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 up-gradation.

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 non-linear relationship between income and natural resources is widely found in the earlier literature, for instance, Koondhar 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 (Erdoğan 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.

Figure 1 Financial development and natural resources outcomes: **a** resource curse, **b** resource endowment, **c** monotonic decreasing, **d** monotonic increasing, and **e** inverted U and U-shaped relationship. Source: Author's extraction based on earlier studies.

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 academicians 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.

Table 1 Literature review of financial development, natural resources, and environmental degradation during COVID-19 pandemic

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 approach	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, NO ₂ , PM _{2.5} , waste	Expressive approach	COVID-19 decreases air pollution levels and waste recycling
Morgan et al. (2021)	Developing countries	COVID-19, environment, and economic impacts	Expressive approach	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-infected cases and financial markets	Regression technique	A positive association found between COVID-19-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.:

$$\ln(FD)_{i,t} = \beta_0 + \beta_1(ORENTS)_{i,t} + \beta_2(SQORENTS)_{i,t} + \beta_3 \ln(TCASES)_{i,t} + \beta_4 \ln(TDEATHS)_{i,t} + \beta_5 \ln(TRECOV)_{i,t} + \beta_6 \ln(TPOP)_{i,t} + \varepsilon_{i,t}$$

$$\therefore \frac{\partial \ln(FD)}{\partial \ln(ORENTS)} > 0, \frac{\partial \ln(FD)}{\partial \ln(SQORENTS)} < 0, \frac{\partial \ln(FD)}{\partial \ln(TCASES)} < 0, \frac{\partial \ln(FD)}{\partial \ln(TDEATHS)} < 0, \frac{\partial \ln(FD)}{\partial \ln(TRECOV)} > 0, \frac{\partial \ln(FD)}{\partial \ln(TPOP)} > 0$$

where FD represents financial development, ORENTS represents oil rents, SQORENTS represent the square of ORENTS, TCASES represent COVID-19 total registered cases, TDEATHS represent COVID-19 total death cases, TRECOV represents COVID-19 total recovered cases, TPOP represents total population, “ln” represents natural logarithm, “i” represents 81 countries, “t” represents time period, and ε represents error term.

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 COVID-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.:

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, Hungary, 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

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 inter-temporal 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

Figure 2 Theoretical framework. Source: Adapted from Anser et al. (2021) and Smith (2020).

Figure 3 Research framework of the study. Source: Author's extraction.

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, Yıldırım et al. (2020), Erdoğan 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

Table 3 Descriptive statistics

Methods	ln(FD)	ORENTS	ln(TCASES)	ln(TDEATHS)	ln(TRECOV)	ln(TPOP)
Mean	3.716	4.324	9.481	5.792	8.948	16.737
Maximum	5.188	37.782	14.78	11.763	13.904	21.087
Minimum	1.202	9.49E-05	4.574	1.098	4.394	12.568
Std. dev.	0.818	8.514	2.222	2.435	2.225	1.695
Skewness	-0.374	2.598	-0.012	0.293	-0.018	0.065
Kurtosis	2.889	9.583	2.535	2.438	2.471	3.129

Source: Worldometer (2020) and World Bank (2020). 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 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	−2.217	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				
R ²	0.281	Adjusted R ²	0.220	
Rw ² -squared	0.360	SIC	104.929	
AIC	86.247	Scale	0.6298	
Deviance	29.567	Prob(Rn ²)	0.000	
Rn ²	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.

Table 5 Sensitivity test—seemingly unrelated regression (SUR) estimates

Variables	Coefficient	Std. error	t-Statistic	Prob.
Constant	4.222	0.990	4.265	0.000
ORENTS	−0.055	0.027	−2.004	0.048
SQORENTS	0.001	0.0008	1.409	0.163
ln(TCASES)	−0.597	0.222	−2.686	0.009
ln(TDEATHS)	0.027	0.090	0.300	0.764
ln(TRECOV)	0.700	0.195	3.576	0.000
ln(TPOP)	−0.067	0.069	−0.977	0.331
Statistical tests				
R ²	0.288			
Adjusted R ²	0.227			
S.E. of regression	0.719			
Durbin-Watson stat	2.052			

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

Table 6 IRF estimates

Months	Response of ln(FD)					
	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

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 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

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 a cause of 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

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

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 it 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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