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ANALYZING THE IMPACT OF GOVERNMENT'S RESPONSES TO THE COVID-19 PANDEMIC ON THE VIETNAMESE STOCK MARKET'S PERFORMANCE: A SECTOR-INDEX APPROACH

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Abstract. This study aims to investigate the impact of the COVID-19 pandemic and how the government's intervention influenced the performance of the Vietnamese stock market, including Ho Chi Minh and Hanoi stock exchanges, at the whole market level and especially at the sector level. Panel data at the sector level is obtained from 31 January 2020 to 23 July 2021 and divided into four different periods corresponding to the COVID-19 waves in Vietnam. GARCH (1,1) is used to predict stock market volatility and the random effect is employed in the panel regression model. The findings show that while stock market returns on the Ho Chi Minh stock exchange did not witness a significant change before and during the pandemic, empirical result indicates that stock market returns on the Hanoi stock exchange significantly changed. Stock market volatilities indicate a significant increase once the pandemic occurs in Vietnam on both stock exchanges. Specifically, the magnitude of the Covid-19 influence weakens over time. More importantly, we find that the intervention of the Vietnamese government significantly lessens the influence of the Covid-19 pandemic on the stock market, especially in the fourth period corresponding to the ongoing wave of COVID 19. The results of this study might offer a useful reference for governors, investors, and other scholars in future public policies and empirical research.

Key words: Covid-19 pandemic, government intervention, stock market performance, Vietnam

1 Introduction

It has been one year since the Covid-19 pandemic occurred in over 170 countries. Due to the uncertainty and widespread of the pandemic, capital markets in many countries have experienced a significant spike in their volatilities. For example, the stock market index in South Korea, one of the leading emerging economies, witnessed a dramatic decrease below 1600 for the first time after a decade[1]. Meanwhile, in Vietnam, the stock market has recorded a plummet in the stock index in 2020, losing 55 points within two months since the first two cases in community were confirmed.

In the middle of the year 2021, the fourth wave of Covid-19 has been swirled through all Asian countries. Responding to the severe consequence of the Covid-19 spread, governments around the globe have implemented emergency actions, in which social distancing has been widely applied. Specifically, the Vietnam government imposed strict policies such as school closures, travel restrictions, and lockdown, somehow resulting in the recovery of the stock market index a positive signal. The Vietnamese stock market was one of the best markets showing impressive performance from April to May 2020 [1]. George Black [2] praised the prompt and effective policies in Vietnam, which are "mass mobilization of the health care system, public employees, and the security forces, combined with an energetic and creative public education campaign". Although the mass vaccination programme has been launched widely, it is still a long way to the end of this pandemic. Therefore, this requires taking a closer look at the Vietnamese stock market during the time of the Covid-19 pandemic.

On top of that, most studies evaluate the impact of the Covid-19 pandemic on economies at either country or firm-specific levels. However, there is scant attention to the sector-level approach in previous studies related to the influence of the Covid-19 outbreak while this approach can help to give a more comprehensive view of the impact of the Covid-19 pandemic. Furthermore, there is scant research on the extent to which government responses interact with both stock market returns and stock market volatilities. Previous studies examine the impact of government's intervention either on the stock return or stock volatility. Lately, Vietnam witnesses a novel coronavirus wave in Ho Chi Minh City and Southern provinces, which necessarily requires huge efforts from governmental authorities in providing appropriate policy responses. Therefore, the research question arises: How does the government's policy responses to the Covid-19 pandemic affect the stock market performance in Vietnam?

Hence, the main objective of this paper is to examine whether the government's responses to Covid-19 outbreak significantly influence the stock market performance in Vietnam in terms of stock returns and volatility. We consider the stock market performance both on the Ho Chi

[1] Source: https://www.statista.com/statistics/1103184/south-korea-coronavirus-impact-on-stock-market/

Minh Stock Exchange (HOSE) and Hanoi Stock Exchange (HNX). Second, since the coronavirus waves in Vietnam occur in separate periods, we aim to explore whether there exist differences in the policy effectiveness of the government on the Vietnamese stock market. To clear this concern, we examine and compare the influence of policy responses in different periods by a sector-level approach.

The contribution of this study is two-fold. First, as far as we are concerned, this is the first study that examines the effect of government policy on the Vietnamese stock market at the sector level during the Covid-19 outbreak in four periods corresponding to four main waves of the pandemic in Vietnam. Second, we also compare the differences between stock market performance in Vietnam pre-Covid-19 and during the pandemic, in terms of stock returns and volatilities.

The rest of the paper is organized as follows. Section 2 is devoted to the literature review. Section 3 explains the data sources and methodologies. The last sections are dedicated to empirical results and key conclusions.

2 Literature review

A variety of studies have been done to examine the effect of the novel coronavirus on stock performance [3–6]. Overall, during the period of Covid-19, multiple countries witness significant economic losses [3]. Concerning the financial markets, the empirical results mainly reach an agreement that the pandemic causes a decline in stock market indices coupled with an increase in volatilities [4, 5]. Al-Awadhi et al [4] figure out the negative effect of daily confirmed cases on various Chinese sectors. While information technology and medicine seem to be the stronger sectors against Covid-19 widespread, other sectors such as beverages, and air transportation exert a sharp decline in stock returns during the Covid-19 pandemic. In the same vein, Ramelli and Wagner [5] emphasize the negative influence of the Covid-19 outbreak on non-financial US's firms and the importance of cash holding as preparation for future pandemic risk. Similarly, He et al. [8] evaluate the impact of Covid-19 on stock markets in Asian, European and American regions. The authors point out that the global pandemic spread negative and short-term effects on these countries.

This notwithstanding, limited studies shed light on how the government's actions during Covid-19 might affect financial stability and different sectors [7–9]. Ashraf [7] asserts that the government's actions might affect the stock market directly and indirectly. Also, Ashraf [7] proposes that the public policies responding to the Covid-19 spread would lessen the negative impact of this pandemic on stock markets. Using a DECO-GARCH model, Bouri et al. [8] examine the impact of three policies, including lockdown, the stimulus package and the travel ban, on 14 New Zealand industries. The empirical results show that only the lockdown policy positively

influences the aggregate stock returns. In the Fever period, social distancing and lockdown rules result in different responses amongst firms, which is also confirmed by Pagano, Wagner, and Zechne [9]. More specifically, Pagano, Wagner, and Zechne [9] measure the resilience of companies during the Covid-19 outbreak. Goodell [10] highlights that the Covid-19 strongly affects banks and other financial sectors, resulting in a sharp increase in non-performing loans combined with massive deposit withdrawals. Curto and Serrasqueiro [11] also emphasize the unequal impact of the Covid-19 on different industries in the US, in terms of stock volatility. Applying the Markov Switching regime AR (1) model, Baek, Mohanty, and Glambosky [12] document an increase in idiosyncratic risks among all US industries and inconsistent variation of system risk between defensive industries and others.

Regarding the case of Vietnam, there are numerous papers examining the impact of Covid-19 on financial markets but little attention is placed on the impact of government responses to Covid-19 on the stock market performance. Also, in Vietnam, there is a lack of quantitative research analyzing the response of stock market to the government's reform during the Covid-19 outbreak. Le et al. [13] carefully examine this issue by a chronology mapping, indicating that until 24th July 2020, the Covid-19 policy responses in Vietnam can control the spread of the outbreak effectively, promptly and proactively by combining a range of policy tools and approaching multiple authority levels. Anh and Gan [14] consider the influence of Covid-19 lockdown on stock returns by a firm-level approach. The empirical shows that the lockdown period, which is one of policy reaction to the Covid-19 outbreak, does positively influence the stock returns of Vietnamese-listed firms. Hence, we also expect a positive impact of policy responses to Covid-19 on the stock market performance in Vietnam. The main hypothesis in this paper is then proposed accordingly, which states that the government's policy responses to Covid-19 lead to a better stock market performance in Vietnam. Also, in this study, we consider the response of Vietnamese government more comprehensively by using an overall index of government's reaction to the Covid-19 pandemic, rather than focusing on a single public policy.

We then propose four hypotheses as follows.

Hypothesis 1: The Covid-19 pandemic cause negative effects on Vietnamese stock markets.

Hypothesis 2: The government's policy responses are likely to increase the stock market returns in Vietnam.

Hypothesis 3: The government's policy responses are likely to decrease the stock market volatilities in Vietnam.

Hypothesis 4: There exist differences in the effectiveness of government's policy responses to Covid-19 among four coronavirus waves in Vietnam.

3 Data and Methodology

3.1 Data Sources

In this paper, we use data of the stock market indices of Ho Chi Minh stock exchange (VN-Index) and Hanoi stock exchange (HNX-Index) to represent the whole stock market of Vietnam. The data of stock market indexes and each sector are retrieved from the website Investing.com and VietstockFinance (finance.vietstock.vn). Stock market return is then measured by the daily change in the stock index. The response of government is obtained from the database of the Oxford COVID-19 Government Response Tracker. Overall government response index [2] is contributed by four main indicators including containment and health index, stringency index, economic support index and risk of openness index. The indices describe the effort of governments in implementing suitable policies during the Covid-19 pandemic but do not imply whether the policies are effective or not. Similar to the study of Anh and Gan [14], we adopt the number of Covid-19 confirmed cases at its lag of 1 to measure the level of the pandemic. We collect the information of confirmed cases from Our World in Data[3] (OWID), which is a scientific project implemented by a research team based at the University of Oxford. All data covers from 30 January 2020 to 23 July 2021, except for data on the Vietnamese stock market index which covers from 21 September 2018 until 23 July 2021.

Furthermore, we also consider control variables representing global market variation such as the US stock return and volatility, oil price, and exchange rate. According to Ashraf [7], national stock market performance is influenced by global factors or events such as oil prices and spill-over effects among countries. Also, Miller and Ratti [15] evidence that stock markets in OCED countries are negatively affected by the crude oil price. Hahn [16] also indicates the strong influence of developed stock markets such as the US on emerging ones, in terms of daily stock indices. Additionally, the volatility spillover effect from to the US to other countries is also documented in previous papers [17, 18]. Data of control variables such as S&P 500, VIX (CBOE Volatility Index), WTI (West Texas Intermediate) Oil price, and Exchange rate USD/VND are collected from the website Investing.com. The positive signal from the global market is expected to improve the stock market performance in Vietnam.

[2] More details are provided at: https://www.bsg.ox.ac.uk/research/research-projects/covid-19-government-response-tracker

[3] http://www.ourworldindata.org/coronavirus

3.2 Methodology

GARCH(1,1) model

In this article, we estimate the daily volatilities by using GARCH(1,1) model proposed by [19]. GARCH is a suitable method for predicting future volatility [20]. According to Bollerslve [21], the GARCH(1,1) specification is enough to capture the characteristics of heteroscedasticity of stock and financial variables. Furthermore, Engle [22] emphasizes GARCH(1,1) as the most robust and simplest model in studying volatilities. Akin to Engle [22], Hansen and Lunde [23] assert that GARCH(1,1) performs better than GARCH models with other numbers of lags.

The GARCH (1,1) model equation 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-run variance rate; u_{n-1}: the rate of the return of the day n-1; σ_{n-1}: the variance of the day n-1; γ, α and β: the weights assigned to V_L, u^2_{n-1} and σ^2_{n-1} respectively and $\gamma + \alpha + \beta = 1$

Setting $\omega = \gamma.V_L$, the GARCH(1,1) model can also be written:

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

For a stable GARCH(1,1) process, the condition is that $\alpha + \beta < 1$. The model is estimated by applying the maximum likelihood method.

Regression method

The event-study method has been widely adopted in previous studies on the Covid-19 pandemic. However, similar to Al-Awadhi et al. [4], the peak of the event is different from the start date, we might consider a more appropriate methodology. Baltagi [24] and Hsiao [25] both emphasize the advantage of panel data regression, which could reduce bias estimates and control for multicollinearity and individual heterogeneity. Additionally, panel data regression is able to detect time-varying relations between variables. Specifically, Bell and Jones [26] argue that "only an RE model can allow these processes to be modelled simultaneously". These authors also point out that "these processes cannot be assessed in the FE model". In studying the impact of Covid-19 on stock markets, Al-Awadhi et al. [4] and Anh and Gan [14] both employ the panel random effect model as the most suitable method for panel data characterized with time-invariant independent variables. We also include the sector fixed-effect dummy variables to control for the factors which are fixed across the period but different across 25 sectors in our sample. The choice of sector fixed-effect dummy variables is to control for the effect of time-invariant of heterogeneities among industries.

Our baseline models are described below.

- At whole-market level:

$$Return_t = \alpha_0 + \beta_1 NewCovidCases_{t-1} + \beta_2 GovernmentResponse_{t-1} + \beta_3 CrossProduct + ControlVariables_{t-1} + \mu_{i,t} \quad (3)$$

$$Volatility_t = \alpha_0 + \beta_1 NewCovidCases_{t-1} + \beta_2 GovernmentResponse_{t-1} + \beta_3 CrossProduct + ControlVariables_{t-1} + \vartheta_{i,t} \quad (4)$$

- At sector-level:

$$Return_{i,t} = \alpha_0 + \beta_1 NewCovidCases_{t-1} + \beta_2 GovernmentResponse_{t-1} + \beta_3 CrossProduct + \sum_{i=1}^{S-1} \beta_i S_i + Control\ Variables_{t-1} + \varepsilon_{i,t} \quad (5)$$

$$Volatility_{i,t} = \alpha_0 + \beta_1 NewCovidCases_{t-1} + \beta_2 GovernmentResponse_{t-1} + \beta_3 CrossProduct + \sum_{i=1}^{S-1} \beta_i S_i + Control\ Variables_{t-1} + \epsilon_{i,t} \quad (6)$$

Where: $Return_t$ is either the stock market returns either in Ho Chi Minh Stock Exchange or Hanoi Stock Exchange (Model (3)) and sector index returns (Model (5)) on day t.

$Volatility_t$ is either the stock market volatitlity either in Ho Chi Minh Stock Exchange or Hanoi Stock Exchange (Model (4)) and sector index volatility (Model (6)) on day t.

New Covid Cases$_{t-1}$ denotes the Covid-19 confirmed cases on day *t–1*.

Government Response$_{t-1}$ indicate the action of government in time of the Covid-19 pandemic on day *t–1*.

Cross Product is the multiplication of government intervention and new Covid-19 confirmed cases at their lags of 1.

S_i represents sector dummy variables.

ControlVariables$_{t-1}$ comprise a set of variables representing fluctuations from international market, such as S&P500 daily returns, daily changes in VIX, WTI oil price and exchange rate. Specifically, in model (3) and model (5), the control variables include the lag variables of S&P500 daily returns, WTI oil price and exchange rate. In model (4) and model (6), instead of using S&P 500, we include daily changes in VIX, other variables are the same.

Similar to previous studies, we employ the new covid cases, government intervention and other international factors by their lags of 1. According to the empirical result from Goodell [10], the financial sector was strongly hit by the Covid-19 pandemic as the non-performing loans have significantly increased. Schoenfeld [27] also points out the worst affected sectors due to the Covid-19 outbreak, including automobile, transport, etc. Anh and Gan [14] also confirm that the

Table 1. Covid-19 waves in Vietnam

Period	Time	Peak	Time periods in this study
1	23 January–16 April 2020	30 March 2020	31 January–16 April 2020
2	25 July–1 December 2020	31 July 2020	25 July–1 December 2020
3	28 January–25 March 2021	31 January 2021	28 January–25 March 2021
4	27 April 2021–ongoing	Unknown	27 April 2021– 23 July 2021

financial sector in Vietnam was most influenced by the widespread outbreak of Covid-19. Different from previous work, to approach the research problem more comprehensively, we include 25 different sectors in Vietnam, which are classified by Vietstock Company. This classification standard is constructed based on NAICS 2007 (The North American Industry Classification System).

To address the research concerns, we conduct the three following tasks:

First, we *c*ompare the differences in stock market performance on both stock exchanges: Ho Chi Minh Stock Exchange (HOSE) and Hanoi Stock Exchange (HNX) before and during the Covid-19 pandemic, in terms of stock returns and stock volatilities.

Second, we analyze the impact of Covid-19 and Vietnamese government's policy responses to the pandemic on two stock exchanges during the whole period.

Third, we analyze the impact of Covid-19 and Vietnamese government's policy responses to the pandemic on the stock market performance by a sector-index approach, in four different periods of Covid-19 waves in Vietnam. We use the random effect model for the panel data for four different periods according to the main coronavirus waves in Vietnam, provided by Wikipedia[4]. Based on the timeline of the Covid-19 in Vietnam and the availability of data, four periods in our study are split as follows.

4 Empirical Results

4.1 Descriptive statistics

During the observed period, the maximum Covid-19 confirmed cases are 7,125, which is lately registered in Ho Chi Minh City. The average returns of stock market in Ho Chi Minh and Hanoi Stock Exchanges are positive numbers. Specifically, the highest return of the stock market at sector level is recorded to other financial sectors, at 8.1%. The overall government response

[4] More details are available at: https://en.wikipedia.org/wiki/COVID-19_pandemic_in_Vietnam

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
I. For the whole stock market					
Ho Chi Minh Stock Exchange					
Return (%)	374	0.065955	1.536447	-6.90762	4.860016
Volatility (%)	374	1.386171	0.557274	0.743928	3.0548
Hanoi Stock Exchange					
Return (%)	374	0.279034	1.700042	-8.37598	5.391659
Volatility (%)	374	1.614711	0.660681	0.732811	4.483064
II. For the specific sectors (25 sectors)					
Stock Return (%)	9,350	0.093968	1.863438	-8.23056	8.447282
Stock Volatility (%)	9,350	1.699821	0.670747	0.593621	5.081133
III. Covid-19 pandemic and Government response					
	Obs	**Mean**	**Std. Dev.**	**Min**	**Max**
Government response (lag of 1, Index, ranges from 0-100 points)	374	56.75021	10.62846	15.1	77.08
New confirmed case (lag of 1)	374	157.877	721.7035	0	7125
IV. Control variables					
	Obs	**Mean**	**Std. Dev.**	**Min**	**Max**
SP500 (%, lag of 1)	374	0.104412	1.848918	-11.98	9.38
Oil price change (%, lag of 1)	374	-0.88329	17.77864	-305.97	37.66
Exchange rate change (%, lag of 1)	374	-0.00171	0.079568	-0.49	0.51
VIX (%)	374	1.675029	0.6855212	0.861759	5.20898

Source: Author's computation

index has the highest point of 77.08 on 9 April 2020, which was in the middle of lockdown in Vietnam. Also, the government response index ranges from 15.1 to 77.08 points, meaning that the Vietnamese government has significantly changed the policy responses during Covid-19 outbreak. The average number of new Covid-19 confirmed cases is roughly 158 cases per day, which strongly increased during the fourth period. Moreover, the correlation matrix does not indicate strong correlations among variables. We then examine if there exists a difference in stock market performance between the pre-Covid period (27 July 2018 to 22 January 2020) and during the Covid-19 pandemic (30 January 2020 to 23 July 2021) on the two Stock Exchanges in Vietnam, in terms of stock market returns and stock market volatilities. The t-test is then adopted to determine if there is a significant difference in the means of two samples, before and during the pandemic. Concerning the t-test for the stock returns in Table 3, we do not find evidence of differences between the two periods on HOSE. However, there is a significant difference in the stock indices between pre-Covid-19 and during Covid-19 period on HNX. Concerning the stock market volatilities, the results from table 4 clearly indicate that there exist significant increases in the stock market volatilities between pre-Covid-19 period and during the Covid-19 time on both

Table 3. T-test results for stock market returns in the two stock exchanges

Variable	Obs	Mean	Std. Err.	Std. Dev.
Ho Chi Minh Stock Exchange				
Return during pre-Covid-19 period	375	.0163873	.0413196	.8001507
Return during Covid-19 period	375	.0671517	.0792447	1.534567
combined	750	.0417695	.0446649	1.223198
Ha: diff < 0	*Ha: diff ≠ 0*		*Ha: diff > 0*	
Pr(T < t) = 0.2851	Pr(T > t) = 0.5702		Pr(T > t) = 0.7149	
Hanoi Stock Exchange				
Return during pre-Covid-19 period	375	.0051252	.0419266	.0875665
Return during Covid-19 period	375	.2800271	.087678	1.697877
combined	750	.1425761	.0488199	1.336989
Ha: diff < 0	*Ha: diff ≠ 0*		*Ha: diff > 0*	
Pr(T < t) = 0.0024	Pr(T > t) = 0.0049		Pr(T > t) = 0.9976	

Table 4. T-test results for stock market volatilities in the two stock exchanges

Variable	Obs	Mean	Std. Err.	Std. Dev.
Ho Chi Minh Stock Exchange				
Volatility during pre-Covid-19 period	374	.9400557	.0104772	.2026195
Volatility during Covid-19 period	374	1.386171	.028816	.5572744
combined	748	1.163113	.0173587	.4747533
Ha: diff < 0	*Ha: diff ≠ 0*		*Ha: diff > 0*	
Pr(T < t) = 0.0000	Pr(T > t) = 0.0000		Pr(T > t) = 1.0000	
Hanoi Stock Exchange				
Volatility during pre-Covid-19 period	374	.9246898	.0157575	.304736
Volatility during Covid-19 period	374	1.614711	.034163	.6606814
combined	748	1.269701	.0226435	.6192894
Ha: diff < 0	*Ha: diff ≠ 0*		*Ha: diff > 0*	
Pr(T < t) = 0.0000	Pr(T > t) = 0.0000		Pr(T > t) = 1.0000	

Source: Author's computation

stock exchange markets. This means the widespread of the Covid-19 essentially leads to a more volatile stock market in Vietnam.

4.2 Stationary tests

This diagnostic test aims to check whether a time series variable is non-stationary and possesses a unit root. We employ the Fisher-type tests developed by Choi [28], in which the null hypothesis proposes that all the panels contain the unit root. Regarding the Stock Returns, Volatility and New Covid-19 confirmed cases and the control variables, the unit root tests indicate that these variables are stationary at level for the whole-time span and in each of the four periods. Government Response contains a unit root at level. However, according to Kao [29],

non-stationary variables might result in biased standard errors, however, the estimates are still consistent. Kao [29] asserts that in the case of panel data, the structural parameter of two independent nonstationary variables is close to zero. Additionally, regarding the modelling panel data analysis, Park [30] did not stress the test of unit roots or cointegration under the assumptions of fixed-effect or random-effect models. Similar to the study of Coulibaly [31], we employ the Government Response Index at the level and then use its lag of 1 as it might take time for policies to be effective.

4.3 Panel estimation

At the whole stock market level

Table 5 shows that in general, the coefficient for newly confirmed Covid-19 cases variable is negative for both stock markets. However, these coefficients are insignificant, which means that in general, the Covid-19 cases do not seem to affect the Vietnamese stock market during the whole period. This can be explained by the resilience of the stock market during the observed period, which witnessed a sharp fall in 2020 and then a gradual recovery by the beginning of 2021.

Concerning the government response, the positive coefficients indicate the effective effort of the Vietnamese government in lessening the adverse effects of Covid-19 pandemic on the stock markets, resulting in an increase in stock returns on both stock exchange markets. This empirical result supports the first hypothesis and confirms the findings of Ashraf [7]. However, these policy responses such as school closure and social distancing seem to positively influence the stock market volatilities, which has been shown in models (4) and (6). This might be due to the anxiety among investors about the severity of the pandemic when the government implements strict policies such as lockdown, school closures, and limited transportation. Furthermore, we find the evidence of positive effects of S&P 500 return on Vietnamese stock market. Also, the more volatile the US stock market is, the more variation in the Vietnam stock prices witnesses. This supports previous studies regarding the volatility spill-over effects between stock markets, indicating that our stock markets are strongly affected by the developed ones. While the lag 1 of WTI oil price increases the stock returns, it seems to negatively affect the stock volatilities with a limited effect. This might be explained that the WTI oil price increase takes time to negatively affect the national stock market.

Table 5. Regression results for the whole market

	Model (3)	
Dependent variable	**Stock market returns on HOSE**	**Stock market returns on HNX**
Newcases(t-1)	-0.0264	-0.0261
	(0.0305)	(0.0201)
Gov_response(t-1)	0.0278***	0.0167**
	(0.00761)	(0.00841)
Cross product	0.000401	0.000395
	(0.000467)	(0.000307)
SP500 (t-1)	0.186***	0.101*
	(0.0615)	(0.0560)
Oil price change (t-1)	0.0111***	0.0126***
	(0.00244)	(0.00473)
Exchange rate change (t-1)	-1.256	-1.018
	(1.013)	(1.052)
Constant	-1.470***	-0.619
	(0.444)	(0.487)
Observations	374	374
R-squared	0.137	0.058
	Model (4)	
Dependent variable	**Stock market volatilities on HOSE**	**Stock market volatilities on HNX**
Newcases(t-1)	-0.00180	-0.00937
	(0.00474)	(0.00602)
Gov_response(t-1)	0.00805***	0.00781***
	(0.00244)	(0.00267)
Cross product	3.01e-05	0.000147
	(7.24e-05)	(9.20e-05)
VIX (t-1)	0.475***	0.373***
	(0.0349)	(0.0371)
Oil price change (t-1)	0.000965**	0.00114
	(0.000385)	(0.000833)
Exchange rate change (t-1)	-0.114	-0.492
	(0.376)	(0.407)
Constant	0.110	0.519***
	(0.155)	(0.153)
Observations	374	374
R-squared	0.351	0.191

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

At sector-index level

The empirical results in Table 6 show that confirmed cases and the stock market returns are negatively associated in the first and fourth periods. Also, the size of influence is lessening over time. This can be partly explained that in later periods, investors might get acquainted with the information from Covid-19 and be more proactive in making their own decision. As time goes by, the stock market reacts to the intervention of the Vietnamese government with positive returns, partly reflecting an increase in trust and confidence of investors. This result is akin to Ashraf [7] as the government's policies during the time of the pandemic can improve the returns of the stock market. Therefore, lately, the stock market in Vietnam continues to reach a new milestone of the index, as of 1400. Although Vietnam is recognized as one of the most successful countries in containing the widespread of the virus, in the last of April 2021, the health crisis comes back, recorded at 2910 cases in total and 35 deaths[5]. This might surprise the investors and shake their trust and confidence. Hence, the growth of confirmed cases still leads to a decrease in stock market returns, but with a lower degree in comparison with the previous ones. Similar to the earlier periods, the intervention of the government helps to lessen the impact of Covid-19 on the stock market, indicated by a positive coefficient of the government action indexed with Covid-19 cases. Notably, the magnitude of government intervention's coefficient is largest in the fourth period. One possible reason is that the latest period has witnessed the strongest coronavirus wave ever, which then urges the government to react quickly and forcefully. Moreover, the effect of the US stock market was strongest in the third period and positively influence the Vietnamese stock market in the first three periods. Additionally, while the oil price positively influences the stock return in the first and third periods, it decreases the stock return in the last period. This suits the argument that it takes time for the oil price to affect the stock market negatively. Furthermore, the Vietnamese stock market reacts to changes in exchange rate with a positive return.

Concerning stock volatilities, the daily increase in Covid-19 confirmed cases leads to a less volatile market, especially in the fourth period. Additionally, over the four periods, the effort of the Vietnamese government seems to be most effective in the last one, resulting in a less volatile stock market. Also, by a sector-index approach, we find that the increase in the US stock volatility leads to a more volatile stock market in Vietnam, except in the fourth period. This confirms the previous result of examining the stock market as a whole.

Simply put, we come to two important findings from the regression of panel data at the sector level. First, the outbreak of Covid-19 negatively affected the stock market performance in Vietnam. Second, the intervention of the Vietnamese government significantly weakens the negative impact of the Covid-19 pandemic on the stock market, leading to a positive stock market performance during the time of Covid-19, in terms of stock returns. These results support

[5] Source: https://thediplomat.com/2021/05/covid-19-stages-another-comeback-in-vietnam/

Table 6. Regression results for panel data at sector-index level

VARIABLES	1st period	2nd period	3rd period	4th period
Model (5) - Dependent variables: Stock returns				
Newcases (t-1)	-0.351***	-0.0152	0.115	-0.0133**
	(0.0383)	(0.0266)	(0.0713)	(0.00558)
Gov_response (t-1)	0.0319***	0.0253***	0.0223	0.0757***
	(0.00362)	(0.00426)	(0.0319)	(0.0153)
Cross product	0.00409***	0.000227	-0.00139	0.000202**
	(0.000703)	(0.000386)	(0.00114)	(8.52e-05)
SP500(t-1)	0.0746***	0.172***	0.417***	-0.243***
	(0.0123)	(0.0158)	(0.0510)	(0.0672)
Oil price change (t-1)	0.0500***	-0.00699	0.0626**	-0.0788***
	(0.00753)	(0.00893)	(0.0254)	(0.0258)
Exchange rate change (t-1)	0.178	3.693**	2.925***	2.586***
	(0.299)	(1.616)	(0.873)	(0.865)
Constant	-1.038***	-1.223***	-1.509	-4.720***
	(0.130)	(0.236)	(1.931)	(0.992)
Sector fixed-effect dummies	Yes	Yes	Yes	Yes
Observations	1,325	2,250	850	1,600
Number of SectorCode	25	25	25	25
Model (6) - Dependent variables: Stock volatilities				
Newcases (t-1)	-0.0218***	-0.0423***	0.150***	-0.00533***
	(0.00551)	(0.00621)	(0.0120)	(0.00124)
Gov_response (t-1)	0.00579***	0.00735***	0.139***	-0.00847**
	(0.00181)	(0.00216)	(0.0122)	(0.00329)
Cross product	0.000627***	0.000922***	-0.00219***	8.31e-05***
	(0.000113)	(0.000114)	(0.000175)	(1.89e-05)
VIX (t-1)	0.212***	0.0896	0.467***	-0.242***
	(0.0344)	(0.0698)	(0.0521)	(0.0888)
Oil price change (t-1)	0.00234***	0.00293**	0.0264***	-0.0140***
	(0.000741)	(0.00121)	(0.00354)	(0.00232)
Exchange rate change (t-1)	0.0837***	-0.305***	0.321***	0.000183
	(0.0324)	(0.118)	(0.0864)	(0.152)
Constant	1.204***	0.811***	-7.250***	2.437***
	(0.113)	(0.150)	(0.749)	(0.192)
Sector fixed-effect dummies	Yes	Yes	Yes	Yes
Observations	1,325	2,250	850	1,600
Number of SectorCode	25	25	25	25

Robust standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

previous studies of Anh and Gan [14] and Ashraf [7].

In sum, the empirical results do not completely support hypothesis 1. We do not find significant impacts of the Covid-19 pandemic on the stock market performance at the whole market level for the whole Covid-19 period. As explained previously, this might be due to the substantial recovery of the stock market from early 2021, which might offset the crash in the previous period. However, when examining the stock markets in different periods and at sector level, we find that the Covid-19 pandemic effect negatively on stock returns during the 1st and the 4th waves. This can be explained by the increasing fear of investors once an unprecedented shock occurs. Especially, the 4th wave of the coronavirus is conceived as one of the most severe spreads since the beginning of 2020, which might strongly affect investors' sentiment than before. In terms of volatility, we only find the negative impact during the 3rd wave of Covid-19. Hypothesis 2 is supported, meaning that the two stock exchanges react to government's policy responses to Covid-19 with positive returns. This somehow demonstrates the effectiveness of governmental policies in lessening the severe impact of the pandemic on the stock markets. However, we do not find evidence supporting hypothesis 3 on both stock exchanges. The analysis at sector-index level does confirm hypothesis 4, indicating that government's intervention affects the stock market differently in four periods. Remarkably, the effort of the government is likely to be strongest in the fourth period, resulting in a better improvement in stock return compared to the previous time and lower stock volatility.

5 Conclusion and policy implications

By using panel data at sector level, we aim to figure out how the government's intervention affects the stock market in Vietnam lately, especially when Vietnam has witnessed the strongest Covid-19 wave ever. We also look at the differences between the stock market returns and volatilities in two periods including the periods before and during the pandemic, both on HOSE and HNX. While the stock market returns do not show a significant change, the stock market in Vietnam is more volatile once the pandemic started in our country.

The main finding of this study is the positive influence of governmental policies during the Covid-19 pandemic on the stock market in Vietnam. While the increase in the new confirmed cases decreases the stock return during the time of Covid-19 outbreak, the response of the Vietnamese government desperately results in a better performance of stock market, in terms of stock return during four periods and stock volatility in the fourth period. We can conclude that the Vietnamese government has actually made a significant in order to recover the stock market during the time of the Covid-19 pandemic, especially in the ongoing period when the Covid-19 pandemic in Vietnam shows no signs of abating and more lockdowns looms.

One limitation of the study is the lack of control variables that represent specific macroeconomic conditions of each country such as GDP growth and interest rates. In addition, we could not separate the impact of each government's policy during the time of COVID-19

outbreak on the stock market performance. Given the limitation of data availability, we then could not indicate which specific policy has the strongest impact on the stock market during the Covid-19 pandemic. To have a more in-depth understanding of how government policies to manage the pandemic influence the stock market performance, this study might be developed by separating and comparing the impact of each policy. Moreover, further studies might focus on indicating the different impacts of the government's policies on different sectors, which has not been addressed in this study.

Furthermore, the empirical results from this paper might serve as a useful reference for academics, governors and investors in future uncertainties. It can be seen that the combination of travel bans, lockdowns and stimulus packages help reduce the severe impact of the Covid-19 pandemic on the Vietnamese stock market. However, the empirical findings signal a possible overreaction of investors during the turbulent period, resulting in higher stock volatility. This might be explained by the increase of fear sentiment that exacerbates such risk. In brief, these empirical results from this study support that the intervention of the government in Vietnam is necessary to recover the economic development in general and improve the stock market performance in particular. On top of that, the intervention of the government to hold investors' trust and confidence is truly needed. We also find the evidence of the significant impact of global factors on the Vietnamese stock market. This implies that government should also take into account international events and factors when proposing policy responses to the Covid-19 outbreak.

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