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# THE COVID-19 PANDEMIC EFFECT ON RISK AND RETURN OF MALAYSIAN TOURISM INDUSTRY

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## Abstract

In this paper, the repercussions and impact of the COVID-19 pandemic are investigated based on the tourism industry risk and returns by employing a quantile regression method via daily data spanning from December 2019 until September 2022 in Malaysia. The results show that the COVID-19 recovered and death exert a substantial asymmetric and pronounced impact on tourism industry risks and returns. From this study, confirmed cases have a more notably significant positive impact at lower risk and higher risk quantiles, while demonstrates a negative impact on the tourism industry at lower return quantiles. Conversely, vaccination progress shows negative influence across all risk quantiles levels but indicates positively impacts return quantiles. The results depict positive and negative correlations between the government response stringency index (GRSI) and risk, and a predominantly positive correlation between GRSI and return. Furthermore, factors such as oil price, exchange rate and inflation play a significant role on tourism corporation risk and return within the tourism sector.



*Keywords:* COVID-19 pandemic, risks and returns of tourism industry, stringency index in government response

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# 1. Introduction

The communicable disease of COVID-19 pandemic, which is caused by the corona microorganism (SARSCoV2 virus) results from severe acute respiratory syndrome (SARSCoV2) as supported by Huang et al. (2020). Consistentt with the World Health Organization (WHO), as of July 2022, the world has been devasted by COVID-19 pandemic. There were approximately 558 million reported cases with 6.36 million deaths (WHO, 2022). Countries and regions worldwide have implemented social distancing, home quarantines campaigns, travel and movement bans to prevent and halt the contagious virus.

Ge et al. (2022) and Aqeel et al. (2022) mentioned that the COVID-19 disease has enormous adverse effects on travel and tourism (T&T). According to Verma and Gustafsson (2020), it has reduced domestic and international tourism demand. From Aleta et al. (2020), the tourism sector has been affected by the outbreak hardest, since many countries have insisted varying levels of T&T social gatherings and restrictions caused by the pandemic. Gössling et al. (2021) further indicated that home quarantine caused detrimental psychological impacts on tourism and travel sectors. International air passengers travel dropped exceeding 60 percent globally (Hao et al., 2020). Many tourist attractions and cities planned trips have declined by 80 to 90 percent (Bhaskara & Filimonau, 2021). International tourist arrivals dropped to 65 percent from Jan to June 2020 (Miech et al., 2021). From Arbulú et al. (2021), the T&T industry plays an important part in contributing to the global services industry and increases the world economy growth.

The stock markets declined dramatically and significantly for the infected districts and countries in the wake of the pandemic. Asian countries showed negative returns as compared to other countries (Liu et al., 2020). In Malaysia, the tourism industry was influenced by confirmed COVID-19 cases, with reported cases reaching about 4.842 million and 36,374 deaths in September 2022. After nearly two years, Malaysia announced the reopening of its borders to international tourists on April 1, 2022. However, perceiving the contracting risks or COVID-19 virus spreading, the total international tourist arrival is still not as high as it used to be as tourists may be reluctant to travel abroad.

There is still a lack of studies discussing risk and returns in tourism sector by the COVID-19 impact. By expanding firm-level data of tourism, this paper assesses the influences of death cases, confirmed cases, rate of recovery, government response stringency index, vaccine progress, and other indicators on various distribution levels of tourism industry risk and returns. This research adds to the literature in three view-points. Firstly, most COVID-19 studies explore the correlations between the COVID-19 disease and financial tourism markets. According to Blake and Sinclair (2003), tourism sector is primarily vulnerable to health and safety hazards. Thus, changes caused by disease epidemics significantly affected this sector. No empirical study investigates the predictors such as the total of confirmed cases, death cases, vaccine injections, and the recovery rate, which affect risk and return of the Malaysian tourism industry.

Secondly, the Malaysia government rapidly executed emergency movements to combat the virus contagious and called on individuals and businesses to refrain from redundant travel, face-to-face meeting and events, as well as other unnecessary events (CNN Business News, 2021). Infection panic and the government-enforced quarantine procedures have caused citizens to cease travellers travel schedules. Present research seldom discusses how governmental restrictions affect risk and return in the tourism industry. If a government effectively responds to the new virus and reduces the number of human deaths

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and confirmed cases volume and thus leads to the steady risk and return of the tourism sector, the other government will learn and even benefit from those practices. This paper contributes results on the influences of government restrictions strategies on the tourism industry risk and returns. Thus, this paper focuses on how the pandemic led to tourism risk and return. This paper employs the quantile regression (QR) method that determines the higher and lower tails distribution (Lee & Chen, 2020; Masiero et al., 2015) with the nexus of tourism sector and COVID-19 risk plus returns.

## 2. Literature Review

### 2.1. The tourism industry challenges faced from the health crisis worldwide

World Health Organization (WHO) confirmed COVID-19 disease's effects on global health risks in late January 2020. Since travel lead to contagion risk and most countries promptly prohibited many outdoor activities and enacted travel bans. McLaughlin (2020) warned that the tourism and travel sector experienced the disease serious results. A sharp decrease in "social consumption" is seen in the tourism-related events have been adversely influenced by the disease, and the contagious virus. Among prohibitions in the early 2020 included dining out, local travel, visits to festival events and trade exhibitions (Hoque et al., 2020). In many countries, some important events have been postponed or even cancelled. The airline sector slashed more than half of flight schedules and cancelled flights entirely at the peak of the virus spread worldwide in early 2020.

One can observe several research investigate the virus influence within a short period. In a study of tourism-specific shocks prior to the virus, some scholars found that virus shocks affected five types of T&T-related sector economic indices, which include airlines, gambling, hotels, restaurants, travel and tourism (T&T), T&T of Bintan's island, Indonesia (Dinarto et al., 2020), ski area in Austria (Correa-Martínez et al., 2020), Nepal (Nepal, 2020), global (Uğur & Akbıyık, 2020), the impact of travel constraints and forecasted global change (Gössling et al., 2021), deglobalization and post pandemic T&T industry (Niewiadomski, 2020), the sustainability of the industry under government's restrictions (Galvani et al., 2020) with the global T&T stock returns (Lee & Chen, 2022).

### 2.2. The COVID-19 inflation impact

Bonam and Smădu (2021) report that it takes about twenty years to recover to the pre-pandemic level from the inflation trend. They show that in the past, pandemics have had substantial long-run impacts on economic activities. According to Stiglitz (2020), this negative impact of pandemics may stem from increased uncertainty, raising safety savings and reducing investment requirement. Similarly, long-term economic losses may be implied from the COVID-19 pandemic pertaining to perceived likelihood tremendous adverse shocks at some point (Kozlowski et al., 2020). In addition, Jordà et al. (2022) discover a significant continual decrease in the interest rate after major pandemics. Lastly, Bilbiie and Melitz (2020) reported that if nominal and real frictions impede the competent resources reorganisation required in adapting the post-pandemic economy. The production may fall, thus eventually leading to an inflationary trend. So, this study includes inflation as one of the control variables.

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## 3. Hypothesis Development

The uncertain duration and infinite scale of the current COVID-19 outbreak may bring about last longer negative crush with so many flight cancellations and transportation system closures in worldwide (Saadat et al., 2020). The economy has been impacted by the pandemic, especially in the industry of travel and tour, as safety is a key issue in decisions making for international tourists. Moreover, from Lee et al. (2021) and Saadat et al. (2020), this pandemic has changed the lifestyle of people globally, menacing their physical condition and initiating prevalent unemployment as industries have closed to prevent the virus from spreading.

A significant and abiding effect in inflationary trend can be felt from pandemics (Bonam & Smădu, 2021). Inflation might affect tourism because tourists would like to stay in resorts offering the best deals, and if there is higher inflation, the deals offered become less and less enticing. Additionally, rising prices can also result in less spending on tourist activities. The arguments supported the COVID-19 pandemic might positively influence the risk and negatively impact return in the tourism industry. Thus, we state the initial hypotheses below.

H1a: COVID-19 deaths cases affect the risk and returns of tourism industry.

H1b: COVID-19 confirmed cases affect the risk and returns of tourism industry.

H1c: COVID-19 recovered cases affect the risk and returns of tourism industry.

H1d: COVID-19 vaccine progress affects the tourism industry risk and returns.

The slope of coefficient varies at different quantile, especially vital in the sample data robust heterogeneity (Assaf & Tsionas, 2018). The pandemic indicators could influence variously on the tourism risk and returns; that is, the pandemic could vary signs and/or significantly influences industry risk and returns over disparate risk and return quantiles. Therefore, we present the second hypothesis below:

H2: The pandemic impact on risk and returns of tourism industry may vary at disparate quantiles.

## 4. Methodology

### 4.1. Data

The week daily data of Malaysia's tourism industry corporate index of Yahoo Finance stock price collected and the pandemic data are collected via the GitHub website, prepared by John Hopkins University Center for Systems Science and Engineering. Since this primal sample on COVID-19 starts from January 24, 2020, this research period runs from January 25, 2020 to September 31, 2022.

In this study, the pandemic data employed are the change rate in confirmed cases, the change rate in mortality, with the total vaccine infected number. The rate of change in mortality is assessed in $(D_t - D_{t-1})/D_{t-1}$, with $D_t$is number of deaths at t period. The confirmed cases are estimated in $(C_t - C_{t-1})/C_{t-1}$, with $C_t$ refers to the confirmed cases number at t period. The daily count recovered cases count sum is referred as the recovered cases in proportion to ten thousand.

Kizys et al. (2021) discovered that through government response stringency index (GRSI) indicator while the government acts to combat the pandemic contagious may reduce the guiding performance of investors in stock markets round the world. A higher GRSI score illustrates a stricter

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response (i.e. 100 = strictest response). This is an organized activity in which governments have engaged on which approaches and convenience times can assist policymakers and citizens to comprehend the strength of government hits toward dependable manner and boost efforts to confront the contagious virus.

The pandemic related information is referred to the reaction of the stock market on the second day as the stock market ended in the evening on the first day. Therefore, this study does not use a lag term for the COVID-19 variables. The impact of the change ratio in the pandemic deaths and confirmed cases on tourism returns will be negative, while the impact on vaccine progress and recovered cases should be positively forecasted. On edge, the influence of the pandemic deaths and confirmed cases on tourism risks will be positive, while the impact on vaccine progress and recovered cases should be negative.

Regarding control indicators, the oil price was generally found negatively affect stock returns in the T&T industry, implying a negative impact at higher prices (Mohanty et al., 2014). Lee and Chen (2022) found that exchange rate and crude oil prices are control variables that significantly impact the stock returns of T&T corporations. Gulsah (2022) compared the results of the GJR and GARCH models. This EGARCH framework offers significant statistics on the tourism sector stock returns volatility and the influence of exchange rates on stock returns. International tourism trend is susceptible to potential independent variable shocks, for example the change in the inflation ratio, the foreign exchange rate and the crude oil price (Nimanussornkul & Do, 2017). Therefore, we consider the above three economic factors as Oil (crude oil price), ExR (currency exchange rate per US$), and INF (inflation). The three control indicators, ExR and INF are collected via the Data Stream database, and the OIL is gathered through the OILPRICE.COM website.

**Table 1.** Descriptive statistics and unconditional correlation

| | SR | SD | GARCH | EGARCH | Case | Death | Recover | VAC | GRSI | Oil(1) | ExR(1) | INF(1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Panel A** | | | | | | | | | | | | |
| Mean | 0.001 | 0.028 | 0.006 | 0.072 | 5031.525 | 40.295 | 1.058 | 0.440 | 59.637 | 1.896 | 4.213 | 122.540 |
| Maximum | 2.5 | 2.9 | 0.696 | 207.959 | 33406 | 592 | 2.49 | 0.072 | 85.19 | 2.08 | 4.490 | 127.9 |
| Minimum | 0.4 | 0 | 0.015 | 0.001 | 0 | 0 | 0.52 | 69 | 11.11 | 1.25 | 4.011 | 117.6 |
| SD | 0.053 | 0.058 | 0.011 | 1.601 | 6924.433 | 76.7704 | 0.277 | 0.275 | 16.135 | 0.234 | 0.113 | 2.606 |
| Skew | 6.241 | 10.704 | 22.623 | 84.962 | 1.981958 | 3.097398 | 1.469 | 0.546 | 0.633 | 1.335 | 0.641 | 0.137 |
| Kurtosis | 209.816 | 349.251 | 1023.268 | 9950.208 | 6.341792 | 13.78991 | 7.243 | 1.662 | 3.043 | 3.685 | 2.642 | 2.375 |
| Variance | 0.003 | 0.003 | 0.0001 | 2.562 | 0.048 | 5893.694 | 0.077 | 0.757 | 260.359 | 0.055 | 0.012 | 6.791 |
| Obs | 30,432 | 30,432 | 30,432 | 30,432 | 30,432 | 30,432 | 30,432 | 30,432 | 30,432 | 30,432 | 30,432 | 30,432 |
| Panel B | | | | | | | | | | | | |
| SR | 1 | | | | | | | | | | | |
| SD | 0.0023 | 1 | | | | | | | | | | |
| GARCH | 0.0293 | 0.0072 | 1 | | | | | | | | | |
| EGARCH | 0.0022 | 0.0362 | 0.0855 | 1 | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | 0.0117 | 0.0099 | 0.002 | 0.0016 | 1 | | | | | | | |
| Death | 0.0199 | 0.0153 | 0.0075 | 0.0152 | 0.5883 | 1 | | | | | | |
| Recover | 0.0263 | 0.0003 | 0.0133 | 0.0322 | 0.2168 | 0.0021 | 1 | | | | | |
| VAC | 0.003 | 0.0176 | 0.0072 | 0.0165 | 0.0989 | 0.1996 | 0.2099 | 1 | | | | |
| GRSI | 0.0067 | 0.0009 | 0.0146 | 0.0024 | 0.2017 | 0.4552 | 0.1919 | 0.8341 | 1 | | | |
| Oil(1) | 0.0114 | 0.0043 | 0.002 | 0.0013 | 0.0058 | 0.008 | 0.0075 | 0.0801 | 0.0844 | 1 | | |
| ExR(1) | 0.0099 | 0.0054 | 0.0089 | 0.0083 | 0.2176 | 0.2606 | 0.1262 | 0.6973 | 0.7177 | 0.0313 | 1 | |
| INF(1) | 0.02 | 0.0337 | 0.0062 | 0.0087 | 0.0536 | 0.3339 | 0.0107 | 0.5432 | 0.4651 | 0.0123 | 0.3358 | 1 |

Note: *JB: JarqueBera. Panel a*: descriptive statistics. *Panel b*: unconditional correlation. *SD* is the standard deviation. *SR* is tourism industry stock returns, *Case* refers to a country's COVID cases number, *Death* refers to a country's COVID deaths number, *Recover* refers to COVID cases recovered total number, *VAC* is total number of vaccines injected, *OIL* is the crude oil price, *INF* is inflation, *GRSI* is government response stringency index, and *EXG* is change rate of a nation's currency exchange rate per USD.

Summary statistics (panel a) and the indicators' unconditional correlation (panel b) are shown in Table 1. Banz and Breen (1986) proposed the lagged period of t1 to prevent the look-ahead bias, so this study employs ExR(1), Oil(1) and INF(1). Ranging from 0 percent to 207.595, the sample mean of tourism industry returns (SR) 0.001, standard deviation (SD) 0.028, EGARCH 0.072 and GARCH and 0.006 with a standard deviation of 0.053, 0.058, 1.601, and 0.011 respectively. The link between the pandemic-confirmed cases (deaths) and financial risk shows positive, and the association between financial risk and the government response stringency index (GRSI) is negative. ExR, Oil, and inflation adversely correlate to tourism industry returns (SR), as consistent with Mohanty et al. (2014) research. The multicollinearity through the indicators is non-problematic since the minor correlation values among the indicators.

## 4.2. Model

### 4.2.1. Model to measure Stock Returns

We estimate tourism sector stock returns (*SR*) as:

$$\frac{P_t - P_{t-1}}{P_{t-1}} \quad (1)$$

with $P_t$ refers to the index of closing price adjusted at t period, Ringgit Malaysia (RM).

### 4.2.2. Volatility Risk measurement model

I. Generalized Autoregressive Conditional Heteroscedastic (GARCH) strategy

Sourcing by Autoregressive Conditional Heteroscedastic (*ARCH*), example *GARCH*(1,1):

Average equation $rp_t = \mu + \phi_1 rp_{t-1} + \varepsilon_t$ (2)

Variance equation $\sigma^2_t = \omega + \alpha_1 \varepsilon^2_{t-1} + \beta_1 \sigma^2_{t-1}$ (3)

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where $\omega > 0$, $\alpha_1 \geq 0$, *and* $\beta_1 \geq 0$, and : $\mu$= average return, $rp_t$ = asset at time t return, $\varepsilon_t$ = residual return = $v_t\sqrt{h_t}$, $\sigma^2_v$ =1 and $h_t = \theta_0 + \sum^{q}_{i=1} \theta_i\varepsilon^2_{t-i} + \sum^{p}_{i=1} \delta_i h_{t-I}$ (4)

with $\sigma^2_t$ refers to conditional variance.

An own lag of linear function represents the return, where lag 1 refers to the equation of average. The variance equation relies on conditional variance own lag with prior volatility and news. The *ARCH* (prior news) term is employed to measure the effect of clustering. Besides that, the *GARCH* (past conditional variance) term is employed to figure out the volatility persistency.

II. Exponential Generalized Autoregressive Conditional Heteroscedastic (EGARCH)

Absolutely, the effect of leverage, commonly observed in financial markets, can be explored through an asymmetric GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model. This model specifically captures a phenomenon where negative news tends to cause a notably greater increase in volatility compared to positive news of the same magnitude. This asymmetry in the volatility response to bad and good shocks is a characteristic feature often addressed by asymmetric GARCH models.

The fundamental *EGARCH*(1,1) strategy is depicted as the following:

Average equation: $rp_t = \mu + \o_1 rp_{t-1} + \varepsilon_t$ (5)

Variance equation: $ln\sigma^2{}_t = \omega + \beta_1 ln\sigma^2{}_{t-1} + \alpha_1|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}| + \gamma\frac{\varepsilon_{t-1}}{\sigma_{t-1}}$ (6)

with,

The parameter of leverage, $\gamma$ anticipated for negativity and significant, with the bad shock impact volatility greater than the good shock.

### 4.2.3. Quantile Regression (QR)

The use of quantile regression (QR) approach in tourism research is greatly encouraged by Assaf and Tsionas (2018). The QR method allows a common estimate in the effect of covariate divergent quantiles on endogenous indicators (Yuan & Yin, 2010). Although the results do not vary among quantiles, the QR method generally results in a better robust and comprehensive hypothesis test. Since the intrinsic heterogeneity is generally greater in market conditions volatility, and the correlations among stock market returns plus endogenous indicators may differ among the condition segregations.

According to Chiang et al. (2010), the QR model has advance strength and provide greater effective estimations because this model provides conditional quantile functions complete series. Furthermore, the QR model exhibits the strength of leptokurtosis, heteroscedasticity and skewness that are normal financial data characteristics (Baur et al., 2012). The following regression model is shown below:

$SR_{i,t} = \beta_0 + \beta_1 COVID_{i,t} + \beta_2 GRSI_{i,t} + \beta_3 CV_{i,t-1} + \varepsilon_{i,t}$ (7)

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$$Ri_{i,t} = \beta_0 + \beta_1 COVID_{i,t} + \beta_2 GRSI_{i,t} + \beta_3 CV_{i,t-1} + \varepsilon_{i,t}$$

(8)

Here, $SR_{i,t}$and $Ri_{i,t}$ represents Malaysia's tourism firms returns and risk respectively in *t* period. The COVID-19 indicators are confirmed cases, deaths, recovered cases and vaccination progress. *GRSI* is a country's government response stringency index in period *t*. *CV* is the 3 control indicators which may affect stock return (*SR*) and *Ri: ExR* (currency exchange rate to USD), *INF* (inflation) and *OIL* (crude oil price). The three control indicators lagged term is included to tackle potential endogeneity.

Equation (7) and equation (8) are analyzed using the QR approach to enhance the results to support the COVID-19 effects variables for SR variations by admitting quantile of stock return's alteration distribution (*y*), $Q_y(Ø|\mathrm{X})$, which is prompted from COVID-19 effects issues. Thus, we identify Ø *y* (*SR*) conditional quantile function in the following Equation (9):

$$Q_y(Ø|x) = \inf \{ \partial | F_y(\partial|x) \geq Ø \} = \sum_{\mathrm{h}} \beta_{\mathrm{h}}(Ø)\, x_h = x\beta(Ø).$$

(9)

Here, $F_y(\partial|x)$ represents the *y* given *x* conditional distribution function. This QR coefficient β(Ø) characterizes the of dependence relationship across the Øth *y* conditional quantile and vector *x*. These coefficients, β(Ø), in its specified Ø, can be determined through the weighted absolute deviations between *y* and *x* minimization.

$$\hat{\beta}(Ø|x) = \mathrm{argmin} \sum_{\mathrm{t=1}}^{\mathrm{T}} (Ø - 1_{\{\mathrm{y_t} < x'_{\mathrm{t}}\beta(Ø)\}})\, |\mathrm{y_t} - x'_{\mathrm{t}}\beta\,(Ø)|.$$

(10)

In this context, $1_{\{\mathrm{y_t} < x'_{\mathrm{t}}\beta(Ø)\}}$refers to its function of standard indicator.

Utilizing the linear programming algorithm, we obtain this issue solution. Next, we obtain estimated coefficients standard errors using a process of pair bootstrapping, known for providing asymptotically valid standard errors even in cases of misspecifications and heteroscedasticity within this QR model. When there is a linear dependence in terms of the exogenous variables vector, we specify the model of conditional linear quantile in the following Equation (11):

$$Q(Ø|x) = \beta(Ø) + \sum_{\mathrm{h}} \partial_{\mathrm{h}}(Ø)\, x_h.$$

(11)

We assessed the dependent variable (SR) throughout various quantiles, namely (q = {0.05; 0.1; 0.2; 0.3, ...; 0.9; 0.95}). This ∂(Ø) measures represent the COVID-19 impacts. When the measures remain consistent throughout their quantiles, it signifies a constant dependence structure. Should they decrease (or increase) across quantiles, it indicates a decreasing (or increasing) dependence structure. Additionally, if the values differ for low (or high) quantiles, it suggests an asymmetric (or symmetric) dependence structure.

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## 5. Results

### 5.1. Estimation of the impact of COVID-19 case on Tourism Firms Stock Return Volatility Risk EGARCH

Table 2 depicts the assessment results of the quantile regression (*QR*) method for the impacts of the pandemic-confirmed cases on tourism firm volatility risk. The Ordinary Least Squares (*OLS*) results are shown for comparison. The *OLS* slope for confirmed cases demonstrates insignificance, suggesting that an increase in confirmed cases within a country might not significantly impact Malaysia's tourism industry volatility risks. On the contrary, in Table 2, the *QR* results of the confirmed cases show a significant coefficient at 0.012 to 0.085. It is noteworthy that confirmed cases exhibit a notably significant positive lower quantiles levels coefficient starting at 0.05-0.30 and 0.80-0.95 which suggest that COVID-19 confirmed cases increase firm volatility risk at low return and high-risk tourism firms. Thus, the COVID-19 confirmed cases substantially impact tourism returns at low and high-return tourism firms.

From the control indicators, the government response stringency index (*GRSI*) negatively affects the corporate volatility risk. This situation is relatively reasonable since, within this restricting government framework, it controls the disease of COVID-19. *GRSI* normally decreases tourism corporate volatility risk, except for the 0.05, 0.50, 0.60, 0.90 and 0.95 quantiles. Nevertheless, oil price negatively affects stock return (SR) at all the quantiles. The currency exchange rate (*ExR*) and *INF* significantly affects tourism firms' stock return volatility. Thus, the findings support hypothesis $H_{1b}$ that the pandemic confirmed cases remarkably influences tourism corporate volatility risk.

Comparing the findings between Quantile Regression (QR) and Ordinary Least Squares (OLS) estimations uncovers a discrepancy. The OLS results tend to underestimate the positive relationship between confirmed cases and firm volatility risk, particularly at both lower and higher quantiles. This discrepancy suggests that the OLS approach might yield a biased conclusion by not fully capturing the nuanced impact of confirmed cases on volatility risks within the industry. The QR analysis offers a more comprehensive understanding by revealing a stronger association between confirmed cases and volatility risks at various levels, which the OLS method might not adequately portray.

**Table 2.** COVID-19 effects confirmed cases with tourism stock return risk of volatility

| Variable | OLS | Qu5 | Qu10 | Qu20 | Qu30 | Qu40 | Qu50 | Qu60 | Qu70 | Qu80 | Qu90 | Qu95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 0.552 | 0.030** | 0.066*** | 0.098*** | 0.023*** | 0.037*** | 0.056*** | 0.007*** | 0.012*** | 0.023*** | 0.038*** | 0.077*** |
| Confirmed | 0.086 | 0.012*** | 0.042* | 0.052* | 0.046* | 0.061 | 0.050 | 0.016 | 0.030 | 0.085* | 0.032*** | 0.052* |
| GRSI | -0.027 | -0.014 | -0.051*** | -0.096*** | -0.016*** | -0.017* | -0.064 | -0.067 | -0.042*** | -0.095*** | -0.047 | -0.016 |
| Oil(1) | 0.089 | -0.074*** | -0.013*** | -0.033*** | -.057*** | -0.082*** | -0.008*** | -0.001*** | -0.018*** | -0.029*** | -0.004*** | -0.082*** |
| ExR(1) | 0.044 | 0.021 | -0.028 | -0.016*** | -0.017*** | -0.047*** | -0.048*** | -0.035** | -0.021*** | -0.041 | 0.025 | 0.018 |
| INF(1) | - | -0.023 | 0.016 | 0.069 | 0.019 | 0.077 | -0.041 | - | - | - | - | - |

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| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.070 | | | *** | | | | 0.016 * | 0.038 *** | 0.093 *** | 0.021 *** | 0.049 *** |
| Adj./Pseudo $R^2$ | 0.600 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.600 | 0.000 | 0.000 | 0.600 | 0.000 | 0.000 |
| Obs | | | | | | 30432 | | | | | | |

Note: Confirmed: COVID-19 confirmed cases; *GRSI*: Government Response Stringency Index; *Oil*: Crude Oil Price; *ExR*: Exchange rate; *INF*: Inflation
*** Significance at the level of 1%, ** Significance at the level of 5%, * Significance at the level of 10%

### 5.2. The COVID-19 deaths impact case estimates for Tourism Firms Volatility Risk of Stock Return - EGARCH

In Table 3, we can see the quantile regression (*QR*) outcomes for the COVID-19 deaths impact for volatility (*Vol*) of stock return. This *SR OLS* slope shows an insignificant impact on death cases. Furthermore, the *QR* results show a significantly negative effect on *Vol*, except 0.3, 0.4, 0.7 and 0.95 quantiles, indicating that COVID-19 death substantially leads to lower *Vol*, exhibiting substantial sign disparity.

From control variables, the government response stringency index (GRSI) positively and significantly influences *Vol*, except at the higher stock return volatility firms, 0.7, 0.8, 0.9 and 0.95 quantiles. The result indicates that *GRSI* meaningfully and robustly spurs volatility for raising volatility risk firms. The result is as expected since the government implemented quarantine procedures which led many people to cancel their tourism plans, thus increasing tourism firm stock return volatility risk. The *OIL*, *INF*, and *ExR* show a significant effect on *Vol*. Therefore, the findings support hypothesis $H_{1a}$ that the death cases remarkably influence tourism firm stock return (*SR*) volatility.

**Table 3.** Impacts of virus deaths on tourism stock return volatility

| Variable | OLS | Qu5 | Qu10 | Qu20 | Qu30 | Qu40 | Qu50 | Qu60 | Qu70 | Qu80 | Qu90 | Qu95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 1.737 ** | 0.089 | 0.038 | 0.011 | 0.012 * | 0.020 ** | 0.033 *** | 0.038 *** | 0.075 *** | 0.017 *** | 0.032 *** | 0.074 *** |
| Death | -0.020 | -0.011 *** | -0.042 * | -0.058 * | -0.074 | -0.023 | -0.040 ** | -0.043 ** | -0.042 | -0.069 * | -0.015 * | -0.027 |
| GRSI | -0.001 | 0.046 ** | 0.048 * | 0.089 * | 0.031 * | 0.020 * | 0.042 *** | 0.057 *** | 0.023 | -0.051 | 0.083 | 0.093 |
| Oil(1) | 0.14* | -0.064 *** | -0.014 *** | -0.032 *** | -0.056 *** | -0.073 *** | -0.070 *** | -0.001 *** | -0.019 *** | -0.030 *** | -0.004 *** | -0.077 *** |
| ExR(1) | -0.036 | 0.063 *** | 0.041 | -0.044 | -0.085 | -0.023 * | -0.024 * | -0.030 | 0.037 | 0.011 | 0.008 | 0.024 |
| INF(1) | -0.014 ** | -0.041 | 0.024 | 0.011 *** | 0.068 | 0.011 | 0.013 | -0.013 | -0.015 | -0.070 *** | -0.018 *** | -0.005 *** |
| Adj./Pseudo $R^2$ | 0.600 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.600 | 0.000 | 0.000 | 0.600 | 0.000 | 0.000 |
| Obs | | | | | | 30432 | | | | | | |

Note: *Death*: COVID-19 death cases

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### 5.3. Estimates of the impact of COVID-19 recovered cases on Tourism Firms Stock Return Volatility Risk- EGARCH

Table 4 shows *QR*'s estimation findings for the recovered cases' effect on stock return volatility (*Vol*). This *SR OLS* slope has no significant impact on a recovered case. The *QR* results exhibit a significantly positive effect on *Vol*, except 0.05 quantiles, revealing that COVID-19 significantly impacts *Vol*. The non-negative impact of recovered cases. The duration for recovery from the disease typically spans around ten days. Due to this timeframe, there's a propensity for the number of patients to increase exponentially. Patients will limit travel or practice social distancing after they have experienced suffering from coronavirus disease.

**Table 4.** Impacts of virus recovered cases on tourism stock return volatility risk

| Variable | OLS | Qu5 | Qu10 | Qu20 | Qu30 | Qu40 | Qu50 | Qu60 | Qu70 | Qu80 | Qu90 | Qu95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 0.015 | 0.023 | 0.015 | 0.016 | 0.012* | 0.017* | 0.035*** | 0.045*** | 0.092*** | 0.017*** | 0.035*** | 0.065*** |
| Recovered | 0.032 | 0.037 | 0.031*** | 0.008*** | 0.019*** | 0.027*** | 0.034*** | 0.050*** | 0.077*** | 0.011*** | 0.024*** | 0.006*** |
| GRSI | -0.012 | 0.031 | 0.094 | 0.027 | -0.054 | 0.056 | 0.020* | 0.014 | -0.029 | -0.042 | -0.074 | 0.025 |
| Oil(1) | 0.094 | -0.001*** | -0.014*** | -0.033*** | -0.053*** | -0.073*** | -0.076*** | -0.001*** | -0.017*** | -0.027*** | -0.004*** | -0.006*** |
| ExR(1) | -0.040 | 0.044* | 0.027 | -0.046 | -.037 | -0.017 | -0.017 | -0.009 | 0.001 | 0.003 | 0.076 | 0.002 |
| INF(1) | -0.011* | -0.031 | 0.020 | 0.094*** | 0.040 | 0.088 | -0.030 | -0.073 | -0.037*** | -0.079*** | -0.022*** | -0.047*** |
| Adj./Pseudo $R^2$ | 0.500 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.600 | 0.000 | 0.000 | 0.600 | 0.000 | 0.000 |
| Obs | | | | | | | 30432 | | | | | |

Note: *Recovered*: COVID-19 recovered cases

GRSI reveals significantly positive impacts on Vol, only at the 0.5 quantile from control variables. The OIL, INF, and ExR show a significant effect on Vol. Hence, the results confirm hypothesis H1c which shows that COVID-19 recovered cases impact tourism firm stock return volatility.

### 5.4. Estimates of the impact of COVID-19 vaccination progress on Tourism Firms Stock Return Volatility Risk - EGARCH

Table 5 shows the estimation findings of QR for the effect of the vaccination progress on Vol. The OLS slope and the QR results depicts a negative impact on Vol significantly, at all quantiles, indicating that the pandemic substantially affects Vol. The higher vaccination progress, the lower tourism firms' stock return volatility risk.

From control indicators, GRSI negatively and significantly influences Vol at all quantiles. The result indicates that implementing GRSI leads to a decreased volatility risk firm. However, the oil prices positively affect Vol, only at 0.4 quantiles. Nevertheless, ExR had a positively significant impact on Vol, except 0.2, 0.9, and 0.95 quantiles. Furthermore, INF shows positively significant at the lower and higher

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volatility firms, at 0.05, 0.1, 0.8, 0.9 and 0.95 quantiles. Thus, the results confirm hypothesis H1d that COVID-19 vaccination progress has significant influences on tourism firm stock return volatility.

**Table 5.** Impacts of COVID-19 vaccination progress on tourism stock return volatility risk

| Variable | OLS | Qu5 | Qu10 | Qu20 | Qu30 | Qu40 | Qu50 | Qu60 | Qu70 | Qu80 | Qu90 | Qu95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 2.319 | -0.002 | 0.014 | 0.038 | 0.086 | 0.024** | 0.018* | 0.028* | 0.027* | 0.029 | 0.098* | 0.225* |
| VP | -1.97*** | -0.014*** | -0.016*** | -0.015*** | -0.021*** | -0.017* | -0.016* | -0.028*** | -0.034** | -0.060*** | -0.029*** | -0.070*** |
| GRSI | -0.022*** | -0.015*** | -0.013*** | -0.012* | -0.045*** | -0.053*** | -0.033* | -0.046** | -0.071*** | -0.010*** | -0.048*** | -0.012*** |
| Oil(1) | 0.84 | 0.006 | 0.013 | 0.012 | 0.037 | 0.010* | 0.058 | 0.059 | 0.091 | 0.088 | 0.034 | 0.077 |
| ExR(1) | 0.191*** | 0.012*** | 0.015*** | 0.076 | 0.018* | 0.073*** | 0.085*** | 0.097*** | 0.010*** | 0.067* | 0.021 | 0.049 |
| INF(1) | 0.006 | 0.041*** | 0.073*** | 0.012 | 0.058 | 0.083 | 0.034 | 0.076 | 0.012 | 0.033* | 0.015*** | 0.042*** |
| Adj./Pseudo $R^2$ | 0.500 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.600 | 0.000 | 0.000 | 0.600 | 0.000 | 0.000 |
| Obs | 30432 | | | | | | | | | | | |

Note: *VP*: Vaccine Progress

### 5.5. Estimates of the impact of the COVID-19 Case on Tourism Firms Stock Return

Table 6 depicts the outcome of using quantile regression (QR) to assess how confirmed cases affect stock return (SR). The Ordinary Least Squares (OLS) results are compared. The OLS slope for confirmed cases demonstrates insignificance, suggesting that an increase in confirmed cases within a country might not significantly impact Malaysia's tourism industry volatility risks. Confirmed cases are associated with a non-significant coefficient from 0.40 to 0.95 quantiles, and they have a significant negative coefficient at lower quantile degrees from 0.05 to 0.30, implying that the confirmed cases reduce SR at low-return firms. Thus, the confirmed cases significantly influence the tourism firm's returns on low-return tourism firms.

From control indicators, GRSI generally had positive and significant impacts on SR. The restricting strategy of government controls the disease of COVID-19. SR is normally increased by GRSI, except the quantile of 0.5. Nevertheless, exchange rate, foreign exchange and oil price significantly negatively affect SR at the 0.05–0.4 quantiles and 0.8–0.95 quantiles. Thus, the results confirm hypothesis H1b which shows that COVID-19 confirmed cases substantially impact tourism industry returns for low-return firms.

**Table 6.** COVID-19 confirmed cases impacts for stock returns of tourism

| Variable | OLS | Qu5 | Qu10 | Qu20 | Qu30 | Qu40 | Qu50 | Qu60 | Qu70 | Qu80 | Qu90 | Qu95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 0.052** | 0.379*** | 0.224*** | 0.237*** | 0.176*** | 0.176*** | 0.164 | 0.038* | 0.038* | 0.094*** | 0.276*** | 0.172*** |
| Confirmed | 0.028 | -0.023* | -0.018** | -0.019*** | -0.013*** | 0.011 | 0.030 | 0.061 | -0.068 | 0.037 | 0.056 | 0.089 |
| GRSI | 0.020*** | 0.033*** | 0.026*** | 0.029*** | 0.022*** | 0.021*** | 0.258 | 0.090*** | 0.094*** | 0.020*** | 0.015*** | 0.014** |
| Oil(1) | -0.077* | -0.009* | -0.069* | -0.013* | -0.048* | -0.048* | -12.315 | -0.034 | -0.039 | -0.016* | -0.028* | -0.055* |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ** | | | ** | * | * | | | | ** | ** | ** |
| ExR(1) | -0.055* | -0.023*** | 0.046 | -0.024*** | -0.025*** | -0.023*** | -0.128 | 0.030 | -0.034 | 0.034 | 0.087 | -0.016* |
| INF(1) | -0.025 | -0.003*** | -0.014*** | -0.057** | -0.032* | -0.032* | -0.064*** | -0.016 | -0.016 | -0.050* | -0.018*** | -0.059 |
| Adj./Pseudo $R^2$ | 0.500 | 0.019 | 0.009 | 0.008 | 0.004 | 0.004 | 0.014 | 0.004 | 0.004 | 0.009 | 0.015 | 0.025 |
| Obs | | | | | | 30432 | | | | | | |

### 5.6. The COVID-19 death case impact estimates for Firms Return of Tourism

Table 7 depicts the results of using *QR* to assess the number of COVID-19 deaths impact for stock return (*SR*). This *SR OLS* slope analysis depicts an insignificant impact on death cases. The *QR* results show a negative influence on *SR* significantly across low-return quantiles, 0.20-0.40. This reveals that higher number of COVID-19 death cases significantly affect *SR* at low-return tourism firms, which shows the disparity in sign. The findings align partially with Al-Awadhi et al. (2020), who found that stock returns are negatively influenced by the deaths and daily rise in total confirmed cases using a panel regression approach.

**Table 7.** Impacts of virus deaths on tourism stock return

| Variable | OLS | Qu5 | Qu10 | Qu20 | Qu30 | Qu40 | Qu50 | Qu60 | Qu70 | Qu80 | Qu90 | Qu95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 0.044* | 0.039 | 0.031 | 0.116*** | 0.098*** | 0.090*** | 0.144 | 0.004 | 0.004 | 0.101*** | 0.292*** | 0.147* |
| Death | -0.041 | -0.058 | -0.099 | -0.020*** | -0.012*** | -0.010*** | -0.004 | -0.020 | -0.022 | -0.064 | -0.012 | -0.093 |
| GRSI | 0.039 | 0.016** | 0.031 | 0.050 | 0.066** | 0.060** | 0.258* | 0.011*** | 0.015*** | 0.016*** | 0.094 | 0.020* |
| Oil(1) | -0.008*** | -0.021*** | -0.016*** | -0.011*** | -0.028 | -0.020 | -12.315 | -0.055** | -0.059** | -0.018*** | -0.032*** | -0.056*** |
| ExR(1) | 0.062 | -0.027*** | -0.015*** | -0.011** | -0.016*** | -0.010*** | -0.128 | 0.031 | 0.033 | -0.011 | 0.033 | -0.019* |
| INF(1) | -0.023 | -0.050 | -0.049 | -0.018 | -0.012 | -0.012 | -0.064*** | 0.090 | 0.097 | -0.045* | -0.017*** | -0.053 |
| Adj./Pseudo $R^2$ | 0.530 | 0.012 | 0.004 | 0.004 | 0.002 | 0.002 | 0.014 | 0.004 | 0.004 | 0.009 | 0.015 | 0.025 |
| Obs | | | | | | 30432 | | | | | | |

About the control indicators, *GRSI* reveals a significant positive influences *SR*, except at the 0.1, 0.2 and 0.9 quantiles. *GRSI* typically increases *SR* as part of restrictive government strategies to combat the COVID-19 pandemic. This is parallel with Zaremba et al. (2020) who show that government interventions (*GRSI*) drive global stock market volatility using panel regressions. The oil prices and exchange rate show significant negative effects on *SR*. However, inflation only shows significance at the 0.5, 0.8 and 0.9 quantiles. These illustrate that higher *Oil*, *ExR*, and *INF* lead to lower stock returns. Hence, our findings hold hypothesis $H_{1a}$ that the pandemic deaths cases considerably influence tourism returns for lower return firms.

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### 5.7. Estimates of the effect of COVID recovered cases on Tourism Firms Stock Return

Table 8 exhibits the results of *QR* for the influence of recovered cases number on stock return (*SR*). This *SR* estimated *OLS* slope reveals significantly 1 percent level negative. With this, the greater COVID-19 recovered cases number occurs, the lesser the SR. These estimates of QR show a significant negative effect of stock return for all quantiles, except 0.95 level, indicating that the pandemic substantially affects *SR*.

Similar to Tables 6 and 7, *GRSI* reveals a significant positive influence on *SR*, except at the 0.5 quantile. The oil prices show a significant effect on *SR*, except for 0.05, 0.3, 0.4, and 0.5. However, the exchange rate only had a significant impact on SR for low-return firms, from 0.05 to 0.4. Nevertheless, inflation only shows significance at the 0.05, 0.1, 0.5, and 0.9 quantiles. Hence, our findings hold hypotheses $H_{1c}$ that the pandemic recovered cases have noteworthy influences on tourism corporate returns.

**Table 8.** Impacts of virus recovered cases on tourism stock return

| Variable | OLS | Qu5 | Qu10 | Qu20 | Qu30 | Qu40 | Qu50 | Qu60 | Qu70 | Qu80 | Qu90 | Qu95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 0.020 | 0.202*** | 0.095*** | 0.117*** | 0.106*** | 0.106*** | 0.152 | 0.015 | 0.015 | 0.122*** | 0.268*** | 0.144* |
| Recover | -0.016*** | -0.044*** | -0.031*** | -0.021*** | -0.013*** | -0.011*** | -0.182* | -0.021** | -0.023** | -0.008*** | -0.006** | -0.022 |
| GRSI | 0.015*** | 0.022*** | 0.020*** | 0.021*** | 0.017*** | 0.011*** | 0.258 | 0.011*** | 0.013*** | 0.002*** | 0.016** | 0.018* |
| Oil(1) | -0.011*** | -0.064 | -0.069** | -0.015*** | -0.024 | -0.021 | -12.315 | -0.061*** | -0.067*** | -0.021*** | -0.030*** | -0.056*** |
| ExR(1) | -0.040 | -0.033*** | -0.016*** | -0.010** | -0.015*** | -0.015*** | -0.128 | -0.061 | 0.061 | 0.004 | -0.067 | -0.019* |
| INF(1) | -0.021 | -0.024*** | -0.001*** | 0.028 | 0.025 | -0.025 | -0.064*** | 0.051 | -0.051 | 0.004 | -0.002*** | -0.051 |
| Adj./Pseudo $R^2$ | 0.530 | 0.041 | 0.020 | 0.012 | 0.005 | 0.005 | 0.014 | 0.005 | 0.005 | 0.010 | 0.015 | 0.025 |
| Obs | | | | | | | 30432 | | | | | |

### 5.8. COVID-19 vaccine progress impact estimates for Stock Return of Tourism Firms

Table 9 illustrates QR outcome for the vaccination progress impact for stock return (SR). This SR OLS slope estimation shows positive level of 5 percent. As the number of vaccines injected increases, stock return would also rise. The QR results reveal a significant positive influence for SR throughout all quantiles, except the 0.9 and 0.95 level.

**Table 9.** Impacts of COVID-19 vaccination progress on tourism stock return

| Variable | OLS | Qu5 | Qu10 | Qu20 | Qu30 | Qu40 | Qu50 | Qu60 | Qu70 | Qu80 | Qu90 | Qu95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 0.513** | 1.213** | 1.467*** | 0.636* | 0.392* | 0.392* | 0.196 | 0.030 | 0.031 | 0.497 | 0.344 | 0.499 |
| VP | 0.041** | 0.010** | 0.042 | 0.012*** | 0.097*** | 0.091*** | 0.044* | 0.070*** | 0.077*** | 0.058* | 0.031 | 0.069 |
| GRSI | 0.012 | 0.015* | 0.065 | 0.094* | 0.010*** | 0.011*** | 0.258* | 0.060* | 0.063* | 0.045* | 0.085 | 0.030 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oil(1) | -0.204* | -0.556** | -0.650*** | -0.272* | -0.177* | -0.110* | -12.315 | -0.013 | -0.015 | -0.172 | -0.017 | -0.129 |
| ExR(1) | -0.061* | -0.039*** | -0.038 | -0.028 | -0.017 | -0.017 | -0.128 | -0.012 | -0.012 | -0.011* | -0.019** | -0.097 |
| INF(1) | -0.058*** | -0.032 | -0.013*** | -0.077*** | -0.044*** | -0.044*** | -0.064*** | -0.030 | -0.039 | -0.064** | -0.019*** | -0.014*** |
| Adj./Pseudo $R^2$ | 0.400 | 0.023 | 0.010 | 0.018 | 0.014 | 0.014 | 0.014 | 0.017 | 0.017 | 0.031 | 0.041 | 0.008 |
| Obs | 30432 | | | | | | | | | | | |

**Table 10.** The slope estimates equality statistical test throughout multiple quantiles

| | **Quantile** | **Return: $\chi^2$ statistic (p value)** | **Risk: $\chi^2$ statistic (p value)** |
|---|---|---|---|
| Panel a, Case impact | 0.05 vs 0.95 | 0.019(0.000)*** | 0.018(0.000)*** |
| | 0.1 vs 0.9 | 0.096(0.000)*** | 0.099(0.000)*** |
| | 0.2 vs 0.8 | 0.072(0.000)*** | 0.096(0.000)*** |
| | 0.3 vs 0.5 | 0.035(0.000)*** | 0.045(0.000)*** |
| Panel b, Death impact | 0.05 vs 0.95 | 0.094(0.000)*** | 0.091(0.000)*** |
| | 0.1 vs 0.9 | 0.045(0.000)*** | 0.045(0.000)*** |
| | 0.2 vs 0.8 | 0.037(0.000)*** | 0.030(0.000)*** |
| | 0.3 vs 0.5 | 0.030(0.000)*** | 0.025(0.000)*** |
| Panel c, Recover impacts | 0.05 vs 0.95 | 0.048(0.000)*** | 0.006(0.000)*** |
| | 0.1 vs 0.9 | 0.032(0.000)*** | 0.003(0.000)*** |
| | 0.2 vs 0.8 | 0.020(0.000)*** | 0.001(0.000)*** |
| | 0.3 vs 0.5 | 0.035(0.000)*** | 0.020(0.000)*** |
| Panel d, Vaccine Progress | 0.05 vs 0.95 | 0.048(0.000)* | 0.032(0.000)*** |
| | 0.1 vs 0.9 | 0.011(0.000)*** | 0.016(0.000)*** |
| | 0.2 vs 0.8 | 0.014(0.000)*** | 0.050(0.000)*** |
| | 0.3 vs 0.5 | 0.016(0.000)*** | 0.023(0.000)*** |
| Panel d, Stringency Index | 0.05 vs 0.95 | 0.027(0.000)*** | 0.058(0.000)*** |
| | 0.1 vs 0.9 | 0.016(0.000)*** | 0.023(0.000)*** |
| | 0.2 vs 0.8 | 0.019(0.000)*** | 0.089(0.000)*** |
| | 0.3 vs 0.5 | 0.021(0.000)*** | 0.031(0.000)*** |

Note: The $\chi^2$statistics for slope parameters equality among various quantiles present the differences via slope estimate in the *Ø and 1Ø* quantiles. The disparities observed across different quantiles hold significance across a majority of scenarios. Note that the COVID-19 results influence on tourism industry returns following the *Equation (1)*, where bootstrapped replications are performed on standard errors.

Similar to Tables 6, 7 and 8, GRSI almost positively and significantly affects SR, except at the 0.1, 0.9, and 0.95 quantiles. However, the Oil and ExR significantly affect SR at certain quantiles. Nevertheless, INF shows a significant negative impact on SR, except 0.05, 0.6 and 0.7 quantiles. Therefore, the findings support hypothesis H1d that the pandemic vaccination progress has noteworthy impact on tourism sector returns.

Panel a, b, c and d of Table 10 illustrate that F-tests to examine the equality of slope parameters among various quantiles, hold hypotheses H1a, H1b, H1c and H1d which the pandemic cases, deaths, recovered, vaccine progress, as well as GRSI index, have a meaningful impact on SR and stock return volatility.

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### 5.9. Robustness Check

Three other dependent indicators in the same model are considered in Tables 11 and 12, which are GARCH, standard deviation and international tourist arrival. This allows for comparisons across the dependent indicators (GARCH, standard deviations, and international tourist arrivals) of the variables' influence on stock return (SR) and stock return volatility. Both the ordinary least square slope and QR estimate among the influence of the pandemic variables in stock return volatility (GARCH model), as compared with other COVID-19 variable recovered cases only are considerably positive significant at the 1 percent level, showing that as increase recovered occur, more stock return volatility risk would rise. The recovered cases are significantly positive coefficients at 0.5, 0.6, 0.7, and 0.9, signifying that COVID-19 recovered cases increase stock return volatility risk (GARCH).

On the other hand, the COVID-19 cases, death cases and vaccine progress have noteworthy impact on stock return volatility (standard deviation) in OLS slope and QR estimation. The confirmed cases report positive significance at all quantiles, and the death cases reveal negative significance at all quantiles. The recovered cases show a considerably negative impact on stock return volatility (standard deviation) at 0.5, 0.6, 0.7, and 0.8 quantiles. The vaccine progress shows negative significance at all quantiles, except 0.95 quantiles. The results indicate that higher death cases lead to higher stock return volatility risk; higher death, recovered cases, and vaccine progress lead to lower stock return volatility risk. Hence, we can conclude that the COVID-19 disease substantially affects stock return volatility.

**Table 11.** Estimation of the impact of COVID case, death, recover and vaccine progress on Tourism Firms Risk

| | GARCH | | | | | | Standard Deviation | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | OLS | Q50 | Q60 | Q70 | Q80 | Q90 | OLS | Q50 | Q60 | Q70 | Q80 | Q90 |
| C | 0.042 (0.047) | 0.011 (0.027) | 0.081 (0.073) | 0.030 (0.031) | 0.023 (0.049) | 0.104 (0.122) | 0.113 (0.279) | 0.012 (0.226) | 0.090 (0.315) | 0.099 (0.430) | 0.041 (0.5265) | 0.203 (1.013) |
| Confirmed | 0.013 (0.011) | **0.011*** ** (0.064) | 0.018 (0.017) | 0.075 (0.074) | 0.012 (0.012) | 0.031 (0.029) | **0.037*** ** (0.066) | **0.042*** ** (0.053) | **0.055*** ** (0.074) | **0.068*** ** (0.010) | **0.057*** ** (0.012) | **0.067*** ** (0.024) |
| Death | 0.36 (0.091) | 0.035 (0.052) | 0.094 (0.014) | 0.098 (0.061) | 0.082 (0.096) | 0.027 (0.024) | **-0.026*** ** (0.054) | **-0.022*** ** (0.044) | **-0.034*** ** (0.061) | **-0.042*** ** (0.083) | **-0.033*** ** (0.010) | **-0.045*** ** (0.019) |
| Recovered | **0.007** ** (0.003) | **0.028*** (0.019) | **0.012** ** (0.051) | **0.061*** ** (0.022) | 0.019 (0.034) | **0.018** ** (0.085) | **-0.041*** * (0.020) | **-0.065*** ** (0.016) | **-0.076*** ** (0.022) | **-0.067*** * (0.030) | **-0.058*** (0.037) | -0.029 (0.071) |
| VP | 0.044 (0.050) | **-0.061*** * (0.029) | **-0.017** ** (0.079) | -0.019 (0.034) | -0.036 (0.053) | -0.097 (0.013) | **-0.011*** ** (0.030) | **-0.011*** ** (0.024) | **-0.015*** ** (0.034) | **-0.020*** ** (0.046) | **-0.015*** ** (0.057) | **-0.022*** ** (0.011) |
| GRSI | **-0.016** * (0.091) | -0.014 (0.056) | -0.028 (0.014) | -0.063 (0.061) | -0.040 (0.096) | **-0.050** ** (0.024) | **-0.014*** ** (0.054) | **-0.063*** (0.044) | **-0.094*** (0.061) | **-0.022*** ** (0.084) | **-0.028*** ** (0.010) | **-0.037*** ** (0.020) |
| Oil(1) | - | -0.043 | - | -0.083 | - | - | 0.109 | 0.015 | 0.015 | 0.033 | 0.114 | 0.259 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.013 (0.022) | (0.013) | 0.026 (0.035) | (0.015) | 0.052 (0.024) | 0.040 (0.059) | (0.134) | (0.109) | (0.151) | (0.207) | (0.253) | (0.486) |
| ExR(1) | 0.025 (0.079) | **0.014***** (0.045) | **0.021*** (0.012) | 0.030 (0.053) | 0.010 (0.083) | 0.080 (0.020) | **0.009**** (0.005) | 0.004 (0.001) | 0.006 (0.005) | 0.002 (0.007) | 0.004 (0.009) | 0.004 (0.017) |
| INF(1) | **-0.069*** (0.036) | -0.024 (0.021) | -0.012 (0.057) | **-0.048**** (0.024) | -0.020 (0.038) | -0.040 (0.095) | **-0.001***** (0.001) | **-0.001*** (0.001) | **-0.001*** (0.001) | **-0.001***** (0.001) | **-0.001**** (0.001) | **-0.002***** (0.001) |
| Adj./Pseudo $R^2$ | 0.400 | 0.030 | 0.010 | 0.040 | 0.050 | 0.050 | 0.040 | 0.056 | 0.054 | 0.051 | 0.026 | 0.030 |
| Obs | | | | | | | 30432 | | | | | |

In table 11, GRSI and INF demonstrate noteworthy negative influences on stock return volatility (GARCH and standard deviation) at all quantiles. ExR and Oil indicate salient impact on stock return volatility. In addition, tourism firms may need more management and marketing strategies to confront the risk all along the risky pandemic span.

In table 12, higher COVID-19 confirmed cases and death cases lead to decrease international tourist arrival. The movement restrictions in whole country decreases the number of tourist arrivals in Malaysia.

**Table 12.** Estimates of COVID cases impact, vaccine progress, recovery, and death on international tourist arrivals

| Variable | OLS | Q10 | Q30 | Q50 | Q70 | Q90 |
|---|---|---|---|---|---|---|
| C | -130.431 | -66.946 | -49.998 | -254.939 | -218.520 | -276.648 |
| Confirmed Case | -0.077 | **-0.536*** | **-0.636*** | **-0.384*** | **-0.148*** | **-0.711*** |
| Death Case | **-0.0938*** | **-0.113*** | **-0.039*** | **-0.221*** | **-0.074*** | **-0.370*** |
| Recover Case | -2.402 | -3.043 | -3.034 | -1.752 | -1.653 | -0.963 |
| VP | -0.042 | -0.151 | -0.018 | -0.125 | -0.087 | -0.076 |
| GRSI | -0.001 | **0.001*** | **0.001*** | **-0.001*** | **-0.001*** | **-0.001*** |
| Oil(1) | **-0.267*** | **2.280*** | **0.179*** | **-2.142*** | **-0.790*** | **-3.858*** |
| ExR(1) | 11.658 | **14.076*** | **10.211*** | **24.711*** | **17.340*** | 22.115 |
| INF(1) | 27.697 | 10.115 | 9.995 | 51.268 | 45.036 | 57.499 |
| Adj./Pseudo $R^2$ | 0.737 | 0.544 | 0.484 | 0.597 | 0.700 | 0.788 |
| Obs | | | | 30432 | | |

## 6. Conclusion

Consumer discretionary spending has collapsed due to COVID-19, and travel-related industries are badly affected. Restaurants, casinos, leisure facilities, and hotels cancel or reduce particular events, reducing labour force and productivity, and eventually affecting the tourism industry's profit. This paper analyses COVID-19 variables influence of risk and return for tourism. These results show that COVID-19 recovered and death cases exert an asymmetric influence on tourism industry risks and return at the majority quantiles. Confirmed cases show a more positive significant impact at lower risk and higher risk quantiles and a negative impact on the tourism industry at lower return quantiles identified by this study. Vaccination progress shows a negative influence across all levels of risk quantiles and a positive effect on return quantiles. Lastly, this presents both positive and negative correlations between the stringency index of government response (*GRSI*) and stock return risk (*SR*), and the encouraging correlation across *SR* and *GRSI*. Oil price (*Oil*), exchange rate (*ExR*), and inflation (*INF*) play a significant role in tourism corporate risk and return.

In conclusion, our results show that the influences of the pandemic indicators, GRSI, Oil, ExR and INF on the tourism sector risk and returns differ among risk and return quantiles. These findings indicate that ordinary least square captures the average behavior but misdiagnose the correlative of the pandemic indicators, GRSI, and control indicators on tourism corporate risk and return. The quantile regression model is better than general ordinary least squares methods for fitting Malaysia's pandemic data and stock volatility and returns. This study's findings confirm Assaf and Tsionas (2018) demonstrate that employing the quantile regression method can attain more robust and complete hypothesis detection, although the results non-saliently vary among quantiles.

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