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Does the COVID-19 pandemic affect the tourism industry in China? Evidence from extreme quantiles approach

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ABSTRACT

The tourism industry carries great significance in the economic development of any country. It has been observed that the COVID-19 crisis has affected global travel and tourism more than any other sector globally as well as in China. The travel restrictions, home isolation, and quarantine orders have given massive damage to China's once thriving tourism industry. Despite this phenomenal impact, the existing literature has a dearth of empirical studies related to the impact of the COVID-19 pandemic on the tourism industry. This study attempts to reflect a thorough picture of the current scenario and the crisis effects under different intensities reflected through quantiles of Covid-19 related deaths. The study has utilized the QARDL model and the Wald test on the daily time series data of COVID-19 intensity, the real effective exchange rate, oil prices, and the tourism development index from January 1, 2020, to March 15, 2021. The outcomes indicate that COVID-19 related deaths have a negative, but significant impact on China's tourism in the long run and short run. The oil prices also show a negative influence on tourism in the long run, but there is no significant impact of the oil prices on tourism in the short run. At the same time, the increase in the real effective exchange rates tends to support tourism in the long run, but does not influence tourism development in the short run.

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1. Introduction

The tourism industry is one of the leading industries contributing to sustainable economic growth (Brida et al., 2020; Fu et al., 2020; Pulido-Fernández & Cárdenas-García, 2021; Wu et al., 2020). This industry has a broader perspective for economic development, employment opportunities, poverty alleviation, and foreign currency

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Figure 1. China's tourism revenue from 2008 to 2019.
Source: Statista 2021

inflows for the countries (Badulescu et al., 2020). However, the tourism industry is highly vulnerable to environmental changes and destructive pandemics, such as natural hazards, flood, earthquake, explosions, and other global financial and economic catastrophe due to the highly contagious diseases (Mirza, Rahat, et al., 2020; Rizvi, Mirza et al., 2020; Su, Huang, et al., 2021; Umar, Ji, Mirza, et al., 2021). In this context, considering the high safety risk and environmental factors, the tourism industry also extensively depends upon the behavioral patterns of the travelers, their selection of the destination, etc. (Ritchie & Jiang, 2019). Recently, the tourism and hospitality industry bears the brunt of the COVID-19 outbreak. The ramification of COVID-19 has reduced the global mobility within countries and become the contributory factor of the economic losses of the tourism sector (Gössling et al., 2020).

According to the recent statistics presented by Worldometer Data Tracker (WDT), as of 25 March 2021, the aggregated COVID-19 registered cases worldwide have crossed 126.7 million with 2.7 million deaths. However, the globally recovered cases are 102.2 million. The statistics further states that the widely spread infection has affected more than 90,159 Chinese citizens, with 4,636 casualties. The COVID-19 pandemic has substantially affected the global economic and financial determinants (Rizvi, Yarovaya, et al., 2020; Sharif et al., 2020; Yarovaya et al., 2020), particularly the tourism industry in China. Global tourists have a fear of mixing up with the Chinese due to the virus threat. Therefore, they canceled various upcoming events and programs. Moreover, the international and domestic traveling restrictions have put the hospitality and tourism-associated industries in the imminent danger of collapse. China's inbound international tourism system was the major pillar of economic growth, covering local transportation, air transportation, cruises, accommodation resorts, hotels and restaurants, traditional festivals, and different sports events. Figure 1 represents the rapid growth in China's revenue from tourism from 2008 to 2019. The number of tourists was declined quickly within few weeks as the unknown cause of infection and death was later on diagnosed as COVID-19 disease. Many

countries have banned traveling, closed borders, and imposed lockdowns to curb the rapid spread of COVID-19.

COVID-19 is a highly contagious disease. This widely spreading disease has severely influenced the world economy and hampered tourist activities. According to the Annual Economic Impact Report (EIR) issued by the World Travel & Tourism Council (WTTC) quantified the massive losses of amount US \$4.5 trillion bear by the global Travel and Tourism industry in the year 2020 due to the devastating effects of the lockdowns, crippling travel restrictions, and COVID-19 crisis. The vast losses plummeted almost the proportion of 5.5% of the economic wealth of the world. These global tourism industry contributions to the GDP declined by 49.1% in 2020 compared to the preceding year of 2019. The dropdown figure demonstrates the struggling of the tourism sector due to the travel bans. However, the pandemic has also increased the unemployment in the tourism sector, which has provided 334 million jobs in the world in 2019. Moreover, the recent statistics present the 18.5% of job losses related to the travel and tourism industry are almost the unemployment of 272 million people.

Globally presented literature highlights various factors which directly and indirectly affect the inbound and outbound tourism industry. For instance, social-economic condition (Lee & Chen et al., 2020), infrastructure, hospitality rating, culture (Khalifa, 2020), energy consumption, commodity prices, and exchange rate (Su, Qin, Tao, Shao, et al., 2020; Su et al., 2020; Umar et al., 2021), financial and non-financial crises (Mirza, Naqvi, et al., 2020; Umar, Mirza, Rizvi, et al., 2021; Umar et al., 2020) and COVID-19 (Foo et al., 2020; Škare et al., 2021). Moreover, COVID-19 has exposed vulnerability across geographical and social groups due to the precedent travel restrictions, home isolation, and quarantine orders. This has created a massive deviation in the tourism industry. The existing literature is extensively missing empirical studies related to the impact of the COVID-19 epidemic on the tourism industry. Therefore, there is a need for more studies on the COVID-19 impact on tourism to show a clear picture of the current scenario and effects of crisis for the understating of policymakers and tourism agencies. Additionally, the current crisis holds an important message about the tourism system's resilience and teaches how to face other possible upcoming and ongoing crises which will have a potentially more devastating effect than COVID-19.

This study attempt to explore the relationship of COVID-19 with the tourism industry of china. To fill the gap and the obvious flaws of the previous studies in the econometric techniques, the study employs the time series data from January 1, 2020, to March 15, 2021. However, various studies employed the time series analysis but remained incapable of quantifying the precise relationship dependency between the COVID-19 and tourism at various time series quantiles. Moreover, the majority of studies have assumed the linear relationship between COVID-19 and tourism. The use of linear relationship models highlights various issues such as structural break and short-term volatilities neglecting. However, in real-time, the macroeconomic variables associations are nonlinear, and linear modeling may mislead the results (Adedoyin et al., 2020).

To determine the reliable and precise outcomes of the study, the selection of proper methodology is the most critical step in an empirical study. By considering the above flows of the previous studies, this study incorporates the quantile autoregressive

distribution lag QARDL approach to analyze the impact of COVID-19 on the tourism stock. The QARDL approach accommodates the magnitude of the tourism stock in quantile and provides more detailed insights of variable's asymmetric and nonlinear relationships in the long run and short run to scrutinize the results by policymakers and investors stock. The study specifically focuses on the tourism industry and COVID-19 association due to various reasons. First, the tourism industry of the world as well as of China experiences rapid growth. China's tourism industry is a major contributor to China's Gross Domestic Production (GDP) for more than 20 years. The tourism revenue of china was 5.73 Trillion CNY in the year 2019, and the forecasted tourism sector GDP share by 2025 is 10.93% (Ma et al., 2020). Second, China's tourism industry became the major victim of the COVID-19 epidemic and experienced severe losses in the incomes of the travel tourism and hospitality sectors (Salisu et al., 2020). Third, it has been observing that the post-pandemic shock always decline the economic activities of tourism; for instance, hospitality and transportation (Page et al., 2006; Zenker & Kock, 2020) is now in the phase of rescue to recovery; therefore, it is essential to know the impact of COVID-19 during the rescue phase on the tourism industry.

While measuring the tourism economic and financial effects, the three major paradigms are incorporated to quantify total tourism effects. First, according to (Balli et al., 2019), the overall tourism flows receipts (income) of inbound international tourism. Second are expenses incurred in the economic activities of international tourism (Aslan, 2016; Shahzad et al., 2017), and third, the number of overall tourist arrival (Sharif et al., 2017). Individual use of these three constructs does not support the partial relationship with the independent variables. Therefore, the single weighted composite index has been constructed with the principal component analysis (PCA) index for travel and tourism. This index provides the most relevant of all three paradigms of tourism in one exclusive composite index

The study outcomes indicate that the COVID-19 outbreak has a negative impact on China's tourism industry in the deep economic recession and economic boom. In contrast, the effective exchange rate positively influences tourism economic activities in all economic conditions. On the other hand, the oil prices negatively influence tourism in a mild economic downturn. In the context of short-run dynamics, the results reveal that the COVID-19 outbreak devastates tourism in economic crisis, oil prices also negatively affect the tourism in deep recession, whereas the exchange rate increase supports tourism in the severe to mild economic instability in China.

The remaining part of the study is strictures as following: Section two provides the details of theoretical work. Moreover, section 3 covers the data and methodology. Section 4 discusses the analysis outcomes, and section 5 consists of the conclusion and policy recommendations.

2. Literature review

From the existing literature, several studies have examined the economic factors that influence global tourism development. However, few pieces of research have theoretically and empirically analyzed the impact of the COVID-19 pandemic on the tourism

Table 1. Summary of COVID-19 and tourism literature.

Author references	Country	Time	Method	Key findings
(Hoque et al., 2020)	China	Post Pandemic	Secondary data methodology (Boolean search technique)	↑COVID-19 ↓ Tourism
(McCartney, 2020)	Macao	Post Pandemic	Three Wave Analogy	↑COVID-19 ↓ Tourism ↑ Economic Consequences
(Bakar & Rosbi, 2020)	COVID-19 Top affected countries	Post Pandemic	Demand and supply curve analysis	↑COVID-19 ↓demand of traveling & Tourism
(Foo et al., 2020)	Malaysia	Post Pandemic	Statistic review	↑COVID-19 ↓ Tourism
(C. Huang et al., 2020)	China	23-01-2020 to 28-02-2020	Automated content analysis (499 Newspapers Articles)	↑COVID-19 ↓ Tourism
(Rogerson & Rogerson, 2020)	South Africa	Pre & Post Pandemic	Spatial Analysis	↑COVID-19 ↓ Tourism
(Jones & Comfort, 2020)	World	Post Pandemic	Statistic review	↑COVID-19 - ↓Tourism contribution to Sustainable development
(Pham et al., 2021)	Australia	Post Pandemic	general equilibrium modeling method	↑COVID-19 – No effect of Tourism Contribution to economic development
(Sikiru & Salisu, 2021)	USA	Pre & Post Pandemic 2016-2020	Engle–Ng test	↑COVID-19 –tourism stocks fluctuations ↑ gold prices
(Škare et al., 2021)	185 countries	Pre & Post Pandemic 1995-2019	Panel structural vector auto-regressive method (PSVAR)	↑Previous Pandemics ↓Tourism

Source: Authors's own creation.

of the world. Table 1 covers the maximum studies carried out to explain the relationship between COVID-19 and tourism.

(Hoque et al., 2020) measure the impact of the COVID-9 outbreak on China's tourism industry. The study outcomes demonstrate that China's tourism industry has experienced more destructive effects of the COVID-19 outbreak than the other countries' tourism. The fear of the disease has stopped almost all the social and cultural activities, the air industry and tourism industry affected to a large extent. The high intensification of the COVID-19 disease subsequently needs time to mitigate the unprecedented effect on China's tourism industry. In addition, (McCartney, 2020) studied the spreading patterns of coronavirus and tourism downfall in Macao. The study's objective was to present the key policy and health measures to eliminate the devastating effects of the first and second waves of COVID-19. Moreover, the study highlights the economic consequences of the tourism and hospitality industry and presents the three-wave analogy regarding the response of the Macao economy to the COVID-outbreak. (Bakar & Rosbi, 2020) study the correlation between the COVID-19 epidemic and the job losses in the world's tourism industry. To measure the economic downfall of the tourism industry, the study employed the demand and supply curve analysis. The results indicate that the COVID-19 fear has dropped the demand for traveling and tourism due to the lockdown and mobility restrictions. As a result, the tourism sector's revenue keeps declining with the decrease in demand as per the

demand and supply theory and market equilibrium. Furthermore, (Foo et al., 2020) also analyze the impact of the widely spread disease of Coronavirus and the impact of the COVID-19 outbreak on Malaysia's tourism industry. The study states that the Malaysian tourism industry heavily and adversely influenced by the COVID-19 outbreak. Soon after the virus spread in China, the Malaysian government has imminently imposed traveling restrictions and canceled all international events. The study suggests the government provides economic stimulus packages for the tourism industry to survive in the pandemic.

Similarly, (Chen et al., 2020) studied the post-pandemic effects of the COVID-19 on the tourism industry of China due to the published contents such as newspaper articles. The study uses an automated content analysis approach and invites further studies covering emotional factors related to a health crisis, strategies to control the epidemic, and the advertising content of the tourism products use after the pandemic for health safety. This initiative promotes the SEM enterprises' tourism practices under health and social experts' experiences and increases the future sustainability of the tourism business in China. (Rogerson & Rogerson, 2020) determine that the COVID-19 pandemic has imposed devastating and damaging effects on the tourism sector of South Africa, with other economic consequences faced by the whole nation. However, these effects are more intensified at the important tourism spots that economically are the main contributor to the whole industry's revenue. The purpose of the study is to highlight the exposed infected tourism locations of South Africa with the help of different indicators. The study's outcomes point out the local authorities who did vulnerable practices against the COVID-19 spreading and become the cause of the collapse of the tourism industry at those specific locations.

Another study conducted by (Jones & Comfort, 2020) discovered the relationship between tourism and sustainable development under the umbrella of the COVID-9 crisis. The study explains the COVID-19 outbreak challenges for the tourism industry, which ultimately affect the environment. Similarly, (Prayag, 2020) evaluates the impact of the COVID-19 pandemic on the tourism sector's resilience concerning the socioecological system. The study explores the lasting effects of the pandemics on individuals, organizations, and nations and their resilience by adopting a three-level approach. (Pham et al., 2021) estimate the short-run economic effects of the inbound tourism industry on the economic development of Australia due to the COVID-19 epidemic. The analysis incorporates the tourism industry and occupational level macroeconomic effects by employing the computable general equilibrium modeling method to measure the tourism industry's direct contribution. The analysis outcomes revealed that the COVID-9 outbreak is not only the reason for the decline of tourism contribution to the economic development of Australia.

Moreover, (Sikiru & Salisu, 2021) explain that the lockdown and mobility ban due to the COVID-19 pandemic negatively influence the hospitality sector with regard to the travel and tourism stock fluctuations. The analysis also examines the impact of long-standing hedging of gold on travel and tourism stock and concludes that the inclusion of gold for the diversified portfolio reduces the risk on returns during the crisis phase. However, (Škare et al., 2021) measured the potential impact of COVID-19 on the tourism industry of 185 countries by using the Panel structural vector

auto-regressive method and conclude that the COVID-9 pandemic has severer strives effects on the tourism industry of the world, and it will take more than 10 months to recover the stable condition.

3. Methodology

3.1. Data

To examine the COVID-19 impact on China's tourism, the data of the independent variables has been obtained from various sources such as the COVID-19 represented in a current study as a daily registered number of infected cases obtained from Worldometer. While the control variables such as oil prices are illustrated by the West Texas Intermediate crude oil daily prices. Moreover, the study also considers the real effective exchange rate as one of the dominant factors contributing to tourism development. The daily data of effective real exchange rate (ER) of China and oil prices were obtained from the DataStream website, whereas the dependent variable tourism was explained through the Principal Component Analysis (PCA) index of tourism development. The study employs the time series data from January 1, 2020, to March 15, 2021, with a total of 214 daily observations. The data has been transformed into logarithm values to obtain comparable results.

3.2. Methodology

The autoregressive distributed lag (ARDL) is an econometric technique used to determine the long-run association between the time series of variables by considering the different order of cointegration. In contrast, the Quantile Autoregressive distributed Lag (QARDL) model is the upgraded version of ARDL, demonstrating the cointegration and the short-run dynamics among independent and dependent macroeconomic variables over various parts of the conditional distribution of the variables. In this study, the QARDL (Cho et al., 2015) was employed to analyze the impact of the COVID-19 pandemic, oil prices, and real effective exchange rate on China's tourism. This approach provides more insights into the nonlinear relationships with the details of location-based asymmetry by using different quantiles. However, the Wald test (also called the Wald Chi-squared test) also is used to examine the significance of the explanatory variables in the long and short run. (Godil et al., 2020).

Considering the above explanations for the current study, the QARDL method is a suitable and reliable approach to assess the nonlinear linkage between the focus and control variables. The ARDL model equation for the study variables presented as under:

$$TOR_{2t} = \alpha + \sum_{i=1}^l \varphi_i TOR_{2t-i} + \sum_{i=0}^m \omega_i COVID19_{t-i} + \sum_{i=0}^n \lambda_i ER_{t-i} + \sum_{i=0}^o \theta_i OIL_{t-i} + \varepsilon_t \text{ equation} \quad (1)$$

Hence, the error term in equation 1 mentioned as ε_t defined as $TOR_{2t} - E\left[\frac{TOR_{2t}}{\sigma_{t-1}}\right]$. The smallest field σ of variables $[TOR_{2t}, COVID19_t, ER_t, OIL_t]$ and symbols $l, m, n,$

and o means the lag order of Schwarz information criteria (SIC) (2016). The variable use in equation one is the symbolic representation of TOR for tourism, TOR_{2t-i} = preceding tourism value, COVID-19, is several infected cases, and OIL is the crude oil prices, whereas the ER is a real effective exchange rate.

Moreover, in the extension of [equation 1](#), the QARDL model defines the quantile estimations as below:

$$Q_{TOR} = \alpha(\tau) + \sum_{i=1}^l \varphi_i(\tau) TOR_{2t-i} + \sum_{i=0}^m \omega_i(\tau) COVID19_{t-i} + \sum_{i=0}^n \lambda_i(\tau) ER_{t-i} + \sum_{i=0}^o \theta_i(\tau) OIL_{t-i} + \varepsilon_t(\tau) \text{ equation} \quad (2)$$

where, $\varepsilon_t(\tau) = TOR_{2t} - Q_{TOR_{2t}}(\tau/v_{t-1})$ and $0 > \tau < 1$ represent quantile (Kim & White, 2003). Next, [equation 2](#) transformed into [equation 3](#) due to the [equation 2](#) expected serial correlation.

$$Q_{\Delta TOR_{2t}} = \alpha + \rho TOR_{2t-1} + \hat{\alpha}_{COVID19} COVID-19_{t-1} + \hat{\alpha}_{OIL} ER_{t-1} + \hat{\alpha}_{ER} OIL_{t-1} + \sum_{i=1}^{l-1} \varphi_i \Delta TOR_{2t-1} + \sum_{i=0}^{m-1} \omega_i \Delta COVID19_{t-1} + \sum_{i=0}^{n-1} \lambda_i \Delta ER_{t-1} + \sum_{i=0}^{o-1} \theta_i \Delta OIL_{t-1} + \varepsilon_t(\tau) \text{ equation} \quad (3)$$

However, according to the QARDL approach presented by Cho et al. (2015) the quantile error correction model can be reparametrized as under:

$$Q_{\Delta TOR_{2t}} = \alpha(\tau) + \rho(\tau)(TOR_{2t-1} - \beta_{COVID19}(\tau) COVID19_{t-1} - \beta_{ER}(\tau) ER_{t-1} - \beta_{OIL}(\tau) OIL_{t-1}) + \sum_{i=1}^{l-1} \varphi_i(\tau) \Delta TOR_{2t-1} + \sum_{i=0}^{m-1} \omega_i(\tau) \Delta COVID19_{t-1} + \sum_{i=0}^{n-1} \lambda_i(\tau) \Delta ER_{t-1} + \sum_{i=0}^{o-1} \theta_i(\tau) \Delta OIL_{t-1} + \varepsilon_t(\tau) \text{ equation} \quad (4)$$

The delta method is used to test the cumulative short term effect of the past Tourism on the existing tourism The delta method presented as $\varphi_i = \sum_{j=i}^{l-1} \varphi_j$ while the cumulative short-run effect of the preceding and existing levels of COVID-19, ER, and OIL examined $\omega_i = \sum_{j=i}^{m-1} \omega_j$, by $\lambda_i = \sum_{j=i}^{n-1} \lambda_j$, and $\theta_i = \sum_{j=i}^{o-1} \theta_j$ Respectively. . The ρ value of error correction measure ECM coefficient presented in [equation 4](#) should be negative and significant. The coefficients related to long-run for COVID-19, oil price, and exchange rate are estimated as under:

$$\beta_{COVID19*} = -\frac{\beta_{COVID19}}{\rho}, \quad \beta_{ER*} = -\frac{\beta_{ER}}{\rho}, \quad \text{and} \quad \beta_{OIL*} = -\frac{\beta_{OIL}}{\rho}$$

Table 2. Results of descriptive statistics.

Variables	Mean	Min.	Max.	Std. Dev.	J-B Stats
TOR	0.0025	0.0011	0.0038	0.1014	18.4861***
COVID	0.0041	0.0033	0.0057	1.0312	17.1015***
ER	0.0137	0.0110	0.0281	1.1138	45.2289***
OIL	0.0248	0.0115	0.0426	0.1126	22.5590***

Note: The asterisk ***, ** and * represent level of significance at 1%, 5% and 10% respectively. .
Source: Authors Estimations.

3.3. Wald test

This study analyzes the asymmetric impact of COVID-19, OIL, and ER on Tourism in the short-term and long-term with the Wald test. The null hypothesis is as under:

$$H_0 : \rho_*(0.05) = \rho_*(0.1) = \dots = \rho_*(0.95)$$

Against the alternative one

$$H_0 : \exists i \neq j / \rho(i) \neq \rho(j)$$

Similar patterns are used for $\beta_{COVID19}$, β_{OIL} , and β_{ER} parameters and for specific lags by φ_i , γ_i , ω_i , and θ_i Of short-term parameters.

4. Results and discussions

4.1. Descriptive statistics

Table 2 demonstrates the descriptive statistics of TOR, COVID, ER, and OIL. Tourism (TOR) has a mean value of 0.0025 with a minimum of 0.0011 and a maximum of 0.0038. Similarly, COVID-19 shows 0.0041 as a mean value which lies between 0.0033 and 0.0057. Moreover, the exchange rate (ER) has a mean value of 0.0137, between 0.0110 and 0.0281. However, the mean value of OIL is 0.0248 with a minimum and maximum of 0.0115 and 0.0426, respectively. The Jarque-Bera test results illustrate that all variables are significant at a 1% level of significance to determine the normality among variables. This has declared that the time-series data of all the variables are not normally distributed. Thus, the quantile regression analysis is feasible to use on the selected date.

4.2. Stationary test

Before applying any econometric technique to the data, such as regression analysis, it is necessary to determine the unit root or trend and coherence of data which may cause issues in the statistical inference of time series data (Su, Cai, et al., 2021; Su, Qin, Tao, Shao, et al., 2020; Umar, Su, Rizvi, et al., 2021). This study uses the Augmented Dickey-Fuller test (ADF) for unit root and the Zivot-Andrew (ZA) test, which is famous for scrutinizing the data stationarity of the time series with a structural break (Umar, Ji, Kirikkaleli, Shahbaz, et al., 2020; Umar, Ji, Kirikkaleli, et al., 2021). Table 3 exhibits the unit root test outcomes, which suggest that all the variables such as TOR, COVID-19, ER, and OIL have unit roots at a level. The estimated

Table 3. Results of unit root test.

Variables	ADF (Level)	ADF (Δ)	ZA (Level)	Break Year	ZA (Δ)	Break Year
TOR	-1.305	-7.448***	-1.004	12\02\2020	-9.446***	06\11\2020
COVID	-0.557	-3.800***	-0.993	05\03\2020	-7.426***	19\01\2021
ER	-1.279	-4.558***	-0.477	16\06\2020	-11.331***	02\05\2020
OIL	-0.667	-6.073***	-0.599	15\03\2020	-8.220***	19\09\2020

Note: The values in the table specify statistical values of the ADF and ZA tests. The asterisk ***, **, and * represent the level of significance at 1%, 5%, and 10%, respectively.

Source: Author Estimation.

Table 4. Results of quantile autoregressive distributed lag (QARDL).

Quantiles (τ)	Constant $\alpha_*(\tau)$	ECM $\rho_*(\tau)$	Long-Run Estimates			Short-Run Estimates			
			$\beta_{\text{COVID}}(\tau)$	$\beta_{\text{ER}}(\tau)$	$\beta_{\text{OIL}}(\tau)$	$\varphi_1(\tau)$	$\omega_0(\tau)$	$\lambda_0(\tau)$	$\theta_0(\tau)$
0.05	0.005 (0.009)	-0.120* (-1.806)	-0.123** (-2.201)	0.331*** (2.991)	-0.206*** (-3.164)	0.570** (2.979)	-0.041** (-2.351)	0.011* (1.727)	-0.042** (-2.350)
0.10	0.012 (0.004)	-0.111* (-1.707)	-0.157** (-2.208)	0.340*** (3.000)	-0.214*** (-3.253)	0.559** (2.960)	-0.053** (-2.463)	0.016* (1.922)	-0.049* (-1.841)
0.20	0.014 (0.011)	-0.126* (-1.955)	-0.147** (-2.212)	0.311*** (2.991)	-0.211*** (-3.145)	-0.568** (2.984)	-0.048** (-2.152)	0.025** (2.228)	-0.014 (-1.552)
0.30	0.009 (0.006)	-0.115** (-1.960)	-0.124*** (-1.607)	0.300** (2.975)	-0.219** (-2.260)	0.549** (2.969)	-0.040** (-2.049)	0.015** (2.220)	-0.008 (-0.939)
0.40	0.015 (0.010)	-0.118** (-1.974)	-0.135 (-1.200)	0.308** (2.952)	-0.122 (1.551)	0.461** (2.958)	-0.051* (-1.858)	0.021** (2.230)	-0.013 (-0.727)
0.50	0.021 (0.012)	-0.121** (-1.980)	-0.140 (-1.604)	0.318** (2.933)	-0.131 (-1.149)	0.479** (2.988)	-0.046 (-1.442)	0.029 (1.526)	-0.019 (-0.438)
0.60	0.025 (0.008)	-0.110** (-2.001)	-0.121 (-1.213)	0.310** (2.942)	-0.121 (-0.965)	0.458*** (2.992)	-0.050 (-1.340)	0.024 (1.416)	-0.029 (-0.846)
0.70	0.020 (0.013)	-0.128** (-1.990)	-0.119 (-1.621)	0.306* (1.958)	-0.113 (-0.879)	0.467*** (3.001)	-0.056 (-1.047)	0.017 (1.218)	-0.037 (-1.165)
0.80	0.025 (0.007)	-0.117** (-2.000)	-0.126*** (-2.916)	0.308* (1.957)	-0.109 (-0.658)	0.476*** (3.002)	-0.044 (-0.654)	0.023 (0.610)	-0.028 (-1.552)
0.90	0.022 (0.018)	-0.119** (-1.991)	-0.111*** (-3.222)	0.309* (1.941)	-0.117 (-0.347)	0.457*** (3.000)	-0.059 (-0.241)	0.014 (0.314)	-0.020* (-1.772)
0.95	0.027 (0.005)	-0.112** (-2.002)	-0.118*** (-3.415)	0.304* (1.954)	-0.110 (-0.162)	0.448*** (3.001)	-0.042 (-0.161)	0.010 (0.221)	-0.022* (-1.900)

Note: The table reports the quantile estimation results. The t-statistics are between brackets. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. Source: Author Estimations.

values are more than the threshold value of nonstationary. Therefore, all the variables become stationary at first difference with different structural breaks. Thus, there is no trend in data, and each variable has different integration order.

4.3. Quantile ARDL for China

The results of the QARDL model presented in Table 4 demonstrate that the error correction term parameter of dependency is significant with negative values at all quantiles, which shows that the system corrects its previous period disequilibrium more rapidly COVID-19, ER, OIL, and tourism. Similarly, the beta coefficient of the variables compares the strength of the effect of the independent variable on the dependent variable or a relationship between variables in the long run. The beta of COVID-19 has significant negative values at the lowest to middle (0.05-0.30) quantiles and higher to highest (0.80-0.95) quantiles. These outcomes indicate that when tourism is already low in the long run, the increase in COVID-19 cases further decreases tourism. Also, when tourism in a country is on peck, the increase of

COVID-19 cases significantly decreases tourism. These results confirm the findings of (Foo et al., 2020; Huang et al., 2020; Rogerson & Rogerson, 2020) regarding the impact of COVID-19 on tourism. However, according to Table 4, in a normal scenario, the COVID-19 does not influence tourism.

On the other hand, the contrary results of the real exchange rate and tourism relationship indicated that the beta coefficient value of ER is positive and significant at all quantile, which means that the increase in real exchange rate supports the truism industry. The inbound international tourism increases when the exchange rate is favorable economic. At the same time, in the long run, the beta coefficient of OIL shows the negative and significant values at the lowest to the middle (0.05-0.30) quantiles. The significant negative value of the beta coefficient illustrates that in the tourism instability, the increase in oil prices decreases China's tourism in the long run. However, in normal and boom conditions, the oil prices are insignificant to tourism.

Moving towards the short turn dynamics, the results reveal that its own accumulated past positively and significantly influences the change in the current TOR at all grid of quantile except the low quantile where the influence is negatively significant. Moreover, the cumulative variation in the preceding COVID-19 outbreak negatively impacts the existing COVID-19 outbreak at the lowest to middle (0.05-0.40) quantiles. Similarly, the preceding and existing oil price changes negatively and significantly moved with existing oil prices at extremely lower (0.05-0.10) quantal. However, the aggregate exchange rate ER fluctuations in the past and current positively affect the current ER at lowest to middle (0.05-0.40) quantiles.

4.4. Wald test

The Wald test is used to determine the short and long-run constancy of parameters, the asymmetric association among the explained variables. Table 5 illustrates the outcomes of the Wald test. According to the results, the coefficient of dependency is significant; therefore, the null hypothesis of the linearity of the speed adjustment coefficient is not accepted.

Table 5. Results of the Wald test for the constancy of parameters.

Variables	Wald-statistics
ρ	9.948*** [0.000]
β_{COVID}	6.337*** [0.000]
β_{ER}	4.573*** [0.000]
β_{OIL}	16.582*** [0.000]
φ_1	4.918** [0.090]
ω_0	3.746*** [0.000]
λ_0	1.372 [0.447]
θ_0	0.347 [0.999]

The p-values are between square brackets. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Source: Author Estimations.

Table 6. Granger causality in quantile test results.

Quantiles	ΔTOR_t	$\Delta COVID_t$	ΔTOR_t	ΔER_t	ΔTOR_t	ΔOIL_t
	\downarrow $\Delta COVID_t$	\downarrow ΔTOR_t	\downarrow ΔER_t	\downarrow ΔTOR_t	\downarrow ΔOIL_t	\downarrow ΔTOR_t
[0.05-0.95]	0.000	0.000	0.000	0.000	0.000	0.000
0.05	0.000	0.000	0.000	0.000	0.000	0.000
0.10	0.000	0.000	0.000	0.000	0.000	0.000
0.20	0.000	0.000	0.000	0.000	0.000	0.000
0.30	0.000	0.000	0.000	0.000	0.000	0.000
0.40	0.000	0.000	0.000	0.000	0.000	0.000
0.50	0.000	0.000	0.000	0.000	0.000	0.000
0.60	0.000	0.000	0.000	0.000	0.000	0.000
0.70	0.000	0.000	0.000	0.000	0.000	0.000
0.80	0.000	0.000	0.000	0.000	0.000	0.000
0.90	0.000	0.000	0.000	0.000	0.000	0.000
0.95	0.000	0.000	0.000	0.000	0.000	0.000

Source: Authors Estimation.

In the same way, the other beta coefficient of COVID-19, ER, and OIL in the long run show significant values. Therefore, they also reject the null hypothesis. These results demonstrate that the co-integrating coefficients between COVID-19 and tourism, exchange rate and tourism, oil prices, and tourism in china are not symmetric.

While considering the short-run moves, the results indicate that cumulative past tourism significantly influences the current tour. Similarly, the COVID-19 significant value rejects the null hypothesis of the symmetric relationship between COVID-9 and tourism in the short run. However, the exchange rate and oil prices Wald results do not reject the null hypothesis of short-run parameter consistency. Thus the exchange rate and oil prices have a symmetric influence on the tourism of China.

4.5. Granger causality in quantiles

This study also applied the Granger causality test in quantile to examine the variable's interconnection by analyzing the directional moves or causality. The null hypothesis for the quantile casualty test is no causality among variables. Table 6 shows the results of the Granger causality test in quantile. The test outcomes presented as the probability values to explore the significance or insignificance at all grids of quartile to accept or reject the null hypothesis. According to the test outcome, the fluctuations in the COVID-19 ($\Delta COVID_{19t}$ to ΔTOR_t) decrease tourism at a 1% significance level for all quantile distribution.

Similarly, the change in tourism influence the change in COVID-19 across all quantile. Moreover, the test indicates the same results for the (ΔTOR_t to ΔER_t) and (ΔER_t to ΔTOR_t). Furthermore, the study also reveals the same results for other control variable and show the bidirectional between oil prices fluctuations and tourism variations at all quantiles.

5. Conclusion and policy recommendations

5.1. Conclusion

Covid-19 has imposed a severe impact on the global economy. The unprecedented global travel restrictions are the cause of massive disruption of economic activities.

The traveling bans, closing of borders, and lockdowns have ceased the tourism industry, which is the major contributor to China's GDP. China's travel and tourism industry has shown rapid growth since 2008, but the recent crisis has immensely declined tourism. Therefore, it is essential to measure the pandemic counteract of the tourism industry of China. This empirical study attempts to explore the impact of the COVID-19 pandemic on the performance of the tourism industry of China in the long run and short run.

The study employs the QARDL method to explore the asymmetric relationship. Wald test to assess the variable significance and Granger causality test for quantile to determine the type of causality between variables across the grid of quantiles. The data set consists of the time series data of all variables from January 1, 2020, to March 15, 2021. The QARDL model is a better fit to analyze the long-run relationship and short-run dynamics of the data by considering the potential asymmetric and nonlinear association among COVID-19, exchange rate, oil prices, and tourism. The outcomes of the QARDL model indicate that the estimated parameter ECM is significant with an expected negative value in the long run at a grid of all quantiles, which means that in the long run, the system returns to its equilibrium relationship between the COVID-19, ER, OIL and TOR.

Moreover, the QARDL results reveal that COVID-19 has a significantly negative impact on tourism at low to intermediate (0.05-0.30) quantile and extremely high (0.80- 0.95), which illustrates that when the tourism is already facing recession in the country, the COVID-19 brings more decline in tourism and when the tourism is on the boom the COVID-19 drops down the tourism in China. Similarly, the oil prices also negatively influence the tourism of China in the long run. According to the results, the negative impact of oil shows in the low to the middle (0.05-0.30) quantile only, which means that when tourism is already struggling, the increase in oil prices further decreases tourism. On the other hand, the results indicate that the real effective exchange rate has a positive impact on the tourism development at all quantiles which means that the increase in exchange rates is always favorable to China's tourism.

From the perspective of the short-run dynamics, the finding indicates that the previous cumulative tourism (TOR) positively and significantly influenced the changes in the existing TOR at all quantiles except the low quantile, where the influence is significant but negative. Moreover, the aggregate variation in the preceding COVID-19 has a negative and significant impact on the existing COVID-19 at the lowest to middle (0.05-0.40) quantiles. Likewise, the preceding and existing oil price changes negatively and significantly influence the current fluctuations of oil prices at extremely lower (0.05-0.10) quantile. However, the combined exchange rate ER fluctuations in the past and current co-move with the current ER at the lowest to the middle (0.05-0.40) quantiles.

Furthermore, the Wald test results show the significant values of Beta coefficients of COVID, ER, and OIL which endorse the asymmetric relationship of the focus and control variables with tourism in the long run. In addition, for the short-run dynamics, the Wald test results endorse the asymmetric relationship of COVID-19 with tourism, while the exchange rate and oil prices have an asymmetric association with

tourism in China. Moreover, The Granger Causality test for the directional association also exhibits the bidirectional causal relationship between all the variables and tourism at all quantiles. Thus the findings of the empirical results of the current study endorse cointegration among the COVID-19, exchange rate, oil prices, and tourism of China.

5.2. Policy recommendations

The study outcomes can significantly explain the intensity of the COVID-19 negative impacts on tourism to the policymakers, law enforcement agencies, domestic and international tourism agencies, and investors of the hospitality and travel sectors. Following the suggested policy implementation guide to take the vital measurements to mitigate the post-pandemic negative effects and support China's inbound international tourism industry.

The government of China needs to support and subsidized the tourism sector to mitigate the post-pandemic effects such as losses of jobs of workers of travel, tourism, and hospitality industries; Moreover, the government should amend the laws and policies and give relaxation in taxes to the investors of the tourism industry to support them in the phase of crisis with fiscal, liquidity and health protection. Global mobility in the form of tourism is now considered the main contributory factor for the rapid diffusion of the COVID-19 virus. Also, tourists now avoid visiting the countries highlighted with the intense health crisis. Therefore, to bring back travelers' confidence, China's tourism system needs to be reconstructed by considering all the parts of the value chain of tourism that may cause the virus's spreading. The concerned authorities should promote the individual travelers' and workers' risk assessment. Implementing mandatory mask-wearing and social distancing and health care quality innovations will enhance the health and hygienic protocol. The coordination between private and public policy support will also increase the sustainability of tourism's economic activities. The tourism and hospitality industry management should carefully examine the COVID-9 pandemic effects on the business and adopt the new risk management methods to mitigate the post-pandemic long-term negative effects.

In addition, the issuance of the digital Green Certificates proposed by the World Travel & Tourism Council and European Travel Council will also help the tourism sector recover the losses and get stability. A digital green certificate is a form of digital health pass that ensures the travelers' health safety and the workers of the host country with proof of vaccination and negative test of COVID-19. These much-needed health and hygiene measures support the economies and tourism industries and save numbers of jobs.

5.3. Limitations of the study

The study's main limitation is its short study duration taken from the start of the COVID-19 pandemic. The large time-series data gives more reliable and authentic results. The studies conducted after few years can present more comprehensive outcomes on the phenomena and properly determine the post-pandemic effects of

COVID-19 on tourism. Moreover, due to the shortage of time, this study has not incorporated the other economic factors which directly influence tourism activities, such as exchange rate, political-economic uncertainty, etc.

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