

Factors Impact of the Stock Market Performance During the Covid-19 Crisis

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Abstract

Research originality: This research adds the exchange rate variable and the use of the Vector Autoregressive (VAR) model that can add to the financial literature.

Research Objectives: This study examines how macroeconomics can impact a business during a crisis. The stock market has associated access with new COVID-19 cases and new deaths in Indonesia. During the pandemic, the exchange rate is critical, so this study observes the exchange rate of IDR against USD. This paper investigates the relationship between new cases, new deaths, and the exchange rate with the stock market index.

Research Methods: The study retrieves the daily data from March 2, 2020, to June 30, 2022, from Our World in Data, Indonesia's stock exchange, and Indonesia's Statistic Central Bureau. We have used the ADF, Vector Autoregressive (VAR) Model, impulse response function, and the Toda Yamamoto causality test.

Empirical Results: The findings reveal a significant negative impact of new COVID-19 cases, new deaths, and exchange rates on the stock market. Toda Yamamoto's causality analysis reveals substantial evidence of unidirectional daily growth of new COVID-19 deaths in the stock market and a bidirectional causality of new COVID-19 cases and new COVID-19 deaths.

Implications: The policy implications of this study are to stabilize markets, impact overall financial stability, support entrepreneurship, and develop a competitive market environment that can encourage innovation.

Keywords:

stock market; covid-19 crisis; exchange rate; VAR

How to Cite:

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INTRODUCTION

Numerous novel coronavirus (COVID-19) cases occurred quickly and have spread outside the Wuhan region and other countries. In early March 2020, the WHO announced COVID-19 as a pandemic; hence, the disease's anticipation was as soon as possible to global attention. Based on a WHO publication on November 8, 2020, it had confirmed more than 49.7 million cases and over 1.2 million deaths globally. The outbreak of COVID-19 has affected countries around the world (Alam et al., 2020). The countries are facing healthcare problems and an unprecedented economic downturn. The IMF has predicted that the pandemic has negatively impacted activity more in the first half of 2020, and the recovery projection will be more gradual. Suryahadi et al. (2020) noted that the economic impact reduced the economic growth rate 2020 from around 5% to between 4.2% and -3.5%.

There has been much research on the impact of the novel coronavirus (COVID-19) pandemic on financial markets and volatility (Al-Awadhi et al., 2020; Albulescu, 2020; N. Apergis & Apergis, 2022; Fu & Shen, 2020; Harjoto et al., 2021; Liu et al., 2020; Mubarak & Al Arif, 2021; Narayan et al., 2020; Sharma, 2020; Shen et al., 2020); the exchange rate (Devpura, 2021; Iqbal et al., 2020; Narayan, 2020a, 2020b, 2022; Iyke, 2020), inflation (Alam, 2020; Apergis & Apergis, 2021; Asravor & Fonu, 2021; Blundell et al., 2020; Bresser-Pereira, 2020; Jelilov et al., 2020; Nasir et al., 2021; Seiler, 2020; Shah et al., 2020); oil price (Ajami, 2020; Meher et al., 2020; Narayan, 2020b; Prabheesh et al., 2020); value chain (Qin et al., 2020), and the policy during the COVID-19 (Song et al., 2020; Zhu et al., 2024). The research gap in this study is a combination of macroeconomic variables and pandemics that can impact stock prices and the response to the relationship.

Overall, countries with the most vulnerability during the first four months of the COVID-19 pandemic faced significant deterioration in some key financial markets. India and Indonesia are two such examples. However, the daily market effects of the COVID-19 pandemic in its first four months were transitory, lasting only a few days. Additional analysis suggests that the two countries' equity and US-based foreign exchange markets became (or remained) resilient in the face of growing cases of COVID-19 inflections and deaths in India over the recent months (May 2, 2020, to January 22, 2021).

At the time of the war and pandemic, many reports in the popular press predicted that the pandemic and war would have a tremendous impact on the economies of severely affected countries. The dependence between the stock market and cryptocurrencies increases aftershocks in pandemics and wars, so it becomes higher when the stock market is under stress (Abdou et al., 2024). Given the mixed results of the above studies and the significant role of the Indonesia stock exchange composite in Indonesia, there is a need to understand better the coronavirus cases and the exchange rates influencing its development.

In this paper, we test the relationship between daily case growth and deaths and the exchange rate towards the stock market using the vector autoregressive model (VAR),

impulse response function, and the Toda Yamamoto causality test. In this article, we position our research question within this predictability literature by asking whether the standard question in this literature of COVID-19 and exchange rates predicts stock market returns.

We ask a different question: Were the daily growth cases, deaths, and exchange rate shocks on stock returns? Our objective is to understand the response effect of the daily growth of new cases and deaths and the exchange rate on the stock market. We hypothesize that COVID-19 and the exchange rate impact and shock the stock market. Our motivation for this hypothesis is based on Narayan et al. (2020), which shows that compared to normal times, the impact of exchange rates is much more substantial on the stock market during the pandemic, and the exchange rate depreciation increases stock returns. Behera & Rath (2021) reveal that the impact of the ongoing COVID-19 pandemic on the stock market is positive. Rizvi et al. (2021) indicate that Indonesia is the most vulnerable during the COVID-19 pandemic, experiencing significant downturns in several of its critical financial markets.

The novelty of this paper is that the daily growth of new cases, new deaths, and exchange rates have a negative impact on the stock market. Also, the response of new deaths, new cases, and exchange rates significantly impacted IDX. The new cases, deaths, and exchange rates have a long-term relationship with the stock market. These results, in line with Mao et al. (2024), reveal that exchange rates have a long-run relationship with the stock market. However, the results of Kwofie & Ansah (2018) study show that the stock market and exchange rates have a long-run and short-run relationship. When new cases, deaths, and exchange rates change, then the movement of the stock market will be in line with them and have a robustness of 45.81%.

METHODS

This paper uses secondary data, namely the daily growth of COVID-19 cases and daily growth of COVID-19 deaths in Indonesia from March 2, 2020, to June 30, 2022, retrieved from the Our World in Data. We collected data from March 2 based on the first case in Indonesia. The Indonesia stock market index (IHSG) closing price was retrieved from Indonesia's stock exchange, and the exchange rate (IDR/USD) was collected from Indonesia's Statistic Central Bureau.

This paper has used Engle & Granger (2015) causality test and Johansen cointegration to determine whether the new cases, new deaths, and exchange rate with IDX (Indonesian Stock Exchange) have been linked. For time analysis, it is essential to determine whether the data set is stationary or not. If the mean-variance and standard deviation are constant, it is static over time. The dataset's static nature is tested using the ADF (Augmented Dickey-Fuller) test proposed by Dickey & Fuller (1981). This study found that there is no cointegration, so we use VAR analysis in this study.

ADF test is based on the null hypothesis that $H_0: Y_t$ is not $I(0)$; thus, $H(0)$ specifies the data of the specified variable is not stationary.

Equation (1) shows the entire model with trends and intercepts:

$$\Delta Y_t = \alpha + \beta T + \rho Y_{t-1} + \sum_{i=1}^k Y_i \Delta Y_{t-i} + e_t \quad (1)$$

Note:

H_0 : Y_t has a unit root test or is not stationary

H_1 : Y_t is stationary

Y_t is the variable selected for the period t , Δ is the difference operator, T denotes a time trend, e_t is an error term disturbance with mean 0 and variance as σ^2 , and k corresponds to the number of lags of the differences in the ADF equation.

Toda Yamamoto's test is to find the causality path among the variables. Toda Yamamoto developed the Toda Yamamoto causality method. It is a tool for discovering whether a one-time series is a substantial long-term relationship between variables. The test of the Granger causality uses the following equations (2) and (3):

$$Y_t = \beta_0 + \sum_{k=1}^M \beta_k Y_{t-k} + \sum_{i=1}^N \alpha_i X_{t-i} + U_t \quad (2)$$

$$X_t = \beta_0 + \sum_{k=1}^M \beta_k X_{t-k} + \sum_{i=1}^N \delta_i Y_{t-i} + V_t \quad (3)$$

The VAR model describes the evolution of a set of k variables. Each period of time is numbered ($t=1, \dots, T$). The variables are collected in vector Y_t , which is of length k . The vector was modeled as a linear function of its previous value. VAR models are characterized by their order, which can be referred to as the number of an earlier period the model will use. A lag is the value of a variable in a previous period. Generally, a p th-order VAR refers to the VAR model, which can include lags for the last p periods. A p th-order VAR is denoted as VAR(p).

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + e^t \quad (4)$$

The variables of the form Y_{t-i} indicate that the variable's value i periods earlier and are called the "ith lag" of Y_t . The variable c is a k -vector of constants serving as the intercept of the model. A_i is a time-invariant ($k \times k$)-matrix, and e_t is a k -vector of error terms. This researcher chose to use VAR analysis because there was no cointegration in this research.

RESULT AND DISCUSSION

In this section, we show the result of descriptive statistical analysis, correlation matrix, unit root test, ARDL, Lag selection criteria to describe our data and analysis what is the model that we used in this research. According to this study, we have no cointegration between the variable, so we use VAR model analysis.

Table 1 shows the average daily growth of new COVID-19 cases is 4527.875, and the standard deviation is 3873.182; the average daily growth of new COVID-19 deaths is 124.9310, and the standard deviation is 90.60437; the average exchange rate is 15406.88, and the standard deviation is 10421.84; and, the average stock price is 5465.623, and the standard deviation is 617.0741. The skewness of stock price is negative; the skewness of new cases, the new death, and the exchange rate are positive. If the

skewness is negative, the data are negatively skewed or skewed left. If the skewness is positive, the data are positively skewed or skewed right.

Table 1. Descriptive Statistics

Variables	Mean	Median	Standard Deviation	Skewness	Kurtosis	Jarque-Bera	Probability
NC	4527.875	4176	3873.182	1.281220	5.315191	158.5192	0.000000***
ND	124.9310	116	90.60437	0.903376	4.012321	57.00990	0.000000***
ER	15406.88	14464	10421.84	12.46356	156.8032	322678	0.000000***
IDX	5465.623	5356.005	617.0741	-0.143931	1.761266	21.49697	0.000000***

Notes: *** denote statistical significance at the 1% levels.
Source: Authors' work.

Table 2 shows the correlation between the variables in the study. Stock market indices positively correlate with new cases and new deaths due to COVID-19 and negatively correlate with the exchange rate. The stock market has high positive correlations with the NC and ND, i.e., 0.776290 and 0.792837, respectively.

Table 2. Correlation Matrix

Variables	NC	ND	ER	IDX
NC	1	0.924565	-0.104893	0.776290
ND	0.924565	1	-0.107896	0.792837
ER	-0.104893	-0.107896	1	-0.130726

Source: Authors' work

Table 3 shows the ADF (Augmented Dickey-Fuller) test at the level and in the first difference. The ADF test is to ascertain whether the data in the study are stationary or not. We can conclude from the table that many variables are stationary at the level and first difference. In this study, first, we use the autoregressive distributed lag (ARDL) test, but the test shows no cointegration, so we use the VAR model, impulse response function, and Toda Yamamoto.

Table 3. Unit Root Test

Variables	Intercept		Intercept, Linear Trend		None	
	t-Statistic	Probability	t-Stat	Probability	t-Stat	Probability
NC	1.116809	0.9976	-0.350778	0.9889	1.891086	0.9862
D(NC)	-3.805492	0.0032***	-4.037124	0.0085***	-3.5999020	0.0004***
ND	-0.337795	0.9161	-2.251712	0.4588	0.928449	0.9059
D(ND)	-19.42271	0.0000***	-19.45282	0.0000***	-19.34923	0.0000***
ER	-17.85051	0.0000***	-18.05604	0.0000***	-1.786411	0.0704*
D(ER)	-12.32157	0.0000***	-12.30167	0.0000***	-12.34175	0.0000***
IDX	-1.204886	0.6733	-4.047062	0.0083***	0.023317	0.6895
D(IDX)	-8.799499	0.0000***	-8.824691	0.0000***	-8.812920	0.0000***

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 percent levels.
Source: Authors' work

The method of this study differs from Albuлесcu (2020), which uses ordinary least squares (OLS) regression. Ciner (2021) uses the Lasso regression, Johansen (1988), Johansen & Juselius (1990), and Kasa (1992) use the cointegration test to consider a compact maximum likelihood test to examine cointegration relations in a whole system of equations, and Asravor & Fonu (2021) employ the ARDL cointegration approach to examine the long-term and short-term relationships.

The bound testing of the cointegration test is used to detect the long-term balance of the research model. We can perform a long-term balance by comparing a critical value and F-statistics on the testing results. The independent variable (IDX), which integrates to the level, is assumed to be the lower bound, while the independent variables (NC, ND, and ER) integrated to the first difference are considered an upper bound. There is no cointegration if the F-statistics value is below the lower bound, and cointegration will occur if it is above the upper bound. However, we cannot conclude the cointegration if the F-statistics value is between the lower and upper bound.

Table 4. Bound Testing Result

Model	F-statistics	Significant	Lower Bound	Upper Bound
IDX	1.9048873	10%	2.72	3.77
		5%	3.23	4.35
		2.5%	3.69	4.89
		1%	4.29	5.61

Source: Authors' work

Table 4 shows the stock price in Indonesia is at the level with the significance of 5%, 2.5%, and 1% in the Bound test. The value of F-statistics was lower than a lower and upper bound value, which meant there was no cointegration among variables of the stock prices in Indonesia. When no cointegration is confirmed, we proceed with simple Granger causality. The VAR equation should be specified on stationary data. There are various reasons why cointegration is not confirmed. Before we have an equation of VAR, we select the lag length criteria. The lag length criteria are shown in Table 5.

Table 5. Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-9393.891	NA	1.41e+21	60.05042	60.09830	60.06956
1	-9292.644	199.2594	8.19e+20	59.50571	59.74509*	59.60137
2	-9252.106	78.74528	7.00e+20	59.34892	59.77979	59.52111
3	-9226.364	49.34629	6.58e+20	59.28667	59.90904	59.53539
4	-9200.518	48.88352	6.18e+20	59.22376	60.03763	59.54900
5	-9165.807	64.76476*	5.48e+20*	59.10420*	60.10957	59.50597*

Notes: *indicates lag order selected by the criterion

LR : sequential modified LR test statistics (each test at a 5% level)

FPE : Final prediction error

AIC : Akaike information criterion

SC : Schwarz information criterion

HQ : Hannan Quinn information criterion

Source: Authors' work

We have selected lag number 5 from Table 5 because AIC has met the criteria supported by LR, FPE, and HQ. We have also tested the stability of the data and concluded it was stable because it was lower than 1. After that, we use the lag number to estimate VAR. The result of vector autoregressive models shows that the COVID-19 daily growth in new cases, daily growth in new deaths, and exchange rate negatively and significantly impact the stock market price indices. If the daily growth cases, daily growth deaths, and exchange rate (depreciates) increase, the IDX will decrease, and vice versa. The findings that daily growth cases negatively impact stock market price support the result from (Al-Awadhi et al., 2020; Erdem, 2020; Harjoto et al., 2021). The daily growth deaths has produced a negative and significant impact on the stock market price, supporting the results of the research of Al-Awadhi et al. (2020) but contradicting the results of Erdem (2020). Baek et al. (2020) examine the effect of COVID-19 on stock market volatility and find both the negative and positive impacts of COVID-19.

Table 6. VAR Model

Variables	IDX	NC	ND	ER
IDX(-1)	0.0572	0.0021	-0.4037	-0.0003
IDX(-2)	-0.0948	-0.0004	-0.1825	8.070×10^{-5}
IDX(-3)	0.2348	0.0007	0.0629	-0.0003
IDX(-4)	-0.0092	0.0056	0.0500	-1.235×10^{-6}
IDX(-5)	0.1125	-0.0034	-0.2413	0.0003

Source: Authors' work

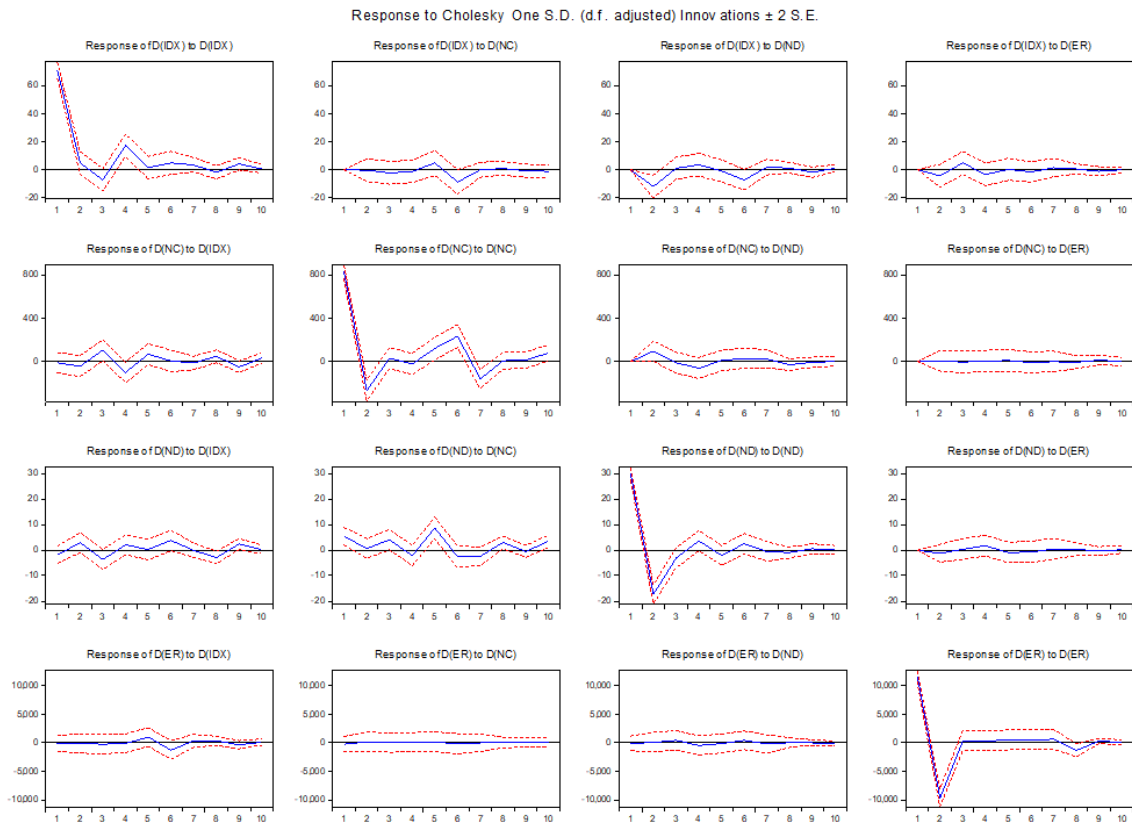
The exchange rate change has a negative and significant impact on the stock market price, supports the findings of (Mroua & Trabelsi, 2020; Sui & Sun, 2016), but is adverse to (Nguyen et al., 2020; Okorie et al., 2021). After we estimate the VAR model, we do the impulse response function.

From Figure 1, the response of stock prices to one standard deviation shock of new cases and for the initial stage is decreased until period 3. It will increase for the next period and become positive until period 5. For periods 5 to 6, the stages will decrease and become negative. The next period will increase from 6 to 7 and become neutral until period 10. The daily growth of the new COVID-19 cases at the beginning decreased the IDX; then, it increased after the people had been vaccinated; however, IDX dropped after the new variant of COVID-19 spread from India as time passed, and the IDX became stable. It can be concluded that the shock of daily new cases can significantly impact IDX.

The response of stock prices to one standard deviation shock of new deaths and for the initial stage is decreased until period 2. It will increase for the next period and become positive until period 4. For periods 4 to 6, the stages will decrease and become negative. The next period will increase from 6 to 7 and become neutral until period 10. The daily growth of the COVID-19 death cases decreased the IDX initially; then it increased after the people had been vaccinated; however, IDX dropped after the new

variant of COVID-19 spread from India time passed, and the IDX has become stable. It can be concluded that the shock of new deaths can significantly affect IDX.

Figure 1. Impulse Response Function



Source: Authors' Work

Table 7. Toda Yamamoto Causality Test

Null Hypothesis:	F-Statistics	Prob.	Conclusion
NC to IDX	1.32646	0.2527	Does not have a relationship
IDX to NC	1.57594	0.1666**	
ND to IDX	3.74167	0.0027***	Unidirectional relationship
IDX to ND	1.26832	0.2775	
ER to IDX	0.72702	0.6036	Does not have a relationship
IDX to ER	1.59640	0.1608	
ND to NC	2.81037	0.0169**	Bidirectional relationship
NC to ND	13.8590	3.E-12***	
ER to NC	0.03111	0.9995	Does not have a relationship
NC to ER	0.88409	0.4920	
ER to ND	0.15190	0.9794	Does not have a relationship
ND to ER	1.01398	0.4095	

Notes: *** and ** indicate statistical significance at 1 and 5 percent levels.

Source: Authors' work

The result from Hoshikawa & Yoshimi (2021) is that the number of daily new infections positively shocks the South Korean stock market, but the daily new cases have a negative trend. The response of stock prices to one standard deviation exchange rate shock and the initial stage decreases until period 2. The stages will increase and become positive until period 3. For the next period, IDX will drop until period 4 and increase in period 5. For the period of 5 to 10, it will be neutral. Initially, the exchange rate negatively impacted IDX during the pandemic but did not impact the stock market during our observation. It can be concluded that the exchange rate responds significantly to the stock prices in Indonesia. Our analysis does not validate and extend the findings of (Delgado et al., 2018). The depreciation of IDR against the USD will make Indonesian products more competitive globally; hence, the firms in Indonesia will export more and increase the stock price. People will find imported products more expensive if IDR depreciates, but in the end, the regulators will balance this by introducing more policies and regulations. The increasing stock prices in Indonesia could explain this; investors should convert the USD to IDR.

After making impulse responses, we perform Toda-Yamamoto. Table 7 shows the Toda-Yamamoto causality test results for the pairwise, whether to reject or accept the null hypothesis based on the probability. The ND has a unidirectional relationship to IDX, meaning that the daily growth of deaths has a directional relationship with IDX. ND to NC has a bidirectional relationship. However, the results show no relationship between NC to IDX, ER to IDX, ER to NC, and ER to ND. Additionally, the results show no statistically significant effect generated by the depreciation or appreciation of the exchange rate on the stock market. Since no causality was found in all directions between the variables found, the estimation results show a negative effect of the exchange rate on the stock market.

Table 8. Robustness Test

Variable	Coefficient	Std. Error	z-Statistics	Prob.
NC	0.102579	0.015906	6.448865	0.0000
ND	3.858330	0.641160	6.017731	0.0000
ER	0.312573	0.001655	188.8806	0.0000
R-squared	0.458096	Adjusted R-squared		0.454666
Rw-squared	0.623513	Adjusted Rw-squared		0.623513

Source: Authors' work

The robustness test was 45.81% from the table above, while this study did not examine 54.19% of the other variables. In the study of Kwofie & Ansah (2018), in line with this research, GSE market returns and exchange rates have a long-run and short-run relationship. Al-Awadhi et al. (2020), Al-Qudah & Houcine (2022), Apergis & Apergis (2022), Erdem (2020), Harjoto et al. (2021), Rizvi et al. (2021) and Putri et al. (2023) show that stock returns are significantly negatively related to daily growth in total confirmed cases and the daily growth in total deaths caused by COVID-19.

COVID-19 caused a negative shock to the global stock markets. The pandemic's impact is more significant in emerging countries and small firms than in developed countries and in better profitability and growth firms. Sharif et al. (2020) have used continuous wavelet transform; the wavelet-based causality runs from the COVID-19 pandemic to the US stock market and reveals that COVID-19 significantly impacts US stock markets in the short term. The US markets reacted to the oil shock rather than COVID-19 news; the oil price strongly affected the US stock market.

Liu et al. (2021) confirmed that the outbreak of COVID-19 has seriously affected firms' average production and operating activities and has induced a massive shock on financial markets. They demonstrate that firms with high operating flexibility experience a more favorable market response when facing the impact of the pandemic. Ciner (2021) stated that stock market stabilization should be a vital part of the policy as the economy recovers from the crisis. Topcu & Gulal (2020) investigated the effects of COVID-19 on emerging stock markets from March 10 to April 30, 2020. Findings reveal that the adverse impact on emerging stock markets has gradually fallen and begun to taper off in mid-April. The outbreak's influence is the highest in Asian emerging markets and lowest in European emerging markets. Tang & Tan (2023) show that the shock infection rates or new cases of COVID-19 in France are likely to be permanent. There are suitable policies for Indonesia, including lockdowns, social isolation, local isolation, and vaccine injection. The findings of Khalid et al. (2021) are not in line with this research. Their findings are that COVID-19 had a negative impact when the IDX market was bearish and did not significantly impact the bullish market.

Our results, in line with Mao et al. (2024), that the COVID-19 pandemic has caused greater volatility in oil and stock markets than was experienced during the 2008 global financial crisis, and its effects continue to be felt. Nwosa (2021) finds that COVID-19 has a negative impact on the exchange rate. The exchange rate movement during the pandemic was due to a decline in exports. The depreciation of the Nigerian currency will affect the prices of local goods and the prices of imported goods. In both pandemic and war shocks, the stock and cryptocurrency markets become more dependent upon each other. When stock markets are in distress, these markets also become more dependent (Bampinas & Panagiotidis, 2024). The result also in line with Sharma et al. (2021), our result used daily COVID-19 cases, temperature, stock market, and currency exchange. COVID-19 cases have a significant long-term impact (in the phase) on exchange rate returns and stock market returns of the most affected countries under study. While Iqbal et al. (2020) report a significant negative (out-of-phase) coherence between the exchange rate and COVID-19 cases, Devpura (2021) finds limited evidence of the effect of COVID-19 on the Euro/USD exchange rate.

Mroua & Trabelsi (2020) reveal that exchange rate changes significantly influence the stock indices' past and current volatility. ARDL estimations show that exchange rate movements significantly affect short- and long-term stock market indices. Sui & Sun (2016) find a significant spillover effect from foreign exchange rates to stock returns in

the short-run, but not vice-versa. Nguyen et al. (2020) show that the exchange rate on Vietnamese stock market indices needs to be more consistent. They find that changes in the USD/VND exchange rate significantly impact the return and volatility of the HNX index only in the GARCH (1,1) setting. Okorie et al. (2021) conclude that a weak positive relationship exists between the exchange rate of Nigeria's Naira versus USD and her stock market returns.

CONCLUSION

This study examined whether the shock of new cases, new deaths, and exchange rate was significantly impacted using daily data from March 2, 2020, to June 30, 2022. Also, this study aims to observe the relationship between new COVID-19 cases, new deaths, exchange rates, and stock market indices. We used ADF to find the unit root test and then examined the cointegration. The result of vector autoregressive models indicates that the daily growth of COVID-19 new cases, new deaths, and exchange rate negatively and significantly impact the stock market price indices.

These findings also show that the shock of new cases, deaths, and exchange rate significantly affect IDX. The finding also shows that new deaths have a unidirectional relationship with IDX, meaning that the daily growth of deaths causes the IDX to decrease. However, new deaths and cases during the COVID-19 pandemic have a bidirectional relationship. It means the relationship between two variables where new deaths and new cases cause changes in the other. The practical implication of this research is to know about the shock response between new cases, new deaths, and the exchange rate to the stock market. The policy implications from this research are to stabilize the market, to impact overall financial stability, to support entrepreneurship, and to develop a competitive market environment that can foster innovation.

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