Asia-Pacific Journal of Science and Technology: Volume: 27. Issue: 06. Article ID.: APST-27-06-14. Research Article

APST

Asia-Pacific Journal of Science and Technology

https://www.tci-thaijo.org/index.php/APST/index

Published by the Research and Technology Transfer Affairs Division,
Khon Kaen University, Thailand

Tourism stocks of Thailand in COVID-19 crisis

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Received 19 June 2021
Revised 6 September 2021
Accepted 5 November 2021

Abstract

The COVID-19 pandemic has affected economies worldwide impacting on industry, service, tourism, and financial sectors including stock markets. This study aims to examine the impact of the COVID-19 pandemic on the volatility of the Tourism & Leisure stock index within the Stock Exchange of Thailand. The The Glosten–Jagannathan–Runkle GARCH (GJR-GARCH) (1,1) model is chosen to analyze the volatility of the data series. The analysis reveals that long-run persistent volatility exists in Tourism & Leisure stocks from shock events. Moreover, negative shocks appear to cause a greater increase in volatility than positive shocks due to the leverage effect. To analyze the impact of COVID-19 on tourism stock volatility, a dummy COVID-19 variable is added to the conditional variance of the GJR-GARCH (1,1) equation. The empirical findings show a significant positive coefficient in the COVID-19 dummy variable for conditional variance, although it is very small. This indicates that the COVID-19 pandemic has had a significant positive impact on tourism stock volatility, although the increase is only slight. This may be due to the Federal Reserve's announcement regarding the unlimited quantitative easing measures in response to the COVID-19 crisis. The results of this study can be used to assist investors and policymakers in their decision- making and risk management of future pandemics.

Keywords: Covid-19, Tourism stock, Quantitative easing measures, GJR-GARCH model

1. Introduction

The coronavirus pandemic (COVID-19) started in December 2019 and is still negatively affecting the economies of many countries around the world. COVID-19 has impacted on both business supply and demand, including shutdown and labor layoffs, resulting in loss of income and reduced household consumption. These impacts also have adversely affected the mental health of people worldwide [1]. Furthermore, worldwide travel restrictions have been put in place, seriously affecting travel-related businesses and the tourism sector [2]. According to Abbas et al. [3], the COVID-19 pandemic has significantly affected the supply chain of the travel and tourism business such as tour operators, transportation, airlines, cruises, accommodation, and attractions, resulting in loss of revenue for the travel and tourism industry. In addition, the COVID-19 pandemic has also affected the financial sector and the stock market. Several studies suggest that the COVID-19 pandemic is impacting on stock markets. For example, Liu et al. [4] studied the impact of the coronavirus pandemic on stock markets in major countries within Asia, Australia, the Middle East, Europe, and the US. The results indicate that COVID-19 had an adverse effect on stock markets in these countries, especially in Asia where more negative abnormal returns were experienced than in other regions. Similarly, Salisu et al. [5] determined that emerging stock markets are more vulnerable to the uncertainty caused by pandemics than developed markets. He et al. [6] explored the impacts and spillover effects of COVID-19 on stock markets in Asia, Europe, and the US, and stated that the pandemic has had an impact and bidirectional spillover effect on these countries. Yousef [7] investigated the impact of COVID-19 on the volatility of the stock market in major G7 countries, demonstrating that the growth rate of daily new cases has had a significant positive impact on G7 stock market volatility. Shehzad et al. [8] found that volatility created a spillover effect between the stock markets of China and Pakistan. Moreover, a leverage

effect exists in the stock markets of both China and Pakistan during the COVID-19 pandemic. In their study of various sector stocks, Hanif et al. [9] found that COVID-19 impacted on the dependence structure of ten sector indices in the stock markets of the US and China. Likewise, Panyagometh [10] examined the impact of COVID-19 on Thailand's stock market through a sample of 46 stocks across 12 sectors, excluding the tourism sector. The results show that COVID-19 has had an impact on the returns and volatilities of most securities.

The impact of COVID-19 on tourism stock indices is receiving increased attention due to its widespread effect on businesses related to the travel and tourism sectors. For example, Sen [11] found that COVID-19 has had a negative impact on tourism stock prices. Chen et al. [12] found that the government restrictions imposed to mitigate the effects of COVID-19 have had a negative impact on tourism stock returns in the US. Furthermore, Lee and Chen [13] investigated the impact of COVID-19 variables on stock returns in the tourism sector across 65 countries, determining that the rate of change in COVID-19 deaths has had a significant negative impact. This is due to COVID-19 creating economic recession and volatility in global stock markets. The US Federal Reserve (Fed), European Central Bank (ECB), and the Bank of Japan (BOJ) have issued various measures in response to the global economic recession caused by the COVID-19 pandemic. These central banks have continued to maintain low interest rates and vastly extended quantitative easing (QE) measures, specifically with the announcement of unlimited QE. The use of QE programs has bolstered demand and the functions of financial markets [14]. Consequently, COVID-19 and QE measures have also affected stock markets worldwide, but a negative shock is more likely to cause increases in stock market volatility than a positive one.

In accordance with the foregoing, this research aims to study the impact of the COVID-19 pandemic on the tourism stock index of Thailand. In particular, the study will investigate how the shock from COVID-19 pandemic affects the volatility of the tourism sector stock index. The tourism industry plays an important role in Thailand's economy, contributing 110 billion USD (21.6%) to the country's gross domestic product (GDP) in 2018. The majority of the direct contribution from travel and tourism came from international tourism (80.2% of the total travel and tourism spending) [15], enhancing economic growth [16,17]. In 2019, 39 million international tourists arrived in Thailand, but this figure fell to 6.8 million (83% decline) in 2020 due to the COVID-19 pandemic [18]. This has had a significant negative impact on investment in the travel and tourism sector, including tourism stocks on Thailand's stock market.

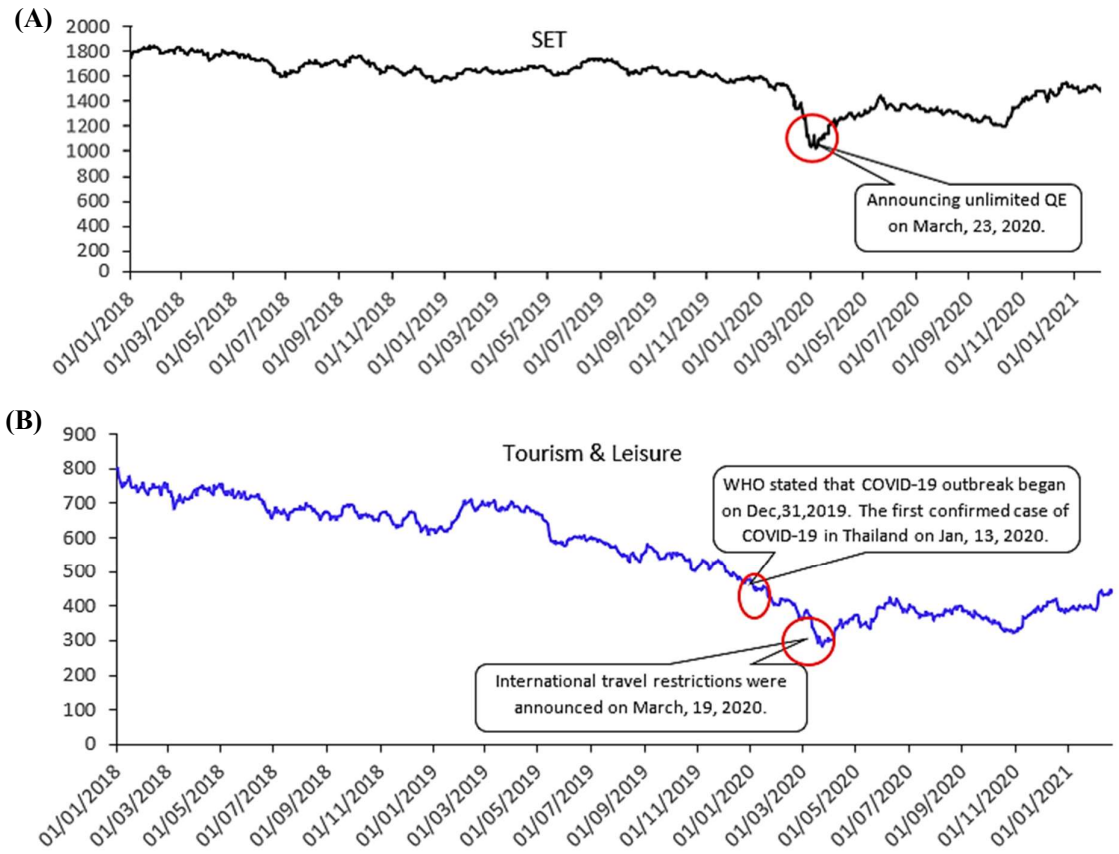

Figure 1 (A) Stock Exchange of Thailand (SET) index, and (B) the tourism stock index (Tourism & Leisure).

As shown in Figure 1, the SET and the tourism stock index (Tourism & Leisure) have simultaneously and significantly decreased since the World Health Organization (WHO) announced the COVID-19 pandemic on December 31, 2019, in China, with the first case of COVID-19 occurring in Thailand on January 13, 2020 [19]. There was a sharp decrease in March 2020 following the announcement of international travel restrictions by the government on March 19, 2020, and the subsequent state of emergency, which took effect on March 26, 2020 [20]. Meanwhile, the Fed announced unlimited QE measures on March 23, 2020 [21], resulting in significant stock market fluctuations and the tourism stock index, although the stocks have subsequently recovered despite the impact from COVID-19.

This study aims to analyze the impact of the COVID-19 pandemic on the tourism stock index volatility in Thailand using the standard GARCH (1,1) and The Glosten–Jagannathan–Runkle GARCH (GJR-GARCH) (1,1) models. The study also investigates the impact of COVID-19 using the pandemic as a dummy variable on the conditional variance equation. The results of the analysis indicate that the COVID-19 pandemic has had a positive impact on the conditional variance of the tourism stock index, but its magnitude is small. This clearly reveals that the COVID-19 pandemic has slightly increased the volatility of tourism stock prices on the SET, causing them to fluctuate in a downward trend. The results of the GJR-GARCH (1,1) model show a positive leverage parameter, implying that a negative shock has a greater effect on the volatility of stock returns than positive. In other words, bad news is more likely to increase stock index volatility than good news of the same magnitude. Moreover, long-term persistent volatility exists due to the shock effect.

This study contributes to the existing scientific literature in two main aspects. Firstly, the empirical findings reveal the effects of COVID-19 on stock market volatility, especially in relation to the SET and the tourism sector, which has not yet been studied. Secondly, the GJR-GARCH is an appropriate model for analyzing the tourism stock index during a pandemic situation, since it can examine the leverage effect of COVID-19 on the volatility of the tourism stock index, indicating that the pandemic has affected the investment risk from a fall in the price of tourism stocks. The findings of this study have implications for investors and policymakers and can be used to aid investors in decision-making and risk management for future pandemic events. To ensure its future security, the tourism industry needs to be transformed in preparation for pandemic situations such as by moving away from mass tourism toward potential tourism, changing tourism products like accommodations and improving the quality of human resources [3]. Investors should also aim to mitigate their risk in the stock market by investing in more diversified businesses.

2. Materials and methods

2.1 Data

This study uses the Tourism & Leisure stock index of the Stock Exchange of Thailand (SET) for analysis. The daily data on closing prices for the period from January 1, 2018 to February 26, 2021 were collected using the Thomson Reuters Database. The data series was converted to the return series using the natural log of relative prices: $\ln(P_t/P_{t-1})$.

Table 1 presents the descriptive statistics of the return series. The return series has a negative average and a very low skewness (close to zero), which means that the return series has a symmetric distribution. However, excess kurtosis is exhibited, meaning that the return series either follows a leptokurtic distribution or there are more extreme outliers. The null hypotheses for the normality of the Jarque-Bera and Kolmogorov-Smirnov tests are rejected in the data series. These results correspond to those presented in Figure 2 while the Tourism & Leisure stock return series exhibit the volatility and outliers. Finally, the Augmented Dickey-Fuller (ADF) test indicates that the return series is stationary with a *p*-value of less than 0.01.

Table 1 Descriptive statistics for the Tourism & Leisure stock return series.

Tourism & Leisure Return	
Mean	-0.001
Median	-0.001
Maximum	0.080
Minimum	-0.085
SD	0.015
Skewness	0.002
Kurtosis	5.051
p-value of the Jarque-Bera test	< 2.2e-16
p-value of the Kolmogorov-Smirnov test	< 2.2e-16
p-value of the Augmented Dickey-Fuller test	< 2.2e-16
Number of observations	824

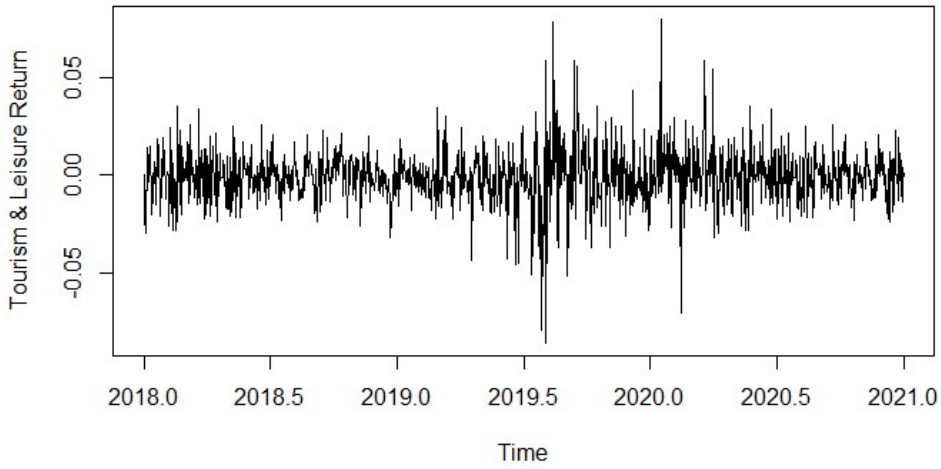

Figure 2 Tourism & Leisure stock return series.

The ARCH effect is tested prior to using the GARCH models. The ARCH-LM test proposed by Engle [22] is used in this study. The results show that the ARCH effect exists in the residuals of the Tourism & Leisure stock return series, as shown in Table 2. The p-values of LM were less than 1%. Therefore, the null hypothesis that the residuals of the return series are homoscedastic is rejected. This result confirms that the models in the GARCH family are appropriate for this study.

Table 2 Results of ARCH-LM test.

Lag Order	Lagrange Multiplier Test Statistic	*p*-value
4	1060.0	0.00e+00
8	400.1	0.00e+00
12	233.6	0.00e+00
16	159.0	0.00e+00
20	118.2	2.22e–16
24	90.3	6.37e–10

Source: Calculated using the aTSA package in the R program.

2.2 Methodology

This study uses the GARCH (1,1) and GJR-GARCH (1,1) models to analyze the volatility of the Tourism & Leisure stock index during the COVID-19 crisis since the financial data characteristics, especially in the stock index, exhibit more volatility and time variance. The GARCH models and the GARCH family are conventional methods for capturing volatility in financial time series data. In the related literature on the subject, such as that of Chong [23], the basic GARCH model was employed to examine US stock market returns and volatility during the subprime mortgage crisis. Similarly, Oberholzera and Venter [24] used various models from the GARCH family, such as GARCH (1,1), GJR-GARCH (1,1), and EGARCH (1,1) to examine the volatility of the JSE/FTSE stock indices during financial crises. Zopiatis et al. [25] employed GJR-GARCH and EGRACH to analyze five hospitality and tourism stock indices in times of crisis. A recent study employed GARCH and GJR-GARCH models to investigate the impact of COVID-19 on stock market volatility for the major G7 stock market indices [7].

The GARCH model presented by Bollerslev [26] was used to explain the symmetry of negative and positive shock effects. Since the start of the crisis, negative shocks appear to have had more effect on volatility than positive shocks. In other words, the signs and sizes of shocks have asymmetric effects on stock market returns. Therefore, since the GJR-GARCH model can measure the asymmetric effects of shocks [27], it is used here to examine the effect of COVID-19 on the Tourism & Leisure stock index volatility of Thailand. The GARCH (1,1) model is presented in Conditional mean equation 1 and Conditional variance equation 2 [28]:

$$y_t = \mu + \varepsilon_t \quad (1)$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 \quad (2)$$

In Equation (1) $y_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$ of the Tourism & Leisure stock index, μ is a constant term, and ε_t is error term. Equation (2) displays the GARCH (1,1) process where σ_t^2 is a conditional variance, ω is a constant term, and α and β are the coefficients.

The $\omega > 0,\ \alpha \geq 0,\ \beta \geq 0$ verify that the value of conditional variance is positive, $\sigma_t^2 > 0$ and $\alpha + \beta < 1$ confirm that the data analysis is stationary, in accordance with the properties of the GARCH (1,1) process. The $\alpha\varepsilon_{t-1}^2$ is the ARCH term and α indicates the short-run persistent shocks, while βh_{t-1} is the GARCH term and parameter β indicates the contribution of shocks to long-run persistence. The $\alpha + \beta$ provides a measure for the degree of shock persistence in a time series; if the value of $\alpha + \beta$ is high and close to 1, this implies greater volatility persistence [29].

The GJR-GARCH (1,1) model is presented in Conditional mean equation (3) and Conditional variance equation 4 [28]:

$$y_t = \mu + \varepsilon_t \tag{3}$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \gamma\varepsilon_{t-1}^2 I(\varepsilon_{t-1} < 0) + \beta\sigma_{t-1}^2 \tag{4}$$

where $I(\cdot)$ is the indicator function, which takes on a value of 1 for $\varepsilon_{t-1} < 0$ and 0 otherwise. The γ is a leverage effect; if γ is positive, then negative, rather than positive shocks, can increase volatility. The condition for positive variance in Equation (4) is $\omega > 0, \alpha > 0, \beta \geq 0$ and $\alpha + \gamma \geq 0$.

To analyze the impact of COVID-19 on Tourism & Leisure stock index volatility, a dummy variable is included in the conditional variance equation of the GJR-GARCH (1,1) model. The dummy variables ($COVID19$) are 0 for the pre-COVID-19 pandemic period (Jan 2018 to Dec 2019) and 1 for the current COVID-19 pandemic period (Jan 2020 to Feb 2020). The equation for GJR-GARCH (1,1) with COVID-19 can be presented as Conditional mean equation 5 and Conditional variance equation 6.

$$y_t = \mu + \varepsilon_t \tag{5}$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \gamma\varepsilon_{t-1}^2 I(\varepsilon_{t-1} < 0) + \beta\sigma_{t-1}^2 + \delta COVID19_t \tag{6}$$

3. Results and discussion

The results for a plain vanilla GARCH (1,1) in Table 3 show that only parameter β is significant at the 0.05 level. The GJR-GARCH (1,1) model results in Table 4 reveal that all the estimated parameters are significant at the 0.05 and 0.01 levels, except for parameter ω, which is insignificant. Moreover, the values of the Akaike and Bayesian information criteria (AIC and BIC) for the GJR-GARCH (1,1) model are lower than a plain vanilla GARCH (1,1). Therefore, the asymmetric GJR-GARCH (1,1) model is appropriate for explaining the volatility of the Tourism & Leisure stock index in this study.

Table 3 Results of the GARCH (1,1) model.

Parameters	Coefficients	Std. Error (*p*-value)
$\boldsymbol{\mu}$	-0.000832	0.000448 (0.3924)
$\boldsymbol{\omega}$	0.000001	0.000004 (0.9902)
$\boldsymbol{\alpha}$	0.033998	0.024291 (0.9358)
$\boldsymbol{\beta}$	0.963931**	0.024497 (0.0243)
$\boldsymbol{\alpha + \beta}$	0.997929	-
Log-Likelihood	2349.827	-
AIC	-5.6938	-
BIC	-5.6709	-

Note: Significance level; 0.01 (***) 0.05 (**) 0.1 (*).

Table 4 Results of the GJR-GARCH (1,1) model.

Parameters	Coefficients	Std. Error (p-value)
μ	-0.001002**	0.000443 (0.0238)
ω	0.000000	0.000000 (0.3460)
α	0.008749***	0.002721 (0.0013)
β	0.974865***	0.003352 (0.0000)
γ	0.030772***	0.008483 (0.0003)
$\alpha + \beta$	0.983614	-
Log-Likelihood	2355.116	-
AIC	-5.7042	-
BIC	-5.6756	-

Note: Significance level; 0.01 (***) 0.05 (**) 0.1 (*).

Table 4 presents the estimated parameters of the GJR-GARCH (1,1) model, demonstrating that short-run (α) and long-run (α+β) persistence exists in the volatility of the Tourism & Leisure stock data series. Specifically, parameter α (0.008749) is statistically significant, indicating that recent shocks have impacted stock index volatility. Parameter β (0.974865) is also statistically significant, indicating that past shocks have impacted stock index volatility. The $\alpha + \beta$ (0.983614) is close to 1, implying that shocks will remain for a long time or have a long memory in conditional variance. Parameter γ (0.030772) is statistically significant and has a positive value, meaning that a leverage effect exists. Negative shocks can create a larger increase in volatility than positive shocks of the same size.

In analyzing the impact of COVID-19 on Tourism & Leisure stock index volatility, the dummy variables ($COVID19$) are added to the GJR-GARCH (1,1) model in equation 6. The results in Table 5 show a significant positive coefficient for COVID-19 dummy variables in the conditional variance. This indicates that the COVID-19 pandemic has caused tourism stocks to become more volatile.

Table 5 Results of the GJR-GARCH (1,1) model with the COVID-19 variable.

Parameters	Coefficients	Std. Error (p-value)
μ	-0.000988**	0.000432 (0.0223)
ω	0.000005***	0.000000 (0.0000)
α	0.000000	0.000344 (0.9999)
β	0.932080***	0.005983 (0.0000)
γ	0.053525***	0.005574 (0.0000)
δ (COVID-19)	0.000014***	0.000000 (0.0000)
$\alpha + \beta$	0.932080	-
Log-Likelihood	2365.974	-
AIC	-5.7351	-
BIC	-5.7007	-

Note: Significance level; 0.01 (***) 0.05 (**) 0.1 (*).

Although the effects of COVID-19 are highly statistically significant (p= 0.0000) for the Tourism & Leisure stock index, the impact is very small, represented by the parameter δ (0.000014). This result confirms that despite the COVID-19 crisis impacting the volatility of Tourism & Leisure stocks, the magnitude is small. This may be due to several factors, such as the provision of accurate information on the COVID-19 pandemic through social media, potentially helping people to change their behavior toward virus prevention [30]; the implementation of government measures to stimulate domestic tourism; and information on the government's vaccine procurement policy, which is still building investor confidence. Furthermore, the Fed's announcement of unlimited QE measures had a noticeable effect on investor confidence, resulting in an increase in stock markets around the

world, including Thailand. The QE measures may be helping to keep stock prices from falling too much due to the negative shock. As presented in Figure 1, the SET index and Tourism & Leisure index rose after the Fed's announcement of unlimited QE measures. Rebucci et al. [31] studied the implementation of QE measures by 21 central banks, revealing that they caused a decrease in domestic sovereign bond yields for both advanced economies and emerging markets. In addition, the results show that the Fed played an important role in stabilizing world bond markets during the COVID-19 crisis. Similarly, Beirne et al. [32] found that the implementation of QE measures in 38 advanced economies affected their financial markets, resulting in lower bond yields and an increase stock prices.

The findings of this current study can contribute to the scientific literature by revealing the effects of the COVID-19 pandemic on the volatility of Leisure & Tourism stocks in Thailand. In particular, the analysis results of the GJR-GARCH model indicate that a leverage effect exists, corresponding to the findings of Shehzad et al. [8], who revealed a leverage effect on the stock markets of China and Pakistan during the COVID-19 pandemic. This indicates that the negative shock resulting from the COVID-19 pandemic has caused leisure and tourism stocks to fluctuate in a downward trend. Therefore, the GJR-GARCH model is considered to be appropriate for analyzing and forecasting leisure and tourism stocks in the future because it can capture the asymmetric impact of COVID-19. Furthermore, the COVID-19 variable should be considered for inclusion in the model.

The limitation of this study is that the variables of the exchange rate and unlimited QE measures have not been included. Previous studies reveal that previous QE measures implemented by the Fed have resulted in a flow of capital into Thailand's stock market, affecting the stock price index [33]. Hence, future studies should include an analysis of the relationship between these variables and tourism stocks to understand the investment phenomenon resulting from unlimited QE measures and the effects of the COVID-19 pandemic on tourism stocks.

4. Conclusion

The aim of this research was to study the impact of the COVID-19 pandemic on the Tourism & Leisure stock index of Thailand and determine how the shock from the crisis has affected the volatility of the Tourism & Leisure stock index. The GJR-GARCH (1,1) model with COVID-19 dummy variables was used to analyze the Tourism & Leisure stock index data. The empirical results reveal long-run persistent volatility exists due to the shock effect. Moreover, the COVID-19 pandemic has caused an increase in tourism stock volatility, although the impact is very small. However, the shock from this crisis may create a long-term memory effect on the volatility of tourism stock prices. In addition, the GJR-GARCH model shows the leverage effect of COVID-19 on tourism stock volatility. This indicates that bad news in relation to the pandemic has a greater effect on volatility than good news, resulting in significant investment risk from the falling prices of tourism stocks.

Therefore, the findings of this study have implications for investors and policymakers in their approach to risk management and policymaking decisions. The government should create good news by implementing various measures such as improving public health and fiscal policies to help the country recover from the situation. The COVID-19 pandemic has resulted in a significant reduction in international tourist arrivals and impacted domestic tourism, affecting related businesses such as hotels and airlines, whose income and liquidity have suffered as a result. Weakening financial conditions have raised concerns about tourism stocks. The tourism sector is expected to recover gradually, depending on the policy of vaccinations worldwide, which will prompt a rise in the number of tourist arrivals. Therefore, investors must consider the impact of the pandemic as well as the QE policy in the future when investing in tourism stocks.

As mentioned previously, the findings of this study can be used to inform investors in decision-making and risk management for mitigating the effects of future pandemic events. The tourism industry needs to be transformed in preparation for a potential pandemic situation in the future by moving from mass tourism to potential tourism, supporting medical tourism, investing in tourism products such as accommodations, and improving the quality of human resources [3]. To manage risk in the stock market, investors should diversify into other businesses such as health, insurance, and technology.

5. Acknowledgments

This study was supported by the Faculty of Economics, Khon Kaen University, Thailand, through the analyzing dependence between volatility of stock prices index and volatility of exchange rates under quantitative easing policy: A copula based ARMA-GARCH model project.

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