31st December 2019 to 18th April 2020.	Regression model	Performance of the sectoral indices such as healthcare, finance, plantation, media, transportation, utilities, construction etc were affected, no impact on real estate sector.

Thus, Previous studies highlighted the impact of Covid 19 and incidental negative news such as announcement of lockdown, major policy changes on the stock indices of the nations among the world such as financial and non-financial firms, firms with large and small capitalisations. The current study attempts to measure the impact of Covid 19 on the emerging economies acting as a trading partner like BRICS taken individually.

Research methodology

BRICS equity returns has been taken from the equity indices of the respective nations. The daily returns of the indices of the BRICS stock market has been calculated with the natural log method. Since the World Bank confirmed first Covid-19 case on 31st decemeber2019, hence the study ranges from 1st jan2020 to 31st march 2021. The study employed ARCH and GARCH family of models. The ARCH model has been developed by Engle in the year 1982 so as to forecast the volatility of the market. In linear regression model, it is presumed that variance in the error term is unconditional i.e not based on any past values, hence stated as variance is constant. But in ARCH model, the variance is assumed to be conditional or based on past values i.e up to previous period. Thus conditional variance is a function of past error terms. The daily number of Covid-19 cases from respective nations has been used as variance regressor to measure the impact of rising cases on the dynamics of volatility of returns.

GARCH model developed by Bollerslev based on the assumption that the number of lagged square error required to notice the conditional variance may be huge in numbers. This study has further applied GARCH extensions such as EGARH(1,1) and MGARCH(1,1). EGARCH(1,1) has been employed in order to check for leverage effect in the returns data. MGARCH(1,1) has been used in order to examine the feedback relationship between conditional variance and conditional mean.

Objectives:

1. To study the impact of rising number of Covid-19 cases on the volatility of stock market of BRICS economies.
2. To analyse the volatility of returns with respect to conditional, persistence and news sensitivity during Covid-19.
3. To examine the asymmetric volatility with respect to size effect and sign effect of returns during Covid-19.
4. To examine the feedback relationship between conditional return and conditional volatility during Covid-19.

Analysis and interpretation

Table 2: Summary statistics

	Brazil	China	India	Russia	South Africa
Mean	-2.79E-05	0.000436	0.000840	-0.000262	0.000580
Max.	0.130223	0.055543	0.074094	0.088251	0.072615
Min.	-0.159930	-0.080391	-0.137063	-0.146824	-0.102268
SD	0.028903	0.013763	0.019789	0.025988	0.019064
Skewness	-1.338657	-0.829998	-1.787646	-1.401678	-1.113399
Kurtosis	13.32000	8.448310	14.03597	10.31347	10.23651
Jarque-Bera	1240.901	354.1331	1469.115	669.6893	625.8055
Prob.	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	262	262	262	262	262

The summary statistics shows that the highest mean daily return has been showed by India i.e 0.000840, followed by South Africa having mean return of 0.000580 and china as 0.000436 while the Russian stock market has shown lowest mean return. The stock market of Brazil is highly volatile (0.028%) followed by Russia(0.025%), India (0.0197%), South Africa (0.0190%) and china showing least volatility(0.013%). The stock returns data shows the maximum variations in the returns are found to the left side of the data hence all the returns are negatively skewed. The basic features of financial time series data is confirmed by summary statistics.

Table 3: Checking stationary of daily stock returns

	t-statistics	Critical values at 5%	Prob.	Remarks
BRAZIL	-18.67842	-2.872413	0.0000	Stationary at level
RUSSIA	-14.18749	-2.872413	0.0000	Stationary at level
INDIA	-16.67651	-2.872413	0.0000	Stationary at level
CHINA	-14.76764	-2.872413	0.0000	Stationary at level
SOUTH AFRICA	-15.12714	-2.872413	0.0000	Stationary at level

In order to run ARCH models, the ADF test has been conducted in the returns series. ADF test confirms the mean reverting behaviour of the time series data. Further conditional mean equation has been generated after confirming for the stationary of the data. The fitness of the mean equation has been checked by analysing correlogram Q stat and the squared residuals from the series. The mean equation following the Auto Regressive Moving Average (ARMA) model has been shown below:

$$Rt = \beta Rt{-}1 + \varepsilon t + \lambda \varepsilon t{-}1$$

where Rt is indicative of the returns from specific index, and ε is error component. The above mean equation has been derived using Akaike information criterion (AIC) in order to determine the optimum lag length

Table 4: Confirming Volatility clustering through ARCH effects:-

Heteroskedasticity Test: ARCH	**Brazil**	**Russia**	**India**	**China**	**South Africa**
F-stat	165.8776	52.50535	6.384165	1.305897	19.09446
Prob. F(1,259)	0.0000	0.0000	0.0121	0.0542	0.0000
Obs*R-squared	101.8977	43.99249	6.278698	1.309379	17.92073
Prob. Chi-Square(1)	0.0000	0.0000	0.0122	0.0525	0.0000

The above statistics found the trace of ARCH effects. The presence of volatility clustering is a must to apply GARCH models. The data shows the clustering of volatility indicating the circumstances that during the Covid, the highly volatile period is accompanied by the period of increasing volatility whereas the low volatile periods go along with less volatile periods.

Table 5: GARCH (1,1) model- showing the impact of increase in number of cases on BRICS volatility

Variable	Coefficient	Prob.	Impact
BRAZIL			significant impact on volatility
RESID(-1)^2	0.164821	0.0919	
GARCH(-1)	0.383260	0.0494	
CASES_BRAZIL	-0.234148	0.0141	
			significant impact on volatility
RUSSIA			
RESID(-1)^2	0.146982	0.1107	
GARCH(-1)	0.435736	0.0392	
CASES_RUSSIA	0.255409	0.0410	
			significant impact on volatility
INDIA			
RESID(-1)^2	0.214622	0.0308	
GARCH(-1)	0.293556	0.0852	
CASES_INDIA	0.143658	0.0005	
			Insignificant and negative impact on volatility
CHINA			
RESID(-1)^2	0.119807	0.0006	
GARCH(-1)	0.776579	0.0000	
CASES_CHINA	0.001347	0.9450	
			Insignificant impact on volatility
SOUTH AFRICA			
RESID(-1)^2	0.123414	0.0577	
GARCH(-1)	0.720774	0.0000	
CASES_SOUTH_AFRICA	0.017358	0.3650	

The above results confirmed the significant impact of rising Covid19 cases on the volatility of returns in case of Brazil, Russia and India, while China and South Africa have insignificant impact of rising cases. The significant ARCH term is indicative of the nature of volatility due to shock, news and any significant information where as significant GARCH represents the nature of volatility as a tendency to remain persistent in the market. China emerged as the focal point of pandemic which moved to Europe and then to US. Insignificant impact of rising cases has been observed in case of china, this is due to the fact that china on account of resilient infrastructure, had been able to muddle through with the undesirable shock of Covid 19, while the global markets had to face a plunge in the later stage of pandemic (He et al. 2020 and Ali et al. 2020). Insignificant impact has been confirmed in case of South Africa, according to WHO[1], the African region observed the least number of Covid cases as compared with other regions of world.

EGARCH(1,1) Model

The exponential GARCH Model has been developed by Nelson in the year 1991 to understand the difference between the symmetric and asymmetric impact of positive and negative news. According to EGARCH model, volatility is asymmetric in nature, which reveals the unequal consequences of positive and negative sensitive information to create sensation in the market. Similar evidences have been showed by Ekong & Onye, 2017 and Magweva & Sibanda, 2020. As a technique, EGARCH also allows for the examination of the presence of leverage effects, stating that negative information leads to turmoil in the market more as compared with positive information.

Table 6: Testing for asymmetries in volatility due to Covid-19

Nations	constant(B2)	size effect(B3)	sign effect(B4)	GARCH(B5)
Brazil	0.044430 (0.39237)	0.139752 (0.02864)	-0.25067 (0.00000)	0.893024 (0.0000)
Russia	-0.051329 (0.2461)	0.139091 (0.0136)	-0.142120 (0.000)	0.961838 (0.000)
India	.034256 (0.1415)	-0.011538 (0.5808)	-0.218124 (0.0000)	0.961909 (0.0000)
China	-0.237015 (0.0005)	0.526334 (0.0000)	-0.147132 (0.0007)	0.705991 (0.0000)
South Africa	0.003175 (0.8974)	0.061802 (0.0823)	-0.247213 (0.0000)	0.944310 (0.0000)

EGARCH model allows for testing the asymmetric effect. B(2) is a constant term. B(3) and B (4) allows for estimating the impact of shock i.e Covid in our case. B(3) represents size effect and B(4) represents sign effect. B(5) is the GARCH term. The values are significant at the level of 1%. The negative and significant sign effect represents that bad news has more impact on affecting the volatility in the market in comparison with good event news. So the inverse relationship between error component and volatility is confirmed in BRICS economies. It further signifies the nature of volatility due to positive news is having

[1] **https://covid19.who.int/**

decreasing impact on the volatility. Also the high GARCH parameters indicate that the volatility is persistent for a longer period of time in the market.

Table 7: MGARCH estimates: testing for feedback relationship between variance & returns

Nations	Coefficient	Prob.
Brazil	-0.089477	0.0061
Russia	0.036215	0.4078
India	0.051987	0.2733
China	0.233306	0.4612
South Africa	0.040018	0.4686

Table 7: MGARCH allows for the study of feedback relationship between volatility and returns. The impact of variance on the overall volatility of the BRICS returns is not significant as found in the work of Banumathy and Azhagaiah 2015; Duttilo et al. (2021), except in the case of Brazil having prob. value less than 0.05. This confirms the fact that during Covid 19 except Brazil, BRICS stock market do not validate a risk -return relationship.

Conclusion:

The purpose of the study was to highlight the Volatility dynamisms of the stock returns in case of BRICS economies and the impact caused by Covid 19. The study found that except China and South Africa, the rising number of Covid 19 cases has significant impact on BRICS economies volatility. Also the sign effect confirms the presence of volatility due to negative news in the market generates more turmoil situation as compared to positive one in the BRICS economies. The level of persistence is found to be high, revealing that it takes time to volatility to wipe out from the market, indicating that the BRICS stock market remained volatile for a longer period of time due to the arrival of Covid news.

Implications of the research:-

The current research will help the investors to acknowledge the pattern of volatility dynamisms of BRICS stock market. BRICS nations emerged as significant global trading partners. Any change in the stock markets of the BRICS nations has bearing on other nations of the world too. The study confirms the trace of leverage effects in the BRICS stock market during Covid period. So the investors should be cautious when they see the arrival of negative information or news in the market. Also the insignificant feedback relationship between variance and the returns confirms that higher the volatility higher the returns do not hold appropriate for the BRICS economies except Brazil. This study has implications while making portfolio investment decisions. The current research will guide the investors to incorporate Var (value at Risk) decisions persistent to the level of risk return in the context of portfolio diversification.

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