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Stock market returns and liquidity during the COVID-19 outbreak: evidence from the financial services sector in Vietnam

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Abstract

Purpose – This paper aims to explore the influence of the COVID-19 outbreak and the Government's disease control measures on the stock returns and liquidity of Vietnam-listed companies in the financial services sector.
Design/methodology/approach – The authors have conducted a panel data regression analysis using data from 50 banking, insurance and finance companies listed in Vietnam's two biggest stock exchanges (HNX and HOSE) within the period from January 30th, 2020 to May 15th, 2021.
Findings – The regression results indicate that the daily growth in the total number of confirmed cases caused by COVID-19 has significant negative effects on the stock market returns and liquidity. Nevertheless, the Government's imposition of lockdown yields significant and positive outcomes on stock performance. In addition, the study reveals remarkable differences in returns of large-cap and small-cap stocks under the impact of the COVID-19 pandemic.
Research limitations/implications – The study indicates government and regulators should act more actively to limit the outbreak of the virus, improve investor confidence as well to support the financial services industry and deal with the outbreak of the pandemic later.
Originality/value – This is the first study to explore the influence of the COVID-19 outbreak and the Government's disease control measures on the stock returns and liquidity of Vietnam-listed companies in the financial services industry.

Keywords COVID-19, Daily stock returns, Liquidity, Financial services industry, Vietnam
Paper type Research paper

1. Introduction

Since early 2020, the COVID-19 pandemic has become a "hot topic" evoking great interest across boundaries. The illness onset was on December 31st, 2019 with dozens of mysterious pneumonia cases emerged in Wuhan City, Hubei Province, China (Sohrabi *et al.*, 2020). In less than 3 months, the outbreak has spanned rapidly to every corner of the globe. Millions

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of infections and deaths attributed to the COVID-19 have been reported in more than 200 countries wherein Vietnam's first confirmed case was on January 23rd, 2020. On March 11th, 2020, the World Health Organization has declared the COVID-19 "a global pandemic" (WHO, 2020). The COVID-19 pandemic has tremendously affected the socioeconomy of almost all nations in the world, and the scenario looks even more complicated and unpredictable that may push many governments to the threat of so-called dual economic and public health crisis. Regarding economic aspect, the stock market is one of the most vulnerable sectors.

The impact of the worldwide COVID-19 pandemic on the stock market seemingly remains inconclusive in the least near future. Such inconclusiveness creates ground for an in-depth investigation of the stock market's liquidity and profitability in response to the pandemic outbreak and the disease control policies imposed by the Government.

Although extensive studies have been carried out to address the interest in this research area (Al-Awadhi *et al.*, 2020; Alfaro *et al.*, 2020; Baig *et al.*, 2021; Eleftheriou and Patsoulis, 2020; He *et al.*, 2020; Liu *et al.*, 2020; Mdaghri *et al.*, 2021; Zhang *et al.*, 2020), most of them are limited to such countries as the USA, China, France, Germany, Italy, Japan, Korea and Spain, and not concentrated in any one industry, for instance, banking and finance.

Banking and finance sector plays a vital role in the stock market of most nations including Vietnam. Research by the World Bank (2019) has claimed a strong tie between GDP per capita growth and credit growth in Vietnam. By the end of 2019, the market capitalization of the financial services sector was 29.08%, which accounted for the highest share of the total stock market. Therefore, a study on the influence of the COVID-19 pandemic on the stock profitability and liquidity of listed companies in this sector is undoubtedly crucial to the development of Vietnam's stock market.

In Vietnam particularly, there is a study by Anh and Gan (2021) investigating the effects of the COVID-19 outbreak and its following lockdown on daily stock returns of companies listed in Vietnam's stock exchanges over the period from January 30th, 2020 to May 30th, 2020. The study, however, is carried out when there was no death related to the coronavirus yet reported in Vietnam. Also, the researchers focus on stock returns associated with five industries (finance, consumer goods, industrial goods, energy and utilities). Another more recent study by Phuong (2021) evaluates the impact of the COVID-19 on the performance of Vietnam's banking industry during the three nationwide lockdowns imposed in 2020. Yet, its emphasis is solely on the stock returns of banking firms.

Unlike the two aforementioned studies, our research intends to establish the provable link concerning the stock returns and liquidity of Vietnamese-listed banking, finance and insurance companies in response to the COVID-19 outbreak and the stringent imposition of nationwide lockdown. Simultaneously, the research assesses the influence of the COVID-19 surges on the profitability and liquidity of large-cap and small-cap companies. We extend the period of observations from January 30th, 2020 to May 15th, 2021.

The rest of this paper is organized as follows: The next section provides the background and overview. Section 3 presents the data and research methodology. Section 4 presents the empirical tests and further analysis. Section 5 presents conclusions and implications.

2. Background and overview

2.1 The Black Swan theory and COVID-19 pandemic

The Black Swan theory was developed by Nassim Nicholas Taleb, the Lebanese-American scholar, who made the concept famous in his 2007 book "The Black Swan: The Impact of the Highly Improbable" (Taleb, 2007). He describes a Black Swan event to have the following three distinguishing characteristics: (1) It must be unexpected. This is an *a priori* unlikely event, where there is no evidence that it will happen, and therefore it is a surprise to analysts and the market. (2) They have an outsized impact. These are events that significantly affect

the economy or world politics. (3) Events and their causality that we tend to explain after the event. In other words, once they have happened, and only then, there is evidence that such an event could have been avoided, and theories are created that explain why it came to be. The COVID-19 pandemic currently affecting the world has all the characteristics that define a black swan case. This event appeared to be a Black Swan event (Mishra, 2020).

According to the black swan theory, the consequences of Black Swan event is one of the risks that has to be faced when operating in the stocks markets. Therefore, although these are events with a low probability of occurring, it would be a serious mistake to ignore them. This implies that investors need to have a diversified and structured portfolio with different asset types so that they can act as counterweights in the event of having to respond to varying economic or financial circumstances. In other words, black swans, whose occurrence, as the world has become more complex and globalised, is more common and to which investors are beginning to become accustomed.

2.2 An overview of COVID-19 pandemic in Vietnam

According to the report of the Ministry of Health of Vietnam available on its official website (https://ncov.vncdc.gov.vn/), the timeline of the COVID-19 pandemic from January 23rd, 2020 to May 15th, 2021 has unfolded as follows:

2.2.1 The first 16 confirmed cases. On January 23rd, 2020, Vietnam announced the first two confirmed cases admitted to Cho Ray Hospital who were a Chinese man and his son from Wuhan, China. On February 1st, 2020, a 25-year-old woman who worked as a receptionist at a hotel in Khanh Hoa Province where the two Chinese men had stayed was tested positive for the virus. It was considered the first locally transmitted case in Vietnam. Since then, the local transmission began to develop with a cluster of cases detected in several Northern provinces. On February 12th, 2020, the local authorities imposed quarantine and self-isolation restrictions on the whole Son Loi Commune, Binh Xuyen District, Vinh Phuc Province to limit the spread of the disease.

2.2.2 A fleet of cases imported from abroad. On March 6th, 2020, Hanoi announced the first case of the city, also known as the 17th confirmed patient in Vietnam. On March 10th, 2020, Binh Thuan Province reported a "super infectious case" named the 34th COVID-19 patient. This patient returned to Vietnam from the USA via Tan Son Nhat International Airport, then visited Phan Thiet where she was in close proximity with a number of people. Soon after she was tested positive for the virus, as many as 11 people were found to get infected from her, making her the greatest source of contagion at the time. On March 17th, 2020, the Government suspended the issuance of visas for foreigners entering Vietnam.

2.2.3 A threat of community transmission. On March 20th, 2020, the Ministry of Health announced the 86th and 87th COVID-19 patients who were two female nurses working at the Tropical Diseases Center of Bach Mai Hospital (Hanoi). As of March 21st, 2020, Vietnam declared a temporary suspension of entry for all foreigners. As of April 1st, 2020, a nationwide lockdown for 15 days was effective as a drastic epidemic control measure. On April 15th, 2020, the lockdown was announced to be extended in Hanoi, Ho Chi Minh City and some high-risk provinces. As of April 23rd, 2020, the restrictions on nationwide lockdown were lifted while other prevention and control measures remained in effect. On April 25th, 2020, Prime Minister Nguyen Xuan Phuc issued Directive 19 to maintain pandemic prevention and control measures in the New Normal state.

2.2.4 A rediscovery of community-acquired infections. On July 25th, 2020, the Ministry of Health announced the 416th confirmed case in Da Nang City, which was the first case with untraceable source of infection. A ban on entry into and exit from Hospital C was immediately imposed. On July 26th, 2020, the 418th COVID-19 patient was reported, followed by the blockage of Da Nang Hospital. On July 27th, 2020, 11 infected cases were furthermore

recorded. In response to this surge, the authority of Da Nang enacted lockdown and social distancing restrictions on the entire city by July 28th, 2020. Still, the first death attributed to the COVID-19 in Vietnam was reported on July 31st, 2020.

2.2.5 Long-term pandemic control alongside socioeconomic development practices. As of September 7th, 2020, Vietnam witnessed some positive signals in containing the epidemic. The situation began to be largely under control as almost all economic activities, including transportation services by plane, train or coach from and to Da Nang, resumed. Da Nang authorities decided to ease the social distancing restrictions from September 11th, 2020. Following that, Vietnam officially has resumed international commercial flights effective September 15th, 2020 until further notice. On September 24th, 2020, Prime Minister Nguyen Xuan Phuc issued Telegram No.1300/CĐ-TTg requesting heads of units under the Ministry of Health as well as of local authorities to strictly follow the directive on strengthening the prevention and control measures of the COVID-19. It is to maintain Vietnam's notable achievements in battling the COVID-19, which will help facilitate the recovery and development of the whole socioeconomy.

2.2.6 Continued restrictions on social distancing in the COVID-19 epicenter. On January 1st, 2021, a new, highly infectious variant of the COVID-19 originated from the United Kingdom was discovered in a Vietnamese 45-year-old female patient. By the noon of January 28th, 2021, Hai Duong Province implemented social distancing after 75 community transmission cases being recorded within the day, leading to an end of 55 coronavirus-free days in Vietnam. On April 27th, 2021, a hotel receptionist was diagnosed with the virus as being in close contact with some experts from India, named as 2857th patient. Since then, Vietnam has experienced a rapid-spreading outbreak both in quarantine camps and in the community. With this stance, the Government of Vietnam has tightened the COVID-19 restrictions to curb a new wave of infections. In the afternoon of May 15th, 2021, the Ministry of Health announced the 36th COVID-19-related death, also known as the 3839th confirmed patient in Bac Ninh Province. This event has remarked the most severe outbreak since the onset of the COVID-19 epidemic in Vietnam so far.

2.3 Impact of the COVID-19 outbreak on stock returns and market liquidity

Extensive past studies have established the potential impact of pandemics on the stock market. For instance, Chen *et al.* (2007, 2009) investigate the effect of the SARS outbreak on the performance of Taiwan's stock market. The findings reveal that SARS has a significant and negative impact on the stock returns of businesses in hospitability and tourism as well as retail and wholesale sectors. In contrast, a positive relationship is found between the epidemic and the returns on biotech stocks. Similar findings are concurred in research by Jiang *et al.* (2017), which reports an unfavorable nexus between the H7N9 outbreak and China stock indices. Likewise, Ichev and Marinč (2018) assess the extent to which the Ebola epidemic surging in 2014–2016 influenced US stock prices at the time. They claim that such disease yields the most significant effect on American companies that have businesses in West Africa and the USA; also, stock returns of small-sized companies are seemingly more sensitive and vulnerable to the epidemic as compared to those of the bigger ones.

Since the outbreak of the COVID-19 spanning on a global scale, its negative impact on stock returns has prevailed in a bulk of studies. Al-Awadhi *et al.* (2020) claim that the increase in daily inbound confirmed cases and deaths in China tremendously affects the returns of all stock types in the capital market. This conclusion is supported by a research of Ashraf (2020), using data observations from 64 stock markets over the globe. In addition, findings from study by Zhang *et al.* (2020) on the link between the COVID-19 pandemic and market risk in 12 countries reveal a considerable increase in the risk level of the global financial market in consequence of the disease. The uncertainties in the pandemic outlook and its related economic losses also worsen the market volatility. He *et al.* (2020) evaluate the market

performance of eight nations and explore that besides unfavorable influence on stock returns, there exists a spillover effect among Asian, European and American countries. Liu *et al.* (2020) explore the short-term impact of the COVID-19 outbreak on the top 21 stock markets in pandemic-most-affected countries. When using the case-study method, it has witnessed a rapid and significant decrease in the profitability of these stock markets due to the outbreak. Goodell (2020) argues that the financial services sector, including banks and other financial institutions, is heavily affected by the COVID-19 due to increasing bad debts resulting from deteriorating incomes and escalating deposit withdrawals. Mdaghri *et al.* (2021) investigate how the COVID-19 impacts the liquidity of stock markets in the Middle East and North Africa (MENA) countries, taking into account the market depth and tightness. The study shows that the increasing number of confirmed cases and deaths positively impact the market liquidity, although there exist differences in liquidity dynamics between small-caps and large-caps. Nevertheless, the results on industry-level and country-level conclude a negative and significant relation between the COVID-19 epidemic and the stock market liquidity.

Although the impact of the COVID-19 outbreak focusing on the Vietnam market is still sparsely investigated, some researchers have shown their interest in the topic. Anh and Gan (2021) deployed panel regression analysis to examine the influence of the COVID-19 before and after the imposition of pandemic restrictions on the stock returns of listed companies on Vietnam's stock exchanges. Their findings confirm a negative nexus between the increase in the daily number of confirmed cases and the stock returns, in which the worst-affected sector is banking and finance. Notwithstanding such negative impact, the research indicates that the stock market as well as other businesses have experienced a noticeable upward trend after the Government enacted epidemic control programs. Phuong (2021) utilizes the case-study method to examine the influence of the COVID-19 on the Vietnam banking sector in particular and explores that Vietnamese investors have different reactions during the three waves of the COVID-19, reflecting on the stock prices of listed banks on the exchanges in 2020.

2.4 The impact of the COVID-19 lockdown on stock returns and market liquidity

In response to the COVID-19 outbreak, authorities worldwide have conducted a broad range of pandemic prevention and control measures to ensure public health, including but not limited to travel restrictions, declaration of national health emergency, provincial and national curfews, social distancing, cancelation of public events, temporary closures of educational institutions as well as nonessential businesses, self-raising awareness of disease prevention (wearing face masks, hand washing, etc.) and digital transformation in business and education operation from offline to virtual. According to Van Hoof (2020), the COVID-19 pandemic is an unprecedented event that forces one-third of the world's population to these experiences.

To date, there exists a considerable amount of studies on the impact of the COVID-19 lockdown on stock returns and market liquidity. A study by Eleftheriou and Patsoulis (2020) sampling the stock market indices of 45 countries is an instance wherein its findings suggest a significantly negative relation between the pandemic restriction policies and the global stock market performance. It is congruent with research by Baig *et al.* (2021), which finds that the COVID-19-related lockdown reduces the stability and liquidity of the US stock market. Anh and Gan (2021), however, draw an opposite conclusion when examining the performance of the Vietnam stock market. They argue that the epidemic preventive measures, including lockdown, create a significant positive effect on the stock returns of all businesses.

All in all, extensive research on the COVID-19 outbreak and its following lockdown influencing the global stock market returns and liquidity has been widely carried out. Yet, at least to the extent of our knowledge, there is a dearth of such studies in Vietnam, particularly in the banking, finance and insurance industry. Therefore, this study intends to extend the past findings concerning the response of Vietnamese banks and other financial institutions to

the COVID-19 outbreak. The paper would provide substantial empirical knowledge to academic researchers, the Government, local authorities and investors in forecasting stock returns and liquidity of banking, finance and insurance companies in dealing with future pandemics.

3. Data and methodology

3.1 Data

This study focuses on investigating the influence of the COVID-19 outbreak and the epidemic-related restrictions on the stock returns and liquidity of 50 banking, finance and insurance companies listed in Vietnam's stock exchanges (HOSE and HNX). Daily stock data, including share prices, market capitalization and market-to-book ratio are obtained from Vietnam Stock's website (https://vietstock.vn/). The period of data sampling starts from January 30th, 2020, which is the first trading day after Lunar New Year and also a remarked day of the first Vietnamese national confirmed case. The final data collection date is May 15th, 2021, which is the 15th day after a four-day holiday for Reunification Day and International Workers' Day. Data of daily confirmed cases and deaths in Vietnam are collected from the official website of the Ministry of Health (https://ncov.vncdc.gov.vn/).

Figures 1 and 2 show aggregate daily stock returns and liquidity, on average, of 50 financial institutions listed on the Vietnam stock exchanges wherein the period of data observations spans from January 30th, 2020 to May 15th, 2021. Figure 3 indicates the daily confirmed patients and deaths related to the COVID-19 epidemic. The authors expect an inverse relationship between the severity of the pandemic situation and the stock profitability and liquidity of companies in the sample, especially for the period from July 31st, 2020 onward.

3.2 Methodology

3.2.1 Research model. Based on past studies conducted by Al-Awadhi *et al.* (2020), Anh and Gan (2021) and Mdaghri *et al.* (2021), a model to explore the influence of the COVID-19 outbreak and the disease-related control measures on stock returns and liquidity of Vietnam-listed banking, finance and insurance companies is developed. Specifically,

Models (1–3) examine the impact of the COVID-19 outbreak on stock returns and liquidity:

$$\mathrm{DSR}_{i,t} = \alpha_{01} + \alpha_{02}\mathrm{CASE\_G}_{t-1} + \alpha_{03}\mathrm{DEATH\_G}_{t-1} + \alpha_{04}\mathrm{MARCAP}_{i,t-1} + \alpha_{05}\mathrm{MTB}_{i,t-1} + \epsilon_{0i,t} \quad (1)$$

$$\mathrm{AMIHUD}_{i,t} = \alpha_{11} + \alpha_{12}\mathrm{CASE\_}G_{t-1} + \alpha_{13}\mathrm{DEATH\_G}_{t-1} + \alpha_{14}\mathrm{MARCAP}_{i,t-1} + \alpha_{15}\mathrm{MTB}_{i,t-1} + \epsilon_{1i,t} \quad (2)$$

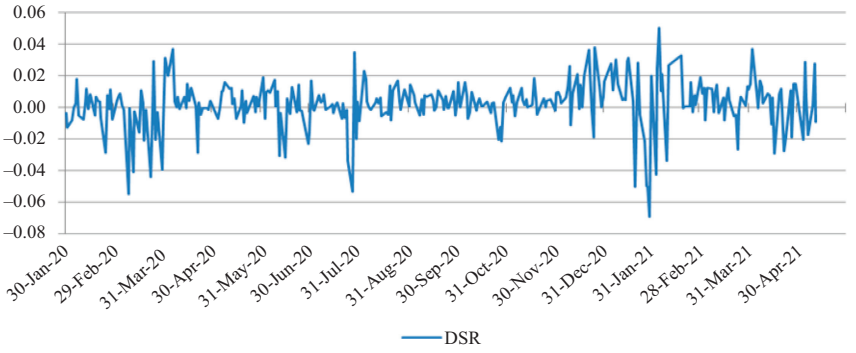

Figure 1. Cumulative average daily returns of Vietnam-listed banking, finance and insurance companies

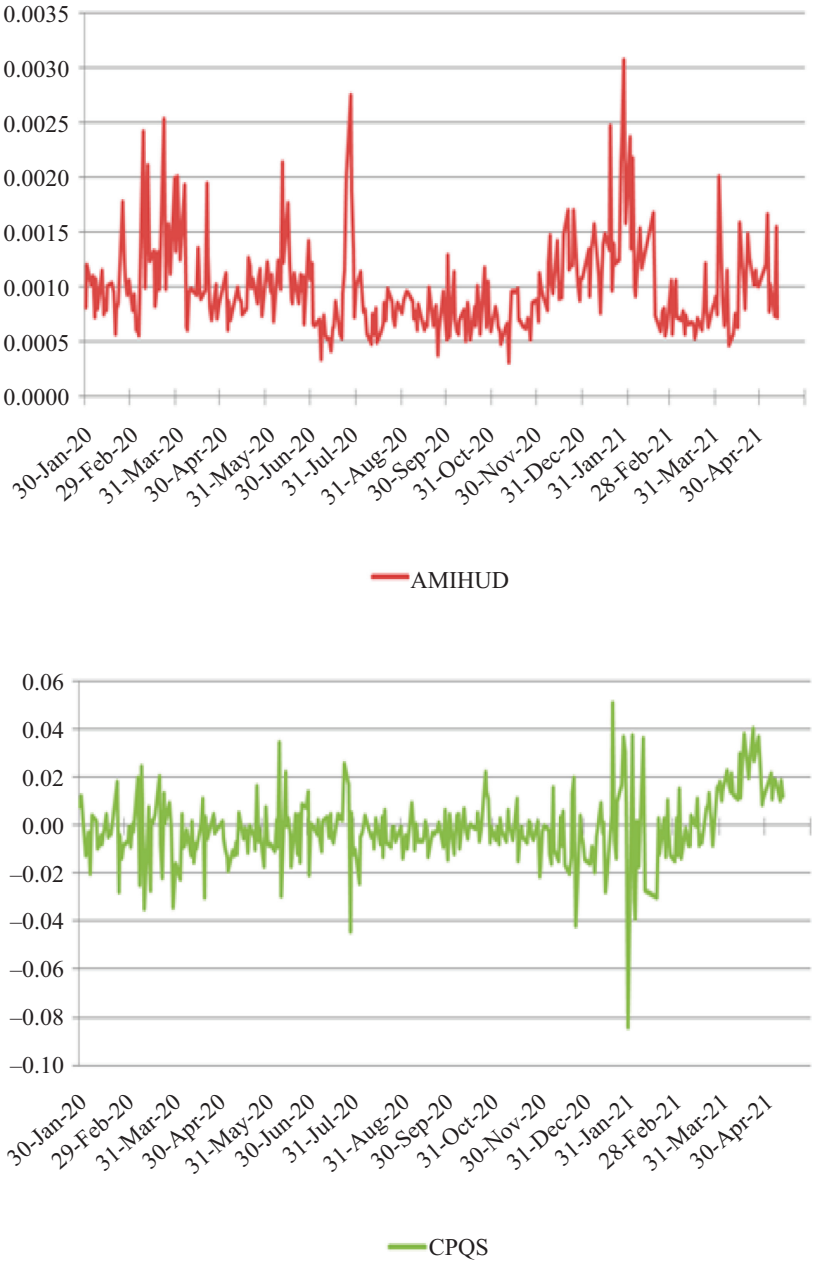

Figure 2.
Cumulative average daily stock liquidity of Vietnam-listed banking, finance and insurance companies

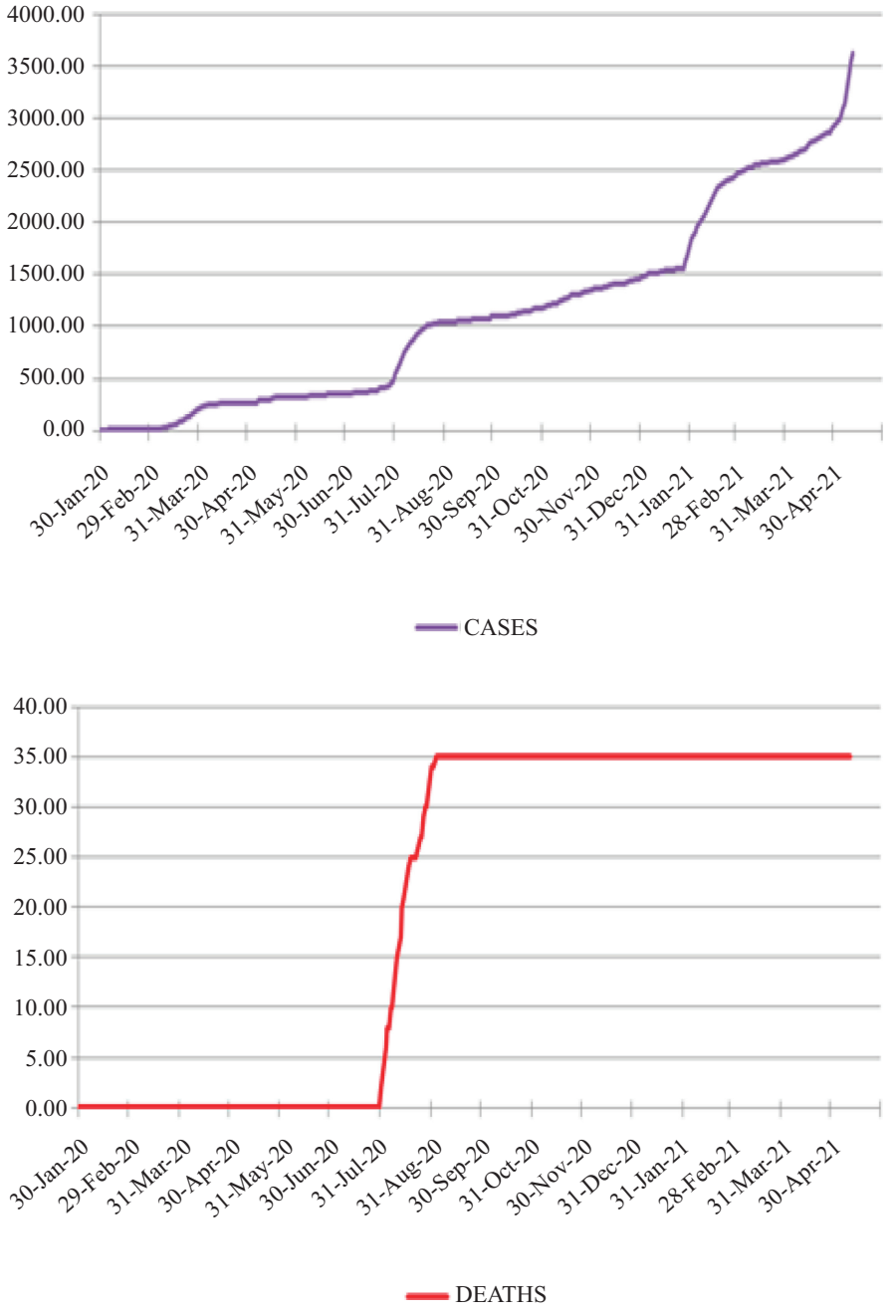

Figure 3.
Number of daily COVID-19 confirmed cases and deaths in Vietnam

$$\mathrm{CPQS}_{i,t} = \alpha_{21} + \alpha_{22}\mathrm{CASE\_G}_{t-1} + \alpha_{23}\mathrm{DEATH\_G}_{t-1} + \alpha_{24}\mathrm{MARCAP}_{i,t-1} + \alpha_{25}\mathrm{MTB}_{i,t-1} + \epsilon_{2i,t} \quad (3)$$

Models (4–6) assess the impact of the COVID-19 outbreak on stock returns and liquidity before the imposition of lockdown:

$$\mathrm{DSR}_{i,t} = \beta_{01} + \beta_{02}\mathrm{CASE\_G}_{t-1} + \beta_{03}\mathrm{DEATH\_G}_{t-1} + \beta_{04}\mathrm{MARCAP}_{i,t-1} + \beta_{05}\mathrm{MTB}_{i,t-1} + \beta_{06}\mathrm{D\_BFLOCK}_{i,t} + \theta_{0i,t} \quad (4)$$

$$\mathrm{AMIHUD}_{i,t} = \beta_{11} + \beta_{12}\mathrm{CASE\_}G_{t-1} + \beta_{13}\mathrm{DEATH\_G}_{t-1} + \beta_{14}\mathrm{MARCAP}_{i,t-1} + \beta_{15}\mathrm{MTB}_{i,t-1} + \beta_{16}D\_\mathrm{BFLOCK}_{i,t} + \theta_{1i,t} \quad (5)$$

$$\mathrm{CPQS}_{i,t} = \beta_{21} + \beta_{22}\mathrm{CASE\_G}_{t-1} + \beta_{23}\mathrm{DEATH\_G}_{t-1} + \beta_{24}\mathrm{MARCAP}_{i,t-1} + \beta_{25}\mathrm{MTB}_{i,t-1} + \beta_{26}\mathrm{D\_BFLOCK}_{i,t} + \theta_{2i,t} \quad (6)$$

Models (7–9) investigate the impact of the COVID-19 outbreak on stock returns and liquidity after the imposition of lockdown:

$$\mathrm{DSR}_{i,t} = \omega_{01} + \omega_{02}\mathrm{CASE\_G}_{t-1} + \omega_{03}\mathrm{DEATH\_G}_{t-1} + \omega_{04}\mathrm{MARCAP}_{i,t-1} + \omega_{05}\mathrm{MTB}_{i,t-1} + \omega_{06}\mathrm{D\_LOCK}_{i,t} + \omega_{0i,t} \quad (7)$$

$$\mathrm{AMIHUD}_{i,t} = \omega_{11} + \omega_{12}\mathrm{CASE\_G}_{t-1} + \omega_{13}\mathrm{DEATH\_G}_{t-1} + \omega_{14}\mathrm{MARCAP}_{i,t-1} + \omega_{15}\mathrm{MTB}_{i,t-1} + \omega_{16}\mathrm{D\_LOCK}_{i,t} + \omega_{1i,t} \quad (8)$$

$$\mathrm{CPQS}_{i,t} = \omega_{21} + \omega_{22}\mathrm{CASE\_G}_{t-1} + \omega_{23}\mathrm{DEATH\_G}_{t-1} + \omega_{24}\mathrm{MARCAP}_{i,t-1} + \omega_{25}\mathrm{MTB}_{i,t-1} + \omega_{26}\mathrm{D\_LOCK}_{i,t} + \omega_{2i,t} \quad (9)$$

Models (10–12) explore the impact of the COVID-19 outbreak on stock returns and market liquidity of large and small market capitalization stocks:

$$\mathrm{DSR}_{i,t} = \varphi_{01} + \varphi_{02}\mathrm{CASE\_G}_{t-1} + \varphi_{03}\mathrm{DEATH\_G}_{t-1} + \varphi_{04}\mathrm{MARCAP}_{i,t-1} + \varphi_{05}\mathrm{MTB}_{i,t-1} + \varphi_{06}\mathrm{D\_MRK}_{i,t-1} + \epsilon_{0i,t} \quad (10)$$

$$\mathrm{AMIHUD}_{i,t} = \varphi_{11} + \varphi_{12}\mathrm{CASE\_G}_{t-1} + \varphi_{13}\mathrm{DEATH\_G}_{t-1} + \varphi_{14}\mathrm{MARCAP}_{i,t-1} + \varphi_{15}\mathrm{MTB}_{i,t-1} + \varphi_{16}\mathrm{D\_MRK}_{i,t-1} + \epsilon_{1i,t} \quad (11)$$

$$\mathrm{CPQS}_{i,t} = \varphi_{21} + \varphi_{22}\mathrm{CASE\_}G_{t-1} + \varphi_{23}\mathrm{DEATH\_G}_{t-1} + \varphi_{24}\mathrm{MARCAP}_{i,t-1} + \varphi_{25}\mathrm{MTB}_{i,t-1} + \varphi_{26}\mathrm{D\_MRK}_{i,t-1} + \epsilon_{2i,t} \quad (12)$$

3.2.2 Measurement of variables. $DSR_{i,t}$ indicates the return of stock i on day t. The daily return of a stock measures the changes in the stock's closing prices for any two consecutive trading days (Keythman, 2018). The formula of daily stock return used in many previous studies such as Al-Awadhi *et al.* (2020), Anh and Gan (2021) and Keythman (2018) is as follows:

$$DSR_{i,t} = \ln(P_{i,t}/P_{i,t-1})$$

where $P_{i,t}$ and $P_{i,t-1}$ are the closing prices of stock i on day t and $t-1$, respectively.

$AMIHUD_{i,t}$ is a liquidity ratio that reflects the market depth, as proposed by Amihud (2002). $AMIHUD_{i,t}$ represents the price shock resulting from the volume of shares traded in the day. The higher value of the indicator, the less liquid the market is. According to Amihud (2002), this variable can be calculated as follows:

$$AMIHUD_{i,t} = \frac{|DSR_{i,t}|}{Ln(Volume_{i,t})}$$

where $Volume_{i,t}$ represents the dollar volume of stock i at day t.

$CPQS_{i,t}$ is another liquidity ratio that measures the market tightness, as also developed by Chung and Zhang (2014). $CPQS_{i,t}$ reflects the difference between the ask and bid prices of a stock on the day. The higher value of the indicator, the higher the transaction cost incurred. According to studies of Gao *et al.* (2020) and Mdaghri *et al.* (2021), this variable is calculated using the following equation:

$$CPQS_{i,t} = \frac{Ask_{i,t} - Bid_{i,t}}{(Ask_{i,t} + Bid_{i,t})/2}$$

where $Ask_{i,t}$ and $Bid_{i,t}$ are, respectively, the ask and the bid closing prices of stock i at day t.

$CASE\_G_{i,t}$ is the growth rate of confirmed COVID-19 cases on day t. The indicator can be determined as suggested by Al-Awadhi *et al.* (2020) as follows:

$$CASE\_G_{i,t} = \frac{CASE_{i,t} - CASE_{i,t-1}}{CASE_{i,t-1}}$$

where $CASE\_G_{i,t}$ and $CASE_{i,t-1}$ are the number of confirmed COVID-19 cases on day t and $t-1$, respectively.

$DEATH\_G_{i,t}$ is the growth rate of COVID-19-related deaths reported on day t. The formula computing this variable (Al-Awadhi *et al.*, 2020) is:

$$DEATH\_G_{i,t} = \frac{DEATH_{i,t} - DEATH_{i,t-1}}{DEATH_{i,t-1}}$$

where $DEATH_{i,t}$ and $DEATH_{i,t-1}$ are the number of reported COVID-19-related deaths on day t and $t-1$, respectively.

$MARCAP_{i,t}$ represents the market capitalization of company i on day t. It is the total market value of all outstanding shares of the listed company and hereby is considered a valid measurement of firm size. In such research as by Al-Awadhi *et al.* (2020) and Anh and Gan (2021), the equation of market cap can be computed as:

$$MARCAP_{i,t} = Ln(\text{market capitalization of company } i \text{ on day } t)$$

$MTB_{i,t}$ is the market-to-book ratio of a company on day t. Market value is a determinant of investor expectation toward the company's future cash flows; meanwhile, book value is the actual amount spent on the business operation to generate profit for the company in specific and added value for the economy in general. Market-to-book ratio reflects the return on each

unit of currency invested relative to the coexpected book value. Following the previous studies of Al-Awadhi *et al.* (2020) and Anh and Gan (2021), this ratio can be calculated as below:

$$\text{MTB}_{i,t} = \frac{\text{Market value of company } i \text{ on day } t}{\text{Book value of company } i \text{ on day } t}$$

$\text{D\_MRK}_{i,t}$ is a dummy variable whose value equals 1 if market capitalization of a stock is in large 50th percentile; and zero otherwise.

$\text{D\_BFLOCK\_}j_{i,t}$ is a dummy variable representing different periods before the Government imposed lockdown, which has four variants as follows:

$\text{D\_BFLOCK\_1}_{i,t}$ equals 1 if the day is before April 1st, 2020; and zero otherwise.

$\text{D\_BFLOCK\_2}_{i,t}$ equals 1 if the day is during the period from April 16th, 2020 to July 27th, 2020; and zero otherwise.

$\text{D\_BFLOCK\_3}_{i,t}$ equals 1 if the day is during the period from September 11th, 2020 to January 27th, 2021; and zero otherwise.

$\text{D\_BFLOCK\_4}_{i,t}$ equals 1 if the day is during the period from March 3rd, 2021 to May 3rd, 2021; and zero otherwise.

$\text{D\_LOCK\_}j_{i,t}$ is a dummy variable representing different periods after the Government imposed lockdown, which has four variants as follows:

$\text{D\_LOCK\_1}_{i,t}$ equals 1 if the day is during the period from April 1st, 2020 to April 15th, 2020; and zero otherwise.

$\text{D\_BFLOCK\_2}_{i,t}$ equals 1 if the day is during the period from July 28th, 2020 to September 10th, 2020; and zero otherwise.

$\text{D\_BFLOCK\_3}_{i,t}$ equals 1 if the day is during the period from January 28th, 2021 to March 2nd, 2021; and zero otherwise.

$\text{D\_BFLOCK\_4}_{i,t}$ equals 1 if the day is during the period from May 4th, 2021 onward; and zero otherwise.

3.2.3 Estimation method. Panel data regression helps to minimize issues regarding estimation biases, multicollinearity and individual heterogeneity and also to detect how the relationship between dependent and independent variables changes over time (Baltagi, 2008; Hsiao, 2014). According to Bell and Jones (2015), the random-effects model is more appropriate and provides more explanatory power than the fixed one. As advocated by past studies of Al-Awadhi *et al.* (2020) and Anh and Gan (2021), a panel data regression model with random effects is developed in this paper.

4. Empirical results

4.1 Summary of descriptive statistics and multicollinearity test

Table 1 provides the summary statistics of the variables under consideration, including average value, minimum value, maximum value and SD. Notably, the average daily stock returns (DSR) of Vietnamese-listed companies in the financial services sector are 0.184%. Liquidity ratios indicated by AMIHUD and CPQS have respective mean values of 0.098 and −0.014%. The average growth rates of daily confirmed cases and deaths are equivalent to 3.027 and 1.545%, respectively. The natural logarithm of daily market capitalization is approximately 28.68. Last but not least, the average market-to-book ratio takes a value of 1.01.

Table 2 represents the correlation matrix and the VIF coefficients of the independent variables. The correlation among the independents is found weak, except for the one between

MARCAP and MTB variables. Nevertheless, the VIF values of all independent variables in the model are smaller than 3, implying no multicollinearity detected in the model.

4.2 Regression results

4.2.1 Impact of the COVID-19 outbreak on stock returns and market liquidity. Table 3 provides the results of panel data regression with random effects in Models (1–3).

The results of Model (1) suggest that the growth rate of daily confirmed cases in Vietnam has a negative and significant effect on the stock returns of Vietnamese-listed companies operating in the banking, finance and insurance industry. It is consistent with the research findings of Al-Awadhi *et al.* (2020) and Anh and Gan (2021), which claim that the COVID-19 outbreak has deteriorated the stock returns of most companies in the market. The negative nexus between the increasing number of daily deaths and the returns on stock, however, is found statistically insignificant. It is due to the characteristics of the data used in the model. That is, the COVID-19-related deaths recorded in Vietnam are relatively low, and most of them occurred in the elderly or those with preexisting morbidity.

In Models (2) and (3), there exists a significantly positive nexus between the two liquidity ratios, AMIHUD and CPQS, and the growth rate of daily COVID-19 infections in Vietnam. These findings confirm that the worsening severity of the COVID-19 hinders the depth of Vietnam's stock market and soars the transaction cost incurred. However, the daily increase in COVID-19 deaths in Vietnam does not appear to have a significant impact on market tightness and depth. This finding is consistent with the empirical results of Mdaghri *et al.* (2021).

Regarding company-related characteristics, under the impact of the COVID-19 pandemic, market capitalization has a significant and positive correlation to stock returns. Meanwhile, market-to-book ratio is found significantly negatively correlated with stock profits. These results imply that Vietnam-listed banking, insurance and financial companies with overvalued stocks yet low market capitalization tend to yield lower stock returns amid the pandemic outbreak, which is congruent with previous studies of Al-Awadhi *et al.* (2020) and Anh and Gan (2021). Yet, market-to-book ratio has a significant and positive nexus with market depth and tightness. Nevertheless, the regression results of the two models show a significantly negative correlation between market capitalization and both market depth and tightness as advocated by a study of Mdaghri *et al.* (2021).

4.2.2 Impact of the COVID-19 pandemic on stock returns and market liquidity before and after the imposition of lockdown. Table 4 indicates the results of panel data regression with random effects applied for Models (4) and (7). Specifically, the regression coefficients of dummy variables D_BFLOCK_1 and D_BFLOCK_2 are both negative and significant at 1% level. This suggests a negative impact of the COVID-19 pandemic on the stock returns of banking, finance and insurance companies in Vietnam before the first two nationwide lockdowns (before April 1st, 2020 and from April 16th to July 27th, 2020). It may be attributed to investor anxiety over the prospect of the COVID-19 outbreak plunging into chaos on Vietnam's stock market. Yet, the coefficients of two dummy variables D_BFLOCK_3 and

Variable	*N*	Mean	SD	Min	Max
AMIHUD	16,100	0.00098	0.00129	0.00000	0.02667
CPQS	16,100	−0.00140	0.03136	−0.22222	0.20000
DSR	16,100	0.00184	0.03338	−0.23889	0.47000
CASES_G	16,100	0.03027	0.12073	0.00000	1.50000
DEATHS_G	16,100	0.01545	0.13001	0.00000	2.00000
MARCAP	16,100	28.67908	2.24604	17.59970	33.62249
MTB	16,100	1.00935	0.64396	0.00000	4.01000

Source(s): Authors' calculations

Table 1.
Descriptive statistics

Table 2.
Correlation matrix

	AMIHUD	CPQS	DSR	CASES_G	DEATHS_G	MARCAP	MTB
AMIHUD	1.0000						
CPQS	−0.0496	1.0000					
DSR	0.0416	−0.6259	1.0000				
CASES_G	0.0589	0.0338	−0.0958	1.0000			
DEATHS_G	−0.0044	−0.0447	0.0271	0.0917	1.0000		
MARCAP	−0.1985	0.0361	−0.0020	−0.0171	−0.0127	1.0000	
MTB	−0.1217	0.0561	0.0160	−0.0432	−0.0383	0.7805	1.0000
VIF (mean = 1.79)				1.01	1.01	2.56	2.57

Source(s): Authors' calculations

Table 3.
Regression results of Models (1–3)

Variable	Model (1)	Model (2)	Model (3)
CASES_G	−0.01585*** (0.00361)	0.00036** (0.00016)	0.00795** (0.00386)
DEATHS_G	−0.00450 (0.00369)	−0.00014 (0.00015)	−0.00556 (0.00349)
MARCAP	0.00038*** (0.00014)	−0.00009** (0.00005)	−0.00132*** (0.00035)
MTB	−0.00231*** (0.00058)	0.00017** (0.00007)	0.00940*** (0.00184)
_CONS	−0.00560 (0.00370)	0.00332** (0.00131)	0.02576*** (0.00902)

Note(s): Robust SEs are in parentheses. ***$p < 0.01$; **$p < 0.05$

D_BFLOCK_4, despite being consistent with expected negative signs, are statistically insignificant. This result implies that investor sentiment in the two periods from September 11th, 2020 to January 27th, 2021 and from March 3rd to May 3rd, 2021 appeared to be less concerned about the influence of the COVID-19 outbreak as in previous periods.

It is worth noting that the regression coefficients of all dummy variables for D_LOCK_J are positive and significant at 1% or 5% level. The result indicates a positive impact of the lockdown measures on stock returns of the banking, finance and insurance companies listed on Vietnam's stock exchanges, which is also consistent with past research of Anh and Gan (2021). One of the reasons for this is an increase in investor confidence toward the Government's well-organized pandemic control programs and policies.

Table 5 displays the results of panel data regression with random effects conducted in Models (4) and (7). As shown, the coefficients of dummy variables D_BFLOCK_1 and D_BFLOCK_2 are positive, whereas it is found negative for D_BFLOCK_3, although all of them are not statistically significant. Meanwhile, the coefficient of the dummy variable D_BFLOCK_4 is negative and significant at 1% level, implying that the COVID-19 outbreak seemingly does not hamper the depth of the stock market during the fourth nonlockdown period.

The coefficient of dummy variable D_LOCK_1 is found positive yet statistically insignificant; meanwhile, the one of D_LOCK_2 is negative and significant at 1% level. It suggests that the market depth appears not to be affected during the first two lockdowns. Nevertheless, the coefficients of D_LOCK_3 and D_LOCK_4 yield positive values and are all significant at 1 and 10% level, respectively, showing that the COVID-19 outbreak greatly influences the stock markets during the more recent lockdown periods.

Table 6 represents the results of panel data regression with random effects from Models (6) and (9). The coefficient of D_BFLOCK_1 is negative at 1% level of significance, implying a drop in transaction costs of the stock market attributed to the COVID-19 during the period before the first lockdown. The coefficients of two dummy variables D_BFLOCK_2 and D_BFLOCK_3, despite their opposite signs, are both statistically insignificant, indicating that the epidemic outbreak does not have any significant effect on the tightness of the stock market during the next two periods. A contrasting result, however, is found for the coefficient

Table 4. Regression results of Models (4) and (7)

	Model (4)					Model (7)		
Variable (DSR)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CASES_G	−0.01241*** (0.00363)	−0.01606*** (0.00365)	−0.01494*** (0.00354)	−0.01525*** (0.00360)	−0.01508*** (0.00354)	−0.01500*** (0.00356)	−0.01502*** (0.00359)	−0.01518*** (0.00357)
DEATHS_G	−0.00429 (0.00369)	−0.00433 (0.00371)	−0.00307 (0.00370)	−0.00334 (0.00368)	−0.00297 (0.00371)	−0.00663 (0.00446)	−0.00288 (0.00367)	−0.00318 (0.00368)
MARCAP	−0.00069*** (0.00021)	−0.00064*** (0.00021)	−0.00072*** (0.00022)	−0.00074*** (0.00023)	−0.00075*** (0.00022)	−0.00075*** (0.00022)	−0.00068*** (0.00021)	−0.00070*** (0.00021)
MTB	0.00245*** (0.00085)	0.00214*** (0.00079)	0.00261*** (0.00087)	0.00273*** (0.00099)	0.00279*** (0.00092)	0.00278*** (0.00091)	0.00234*** (0.00083)	0.00250*** (0.00085)
(1) D_BFLOCK_1	−0.00246*** (0.00072)							
(2) D_BFLOCK_2		−0.00270*** (0.00073)						
(3) D_BFLOCK_3			0.00044 (0.00054)					
(4) D_BFLOCK_4				−0.00047 (0.00120)				
(5) D_LOCK_1					0.00558** (0.00249)			
(6) D_LOCK_2						0.00217** (0.00088)		
(7) D_LOCK_3							0.00518*** (0.00099)	
(8) D_LOCK_4								0.00375*** (0.00026)
_CONS	0.02066*** (0.00548)	0.01971*** (0.00537)	0.02079*** (0.00556)	0.02147*** (0.00593)	0.02147*** (0.00574)	0.02141*** (0.00570)	0.01961*** (0.00550)	0.02045*** (0.00557)

Note(s): Robust SEs are in parentheses. $^{***}p < 0.01$; $^{**}p < 0.05$

Table 5.
Regression results of Models (5) and (8)

	Model (5)				Model (8)			
Variable (AMIHUD)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CASES_G	0.00030* (0.00016)	0.00037** (0.00016)	0.00035** (0.00016)	0.00035** (0.00016)	0.00037** (0.00016)	0.00035** (0.00016)	0.00037** (0.00016)	0.00036** (0.00016)
DEATHS_G	−0.00011 (0.00014)	−0.00013 (0.00015)	−0.00015 (0.00015)	−0.00014 (0.00015)	−0.00013 (0.00015)	0.00006 (0.00015)	−0.00013 (0.00015)	−0.00014 (0.00015)
MARCAP	−0.00009* (0.00005)	−0.00009* (0.00005)	−0.00009* (0.00005)	−0.00009* (0.00005)	−0.00009* (0.00005)	−0.00009* (0.00005)	−0.00009* (0.00005)	−0.00009* (0.00005)
MTB	0.00018** (0.00007)	0.00017** (0.00007)	0.00017** (0.00007)	0.00023*** (0.00009)	0.00018** (0.00007)	0.00015** (0.00007)	0.00015** (0.00007)	0.00016** (0.00007)
(1) D_BFLOCK_1	0.00006 (0.00005)							
(2) D_BFLOCK_2		0.00002 (0.00003)						
(3) D_BFLOCK_3			−0.00002 (0.00003)					
(4) D_BFLOCK_4				−0.00014** (0.00005)				
(5) D_LOCK_1					0.00014 (0.00010)			
(6) D_LOCK_2						−0.00013*** (0.00005)		
(7) D_LOCK_3							0.00020*** (0.00005)	
(8) D_LOCK_4								0.00018* (0.00010)
_CONS	0.00327** (0.00130)	0.00332** (0.00131)	0.00332** (0.00131)	0.00334** (0.00132)	0.00331** (0.00130)	0.00331** (0.00131)	0.00334** (0.00132)	0.00334*** (0.00130)

Note(s): Robust SEs are in parentheses. ***$p < 0.01$; **$p < 0.05$; *$p < 0.01$

Table 6. Regression results of Models (6) and (9)

Variable (CPQS)	Model (6) (1)	(2)	(3)	(4)	(5)	Model (9) (6)	(7)	(8)
CASES_G	0.01177*** (0.00357)	0.00823** (0.00388)	0.00758** (0.00379)	0.00978*** (0.00381)	0.00786** (0.00386)	0.00780** (0.00388)	0.00758** (0.00387)	0.00784** (0.00385)
DEATHS_G	−0.00702** (0.00345)	−0.00521 (0.00351)	−0.00588* (0.00356)	−0.00435 (0.00342)	−0.00586* (0.00352)	−0.00272 (0.00364)	−0.00660* (0.00351)	−0.00525 (0.00348)
MARCAP	−0.00126*** (0.00034)	−0.00136*** (0.00035)	−0.00133*** (0.00035)	−0.00069** (0.00031)	−0.00128*** (0.00035)	−0.00129*** (0.00035)	−0.00152*** (0.00036)	−0.00119*** (0.00034)
MTB	0.00902*** (0.00178)	0.00963*** (0.00196)	0.00946*** (0.00185)	0.00556*** (0.00136)	0.00917*** (0.00183)	0.00920*** (0.00184)	0.01075*** (0.00207)	0.00858*** (0.00171)
(1) D_BFLOCK_1	−0.00344*** (0.00107)							
(2) D_BFLOCK_2		0.00083 (0.00074)						
(3) D_BFLOCK_3			−0.00073 (0.00062)					
(4) D_BFLOCK_4				0.01175*** (0.00101)				
(5) D_LOCK_1					−0.00504** (0.00241)			
(6) D_LOCK_2						−0.00184** (0.00094)		
(7) D_LOCK_3							−0.01551*** (0.00152)	
(8) D_LOCK_4								0.01544*** (0.00162)
_CONS	0.02500*** (0.00887)	0.02643*** (0.00911)	0.02619*** (0.00907)	0.01019 (0.00813)	0.02510*** (0.00899)	0.02519*** (0.00899)	0.03120*** (0.00943)	0.02266*** (0.00873)

Note(s): Robust SEs are in parentheses. ***$p < 0.01$; **$p < 0.05$; *$p < 0.01$

of D_BFLOCK_4 in which it is positive at 1% level of significance, meaning that transaction costs in the stock market rise under the impact of the COVID-19 over the most recent before-lockdown period.

When examining the effect of lockdowns in Models (6) and (9), it is shown that the coefficients of such dummy variables as D_LOCK_1, D_LOCK_2 and D_LOCK_3 are all positive and significant at 1% or 5% level, indicating there exists a drop in the transaction costs incurred during these periods. Nevertheless, the coefficient of the last dummy variable D_LOCK_4 is positive at 1% level of significance, implying increasing costs in the stock market during the latest lockdown period

4.2.3 Market capitalization analysis. Table 7 displays the regression results with random effects from Models (10–12) that examine the performance of large-cap and small-cap stocks of Vietnam-listed banking, finance and insurance companies. During the COVID-19 surges, large-cap stocks have a notable impact in terms of returns as compared to small-caps. This means firms with smaller market capitalization tend to yield lower returns than those with higher market cap amid the pandemic outbreak in Vietnam, which is against Al-Awadhi *et al.* (2020). Notwithstanding such contrasting arguments, the results show no difference in market liquidity among firms with varied market capitalization.

5. Conclusion and implication

This paper examines the impact of the COVID-19 outbreak and the imposition of pandemic-related lockdown on the stock returns and liquidity of 50 financial services companies listed on Vietnam's stock market from January 30th, 2020 to May 15th, 2021. By constructing panel data regression models with random effects, the study confirms a significantly negative impact of worsening COVID-19 situation on the stock returns and market liquidity. To put it another way, the COVID-19 pandemic has tremendously affected the performance of the financial services industry in Vietnam. This can be attributed to the industry's sensibility and vulnerability toward the risk of increasing bad debts and unusually large-scale deposit withdrawals (Goodell, 2020). The study also reports a significant and negative nexus between the growth rate of daily COVID-19-related cases and stock returns during before-lockdown periods. Yet, the effect on market liquidity in such periods seems inconsiderable.

One notable finding in this study is the significant and positive influence of COVID-19 lockdown on the stock returns and liquidity of Vietnamese banking, finance and insurance firms. The rationale behind this is a boost to investor confidence toward the Government's timely and effective containment strategies in response to the pandemic, especially during the lockdown periods.

The study also investigates the impact of the COVID-19 epidemic on financial services institutions with different sizes of market capitalization. We conclude that small-cap firms tend to have lower returns on stocks as compared to larger firms during the pandemic outbreak. Yet again, there is no difference in stock liquidity regarding company size.

Table 7.
Regression results of Models (10–12)

Variable	Model (10)	Model (11)	Model (12)
CASES_G	−0.01583*** (0.00361)	0.00036** (0.00016)	0.00790** (0.00386)
DEATHS_G	−0.00443 (0.00368)	−0.00014 (0.00015)	−0.00571 (0.00348)
MARCAP	0.00010 (0.00017)	−0.00009 (0.00006)	−0.00087** (0.00044)
MTB	−0.00217*** (0.00059)	0.00017** (0.00007)	0.00909*** (0.00187)
D_MRK	0.00137** (0.00068)	−0.00001 (0.00011)	−0.00218 (0.00171)
_CONS	0.00158 (0.00435)	0.00322** (0.00153)	0.01440 (0.01149)

Note(s): Robust SEs are in parentheses. ***$p < 0.01$; **$p < 0.05$

On the basis of empirical results, this paper proposes several implications for the Government and investors. Firstly, to help the stock market overcome the crisis and recover sustainably, the policymakers and local authorities need to proactively implement stringent containment measures in a timely fashion to enhance investor confidence and be well-prepared for the future waves of the pandemic. Secondly, investors should be self-informed with the latest updates on the epidemic developments and their potential influence on both the economy in general and the stock market in specific based on which a proper analysis for effective and fast fashion response strategies can be carried out. In addition, investors need to carefully consider whether a company has sustainable business performance and corporate governance in the long term to avoid or minimize the impact of a new outbreak and other unforeseeable events. This would also help investors seize investment opportunities that optimize profits or mitigate losses.

References

Al-Awadhi, A.M., Alsaifi, K., Al-Awadhi, A. and Alhammadi, S. (2020), "Death and contagious infectious diseases: impact of the COVID-19 virus on stock market returns", *Journal of Behavioral and Experimental Finance*, Vol. 27, p. 100326.

Alfaro, L., Chari, A., Greenland, A.N. and Schott, P.K. (2020), "Aggregate and firm-level stock returns during pandemics, in real time", Working Paper No. w26950, National Bureau of Economic Research, Massachusetts.

Amihud, Y. (2002), "Illiquidity and stock returns: cross-section and time-series effects$", *Journal of Financial Markets*, Vol. 5, pp. 31-56.

Anh, D.L.T. and Gan, C. (2021), "The impact of the COVID-19 lockdown on stock market performance: evidence from Vietnam", *Journal of Economic Studies*, Vol. 48 No. 4, pp. 836-851.

Ashraf, B.N. (2020), "Stock markets' reaction to COVID-19: cases or fatalities?", *Research in International Business and Finance*, Vol. 54, p. 101249.

Baig, A.S., Butt, H.A., Haroon, O. and Rizvi, S.A.R. (2021), "Deaths, panic, lockdowns and US equity markets: the case of COVID-19 pandemic", *Finance Research Letters*, Vol. 38, p. 101701.

Baltagi, B.H. (2008), *Econometric Analysis of Panel Data*, John Wiley & Sons, New York.

Bell, A. and Jones, K. (2015), "Explaining fixed effects: random effects modeling of time-series cross-sectional and panel data", *Political Science Research and Methods*, Vol. 3 No. 1, pp. 133-153.

Chen, M.-H., Jang, S.S. and Kim, W.G. (2007), "The impact of the SARS outbreak on Taiwanese hotel stock performance: an event-study approach", *International Journal of Hospitality Management*, Vol. 26 No. 1, pp. 200-212.

Chen, C.D., Chen, C.C., Tang, W.W. and Huang, B.Y. (2009), "The positive and negative impacts of the SARS outbreak: a case of the Taiwan industries", *The Journal of Developing Areas*, Vol. 43 No. 1, pp. 281-293.

Chung, K.H. and Zhang, H. (2014), "A simple approximation of intraday spreads using daily data", *Journal of Financial Markets*, Vol. 17, pp. 94-120.

Eleftheriou, K. and Patsoulis, P. (2020), "COVID-19 lockdown intensity and stock market returns: a spatial econometrics approach", Working Paper No. 100662, University Library of Munich, Munich.

Gao, Y., Zhao, W. and Wang, M. (2020), "The comparison study of liquidity measurements on the Chinese stock markets", *Emerging Markets Finance and Trade*, pp. 1-29, doi: 10.1080/1540496X.2019.1709819.

Goodell, J.W. (2020), "COVID-19 and finance: agendas for future research", *Finance Research Letters*, Vol. 35, p. 101512.

He, Q., Liu, J., Wang, S. and Yu, J. (2020), "The impact of COVID-19 on stock markets", *Economic and Political Studies*, Vol. 8 No. 3, pp. 275-288.

Hsiao, C. (2014), *Analysis of Panel Data*, Cambridge University Press, Cambridge.

Ichev, R. and Marinč, M. (2018), "Stock prices and geographic proximity of information: evidence from the Ebola outbreak", *International Review of Financial Analysis*, Vol. 56, pp. 153-166.

Jiang, Y., Zhang, Y., Ma, C., Wang, Q., Xu, C., Donovan, C. and Sun, W. (2017), "H7N9 not only endanger human health but also hit stock marketing", *Advances in Disease Control and Prevention*, Vol. 2 No. 1, p. 1.

Keythman, B. (2018), "How to calculate daily stock return", available at: https://pocketsense.com/calculate-daily-stock-return-5138.html (accessed 17 November 2018).

Liu, H., Manzoor, A., Wang, C., Zhang, L. and Manzoor, Z. (2020), "The COVID-19 outbreak and affected countries stock markets response", *International Journal of Environmental Research and Public Health*, Vol. 17 No. 8, p. 2800.

Mdaghri, A.A., Raghibi, A., Thanh, C.N. and Oubdi, L. (2021), "Stock market liquidity, the great lockdown and the COVID-19 global pandemic nexus in MENA countries", *Review of Behavioral Finance*, Vol. 13 No. 1, pp. 51-68.

Mishra, P.K. (2020), "COVID-19, Black Swan events and the future of disaster risk management in India", *Progress in Disaster Science*, Vol. 8, p. 100137.

Phuong, L.C.M. (2021), "How COVID-19 impacts Vietnam's banking stocks: event study method", *Banks and Bank Systems*, Vol. 16 No. 1, pp. 92-102.

Sohrabi, C., Alsafi, Z., O'Neill, N., Khan, M., Kerwan, A., Al-Jabir, A. and Agha, R. (2020), "World Health Organization declares global emergency: a review of the 2019 novel coronavirus (COVID-19)", *International Journal of Surgery*, Vol. 76, pp. 71-76.

Taleb, N.N. (2007), *The black Swan: The Impact of the Highly Improbable*, Random House, New York, Vol. 2.

Van Hoof, E. (2020). "Lockdown is the world's biggest psychological experiment-and we will pay the price", *Paper Presented at the World Economic Forum*.

WHO (2020), "Coronavirus disease 2019 (COVID-19)", available at: https://covid19.who.int/ (accessed 21 September 2020).

Zhang, D., Hu, M. and Ji, Q. (2020), "Financial markets under the global pandemic of COVID-19", *Finance Research Letters*, Vol. 36, p. 101528.

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