Financial development, oil resources, and environmental degradation in pandemic recession: to go down in flames

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Abstract
The novel coronavirus disease-2019 (COVID-19) is a deadly disease that increases global healthcare sufferings. Further, it affects the financial and natural resource market simultaneously, as both are considered complementary goods. The volatility in the oil prices deteriorates the global financial market to substantiate the “financial resource (oil) curse” hypothesis primarily filled with earlier studies. In contrast, this study moved forward and extended the given relationship during the COVID-19 pandemic in a panel of 81 different countries. The study’s main objective is to examine the volatility in the domestic credit provided to the private sector due to oil shocks and the COVID-19 pandemic across countries. The study is essential to assess the healthcare vulnerability in the COVID-19 pandemic, leading to the damage of financial stability, causing deterioration in the oil rents to affect the global sustainability agenda. The study employed statistical techniques to get sound inferences of the parameter estimates, including robust least squares regression, seemingly unrelated regression, and innovation accounting matrix to get a variable estimate at the level and inter-temporal framework. The results confirmed the U-shaped relationship between oil rents and financial development during the COVID-19 pandemic. Thus, it verifies the “financial resource (oil) curse” hypothesis at the initial stage of the COVID-19 pandemic. Later down, it supports the capital market when economies are resuming their economic activities and maintaining the SOPs to restrain coronavirus at a global scale. The qualitative assessment confirmed the negative effect of financial development and oil shocks on environmental quality during the pandemic crisis. The innovation accounting matrix shows that the COVID-19 pandemic will primarily be the main factor that intervenes in the relationship between oil rents and financial development, which proceed towards the “resource curse” hypothesis during the following years’ time period. Therefore, the need for long-term economic policies is highly desirable to support the financial and resource market under the suggested guidelines of restraining coronavirus worldwide.

Keywords Carbon emissions · Oil rents · Financial development · COVID-19 pandemic · Total population · Robust least square regression

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Introduction

The Fourth Industrial Revolution (Industry 4.0) is focused mainly on a high-tech strategy to improve industrial production embodied internet of things (Awan et al. 2021a). The importance of circular economy also proliferated in the twenty-first century that remains focused on efficient economic and environmental resources to conserve natural ecosystem (Alhawari et al. 2021). The resulting impact of the fusion of digitalization started a new era of green product innovation, enabling policymakers to devise long-term sustainable environmental policies (Awan et al. 2021b, c). Industrial ecology is the sustainable path to move forward towards a green revolution (Ahmed 2016; Awan 2020a). The oil-finance nexus is widely discussed in the earlier economic and resource literature (Godil et al. 2021; Rehman et al. 2021; Malik et al. 2020), which comes to an end with the three most important findings, i.e., (i) Resource curse hypothesis: This hypothesis provides a fundamental overview of the negative relationship between resource rents, including oil rents and economic/financial degradation with a particular logical justification, i.e., the countries that have plenty of natural resources mainly are developing nations, have low institutional quality, lack of good governance, the inability of resource extraction and its optimal consumption, civil unrest, political disputes, and many more other factors that unable to translate its positive impact on countries economic and financial performance (Khan et al. 2020). Thus, these factors lead to the “resource curse” hypothesis (see, Papyrakis and Gerlagh 2004; Boschini et al. 2007; Murshed and Serino 2011; Satti et al. 2014; Badeeb et al. 2017; Tiba and Frikha 2019; Guan et al. 2020; Salahuddin et al. 2018). (ii) Inverse hypothesis: The inverse hypothesis against the resource curse confirmed the positive relationship between natural resource rents and economic/financial development. The few developed and developing countries with resource abundance countries would optimally utilize their scarce resources to achieve economies of scale. Thus, it exhibits the “resource blessing” hypothesis (see Van der Ploeg 2011; Konte 2013; Osaghae 2015; Zubikova 2018; Nawaz et al. 2019; Wei et al. 2020; Baloch et al. 2021). (iii) A hump-shaped relationship: The few research scholars confined their findings in support of a hump-shaped relationship between oil resources and economic/financial development. The three primary functional forms discussed in the earlier literature include (a) an inverted U-shaped relationship, (b) a U-shaped relationship, and (c) a monotonic increasing or decreasing relationship. The first form shows that natural resources, including oil resources, first increase and later decrease economic/financial activities due to low utilization of natural resources (see Xu et al. 2019; Shahbaz et al. 2019). The second form shows a U-shaped relationship where natural resources first decrease and later increase due to achieving resource efficiency through technological upgradation. Finally, the third form shows natural resources either increasing or decreasing with economic and financial activities; however, it cannot signify its impact on later stages. The nonlinear relationship between income and natural resources is widely found in the earlier literature, for instance, Koondhhar et al. 2021, Ndjokou and Tsopmo (2017), Tiba (2019), and Zallé (2019). These three outcomes can be viewed in Figure 1 for ready reference.

The coronavirus disease-2019 (COVID-19) pandemic bursts from the Chinese city Wuhan in late 2019 and then seized all economic and financial activities due to the high mortality rate caused by the SARS-CoV-2 virus in a short period across the globe. The mandatory shutdown of economic institutions, industries, and businesses worldwide to restrain coronavirus negatively affects its financial and oil resource market. As a result, the negative oil price emerged many unwanted economic and environmental issues that led to a global depression. The minimal literature so far analyzed the relationship between oil resources and financial development under the COVID-19 pandemic. Most of the literature found between the adverse effects of the COVID-19 pandemic on the financial sector (see Baker et al. 2020; Akhtaruzzaman et al. 2020; Goodell 2020; Zhang et al. 2020), while a few studies examined the relationship between COVID-19 pandemic and oil resources (see, Ajami 2020; Narayan 2020; Masson and Winter 2020). Table 1 shows the current strikes of earlier literature on the nexus between oil resources and financial development during the COVID-19 pandemic.

The literature is limited; thus, more studies on the given topic are imperative to support policymakers to devise economic policies in a more efficient way. Moreover, the study is essential in a current pandemic from many perspectives. Firstly, this study extended the conventional finance-oil resource nexus by using three main factors of the COVID-19 pandemic, i.e., registered coronavirus cases, death cases, and recovered instances, to evaluate the “financial resource (oil) curse” hypothesis in a broad panel of selected countries across the globe. Secondly, the total population included in the given nexus served as a control variable. Third, the square of oil rents was used to verify the hump-shaped relationship with financial development. The previous studies largely confined the nexus with some other macroeconomic factors, including globalization and human capital (Zaidi et al. 2019), economic growth (Erdogan et al. 2020), price volatility and Islamic financing (Gazdar et al. 2019), technological innovation (Murad et al. 2019; Anser et al. 2020; Khan et al. 2019), sustainable innovation (Awan 2020b), institutional quality (Khan et al. 2019), and renewable energy (Ozcan and Ozturk 2019; Ji and Zhang 2019). Thus, this study included the COVID-19 pandemic in the given nexus that will fill the literature gap. In addition, it would help attract research scholars to work on the given theme to understand the devastation of the current pandemic in the resource market.
The study intended to explore the dynamics of financial instability causing the COVID-19 pandemic that affected the healthcare sustainability agenda. At the same time, its increased oil shocks more firmly negatively affect the green environmental agenda worldwide. The study developed the financial resource modeling framework under the pandemic recession, which earlier limited to assess the stated relationships for robust policy inferences. The real contribution of the study is to amalgamate the healthcare sustainability agenda with the environmental green growth agenda to stabilize the financial and resource market through green and cleaner policies.

Based on the above discussion, the study designed the following research objectives, i.e.

i) To determine the relationship between financial development, oil rents, and environmental degradation COVID-19 pandemic across countries

ii) Evaluate the “financial resource (oil) curse” hypothesis in a broad panel of selected countries

iii) To verify the hump-shaped relationship between financial development, environmental degradation, and oil resource rents in the time of COVID-19 pandemic across countries

iv) Analyze the inter-temporal (forecast) relationship between the stated variables

The study used a cross-sectional regression technique and the forecasting technique to achieve the study’s stated objectives.

Data sources and methodological framework

The study used the following variables to determine the relationship between financial development and oil rents during the COVID-19 pandemic in a cross-section of 81 countries. The domestic credit to the private sector as % of GDP was used as a proxy for financial development that served as a “response variable” of the study, whereas oil rents as % of GDP, COVID-19-registered cases, reported death cases, recovered cases, and total population served as regressors of the survey. The COVID-19 data and the total population is taken from Worldometer (2020, 29th June), whereas the data on financial development and oil rents taken from World Bank (2020) for ready reference. The qualitative assessment was used for understanding the role of economic growth and oil resources in environmental degradation in the time of the COVID-19 pandemic from the academician to give their valuable feedback in a particular situation. Table 2 shows the list of countries as a sample which is being used in the study for ready reference.
| Authors                  | Country                                | %Main factors                                                                 | Methodology      | Results                                                                                                                                                                                                 |
|-------------------------|----------------------------------------|-------------------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hilson et al. (2021)    | Three sub-Saharan Africa               | Artisanal and small-scale mining, socio-economic issues, and COVID-19         | Descriptive     | COVID-19 pandemic decreases small-scale mining activities and vastly increases social vulnerability                                                                                                        |
| Smith et al. (2021)     | South Africa                           | Tourism, protected areas, lockdown COVID-19 measures, etc.                    | Expressive       | Lockdown measures negatively affect international tourism and its revenue leading to an increase in its cost. Further, it increases healthcare issues and job insecurity, which affect the sustainability agenda |
| Fan et al. (2021)       | Asia                                   | Food challenges, supply chain, and COVID-19 pandemic                          | Descriptive     | COVID-19 pandemic affects the food supply chain in a region                                                                                                                                              |
| Alcántara-Ayala et al. (2021) | Global economies                   | Healthcare disasters and COVID-19                                            | Discussion      | COVID-19 increases healthcare risks and exposure to the virus, causing severe healthcare emergencies worldwide                                                                                        |
| Irfan et al. (2021)     | Four countries                         | COVID-19 cases, NO₂, PM₂.₅, waste                                           | Expressive       | COVID-19 decreases air pollution levels and waste recycling                                                                                                                                           |
| Morgan et al. (2021)    | Developing countries                   | COVID-19, environment, and economic impacts                                  | Expressive       | COVID-19 negatively influenced global income and sustainability indicators that need to be overcome by better waste management practices and commitment to mitigate environmental concerns across countries |
| Magazzino et al. (2021) | Brazil                                 | COVID-19 cases, renewable energy, and economic growth                        | Artificial neural networks | Renewable energy helps to increase economic output in the time of COVID-19                                                                                                                            |
| Sharif et al. (2020)    | USA                                    | COVID-19-infected cases, oil prices, stock price index, and geopolitical risk index | Wavelet approach | COVID-19 pandemic increases the country’s geopolitical risk, economic uncertainty, stock market volatility, and oil shocks                                                                          |
| Salisu et al. (2020)    | Ten countries                          | COVID-19 pandemic, oil prices, and stock market index                         | Panel VAR modeling technique | Oil prices and the stock market index are moving in the opposite direction                                                                                                                             |
| Aruna and Rajesh (2020) | India                                  | COVID-19 pandemic, oil price shocks, and stock returns                       | SVAR-X technique | Stock returns positively influenced by oil price shocks during the COVID-19 pandemic, while oil exports shock negatively influenced stock returns in the current pandemic |
| Mazur et al. (2020)     | USA                                    | COVID-19 pandemic and stock market index                                     | Trend analysis   | The resource market, real estate business, hospitality industry, and entertainment sector primarily drop their stock market index. In contrast, a positive stock return exhibited in the food sector, healthcare infrastructure, software houses, and the natural gas sector during the current pandemic |
| Topcu and Gulal (2020)  | 25 Asian and European countries        | COVID-19-infected peoples, oil price shocks, and exchange rates              | Panel regression | The current pandemic primarily harms oil price shocks and exchange rates in Asian countries while its lowest impact on the European countries by mid-April 2020                                           |
| Ashraf (2020a)          | 64 countries                           | COVID-19-infected and death cases and stock market returns                   | Panel regression | COVID-19-infected patients mainly decline the stock market returns as compared to the death cases                                                                                                         |
| Sansa (2020)            | China and the USA                      | COVID-19-confirmed cases and financial markets                              | Regression technique | A positive association found between COVID-confirmed cases and different financial markets during the first 25 days of March 2020                                                                                              |
| Ashraf (2020b)          | 77 countries                           | Social distancing, stock market returns, and COVID-confirmed cases          | Pooled regression | The economic measures to restrain coronavirus, including social distancing, negatively impact stock market returns. Simultaneously, there is an indirect positive impact between stock market returns and a substantial decline in the COVID-confirmed cases |
Theoretical framework

The economic impacts of the COVID-19 pandemic are limited to increasing human sufferings, while it damaged the natural flora and fauna of the globalized world. The healthcare signaling theory is proposed to develop the link between financial development, natural resources, environmental degradation, and the COVID-19 pandemic. The healthcare signaling theory argued that financial development is essential to restore the healthcare sustainability agenda through increasing sustainable financing opportunities in healthcare and commodity markets to create a balance between them. On the other hand, financial development is mainly affected by the global pandemic that emerges in recent years, leading to the global economy into depression. The lifecycle of the financial depression can be viewed in Figure 2.

The rise and fall in the financial development and commodity market are mainly evident during the wake of COVID-19 cases. Anser et al. (2021) argued that financial market activities mainly disrupted due to increased new coronavirus cases. In comparison, an increasing coronavirus testing capability helps restore financial activities, leading the globalized world out of financial depression. On the other hand, Smith (2020) argued that energy and natural resources also inflame due to strict measures adopted to contain coronavirus cases. Thus, it deteriorates energy resources, which need to sustain through taken sustainable measures.

The study is inspired by the scholarly work of Kassouri et al. (2020), Asif et al. (2020), and Dogan et al. (2020), as these studies confined their resulting findings in the context of financial development and natural resource abundance (including oil resources) in different economic settings. The study extended their concepts under the COVID-19 pandemic to analyze the financial resource (oil) curse hypothesis in an independent country panel. The following equation is used for empirical analysis in a given scenario, i.e.:

\[
\ln(FD)_{i,t} = \beta_0 + \beta_1(ORENTS)_{i,t} + \beta_2(SQORENTS)_{i,t} + \beta_3(TCASES)_{i,t} + \beta_4(TEATHS)_{i,t} + \beta_5 \ln(TRECOV)_{i,t} + \beta_6 \ln(TPOP)_{i,t} + \epsilon_{i,t}
\]

Equation (1) shows that oil rents and their square term have expected to follow the inverted U-shaped relationship with the financial development. Thus, it confirmed the “resource blessing” hypothesis in the early phase of financial development, while at a later stage, it will convert into the “resource curse” hypothesis. Further, it is expected that the COVID-19 pandemic negatively affects the financial development that leads to economies towards global depression. Finally, an increase in population growth will likely open new avenues of financial investment to support the international capital market. Figure 3 shows the research framework of the study.

Figure 3 shows that the COVID-19 pandemic has a multifaceted effect on the economy; on one side, the COVID-19 pandemic increases human suffering and increases death tolls, putting enormous pressure on healthcare infrastructure, which increases national healthcare bill. In contrast, it led to a decrease in the financial market and decreasing stock exchange index values below the threshold level, which goes to economies in a global depression. The high oil price volatility was found due to the economy’s tight strategic actions against controlling the coronavirus pandemic. As a result, there would be a negative relationship between oil rents, carbon emissions, and financial development during the COVIDI-19 pandemic. On the other hand, a positive relationship is expected between financial development and population growth, opening new avenues of financial investment in different traits to meet an enormous supply-demand gap.

The following research hypotheses have designed to analyze the nexus between oil rents and financial development during the COVID-19 pandemic, i.e.:
H1: It is likely to negatively impact oil rents and financial development mediated by carbon emissions to verify the financial resource curse hypothesis during the COVID-19 pandemic.

H2: The possible hump-shaped relationship expected between oil rents and financial development during the current pandemic.

H3: The direct relationship likely between population growth and financial development in the light of resource conservation across countries.

These hypotheses would be empirically checked by sophisticated statistical techniques, including robust least square (RLS) regression and innovation accounting matrix (IAM). The study used the M-estimation technique in the RLS regression technique to possibly reduce the error chances in the "response variable" that could be about possible outliers in the cross-sections. The IAM is the forecasting treatment on the studied variables encompassed through different variance shocks over the next period. The high volatility in the resource dynamics and financial market requires urgent attention to analyze its relationship under a dynamic framework. The COVID-19 pandemic also needs to assess in the intertemporal setting due to its negative impact on the financial and oil resource market. The sensitivity test is also applied to confirm the parameter estimates in different statistical operations.

Robust least square regression

The various numbers of robust regression techniques available include:

i) L-estimator that was based on the direct patterns of statistics order.

ii) R-estimators that is found to rank the stochastic term.

iii) M-estimators followed the residuals size and its magnitude to locate in the data set.

iv) GM-estimators, called generalized M-estimators, assign the reduced amount of weights to the high control points and point out the significant stochastic points.

v) S-estimators minimized the error term scale by reducing an M-estimates.

vi) MM-estimators combined the M- and S-estimator to obtain a high breakdown point with elevated asymptotic efficiency.

The classical linear regression estimator is affected by possible structural breaks in the data series of the candidate variables that affected its BLUE property. The robust least square (RLS) has a unique estimating technique that absorbs structural breaks via three methods. Huber (1973) presented the first type of RLS estimator, referred to as M-estimator (maximum likelihood estimator-like), designed to address the structural breaks in the stimulus variable. Although this method is unique in its present scenario, it lacks a problem addressing the possible structural breaks in the regressors. Rousseeuw and Yohai (1984) address this shortcomings address to propose another pragmatic estimator, referred to as S-estimator (scale statistic). The S-estimator is sensitive to the outliers that reported into the regressors. Finally, Yohai 1987 combined both the Huber estimator and Rousseeuw and Yohai estimator

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Table 2 Sample of countries

USA, Brazil, Russia, India, UK, Spain, Peru, Chile, Italy, Mexico, Pakistan, Turkey, Germany, France, South Africa, Bangladesh, Qatar, Colombia, China, Egypt, Belarus, Ecuador, Indonesia, Netherlands, UAE, Iraq, Kuwait, Ukraine, Oman, Philippines, Poland, Bolivia, Afghanistan, Romania, Nigeria, Kazakhstan, Japan, Austria, Guatemala, Ghana, Azerbaijan, Moldova, Serbia, Algeria, Cameroon, Morocco, Czechia, Malaysia, Uzbekistan, Australia, Tajikistan, Gabon, Kyrgyzstan, Bulgaria, Mauritania, Hungry, Greece, Thailand, Croatia, Albania, Madagascar, Equatorial Guinea, Estonia, Lithuania, Slovakia, Slovenia, New Zealand, Tunisia, Benin, Jordan, Niger, Georgia, Chad, Mozambique, Libya, Surinam, Vietnam, Guyana, Angola, Brunei, Trinidad and Tobago, Barbados

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Figure 2 Theoretical framework.
Source: Adapted from Anser et al. (2021) and Smith (2020).
to form a new, viable, and high magnitude estimator referred to as MM-estimator. This estimator starts working from S-estimator, moves to the M-estimation procedure, and completes its form to combine it with the MM-estimator, equally handling structural breaks from the entire represented model.

Results and discussion

Table 3 shows the descriptive statistics of the candidate variables for ready reference. The natural logarithm of COVID-19 pandemic, total population, and financial development offers the average value of 9.481 (COVID-registered cases), 5.792 (COVID death cases), 8.948 (COVID-recovered patients), 16.737 (total population), and 3.716 (financial development), respectively. The average value of oil rents is about 4.324% of GDP, with a maximum of 37.782%. The high dispersion in the oil rents can be seen in the respective table, where the standard deviation value reached 2.598% of GDP, higher than the rest of the candidate variables. Similarly, the given variable (ORENTS) peak is the highest among the rest of the variables, as the kurtosis value reached 9.583. Thus, the more significant standard deviation and the high peak distribution of the ORENTS confirmed the volatility in the resource market due to the COVID-19 pandemic.

Table 4 shows the RLS estimates and found the U-shaped relationship between oil rents and financial development during the COVID-19 pandemic. The result implies that an increase in oil rents initially decreases financial development to support the “financial resource (oil) curse” hypothesis. In contrast, at the later stage, it helps to increase the capital market and improves financial development that substantiates the “financial resource blessing” hypothesis. Many earlier studies confirmed the non-linear relationship between oil rents and financial resources during the current pandemic, for instance, Yildirim et al. (2020), Erdogan et al. (2020), Canh and Thong (2020), and Chebab et al. (2020). These studies confirmed the positive and negative impact of natural resources with different mediating variables on countries’ economic growth. The main factors include oil revenues, oil exports, financial development, and population growth.
COVID-recovered cases, TPOP shows total population, and TDEATHS shows total COVID death cases, TRECOV shows total COVID-registered cases, ORENT shows oil rents, TCASES shows total COVID-registered cases, and "LN" shows natural logarithm.

Table 4 Robust least square regression (M-estimator)

| Variables   | Coefficient | Std. error | z-Statistic | Prob. |
|-------------|-------------|------------|-------------|-------|
| ORENTS      | −0.065      | 0.028      | −2.255      | 0.024 |
| SQORENTS    | 0.002       | 0.001      | 1.702       | 0.088 |
| ln(TCASES)  | −0.516      | 0.233      | −2.177      | 0.026 |
| ln(TDEATHS) | −0.004      | 0.094      | −0.043      | 0.965 |
| ln(TRECOV)  | 0.648       | 0.205      | 3.161       | 0.001 |
| ln(TPOP)    | −0.062      | 0.072      | −0.862      | 0.388 |
| Constant    | 4.081       | 1.037      | 3.935       | 0.000 |

Robust statistics

R² 0.281 Adjusted R² 0.220
Rw²-squared 0.360 SIC 104.929
AIC 86.247 Scale 0.6298
Deviance 29.567 Prob(Rn²) 0.000
Rn² 27.431

Note: Dependent variable: ln(FD). FD shows financial development, ORENT shows oil rents, TCASES shows total COVID-registered cases, TDEATHS shows total COVID death cases, TRECOV shows total COVID-recovered cases, TPOP shows total population, and “LN” shows natural logarithm.

deepening, trade openness, and institutional quality. The high need for exploring more economic factors is pivotal for understanding the apparent relationship between the two stated variables. Therefore, the COVID-19 pandemic has important policy implications in forming a natural epidemic to access this nexus across the globe.

The negative impact of the COVID-19 pandemic on financial development is found when there is an increase in COVID-19-registered cases across the globe. The elasticity estimate shows that if there is a 1% increase in the total reported cases, financial development decreases by −0.526 percentage points. Thus, almost 53% of financial development reduces worldwide due to the current pandemic. It required financial support policies in expansionary fiscal and monetary stimulus to support the capital market and foreign investors to recover their investment and reaping economic profit. Further, it carried forward for more investment at a global scale. The financial market will stabilize over time because of an increase in the total number of recovered cases. The elasticity estimate shows that if there is a 1% increase in total recovered cases, financial development increases by 0.648 percentage points. Almost 65% of the capital market retrieved due to a substantial decline in the coronavirus-registered cases and increased recovered patients across countries. The results linked with the earlier studies of Huo and Qiu (2020), Al-Awadhi et al. (2020), Lahmiri and Bekiros (2020), and Salisu and Vo (2020). These studies confirmed that stock prices were affected mainly by the current pandemic through specific tight economic measures adopted by the economies to contain coronavirus (Huo and Qiu 2020). The higher number of fatalities and infected cases by coronavirus put negative pressure on the capital market, showing low stock returns across countries (Al-Awadhi et al. 2020). The significant volatility exhibit under the cryptocurrency markets leads the capital market to unstable over time (Lahmiri and Bekiros 2020). On the other hand, the healthcare-related recovery of the patient’s news from the COVID-19 pandemic mainly improves the stock market return (Salisu and Vo 2020). Thus, these factors lead to a much conclusive policy that embarks on sustained economic and financial development.

Table 5 shows the sensitivity test by seemingly unrelated regression (SUR) modeling and confirmed that the given estimates of RLS regression are correct and unbiased. Furthermore, the results of SUR modeling validate the RLS estimates with improve coefficient values.

Table 6 shows the impulse response function (IRF) estimates and found that the COVID-19 pandemic will be negatively influenced by the financial development that leads to the “financial resource (oil) curse” hypothesis. In contrast, the total population will positively impact financial development in the next coming years.

Table 7 shows the variance decomposition analysis (VDA) and found that oil rents will likely significantly influence the financial development with a variance error shock of 2.508% till next October 2021. This was followed by total recovered cases, death cases, total population, and total recovered cases with variance error shocks of 1.234%, 0.876%, 0.773%, and 0.333%, respectively.


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Qualitative assessment for financial development, environmental degradation, natural resources, and COVID-19 pandemic

The second part of the study is to get feedback from the academician about the role of financial development and natural resources on air quality level during a pandemic recession. Table 8 shows the academic response to the questions for ready reference.

The academic response opens a new avenue of thoughts for the policymakers to reconsider their economic policies and formulate resource-based policies that linked it with financial development, healthcare policies, and pro-environmental behavior. The results are in line with the earlier studies; for instance, Ahmed and Jahanzeb (2020) argued that financial development played an important role in increasing the technology innovation and environmentally sustainable technologies that help achieve sustainable development agenda. Ahmed and Bhattacharya (2020) concluded that energy transition from non-renewable to renewable fuels help to mitigate carbon emissions and improve the global green growth agenda. Ahmed (2017) found that financial development helps to achieve energy efficiency, leading to improve global trade and economic production. Ahmed et al. (2016) concluded that urbanization is the detrimental factor that obstructs the green growth agenda via increasing carbon emissions. Ahmed and Ozturk (2018) suggested that sustainable technologies help to improve energy resources, shifting from non-renewable fuels to renewable fuels, which is imperative for green growth. Ahmed and Ahmed (2018) provoked the need to impose stringent environmental policies to improve air quality. Ahmed et al. (2016) concluded that renewable energy is the optimized solution to move forward towards green development. These studies provide several solutions

| Table 6 | IRF estimates |
|---------|--------------|
| Response of ln(FD) |
| Months | GEUH(FD) | ln(TCASES) | ln(TDEATHS) | ln(TPOP) | ln(TRECOV) | ORENTS |
| February 2021 | 0.0388 | 0.0139 | 0.0119 | −0.0121 | 0.0239 | 0.0064 |
| March 2021 | 0.0140 | 0.0034 | −0.0108 | −0.0098 | 0.0023 | 0.0163 |
| April 2021 | −0.0050 | 0.0070 | −0.0017 | 0.0003 | −0.0002 | 0.0027 |
| May 2021 | −0.0012 | 0.0068 | −0.0005 | −0.0003 | 0.0006 | 0.0012 |
| June 2021 | −0.0014 | 0.0070 | 8.43E-05 | −0.0001 | 0.0007 | 0.0001 |
| July 2021 | −0.0012 | 0.0069 | 9.18E-05 | −0.0002 | 0.0007 | 9.76E-05 |
| August 2021 | −0.0012 | 0.0068 | 0.0001 | −0.0002 | 0.0007 | 5.47E-05 |
| September 2021 | −0.0012 | 0.0067 | 9.89E-05 | −0.0002 | 0.0007 | 5.67E-05 |
| October 2021 | −0.0012 | 0.0066 | 9.82E-05 | −0.0002 | 0.0007 | 5.45E-05 |

Note: FD shows financial development, ORENT shows oil rents, TCASES shows total COVID-registered cases, TDEATHS shows total COVID death cases, TRECOV shows total COVID-recovered cases, TPOP shows total population, and “LN” shows natural logarithm

| Table 7 | VDA estimates |
|---------|--------------|
| Variance decomposition of ln(FD) |
| Months | S.E. | Ln(FD) | ln(TCASES) | ln(TDEATHS) | ln(TPOP) | ln(TRECOV) | ORENTS |
| February 2021 | 0.8383 | 97.9103 | 0.2779 | 0.1431 | 0.5484 | 1.0952 | 0.0249 |
| March 2021 | 0.8579 | 95.5126 | 0.2692 | 0.6054 | 0.6161 | 1.1483 | 1.8482 |
| April 2021 | 0.8623 | 94.8968 | 0.2805 | 0.8536 | 0.7559 | 1.1444 | 2.0685 |
| May 2021 | 0.8647 | 94.4299 | 0.3071 | 0.8753 | 0.7541 | 1.1403 | 2.4930 |
| June 2021 | 0.8653 | 94.3427 | 0.3069 | 0.8760 | 0.7569 | 1.2249 | 2.4924 |
| July 2021 | 0.8655 | 94.3085 | 0.3069 | 0.8758 | 0.7728 | 1.2281 | 2.5075 |
| August 2021 | 0.8657 | 94.2938 | 0.3152 | 0.8766 | 0.7729 | 1.2332 | 2.5078 |
| September 2021 | 0.8657 | 94.2851 | 0.3225 | 0.8767 | 0.7738 | 1.2333 | 2.5082 |
| October 2021 | 0.8658 | 94.2734 | 0.3330 | 0.8769 | 0.7736 | 1.2345 | 2.5082 |

Note: FD shows financial development, ORENT shows oil rents, TCASES shows total COVID-registered cases, TDEATHS shows total COVID death cases, TRECOV shows total COVID-recovered cases, TPOP shows total population, and “LN” shows natural logarithm
to mitigate carbon emissions through sustainable financing instruments.

### Conclusions and policy implications

The current pandemic seizes all economic and financial activities, and the world is struggling hard to escape from the pandemic with unified economic policies. The financial distress and volatility in commodity prices are the common symptoms that largely exacerbate during the COVID-19 pandemic. The unprecedented oil price shocks lead the world economies to global financial depression. In a given circumstance, the study analyzed the role of oil resource rents in financial development to observe the devastating effects of the coronavirus pandemic in a panel of 81 selected countries. The results substantiate the “financial resource (oil) curse” hypothesis in the early phase of COVID-19 cases. In contrast, when economic activities begin to resume later, oil resource rents support the financial market. The increased number of coronavirus-registered cases decreases financial activities, while its intensity is comparatively less than the increase in financial

### Table 8 Questions asked for environmental protection in the time of COVID-19

| Items | Statements | Response |
|-------|------------|----------|
| Q.1.  | Does financial development increase carbon emissions during the pandemic recession? | Financial development causes a greater deterioration of environmental quality by increasing carbon emissions via the channel of unsustainable financial activities, which are merely flamed by irresponsible consumption and production. For example, during the COVID-19 pandemic, carbon emissions substantially decrease because of no economic and financial activities. However, it increases tremendously when economic activities begin to resume. Thus, we may conclude that financial development should promote sustainable financing opportunities in healthcare infrastructure to minimize the spread of COVID-19 cases and subsequently decreases carbon emissions globally. |
| Q.2.  | Does the conservation of natural resources support the environmental sustainability agenda? | Natural resource management is pivotal for progressing towards green growth development. However, in many parts of the world, natural resources negatively affect the country’s economic growth to support the “resource curse” hypothesis, leading to a deteriorating natural environment. On the other hand, natural resources conservation supports the country’s economic resources while utilizing natural resources for productive purposes. Thus, the process of industrialization transformation begins to resume towards broad-based growth. |
| Q.3.  | Does oil resource rents help to promote financial activities? | The extraction of oil resources and their efficient utilization would help speed up financial activities that achieve economic prosperity. |
| Q.4.  | Do economic and financial activities cause a second wave of the COVID-19 cases globally? | Socialization and commercialization are the key factors that likely cause the second wave of COVID-19 cases. The high level of economic and financial activities led them close to the economic agents to get involved in buying and selling goods. The unstandardized procedures and avoiding COVID-19 prevention SOPs increase the number of newly infected cases globally, needing careful monitoring of economic activities to avoid coronavirus cases. |
| Q.5.  | Does the financial resource curse hypothesis exist under a pandemic crisis? | The pandemic crisis begins to decline economic and financial activities. At the same time, it also affected the commodity market in the form of volatility in the commodity prices, which ultimately negatively affected financial activities to confirm the “financial resource curse” hypothesis globally. |
activities due to increased recovered patients across countries. Environmental degradation is viewed mainly because of resuming high economic and financial activities, which is likely a cause of the possible emergence of the second wave of COVID-19 pandemic. The inter-temporal relationship shows that the COVID-19 pandemic is likely to cause more deterioration in financial activities in coming years. The dire need for unified economic policies is vital to restraining the coronavirus pandemic, ultimately supporting oil resources and financial development.

The financial sector should need to initiate green financing opportunities in healthcare infrastructure to minimize its negative environmental externalities globally. The stability in the oil prices is vital as the outbreak of COVID-19 severely drops down the demand for oil products that ultimately affected the global oil and gas sector. The need for building a digital value chain would be helpful to restore oil prices and demand for oil products accordingly. The hostile oil prices are considered a threat towards cleaner production advancement, as cheap energy prices give the industries incentives to use fossil fuel energy, increasing air pollution, leading to green energy projects. Although it is understood that the COVID-19 pandemic will vanish, after all, the low vision of using non-greening fuels will subside. The world would have the only solution to greening fuels to improve the air quality index in the long run. There is a high need to support renewable energy sources through green financing opportunities, which would enhance the sustainable environmental agenda (Qureshi et al. 2016; Khan et al. 2016). The economies need to announce some excellent bailout packages to the investors and expand fiscal policies to support the private sector suffering mainly from the current pandemic. The financial industry needs the easy monetary instruments to resolve given financial crisis through expanded asset purchase programs, sale and purchase of government securities, and asset liquidity provision. The need to balance corporate liquidity and its production cost would require sound economic policies to settle the financial crisis. The following policy implications are proposed to achieve healthcare sustainability across countries, i.e.:

i) Financial depression can be reduced by adopting standardize operating procedures to contain the coronavirus disease.

ii) The higher recovery cases give confidence to the financial investors to adopt a strict compliance of governments’ actions to contain coronavirus by adopting strict measures during their buying and selling process.

iii) Maintaining the social distances among the economic agents and the general public helps to reduce the coronavirus cases, leading to capitalize on financial and resource markets to achieve healthcare sustainability.

iv) The cost of carbon emissions may negatively affect the healthcare sustainability agenda, which clean and green policies can reduce.

v) The environmental and healthcare policies would be designed to reduced coronavirus cases, leading to support financial development and resource market efficiently.

The study followed the systematic procedure to assemble all the facts of the stated issues. It linked with the COVID-19 pandemic, enabling policymakers to devise healthcare sustainability policies to contain coronavirus and improve the financial and resource market. The study’s primary aim to devise a long-term resource conservation framework linked with healthcare sustainability. In comparison, it required a multilevel governance framework to involve all stakeholders in the green development project to attain economic profit (Awan 2020a). Based on the realization of environmental sustainability, a higher need to focus on the social sustainability agenda is pivotal for long-term sustainable policies (Awan et al. 2020a, b). In addition, technology innovation helps to improve environmental quality and sustainable growth (Cheng et al. 2021). These factors are likely to add to future research, where healthcare sustainability can be achieved through supporting governance framework, social sustainability, and technology innovations.

There is a high time to resolve our global border issues and unite to resettle geographical conflicts, political disputes, civil unrest, healthcare issues, and financial crisis. Thus, through collaboration and coordination, the world can move forward with strategic wisdom in the current pandemic.

Availability of data and materials The data is freely available at Worldometer (2020) at https://www.worldometers.info/coronavirus/ and World Development Indicators published by World Bank (2020) at https://databank.worldbank.org/source/world-development-indicators.

Author contribution MKA: Conceptualization, methodology, and writing-reviewing and editing. MAK: Software and formal analysis. KZ: Software, formal analysis, and resources. AAN: Supervision, resources, and software. SEA: Formal analysis and resources. MMQA: Resources, visualization, and formal analysis. AK: Data curation and validation.

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Declarations

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References

Ahmed K (2016) The sheer scale of China’s urban renewal and CO 2 emissions: multiple structural breaks, long-run relationship, and short-run dynamics. Environ Sci Pollut Res 23(16):16115–16126

Ahmed K (2017) Revisiting the role of financial development for energy-growth-trade nexus in BRICS economies. Energy 128:487–495

Ahmed K, Ahmed S (2018) A predictive analysis of CO 2 emissions, environmental policy stringency, and economic growth in China. Environ Sci Pollut Res 25(16):16091–16100

Ahmed K, Bhattacharya M (2020) Towards a sustainable development: the role of energy and institutions in combating CO 2 emissions for the ASEAN-8. In: Awaworyi CS (ed) Moving from the millennium to the sustainable development goals. Palgrave Macmillan, Singapore. https://doi.org/10.1007/978-981-15-1556-9_10

Ahmed K, Jahanzeb A (2020) Does financial development spur environmental and energy-related innovation in Brazil? Int J Financ Econ 26:1706–1723. https://doi.org/10.1002/ijfe.1873

Ahmed K, Ozturk I (2018) What new technology means for the energy demand in China? A sustainable development perspective. Environ Sci Pollut Res 25(29):29766–29771

Ahmed K, Bhattacharya M, Quzi AQ, Long W (2016) Energy consumption in China and underlying factors in a changing landscape: empirical evidence since the reform period. Renew Sust Energ Rev 58:224–234

Ajami R (2020) Globalization, the challenge of COVID-19 and oil price uncertainty. J Asia Pac Bus 21:77–79. https://doi.org/10.1080/10599231.2020.1745046

Akhtanuzzaman M, Moubaker S, Sensoy A (2020) Financial contagion during COVID–19 crisis. Financ Res Lett 38:101604. https://doi.org/10.1016/j.frl.2020.101604

Al-Awadhi AM, Al-Saifi K, Al-Awadhi A, Alhamadi S (2020) Death and contagious infectious diseases: impact of the COVID-19 virus on stock market returns. J Behav Exp Finance 27:100026

Alcántara-Ayala I, Burton I, Lavell A, Mansilla E, Maskrey A, Oliver-Smith A, Ramírez-Gómez F (2021) Root causes and policy dilemmas of the COVID-19 pandemic global disaster. International Journal of Disaster Risk Reduction 52:101892

Alhawari O, Awan U, Bhutta MKS, Ülkü MA (2021) Insights from circular economy literature: a review of extant definitions and unravelling paths to future research. Sustainability 13(2):859. https://doi.org/10.3390/su13020859

Anser MK, Khan MA, Awan U, Batool R, Zaman K, Imran M, Sasmoko, Indrianti Y, Khan A, Bakar ZA (2020) The role of technological innovation in a dynamic model of the environmental supply chain curve: evidence from a panel of 102 countries. Processes 8(9):1033. https://doi.org/10.3390/pr8090103

Anser MK, Khan MA, Zaman K, Nassani AA, Askar SE, Abro MMQ, Kabbani A (2021) Financial development during COVID-19 pandemic: the role of coronavirus testing and functional labs. Financial Innovation 7(1):1–13

Aruna M, Rajesh AH (2020) Impact of COVID 19 virus cases and sources of oil price shock on Indian stock returns. Structural VAR approach. IAEE Energy Forum 20(1):68–70

Asfah BN (2020a) Stock markets’ reaction to COVID-19: cases or fatalities? Res Int Bus Financ 54:101249

Asfah BN (2020b) Economic impact of government interventions during the COVID-19 pandemic: international evidence from financial markets. J Behav Exp Finance 27:100371

Asif M, Khan KB, Anser MK, Nassani AA, Abro MMQ, Zaman K (2020) Dynamic interaction between financial development and natural resources: evaluating the ‘resource curse’ hypothesis. Res Policy 65:101566

Awan U (2020a) Industrial ecology in support of sustainable development goals. In: Leal Filho W, Azul A, Brandli L, Lange Salvia A, Wall T (eds) Industry, innovation and infrastructure. Encyclopedia of the UN Sustainable Development Goals. https://doi.org/10.1007/978-3-319-95726-5_18

Awan U (2020b) Steering for sustainable development goals: a typology of sustainable innovation. In: Leal Filho W, Azul A, Brandli L, Lange Salvia A, Wall T (eds) Industry, innovation and infrastructure. Encyclopedia of the UN Sustainable Development Goals. https://doi.org/10.1007/978-3-319-71059-4_64-1

Awan U, Kraslawski A, Huiskonen J (2020a) Progress from blue to the green world: multilevel governance for pollution prevention planning and sustainability. In: Hussain C (ed) Handbook of environmental materials management. Springer, Cham

Awan U, Kraslawski A, Huiskonen J, Suleman N (2020b) Exploring the locus of social sustainability implementation: a South Asian perspective on planning for sustainable development. In: Leal Filho W, Tortato U, Frankenberger F (eds) Universities and sustainable communities: meeting the goals of the agenda 2030. World Sustainability Series. Springer, Cham. https://doi.org/10.1007/978-3-030-30306-8_5

Awan U, Sroufe R, Shahbaz M (2021a) Industry 4.0 and the circular economy: a literature review and recommendations for future research. Bus Strateg Environ 30(4):2038–2060

Awan U, Nauman S, Sroufe R (2021b) Exploring the effect of buyer engagement on green product innovation: empirical evidence from manufacturers. Bus Strateg Environ 30(1):467–477

Awan U, Arnold MG, Gölgenci I (2021c) Enhancing green product and process innovation: towards an integrative framework of knowledge acquisition and environmental investment. Bus Strateg Environ 30(2):1283–1295

Badeea RA, Lean IH, Clark J (2017) The evolution of the natural resource curse thesis: a critical literature survey. Res Policy 51:123–134

Baker SR, Bloom N, Davis SJ, Kost KJ, Sammon MC, Viratyosin T (2020) The unprecedented stock market impact of COVID-19 (No. w26945). National Bureau of Economic Research

Baloch MA, Ozturk I, Bekun FV, Khan D (2021) Modeling the dynamic linkage between financial development, energy innovation, and environmental quality: Does globalization matter? Bus Strateg Environ 30(1):176–184

Boschini AD, Pettersson J, Roine J (2007) Resource curse or not: a question of appropriability. Scand J Econ 109(3):593–617

Canh NP, Thong NT (2020) Nexus between financialisation and natural resources rents: empirical evidence in a global sample. Res Policy 66:101590

Chebab D, Mazlan NS, Ngah WSW, Chin L (2020) Is finance-growth nexus linear in selected countries of Middle East and Northern Africa? J Econ Integr 35(2):326–352

Cheng Y, Awan U, Ahmad S, Tan Z (2021) How do technological innovation and fiscal decentralization affect the environment? A story of the fourth industrial revolution and sustainable growth. Technol Forecast Soc Chang 162:120398

Dogan E, Altinöz B, Tzeremes P (2020) The analysis of ‘financial resource curse’ hypothesis for developed countries: evidence from asymmetric effects with quantile regression. Res Policy 68:101773

Erdog˘an S, Yıldırım DC, Gedikli A (2020) Natural resource abundance, financial development and economic growth: an investigation on Next-11 countries. Res Policy 65:101559

Fan S, Teng P, Chew P, Smith G, Copeland L (2021) Food system resilience and COVID-19—lessons from the Asian experience. Global Food Security 28:100501

Gazdar K, Hassan MK, Sfaa MF, Grassa R (2019) Oil price volatility, Islamic financial development and economic growth in Gulf Cooperation Council (GCC) countries. Borsa Istanbul Rev 19(3):197–206

Godil DI, Sharif A, Ali MI, Ozturk I, Usman R (2021) The role of financial development, R&D expenditure, globalization and...
institutional quality in energy consumption in India: new evidence from the QARDL approach. J Environ Manag 285:112208
Goodell JW (2020) COVID-19 and finance: agendas for future research. Financ Res Lett 35:101512
Guan J, Kirikkaleli D, Bibi A, Zhang W (2020) Natural resources rents nexus with financial development in the presence of globalization: is the “resource curse” exist or myth? Res Policy 66:101641
Hilson G, Van Bockstael S, Sauerwein T, Hilson A, McQuilken J (2021) Artisanal and small-scale mining, and COVID-19 in sub-Saharan Africa: a preliminary analysis. World Dev 139:105315
Huber PJ (1973) Robust regression: asymptotics, conjectures and Monte Carlo. Ann Stat 1(5):799–821
Ho X, Qiu Z (2020) How does China’s stock market react to the announcement of the COVID-19 pandemic lockdown? Economic and Political Studies 8(4):436–461
Irfan M, Ahmad M, Faried Z, Iqbal N, Sharif A, Wu H (2021) On the indirect environmental outcomes of COVID-19: short-term revival with futuristic long-term considerations: an application. Int J Environ Health Res 1–11. https://doi.org/10.1080/09603123.2021.1874888
Ji Q, Zhang D (2019) How much does financial development contribute to renewable energy growth and upgrading of energy structure in China? Energy Policy 128:114–124
Kassouri Y, Altuntas H, Bilgili F (2020) An investigation of the financial resource curse hypothesis in oil-exporting countries: the threshold effect of democratic accountability. J Multinatl Financ Manag 56:100639. https://doi.org/10.1016/j.mulfin.2020.100639
Khan MM, Zaman K, Irfan D, Awan U, Ali G, Kyophilavong P, Shahbaz M, Naseem I (2016) Triangular relationship among energy consumption, air pollution and water resources in Pakistan. J Clean Prod 112:1375–1385
Khan MA, Khan MA, Abdulahi ME, Liaqat I, Shah SS (2019) Institutional quality and financial development: the United States perspective. J Multinatl Financ Manag 49:67–80
Khan Z, Hussain M, Shahbaz M, Yang S, Jiao Z (2020) Natural resource abundance, technological innovation, and human capital nexus with financial development: a case study of China. Res Policy 65:101585
Korte M (2013) A curse or a blessing? Natural resources in a multiple growth regimes analysis. Appl Econ 45(26):3760–3769
Kooondhar MA, Shahbaz M, Ozturk I, Randhawa AA, Kong R (2021) Revisiting the relationship between carbon emission, renewable energy consumption, forestry, and agricultural financial development for China. Environ Sci Pollut Res. https://doi.org/10.1007/s11356-021-13606-1
Lahmini S, Bekiros S (2020) The impact of COVID-19 pandemic upon stability and sequential irregularity of equity and cryptocurrency markets. Chaos, Solitons Fractals 138:109936
Magazzino C, Mele M, Morelli G (2021) The relationship between renewable energy and economic growth in a time of Covid-19: a machine learning experiment on the Brazilian economy. Sustainability 13(3):1285. https://doi.org/10.3390/su13031285
Malik MA, Masood T, Ozturk I (2020) Identifying structural breaks and growth regimes in middle eastern economies. Int J Financ Econ. https://doi.org/10.1002/ijfe.2148
Masson R, Winter J (2020) Energy and environmental policy trends: addressing the threat of COVID-19 and the oil price war in the petroleum sector. The School of Public Policy Publications 13:1–2
Mazur M, Dang M, Vega M (2020) COVID-19 and the March 2020 stock market crash. Evidence from S&P500. Financ Res Lett 38:101690. https://doi.org/10.1016/j.frl.2020.101690
Morgan AK, Awatu BA, Quartyee T (2021) The effects of COVID-19 on global economic output and sustainability: evidence from around the world and lessons for redress. Sustainability: Science, Practice and Policy 17(1):77–81
Murad MW, Alam MM, Noman AHM, Ozturk I (2019) Dynamics of technological innovation, energy consumption, energy price and economic growth in Denmark. Environ Prog Sustain Energy 38(1):22–29
Murshed SM, Serino LA (2011) The pattern of specialization and economic growth: The resource curse hypothesis revisited. Struct Chang Econ Dyn 22(2):151–161
Narayan PK (2020) Oil price news and COVID-19—is there any connection? Energy Research Letters 1(1):1376
Nawaz K, Lahiani A, Roubaud D (2019) Natural resources as blessings and finance-growth nexus: a bootstrap ARDL approach in an emerging economy. Res Policy 60:277–287
Ndjokou IMMM, Tsopmo PC (2017) The effects on economic growth of natural resources in Sub-Saharan Africa: does the quality of institutions matters? Econ Bull 37(1):248–263
Osaghae EE (2015) Resource curse or resource blessing: the case of the Niger Delta ‘oil republic’ in Nigeria. Commonwealth & Comparative Politics 53(2):109–129
Ozcan B, Ozturk I (2019) Renewable energy consumption-economic growth nexus in emerging countries: a bootstrap panel causality test. Renew Sust Energ Rev 104:30–37
Papyrakis E, Gerlagh R (2004) The resource curse hypothesis and its transmission channels. J Comp Econ 32(1):181–193
Qureshi MI, Awan U, Arshad Z, Rasli AM, Zaman K, Khan F (2016) Dynamic linkages among energy consumption, air pollution, greenhouse gas emissions and agricultural production in Pakistan: sustainable agriculture key to policy success. Nat Hazards 84(1):367–381
Rehman A, Ma H, Chishti MZ, Ozturk I, Irfan M, Ahmad M (2021) Asymmetric investigation to track the effect of urbanization, energy utilization, fossil fuel energy and CO2 emission on economic efficiency in China: another outlook. Environ Sci Pollut Res 28(14):17319–17330
Rousseuw PJ, Yohai VJ (1984) Robust regression by means of S-estimators, in Robust and nonlinear time series. In: Franke J, Härdle W, Martin D (eds) Lecture Notes in Statistics No. 26, Berlin, Springer-Verlag
Salahuddin M, Alam K, Ozturk I, Sohag K (2018) The effects of electricity consumption, economic growth, financial development and foreign direct investment on CO2 emissions in Kuwait. Renew Sust Energ Rev 81:2002–2010
Salisu AA, Vo XV (2020) Predicting stock returns in the presence of COVID-19 pandemic: the role of health news. Int Rev Financ Anal 71:101546
Salisu AA, Ebusu GU, Usman N (2020) Revisiting oil-stock nexus during COVID-19 pandemic: Some preliminary results. Int Rev Econ Financ 69:280–294
Sansa NA (2020) The impact of the COVID-19 on the financial markets: evidence from China and USA. Electronic Research Journal of Social Sciences and Humanities 2(2):29–39
Satti SL, Farooq A, Loganathan N, Shahbaz M (2014) Empirical evidence on the resource curse hypothesis in oil abundant economy. Econ Model 42:421–429
Shahbaz M, Ahmed K, Tiwari AK, Jiao Z (2019) Resource curse hypothesis and role of oil prices in USA. Res Policy 64:101514
Sharif A, Aloui C, Yarovaya L (2020) COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the U.S. economy: fresh evidence from the wavelet-based approach. Int Rev Financ Anal 70:101496
Smith DC (2020) COVID-19 and the energy and natural resources sectors: little room for error. Journal of Energy & Natural Resources Law 38(2):125–129. https://doi.org/10.1080/02646811.2020.1747171
Smith MKS, Smit IP, Swemmer LK, Mokhatla MM, Freitag S, Roux DJ, Dziba L (2021) Sustainability of protected areas: vulnerabilities and opportunities as revealed by COVID-19 in a national park management agency. Biol Conserv 255:108985
Tiba S (2019) Exploring the nexus between oil availability and economic growth: insights from the non-linear model. Environ Model Assess 24(6):691–702
Tiba S, Frikha M (2019) The controversy of the resource curse and the environment in the SDGs background: the African context. Res Policy 62:437–452
Topcu M, Gulal OS (2020) The impact of COVID-19 on emerging stock markets. Financ Res Lett 36:101691. https://doi.org/10.1016/j.frl.2020.101691
Van der Ploeg F (2011) Natural resources: curse or blessing? J Econ Lit 49(2):366–420
Wei H, Rizvi SKA, Ahmad F, Zhang Y (2020) Resource cursed or resource blessed? The role of investment and energy prices in G7 countries. Res Policy 67:101663
World Bank (2020) World development indicators. World Bank, Washington D.C
Worldometer (2020). COVID-19: coronavirus pandemic. Online available at https://www.worldometers.info/coronavirus/ (accessed on 29th June 2020).
Xu H, Jilenga MT, Deng Y (2019) Institutional quality, resource endowment, and economic growth: evidence from cross-country data. Emerg Mark Financ Trade 55(8):1754–1775
Yıldırım S, Gedikli A, Erdoğan S, Yıldırım DC (2020) Natural resources rents-financial development nexus: evidence from sixteen developing countries. Res Policy 68:101705
Yohai VJ (1987) High breakdown-point and high efficiency robust estimates for regression. Ann Stat 15(2):642–656
Zaidi SAH, Wei Z, Gedikli A, Zafar MW, Hou F, Iftikhar Y (2019) The impact of globalization, natural resources abundance, and human capital on financial development: evidence from thirty-one OECD countries. Res Policy 64:101476
Zallé O (2019) Natural resources and economic growth in Africa: the role of institutional quality and human capital. Res Policy 62:616–624
Zhang D, Hu M, Ji Q (2020) Financial markets under the global pandemic of COVID-19. Financ Res Lett 36:101528. https://doi.org/10.1016/j.frl.2020.101528
Zubikova A (2018) Curse or blessing: economic growth and natural resources (Comparison of the Development of Botswana, Canada, Nigeria and Norway in the Early 21st Century). Agricultural and resource economics: international scientific e-journal 4(1):20–41

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