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The impact of COVID-19 on the tourism industry stocks returns in Mauritius. Evidence from quantile regression analysis

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ABSTRACT

The tourism industry has been severely affected by the COVID-19 outbreak in Mauritius, where this industry is the backbone of the economy. Just like tourism revenue, tourism returns are also expected to be affected. Hence, this paper examines the impact of COVID-19 on tourism returns in Mauritius by using a quantile regression model and daily data from 18 March to 30 June 2020. The results show that the COVID-19 variables used in the study impact negatively on tourism stock returns. For instance, it is observed that COVID-19 confirmed cases exert negative effects on tourism returns at higher quantiles. Similar results were obtained for COVID-19 recovered cases. Also, a positive link was found between the government response stringency index and tourism returns. However, stock volatility is observed to reduce the industry's return. This paper further provides useful insights for policymakers, investors, and managers in the tourism industry.

Keywords: COVID-19; tourism returns; quantile regression; Mauritius

1. Introduction

Mauritius, a subtropical island in the Indian Ocean, is also an important tourist destination. The tourism industry is a crucial pillar for the Mauritian economy. This sector has been severely hit by the outbreak of the pandemic. The country, which used to welcome more than a million tourists a year (1,383,488 in 2019), has seen this figure drop severely in 2020 (308,980) following the government policies put in place to contain the pandemic[1]. On 18 March 2020, the first three cases of COVID-19 were registered in Mauritius, and all borders were closed on 19 March 2020. Also, a curfew was imposed on 20 March, and eventually a complete lockdown was implemented on 24 March due to a rapid increase in the number of COVID-19 cases.

The COVID-19 pandemic has dragged down the economy since the beginning of 2020. Like the tourism sector, the financial markets have also been affected. The poor economic environment, together with quarantine and lockdown, is likely to impact the financial market. Studies have shown that the stock markets have reacted negatively to the growth in COVID-19 cases based on panel data[2]. It should be noted that the tourism and hospitality industry is highly vulnerable to socioeconomic factors, as well as environmental and political factors, including political crises, wars or even natural disasters, and pandemics[3–5]. However, the massive economic downturn caused by the COVID-19 pandemic is more severe and has lasted longer[6]. Also, this pandemic has led to lots of uncertainties in the economy, thereby impacting the financial markets. Several

scholars have investigated the impact of COVID-19 on the tourism and leisure industries. For instance, Abbas[7], Jones et al.[8], and Avery[9] highlighted that disturbances or disruptions in the face of epidemics, pandemics, or even seasonal influenza outbreaks have disastrous effects on the flow of tourism and greatly affect the tourism sector. Researchers have also discussed the impact of the COVID-19 pandemic on the behaviour of tourists and their mental health. For instance, Aman et al.[10], Bauer et al.[11], and Park et al.[12] highlighted that tourists fear about their wellbeing when there is a pandemic and cancel all their travel plans. Vaccines have also been noted to be an important factor determining the flow of tourists during a pandemic. In the absence of effective vaccines, there is a higher risk of infection when tourists are traveling from one country to another[13–16]. More so, various papers talk about the high risk of diseases and viruses spreading from travelers to the local people and vice versa[17–20].

Since the tourism industry is highly affected by the pandemic, the firms operating in the industry will register a negative performance on their stock price and stock return. For instance, Chen[21] highlighted that the factors influencing a particular hotel firm's stock price include its present and future expected cash flows as well as the perceived riskiness of stock cash flows. More so, Chen et al.[22] pointed out the outbreak of the SARS epidemic in 2003 resulted in a severe drop in Taiwanese hotel stock prices. Other scholars have found that a relationship between the travel and tourism industries and unexpected events. More specifically, Zopiatis et al.[23] found that the travel and leisure industry may result in a varied stock price movement pattern as compared to other industries.

Zooming on specific studies on COVID-19 and stock returns, Liu et al.[24] employed the ordinary least squares method and found that stock returns fluctuated in an adverse manner over the period 21 December 2019 to 18 March 2020, in countries and regions mostly affected by the pandemic, such as Asia. The same scholar also highlighted the fact that the pandemic has had major negative impacts on major stock indices. Analysing the impact of COVID-19 on stock returns in China, Al-Awadhi et al.[25] found that an increase in the daily growth in total confirmed cases and that in total cases of death because of the pandemic have resulted in adverse effects on stock returns across all firms in China. Moreover, Zhang et al.[26] related that the uncertainty with the COVID-19 pandemic and the massive related economic losses have resulted in highly unstable and unpredictable stock markets.

In addition to that, the paper by Liu et al.[4] investigated the performance of 40 tourism and hospitality stock market indices worldwide. The researchers employed the Granger causality test and network analysis to test the spillover effects among the stock markets and also employed econometric modelling to investigate the impact of COVID-19 on the stock markets by considering the government response stringency index and other country-level factors. They found that the dynamics of interconnectedness network structures differ significantly in the pre-pandemic and in-pandemic periods, and they also observed that the interconnectedness structure significantly and robustly affects stock returns in the tourism and hospitality markets. Manjula Bai[27] argued that the tourism industry is one of the most affected by the pandemic, as both demand and supply for travel have been affected. More so, Sigala[28] found through his research that COVID-19's impact on tourism is different through various time periods, is significant and has an international effect. Since there have been no studies so far on the impact of the COVID-19 pandemic on the financial market in Mauritius, and since the tourism industry is an important pillar of the Mauritian economy and was severely hit by the virus, such an investigation becomes crucial.

Hence, the present paper aims at analysing the impact that the pandemic has had on the tourism returns for the island economy. The paper employs the quantile regression method, which enables the detection of a more precise data range for the validity of the null hypothesis and allows the exploration of the full spectrum of conditional quantiles for examining the contemporaneous relation between stock returns and the pandemic.

The COVID-19 pandemic impact on the tourism return in Mauritius has not been researched so far. Hence, this study will shed light on the link between the pandemic and tourism returns by using the quantile regression technique.

The rest of the paper is organized as follows: Section 2 discusses the model and the data. The empirical results are presented in Section 3, and finally, Section 4 concludes the paper.

2. Methodology

The aim of the study is to investigate the extent to which COVID-19 has affected the stock returns of the tourism industry in Mauritius. Daily data has been used for the period 18 March 2020 to 30 June 2020 (see Osuji and Evans[29] and Lee and Chen[30]). The model is adopted from the related research of Li et al.[31], as Equation (1), and the variables are defined in **Table 1**.

$$SRt = \beta_0 + \beta_1\, COVID\_19t + \beta_2 GRt + \beta_3 VOLt + \beta_4 OILt + \varepsilon t \tag{1}$$

where t represents time; $\beta_1 \ldots \beta_4$ represents the parameter estimates and ε_t is the random disturbance term.

Table 1. Variables used in the study.

Variables	Definition	Related literature	Data source
SR	Stock returns of the tourism industry	[23,31]	Stock exchange of Mauritius (SEM)
COVID variables	COVID-19 confirmed cases and recovered cases	[2,32]	Worldometer
GR	Government response stringency index which is a composite measure based on nine response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 = strictest response)	[33,34]	Our world in data[1]
VOL	Stock volatility measured by stock return variance	[35]	Computed from data extracted from SEM
OIL	Crude oil prices	[31]	Oil price.com

The methodology used is the quantile regression (QR) method which enables the detection of a more precise data range for the validity of the null hypothesis. This technique was introduced by Koenker and Bassett[36] which allows the exploration of the full spectrum of the conditional quantiles for examining the contemporaneous relation between stock return returns and the pandemic. Also, Assaf and Tsionas[37] recommended the QR for tourism-related studies. It is considered superior to the OLS technique as this method estimates the models in which quantiles of the conditional distribution of the returns are expressed as functions of observed covariates instead of modelling the "mean" of the stock returns based on a least squares approach. QR is considered better than the least squares regression as the latter leads to mis-specification and produces ambiguous functional relations between the dependent and independent variables[35]. As highlighted by Baur et al.[38], the QR is robust to heteroscedasticity, skewness, and leptokurtosis, which are common characteristics of financial data.

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[1] https://ourworldindata.org/grapher/covid-stringency-index

To assess the impacts of COVID-19 variables on tourism stock return in Mauritius, the QR approach is thus used which allowed for the conditional τ quantile of stock return's alternation distribution (y), $Q_y(\tau|X)$ to be influenced by the impacts from COVID-19 factors. Analogously, the linear conditional quantile function is written as Equation (2):

$$Q_y(\tau|X = x) = x_i'\beta \tag{2}$$

where $x_i'\beta$ is the conditional mean of the sample of the dependent variable given *xi* and *wi* is the weighting factor. By minimizing weighted deviations from the conditional quantile, the following is obtained (Equation (3)):

$$\beta_{quantile,\tau} = argmin \sum_{i=1}^{n} \rho_\tau (y_i - x_i') \tag{3}$$

where the conditional distribution of the dependent variable *yi* that is stock return in this case, is characterized by different values of the *τth* quantile given x_i[39], and ρ_τ is a weighting factor called a check function. For any $\tau \epsilon (0,1)$, the check function is defined as Equation (4):

$$\rho_t(\mu_t) = \{(\tau - 1)\mu_t \tau\mu_t \; if \; \mu_t \leq 0, if \; \mu_t \geq 0 \tag{4}$$

where $\mu_t = y_i - x_i'$. Equations (3) and (4) imply that (Equation (5)),

$$\beta_{quantile,\tau} = arg\,min \left[\sum_{i:y_i > x_i'} \tau |y_i - x_i'\beta| + \sum_{i:y_i > x_i'} (1 - \tau)|y_i - x_i'\beta| \right] \tag{5}$$

The above equation posits that the quantile regression estimators can be achieved by minimizing a weighted sum of the absolute errors, where the weights are dependent on the quantile values. For instance, the median regression is when $\tau = 0.5$. The quantile regression is not restrictive at the median level and allows the estimation of the interrelationship between a dependent variable and its explanatory variables at any specific quantile. The dependent variable (SR) is being assessed across the following quantiles: τ {0.1; 0.2; 0.3 . . . ; 0.9}. The main independent variable is COVID-19.

3. Empirical results

3.1. Impacts of COVID-19 confirmed cases on tourism stock returns

The estimated coefficients of the impact of COVID-19 confirmed cases on tourism stock returns are depicted in **Table 2**. The OLS estimates as well as the QR estimates at quantiles 0.1 to 0.9 are reported. According to the OLS estimates, it has been observed that COVID-19-confirmed cases do not have any significant impact on tourism stock return. However, the QR estimates are different. For instance, the coefficient for the median is insignificant. This finding implies that, in general, there is no correlation between the median of the stock returns and COVID-19 confirmed cases. This also suggests that the single coefficient derived by a mean regression can obscure important results. The conditional expectation represents the average relationship, which can be significantly different from quantile effects. It is evident from the figures that the positive and negative impacts on the tails cancel each other out, leaving very little effect on the mean.

Table 2. Estimates of the QR-based COVID confirmed cases.

Variables	OLS	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
Constant	4.032**	–2.275	4.980	7.402*	8.034***	8.115***	6.923*	5.811**	7.067**	8.758**
Covid cases	–0.002	0.002	0.003	0.002	–0.002	–0.003	–0.003	–0.004*	–0.008**	–0.006**
GR	0.026*	0.052**	0.012	–0.009	–0.001	0.003	0.012	0.027	0.037**	0.034
OIL (–1)	0.048	0.045	–0.032	–0.027	–0.008	–0.001	0.024	0.066	0.096	0.089
VOL (–1)	–0.034***	–0.026***	–0.038***	–0.035***	–0.036***	–0.036***	–0.036***	–0.038***	–0.044***	–0.049***
Adj/Pseudo R^2	0.44	0.28	0.33	0.34	0.36	0.36	0.34	0.33	0.36	0.38

Note: OLS: ordinary least squares; QR: quantile regression. *Significance at the 10% level, **Significance at the 5% level and ***Significance at the 1% level.

Interestingly, while analyzing **Table 2**, it is observed that at higher quantiles, the coefficient is negative and significant, implying that COVID-19 confirmed cases have had a negative impact on tourism stock returns on the island. Hence, it can be concluded that COVID-19 uncertainty has adversely affected the tourism stock return. This result is in line with Xu[40], analyzing the relationship between stock returns and the COVID-19 pandemic in Canada and the US.

Also, not surprisingly, it is observed that the χ^2-statistic value is statistically significant at conventional test levels. It can therefore be concluded that the coefficients differ across quantile values and that the conditional quantiles are not identical. Analyzing the F tests of the equality of slope parameters across different quantiles in **Table 3**, that is, the variances between slope estimates at the τ and the (τ-1) quantiles, it can be concluded that the nonlinear, negative, and significant effects of COVID-19 do influence stock returns.

Table 3. Statistical test of the equality of slope estimates across various quantiles.

Quantile	χ^2-statistic (*p* value)
COVID-19 cases	
0.1 vs 0.9	20.82092 (0.0003)
0.2 vs 0.8	16.72490 (0.0022)
0.3 vs 0.7	8.044650 (0.0400)
0.4 vs 0.6	14.46243 (0.0272)
Recovered cases	
0.1 vs 0.9	22.38128 (0.0002)
0.2 vs 0.8	8.396792 (0.0281)
0.3 vs 0.7	6.985058 (0.0415)
0.4 vs 0.6	14.68863 (0.0452)

Further, referring to the results, it is noted that the government intervention index, GR, positively affects tourism stock returns under the OLS estimation and at two different quantiles under the QR estimation. In fact, government containment and health responses, as well as income support packages, are more likely to result in a positive market reaction by improving investors' confidence and reducing the adverse economic effects of the disease[41]. Hence, the result proves the argument that strict government actions reduce the intensity of local outbreaks and weaken the negative market reaction to the growth in COVID-19 confirmed cases[25,41]. While no significant results were obtained for the link between oil prices and the stock return, a negative and significant relationship was obtained for stock volatility. The link between stock market returns and their volatility is usually nonlinear and dynamic. The present result confirms the asymmetric volatility hypothesis[42].

3.2. Impacts of COVID-19 recovered cases on tourism stock returns

The impact of COVID-19 recovered cases on tourism stock returns is also investigated, and the results are shown in **Table 4**. While the OLS estimates indicate that there is no significant link between these two variables, the QR estimates are different. For instance, at 0.7–0.9 quantiles, there is evidence that even though there have been recovered cases from the pandemic, it has negatively affected tourism stock returns. Thus, it proves that the uncertainty linked to the pandemic negatively affects stock returns. Analyzing the results of the F tests for the equality of slope parameters across different quantiles, confirms that the variances across different quantiles are substantial for all conditions. Regarding the other variables, the government intervention index continues to have a positive and significant impact on the stock return. Such a result is observed at 0.1 and 0.8 quantiles. Consistent with the results in **Table 2**, the variable oil continues to be insignificant, while volatility still depicts a negative link with the tourism stock return.

Table 4. Estimates of the QR-based COVID recovered cases.

Variables	OLS	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
Constant	4.150**	−1.829	4.147	7.275 **	7.959***	8.031**	7.812***	7.208**	6.369*	11.477**
Recovered cases	−0.001	0.002	0.001	−0.001	−0.002	−0.002	−0.003*	−0.004**	−0.005**	−0.004**
GR	0.024*	0.051**	0.019	−0.009	−0.001	0.001	0.003	0.014	0.031**	0.017
OIL (−1)	0.045	0.042	0.020	−0.011	−0.004	−0.002	0.009	0.036	0.089	0.035
VOL (−1)	−0.034***	−0.027***	−0.036 ***	−0.032***	−0.036***	−0.037***	−0.036***	−0.038***	−0.044***	−0.052***
Adj/pseudoR²	0.47	0.28	0.33	0.34	0.36	0.36	0.34	0.33	0.34	0.37

Note: OLS: ordinary least squares; QR: quantile regression. *Significance at the 10% level, **Significance at the 5% level, and ***Significance at the 1% level.

4. Conclusion and policy recommendation

The COVID-19 pandemic has shaken the whole world. The tourism industry is one that has been severely hit, mainly because of travel and flight restrictions, the closure of borders, and months of confinement. The small island developing state of Mauritius has seen its economy go downhill as the tourism sector is the backbone of the Mauritian economy. There have been various papers that have investigated the impact of COVID-19 on the economy of the island or even on the tourism sector; however, as per the author's knowledge, no study has been done on the impact of COVID-19 on the stock return of the tourism sector. Hence, this paper systematically investigates the impact of COVID-19 confirmed cases and recovered cases on tourism returns for the island economy of Mauritius. Using the quantile regression on daily data, the findings of the study suggest that tourism returns have been negatively affected by the COVID-19 pandemic, and this result is significant mainly for the higher quantiles. Moreover, the findings show that the government policy responses due to COVID-19 have increased tourism returns in the country.

Hence, government intervention policies such as promptly imposing travel restrictions for high-risk countries, rapid closure of borders, and complete lockdown have all shown their benefits for the economy and public health in general. It also boosts the confidence of investors in the stock market. The empirical results further reveal that there is a negative link between stock volatility and the industry's returns. This study thus reconciles the current debate on the link between COVID-19 and stock returns.

Moreover, this study also provides deeper knowledge on the impact of the COVID-19 pandemic on the stock returns of the tourism industry and provides useful insights and implications for policymakers, stock market investors, and those managing the tourism sector. There is a need for policymakers to better manage these types of unexpected tragedies. More so, investors and stockholders should have adequate knowledge of

the impact of these types of disasters on the stock return and be better able to diversify their portfolios of investments to minimize the losses.

Conflict of interest

The author declares no conflict of interest.

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