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Article

Government's responses and performance of stock markets during COVID-19: Evidence from ASEAN stock markets

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Abstract: This study aims to investigate the effects of government interventions on stock market performance of six countries within the ASEAN region that experienced the greatest impact during the COVID-19 pandemic in two aspects: stock returns and stock volatilities. The paper uses government response index and its components, including stringency index, containment and health index and economic support index as proxies for government actions. The paper first applies the GARCH(1,1) model to extract the volatilities of the studied stock markets. Subsequently, a panel regression model with fixed random effect is adopted to analyze how the performance of stock markets is influenced by government policy responses. The empirical results suggest that government's interventions exert positive, significant effect on the stock returns of ASEAN markets. Additionally, the stock markets are more volatile under the implementation of restriction policies and containment and health policies, whereas the economic support policies are associated with decreased volatilities. The overall effect of government response policies also boosts the volatility of ASEAN stock markets. Our findings provide essential and reliable evidence for policymakers and stakeholders to alleviate the profound impact of the widespread COVID-19 outbreak.

Keywords: government's responses; COVID-19; ASEAN countries; GARCH(1,1); stock market performance

1. Introduction

On March 2020, COVID-19, resulting from the SARS-CoV-2 virus, was officially announced as a global pandemic. From the first known case in Wuhan China, SARS-CoV-2 and its variants quickly spread out to over the world. According to Johns Hopkins University, at the end of 2022, there are more than 660 million confirmed cases with over 6.6 million deaths across the globe.

Amid the widespread impact of the pandemic, nearly all economies have experienced significant losses. As per Albulescu (2021), the significant economic repercussions of the deadly coronavirus encompass substantial losses in diverse industries, including trade, tourism, transportation, and even local food sectors. Not an exception, many stock markets over the world have witnessed a dramatic decrease (Morales and Andreosso-O'Callaghan, 2020). When the global pandemic is confirmed on March 2020, the US stock market plummeted with the Down John Industrial Average Index reduced by 6.400 points, approximately 26%. At that time, many other stock markets in ASEAN countries were also heavily damaged, such as Vietnam (dropped by 35%), Philippines (32%), Thailand (30%), Indonesia (28%), Singapore (23%) and Malaysia (15%).

In reaction, governments globally have enacted emergency measures, such as

social distancing (including closure of school, workplaces, markets, travel restrictions), containment and health (raising public awareness about the pandemic, testing and policy regarding quarantine measures), and income support packages (government financial aid in the form of cash). The primary objective of these actions is to contain the spread of the pandemic and minimize the economic impact at the same time. However, the effectiveness of these actions is uncertain. For example, social distancing could reduce the number of infected cases, but it also affects the earnings of millions of individuals. The impacts of government actions on stock markets, which contain the pool of sophisticated and noise traders, is even more unpredictable. Effective containment and health response measures, along with income support packages, are expected to yield positive effects on the market since it boosts the investors' confidence and mitigate the economic affects due to the pandemic (Ashraf, 2020). However, social distancing may exert both direct and indirect influences on the stock markets. For the direct effect, this action may reduce the stock market returns and increase the stock volatility since it adversely influences the economic activities. On the contrary, in long term, social distancing may help to control the number of new infections, which in turn, will facilitate the economic development and therefore positively affect the stock market. As a result, the impacts of this measure on stock market have been found differently in various countries. Chang et al. (2021), Yang and Deng (2021), Bouri et al. (2021) claims that social distancing helps to increase stock returns while Ashraf (2020), Shanaev et al. (2020), Alexakis et al. (2021), Zhou and Kumamoto (2020) dispute and state that stock returns have decreased under the effects of this policy.

Various studies have been conducted to examine the effects of COVID-19 on macroeconomic indicators and financial markets such as those of Liu et al. (2020); Ramelli and Wagner (2020) and Al-Awadhi et al. (2020). While earlier research has often focused on countries like the US and China, there remains a limited body of studies examining the impact of government policy responses to COVID-19 on the economies and stock markets of ASEAN countries. In this context, the objective of this study is to assess the dynamics of financial markets in react to the implementation of government policy responses, which is represented by the Oxford COVID-19 Government Response Tracker (OxCGRT) (Hale et al., 2021). To be more precise, this study anticipates capturing the impact of government intervention on stock market performance, focusing on two key facets: stock returns and stock volatilities. The paper concentrates on the stock markets of some of the most impacted countries in ASEAN, filling a research gap given the limited studies conducted on the stock markets in this region. Additionally, according to the World Atlas, these selected countries are considered as the six dominant Southeast Asian countries, which are Thailand, Malaysia, Indonesia, the Philippines, Singapore and Vietnam. These markets experienced a swift decline from mid-February to late March, mirroring the trend observed in the US stock market. Within the scope of this study, the following questions are raised: First, what impact do government interventions have on the performance of stock markets in specific ASEAN nations, considering both in returns and volatility? Second, what are the effects of various government policies aimed at addressing the COVID-19 pandemic on the performance of these markets?

This paper makes a threefold contribution to the existing literature. Firstly, it is

among the initial studies, to our knowledge, that examines the influence of government policy responses on the stock markets of the six most impacted countries in the ASEAN region during the COVID-19 pandemic through a panel regression approach. This study fills the gap in the existing literature that has not investigated the effect of government's interventions to COVID-19 pandemic on ASEAN stock markets as a whole yet. Secondly, while prior studies concentrate on either stock market returns or stock market volatilities, our research takes a comprehensive approach. We systematically assess the impact of government intervention on stock market performance, considering both stock returns and volatilities. Third, this paper might suggest meaningful insights and appropriate policies for ASEAN policymakers and stakeholders to understand the influence of COVID-19 and maintain their stock markets better in the future.

The subsequent sections of the paper are organized as follows: Section 2 provides an introduction to the literature review addressing the research problem. In Section 3, the data and research methods are presented. Empirical results will be outlined in Section 4. The study concludes in Section 5.

2. Literature review

There has been a rapid expansion of research exploring the effects of the COVID-19 pandemic on both the economy and financial markets. Specifically, a substantial body of literature has extensively examined the influence of COVID-19 on the stock market returns and figured that the global stock markets have been adversely impacted by the COVID-19 pandemic. Al-Awadhi et al. (2020) studied the impact of confirmed cases and total deaths that caused by COVID-19 on from the Hang Seng Index and Shanghai Stock Exchange Composite Index from 10 January to 16 March 2020. The research findings suggest that the daily stock returns were adversely affected by the progression of the COVID-19 pandemic. Utilizing an event study approach, Liu et al. (2020) suggested a rapid decline in the stock markets of significant impacted nations and regions subsequent to the onset of the viral outbreak and countries within the Asian region exhibited more pronounced negative abnormal returns when compared to their global counterparts. Applying a similar methodology, He et al. (2020) conducted a study to examine the effects of COVID-19 on various sectors of the Chinese stock market. Their findings revealed that most of the important industries were adversely affected by the pandemic. The similar study on the UK stock market by Tahat and Ahmed (2020) indicated that the sectoral market returns witnessed a severe impact by the outbreak. Sutrisno et al. (2021) established a noteworthy correlation between the COVID-19 pandemic and stock returns on ASEAN stock exchanges through the application of an event study approach.

Another segment of the literature delves into assessing the effects of government interventions on the stock market during the COVID-19 outbreak. Nevertheless, there is currently no consensus within this literature on the topic. Chang et al. (2021) claimed that government responses, including workplace closures, international travel restrictions, and financial support implementation, were found to have a positive impact on stock market returns. This conclusion is drawn from the analysis of panel data encompassing 20 countries during the period from 2 January to 21 July 2020. In

a similar vein, Ashraf (2020) reached to the same conclusion when investigating daily data of market returns of 77 stock markets from 22 January to 17 April 2020. The research indicated that stock market returns experienced an increase in response to government interventions, including public awareness campaigns, quarantining policies, and income support packages. Notably, government social distancing measures were found to have a negative impact on stock market returns. Similar to Ashraf (2020), Yang and Deng (2021) employed a panel regression model using data from 20 OECD countries and reached a similar conclusion. Their findings indicate that the government response index, containment and health index, and stringency index all exerted a positive influence on stock market returns. This aligns with the finding of Bouri et al. (2021), who studied the effects of government's responses on 14 industry stock indices of New Zealand. Their research indicates that three policies—lockdown, financial aid packages, and travel bans—were generally observed to have positive effects on industry-level stock markets.

While it is expected that authority's intervention will enhance market sentiment and consequently lead to increased market returns, several scholars have reported contrasting findings (Gil-Alana and Claudio-Quiroga, 2020; He et al., 2020; Zaremba et al., 2020). As per Shanaev et al. (2020), government policy intervention, particularly categorized into two aspects—lockdown measures and financial supports, is identified as the primary driver for the downturn of the stock market. Employing the dynamic Spatial Durbin Model with fixed effects and analyzing data from 45 major stock indices, Alexakis et al. (2021) found a negative correlation between stock market returns and the intensity of social distancing. Aharon and Siev (2021) have similar finding when analyzing 25 international capital market indices. According to their study, government's intervention such as closures and public campaigns negatively impacts the stock market returns. Interestingly, economic measures in the form of income support package increases the returns while debt/contract relief has the opposite effect.

An additional body of literature exploring the impact of government interventions on stock market volatility has emerged, given the heightened market volatility induced by the COVID-19 pandemic in many countries. Sharif et al. (2020) employed the coherence wavelet method alongside wavelet-based Granger causality tests on recent daily data in the United States. Their findings unveiled an unprecedented impact of COVID-19 and oil price shocks on geopolitical risk levels, economic policy uncertainty, and stock market volatility across low-frequency bands. In a study encompassing data from 11 countries in the Asia-Pacific region, Ibrahim et al. (2020) investigated the correlation between stock market volatilities and government response measures. Their findings suggest a significant reduction in volatility in most domestic equity markets due to the implementation of government intervention measures. In contrast, Zaremba et al. (2020) utilized a sample of 67 countries to demonstrate that such interventions could increase equity market volatilities. More specifically, information programs and the cancellation of public events were identified as key factors driving up volatility. This perspective was echoed by Baker et al. (2020) who asserted that trading restrictions and social distancing were the primary drivers of the unprecedented reaction observed in the US stock market, an occurrence unparalleled even in previous pandemics. Bakry et al. (2022) also assert

that government actions lead to an increase in stock volatility in emerging markets and a decrease in developed markets. Sadiq et al. (2021) delved into the repercussions of COVID-19 on ASEAN stock markets during the period spanning from 21 March 2020, to 28 April 2020, with a particular emphasis on the sectors most severely impacted. The empirical findings divulge a detrimental impact of COVID-19 on the stock markets of these nations, with Indonesia and Singapore emerging as the most adversely affected. Their findings suggested that the apprehension related to COVID-19 serves as a catalyst for increased public attention toward stock market volatility.

Government interventions exert an influence on market liquidity through various measures, as indicated in the research by Zaremba et al. (2021) Findings derived from a study encompassing 49 countries during the period from January to April 2020 reveal that the closure of workplaces and schools tends to diminish liquidity in emerging markets. Conversely, information campaigns have a stimulating effect on trading activity, subsequently enhancing liquidity in the equity market. The repercussions of these interventions vary across countries. Additionally, government responses involving social distancing measures contribute to stabilizing the international financial market, although their impact is constrained, according to the insights provided by Bickley et al. (2021).

There was a study that concentrated on both stock market returns and stock market volatilities. Zhuo and Kumamoto (2020) investigated global stock market reactions to COVID-19 and government social distancing policies. Their use of a panel VAR model on data from 15 countries led them to assert that an escalation in government containment policies is associated with a decrease in stock returns. Their findings also stated that stock market volatility goes up upon the implementation of containment policies. However, there is lack of studies investigating the impacts of government responses on both aspects of the stock market in ASEAN countries.

Therefore, addressing the existing void in the literature, our research endeavors to offer a thorough exploration of the impact of government interventions amid the COVID-19 period on stock market performance across ASEAN stock exchanges. This investigation will focus on two dimensions of performance: stock returns and stock volatilities.

3. Methodology

3.1. Regression models

The research methodology encompasses two distinct stages. Initially, the GARCH(1,1) model is employed to estimate stock volatilities across ASEAN countries throughout the specified sampling duration. Subsequently, the Panel Regression Model is applied to investigate the influence of government responses on market performance, examining both stock volatilities derived from the initial step and stock returns.

3.1.1. GARCH(1,1) model

We employ the GARCH(1,1) model, originally proposed by Bollerslve (1986) in order to estimate daily volatilites. This model is wesll-suited for financial variables. particularly those that have exhibited volatility clustering. Throughout the sample

period, the stock markets in the researched countries experienced significant volatility, characterized by substantial return movements followed by subsequent similar movements, a phenomenon commonly referred to as volatility clustering. Consequently, the GARCH(1,1) model emerges as the most suitable choice for this scenario. Additionally, GARCH(1,1) is considered both robust and straightforward in estimating volatilities (Engle, 2001). In line with Engle (2001), Hansen and Lunde (2005) advocate GARCH(1,1) as superior to GARCH models with different numbers of lags. They conduct a comparative analysis of 330 ARCH-type models concerning their efficacy in capturing the conditional variance. The result indicates an absence of evidence suggesting that more sophisticated models surpass the performance of a GARCH(1,1) model. Moreover, Bollerslve (1992) contends that the GARCH(1,1) method adeptly captures the heteroscedastic characteristics of financial variables.

The equation for the GARCH(1,1) model is as follows:

$$\sigma_n^2 = \gamma V_L + \alpha u_{n-1}^2 + \beta \sigma_{n-1}^2 \quad (1)$$

where: V_L: the long-term volatility; u_{n-1}: the return rate of the day $n - 1$; σ_{n-1}: the variance of the day $n - 1$; γ, α and β: the weights of V_L, u^2_{n-1} and σ^2_{n-1} respectively with the constraint that $\gamma + \alpha + \beta = 1$.

Setting $\omega = \gamma.V_L$, the GARCH(1,1) model then can be rewritten as:

$$\sigma_n^2 = \omega + \alpha u_{n-1}^2 + \beta \sigma_{n-1}^2 \quad (2)$$

The GARCH(1,1) model captures stock volatility by correlating the conditional variance of stock returns with past squared errors and past conditional variances. It offers a versatile framework for examining and predicting volatility dynamics within financial markets. In order to establish a stable GARCH(1,1) process, it is required that $\alpha + \beta < 1$. The estimation of this model is accomplished through the maximum likelihood method. Once the variances (σ_n^2) are estimated, we proceed to calculate volatilities (σ_n) by taking the square root of the variances.

3.1.2. Panel regression method

Previous examinations of the COVID-19 pandemic have commonly employed the event-study method. However, Al-Awadhi et al. (2020) argue against its suitability, noting that the start date does not align with the peak of the event. For a comprehensive analysis of a group of countries, panel data regression emerges as the most suitable approach, as highlighted by Baltagi (2021). This method is advantageous in mitigating biased estimates while addressing concerns related to multicollinearity and individual heterogeneity. Notably, Bell and Jones (2015) contend that the random-effect model, capable of handling time-invariant variables, is more fitting than the fixed-effect regression method. In this study, we employ the random-fixed effect model with the assumption of homogeneity under the parameter of interest, aligning with the perspectives of Bersvendsen and Ditzen (2021) regarding the traditional data regression such as fixed-effect and random effect models. Additionally, country fixed-effect dummy variables are incorporated to account for factors fixed over the observed period but subject to change across the six ASEAN countries in our sample. Our baseline models are described below:

$$Return_{i,t} = \alpha_0 + \beta_1 Government\ Response\ Index_{i,t} + \sum_{i=1}^{C-1} \beta_i\, C_i + Control\ Variables_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$Return_{i,t} = \alpha_0 + \beta_1 Stringency\ Index_{i,t} + \sum_{i=1}^{C-1} \beta_i\, C_i + Control\ Variables_{i,t} + \varepsilon_{i,t} \quad (4)$$

$$Return_{i,t} = \alpha_0 + \beta_1 Containment\ and\ Health\ Index_{i,t} + \sum_{i=1}^{C-1} \beta_i\, C_i + Control\ Variables_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$Return_{i,t} = \alpha_0 + \beta_1 Economic\ Support\ Index_{i,t} + \sum_{i=1}^{C-1} \beta_i\, C_i + Control\ Variables_{i,t} + \varepsilon_{i,t} \quad (6)$$

$$Volatility_{i,t} = \alpha_0 + \beta_1 Government\ Response\ Index_{i,t} + \sum_{i=1}^{C-1} \beta_i\, C_i + Control\ Variables_{i,t} + \epsilon_{i,t} \quad (7)$$

$$Volatility_{i,t} = \alpha_0 + \beta_1 Stringency\ Index_{i,t} + \sum_{i=1}^{C-1} \beta_i\, C_i + Control\ Variables_{i,t} + \epsilon_{i,t} \quad (8)$$

$$Volatility_{i,t} = \alpha_0 + \beta_1 Containment\ and\ Health\ Index_{i,t} + \sum_{i=1}^{C-1} \beta_i\, C_i + Control\ Variables_{i,t} + \epsilon_{i,t} \quad (9)$$

$$Volatility_{i,t} = \alpha_0 + \beta_1 Economic\ Support\ Index_{i,t} + \sum_{i=1}^{C-1} \beta_i\, C_i + Control\ Variables_{i,t} + \epsilon_{i,t} \quad (10)$$

where:

Return$_{i,t}$: the stock market returns in country *i* on day *t*.

Volatility$_{i,t}$: the stock market volatitliy in country *i* on day *t*.

Government Response Index$_{i,t}$, Stringency Index$_{i,t}$, Containment and Health Index$_{i,t}$ and Economic Support Index$_{i,t}$: the action of government in each category in country *i* during the COVID-19 pandemic on day *t*.

C_i: the country fixed effect.

Control Variables$_{i,t}$: the control variables. In Equations (3)–(6), the control variables include the confirmed cases, change in market capitalization, S&P 500 daily returns and changes in WTI oil price. In Equations (7)–(10), we use daily changes in VIX instead of S&P 500, while the other variables remain unchanged.

3.2. Data set

The research period in this paper spans from 1 February 2020 to 31 March 2022, ensuring a comprehensive examination of stock market dynamics following the implementation of policy responses. This time frame is selected to encompass the entire duration from the initiation of the COVID-19 pandemic until its latest variant, Omicron, spanning from November 2021 until February 2022. Our study focuses on the six most impacted countries in ASEAN, as identified by Reporting ASEAN as of 28 August 2021. These countries are Vietnam, the Philippines, Thailand, Indonesia, Singapore, and Malaysia. In each country, we select the most important index that serves as a representative benchmark for the entirety of the stock market. To be specific, these indices are VN-Index for Vietnam, Philippines Stock Exchange Index (PSE Index) for Philippines, Stock Exchange of Thailand Index (SET Index) for Thailand, Jakarta Composite Index (JCI) for Indonesia, Straits Times Index (STI) for Singapore and Kuala Lumpur Composite Index (KLCI) for Malaysia. The stock indices utilized in our study have been sourced from Investing.com. To compute stock

market returns, we determine the daily variations in the stock index. We also use daily changes in market capitalization of the stock market of each country as it could influence the stock returns and stock volatilities. The government's policy responses are gathered from the Oxford COVID-19 Government Response Tracker database (OxCGRT). These indices provide a comprehensive overview of the pandemic intervention measures enacted by governments, categorizing them into three dimensions: the stringency index (encompassing closures of schools, workplaces, markets, public transport, event cancellations, gathering restrictions, stay-at-home requirements, and domestic and international travel restrictions), the containment and health index (encompassing public information campaigns, testing and quarantine policies, contact tracing, emergency investments in healthcare, and investments in COVID-19 vaccines), and the economic support index (government financial aid, debt/contract relief, fiscal measures and giving international support). By isolating different aspects of government's response policy, the study aims to these impacts on the stock market and investors' sentiment separately, allowingthereby providing comparison and providing appropriate strategypolicy recommendatiosuggestion for governments during the time of crisisthe. Furthermore, in this study, we apply the overall government response index and all three components' indices to fully capture the influences of government actions on the performance of stock markets. The data on confirmed cases is sourced from a research initiative conducted by a team of researchers affiliated with the University of Oxford, known as Our World in Data (OWID).

In addition, Ashraf (2020) clames that the performance of national stock markets is susceptible to the influence of global factors, potentially leading to spill-over effects across countries. Therefore, in order to mitigate the impact of global market fluctuations and account for unobserved effects, we incorporate global variables, such as the stock returns on the US stock exchange and the international oil price, into our analysis. Furthermore, earlier studies such as those of Kharchenko and Tzvetkov (2013) and Nghi and Kieu (2021) have observed a volatility spillover phenomenon from the United States to other nations. Consequently, we incorporate the CBOE's volatility index, commonly known as the VIX, into our analysis. The VIX serves as an indicator of market risk and investor sentiment, measured by the standard deviation movement of the S&P 500. This metric is employed as a barometer for investment decisions, often referred to as the "Fear Index" of the stock market. The details are summarized in **Table 1**.

Table 1. List of variables.

Variable name	Definition	Source
Dependent variables		
Stock return	Daily changes of stock price	Own calculation
Stock volatility	Standard deviation of a stock's daily return estimated by GARCH(1,1) models	Own calculation
Independent variables		
Overall Government Response Index	A composite index of stringency, containment and health, and economic support indices	Oxford COVID-19 Government Response Tracker (OxCGRT)

Table 1. (*Continued*).

Variable name	Definition	Source
Stringency Index	Quantify the closures of schools, workplaces, markets, public transport, event cancellations, gathering restrictions, stay-at-home requirements, domestic and international travel restrictions	OxCGRT
Containment and Health Index	Encompass public information campaigns, testing and quarantine policies, contact tracing, emergency investments in healthcare, and investments in COVID-19 vaccines	OxCGRT
Economic support Index	Measure government financial aid, debt/contract relief, fiscal policy and international support during COVID-19 period	OxCGRT
Control variables		
Confirmed COVID cases	Daily confirmed cases per million people	Our World in Data (OWID)
Market Capitalization	The total value of a publicly traded company's outstanding shares of stock	World Bank database
S&P 500 Return	Changes in S&P 500 Index, which represent a market weighted index for 500 leading public companies in the US	Investing.com
VIX	Indicator of market volatility, measuring market risk and investor sentiment, derived from real time	Investing.com
Oil price	Change in West Texas Intermediate (WTI) oil price	Investing.com

In summary, the regression model incorporates several control variables, namely confirmed cases, returns on the S&P 500 Index, VIX (CBOE Volatility Index), changes in WTI (West Texas Intermediate) Oil price, and changes in market capitalization of the stock markets. The data for these variables are gathered from the website Investing.com. This website implements thorough data validation and normalization procedures to maintain the accuracy and consistency of the data across various markets and asset classes. Therefore, the validity of this data set is guaranteed.

4. Findings

4.1. Descriptive statistics

Table 2 displays the descriptive statistics for all variables considered in the models. The average stock return is 0.035%, indicating a positive mean return. However, the relatively high standard deviation of 1.447% suggests a considerable level of variability in stock returns. The lowest daily return was recorded in Philippines on 19 March 2020 at about −13.1% and the highest one is 11.34% that happened in Indonesia on 26 March 2020. The average stock volatility, at 1.242%, signifies the degree of variability or dispersion in stock prices. In contrast, the S&P 500 Index demonstrates a lower average return and standard deviation, approximately at 0.0007% and 0.016% respectively. Concurrently, the number of confirmed cases

undergoes a swift escalation throughout the sample period, reaching a peak of 9,564,609. The average values of Government responses, Stringency Index and Containment and Health Index are at around 61 with moderate standard deviation of 13. Conversely, the Economic Support Index exhibits an average value of 51 with a notably higher standard deviation of 35, indicating greater volatility compared to the other three indices.

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Stock Returns	3196	0.0353	1.447035	−13.1043	11.34118
Stock Volatilities	3196	1.242489	0.668958	0.534279	6.618576
Government responses	3196	61.23379	12.58893	0	80.52
Stringency Index	3196	61.29722	14.55353	0	100
Containment and Health Index	3196	62.65986	13.10563	0	84.52
Economic Support Index	3196	51.25156	35.73231	0	100
Return on S&P 500 Index	3196	0.00068	0.016287	−0.11984	0.093828
VIX Index	3196	24.85897	9.829631	0	82.69
Changes of Oil price	3196	0.083057	2.522954	−17	21.1
Changes of Market Capitalization	3196	16.41402	37.02655	−12.7512	107.9247
Confirmed Cases	3196	917,721.8	1,401,158	0	9,564,609

Source: Author's computation.

In addition, we also observe the variations in stock returns and stock volatilities during the sample period graphically, as shown in the **Figures 1** and **2**. These figures illustrate that all six stock markets experienced turbulence in March 2020, characterized by significant return fluctuations followed by continued large movements, indicative of volatility clustering. It is noteworthy that March 2020 marked a period of a dramatic global stock market crash amid the COVID-19 pandemic.

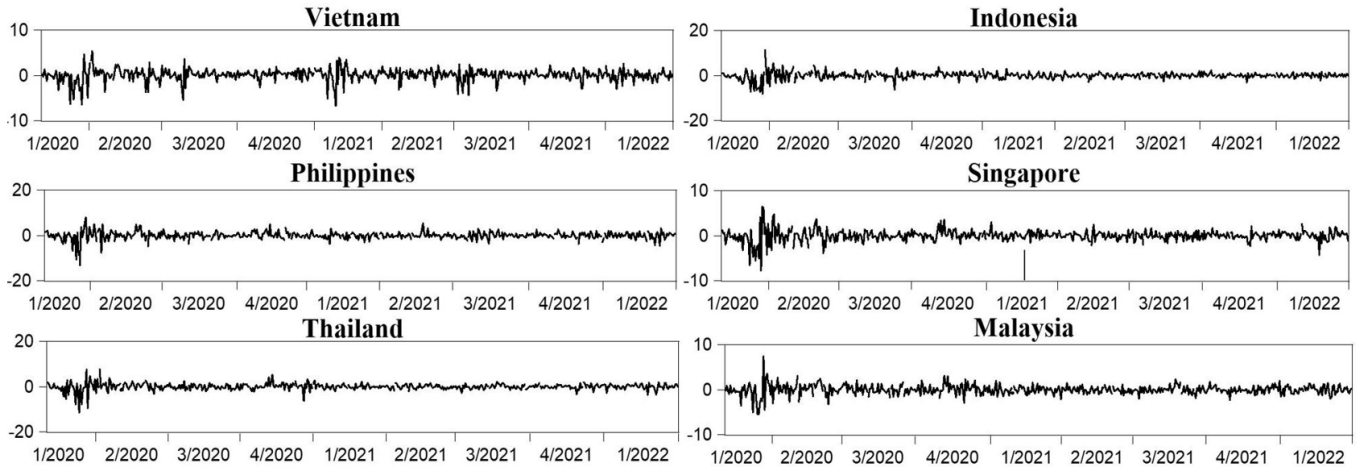

Figure 1. Stock returns during the sample period.

Source: Author's computation.

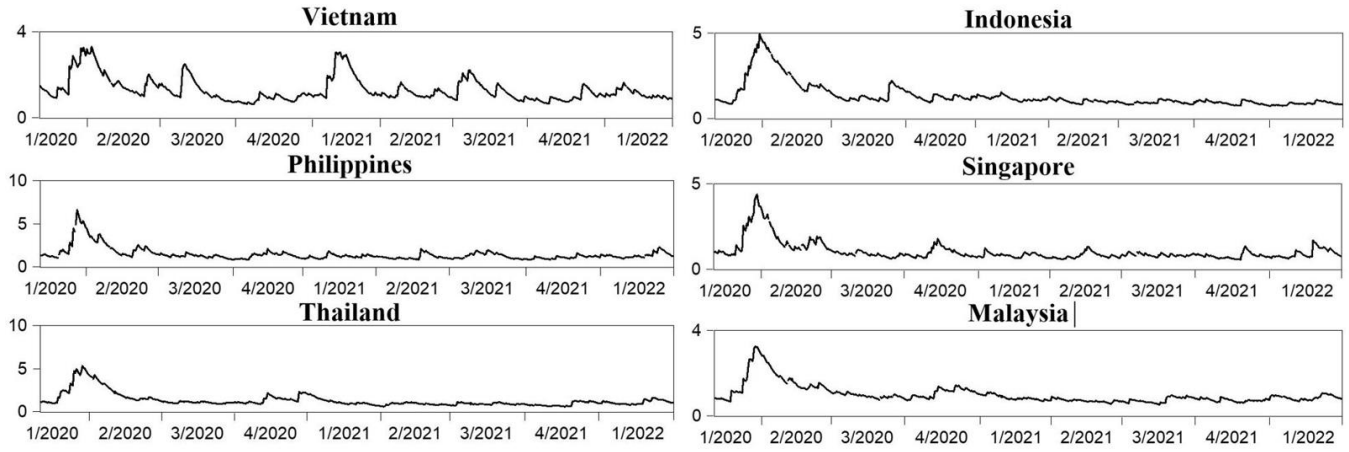

Figure 2. Stock volatilities during the sample period.
Source: Author's computation.

Figure 3 represents the government response index during the sample period. All six countries increase the government response rapidly at the beginning and then keep hovering around the average index level, at about 61, which implies that governors in these ASEAN countries have significantly altered their policy responses to reduce the impact of the COVID-19 outbreak.

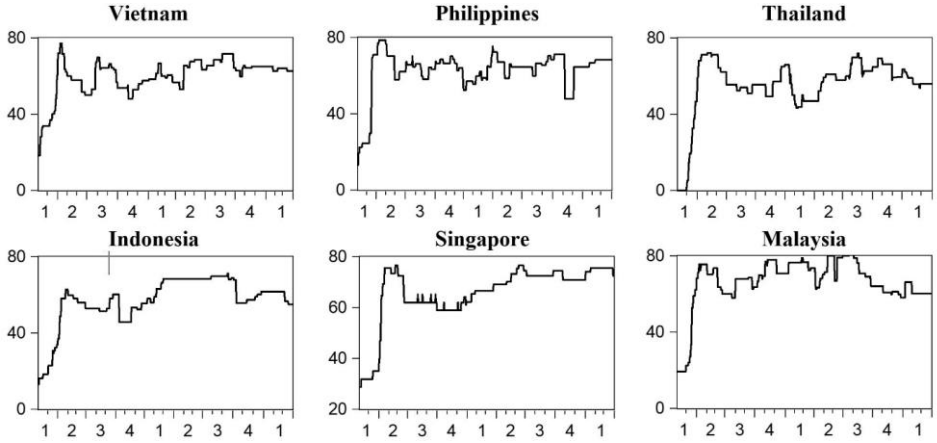

Figure 3. Government response index during the sample period.
Source: Author's computation.

4.2. Panel regression results

Prior to the unit root tests, we employ the cross-sectional dependence test to decide whether the first or second-generation unit root test should be conducted. Following the cross-sectional dependence test, the analysis detects the presence of such dependence in the sample. Subsequently, the second-generation unit root test developed by Pesaran (2007) is then employed, with the hypothesis stating that all the panels contain the unit root. The analysis indicates that Stock Returns, Volatilities and Government's response policies are stationary for the whole period. The unit root tests indicate that the international variables such as S&P 500 return, VIX and changes in oil prices contain a unit root at level. However, as highlighted by Park (2011), the unit root is not an obligatory condition under fixed or random effects in panel data. The regression results for stock returns are shown at **Table 3**. The coefficients associated

with the government response index, stringency index, containment and health index, and economic support index are all positive and statistically significant at both the 5% and 10% levels. This evidence indicates that government's interventions positively affect the stock returns across six ASEAN countries during the observed period. These findings are akin to Yang and Deng (2021), Chang et al. (2021) and Bouri et al. (2021). In contrast, the number of confirmed cases does not exert any discernible impact on stock returns, as indicated by the non-significant coefficients in all four regressions. This evidence is similar with the results of Baker et al. (2020), Indrastuti (2021) but not with those of Ashraf (2020) and Khan et al. (2020). Market capitalization, another country specific variable, has positive influence on stock returns of selected countries during the sample period with all statistically significant coefficients at 1%. It is not surprising that the US stock market have positive impact on the stock returns in six selected ASEAN countries. Furthermore, changes in oil prices also affect positively and significantly the stock returns during the research period.

Table 3. Panel regression results for stock returns.

Model	**(1)**	**(2)**	**(3)**	**(4)**
Government response Index	0.00187**			
	(3.37)			
Stringency Index		0.00150*		
		(2.31)		
Containment and Health Index			0.00157*	
			(2.45)	
Economic Support Index				0.00099**
				(3.54)
Confirmed cases	-7.5×10^{-9}	-3.9×10^{-9}	-7.7×10^{-9}	-2.8×10^{-9}
	(−1.88)	(−1.03)	(−1.94)	(−0.84)
Changes of Market capitalization	1.0145***	1.0148***	1.0149***	1.0147***
	(41.61)	(41.77)	(41.68)	(41.61)
Changes of Oil prices	0.0167**	0.0168**	0.0168**	0.0166**
	(2.92)	(2.92)	(2.92)	(2.90)
Returns on S&P 500 Index	5.4731**	5.4814**	5.4885**	5.4995**
	(2.57)	(2.57)	(2.58)	(2.58)
Constant	−16.73***	−16.71***	−16.72***	−16.67***
	(−41.93)	(−41.74)	(−41.70)	(−41.26)
Country fixed-effect	Yes	Yes	Yes	Yes
R-square	0.0010	0.0010	0.0010	0.0010
Number of countries	6	6	6	6

The numbers in parentheses are *t*-statistics. ***, **, * represent a statistical significance at 1%, 5% and 10% of the parameters respectively.
Source: Author's computation.

Table 4 represents the regression results for stock volatilities. Significantly, government interventions, encompassing the stringency index, containment and health index, and the overall government response index, have notably contributed to an

increase in stock volatilities in the sampled countries. This observation aligns with the conclusions drawn in prior studies (Ashraf, 2020; Baker et al., 2020; Sharif et al., 2020; Yang and Deng, 2021; Zaremba et al., 2020; Zhuo and Kumamoto, 2020). Interestingly, economic support index helps to decrease the stock volatilities. The number of confirmed cases has almost no impact on stock volatilities during the sample period. Meanwhile, changes of market capitalization—the other country specific variable—have positive and significant effect on stock volatilities. The findings also indicate that the CBOE VIX Index and changes in oil prices are associated with higher volatility in the six selected ASEAN stock markets.

Table 4. Panel regression results for stock volatilities.

Model	**(5)**	**(6)**	**(7)**	**(8)**
Government response Index	0.00336*			
	(1.96)			
Stringency Index		0.00667***		
		(4.30)		
Containment and Health Index			0.00518**	
			(2.58)	
Economic Support Index				−0.00274**
				(−3.40)
Confirmed cases	-7.7×10^{-8}**	-7.2×10^{-8}***	-8.3×10^{-8}***	-7.9×10^{-8}***
	(−5.80)	(−4.46)	(−5.86)	(−7.49)
Changes of Market capitalization	0.0656***	0.0612***	0.0646***	0.0704***
	(10.53)	(9.80)	(10.49)	(11.85)
Changes of Oil prices	0.0103***	0.0093***	0.0101***	0.0114***
	(6.59)	(5.11)	(6.14)	(8.36)
VIX Index	0.0486***	0.0477***	0.0489***	0.0461***
	(8.55)	(8.45)	(8.61)	(7.37)
Constant	−1.179***	−1.291***	−1.282***	−0.847**
	(−5.59)	(−6.63)	(−5.77)	(−3.27)
Country fixed-effect	Yes	Yes	Yes	Yes
R-square	0.0394	0.0470	0.0415	0.0392
Number of countries	6	6	6	6

The numbers in parentheses are *t*-statistics. ***, **, * represent a statistical significance at 1%, 5% and 10% of the parameters respectively.
Source: Author's computation.

The paper then carries on the robustness check. We conducted a re-examination of the results through two approaches. Firstly, by introducing a new variable into the baseline models, specifically new confirmed COVID-19 cases in each country. The findings remain consistent with those of the baseline models. Secondly, we employed the Panel-Corrected Standard Errors (PCSE) model instead of the random effect model, allowing for the consideration of contemporaneous correlation across the panel. The results reaffirm that government policy responses to COVID-19 positively impact stock returns in ASEAN countries. Moreover, the implementation of public policies

appears to contribute to increased volatility in the stock markets of these countries.

5. Discussion

The interventions of government have a positive impact on stock returns across six ASEAN countries throughout the observed period. Despite the negative influences that government interventions may have on the economy, the overall impacts of those actions still increase the stock returns on average. The results show that investors perceive government responses as effective measures to contain the widespread of COVID-19 and it, in turn, will benefit the economy in the post-pandemic periods. In term of stock volatilities, various government policies seem to have different effects. During the COVID-19 pandemic, income support packages in form of cash or debt/contract relief will boost the confidence of investors and mitigate the economic effects of the pandemic simultaneously. Hence, the stock market becomes less volatile as investors believe in the effectiveness of government's economic support policy. On the other hand, a high stringency index and containment and health index create the perception among investors of heightened severity in the COVID-19 pandemic. This perception induces increased investors anxiety and consequently, elevates the stock market volatility.

On average, the number of COVID-19 confirmed cases almost has no impact either on the stock returns or on stock volatilities of six ASEAN countries throughout the research period on average. It can be explained that while the increasing of number of confirmed cases can impose a negative sentiment to the markets, investors maintain confidence in the effectiveness of government's interventions to mitigate the impacts of COVID-19 and focus on their long-term strategies rather than following the noises.

Changes in market capitalization have a positive and significant impact on both stock returns and volatilities. It is evident that the increase in market capitalization changes correlates with higher stock returns. However, stock volatilities concurrently escalate with the rise in market capitalization changes. This pivotal outcome aids policymakers in devising efficacious market management strategies amid the pandemic period.

Changes in oil price is another variable that positively affects both stock returns and volatilities. Normally, an increase in oil price would associate with lower expectation of growth rate of the economy and therefore, hindering the company's growth prospect. It, in turn, will result in dampening the stock returns. However, this might not hold true during the pandemic outbreak when economic activities are reduced by government's restrictions. An increase in oil price could instill a positive market sentiment, signaling expectations of increased future economic activities. As a result and consequently resulting in higher stock returns. In term of volatilities, an increase in oil prices would normally associate with a rise in the rate of expected inflation. This can negatively affect the investor's sentiment and therefore, result in different trading behaviors. This, in turn, will drive up the stock volatilities.

Two important indices of the US stock market—returns on S&P 500 Index and VIX Index—appear to positively impact the stock returns and stock volatilities respectively. This implies that market risk emanating from the US stock exchange amplifies the fear and stress levels among investors in ASEAN countries. These results

are consistent with previous studies highlighting volatility spillover effects between stock markets, underscoring the substantial impact of developed markets on emerging ones.

6. Conclusion

This study aims to explore the influence of government interventions on stock market performances during the COVID-19 pandemic outbreak in six ASEAN countries. The government response index and its components—stringency index, health and containment index, and economic support index—are utilized as proxies for government interventions. The findings indicate a noteworthy alteration in the stock market performance of ASEAN countries during the sample period, driven by the responses of governments to the COVID-19 pandemic. Notably, government interventions contribute to an increase in stock returns in the selected ASEAN countries. In addition, among three policy categories, only economic support policies help to reduce stock volatilities, while restriction measures and containment and health policies make the stock markets more volatile. Therefore, to improve the performance of stock markets during future pandemics, it is crucial for the governments to reassure investors while concurrently implementing measures to prevent the widespread of the pandemic. The authorities should promptly and transparently disclose information to enhance investor confidence, consequently contributing to the restoration of stock market performance. Additionally, regarding investors, it is essential for them to avoid yielding to undue panic amid a pandemic and, instead, diligently monitor and interpret government interventions as indicators for anticipating upcoming market trends.

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References

Aharon, D. Y., & Siev, S. (2021). COVID-19, government interventions and emerging capital markets performance. Research in International Business and Finance, 58, 101492. https://doi.org/10.1016/j.ribaf.2021.101492

Al-Awadhi, A. M., Alsaifi, K., Al-Awadhi, A., et al. (2020). Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns. Journal of Behavioral and Experimental Finance, 27, 100326. https://doi.org/10.1016/j.jbef.2020.100326

Albulescu, C. T. (2021). COVID-19 and the United States financial markets' volatility. Finance Research Letters, 38, 101699. https://doi.org/10.1016/j.frl.2020.101699

Alexakis, C., Eleftheriou, K., & Patsoulis, P. (2021). COVID-19 containment measures and stock market returns: An international spatial econometrics investigation. Journal of Behavioral and Experimental Finance, 29, 100428. https://doi.org/10.1016/j.jbef.2020.100428

Ashraf, B. N. (2020). Economic impact of government interventions during the COVID-19 pandemic: International evidence from financial markets. Journal of Behavioral and Experimental Finance, 27, 100371. https://doi.org/10.1016/j.jbef.2020.100371

Baker, S. R., Bloom, N., Davis, S. J., et al. (2020). The Unprecedented Stock Market Reaction to COVID-19. The Review of Asset Pricing Studies, 10(4), 742–758. https://doi.org/10.1093/rapstu/raaa008

Bakry, W., Kavalmthara, P. J., Saverimuttu, V., et al. (2022). Response of stock market volatility to COVID-19 announcements and stringency measures: A comparison of developed and emerging markets. Finance Research Letters, 46, 102350. https://doi.org/10.1016/j.frl.2021.102350

Baltagi, B. H. (2008). Econometric analysis of panel data. John Wiley & Sons Ltd., Chichester.

Bell, A., & Jones, K. (2014). Explaining Fixed Effects: Random Effects Modeling of Time-Series Cross-Sectional and Panel Data. Political Science Research and Methods, 3(1), 133–153. https://doi.org/10.1017/psrm.2014.7

Bersvendsen, T., & Ditzen, J. (2021). Testing for slope heterogeneity in Stata. The Stata Journal: Promoting Communications on Statistics and Stata, 21(1), 51–80. https://doi.org/10.1177/1536867x211000004

Bickley, S. J., Brumpton, M., Chan, H. F., et al. (2021). The stabilizing effect of social distancing: Cross-country differences in financial market response to COVID-19 pandemic policies. Research in International Business and Finance, 58, 101471. https://doi.org/10.1016/j.ribaf.2021.101471

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. Journal of econometrics, 31(3), 307–327. https://doi.org/10.1016/0304-4076(86)90063-1

Bollerslev, T., Chou, R. Y., Kroner, K. F. (1992). ARCH modeling in finance: A review of the theory and empirical evidence. Journal of econometrics, 52(1-2), 5–59. https://doi.org/10.1016/0304-4076(92)90064-X

Bouri, E., Naeem, M. A., Nor, S. M., et al. (2021). Government responses to COVID-19 and industry stock returns. Economic Research-Ekonomska Istraživanja, 35(1), 1967–1990. https://doi.org/10.1080/1331677x.2021.1929374

Chang, C.-P., Feng, G.-F., & Zheng, M. (2021). Government Fighting Pandemic, Stock Market Return, and COVID-19 Virus Outbreak. Emerging Markets Finance and Trade, 57(8), 2389–2406. https://doi.org/10.1080/1540496x.2021.1873129

Engle, R. (2001). GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics. Journal of Economic Perspectives, 15(4), 157–168. https://doi.org/10.1257/jep.15.4.157

Gil-Alana, L. A., & Claudio-Quiroga, G. (2020). The COVID-19 impact on the Asian stock markets. Asian Economics Letters, 1(2). https://doi.org/10.46557/001c.17656

Hale, T., Angrist, N., Goldszmidt, R., et al. (2021). A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). Nature Human Behaviour, 5(4), 529–538. https://doi.org/10.1038/s41562-021-01079-8

Hansen, P. R., & Lunde, A. (2005). A forecast comparison of volatility models: does anything beat a GARCH(1,1)? Journal of Applied Econometrics, 20(7), 873–889. https://doi.org/10.1002/jae.800

He, P., Sun, Y., Zhang, Y., et al. (2020). COVID–19's Impact on Stock Prices Across Different Sectors—An Event Study Based on the Chinese Stock Market. Emerging Markets Finance and Trade, 56(10), 2198–2212. https://doi.org/10.1080/1540496x.2020.1785865

Ibrahim, I., Kamaludin, K., & Sundarasen, S. (2020). COVID-19, Government Response, and Market Volatility: Evidence from the Asia-Pacific Developed and Developing Markets. Economies, 8(4), 105. https://doi.org/10.3390/economies8040105

Indrastuti, D. K. (2021). Impact of Confirmed, Death, and Recovered Cases of COVID-19 Toward Stock Exchange Composite Index. Review of Integrative Business and Economics Research, 10, 1–10.

Khan, K., Zhao, H., Zhang, H., et al. (2020). The impact of COVID-19 pandemic on stock markets: An empirical analysis of world major stock indices. The Journal of Asian Finance, Economics and Business, 7(7), 463–474. https://doi.org/10.13106/jafeb.2020.vol7.no7.463

Kharchenko, I., Tzvetkov, P. (2013). Estimation of volatilities and spillover effects between developed and emerging market economies. Lund University Publications.

Liu, H., Manzoor, A., Wang, C., et al. (2020). The COVID-19 Outbreak and Affected Countries Stock Markets Response. International Journal of Environmental Research and Public Health, 17(8), 2800. https://doi.org/10.3390/ijerph17082800

Morales, L., & Andreosso-O'Callaghan, B. (2020). COVID-19: Global Stock Markets "Black Swan." Technological University Dublin. https://doi.org/10.21427/GV7K-1C77

Nghi, L., & Kieu, N. (2021). Volatility spillover from the united states and Japanese stock markets to the Vietnamese stock market: A frequency domain approach. Panoeconomicus, 68(1), 35–52. https://doi.org/10.2298/pan170428003n

Park, H. M. (2011). Practical guides to panel data modeling: a step-by-step analysis using stata. Public Management and Policy Analysis Program, Graduate School of International Relations, International University of Japan, 12, 1–52.

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. Journal of Applied Econometrics, 22(2), 265–312. https://doi.org/10.1002/jae.951

Ramelli, S., & Wagner, A. F. (2020). Feverish Stock Price Reactions to COVID-19*. The Review of Corporate Finance Studies, 9(3), 622–655. https://doi.org/10.1093/rcfs/cfaa012

Sadiq, M., Hsu, C.-C., Zhang, Y., et al. (2021). COVID-19 fear and volatility index movements: empirical insights from ASEAN stock markets. Environmental Science and Pollution Research, 28(47), 67167–67184. https://doi.org/10.1007/s11356-021-15064-1

Shanaev, S., Shuraeva, A., & Ghimire, B. (2020). The Financial Pandemic: COVID-19 and Policy Interventions on Rational and Irrational Markets. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3589557

Sharif, A., Aloui, C., & Yarovaya, L. (2020). COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. International Review of Financial Analysis, 70, 101496. https://doi.org/10.1016/j.irfa.2020.101496

Sutrisno, S., Panuntun, B., & Adristi, F. I. (2021). Pandemic impact of COVID-19 on the stock market index and return of stock market index (event study on stock market index in ASEAN exchange). Modus, 33(1), 47–66. https://doi.org/10.24002/modus.v33i1.4068

Tahat, Y., Ahmed, A. (2020). Stock Market Returns and COVID-19 Outbreak: Evidence from the UK. Memo: University of Dundee.

Yang, H., & Deng, P. (2021). The Impact of COVID-19 and Government Intervention on Stock Markets of OECD Countries. Asian Economics Letters, 1(4). https://doi.org/10.46557/001c.18646

Zaremba, A., Aharon, D. Y., Demir, E., et al. (2021). COVID-19, government policy responses, and stock market liquidity around the world: A note. Research in International Business and Finance, 56, 101359. https://doi.org/10.1016/j.ribaf.2020.101359

Zaremba, A., Kizys, R., Aharon, D. Y., et al. (2020). Infected Markets: Novel Coronavirus, Government Interventions, and Stock Return Volatility around the Globe. Finance Research Letters, 35, 101597. https://doi.org/10.1016/j.frl.2020.101597

Zhuo, J., Kumamoto, M. (2020). Stock market reactions to COVID-19 and containment policies: A panel VAR approach. Economics Bulletin, 40(4), 3296–3305.