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Effect of Coronavirus Disease (COVID-19) to Airlines Industry

Nashirah Abu Bakar[1], Sofian Rosbi[2]
[1]*Islamic Business School, College of Business, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia*
[2]*Faculty of Applied and Human Sciences, Universiti Malaysia Perlis, 01000 Kangar, Perlis, Malaysia*

Abstract:
Background*: The coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. COVID-19 detected in Wuhan, China, in late 2019 and has set off a global pandemic. The COVID-19 virus can spread from an infected person's mouth or nose in small liquid particles when they cough, sneeze, speak or breathe. The COVID-19 cause patient to have symptoms namely cough, fever, tiredness, loss of smell and loss of taste. In preventing the spreading of COVID-19, the movement control order implemented in various countries. Therefore, the restriction of movement for tourists creates impact towards airlines industry in worldwide.*
Materials and Methods*: This study selected two companies that involved in airlines industry. This study selected analysis period starting from October 2019 until October 2020 to analyze the effect of COVID-19 outbreak towards share price. The number of observations is 13 months. The first company shows the outbreak of COVID-19 gives negative impact of towards company share price. The minimum value of average monthly share price for company X is MYR 0.594 per unit. Meanwhile, the second company also indicates outbreak of COVID-19 creates negative impact towards share price movement. The minimum value of average monthly share price for company Y is SGD 3.517 per unit.*
Results*: During COVID-19 outbreak, the changes of share prices for company X shows the minimum rate is -35.9%. In addition, the changes of share prices for company X shows the minimum rate is -41.2%. The correlation between changes of share price of company X and Y is 0.813. This indicates both of companies experienced negative share price movement.*
Conclusion: *The outbreak of COVID-19 contributes to negative movement for share price of two companies that involved with airlines system. Therefore, this study will help government to develop suitable policy in assisting airlines industry to survive in this pandemic outbreak.*
Key Word*: Coronavirus disease; COVID-19; Airlines industry; Correlation analysis, Share price.*

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I. Introduction

Airline industry can be classed as one of the wide aviation industry. This industry was provided a large revenue due to offering global services such as carrying passengers and cargo over large distances. Therefore, this industry is looking forward for major contribution to the development of economic growth worldwide. However, COVID-19 virus occurred in year 2019 in Wuhan, China give huge impact on the development of airlines industry. This virus was spread very fast and in year 2020, all the country worldwide was affected by the COVID-19 virus (Abu Bakar and Rosbi, 2021a: Abu Bakar and Rosbi, 2020a).

Therefore, in March 2020 the World Health Organization (WHO) was declared the COVID-19 outbreak as pandemic because this virus was spread worldwide (Abu Bakar and Rosbi, 2021b; Abu Bakar and Rosbi, 2020b). Most of country was implemented lockdown policy in order to reduce the spread of COVID-19 virus. The implementation of lockdown rule by most countries worldwide give a serious impact to airline industry (Pascual and Cain, 2021; Abu Bakar and Rosbi, 2020c). Consequently, most of the flight was canceled and airlines companies must return back the ticket flight fees to the customers. According to Sheikh Yahya (2020) Malaysia aviation industry is lose for RM13 billion in year 2020 as air travel continues to face travel restrictions. Therefore, numerous studies mention that airline industry has been the hardest hit industry during the COVID-19 pandemic (Abu Bakar and Rosbi, 2020; Skare, et al., 2021; Wen, et al., 2021; Zubair and Shamsudin, 2021). According to Florido-Benitez, (2021) international and domestic travel have to stop their operation in order to reduce COVID-19 pandemic effects to the minimum level.

The implementation of lockdown policy give impact on the development of airline industry in Malaysia. Lockdown was implemented to prevent the spread of the virus within the country and through the importation by travelers. There were varying lengths and degrees of lockdowns that were implemented globally (Chua, et al., 2022). Malaysia was implement lockdown since 18th March 2020. All the border was closed for

control the spread of COVID-19 virus. As mentioned by Suk and Kim (2021) COVID-19 have stretched business resilience to a critical point that has caused damage and shock that the aviation industry has never endured before. Malaysia also established stringent travel restrictions and close the borders, effectively halting international travel (Abhari, et al., 2021). According to WHO, COVID-19 cases was exceeded 84 million and more than 1.8 million peoples died (Suk and Kim, 2021). COVID-19 pandemic cause unpredictable demand patterns and volatility in the travelling industry worldwide (Vinod, 2021). Consequently, COVID-19 outbreak give significant impact on the economics growth (AbdelMaksoud, et al., 2022; Zhang, 2020) and human live (Aduhene and Osei-Assibey, 2021; Salman, et al., 2022) globally.

COVID-19 pandemic give impact to human life and all the daily activities. Besides the lockdown policy, government also introduce social distance rule to protect individual from COVID-19 virus. Social distancing was implemented as the protection of transmission COVID-19 virus. COVID-19 virus was transmitted through respiratory droplets when people are in close proximity with another peoples. Therefore, to control the rate of infection, governments was implemented social distancing rule to ensure a safe minimum distance (Chua, et al., 2022). Social distance rule is practice in all the face to face activities that are involved in daily activities including airline industry. Therefore, this study was developed to investigate the impact of COVID-19 towards airlines industry. The airline industry is one of the affected industries worldwide (Maneenop and Kotcharin, 2020) and suffer with the high loss revenue due to the lockdown policy implement by most countries worldwide.

This study chose two airlines companies that have significant impact on the spread of COVID-19 virus. As suggested by several studies, government need to plan a good strategic and policy to recover the loss facing by airline industry during the lockdown approach implement in various countries (Aljanabi, 2021). Thus, Migdadi (2021) suggested that the effective of operational strategy patterns during the outbreak of the COVID-19 pandemic comprise three hybrid strategies that are capacity variables, scheduling variables and airlines alliance strategy variables. Therefore, airlines industry need to investigate the new strategy that they can implement to overcome the impact of COVID-19 into their companies. The strategy also need to include the creativity of country in promoting the advantage in visiting their countries.

II. Literature review

Airlines industry was created a good reputation in generating a high amount of revenue. This is due to the demand from customers to use airlines services as one of the main transportation in travelling outside from home country. The good quality of services provided by airlines industry create a high demand from customers to use and repeat their services. According to Prayag (2007), four factors influencing perceptions of determine the importance of airlines services quality are service efficiency, service personalization, reliability and tangibles. Furthermore, Hapsari et al., (2017) demonstrate that customer engagement has the most influential effect on passenger loyalty, followed by customer satisfaction. Customer satisfaction has the largest total effect on customer engagement.

COVID-19 spread in year 2020 give huge impact on the performance of airline industry. As highlight by Jafari, et al., (2021) COVID-19 has hampered the tourism sector with impact on the all other tourism-reliant sectors such as hotels, restaurants, travel agencies and the transport sector massively suffered as a result of the global lockdown policy. Various studies are discussed to overcome the impact of COVID-19 into airlines industry. Vinod, (2021) suggested that airlines need to adapt a new marketing planning process of scheduling, pricing and revenue management that is nimbler to adapt quickly to changing market conditions. This new approach will continue to be relevant in a post-COVID-19 world during and after economic recovery.

A significant number of studies discussed the impacts of COVID-19 on the global trade and economy. Chua, et al., (2022) mentions that COVID-19 pandemic has negatively affect the global economy, change the global trade network and contribute to the sharp decline in demand for oil. Obayelu, et al., (2021) also highlights that COVID-19 outbreak was affected several aspects of international trade and led to a deep fall in transaction, both at the international level and within-regions level. COVID-19 virus was continued spread throughout the world. Therefore, governments are implement several rule in reducing the spread COVID-19 such as quarantine and social distance. Social distance rules are important to limit human interaction especially for airlines activities. While, quarantine rule is important procedure in travelling activity during COVID-19 outbreak. Even most of country discourage travelling overseas during the COVID-19 outbreak, unless it is very essential, thus quarantine procedure is introduced to protect the spread of COVID-19 virus. Quarantine can last from a few days to 14 days, depending on where the person travelled from (Goh and Baum, 2021).

III. Research methodology

The bivariate Pearson Correlation is defined as a sample correlation coefficient, r, which measures the strength and direction of linear relationships between two continuous variables. In addition, the Pearson Correlation evaluates whether there is statistical evidence for a linear relationship among the same pairs of

variables in the population, represented by a population correlation coefficient, ρ. The Pearson Correlation is considered as parametric measure from statistical view.

In implementing Pearson Correlation, a few assumptions need to be fulfilled by the data of two continuous variables. The assumptions are:

(1) The two variables must be continuous type whether interval or ratio.
(2) There is linear relationship between variables.
(3) There is no mission value.
(4) Independence of observations.
(5) Data exhibits normality characteristic.
(6) Random sample of data from the population.
(7) No outliers.

The value of Pearson Correlation coefficient is in the range of -1 to 1. The sign of the correlation coefficient indicates the direction of the relationship. Positive means similar direction of data movement for two variables. Meanwhile, negative means opposite direction of data movement for two variables. Next, the magnitude of the correlation indicates the strength of the relationship. Table 1 shows the strength of relationship for Pearson Correlation. The value of -1 indicates perfectly negative linear relationship. The Pearson coefficient value of 0 explains no relationship. Then, the coefficient value of +1 shows perfectly positive linear relationship.

Table 1: The strength of Pearson correlation coefficient

	Coefficient, r	
Strength interpretation	Positive	Negative
No correlation	$0.0 \leq r < 0.1$	$-0.0 \leq r < -0.1$
Small correlation	$0.1 \leq r < 0.3$	$-0.1 \leq r < -0.3$
Medium correlation	$0.3 \leq r < 0.5$	$-0.3 \leq r < -0.5$
Large correlation	$0.5 \leq r \leq 1.0$	$-0.5 \leq r \leq -1.0$

The Pearson correlation coefficient calculated using Equation (1). Given paired data $\{(x_1, y_1), ..., (x_n, y_n)\}$ with n pairs of data. The sample correlation coefficient between two random and continuous variables x and y is denoted as τ_{xy}.

$$\tau_{xy} = \frac{\mathrm{cov}(x, y)}{s_x \square s_y}$$

…… (1)

The parameters in Equation (1) are described as follows:

$\mathrm{cov}(x, y)$: covariance between variable x and y,

s_x : standard deviation for variable x, and

s_y : standard deviation for variable y.

Next, this study re-arranged the sample correlation formula in Equation (1) to develop robust equation.

$$\tau_{xy} = \frac{\dfrac{\sum_{i=1}^{n} (x_i - \overline{x})(y_i - \overline{y})}{n - 1}}{s_x \square s_y}$$

…… (2)

The parameters in Equation (2) are described as below:

n : sample size,

x_i : the individual sample points for variable x at period *i*, indexed with *i*,

y_i : the individual sample points for variable y at period *i*, indexed with *i*,

$\overline{x}$: sample mean for variable x, and

$$\overline{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

$\overline{y}$: sample mean for variable y.

$$\overline{y} = \frac{1}{n}\sum_{i=1}^{n} y_i$$

Then, this study expanded Equation (2) to become numerically stable.

$$\tau_{xy} = \frac{\dfrac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{n-1}}{\sqrt{\dfrac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n-1}} \cdot \sqrt{\dfrac{\sum_{i=1}^{n}(y_i - \overline{y})^2}{n-1}}}$$

$$\tau_{xy} = \frac{\dfrac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{n-1}}{\dfrac{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2}}{\sqrt{n-1}} \cdot \dfrac{\sqrt{\sum_{i=1}^{n}(y_i - \overline{y})^2}}{\sqrt{n-1}}}$$

$$\tau_{xy} = \frac{\dfrac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{n-1}}{\dfrac{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2} \cdot \sqrt{\sum_{i=1}^{n}(y_i - \overline{y})^2}}{n-1}} = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{n-1} \cdot \frac{n-1}{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2} \cdot \sqrt{\sum_{i=1}^{n}(y_i - \overline{y})^2}}$$

$$\tau_{xy} = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2} \cdot \sqrt{\sum_{i=1}^{n}(y_i - \overline{y})^2}} \quad \text{.....} \quad (3)$$

Equation (3) explains the sample correlation coefficent of two independent and random variables. The calculation of τ_{xy} can be perform using real data for n observation period. The real data should exhibit normal distribution.

Next, this study tried to solve Equation (3) for single-pass algorithm in calculating sample correlations.
Numerator calculation procedure follows these steps:

$$\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y}) = \sum_{i=1}^{n}(x_i y_i - x_i \overline{y} - \overline{x} y_i + \overline{x}\,\overline{y})$$

$$= \sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i \overline{y} - \sum_{i=1}^{n} \overline{x} y_i + \sum_{i=1}^{n} \overline{x}\,\overline{y}$$

..... (4)

The value of $\overline{x}$ and $\overline{y}$ is a constant. Therefore, the arrangement of equation follows below procedure.

$$= \sum_{i=1}^{n} x_i\, y_i - \overline{y}\sum_{i=1}^{n} x_i - \overline{x}\sum_{i=1}^{n} y_i + \sum_{i=1}^{n} \overline{x}\,\overline{y}$$

…… (5)

In developing robust equation, the parameters for $\overline{x}$ and $\overline{y}$ are described as follows:

$$\overline{x} = \frac{\sum_{i=1}^{n} x_i}{n},\ n\overline{x} = \sum_{i=1}^{n} x_i$$

$$\overline{y} = \frac{\sum_{i=1}^{n} y_i}{n},\ n\overline{y} = \sum_{i=1}^{n} y_i$$

Continuation from Equation (5), the development of sample correlation is as follows:

$$= \sum_{i=1}^{n} x_i\, y_i - \overline{y}\, n\, \overline{x} - \overline{x}\, n\, \overline{y} + \sum_{i=1}^{n} \overline{x}\,\overline{y}$$

$$= \sum_{i=1}^{n} x_i\, y_i - 2\, n\, \overline{x}\,\overline{y} + \sum_{i=1}^{n} \overline{x}\,\overline{y}$$

…… (6)

Considering the parameter is described as follow:

$$\sum_{i=1}^{n} \overline{x}\,\overline{y} = \overline{x}\,\overline{y}\sum_{i=1}^{n} 1 = \overline{x}\,\overline{y}\, n = n\,\overline{x}\,\overline{y}$$

Therefore, Equation (6) extend to below procedure.

$$= \sum_{i=1}^{n} x_i\, y_i - 2\, n\, \overline{x}\,\overline{y} + n\,\overline{x}\,\overline{y}$$

$$= \sum_{i=1}^{n} x_i\, y_i - n\,\overline{x}\,\overline{y}$$

…… (7)

Numerator for Equation (3) become Equation (7) in developing correlation coefficient.

Then, denominator for Equation (3), is expand as below:

$$\sum_{i=1}^{n} \left(x_i - \overline{x}\right)^2 = \sum_{i=1}^{n} \left(x^2 - 2\,x\,\overline{x} + \left(\overline{x}\right)^2\right)$$

$$= \sum_{i=1}^{n} x^2 - \sum_{i=1}^{n} 2\,x\,\overline{x} + \sum_{i=1}^{n} \left(\overline{x}\right)^2 = \sum_{i=1}^{n} x^2 - 2\overline{x}\sum_{i=1}^{n} x + \sum_{i=1}^{n} \left(\overline{x}\right)^2$$

$$= \sum_{i=1}^{n} x^2 - 2\,\overline{x}\, n\, \overline{x} + \sum_{i=1}^{n} \left(\overline{x}\right)^2 = \sum_{i=1}^{n} x^2 - 2\,\overline{x}\, n\, \overline{x} + \sum_{i=1}^{n} \left(\overline{x}\right)^2$$

$$= \sum_{i=1}^{n} x^2 - 2n\left(\overline{x}\right)^2 + n\left(\overline{x}\right)^2 = \sum_{i=1}^{n} x^2 - 2n\left(\overline{x}\right)^2 + n\left(\overline{x}\right)^2$$

$$= \sum_{i=1}^{n} x^2 - n(\overline{x})^2 \quad \text{.....} \quad (8)$$

Similarly, the variable y is described as follows:

$$\sum_{i=1}^{n} (y_i - \overline{y})^2 = \sum_{i=1}^{n} \left(y^2 - 2y\,\overline{y} + (\overline{y})^2 \right)$$

$$= \sum_{i=1}^{n} y^2 - \sum_{i=1}^{n} 2y\,\overline{y} + \sum_{i=1}^{n} (\overline{y})^2 = \sum_{i=1}^{n} y^2 - 2\overline{y}\sum_{i=1}^{n} y + \sum_{i=1}^{n} (\overline{y})^2$$

$$= \sum_{i=1}^{n} y^2 - 2\overline{y}\,n\,\overline{y} + \sum_{i=1}^{n} (\overline{y})^2 = \sum_{i=1}^{n} y^2 - 2\overline{y}\,n\,\overline{y} + \sum_{i=1}^{n} (\overline{y})^2$$

$$= \sum_{i=1}^{n} y^2 - 2n(\overline{y})^2 + n(\overline{y})^2 = \sum_{i=1}^{n} y^2 - 2n(\overline{y})^2 + n(\overline{y})^2$$

$$= \sum_{i=1}^{n} y^2 - n(\overline{y})^2$$

..... (9)

Therefore, the Pearson correlation coefficent from Equation (3) can be expressed as below:

$$\tau_{xy} = \frac{\sum_{i=1}^{n} x_i\,y_i - n\,\overline{x}\,\overline{y}}{\sqrt{\sum_{i=1}^{n} x^2 - n(\overline{x})^2} \cdot \sqrt{\sum_{i=1}^{n} y^2 - n(\overline{y})^2}} \quad \text{.....} \quad (10)$$

In Equation (10), the Pearson correlation coefficient is symmetric: corr(X,Y) = corr(Y,X).

Statistical inference based on Pearson's correlation coefficient often focuses on one of the following aims. To analyze test of null hypothesis that the true correlation coefficient ρ is equal to 0, based on the value of the sample correlation coefficient r.

It is the ratio between the covariance of two variables and the product of their standard deviations; thus, it is essentially a normalized measurement of the covariance, such that the result always has a value between −1 and +1.

IV. Result and discussion

The objective of this study is to evaluate the impact of COVID-19 towards financial of companies in airlines industry. The company X is company that involved with airlines industry in Malaysia. This company is multinational low-cost airline headquartered near Kuala Lumpur, Malaysia. Figure 1 shows the dynamic movement of share price for company X during COVID-19 outbreak. The initial value of share price is MYR 1.809. Meanwhile, the value of share price on the last observation is 0.594. Figure 2 shows changes of share price of company X. The change of -35.9 % indicates significant negative impact of COVID-19 towards economy of airlines industries. Therefore, government support is crucial for companies in airlines industry to sustain financially during COVID-19 outbreak.

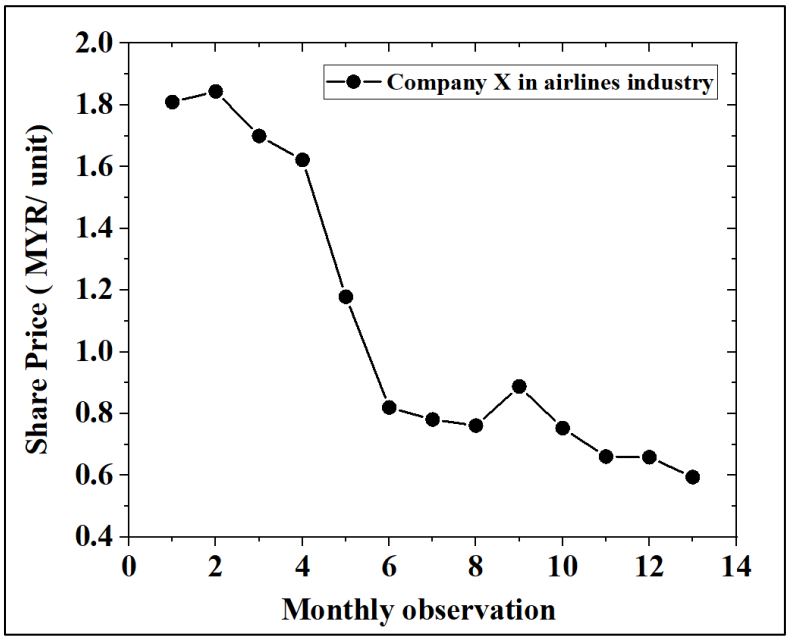

Figure 1: Dynamic movement of share price for company X

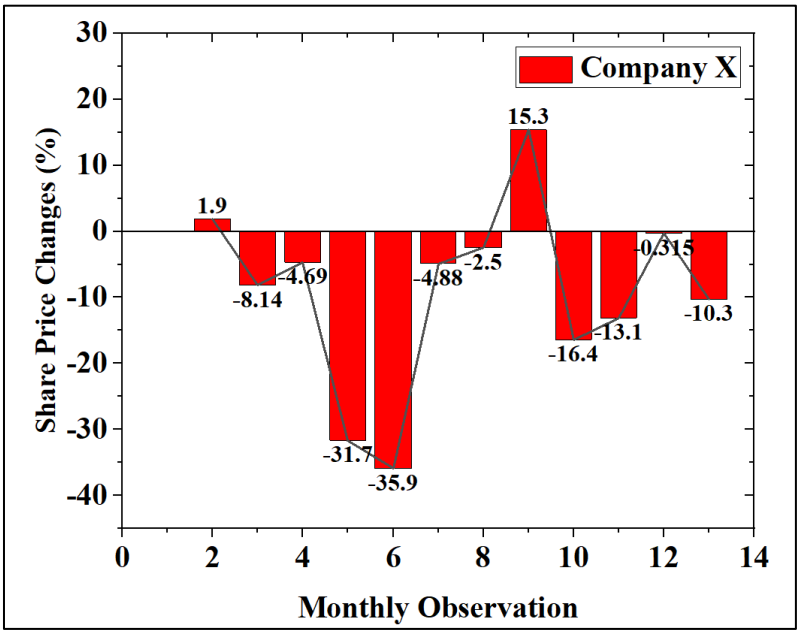

Figure 2: Changes of share price for company X

Then, this study evaluated the impact of COVID-19 towards company of airlines industry in Singapore. This company is named stated company Y that has more than 20 subsidiaries, including many airline-related subsidiaries. Figure 3 shows the dynamic movement of share price for company Y. The observation of analysis involving 13 months starting from October 2019 until October 2020. The initial value of share price is SGD 9.110. Then, the last observation for share price in October 2020 is SGD 3.517. Next, Figure 4 shows the changes of share price for company Y. The value of -41.2% indicates the significant negative impact of COVID-19 towards company of airlines industry.

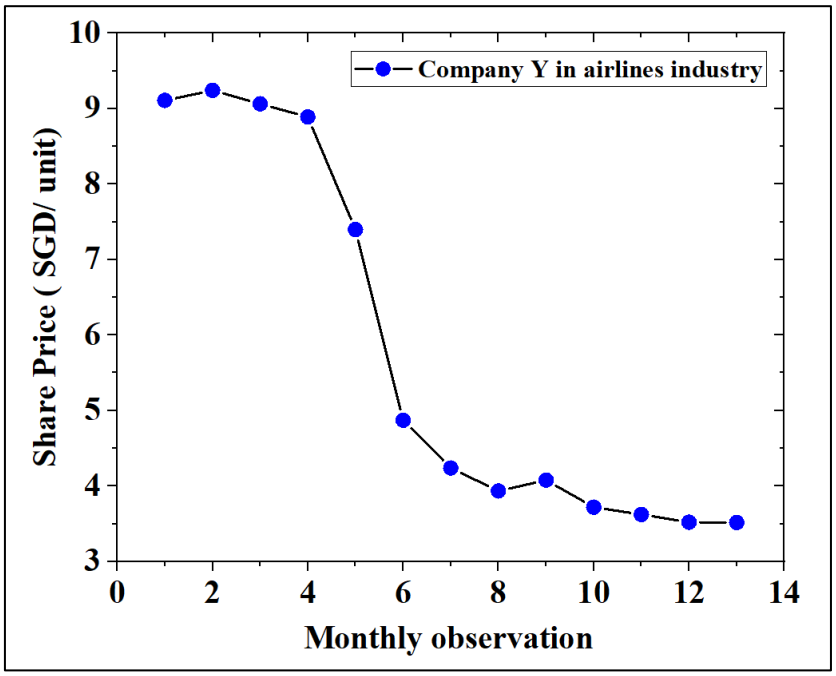

Figure 3: Dynamic movement of share price for company Y

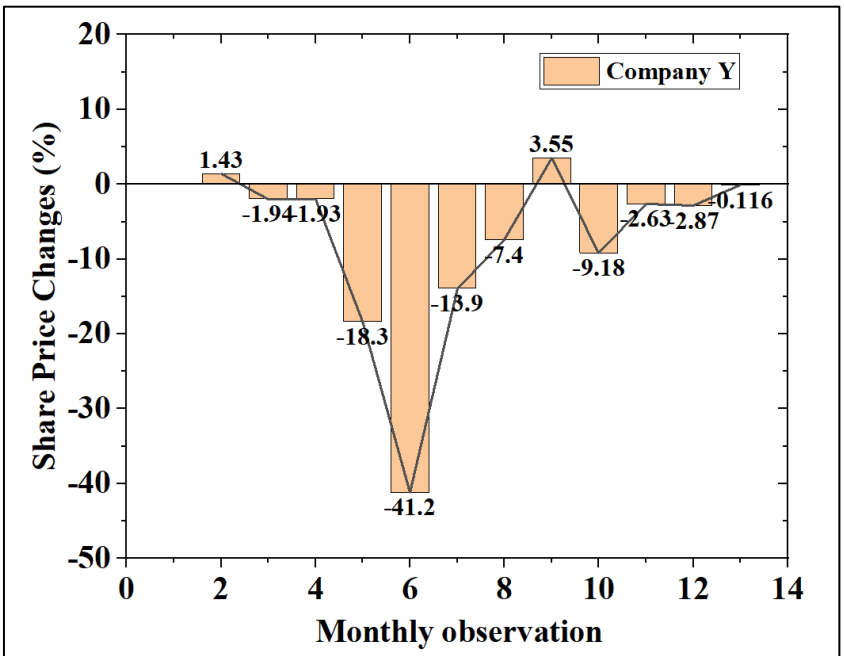

Figure 4: Changes of share price for company Y

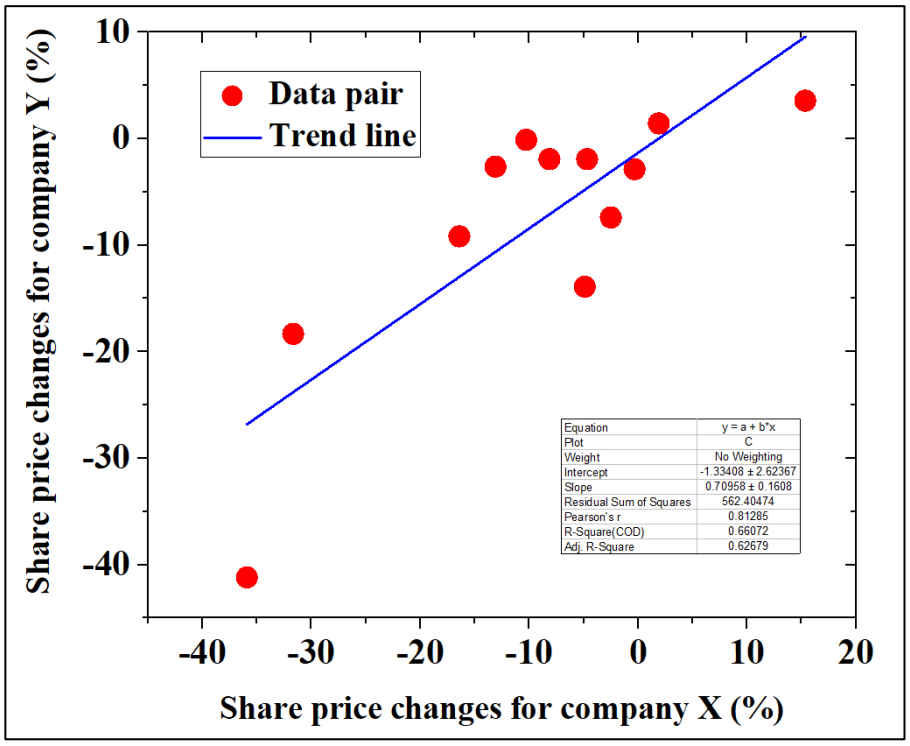

Figure 5: Changes of share price for company Y

Table 2: Pearson correlation coefficient

Parameter	Value
Pearson correlation	0.813
Significant value (p-value)	0.001
Number of data	12

Figure 5 shows the correlation plot between changes rate of share price for company X and Y. Trend shows graphically there is significant relationship between changes rate of share price for company X and company Y. Next, Table 2 shows the Pearson correlation between changes rate of share price for company X and Y. Pearson correlation is statistical test to evaluate the relationship between changes rate of share price for company X and company Y. Table 2 summaries the correlation value is 0.813 that indicates strong relationship between share price changes of company X and company Y. The p-value is 0.001 that is less than 0.05. Therefore, there is significant, positive and strong relationship between share price changes of company X and company Y. The result shows both of companies experienced negative decrement in share price because of COVID-19 outbreak.

V. Conclusion

The objective of this study is to evaluate the impact of COVID-19 towards airlines industry. This study selected two companies that involved in airlines industry. The main findings of this study are:

(1) The decrement of share price for company X shows large negative effect. The initial value of share price is MYR 1.809. Meanwhile, the value of share price on the last observation is 0.594.

(2) The decrement of share price for company Y shows large negative effect. The initial value of share price is SGD 9.110. Then, the last observation for share price in October 2020 is SGD 3.517.

(3) The changes of share prices for company X shows the minimum rate is -35.9%. The coronavirus disease (COVID-19) outbreak has significantly affected the share price movement for company X.

(4) The changes of share prices for company Y shows the minimum rate is -41.2%. The coronavirus disease (COVID-19) outbreak has significantly affected the share price movement for company X.

(5) The Pearson correlation value is 0.813 that indicates strong relationship between share price changes of company X and company Y. The p-value is 0.001 that is less than 0.05. Therefore, there is significant, positive and strong relationship between share price changes of company X and company Y.

Results show the movement control order during COVID-19 outbreak has affected financial status of companies in airlines industry. Therefore, the findings of this study suggest government to develop suitable policy in assisting companies in airlines industry to survive during COVID-19 outbreak. In addition, the companies need

to develop new marketing strategy in order to attract new customers towards their services. On top of that, in surviving during COVID-19 outbreak, companies need to optimize all of their resources to make sure they can increase their revenue in the same time minimizing the operational cost.

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