COVID-19 OUTBREAK AND THE GLOBAL STOCK MARKET LIQUIDITY

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Abstract

The purpose of this study is to examine how the COVID-19 outbreak affected the liquidity of stock markets across the world. By analyzing a sample including daily data from forty-seven stock markets, we found a positive relationship between monthly growth in the number of newly reported COVID-19 cases and monthly market trading volume growth during the period between December 2019 and January 2021. The research findings although contrary to the previous studies in the very early stages (McTier et al., 2013; Chaouachi & Chaouachi, 2020), are consistent with the actual developments up to the present. This implies that stock markets were relevant sources for investors to compensate for the foregone earnings caused by the interruption of economic activities. Therefore, appropriate measures, such as financial support for investors and listed companies as well as improvements in technological infrastructure and administrative procedures, should be implemented to maintain the activities of the stock market in each country. In addition, it is important for the regulators to closely monitor market trading activities and trends to issue early warnings to the market and take appropriate action in the event of a "bubble" in the market.

Keywords: COVID-19, Liquidity, Stock Market, Trading Volume

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1. INTRODUCTION

The COVID-19 pandemic caused an economic recession across the world in 2020. During 2020, the world's collective gross domestic product (GDP) fell by 3.4%. To put this number in perspective, global GDP was estimated at around 84.54 trillion US dollars in 2020, meaning that a 3.4% drop in economic growth results in almost 2.87 trillion US dollars of lost economic output (Statista, n.d.). In addition, COVID-19 also had serious effects on workers, households and businesses, which has been recognized through empirical studies in many countries. For example, the COVID-19 pandemic reduced the income of workers in Vietnam, especially the group without professional and technical qualifications (Do & Pham, 2023). The spread of the pandemic resulting in lockdowns has increased unemployment in many areas, decreased people's ability to pay bills and buy essential items, and decreased average salaries in Petra, Jordan (Abuamoud et al., 2022). In Greece, Toumpalidou and Chatzikonstantinidou (2023) confirmed that during COVID-19, the unemployment rates, by sex, age, and both also increased significantly (compared with the European Union (EU) average, Turkey and the USA rates). Moreover, in Kosovo, COVID-19 also had a negative and

significant impact on family income, saving, jobs, and consumption expenditures of households (Tafa et al., 2022). While this crisis posed many challenges for small and medium-sized enterprises (SMEs) in terms of the consumption market, raw materials, labor force and cash flow (Kabashi & Kabashi, 2023).

Particularly for the stock market, the emergence of the COVID-19 pandemic has caused unprecedented negative impacts. At the end of March 2020, the three major indices of the US stock market — the Dow Jones, S&P 500, and NASDAQ — fell by about 23%, 20%, and 14%, respectively (Imbert et al., 2020) for the first quarter. In Europe, several indices have plunged on the worst day since 1987. The Financial Times Stock Exchange 100 Index (FTSE 100) of the U.K., the DAX (*Deutscher Aktienindex*) of Germany, and the CAC 40 (*Cotation Assistée en Continu*) of France experienced a significant drop of approximately 12% at the end of the trading session on March 12, 2020 (Wearden & Jolly, 2020). The situation was even worse for the Asian indices in the session, as the Nikkei 225 (Japan), Hang Seng (Hong Kong), and Indonesia Stock Exchange (IDX) Composite Index all declined considerably, about 20% (Holmes, 2020).

Nonetheless, surprisingly, two years after the first outbreak in China, signs of recovery can be seen in global stock markets. Rather than following the herd and engaging in panic-based selloffs, as was the case at the start of the epidemic, investors appear to be more active in managing their portfolios and more positive about the economy. The Dow Jones, S&P 500, and NASDAQ all climbed 157.78%, 175.22%, and 185.81%, respectively, as of March 30, 2022, as compared to the end of March 2020[1]. Furthermore, various market indices rose above, or at least recovered to, their pre-pandemic levels, including the Bovestra (Brazil), S&P/TSX (Canada), Nikkei 225 (Japan), SZSE Component (China), FTSE 100 (U.K.), DAX (Germany) and Moscow Exchange (MOEX, Russia) to name a few. This demonstrates that, even though industrial production has decreased and many commercial operations have been temporarily halted, the stock market remains an appealing investment channel.

As a result, the pandemic's impact on stock market indicators differs from that of other companies. However, there are still a small number of studies on the impact of COVID-19 on the stock market, such as the work of Al-Awadhi et al. (2020), Ashraf (2020a, 2020b), Basuony et al. (2021), Chaouachi and Chaouachi (2020), Demirtaş et al. (2021), Díaz et al. (2022), He et al. (2020), Narayan et al. (2021), as well as Öztürk et al. (2020). Some studies compared market index returns before and after the outbreak, while others used a multiple regression model to assess the impact of newly diagnosed COVID-19 cases on index returns. However, the samples used in such papers were limited to the pandemic's early stages. For these reasons, the goal of this article is to provide an answer to the question, "Does there exist a statistically significant relationship between the COVID-19 outbreak and stock markets liquidity all around the world?". The conclusions of this research are likely to be more general and accurate about the effects of the pandemic on the stock market around the world since it uses more extensive and up-to-date research data, variables, and testing techniques.

The remainder of the paper is organized as follows. Section 2 provides the literature review. Sections 3 and 4 address the data and methodology. The findings and discussions are presented in Section 5. Section 6 provides a summary.

2. LITERATURE REVIEW

Significant effects of the global pandemic, for instance, the Black Death (1346–1353), Spanish flu (1918–1920), Asian flu (1957–1958) and severe acute respiratory syndrome (SARS, 2002–2003) on the stock market were imposed by many researchers (Burdekin, 2020; Loh, 2006; McTier et al., 2013; Nippani & Washer, 2004). Thus, as economic uncertainty began to rise due to the COVID-19 outbreak becoming more widespread all over the world, the effect of this pandemic on the financial market has turned into a major topic of concern.

One of the very first studies on this topic was conducted by He et al. (2020), which research method was quite similar to that of Nippani and Washer (2004) and Loh (2006). The studies focused on 8 developed stock markets in the US, Europe, and Asia, which are S&P 500 (the US), Nikkei 225 (Japan), DAX (Germany), Smith Micro Software Inc. (SMSI, Spain), CAC 40 (France), Kneat.com Inc (KSI, South Korea), FTSE MIB (Italy) and CSI 300 (China). The study period was divided into several sub-period, including the pre-event window ranging from January 23rd, 2020, to February 2nd, 2020; the short event window (January 23rd–February 3rd, 2020) and the long event period (January 23rd–March 10th, 2020), in which the market returns were compared to those in comparison period (June 1st, 2019–January 2nd, 2020). Using student's t-tests and the non-parametric Mann–Whitney tests, the study explored that there was a negative impact exerted on the return of the market indices during both the pre-event and short-event period, but the impact on the long event window was, surprisingly, not statistically significant.

Applying a similar approach, a series of authors such as Baker et al. (2020), Shehzad et al. (2020), Mishra et al. (2020), and Narayan et al. (2020), compared stock market indicates like profitability, liquidity, risk, etc., during the COVID-19 pandemic with earlier phases in India, Japan, the US, Germany, Italy, China. The results show that the impact of COVID-19 on the stock market is larger than other pandemics and comparable to economic shocks such as the financial crisis.

Chaouachi and Chaouachi (2020) had another approach in order to find out the effect that the COVID-19 pandemic has on the trading activities stock market. This study focused on the relationship between the number of cases of SARS-CoV-2 infection and the trading volume of the Saudi Arabia stock market (TASI) with data collected between March 2 and May 20, 2020. By using the autoregressive distributed lag model (ARDL), Chaouachi and Chaouachi (2020) could examine the effects of the epidemic on the market. stocks in both the short-run and long run (while previous studies were only able to test the impacts of COVID-19 on the market stocks in the short term). They discovered that there was a significant negative effect imposed by the COVID-19 pandemic on

[1] https://invst.ly/-wizi

the trading volume of the TASI in the long run. This means that when the epidemic is unfavorable, investors will be less willing to trade in the long term. In the short term, Chaouachi and Chaouachi (2020) did not find out a relationship between COVID-19 cases and market liquidity, but the authors explored that the previous day's number of COVID-19 cases has a positive effect on stock market trading volume. It was explained that the worsening epidemic caused investors to try to buy stocks with stable profitability and sell stocks with low profitability according to their assessment.

Applying the fixed-effects model (FEM) in the sample collected from the Turkey stock market (BIST) between February 2nd, 2020, to April 15th, 2020, Öztürk et al. (2020) also found significant negative effects on the returns of the overall BIST index. Sharing the same idea, Al-Awadhi et al. (2020) stated that the growth in the number of daily COVID-19 cases and the daily COVID-19 death toll reported exerted negative impacts on the Chinese stock market at the industrial level, except for those of information technology and pharmaceuticals industry.

Ghosh (2022) focused on assessing the impact of the COVID-19 pandemic on the stock market indices of the clean energy sector using quantile regression methods. This study utilized daily data sets on the four major categories of stocks: Morgan Stanley Capital International (MSCI) Global Alternative Energy Index, WilderHill Clean Energy Index, Renewable Energy Industrial Index (RENIXX) and the S&P 500 Global Clean Index. Adopting a multifactor capital asset pricing model, this paper can be considered a pioneer that explores the nexus between oil prices, interest rates, volatility index, and geopolitical risk upon the stock indices of clean and alternative sources of (renewable) energy in the COVID-19 pandemic situation. The findings showed that clean and alternative energy stocks are powerful instruments for diversification. However, the impact of the volatility index induced by infectious disease is negative and significant across quantiles.

Barakat et al. (2022) determined the impact of COVID-19 on the stock return in Egypt — one of the countries affected strongly by the pandemic. Using a multiple regression model and historical data from 20 listed firms in the EGX100 index between February 2020 and March 2022, the results indicated that COVID-19 significantly negatively impacted the stock's cumulative returns when used as an independent variable and measured using the cumulative coronavirus cases (CCC) and cumulative coronavirus deaths (CCD) collected from the World Health Organization (WHO) database.

Also demonstrated the impact of the pandemic outbreak of COVID-19 on daily stock returns, Rehman et al. (2022) gathered data on the Shanghai Stock Exchange (SSE) and the New York Stock Exchange (NYSE) from January 2, 2020, to April 2, 2020, during the COVID-19 pandemic period. The sample was then split into three event windows. The first window was the window of the post-COVID cases (January 20 for China and January 23 for the USA), the second window was the peak COVID-19 deaths (when deaths numbers reached three digits) window (January 23 for China and March 18 for the USA), and third event window was the peak COVID-19 confirmed cases (when confirmed cases reached four digits) window (January 25 for China and March 13 for the USA). The financial markets of the USA and China showed adverse non-linear reactions to this pandemic, which was unexpected and unprecedented. The Chinese stock market observed abnormal negative returns during COVID-19, peak deaths, and peak cases event windows. The USA stock market also showed the same trend except for the peak death event window, when the returns became positive. The high volatility of the financial markets became the hallmark of the pandemic.

Following the same approach but other authors have expanded the research sample to consider the effect of COVID-19 on the stock market in many countries around the world such as a group of countries heavily affected by COVID-19: the USA, Germany, India, China (Demirtaş et al., 2021) and England, Italy, Brazil, Russia, Spain (Basuony et al., 2021), G7 (Narayan et el. 2021), 23 emerging stock markets (Haroon & Rizvi, 2020), 27 countries that jointly account for 97% of the global market capitalization and 57% of the world population (Díaz et al., 2022), 64 stock markets (Ashraf, 2020b), 77 stock markets (Ashraf, 2020a). Criteria presented for the COVID-19 pandemic in the model were also more diverse such as the infection rate, the death rate, responses of governments (vaccinations, travel restrictions, school closures), the fear of COVID-19, the spread of COVID-19 fake information. However, most of these studies applied normal testing like pooled ordinary least square (POLS) regression, random effects model (REM), and FEM on the sample period ending before December 2020. And the research results were generally quite similar. Firstly, note the significant impact of the COVID-19 pandemic on the stock market indicators. Secondly, stating that COVID-19 promoted trading, but it also made greater instability in the hot bull market.

In general, there have been several studies discussing the impacts of the ongoing COVID-19 pandemic on the stock markets, but it is still limited to the early period of the pandemic and the context of some typical stock markets while those studies did mainly focus on examining such impact on the returns of the indices. Therefore, this study aims to contribute to the literature by analyzing the impact of the COVID-19 outbreak on the stock market liquidity — measured by trading volume — in a sample of both cross-sectional units (47 stock markets among the world's leading economies) and more comprehensive research timeframe (December 2019–January 2021). In addition, the estimation technique used is the generalized method of moments (GMM), which helps to overcome the disadvantages of the multiple regression model and ensures higher reliability and accuracy of the research results.

3. RESEARCH METHODOLOGY

3.1. Research sample

The research sample consisted of data from 47 stock markets from countries among the 55 largest economies worldwide in terms of GDP, according to World Bank statistics in 2020. These stock markets ranged in development from modest to high, and

their success is frequently regarded as a leading indicator for the overall economy. As the virus progressed, indicators of increased economic concern could be seen and forecasted based on the behavior of market indexes. The trade volume data came from the markets' databases, while the macroeconomic indicators came from the International Monetary Fund (IMF), the central bank, and the government statistics office of each country. The data were collected monthly for 14 consecutive months from December 2019 to January 2021, thus the research sample was a set of balance panel data comprising 644 observations, which was sufficient to perform further analysis.

3.2. Research model

In order to address the research question, the outbreak of COVID-19 was measured by the growth rate in the monthly COVID-19 cases reported, whilst market liquidity was represented by the growth rate of the total market trading volume. Furthermore, previous research has shown that macroeconomic factors can affect market liquidity; these factors were added to the research model as control variables. From there, the form of the proposed model is as follows:

$$CTVOL = \alpha + \beta_1 * CNDRC + \beta_2 * INF + \beta_3 * CIP + \beta_4 * CTP + \beta_5 * CNEER \quad (1)$$

Table 1. Description of the variable used in the research model

Variable		*Notation*	*Formula*	*Expected impact*	*Reference*
Dependent variable	*Monthly growth in total reported COVID-19 cases*	CNDRC	$ln\frac{DRC_t}{DRC_{t-1}}$	+/-	Chaouachi and Chaouachi (2020)
Control variables	*Monthly growth in the consumer price index*	INF	$ln\frac{CPI_t}{CPI_{t-1}}$	+/-	Watanabe (2004), Goyenko and Ukhov (2009), Lu-Andrews and Glascock (2010), Liu (2015), Chowdhury et al. (2018)
	Monthly growth in industrial production index	CIP	$ln\frac{IP_t}{IP_{t-1}}$	+/-	
	Monthly growth in the term premium	CTP	$ln\frac{TP_t}{TP_{t-1}}$	+/-	
	Monthly growth in the nominal effective exchange rate	CNEER	$ln\frac{NEER_t}{NEER_{t-1}}$	+/-	
Independent variable	*Monthly growth in stock market trading volume*	CTVOL	$ln\frac{VOL_t}{VOL_{t-1}}$		

Note: DRC_t — total number of COVID-19 cases reported in month t, VOL_t — a total trading volume of the stock market in month t, CPI_t — national consumer price index in month t, IP_t — national industrial production index in month t, TP_t — term premium in month t, obtained by subtracting the 3-month interbank rate from the interest rate of the 10-year treasury bond of month t, $NEER_t$ — nominal effective exchange rate in month t.

3.3. Estimation techniques

The unit root test proposed by Im et al. (2003) to test for the stationarity of a data series in the balance panel dataset is first performed on each variable in this research. Then, we estimate Model 1 using three commonly used methods: ordinary least squares (OLS), FEM, and REM. The validity of those estimations is assessed using several diagnostics including:

- multicollinearity test, in which the variance inflation factor (VIF) of each variable is compared with a threshold value (equal to 4 in this paper);
- heteroskedasticity tests including the Breusch-Pagan test for OLS estimate, Lagrange multiplier (LM) approach for REM, modified Wald statistic suggested by Greene (2000) for FEM;
- autocorrelation test for panel data using Wooldridge (2002) method.

Furthermore, endogeneity, heteroskedasticity, and autocorrelation are common in such models relating to macroeconomic factors, resulting in biases in the estimated results. To address these issues, a proper two-step system GMM (SGMM) estimation is performed, which also contributes to more trustworthy results than the one-step SGMM approach. This type of estimation does not include parameters for evaluating the fitness of the model; however, Hansen's (1982) J-test on the validity of instrumental variables, as well as Arellano-Bond's test on the fit of the lagged variable, are used to examine the validity of the entire estimation.

4. RESEARCH RESULTS

4.1. Correlation matrix

Table 2 illustrates the results of the correlation matrix among the variables in the model, which is used to assess the linear relationship among variables. The independent variable *CNDRC* has a positive correlation with the growth variable of trading volume in the stock market, *CTVOL*.

Table 2. Correlation matrix

Variable	*CTVOL*	*CNDRC*	*INF*	*CIP*	*CTP*	*CNEER*
CTVOL	1.0000					
CNDRC	0.1330	1.0000				
INF	0.0880	-0.0564	1.0000			
CIP	-0.0840	-0.2842	0.0873	1.0000		
CTP	0.0752	0.0537	-0.0100	-0.0677	1.0000	
CNEER	-0.0195	-0.1471	-0.0412	0.1284	-0.1148	1.0000

4.2. Tests for the stationarity

The results of the unit-root tests were presented in Table 3, which implied that there were no non-stationary series among the proposed variables. Therefore, further analysis can be conducted using those proposed variables.

Table 3. Unit-root tests for variables

Variable	*Type of statistic*	*Statistic value*	*p-value*
INF	t-bar	-3.2362	
	t-tilde-bar	-2.2029	
	Z-t-tilde-bar	-8.3377	0.0000
CIP	t-bar	-3.1643	
	t-tilde-bar	-2.2155	
	Z-t-tilde-bar	-8.6139	0.0000
CTP	t-bar	-4.2938	
	t-tilde-bar	-2.4960	
	Z-t-tilde-bar	-11.3946	0.0000
CNEER	t-bar	-2.8732	
	t-tilde-bar	-2.0596	
	Z-t-tilde-bar	-7.3307	0.0000
CNDRC	t-bar	-4.0794	
	t-tilde-bar	-2.2603	
	Z-t-tilde-bar	-9.2040	0.0000
CTVOL	t-bar	-4.1356	
	t-tilde-bar	-2.5885	
	Z-t-tilde-bar	-11.1413	0.0000

4.3. Regression estimation

The theoretical model is first estimated using the OLS approach. We also fit the proposed model with FEM and REM estimation. The results of the estimated model using those methods are illustrated in Table 4.

Table 4. Estimation of Model 1 with OLS, FEM and REM approaches

Independent variable	*Approach*		
	OLS	*FEM*	*REM*
CNDRC	0.0417939***	0.0432978**	0.0417939***
	0.0158716	0.0171273	0.0158716
INF	6.948585**	6.821964*	6.948585**
	3.25723	3.64954	3.25723
CIP	-0.2879515	-0.2666678	-0.2879515
	0.2738712	0.2891002	0.2738712
CTP	0.0875784	0.0901138	0.0875784
	0.0659301	0.0733568	0.0659301
CNEER	0.588099	0.8317098	0.588099
	1.507438	1.747817	1.507438
Constant	-0.018126	-0.0189887	-0.018126
	0.0322234	0.0341184	0.0322234
N	431	431	431
R-Squared	0.0359	0.0358	0.0359

*Note: ***, **, * denote significance level of 1%, 5% and 10% respectively.*

Surprisingly, the estimated result obtained from a random-effects model was pretty much the same as that obtained using the OLS approach, while both share some common characteristics with the estimation of Model 1 with a fixed-effects model. Overall, it is clear that the coefficients of the *CNDRC* variable are positive and statistically significant (at 5% for REM, others at 1%). Regarding the macroeconomic variables, except for *CIP* (the monthly growth rate in industrial production), all other variables have a positive impact on the dependent variable *CTVOL*. However, among those control variables, only *INF* (the monthly inflation rate) has significant coefficients (at 5% for OLS and REM and only 10% for FEM).

Then, several diagnostic tests were run to assess the validity of the model, including the tests for multicollinearity, heteroskedasticity, and autocorrelation. The results of those tests are demonstrated in Table 5 below.

Table 5. Diagnostics of regression model

Panel A: Test for multicollinearity			
Independent variable	***VIF***	***1/VIF***	***Conclusion***
CNDRC	1.11	0.904879	No multicollinearity
INF	1.01	0.987948	No multicollinearity
CIP	1.11	0.904037	No multicollinearity
CTP	1.02	0.983331	No multicollinearity
CNEER	1.05	0.956526	No multicollinearity
Panel B: Test for heteroskedasticity			
Estimation approach	***Chi-square***	***Prob > Chi-square***	***Conclusion***
OLS	8.41	0.0037	Heteroskedasticity
REM	0.00	1.0000	No heteroskedasticity
FEM	10009.69	0.0000	Heteroskedasticity
Panel C: Test for autocorrelation			
F-statistic	***Prob > F***	***Conclusion***	
0.252	0.6180	No autocorrelation	

It is clear that the multicollinearity problem is not present since the VIF values of the independent variables ranged from 1.01 to 1.13, which was much lower than the threshold value of 2. The F-statistic of the Wooldridge-test of autocorrelation equals 0.252, which indicates that the problem of serial correlation is not present in the model.

However, when it comes to the tests for heteroskedasticity, the results were mixed among the three approaches to estimation. While the LM test for the random-effects model implies that heteroskedasticity does not exist, other tests for the OLS and REM methods of estimation all suggest that such a problem exists.

4.4. GMM estimation

Due to the risk that the problem of heteroskedasticity as well as the problem of endogeneity may exist in such a model with macroeconomic variables, we further estimate Model 1 using the GMM. More specifically, the two-step GMM system is used in this paper to further account for those issues. The results of the GMM estimation for the research model were presented in Table 6.

Table 6. Two-step system GMM estimation of Model 1

Panel A: Two-step system GMM estimation						
CTVOL	***Coef.***	***Std. error***	***Z***	***P > |z|***	***95% conf. interval***	
L^1_{CTVOL}	-0.3629616	0.0026329	-137.85	0.000	-0.3681221	-0.3578012
CNDRC	0.1263124	0.0037680	33.52	0.000	0.1189272	0.1336976
INF	20.958390	1.0460090	20.04	0.000	18.908250	23.008530
CIP	-0.0898650	0.0231180	-3.88	0.000	-0.1352977	-0.0444323
CTP	0.0784179	0.0047761	16.42	0.000	0.0690569	0.0877789
CNEER	1.3757930	0.2841275	4.84	0.000	0.8189131	1.9326720
Constant	-0.0930968	0.0067587	-13.77	0.000	-0.1063436	-0.079850
Panel B: Overall information						
Items						***Value***
Number of groups						47
Number of observations						431
Number of instruments						46
Arellano-Bond test for AR(1) in first differences, p-value						0.047
Arellano-Bond test for AR(2) in first differences, p-value						0.087
Sargan test of overidentifying restrictions, p-value						0.000
Hansen-test of overidentifying restrictions, p-value						0.206
GMM instruments for levels — Hansen-test, p-value						0.089
iv(*INF CTP*, eq(level)) — Hansen-test, p-value						0.147

For this estimation, Arellano-Bond tests for autocorrelation and Hansen tests for overidentification restrictions are all satisfied, implying that the estimation has little or no issue. Surprisingly, all independent variables impose significant effects on the dependent variable, while the sign of the coefficients of all the variables stays the same as those in the aforementioned estimations.

More specifically, the fact that the coefficient of *CNDRC* is positive and statistically significant at the 1% level implies that the monthly growth in the number of COVID-19 cases has a positive impact on the monthly growth in the trading volume of the stock markets. In addition, except for *CIP*, all other control variables have significantly positive coefficients. Thus, the regression function could be written as:

$$CTVOL = -0.0931 - 0.3629 * L^1_{CTVOL} + 0.1263 * CNDRC + 20.9584 * INF - 0.0899 * CIP + 0.0784 * CTP + 1.3758 * CNEER \quad (2)$$

5. DISCUSSION

The estimated results imply that the monthly growth in the number of newly reported COVID-19 cases had a positive effect on the monthly growth of the trading volume of stock markets around the world. In other words, in addition to the effects of macroeconomic factors, the spread of the COVID-19 pandemic has considerably led to an increase in trading activity on stock exchanges worldwide. Surprisingly, the findings contradict those of earlier studies on the impact of pandemic on the trading activity by McTier et al. (2013) and Chaouachi and Chaouachi (2020). However, such disparities in findings can be explained by the differences in the research context, such as the time period in which each study was conducted, the stock markets themselves, and the type of disease being studied.

McTier et al. (2013) investigated the impact of seasonal influenza on the NYSE trading value. Although the seasonal flu caused a large number of infections and a high death toll, it was still regarded as a common disease that did not necessitate strict government action, such as social isolation and lockdown, to combat the outbreak. As a result, as McTier et al. (2013) observed, influenza may have primarily affected the stock market through the health and psyche of individual investors. They also suggested that since only a small portion of individual investors were worried about becoming infected when trading in the centralized market, the trading activity became less intensive throughout the outbreak period.

As for the study of Chaouachi and Chaouachi (2020), although they also studied the impact of COVID-19 on the trading volume, the study turned out to be limited in terms of research scope. The research sample was taken from only one market for a short period in the very first stage of the pandemic, between March and May 2020. The research sample was drawn from only one market for a brief period during the pandemic's early stages, between March and May 2020. During this time, the massive drop in trading volume caused by the pandemic's widespread spread resulted from investors' anxiety as well as significant uncertainty about the economy. As a result, they would not take the risk of altering their portfolios to undertake a large number of transactions during such a difficult and unpredictable period. In this article, the sample period was extended from December 2019 to January 2021, in addition to the diversity of indices included in the sample. During that time, investors felt a wide range of emotions, from anxiety, panic, and uncertainty about the future to being calm and proactive in response to what was happening right then. Several waves of the COVID-19 outbreak may, in fact, provide enough time for investors and governments to figure out how to deal with the ongoing pandemic. While investors sought to maximize their wealth, governments were required to take necessary steps to stabilize the economy and protect public health.

In addition, the high degree of linkage between world stock markets also contributes to promoting investment flows from places where the epidemic is spreading to places where it is well controlled. Therefore, the general trend identified in our sample is a positive correlation between disease severity and

stock market trading volume. In particular, the world stock market data until the end of March 2021 also shows that the above positive correlation is consistent with reality. Because despite the global economic downturn in general, the number of new COVID-19 infections is still increasing day by day. Most of the stock markets have recovered. Especially in the USA, Germany, Japan, China, Korea, Russia, Australia, etc., trading value and volume also increased by 1.2–1.7 times compared to the one before the epidemic appeared. The number of new accounts opened suddenly increased, and the trading volume also rose rapidly.

Thus, the increasing trading volume of the stock markets all over the world can be explained as follows.

When the number of newly reported COVID-19 cases was reported, investors' confidence seemed to weaken. There were concerns raised about the uncertainty of the economy, which is directly tied to the risk and short-term profitability of the investors' portfolios. Therefore, in the first place, some investors might have sold off their assets to take profits when the ongoing pandemic turned into a much worse situation, causing the indices to go down significantly. The considerable decrease in the indices, in combination with the information about the pandemic, could have been a negative signal for other investors, which resulted in irrational decisions that they made, such as herd behaviors and instant panic-based selloffs. The final consequence of such actions is that the stock market crashed while the trading volume of the whole market surged, which would last for several trading sessions.

In the long term, the strong responses of governments, such as social distancing or the lockdown of a vast geographical area, might have helped to control the widespread of the pandemic. However, there would always be trade-offs between implementing those measures and the growth of the economy, such as disruptions to trade and industrial production. As a result, many people would look for different types of passive income. Of the most common means of passive income, stock investment seemed to be one of the most suitable options due to the low level of barriers to accessing the stock market, especially the over-the-counter ones. Moreover, in many countries around the world, the government stimulus packages, in terms of cash and check payments, led to a decrease in both interest rates and tax rates as well as a reduction in the cost of utilities, which even further lowered the barriers to participating in the stock market. Those are two main reasons for the jump in the number of new investors (F0) and, consequently, the significant growth in the trading volume on the stock markets during the COVID-19 outbreak.

As the COVID-19 epidemic showed signs of "cooling down" with a decrease in the number of reported cases, several governments decided to halt anti-epidemic measures to promote the recovery of the economy. The investors, who had newly participated in the market during the time of social distancing, then returned to their main jobs before the outbreak, thus resulting in lower trading volume on the stock market. There would also be a drop in capital flows to the stock market, especially from individual investors.

There has always been a high degree of integration among countries' financial markets all over the world. This would allow the flows of capital to come from nations where the pandemic was spreading to those where the disease was well controlled. As a result, the countries in which the pandemic would become worse would likely observe fewer trading activities and consequently lower trading volume on the stock market since investors would try to spend their money on other markets that were operating in the countries with proper control over the ongoing COVID-19.

6. CONCLUSION

By applying the GMM approach to a sample of 47 stock markets around the world that covered a decent period from December 2019 to January 2021, the research pointed out that there was a statistically significant positive impact of the COVID-19 outbreak on the stock market liquidity. In other words, as COVID-19 continued to spread, trading volume on the stock market would increase. The research results, although contrary to the previous studies in the very early stages are consistent with the actual developments up to the present. At the end of March 2021, despite the general global economic recession and the number of new COVID-19 recorded cases continuously increasing day by day, the stock markets in many countries did seem to be recovering. The main indicators of the USA, Germany, Japan, China, Korea, Russia, and Australian markets all increased from 1.2 to 1.7 times compared to themselves before the global outbreak at the end of 2019[2]. Besides, the number of newly opened accounts soared, while trading volume and trading value were much higher during the pandemic period.

Based on these findings, some recommendations were proposed to the government agencies.

Supporting the enterprises, both in terms of payment, tax reduction or credit for the firms to survive during the tough period.

Creating such conditions, for instance, the improvement of the technological infrastructure of the over-the-counter market or the ease of access to leverage (at a reasonable amount) for investors is also essential. This would not only provide a source to raise the income of a proportion of the population but also help the stock market to get ready for being the place where enterprises could raise funds for operating activities when the economy settles the new normal after the lockdown. Since industrial production was suspended while the pandemic was still ongoing, it is important to maintain the liquidity of the stock market which helps to allocate the funds efficiently and contribute to the recovery of the economy and the financial system.

Closely monitoring activities in the market as well as cash flow trends, thereby proactively warning investors in a timely manner and implementing reasonable measures in case there is the a "bubble" in the market. Because a sudden large cash flow, continuously pouring into the stock market could result in a "bubble" in the market, which if broken

[2] https://invst.ly/-wj15

will cause profound consequences for the financial market and the whole economy.

Besides the findings, this study also has its limitations in terms of research scope. The sample was only collected from a group of countries while the time frame could only cover a decent period since the pandemic is still ongoing. In addition to this, the research did only focus on a specific aspect of the stock markets — which was the trading volume. So, further studies should consider obtaining another sample that includes more countries all over the world, extending the study period or increasing the frequency that the data is collected weekly or even daily. Furthermore, focusing on evaluating the difference in the impact between developed, developing and emerging markets or examining the impact of COVID-19 on other market indicators such as profitability or risk could also result in interesting findings.

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