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Natural resources volatility and causal associations for BRICS countries: Evidence from Covid-19 data

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ABSTRACT

Natural resource price volatility has been a major concern in recent time, especially during the COVID 19 period. Although several empirical research have looked into the oil and natural resources prices nexus with economic growth, our study makes a significant contribution to the present literature by estimating the long run natural resource price volatility influence on economic growth as well as the causal associations between volatility of the prices of natural resources and economic growth for BRICS economies over 1995–2020 period.

To conduct empirical estimation, the study has used new and advanced (CUP-FM) continuously updated fully modified and continuously updated bias-corrected (CUP-BC) estimators for long term influences of the natural resources prices and (Dumitrescu and Hurlin, 2012) heterogeneous test for panel causality for the estimation of the causal relationship between the variables. The results provide clear evidences about the negative influence of volatility in natural resources prices, whereas positive impact of gas and oil rents on economic growth or economic performance of the BRICS economies. Moreover, bidirectional causal association is also revealed from our empirical findings to exist between economic growth and price volatility of natural resources. The findings of our study are robust to various policy implementations. It is recommended to reduce the reliance of natural resources as well as the adoption of short run and long run natural resource hedging policies to mitigate the detrimental impacts of price volatility of natural resources on economic growth and environment.

1. Introduction

Our world has encountered several challenges since the beginning of the 21st century, including the international financial crisis of 2007–2008 and the contagious pandemic of the Covid-19 among others, where the former disrupted all social, environmental and economic operations. This pandemic has rapidly spread across all economies, first in developed countries and now in developing countries. Because their health services and health conditions are worse to those in rich nations, and because their macroeconomic indicators are unable to survive such a long-run turbulence in socioeconomic terms, emerging economies are unquestionably at a disadvantage during this era. (DEMICAN ÇAKAR et al., 2021).

Besides impacting other sectors drastically, natural resource volatility is substantially contributed by global financial and economic uncertainty, which could be critical to macroeconomic and microeconomic growth: expenditures at household level, business revenues, and the whole country (B. Lin and Bai, 2021). The world has recently experienced two significant shocks: (a) the Covid 19 epidemic and (b) a decline in prices of the world’s most valuable natural resource, i.e., oil (Sharif et al., 2020). The combination of these two problems will almost certainly lead to a prolonged economic downturn, dragging the biggest economy in the world (the United States) and other nations into another recession. (Sun and Wang, 2021). The association amongst natural resource volatility and economic growth is significant because it has the potential to alter macroeconomic stability and a country’s level of welfare. For example, there are several ways in which a rise in the prices of natural resource commodity, particularly gas and oil costs, can affect output (Yildirim and Oztürk, 2014). At first, the natural gas and oil price shocks dampen overall demand because they produce a redistribution of wealth from oil exporters to oil importers. Second, the company’s ability to invest in new equipment and employees may be hampered by the rise in oil and gas costs. Energy efficiency measures are taken because of the ever-increasing cost of oil and gas. (Bing and Ting, 2021). Furthermore, this low level of consumption of energy occurs before a rise in unemployment as a result of real wager declines (Zhang, 2021). As a result,
lowering real wages increases unemployment and lowers the country’s real GDP. A reduction in oil prices, on the other side, lowers costs of production, increase economic activity and fosters growth (Narayan et al., 2014). Due to increased future returns, this drop would dramatically raise stock market values. The recent drop in natural gas, oil and natural resources, on the other hand, is mostly due to the Covid-19 epidemic. The current pandemic and ensuing world lockdowns in social and economic terms lead to reduction of global aggregate demand and disruptions in supply networks (Prabheesh et al., 2020). According to reports, a substantial drop in oil consumption due to the lockdown environment has resulted in severe drop of oil prices in the world market, with prices falling from 61 US$ in January to 12 US$ in April 2020. The Covid-19 crisis has caused volatility in natural gas, oil and many natural resources, such as gold and minerals (Hordofa et al., 2021).

As a result, in recent era, policymakers and governments have increased their concerns about the influence of price volatility of natural resources on economic growth and sustainability. Studies empirically examined the negative influence of price volatility of natural resources on an economy’s performance in this regard (Guan et al., 2021), (Atil et al., 2020), (Chien et al., 2021), (Khan et al., 2020). The primary focus is on the volatility of oil prices because it is one of the most trading commodities on the world. Therefore, empirical studies show that volatility in oil prices has an adverse influence on economic growth (Y. Lin et al., 2020) (Gkilas et al., 2020), (Nonejad, 2020). However, several studies have investigated the link between natural resource uncertainty and economic prosperity. There is still a big hole in the research about the connection between the price of natural resources and economic development. In instance, the aforementioned research experimentally investigated oil price volatility and its link to the stock market but ignored the impact of natural resource price volatility in the expansion process. The primary purpose of this research is to bring the issue to the attention of policymakers and governments. The policy implications and results of this study may help governments overcome the volatility of natural resource prices and the problems it causes for economic expansion. The development of economies may also be affected by variables like oil and natural gas rents and energy inflation in addition to the ebb and flow of natural resource prices. The rents from the sale of natural gas and oil have been demonstrated in several studies to have a significant impact on economic growth. (Adedoyin et al., 2020).

Therefore, the objective of the present study is to empirically estimate the causal relations between the volatilities of natural resources prices, natural gas and oil rents on the BRICS economies’ economic growth. This study is important since it is one of the few that empirically examined the specified variables while tackling the Covid-19 pandemic, especially for the BRICS economies. The current study, on the other hand, looked at the impact of price volatility of natural resources in natural resources over the pandemic period. Although, substantial literature is present on economic growth and natural resources prior to the Covid 19 pandemic, our analysis is unique and has three-fold addition to the previous literature. To begin with, this is one of the first studies to take into account price volatility of natural resource and economic performance using a large dataset that spans the Covid-19 outbreak period. Nonetheless, recent investigations by (Ma et al., 2021; Sun and Wang, 2021) and others have looked at the relationship of price volatility of natural resources with economic performance. These investigations, however, simply investigated for a causal link between these variables. Our study goes a step further by giving the evidence for long run impact of each independent variable as well as the causal relationship between these variables with economic growth, which is a significant contribution to the literature. As a result, the study gives evidence, particularly from the standpoint of the BRICS economies (Jiao and Liu, 2021). Second, the study used the recent dataset, which encompasses two economic critical situations or crises i.e., the economic crisis globally in 2008, and current Covid 19 pandemic of 2020. Oil prices hit an all time high rate of 145.18 $ per barrel in 2008, July, during the current pandemic era, oil prices plummeted to a new all-time low of ~37.63 $ per barrel. Moreover, during the pandemic, crude oil prices are also falling (Guan et al., 2021) and provided policy recommendations for reducing the uncertainty of natural resource prices and performance of an economy. Therefore, this study is significant one since it is one of the few studies to provide empirical estimations as well as policy recommendations in the Covid 19 period. Regarding empirical estimation, our study is the among a few studies that applied second generation panel estimation technique including (Pesaran, 2007) unit root test and (Westlunf and Edgerton, 2008) panel test for cointegration. Furthermore, our research is the first to use the continuously updated fully modified (CUP-FM) and continuously updated bias-corrected (CUP-BC) estimation methods to estimate the long-term influence of price volatility of natural resources, giving it sufficient superiority over other empirical estimations due to its properties of attending the issue of cross-sectional dependency arising from global unobserved stochastic trends (Samaedi and Raid, 2013), endogeneity, autocorrelation, heteroskedasticity, and fractional integration (Ahmed and Le, 2021). The outcomes of our study are believed to benefit future policy practitioners, researchers, institutions, students, academics concerned with the price volatility of natural resources and growth from the perspective of BRICS economies.

The remainder of our study is arranged in a way that section 2 presents a comprehensive review of the past literature on the relationship between prices of natural resource and growth. The estimation technique and model specification are given in Section 3. Section 4 gives the interpretation of the empirical findings. Finally, in Section 5, the briefly concludes the study and policy recommendations regarding the empirical results is presented.

2. Literature review

The existing literature provide mixed studies regarding natural resource price-growth nexus. Some of the studies investigated oil price and economic growth relationships (B. Lin and Bai, 2021), (Tahar et al., 2021), (Monye Michael and Omogbibi Shulammitie, 2020), (B. Lin and Bai, 2021), some studies investigated gas rents or prices and total natural resource price relationship with growth (Guan et al., 2021), (Shahbaz et al., 2019), (Hayat and Tahir, 2021), (Etokakpan et al., 2020). The researchers have estimated this association both in pre as well as post covid era. For instance, Guan et al. (2021) analyzed the panel data of countries having abundance of natural resources over the period 2000–2020 to examine the effects of price volatility of natural resource on e-growth. The findings of the study from study from ARDL and PMG estimations concluded that economic growth was significantly reduced by volatility of natural resources considerably in the long-run. It was found that Covid-19 and global financial crisis had a much greater impact on the crude oil price than on the gold market. Tahar et al. (2021) employed ARDL model to reveal the long run and short run symmetric effects of price volatility of natural resource commodity prices with economic performance in commodity dependent countries. Their empirical estimation revealed that boom effect (current commodities) of 2004–2014 period had significant variation from past phenomena that illustrated the learning impacts gained from the previous experiences. Furthermore, the non linear ARDL estimations demonstrated that commodity price shocks had asymmetric effects. Before pandemic outbreak of Covid 19, taking Canada as the case study, similarly (Bashar et al., 2013), studied the link between uncertainty in oil price and macroeconomy by applying the structural VAR estimation. According to their primary findings, shocks in oil prices did not influence the aggregate level of output. But these oil price uncertainties had significant contributions to the output level variations. Recenly in the era of COVID-19 taking USA economy into consideration, Sharif et al. (2020) examined the same relationship i.e., oil economic and oil price uncertainty and many other related macroeconomic variables. Their
results using a wavelet-based estimate method showed that variables varied throughout time. On the other hand, the Covid 19 epidemic had a greater effect on the unpredictability of the US economy. The researchers also said that the primary market in the United States that shown both greater and lower frequency across data was oil. Atil et al. (2020) studied the relationship between finance and growth while examining effect of oil prices over the period from 1972 to 2017 in Pakistan. The study applied the long run co variability estimation and found that natural resources had a promoting impact on financial development. But the oil prices affected financial development negatively in the country. Albulascu (2020) examined the oil prices and uncertainty of economic policy in the USA by analyzing the daily data from 21 Jan to 13 March 2020. The authors applied the ARDL estimation model and the results of the study reported that increase in the deaths and cases of Covid 19 had no affect on uncertainty in economic policy in the United States. Oil prices, on the other hand, had a detrimental impact on the uncertainty of economic policy in the Covid 19 era. Applying second generation panel estimation methodology, Shahbaz et al. (2019) found that natural resources had significant and positive impact on economic growth of resource abundant countries. However, resource dependence had a negative impact on the economic growth from 1980 to 2015. However, the other study by Shahbaz et al. (2019) analyzed the USA economy and found opposite results. The authors found that the resource curse hypothesis was valid in the USA. Capitalization and oil prices, on the other hand, help the region’s economy thrive.

Similarly, Hayat and Tahir (2021) estimated the data of three resource rich countries over 1960–2016 period. By applying the ARDL methodology, the study found a crucial role of natural resources in economic development, but volatility in natural resources prices had an adverse affect on economic growth in Saudi Arabia, Oman and UAE. On the contrary, Rahim et al. (2021) studied the impact of rents of natural resources on e-growth over 1990 to 2019 period. According to the author’s findings, natural resource rents considerably hinder economic growth. Human capital development, on the other hand, could be crucial in enhancing the favourable influence of economic growth by natural resources. Similarly, by studying the Nigerian economy, Monye Michael and Omogbital Shulammitte (2020) analyzed the primary data of 320 respondents sample and estimated a negative and significantly negative association of oil prices with economic growth. In case of Pakistan, Chien et al. (2021) analyzed oil prices (crude) volatility association with economic growth over the period of 1980–2018. The results of the ARDL calculation led to the conclusion that the economy as a whole was negatively impacted by the rise in oil prices. Only the areas of transportation and communication saw an improvement. Ma et al. (2021) researched the causal relationship between prices of natural resources with economic growth in China both in post and pre Covid 19 era from 01, January 2019, to 01, April 2021. Their study by employing the wavelet coherence approaches, wavelet power spectrum and frequency domain causality tests revealed that prices of natural resource commodities were more volatile than performance of the economy especially during China’s Covid 19 climax period. The wavelet coherence method, on the other hand, showed that there was a two directional causal relationship of the prices of natural resource commodity with economic performance at different time periods and frequencies. Applying the same estimation techniques for global data, Sun and Wang (2021) studied the nexus of price volatility in natural resource commodities with economic performance from 01, Jan 2019, to 01, July 2021. According to their findings, only prices of natural resource were vulnerable, but in-vulnerability was indicated for the economic performance globally. Moreover, these two variables exhibited no short run or long-run causal linkage in the wavelet coherence technique. Analyzing the data for Algeria over 1970–2012 period, Benramdane (2017) studied the how price volatility of oil impacted economic growth by employing the VAR model. The findings of this study show that the adverse consequences of volatility in oil price on growth outweigh the beneficial advantages of the oil price boom. It was concluded that the “resource curse” enigma in Algeria was driven by price volatility of oil rather than its abundance. In case of G-7 countries, Hordofa et al. (2021) evaluated how different natural resource rents for example natural gas, energy, oil rents affected the performance in economic terms over 1990 to 2020 period. Economic performance was found to be declined during and post COVID-19 pandemic. Natural resource rents, such as oil and gas, were found to aid boost economic performance in this study. Furthermore, the G7 economies’ economic performance was hindered by the structural break imposed by COVID-19 for the year 2019 (Etokakpan et al., 2020). scrutinized the data for Malaysia over 1980 to 2014 period by applying cointegration and Granger causality test and cointegration approach. According to the estimated results, natural gas, at one side, helped in the growth of the economy but it also contributed to environmental damages on the other hand (Katoka and Dostal, 2021). analyzed international prices of commodities, natural resources and economic performance in the countries of Sub Saharan Africa over the period 1990 to 2019. Natural resources promoted economic expansion, using the random coefficient estimate. The results also show that nations with plenty of natural resources that prioritise commodity exports do much better than others. Using the panel for 5 ASEAN countries and applying the ARDL technique, Rosnawintang et al. (2021) studied the relation of volatility of oil prices with economic growth over 1995 to 2018 period. The study found that volatility in oil price had a detrimental impact on economic growth only in the short run. Although there is a large body of empirical research on the impact of natural resource prices, gas prices, oil prices, on the growth or economic performance. However, the relationship between these factors is under researched in the BRICS region. Moreover, to the author’s best knowledge, there have been no attempts to empirically examine and understand the relationship of price volatility of natural resource price with economic growth by applying most novel estimations techniques of CUP FM and CUP-BC. Hence our study is pioneering one in these aspects and is going to be a significant contribution in the literature.

3. Empirical methodology

3.1. Model specification and data

In order to achieve the said objective, the study uses GDP as dependent variable to measure the economic growth. According to (Hordofa et al., 2021), GDP is a well known measure of the performance of an economy considering many and economic factors and indicators such as investment, consumption, revenue, transaction and many other. As a result, GDP is an appropriate measurement for expressing economic performance. Volatility of natural resources price is measured by total natural resource rent (TR). Other independent variables include oil rents (OR), natural gas rents (GR). Data of all of the aforementioned variables spans over 1995 to 2020 and is gathered from World Development Indicators (WDI, 2020). The study takes BRICS economies into consideration-a five countries group, namely: Russia, Brazil, China, South Africa and India. The BRICS economies were selected because they have united to achieve a number of economic and development objectives. These nations’ economy primarily aim to promote security, stability, and peace. Because of this, every change in policy in one economy might have an effect on another. On the other hand, any policy effort that involves the whole BRICS group may have a stronger influence on the remaining developing as well as advanced nations. These factors lead to the use of the BRICS economies as a case study.

Hence the model in its functional form is given as

\[ GDP_t = \alpha_0 + \beta_1 TR_t + \beta_2 OR_t + \beta_3 GR_t + \varepsilon_t \]  

(1)

Where \( TR_t = \) total natural resource rent, \( OR_t = \) oil rent, \( GR_t = \) gas rent.

The econometric functional form of the model is given as

\[ GDP_t = \alpha_0 + \beta_1 TR_t + \beta_2 OR_t + \beta_3 GR_t + \varepsilon_t \]  

(1)
Where subscript $i$ = cross section and $t$ = time.

### 3.1.1. Econometric techniques

#### 3.1.1.1. Cross sectional dependence (CSD) testing

In order to estimate our empirical model, the study uses panel data approaches to account for CSD. When CSD is neglected, panel data estimations reveal significant size distortions and biased results, according to Pesaran (2006). Therefore, before performing preliminary tests for the estimation of the parameters, CSD is examined first. To determine whether CSD exists or not, we use the Langrange Multiplier test proposed by Breusch and Pagan (1980), and Scale LM and CD test proposed by Pesaran. The above tests compare the H0 of “no CSD” to the H1 of the “presence of CSD”.

In the next step of the analysis, unit root test and long run co-integration test are employed because it is compulsory to decide whether the data is stationary or unit root, as non-stationary data highlight the issue of false regression (Pesaran, 2007). Proposed CADF (augmented ADF) test for unit root/stationarity that takes CSD into account. The CIPS (cross-sectional IPS) statistic is generated using the arithmetic averages of CADF data individually calculated for each member of the panel. The H0 of CIPS test states that the series is non-stationary i.e., is having unit root problem.

The unit root analysis findings will indicate that series can either be level stationary, i.e., $I(0)$ or the first difference stationary i.e., $I(1)$. By using LM bootstrap co-integration technique. The significance of this co-integration algorithm produces samples and two statistics for CSD. When CSD is neglected, panel data estimations reveal significance level, according to Pesaran (2006).

3.1.1.1. Econometric techniques
- Conventional OLS method is used to estimate coefficients if the series is stationary. This co-integration algorithm produces samples and two statistics for CSD.
- Therefore, before performing preliminary tests for the estimation of the long run co-integration among variables, our empirical model, the study uses panel data approaches to account for CSD. When CSD is neglected, panel data estimations reveal significance level distortions and biased results, according to (Pesaran, 2006).

3.1.1.1. Cross sectional dependence (CSD) testing.

For this estimation, the study applies (Westerlund and Edgerton, 2008) method for the estimation of the long run co-integration among variables. This co-integration algorithm produces samples and two statistics for CSD. When CSD is neglected, panel data estimations reveal significance level, according to Pesaran (2006).

Moreover, Bai et al. (2009) made direct corrections in biases in the estimations, a bias-corrected estimate is also created by them that is updated constantly until convergence is achieved. The (CUP-BC) estimator is the name of this approach. By completing Monte Carlo simulations, Bai et al. (2009) showed that the CUP-FM and CUP-BC clearly be better than traditional estimators in all circumstances. These estimators are resilient in the presence of ($I(0)$ and ($I(1)$) factors and regressors as well, and they are robust against independent factors and endogeneity problems (Bai et al., 2009).

Through causality test, the study explores the possible bi-directional relationship between economic growth and volatility in natural resource prices at the last of the empirical estimations. To this goal, the causality test that (Dumitrescu and Hurlin, 2012) proposed, is used to uncover plausible bidirectional causality between economic growth and price volatility of natural resources, taking CSD into account. The H0 of the test implies “absence of the causal relationship among variables.”

4. Results and discussion

Table 1 provides descriptive statistics for the research variables, including mean, standard deviation, minimum and maximum values. The mean value of GDP is the greatest while the mean value of GR is the lowest among all variables. The results show that GR has the lowest variability around the mean whereas TR has the highest. Additionally, the Jarque-Bera Test’s J-B statistics show that the data set is normal since the null hypothesis of data normality, H0, cannot be rejected.

Moreover, correlation statistics among variables are given in Table 2 below. It is revealed that GDP only has negative association with OR and TR, all other variables are found to be positively correlated with each other. Furthermore, the correlation among variables is also less than 0.8 which shows that there is no issue of multicollinearity among the variables.

Our empirical estimation firstly begin by estimation of CSD in panel series because ignoring the issue of CSD leads to erroneous findings. For this purpose we applied three different CSD tests namely Bruehs-Pagan LM, Pesaran Scale LM, and Pesaran CD tests. Table 3 provides us the estimations of these three tests. According to the findings we can reject H0 of cross sectional independence. Hence it is proved that CSD is present in our data.

After the confirmation of the CSD, second step of the analysis

### Table 1

| Variables | Mean | Minimum value | Maximum value | Standard. Deviation | J-B Stats |
|-----------|------|---------------|---------------|---------------------|-----------|
| GDP       | 2.23 | 1.760         | 1.467         | 2.24                | 1.337     |
| TR        | 5.62 | 0.004         | 14.50         | 5.62                | 3.568     |
| OR        | 2.55 | 0.25          | 14.50         | 2.55                | 2.074     |
| GR        | 0.765 | 0.006       | 8.67          | 0.77                | 3.018     |

Source: Author’s own Estimation ***, ** and * denote 1, 5 and 10 percent significance level respectively.
Thus, our findings suggest that natural resource rent volatility is harmful to the results of both tests, it is clearly evident that all of the variables are * 10% significance level.

** 5% significance level.

Note.

Table-4
Correlation test.

| Variables | OR  | TR  | GR  | GDP |
|-----------|-----|-----|-----|-----|
| OR        | 1   |     |     |     |
| TR        | 0.1023 | 1   |     |     |
| GR        | 0.6136 | 0.0568 | 1 |
| GDP       | -0.0345 | -0.1925 | 0.1781 | 1 |

Source: Author Estimation

Table-3
Results of CSD tests.

| Variables | Breussch-Pagan LM | Pesaran Scaled LM | Pesaran CD |
|-----------|------------------|------------------|------------|
| GDP       | 424.027          | 33.516           | 10.109     |
| TR        | 310.358          | 49.220           | 13.950     |
| OR        | 637.039          | 40.025           | 7.086      |
| GR        | 729.082          | 66.366           | 24.397     |

Note.

** 5% significance value.
*a 10% significance value.
*a 1% significance value.

involves unit root testing of the data because stationarity of the data is an important as it helps in the adoption of the proper estimation both for short and long run. For this estimation, we applied CIPS and CADF tests proposed by Pesaran (2007) and Table 4 below gives us the results. From the results of both tests, it is clearly evident that all of the variables are level unit root, however they are stationary at their first difference.

Long run cointegration relationship estimation follows the unit root testing. For this purpose we applied (Westerlund and Edgerton, 2008) cointegration test and its results are given in Table 5 below. The H0 of the test states that no cointegration exists in the presence of various panel data problems such as CSD, serial correlation and structural break. The test findings reject the H0 and endorses that long run cointegration exists between TR, OR, GR and GDP.

Table 6 shows (Westerlund and Edgerton, 2008) test results in the existence of the structural breaks. It is necessary to explain the significant value of regime shift. The variables GDP, TR, OR and GR are found to be co-integrated because several key structural breaks occurred locally, regionally and globally, such as Asian crises, RMB exchange rate reforms declared in China (August 2015), 2001’s mild recession and financial crises over 2007–2008 period.

After all these preliminary estimations, now we proceed to the long run coefficient estimations through CUP-FM and CUP-BC techniques. Table 7 below provides us the estimates for these two approaches. It is clearly indicated from the results that all of the variables are statistically significant and either have positive or negative impact on economic growth in BRICS economies. Specifically, TR is found to increase GDP by 0.58 units in CUP-FM and 0.48 units in CUP-BC respectively. Gas resources and oil resources have stimulating impact on countries economic success.

However, gas rents and oil rents have positive impact on economic growth in BRICS countries. For a unit increase in GR, GDP decrease by 0.587 units in CUP-FM and 0.487 units in CUP-BC. Similarly OR are found to increase GDP by 0.439 units in CUP-FM and by 0.233 units in CUP-BC respectively. Gas resources and oil resources have stimulating effect on economic growth through supplying the resources and energy necessary in the production or manufacturing processes that boost economic growth of the group of the economies. Our findings are verified by a number of previous studies including (Pérez and Claveria, 2020), (Hayat and Tahir, 2021), (Wen et al., 2022). (Wen et al., 2022), Etokakpan et al. (2020), Galadima and Aminu (2020) and Topcu et al. (2020).

In addition to long-run coefficient estimations, our study looks into the causality associations between all the variables in consideration. For this, Dumitrescu and Hurlin (2012) heterogeneity granger test for panel causality test is used in our study and Table 8 shows the estimated findings. The results show us that factors and the BRICS nations’ economic development are related in both directions. The regional economic growth is therefore significantly influenced by OR, TR, and GR. On the other hand, it has been shown that OR, TR, and NR in the research region are significantly impacted by economic growth.
mediated implementation in this covid-19 pandemic to accommodate TR, OR granger causes GDP, and a feedback effect has also been additional causal relationship between the study variables. Specifically, GR, (2007) CADF and CIPS unit root test, Westerlund and Edgerton (2008) LM test and Bruesh-Pagan LM test for the CSD testing, the Pesaran metric techniques such as the Pesaran (2007) CD test, Pesaran Sclaled the studied variables and the BRICS countries -analysis produced highly statistically significant findings at the 1%

|          | H0      | Stats | Prob value. |
|----------|---------|-------|-------------|
| TR doesn’t homogeneously cause GDP | 17.029  | 0.000 |
| GDP does’nt homogeneously cause TR | 18.830  | 0.000 |
| GR doesn’t homogeneously cause GDP | 24.665  | 0.000 |
| GDP doesn’t homogeneously cause GR | 14.535  | 0.000 |
| OR doesn’t homogeneously cause GDP | 17.552  | 0.000 |
| GDP doesn’t homogeneously cause OR | 25.30   | 0.000 |

Source: Author’s Estimation

4.1. Conclusion and policy recommendations

Our world has undergone several changes over the last three decades because of the oil price climb of 2003, global financial crisis over 2007–08, outbreak of Covid-19 pandemic and many others. All of these incidents have had a significant impact on global consumption and production patterns. Because of the recent global epidemic, academics and policymakers have paid increased attention to volatility of natural resource price and economic performance. In this sense, it is critical to look into the volatility of natural resource price and economic growth of both developing and developed economies in the pandemic of Covid-19. Furthermore, every country’s locked-down economy lowers economic and industrial activities. This reduces the requirement for oil, natural gas, and other natural resources considerably around the globe. As a result, decreasing energy demand during the Covid-19 period will lead natural resource rents to fluctuate. This natural resource rents volatility may have an impact on countries’ economic progress. In this regard, the current study investigates the causal association between volatility of natural resources and economic growth for BRICS economies over 1995–2020 period. The study has applied several panel data econometric techniques such as the Pesaran (2007) CD test, Pesaran Scaled LM test and Bruch-Pagan LM test for the CSD testing, the Pesaran (2007) CADF and CIPS unit root test, Westerlund and Edgerton (2008) test for the estimation of long run cointegration among panel members.

In terms of the effect of explanatory variables on economic growth, the long-run estimates validity was also assessed in this study. For this, most proper long-run estimations that is the CUP-FM and CUP-BC is applied in our study. The outcomes of these methodologies show that rents of natural oil and gas have a considerable impact on economic performance, whereas total natural resource rents exert a negative impact on BRICS countries’ economic growth. Furthermore, the Granger panel causality test by (Dumitrescu and Hurlin, 2012) shows a bidirectional causal relationship between the study variables. Specifically, GR, TR, OR granger causes GDP, and a feedback effect has also been observed for these variables. This means that any movement in the explanatory variable(s) will have a big impact on the outcome variable and vice versa. On the basis of our empirical findings, a few practical policies are recommended for the policymakers that necessitate the immediate implementation in this covid-19 pandemic to accommodate volatility of natural resources and growth. Firstly, the heavy reliance on oil, natural gas, other natural resources must be condensed by acquiring environmentally friendly and innovative technologies to reduce its negative effect on economic growth. It will contribute to economic growth and satisfy the needs of consumers. Moreover, natural resource hedging, for example, could be useful in reducing volatility in natural resource prices. As a result, policies that incorporate natural resource hedging in both the long and short term must be updated. Furthermore, price ceiling and price freezing regulations may aid in maintaining natural resource rents’ favourable contribution to economic performance. Furthermore, research and development spending might be increased, assisting in the transition of the dependency of natural resource to efficient energy sources. This would lead to long-term development for both the environment and the economy.

Author statement

We have submitted the revision of our article entitled” Natural Resources Volatility and Causal Associations for BRICS countries: Evidence from Covid-19”. All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Furthermore, each author certifies that this material or similar material has not been and will not be submitted to or published in any other publication before its appearance in the resource policy Journal.

Data availability

Data will be made available on request.

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