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Panel Regression Method to Analyse the Stock Market Returns Due To Covid-19

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ABSTRACT

Malaysia's earliest COVID-19 patients, reported on January 25, 2020, were travellers from China to Malaysia through Singapore. The detected confirmed cases, which were associated with religious gatherings were scarce in number before March 2020. The Prime Minister of Malaysia called for the 'Movement Control Order' beginning March 18, 2020. This study aimed to determine the aftereffects of COVID-19 pandemic outbreaks on stock markets by measuring the correlation between market returns and daily growth of total new and death cases of COVID-19. Panel regression methods, namely pooled ordinary least square and fixed-effect methods were used in this study where the dependent variable is stock market returns and independent variables were i) daily growth new death cases COVID-19 ii) natural algorithm market capitalisation iii) Brent Crude Oil Price from January 2, 2020, until March 31, 2020. Findings showed that during MCO for every one confirmed case increase, the stock returns decreased to -0.172 and for every one confirmed death increase, the stock returns decreased to -0.066. Thus, the stock market returns reported significant negatives to both total new cases and death cases' daily growth. The estimated market returns were also negatively influenced by new cases of and deaths due to COVID-19. Besides helping investors make the right decision during a pandemic crisis, the findings can be expanded in future research, by increasing the data frame, independent variables and finding the impact of more specific indices of the sector.

Keywords: *COVID-19, Fixed-effect Method, Panel Regression, Pooled Ordinary Least Square Method, Stock market returns*

1. INTRODUCTION

Stock markets are affected by events like disasters, political events, and sports. They can also be affected by pandemic diseases, such as the 2002 – 2004 Severe Acute Respiratory Syndrome (SARS) and the 2013 – 2016 Ebola Virus Disease (Ebola) [1]. The first 27 confirmed COVID-19 cases were reported in Wuhan City, China, on December 31, 2019. The virus has spread worldwide, and countries are currently struggling to reduce the death toll [2]. Malaysia's first COVID-19 patients identified on January 25, 2020, were travellers from China to Malaysia through Singapore. Confirmed cases were detected in March 2020, and many positive cases were associated with religious gatherings in the previous month [3]. The Prime Minister of Malaysia called for the Movement Control Order (MCO) as of March 18 2020 with strict restrictions on travel, social distance and operational time for schools and businesses [4].

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Businesses and investment markets were hit hard by the COVID-19 outbreak in Malaysia. Bursa Malaysia plunged to 3.33% in March 2020 [5]. Cases also escalated in March 2020. The Ministry of Health Malaysia (KKM) published a new case record every day onwards from here. Therefore, this study aimed to determine the pandemic's effect on stock market returns in two domains, namely the total growth of confirmed cases and total deaths of COVID-19.

2. LITERATURE REVIEW

Panel-data analysis is a longitudinal data analysis. It can be used to observe the behaviour of firms, sectors, states, companies, and others [6], and to investigate short-time series data changes. Panel data is more accurate; it can control the heterogeneity problem [7, 8]. Panel-data analysis provides many data points, increases the degree of freedom, and reduces collinearity. By using this method, stock market returns were found to be significantly and negatively related to the daily growth of reported cases and deaths during the COVID-19 pandemic[1]. However, they advised against using the event-study methodology. The virus peak was not the starting date. Ashraf [8] examined the impact of COVD-19 new and death cases by using the daily COVID-19 and stock market returns data from 64 countries. The results showed that stock price reacted negatively to new and death cases between 40 to 60 days of the first COVID-19 cases

Several past research works concerned the aftereffects of COVID-19 on stock returns. By using the Smooth Time-Varying Cointegration Method, SARS was found to significantly affect stock markets in China and also integrated stock markets of four Asian countries (Japan, Hong Kong, Taiwan, and Singapore) [9]. Thus, the markets' long-standing relationship was weakened. Event-study methodology and brute-force search approach were applied to the financial market. Systemic shocks had more negative impacts than idiosyncratic shocks. News on the number of confirmed cases of deaths at the start of the pandemic caused a faintly significant impact on the market. However, the markets showed positive effects when the number of discharges was announced. Thus, the MCO was slightly significant for the short term and social distancing was negatively related to the financial market [10].

Ichev and Marinč [11] used a regression-based approach and event-study methodology to explore Ebola effects on the geographical proximity of information and its influence on USA stock prices. The Ebola outbreaks yielded negative financial market returns. They also affected small and unstable stocks, specific industry stocks, and stocks exposed to extreme media coverage. Event-study methodology and panel fixed-effect regression method were used to test reactions of 21 stock indices to the COVID-19 outbreak. Japan, Korea, Singapore, Germany, UK and the USA topped the list [12]. The stock market felt a significant negative impact from the outbreak. However, Asian countries suffered more adverse negative effects[13].

Market capitalization is the value of the company in the stock market, and it is calculated by the current share price and share issues of the company. Therefore, market capitalization plays a significant role in shaping the size of the company. Kumar and Kumara [14] examined the impact of stock market performance before and after the COVID-19 outbreak by analysing the market capitalisation. Travel and transportation, the entertainment industry and oil and gas have been most affected by the COVID-19 as it decreases to 40%. On the other hand, Al-Awadhi, et al. [1] stated that stock market returns of information technology and medicine manufacturing sectors performed significantly better. However, the stock market of beverage, air, water, highway transportation, and hotel were severely affected by COVID-19.

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In Malaysia, Lee, et al. [15] examined the impact of COVID-19 on the Malaysia stock market by using stock indices of KLCI by sector as dependent variable and Malaysia, China, and United States of America (USA) COVID-19 new and death cases, Brent Oil Price and The Chicago Board of Option Exchange (CBOE) Volatility Index. The discussion stated that Brent Crude Oil Price had an effect on Kuala Lumpur Composite Index (KLCI) on the previous day and all sector indices besides REIT.

3. METHODOLOGY

Figure 1 displays the study's design model. For data collection at Phase 2, secondary data (January 2, 2020, to April 1, 2020) obtained from KKM, Bursa Malaysia and Investing.com were run on R-Studio. The dependent variable was daily stock market returns of a KLCI, and 13 Malaysia sector indices (consumer, construction, energy, finance, REIT, healthcare, industrial product, utilities, property, technology, telecommunication, transportation, and plantation) and the independent variable were daily confirmed cases and deaths cases due to COVID-19 outbreak in Malaysia, the market capitalisation, and the Brent Crude Oil Price. The data were split before (2 January 2020 to 17 March 2020) and during MCO (18 March 2020 to 31 March 2020).

Market capitalisation can be calculated by:

$$MCAP \quad = \text{Share Price } \times \text{Share Issues} \tag{1}$$

The daily growth percentage can be calculated by using the following equation:

$$C19_t = \frac{I_t - I_{t-1}}{I_{t-1}} \times 100\% \tag{2}$$

3.1 Pooled Ordinary Least Square (OLS) Estimator

OLS methods are used when an individual u_{it} does not exist. OLS produces efficient and consistent parameter estimation. In OLS, data on different units are pooled together without an assumption on individual differences. The regression models to be tested in this study were as given [16, 17]:

$$DR_{i,t} = \alpha_0 + \alpha_1 C19_{i,t-1} + \beta_1 X_{t-1} + \beta_2 OIL_{t-1} + u_{it} \tag{3}$$

In equation (1), the dependent variable is stock returns while the independent variables are the growth of new cases of or deaths due to COVID-19, market capitalisation and Brent Crude Oil Price.

Panel-data applications apply a one-way error component model for the disturbances, namely

$$u_{it} = \mu_i + v_{it} \tag{4}$$

which can be converted to vector form:

$$DR_{i,t} = \alpha_0 + \alpha_1 CI9_{i,t-1} + \beta X_{t-1} + \mu_i + v_{it} = Z\delta + u \tag{5}$$

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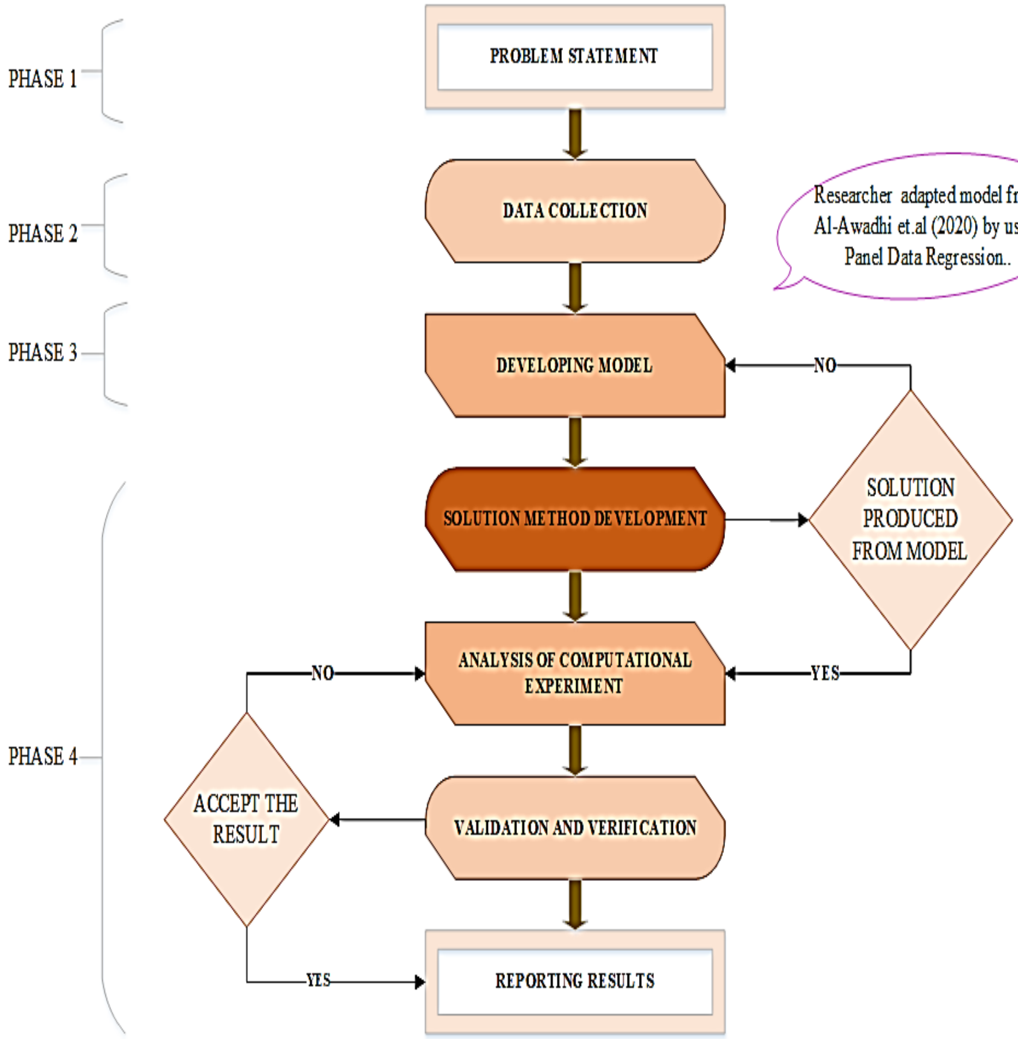

Figure 1: Design Model

where DR is $NT \times 1$, $NT \times K$, $Z = [C19_{NT}, X], \delta' = (\alpha', \beta')$and $C19_{NT}$ is a vector dimension of NT.

Equation (3) can be rewritten as:

$$u = Z_{\mu}\mu + v \tag{6}$$

where $u' = (u_{11}, \dots, u_{1T}, u_{21}, \dots, u_{2T}, u_{N1}, \dots, u_{NT})$ with stacked observation.

The regression equation for the pooled OLS model given for each region is:

$$DR_I = Z_i\delta_i + u_i \quad i = 1,2, \dots, N \tag{7}$$

In vector form, the restricted model in the equation is:

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$$DR = Z\delta + u \tag{8}$$

where DR is $NT \times 1$, β is $(1+K) \times 1$, X is $NT \times K$, and u is $NT \times 1$. The unrestricted model is published as:

$$x_{ij} = \begin{bmatrix} 1 & x_{11} & \cdots & x_{i1} \\ 1 & x_{12} & \cdots & x_{i2} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_{1j} & \cdots & x_{ij} \end{bmatrix}, DR = \begin{bmatrix} DR_{1j} \\ DR_{2j} \\ \vdots \\ DR_{ij} \end{bmatrix} \text{ and } \beta = \begin{bmatrix} \alpha \\ \beta_1 \\ \vdots \\ \beta_K \end{bmatrix} \tag{9}$$

where x_{ij} = the observations vector of the j_{th} independent variable for the unit i over time and DR is the observation vector of the unit i explained by j variable.

$$\hat{\beta}^{POOLED} = (X'X)^{-1}X'y \begin{bmatrix} \hat{\alpha}^{POOLED} \\ \hat{\beta}_1^{POOLED} \\ \vdots \\ \hat{\beta}_K^{POOLED} \end{bmatrix} \tag{10}$$

$$E(u) = 0 \tag{11}$$

$$E(uu') = \sigma_u^2 I \tag{12}$$

$$rank(X) = 1 + K < TN \tag{13}$$

$$E(u|X) = 0 \tag{14}$$

The panel regression assumption in these equations was tested for multicollinearity, serial correlation, and homoscedasticity as defined in Table 1 [18].

Table 1: Type of Test

Type of test	Instrument used	Consequences
Serial correlation	Durbin Watsons (DW) Test	DW = 2 implies no serial correlation DW > 2 implies a positive serial correlation DW < 2 implies a negative serial correlation
Multicollinearity	Variance inflation factor (VIF)	Multicollinearity exists when VIF is greater than 10.
Homoscedasticity	Breusch Pagan test	For the Breusch pagan test, when the p-value is less than 0.05, it indicates a heteroscedasticity problem.

3.3 Fixed-effect Model: Least Square Dummy Variable (LSDV) Model

The fixed effect model is used to analyse the impact of variables that vary over time as it removes the time variant in the model. The LSDV model provides a better way to understand fixed effect Regressor and dummy variables are allowed to be correlated in the fixed-effect model [19]. The assumption for the fixed-effect model is the same as for the pooled OLS method.

The regression equation is represented by

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$$DR_{i,t} = \alpha_0 + \alpha_1 CI9_{i,t-1} + \beta X_{t-1} + \mu_i + v_{it} \tag{15}$$

Averaging over time gives the following

$$\overline{DR_i} = \alpha_0 + \alpha_1 \overline{C19}_i + \beta \bar{X}_i + \mu_i + \bar{v}_{it} \tag{16}$$

Subtracting (13) from (14) results in

$$DR_{i,t} - \overline{DR_i} = \alpha_1\left(CI9_{i,t-1} - \overline{C19}_i\right) + \beta(X_{t-1} - \bar{X}_i) + (v_{it} - \bar{v}_{it}) \tag{17}$$

Averaging across all observations in (3.12) produces

$$\widetilde{DR}_{i,t} = \alpha_0 + \alpha_1 \widetilde{C19}_{i,t-1} + \beta \tilde{X}_{t-1} + \tilde{v}_{it} \tag{18}$$

By utilising the restriction

$$\sum_{i=1}^{N} \mu = 0 \tag{19}$$

3.4 Cluster Robust Estimator

Some of the observation groups are uniformly affected but no individual observation is affected [20]. Before the number of observations approaches infinity, cluster-robust standard errors require an additional assumption (number of clusters) but do not require a model specification for within-cluster error correlation [21]. Cluster-robust estimators are used when errors are correlated within observation groups. In other words, cluster robust estimator controls the heteroscedasticity and autocorrelation. Implementation steps are introduced by [20] and [16].

Assuming independence across clusters but experiencing correlation within clusters:

$$y_i = Z_i\delta + \mu_i \iota_T + v_i \tag{20}$$

Let observations stack by cluster:

$$\tilde{y}_i = \tilde{X}_i \beta + \tilde{v}_i \tag{21}$$

Under the restriction, each equation that has the same β estimator β can be determined. The following is the asymptotic distribution.

$$N^{\frac{1}{2}}\left(\tilde{\beta} - \beta\right) \sim N(0, M^{-1} V M^{-1}) \tag{22}$$

The OLS estimator β is stated as

$$\hat{\beta} = [\mathrm{X}'\mathrm{X}]^{-1} X'y \tag{23}$$

The variance is identified by

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$$Var(\beta) = [\tilde{X}'\tilde{X}]^{-1}X'\Omega X[X'X]^{-1} \quad (24)$$

The robust asymptotic variance cluster matrix β is estimated by

$$V\hat{a}r(\hat{\beta}) = [X'\mathrm{X}]^{-1}\left[\sum_{i=1}^{N}\tilde{X}_i'\tilde{u}_i\,\tilde{u}_i'\tilde{X}_i\right][\tilde{X}'\tilde{X}]^{-1} \quad (25)$$

4. RESULTS AND DISCUSSION

From the summary statistics in Table 2, the highest and lowest daily stock returns were 14.23% and -25.39%, respectively before MCO and during MCO; both are in the energy sector. For Brent crude oil, the minimum price is -24.10%, where it was a day on the lowest stock market returns on March 9, 2020. This also indicated that the Brent Crude Oil Price tended to worsen the energy sector stock returns [22]. On the other hand, the highest daily growth of confirmed cases and deaths was 76.86%, and 167.67% were both during MCO, respectively. On the other hand, the lowest daily growth was 0%. Furthermore, there are no results for the growth of death before the MCO since there are no reported cases during that period.

Correlation matrix in Table 3 displays a weak negative correlation between stock market returns and the reported COVID-19 new cases and deaths ($CNC = -0.2125$ and $CDC = -0.2879$) during the MCO. However, Brent Crude Oil ($OIL = 0.7005$) shows a strong positive correlation during the MCO. Here, the growth of total COVID-19 new cases and deaths was negatively correlated with the stock market returns. $P - value = 0.0117;\ 0.0011;\ 0.0000$ during MCO less than 0.05, it suggests there is a relationship between stock market returns and daily growth new, death cases and Brent Crude Oil price.

Table 2: Summary statistics

	DR		CNC		CDC	MCAP		OIL	
	BM	DM	BM	DM	DM	BM	DM	BM	DM
MEAN	*-0.0088*	*0.0057*	*0.1229*	*0.1145*	*0.1771*	*11.0753*	*10.9586*	*-0.0184*	*-0.0250*
MEDIAN	*-0.0020*	*0.0121*	*0.1184*	*0.0580*	*0.2000*	*11.0448*	*11.0105*	*-0.0087*	*-0.0411*
SD	*0.0011*	*0.0388*	*0.0491*	*0.0075*	*0.1282*	*0.0190*	*0.4565*	*0.0023*	*0.0704*
MAX	*0.0539*	*0.1267*	*0.2170*	*0.7686*	*0.3750*	*12.2057*	*12.1371*	*0.0832*	*0.1443*
MIN	*-0.2539*	*-0.0931*	*0.0615*	*0.0000*	*0.0000*	*10.3778*	*10.3371*	*-0.2410*	*-0.1340*
SKEWNESS	*-3.3002*	*0.0111*	*0.3798*	*2.1230*	*-0.1170*	*0.9837*	*0.8967*	*-2.1575*	*0.9793*
KURTOSIS	*22.3320*	*0.2724*	*-0.8723*	*4.7342*	*-1.3206*	*0.8965*	*0.7112*	*7.3480*	*1.1332*

Notes:
DR = Stock Returns
CNC = Daily Growth of COVID-19 Total New Cases
CDC = Daily Growth of COVID-19 Death Cases
MCAP = Natural Algorithm Market Capitalisation
OIL = Brent Crude Oil Price
SD = Standard deviation
BM = Before MCO
DM = During MCO

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Table 3: Correlation Matrix

		DR	GCNC	GCDC	MCAP	OIL
				BEFORE MCO		
DR	DURING MCO	*1.0000*	*-0.2562 (0.0000) ****		*0.0866 (0.0519)*	*0.5207 (0.0000) ****
GCNC		*-0.2125 (0.0117) ***	*1.0000*		*-0.0305 (0.4952)*	*-0.1624 (0.0003) ****
GCDC		*-0.2879 (0.0011) ****	*-0.2354 (0.0080) ****	*1.0000*		
MCAP		*0.0055 (0.9484)*	*-0.0149 (0.8611)*	*0.0122 (0.8926)*	*1.0000*	*0.0179 (0.6882)*
OIL		*0.7005 (0.0000) ****	*0.0069 (0.9357)*	*-0.0983 (0.2735)*	*-0.0195 (0.8190)*	*1.0000*

Notes: p-value < 0.1; 0.05**; 0.01****

DR = Stock Market Returns
CNC = Daily growth of new cases of COVID-19
CDC = Daily growth of deaths of COVID-19 cases
MCAP = Natural Algorithm Market Capitalisation
OIL = Brent Crude Oil Price

Figure 2 to Figure 4 illustrate the relationship between stock returns and the growth of new cases and deaths. In Figure.3 and Figure 4, new cases and deaths due to COVID-19 rose significantly in March 2020 from 29 cases on March 1, 2020, to 2766 cases on March 31, 2020. But, the stock market returns declined severely in Figure 2 on March 9, 2020. When the confirmed cases of and deaths increased, the stock market returns decreased. Therefore, the stock market returns were negatively related to new cases and deaths due to COVID-19 [1, 8]. Figure 5 shows the Brent Crude oil price decreased significantly on March 9. It illustrates that the stock market returns are positively affected by the growth of Brent Crude Oil prices [15].

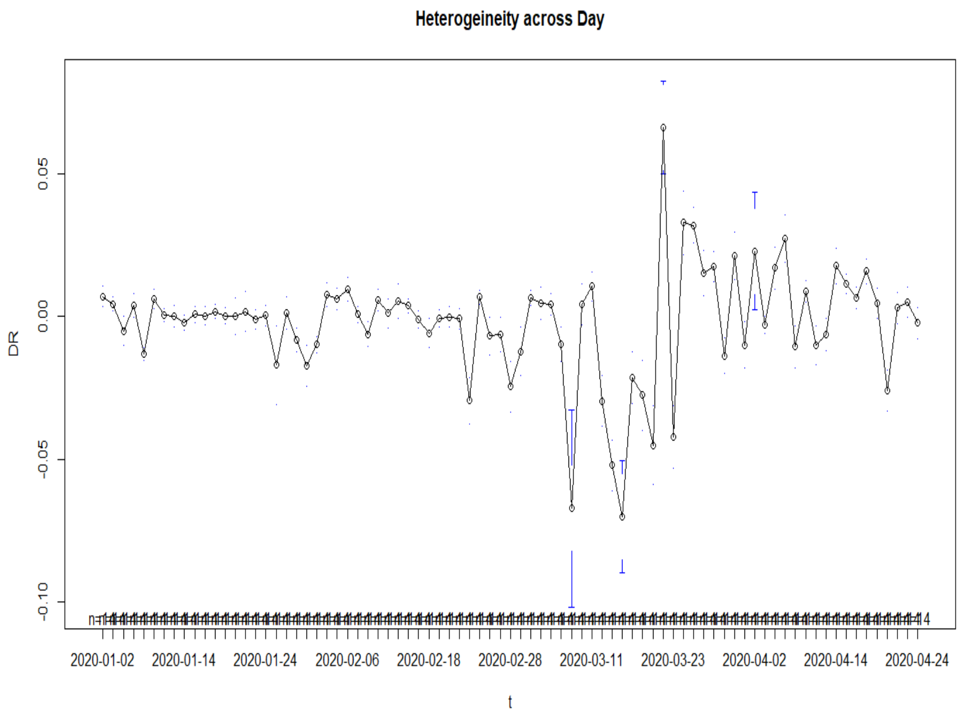

Figure 2: Stock market returns heterogeneity across the day

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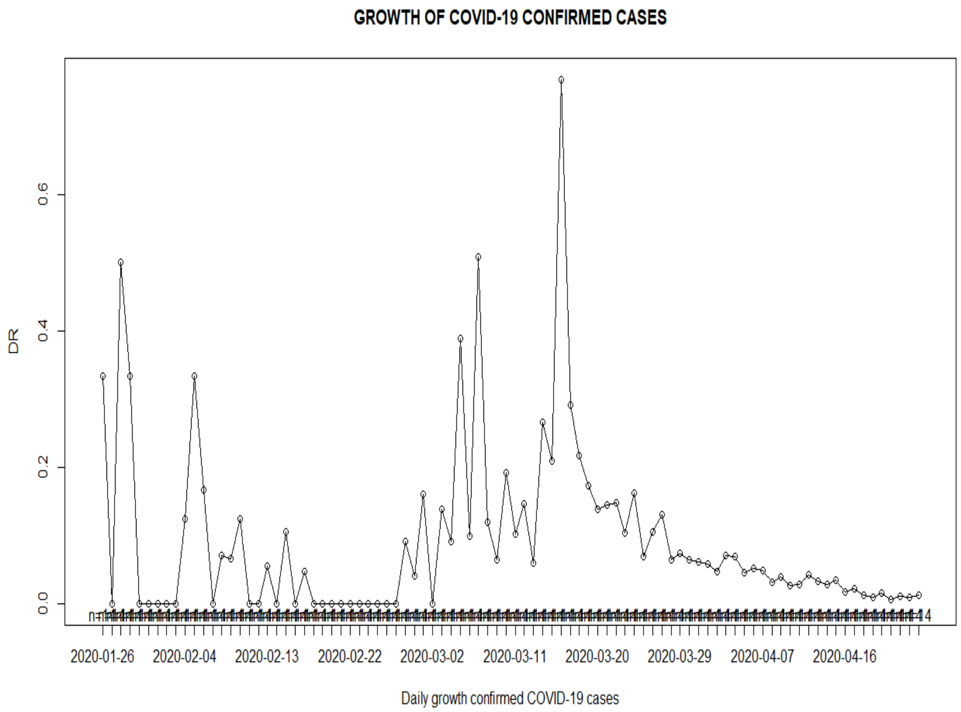

Figure.3: Growth of new COVID-19 cases

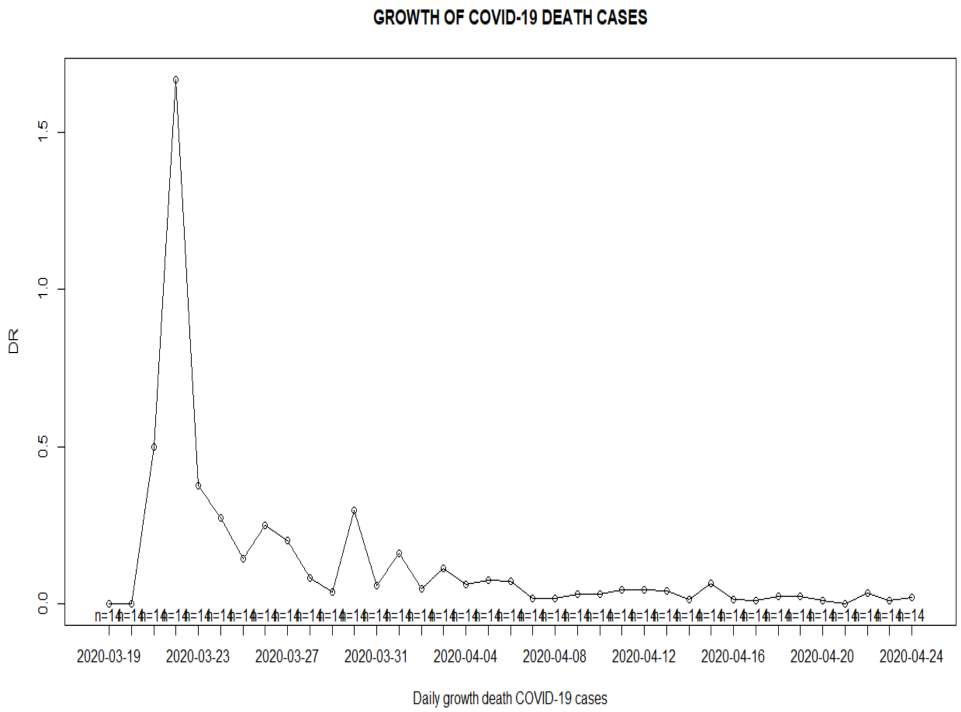

Figure 4: Reported deaths cases of COVID-19

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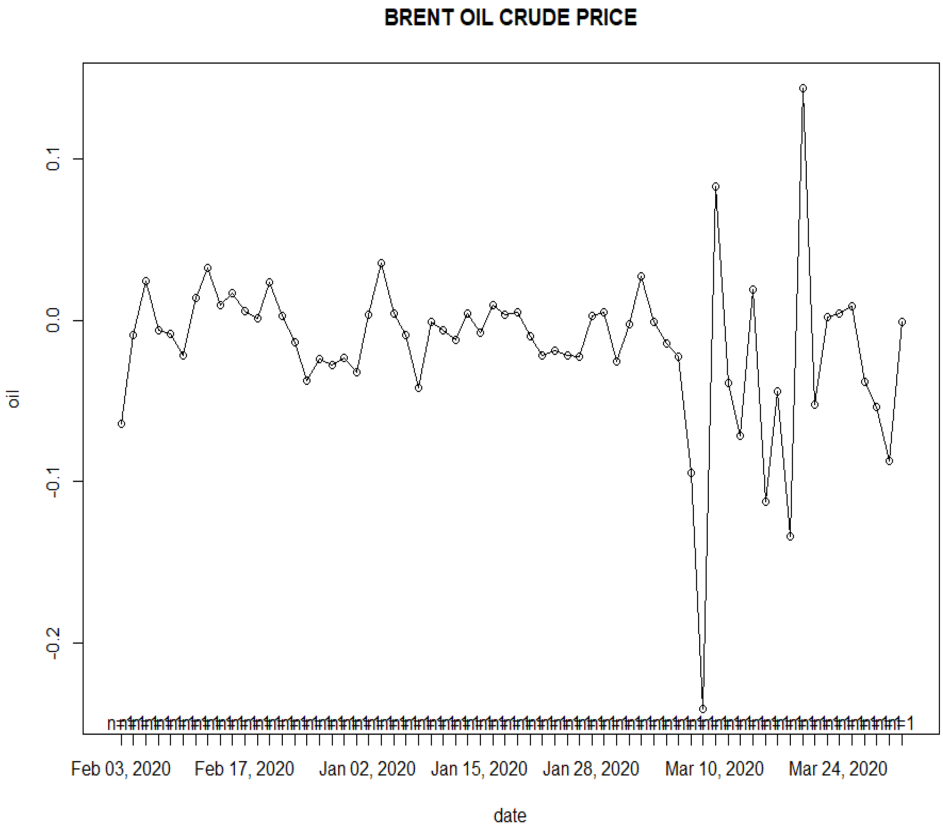

Figure 5: Brent Oil Crude Price

4.1 Correlation between daily growth of stock returns and COVID-19 reported cases.

Two hypotheses were proposed to determine the correlation between stock market outcomes and confirmed cases of COVID-19:

H_0: There is no significant relationship between the stock market return and the growth of COVID-19 cases.

H_1: There is a significant relationship between the stock market return and the growth of COVID-19 cases.

Panel regression methods, namely pooled OLS regression and fixed-effect were used to determine the impact of the daily growth of total new COVID-19 cases before MCO and during MCO. From Table 4, the Breusch-pagan test and Durbin Watsons shows strong heteroscedasticity and autocorrelation before MCO, and a robust estimator needs to be performed. The R-squared values, ($r^2 = 0.538$ and $r^2 = 0.572$) indicate that the stock market returns were explained by 53.8% and 57.2% of the independent variable [8]. In both tables, p-value of the daily growth of total confirmed cases = 0.000 < 0.01. H_1 was accepted. Thus, there was a negative and significant relationship between the stock market returns and the daily growth of reported COVID-19 cases. Herewith, the stock market returns decreased when the total confirmed cases of novel COVID-19 increased. Both pooled OLS and Fixed effect before and after MCO showed the same results

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Table 4: Result of the daily growth of reported new cases of COVID-19

	POOLED OLS		FIXED-EFFECT	
	BEFORE MCO	DURING MCO	BEFORE MCO	DURING MCO
Constant	-0.048	0.004		
	(0.045) **	(0.873)		
$\boldsymbol{CNC_{t-1}}$	-0.026	-0.172	-0.018	-0.249
	(0.000) ***	(0.000) ***	(0.002) ***	(0.000) ***
$\boldsymbol{MCAP_{t-1}}$	0.004	0.001	0.109	-0.560
	(0.052)	(0.784)	(0.000) ***	(0.000) ***
$\boldsymbol{OIL_{t-1}}$	0.232	0.388	0.221	0.317
	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***
DW	1.7772	2.7433	1.9626	2.5288
BP	0.0000	0.007	0.0000	0.006
R-squared	0.307	0.538	0.329	0.574

Notes: p-value < 0.1*; 0.05**; 0.01***

$\boldsymbol{DR_{it}}$ = Stock Market Returns
$\boldsymbol{CNC_{t-1}}$ = Daily Growth of Confirmed New Cases of COVID-19 at $t-1$
$\boldsymbol{MCAP_{t-1}}$ = Natural Algorithm Market Capitalisation at $t-1$
$\boldsymbol{OIL_{t-1}}$ = Brent Crude Oil Price at $t-1$
DW = Durbin Watsons
BP = Breusch-Pagan

Table 5: Result of the daily growth of total new cases of COVID-19 using a robust estimator during MCO

	POOLED OLS		FIXED-EFFECT	
	BEFORE MCO	DURING MCO	BEFORE MCO	DURING MCO
Constant	-0.048	0.022		
	(0.123) **	(0.098) *		
$\boldsymbol{CNC_{t-1}}$	-0.026	-0.172	-0.018	-0.249
	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***
$\boldsymbol{MCAP_{t-1}}$	0.004	-0.001	0.109	-0.560
	(0.016) **	(0.1532)	(0.000) ***	(0.000) ***
$\boldsymbol{OIL_{t-1}}$	0.232	0.388	0.221	0.317
	(0.000) ***	(0.000) ***	(0.000) ***	(0.000) ***

Notes: p-value < 0.1*; 0.05**; 0.01***

$\boldsymbol{DR_{it}}$ = Stock Market Returns
$\boldsymbol{CNC_{t-1}}$ = Daily Growth of Confirmed New Cases of COVID-19 at $t-1$
$\boldsymbol{MCAP_{t-1}}$ = Natural Algorithm Market Capitalisation at $t-1$
OIL = Brent Crude Oil Price at $t-1$

4.2 Correlation between daily growth of stock market returns and deaths due to COVID-19.

Two hypotheses were proposed to determine the correlation between the stock market returns and the number of deaths due to COVID-19.

H_0: There is no significant relationship between the stock market return and the growth of deaths due to COVID-19.
H_1: There is a significant relationship between the stock market return and the growth of deaths due to COVID-19.

Pooled OLS regression and fixed-effect models were used. Table 6 and Table 7 demonstrate the impact of the daily growth of total death cases of COVID-19. The Breusch-pagan test shows

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strong heteroscedasticity to both methods and a robust estimator needs to be performed. $r^2 = 0.563$ and $r^2 = 0.571$ in Table 6, thus, the stock market returns were described by 56.3% and 57.1% of the independent variable [8]. The p-values in Table 6 and Table 7 $= 0.000$ are less than 0.05. H_1 is accepted, thus there was a negative and significant relationship between the stock market returns and the daily growth of deaths due to COVID-19. Therefore, when the daily growth of total deaths due to COVID-19 increased, stock returns decreased. Both pooled OLS and fixed effects before and during MCO showed the same results.

Table 6: Result of daily growth of death cases of COVID-19 during MCO

	POOLED OLS	FIXED-EFFECT
Constant	0.033	
	(0.127)	
$\boldsymbol{CDC_{t-1}}$	-0.066	-0.072
	(0.000) ***	(0.000) ***
$\boldsymbol{MCAP_{t-1}}$	-0.0003	-0.149
	(0.954)	(0.3957)
$\boldsymbol{OIL_{t-1}}$	0.364	0.382
	(0.000) ***	(0.000) ***
DW	2.4512	2.5486
BP	0.0007	0.0007
R-squared	0.563	0.571

Notes: p-value < 0.1*; 0.05**; 0.01***

$\boldsymbol{DR_{it}}$	=	Stock Market Returns
$\boldsymbol{CDC_{t-1}}$	=	Daily Growth of New cases of COVID-19 at $t-1$
$\boldsymbol{MCAP_{t-1}}$	=	Natural algorithm market capitalisation at $t-1$
$\boldsymbol{OIL_{t-1}}$	=	Brent Crude Oil Price at $t-1$
DW	=	Durbin Watsons
BP	=	Breusch-Pagan

Table 7: Result of the daily growth of death cases of COVID-19 using a robust estimator during MCO

	POOLED OLS	FIXED-EFFECT
Constant	0.033	
	(0.1459)	
$\boldsymbol{CDC_{t-1}}$	-0.066	-0.072
	(0.000) ***	(0.000) ***
$\boldsymbol{MCAP_{t-1}}$	-0.0003	0.15
	(0.873)	(0.000) ***
$\boldsymbol{OIL_{t-1}}$	0.364	0.382
	(0.000) ***	(0.000) ***

Notes: p-value < 0.1*; 0.05**; 0.01***

$\boldsymbol{DR_{it}}$	=	Stock Market Returns
$\boldsymbol{CDC_{t-1}}$	=	Daily growth of new cases of COVID-19 at $t-1$
$\boldsymbol{MCAP_{t-1}}$	=	Natural algorithm market capitalisation at $t-1$
$\boldsymbol{OIL_{t-1}}$	=	Brent Crude Oil Price at $t-1$

4.3 Analysing performance of stock market returns with sector indices as dummy variables

Further analysis was done to analyse the stock market sector indices as a dummy variable. Table 8 shows the stock market returns in sector indices during pandemics using market capitalisation. The p-values = 0.003, 0.009, 0.000, 0.014, 0.031 < 0.05, indicate that the sector indices for consumer, energy, industrial product, telecommunication, and transportation were most affected as it has negative and had a significant relationship with the stock returns. However,

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the healthcare industry performs significantly better than the rest of the sector. On the other hand, COVID-19 does not affect the finance, plantation, REIT, technology, and utility sector stock returns.

Table 8: Sector dummy variables analysis with LSDV using robust standard error

VARIABLES	
CONSTANT	0.044 (0.1678)
$\boldsymbol{MCAP_{t-1}}$	-0.004 (0.142)
CONSTRUCTION	-0.007 (0.003) ***
CONSUMER	-0.003 (0.009) ***
ENERGY	-0.008 (0.000) ***
FINANCE	-0.003 (0.259)
HEALTHCARE	0.003 (0.000) ***
INDUSTRIAL PRODUCT	-0.007 (0.014) **
PLANTATION	0.002 (0.265)
PROPERTY	-0.005 (0.000) ***
REIT	-0.0001 (0.802)
TECHNOLOGY	-0.007 (0.106)
TELECOMMUNICATION	-0.002 (0.031) **
TRANSPORTATION	-0.004 (0.000) ***
UTILITIES	-0.001 (0.194)

Notes: p-value < 0.1*; 0.05**; 0.01***
$\boldsymbol{DR_{it}}$ = Stock market returns
$\boldsymbol{MCAP_{t-1}}$ = Natural algorithm market capitalisation at day $t-1$

4.4 Finding daily growth of total new cases to estimate the daily stock market returns.

The study was to estimate the stock market returns during a pandemic. The study analysed the equation before MCO and after MCO, $DR_{i,t} = -0.048 - 0.026CNC_{i,t-1} + 0.004MCAP_{i,t-1} + 0.232OIL_{i,t-1} + u_{it}$ and $DR_{i,t} = 0.002 - 0.172CNC_{i,t-1} - 0.001MCAP_{i,t-1} + 0.388OIL_{i,t-1} + u_{it}$ where $DR_{i,t}$ = the stock market returns; $CNC_{i,t-1}$= the daily growth of total new cases and u_{it}= the error term.

Figure 6 shows the estimated stock market returns using daily growth of total new COVID-19 cases. During the period before MCO, the stock returns decreased to a negative value in January (-2.2%). However, in February, it started to increase to positive returns (0.1%). In March, the

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returns suddenly decreased to -7.2% during MCO. Cases started to increase in the following month but with a negative value. This took place because the earliest COVID-19 cases appeared in January 2020. In February, the daily growth of new cases decreased until March, thus new cases increased. Therefore, the daily growth of total reported cases was affected by the stock market returns to negative values.

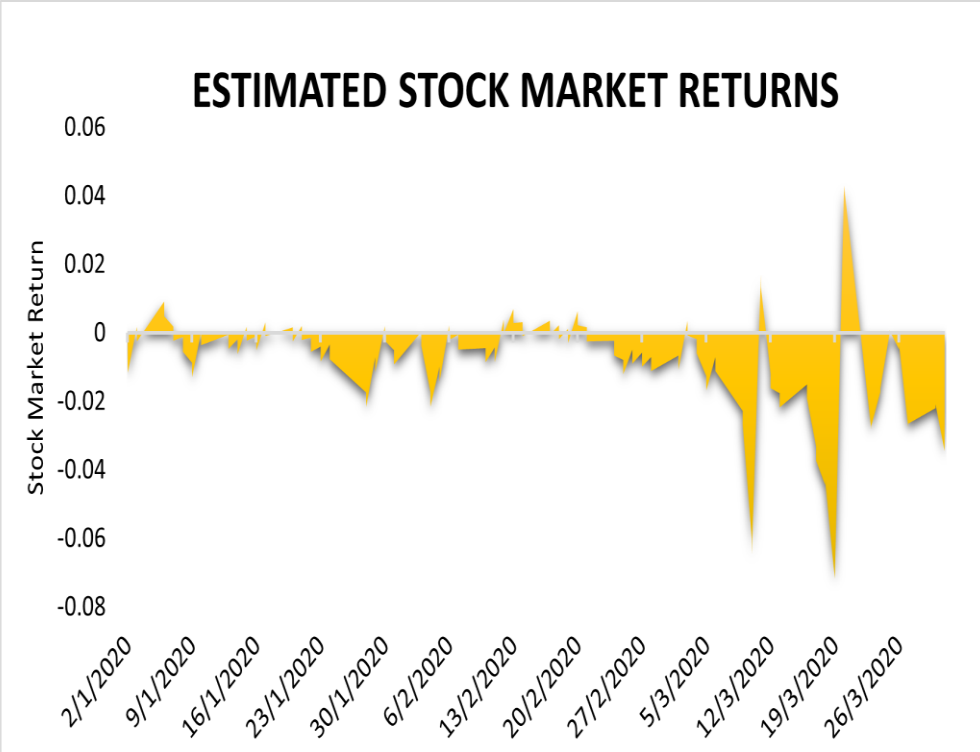

Figure 6: Estimated Stock Returns (the Growth of COVID-19 New Cases)

4.6 Finding daily growth of total deaths to estimate the daily stock market returns.

In order to satisfy the second specific objective to predict the stock market returns during a pandemic using daily growth of total deaths, the study analysed the equation $DR_{i,t} = 0.033 - 0.066CNC_{i,t-1} - 0.00403 + 0.364OIL_{i,t-1} + u_{it}$ where $DR_{i,t} =$ the stock market returns, $CDC_{i,t-1} =$ the daily growth of total new cases and $u_{it} =$ the error term. Figure 7 shows the estimated stock market returns using daily growth of total new COVID-19 cases. The stock market returns started to decline on March 23 2020 to the value of -2.00% but it started to increase from March 24 2020 until March 28 2020. However, it started to decrease at the end of March. This may have been caused by the increase in the growth of deaths in March. However, even when there were no new deaths, the stock returns did not decrease until negative returns. Therefore, the daily growth of total death cases was affected by the stock market returns.

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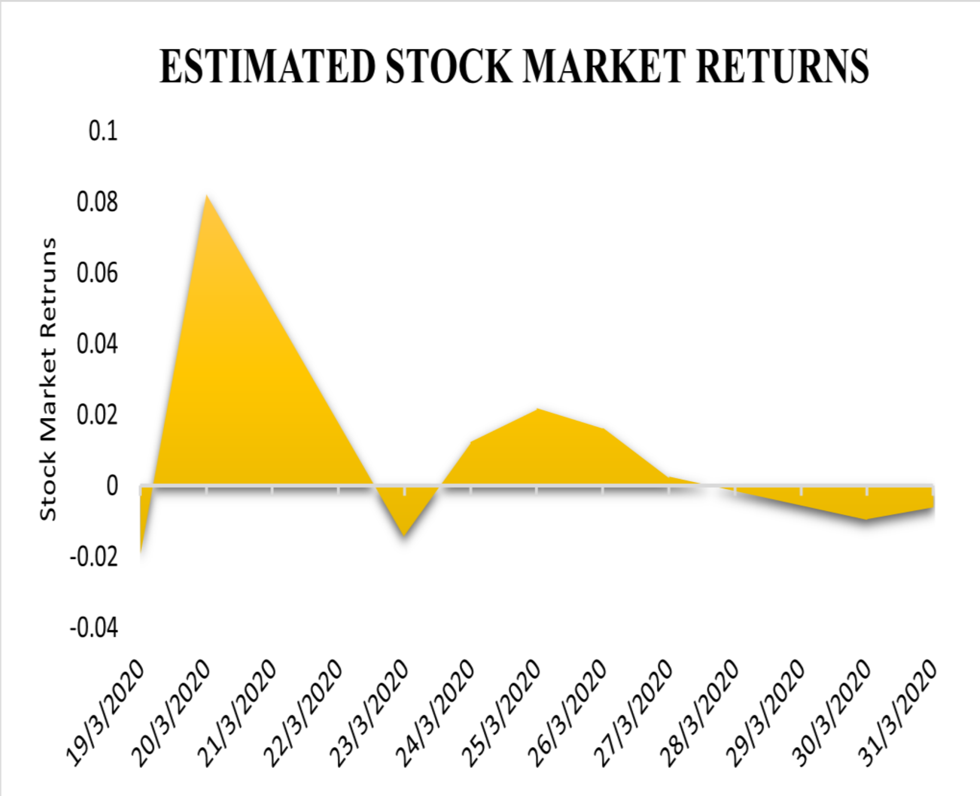

Figure 7: Estimated Stock Returns (the Growth of COVID-19 Death Cases)

5. CONCLUSION

This study aimed to determine the impact of the COVID-19 pandemic on stock market returns in Malaysia. Panel regression was used to analyse the correlation between stock returns and daily growths in total new cases and death cases. The stock market returns reacted negatively to both cases. Hence, the stock market returns declined when the COVID-19 new cases and deaths increased [1, 8]. Meanwhile, the study was constructed to estimate the daily stock returns during the COVID-19 pandemic. The finding showed that the market returns were negatively influenced by the new cases of and deaths due to COVID-19. Overall, this research suggests that the COVID-19 outbreak severely affected the stock market outcomes.

This study helps investors to get more information about the stock market during a pandemic. The investors should only start investing when the number of COVID 19 cases shows a gradual trend of decrease or when the "spreadability" clusters are reduced to an utmost minimal state. Also, future researchers can increase the data frame, independent variables and find the impact of more specific indices of the sector. On the other hand, another approach that can be used in place of the current approaches is the Event Methodology.

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