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THE IMPACT OF COVID-19 PANDEMIC AND FINANCIAL ASSET PRICES ON THE PERFORMANCE OF THE VIETNAM STOCK EXCHANGE - EVIDENCE FROM A NON-LINEAR ARDL CO-INTEGRATION APPROACH

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The paper is to examine the impact of the Covid-19 pandemic and external shocks, which can come from changes in oil prices and financial asset prices on the stock exchange performance in an emerging economy. By drawing the daily time - series data covering in the period of Jan 23rd 2020 to Jun 4th 2021, and the non-linear autoregressive distributed lag (NARDL) for analyzing the positive and negative co-integrated variables, the research results indicate that there is no impact of Covid-19 pandemic on the performance of the Vietnam stock exchange. In addition, our findings support a long - run relationship between oil price volatility and the stock exchange fluctuations. Further discussed on the short - run relationship, it is evident that raise in gold price causes to decrease the stock performance while the fluctuations of oil prices have a positive and significant impact on the growth of the stock exchanges. In terms of cryptocurrency and its fluctuations on stock exchange, an increase or a decrease in cryptocurrency prices is positively/negatively consistent with the growth of stock exchange but this effect is quite small. Finally, the research has some implications for investors in the light of investing on the stock exchanges during the pandemic.

Keywords: Covid-19, stock exchange, external shocks, NARDL.

JEL Classifications: C22, F65, O16

1. Introduction

The pandemic has caused a great harm to economic performance as well as their financial markets in many countries. For China, the country that has had the first impact of the pandemic, China's economy was disrupted throughout the first and second quarters of 2020, leading to an increase in the country's negative economic growth for the first time since economic reforms in 1977. Simultaneously, China's stock exchange plummeted, sending the market into a bleak and difficulty recovery. Further, the pandemic continued to spread to other countries around the world, causing a great harm to the global economy. Governments have also continuously implemented blockade of some areas,

using strong measures in case the infection rate cannot be controlled. As for the United States, the number of cases increased in 44 US states, of which 10 states recorded a record high increase: Colorado, Idaho, Indiana, Minnesota, New Mexico, North Carolina, North Dakota, West Virginia, Wisconsin, and Wyoming (The National Law Review, 2020) at the time of Oct 2020, and then affected the entire country.

It is important to note that Covid-19 has not been controlled, China's economy had a sharp decline in the first quarter of 2020, but then there was a slight recovery in the following quarters. Specifically, the epidemic peaked in China in the first quarter of 2020 and the global economic slowdown has caused

the Chinese economy to grow negative 6.8%. However, starting from Q2 onwards, China's economy has recovered quite quickly, China's economy still maintained 2.3% growth in 2020. This result is in contrast to many other countries in Europe and the United States. In fact, the economies of the United States, Japan, Europe and many other regions need longer time to recover. According to the World Bank (2020), the global economy shrank by 4.3% in 2020, it is forecasted that in 2021 the global economy will grow positively at a slow pace, and closely connected with the progress of vaccination in countries.

Governments are acting quickly and aggressively to overcome the coronavirus and its economic impact. Macroeconomic policies, such as increasing fiscal spending, lowering interest rates, and implementing health policies, are effective means of stabilizing financial markets and restoring the economy (Henderson and Platt, 2020). In addition, Covid - 19 had a negative short - run impact on stock exchange, however, the impact of the pandemic on the stock exchanges is comparatively less than that of the global stock exchanges as in the study by Salman & Ali (2021), similar to the volatility of Chinese stock exchanges could also have a spill over impact on the smaller stock exchanges. Similarly, Bora & Basistha (2021) also indicated that the Covid-19 pandemic has an impact on stock price volatility, and the profit of stock prices. Specifically, profit of stock exchange pre-pandemic period is higher than during Covid pandemic in the Indian market. This is easily explained that India was the country with the largest number of infections and deaths in the world, the impact of the pandemic on financial markets has worsened due to the disruption of most economic activities and financial markets.

Vietnam had its first case of Covid-19 infection on January 23, 2020, which occurred with two men in China traveling in Vietnam. However, Vietnam is considered a country with good disease control ability in terms of the number of new cases and the number of deaths. Combined with the isolation, distancing and vaccination campaign, the control of the spread of the disease has achieved good results, the country has only 8364 infections and 51 deaths as of June 4, 2021. Along with this backdrop, the macro-

economic and fiscal framework remains stable with GDP growth of 1.8% in the first half of 2020, reaching 2.92% for the whole year. Vietnam is one of the few countries in the world that does not meet an economic recession. Thanks to strong fundamentals and relative control of the COVID-19 pandemic, Vietnam's economy is currently recovering in 2021, GDP growth in the second quarter of 2021 reaches 5.64%, much higher than this in the same period of 2020 (Thanhniem, 2021). Positive signals from economic growth have significantly supported the stock exchange, VNINDEX in 2020 reached 1103.87 points, 67% higher than at the beginning of 2020, and rated as having the top growth in frontier markets. In addition, FTSE Russel has evaluated to upgrade Vietnam from a frontier market to an emerging market. As suggested in Vietnam Report (2021), the stock exchange continued to sublimite and grow in the first months of 2021, VNINDEX peaked on May 31, 2021 at 1328.05 points, 20% higher than the beginning of the year.

Despite the strong economic slowdown, Vietnam is one of the few countries that still maintain positive economic growth, especially the high growth of the stock exchange. Meanwhile, Vietnam has also flexibly controlled the impact of Covid-19 on the economy. Additionally, the assessment of the impact of the COVID-19 pandemic along with the effects of external shocks on the stock exchange, has not been done in any research, especially in the context of the developing economies. In the case of Vietnam, this country has a high openness, depends heavily on the global supply chain and foreign direct investment, the operation of the economy and the stock exchange are affected by external shocks. In this study, we will assess the effects of external shocks through fluctuations in oil, bitcoin and gold prices as well as the effects of internal shocks through the spread of the pandemic.

This study is carried out with the structure as follows: part 1 explains the objectives of the study. Part 2 discusses previous studies related to the relationship between internal, external shocks and stock exchange performance. Part 3 analyses the data collection and research model, especially the NARDL model. Subsequently, the results and discussions are proposed in Part 4, and Part 5 for conclusions.

This study aims to clarify research gaps in emerging countries to assess the impact of internal and external shocks on the stock exchange. Unlike previous studies on this relationship, the asymmetric relationship between internal and external shocks to the stock exchange has not been analyzed in the case of Vietnam. In the context that the country has a very low number of confirmed covid cases along with a high grow on the stock exchange, and the economy is still growing positively. Therefore, the selection of a sample for this study in Vietnam will contribute to providing empirical evidence and the impact on the stock exchange in the context of the current global pandemic.

2. Literature Review

2.1. Covid-19 pandemic and stock exchange performance

The Covid-19 spread to become a global pandemic, which has had many impacts on the economic growth of many countries. China's economy went negative in the first quarter of 2020, and this is the first time this country failed to meet its growth target since economic reform. In addition, the economies of Japan, Singapore, the United States and European countries also fell into recession with negative growth. Thereby, the pandemic has seriously affected most of the global stock exchange. In the study of Baek et al. (2020), the pandemic has greatly impacted on the US stock exchange. Using the method of Markov Switching AR model, the research results confirm that stock volatility is affected by macro factors and is very sensitive by a number of new cases of Covid19. These effects include both positive and negative effects, however, the negative effects are larger.

Uddin et al. (2021) argued that the impact of the pandemic on the global stock exchange significantly varies and depends on the context of each country. Using the panel data from 34 developed and emerging countries, Uddin et al. (2021) argued that country - level economic characteristics of each country and appropriate policy response can have the effect of reducing stock exchange volatility in the light of the covid19 pandemic.

On a study of Gao et al. (2021), using the wavelet - based quantile on quantile for analyzing the impact of the pandemic on stock exchange

shocks in US and China, research shows that the pandemic is the main factor causing the sharp volatility of US stocks. In particular, the US maintained a steady growth in the number of new infections on a monthly basis, which made the US stock exchange less sensitive to the impact of the pandemic, however, in contrast to more sensitive to the pandemic in the case of the Chinese stock exchange. Further argued on the pandemic's impact, Gao et al. (2021) discussed that there is a difference in the reaction in the financial markets in US and China, and it is depending on the methods of disease management. Further, the central bank's policy of loosening interest rates also prevents the volatility of the stock exchange effectively in China, while with the US maintaining interest rates near 0% has made it difficult for the market to promote sufficient monetary policy to avert a potential future crisis. For both markets, in the context that the epidemic cannot be controlled, loosening monetary policy is still considered a necessary measure to stabilize the market.

During this pandemic, India has been known as the worst - affected economy in the world. As suggested in Pathak et al. (2021), the death toll estimated at about 4 million, most people believe that the death toll is 10 times far greater than the official count. In this disease, the growth in GDP during 2020 - 2021 is estimated at - 8 per cent compared to the growth of 4 percent during 2019 - 2020. The initial policy choice of lives over likelihoods succeeded by lives as well as likelihoods that was maintaining in India during over the pandemic in 2020. Before the pandemic, the Indian stock exchange continued to grow at a high rate during January 2020, but since the outbreak, the market fell into fear and the stock index plummeted (Ravi, 2020). According to research by Bora & Basistha (2021), the Indian stock exchange has suffered heavy volatility during the Covid pandemic, the profit margin during pandemic is lower than pre-pandemic. Ram (2020) in his research argued that the pandemic disrupts the entire global sharing system, Indian stocks fluctuate sharply due to the disruption of the global financial system and reduce profit margins for investors in the Indian market. In some case, India's health crisis occurred, market returns remained negative, while the Indian stock exchange

always achieved certain growth in the pre- pandemic (Sahoo, 2021).

2.2. External shocks and stock exchange performance

A country developed based on tradable activities, the economy in general and the stock exchange in particular is often affected by external shocks, which can come from changes in oil prices and financial asset prices. Changes in world prices have altered economic activities in the country. The impact of oil prices on the stock exchange has been carried out in a number of studies by Bastianin et al. (2016), Degiannakis et al. (2018), Baker (2020). Most of the studies suggest that the impact of oil prices on the stock exchange is depending on the stock exchange of each country, industry, oil-importing country or oil- exporting country. Researcher indicates that oil price volatility will spill over into the stock exchange (Degiannakis et al., 2018).

In Baker's study (2020) a drop in oil prices will have a great impact on oil-producing countries, especially in the context of the pandemic. When oil prices dropped sharply in April 2020, many activities of oil-related industry enterprises and oil- related countries have been paralyzed. As assessed by Bastianin et al. (2016), it is evident that the oil demand shock on stock exchange volatility in G7 is found, therefore, the economic policies and sufficient regulations need to minimize negative impacts from unexpected fluctuations of oil prices, as well as create favorable conditions for stable operation of the stock exchange. In addition, Olayungbo (2020) researched in an oil country in OPEC, the stock exchange had a negative impact due to the falling of the world oil price during the pandemic.

Petroleum is a major source of energy to supply economic and human activities. Economic growth and production always require high demand for energy, including oil. In the study of Agarwalla et al. (2021) argued that, in the short term, an increase in oil prices has an impact on the growth of the energy sector index on the Indian stock exchange, or in other words, an increase in global oil prices will have a growth impact on the stock exchange in India. Further, the long-term impact still confirms this relationship. Meanwhile, fluctuations in oil

prices can encourage speculation, which in turn leads to higher oil prices, while rising oil prices are also caused by expanding business demand on a global scale, therefore, it leads to higher profit margins and stock exchange growth. However, the evidence is that Jordan, which has a small economy and stock exchange size, is a middle-income country, Abuolien et al. (2019) argued that there is a negative impact between oil prices and the stock exchange.

The financial market is a place where securities and financial assets are traded, typically financial assets such as gold, silver, or cryptocurrencies as bitcoin. Recently, financial assets such as bitcoin have attracted a lot of attention from investors and researchers, and this investment channel also attracts a lot of idle capital in the economy. In fact, Bitcoins are stored by using blockchain technology that allows the system to decentralize the arrival of new bitcoins and confirm transactions. Additionally, energy source and technology level become an important input in bitcoin production, thereby forming the required returns of bitcoin miners. As a result, many expensive new technologies and energy prices create pressure to shape the bitcoin price (Symitsi & Chalvatzis, 2018). In the study by Ahmed (2021) to assess the reaction of emerging and developed markets to the change of bitcoin, the study suggested that the financial market is more sensitive to falling price movements than the increase of price. Specifically, the increase/decrease component of the realized variance has a negative/positive effect on market returns.

Research by Kumar & Mensah (2021) the cryptocurrency market is closely linked to the financial market in general, which can increase transactions in the cryptocurrency market and indirectly cause financial instability in the wave of shocks of transactions in the cryptocurrency market. The integration between the operation of the cryptocurrency market and the stock exchange is different, Kumar & Mensah (2021) argued that the low level of integration between markets at higher frequencies, develops more strongly in mid-frequency markets and perfectly integrated in low-frequency markets. In the case of African countries, Kumar & Mensah (2021) asserted that the stock exchange may face a

disruption of the crypto market in the medium term and therefore investors will seek solution to hedge price risks by investing in cryptocurrencies in the short term.

3. Data and Methodology

3.1. Data

This study has variables such as VNINDEX, COVID, Bitcoin, Gold and Oil. The VNINDEX is collected from Ho Chi Minh City Stock Exchange (HOSE) located in Ho Chi Minh City, an economic hub in Vietnam. The Covid - 19 is denoted for number of confirmed cases while the price of bitcoin, gold, and oil is retrieved from Goldprice.com, Bloomberg and Nasdaq. Due to the availability of data, the requirement of enough number of observations for doing the estimation of non-linear autoregressive distributed lag (NARDL), and the pandemic spread to Vietnam on Jan 23rd 2020, therefore, this study has conducted within the period of Jan 23rd 2020 to Jun 4th 2021, the number of observations is efficient.

3.2. Empirical Model

The functional form in linear model this study can be written as below:

$$VNINDEX = f(\text{Covid, Bitcoin, Gold, Oil})$$

As discussed in the literature, time-series analysis can indicate the long run and short run relationships among variables and it assumes that symmetric relationships are existed. However, Shin et al. (2014) demonstrated the NARDL by considering an asymmetric long- run regression:

$$Y_t = \beta^+ X_t + \beta^- X_t + u_t$$

Like other cointegration methods, the ARDL can be suitable for time-series data, which are stationary at the $I(0)$, or $I(1)$, or a combination of $I(0)$ and $I(1)$. In the case of presence of $I(2)$ variables, the method of the ARDL cannot be employed because of invalid of the F-statistic value of cointegration test. As suggested in Shin et al. (2014), X_t can be decomposed into X_t^+ and X_t^- , indicating the positive and negative fluctuations in growth rate of X_t . Accordingly, proposing the nonlinear ARDL (p, q) model can be shown as follows:

Table 1: Data Sources and Description

Variables	Units of Measurement	Data Sources	Expected Sign	Previous Studies
Dependent variable				
VNINDEX (The index of Ho Chi Minh City Stock Exchange)	Points	Hsx.vn		Bastianin et al. (2016), Degiannakis et al. (2018), Uddin et al. (2021), Gao et al. (2021), Ahmed (2021)
Independent variable				
Covid (Number of confirmed cases)	People	WHO	-/+	Baek et al. (2020), Uddin et al. (2021), Gao et al. (2021)
Bitcoin (price)	USD	Goldprice.com	-	Ahmed (2021), Kumar & Mensah (2021)
Gold (price)	USD/oz	Goldprice.com	-/+	Kumar & Mensah (2021)
Oil (Brent Crude price)	US per barrel	Bloomberg and Nasdaq	-/+	Bastianin et al. (2016), Degiannakis et al. (2018)

Source: Author's research design

$$Y_t = \sum_{k=1}^p \phi_k Y_{t-k} + \sum_{k=1}^q (\beta_k^+ X_{t-k}^+ + \beta_k^- X_{t-k}^-) + \varepsilon_t$$

Where:

X_t is a 1×1 vector of multiple regressors,

$X_t = X_0 + X_t^+ + X_t^-$

β_k is the autoregressive parameter

β_k^+, β_k^- are the asymmetric distributed lag parameters.

Considering the literature, the general NARDL equation in a non-linear relationship is normally indicated in the following form:

$$\begin{aligned} \Delta VNINDEX_t = & \beta_0 + \beta_1 VNINDEX_{t-1} + \beta_2 Covid_{t-1} + \beta_3 Bitcoin_{t-1} + \beta_4 Gold_{t-1} + \beta_5 Oil_{t-1} \\ & + \sum_{i=1}^a \beta_6 VNINDEX_{t-i} + \sum_{i=1}^b \beta_7 Covid_{t-i} \\ & + \sum_{i=1}^c \beta_8 Bitcoin_{t-i} + \sum_{i=1}^c \beta_9 Gold_{t-i} + \sum_{i=1}^c \beta_{10} Oil_{t-i} + \varepsilon_t \end{aligned}$$

Where:

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$, indicating for the long-run coefficients of linear ARDL model,

$\beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}$, indicating for the short-run coefficients of linear ARDL model

In the situation of the positive and negative parts are co-integrated with each other, it is evident that the long-run relations could be existed. In this case, the nonlinear co-integration regression of the relationship of the price volatility of financial assets and Covid - 19 pandemic on the stock exchange performance is shown as follows:

$$\begin{aligned} VNINDEX_t = & \beta^+ Covid_t^+ + \beta^- Covid_t^- + \beta^+ Bitcoin_t^+ + \beta^- Bitcoin_t^- + \beta^+ Gold_t^+ + \beta^- Gold_t^- \\ & + \beta^+ Oil_t^+ + \beta^- Oil_t^- + \varepsilon_t \end{aligned}$$

To estimate the nonlinear ARDL model among the variables based on Shin et al. (2014), we have:

$$\begin{aligned} \Delta VNINDEX_t = & \beta_0 + \beta_1 VNINDEX_{t-1} + \beta_2 Covid_{t-1}^+ + \beta_3 Covid_{t-1}^- + \beta_4 Bitcoin_{t-1}^+ \\ & + \beta_5 Bitcoin_{t-1}^- + \beta_6 Gold_{t-1}^+ + \beta_7 Gold_{t-1}^- + \beta_8 Oil_{t-1}^+ + \beta_9 Oil_{t-1}^- \\ & + \sum_{i=1}^a \beta_{10} VNINDEX_{t-i} + \sum_{i=1}^b \beta_{11} Covid_{t-i}^+ + \sum_{i=1}^c \beta_{12} Covid_{t-i}^- \\ & + \sum_{i=1}^b \beta_{13} Bitcoin_{t-i}^+ + \sum_{i=1}^c \beta_{14} Bitcoin_{t-i}^- + \sum_{i=1}^b \beta_{15} Gold_{t-i}^+ + \sum_{i=1}^c \beta_{16} Gold_{t-i}^- \\ & + \sum_{i=1}^b \beta_{17} Oil_{t-i}^+ + \sum_{i=1}^c \beta_{18} Oil_{t-i}^- + \varepsilon_t \end{aligned}$$

4. Results

4.1. Descriptive Statistics

Table 2 summarizes the descriptive statistics of variables used in the study. There are 354 observations in this study, according to the test of normal distribution of data, all series are normally distributed as shown by Jarque - Bera. The data of Covid - 19 has the kurtosis value of 48.29 that is much far from the kurtosis of normal distribution of 3, indicating that Kurtosis is described as peakedness, and sharply curved peak. In addition, the asymmetry of the probability distribution is discussed by

skewness. Series of Gold, and Oil show negative skewness while positive skewness for VNINDEX, Covid, and Bitcoin.

The Vietnam Stock Exchange has two main markets such as Ho Chi Minh City Stock Exchange (HOSE), and Hanoi Stock Exchange (HNX). In which, HOSE is much larger than HNX in terms of trade volumes and market capitalization. HOSE was established in 2000 and is a general representative for securities in Vietnam. The stock index is called by VNINDEX.

The Vietnam stock exchange has dramatically changed from 2000 to 2020. In the Covid - 19 pandemic it negatively affected the market by an

unprecedented sharp decline since Jan 2020. VNINDEX dropped 33.51% within two months to the lowest points in three years. However, well controlled the pandemic, Vietnam stock exchange recovered quickly in the remaining months of

2020. Specifically, the market recorded an unprecedented number of new investors entering to the market, leading to the closing of the market in 2020 with an increase of approximately 15% compared to the end of 2019 (Huong, 2021). Similarly, the market continues to grow and is assessed to have lots of room for development on the basis of economic recovery and domestic, foreign investment flows. In the period of Jan 23rd 2020 to Jun 4th 2021, the VNINDEX has significantly changed two-folds in the range of 659.21 and 1360.42. In which, the stock exchange had declined in early 2020 in relation to the appearance of pandemic on Jan 30th 2020 in Vietnam.

The oil price has a historic drop in the pandemic in the case the price of crude oil strongly dropped. As suggested in Lee (2020), the depression in demand along with a price war between Saudi Arabia and Russia in early Mar 2020. Next, the price of oil has slowly recovered in May 2020 in agreement with the deep production cuts from giant oil producers in order protect bankruptcy and cut losses. After May 2020, the oil market has increasingly recovered and stabilized.

Unexpected fluctuations are considered for the bitcoin price in the period of Jan 23rd 2020 to Jun 4th 2021. During 2020, bitcoin is one of the most

common cryptocurrencies, and the bitcoin price increase occurred in 2010. The price changes for bitcoin significantly reflect the development level of bitcoin in the market. The pandemic has crashed many kinds of economic activities worldwide, against the government policy and fear of depression about the global economy, the bitcoin price has dramatically surged past \$7200 in the early 2020 to \$28996.28 in the end of 2020, an increase of approximately 400% from the start of 2020. As discussion on Kaur (2020) bitcoin is different from established markets as stock exchanges, commodities markets because a huge number of new investors are currently participating, and it is therefore to note that more demand in bitcoin market is statistically consistent with a rise of bitcoin price in the market. Most experts have a prediction that bitcoin price can soar to the record of \$66000 by the end of 2021 as well as bitcoin will easily overpass the US dollar to be the dominant financial assets in the global financial market by the year 2050 (Bambrough, 2021). Other financial instrument as gold, the gold price has slightly changed in the period of 2020 - 2021 with the minimum and maximum price of \$1474.25/oz and \$2067.15/oz, respectively. It concludes that the gold market is more stable than Bitcoin market in terms of price.

Table 2: Descriptive Statistics

Items	VNINDEX	Covid	Oil	Gold	Bitcoin
Mean	978.9789	1328.446	48.48175	1789.729	22317.63
Median	933.3850	1073.000	45.22000	1802.425	11567.18
Maximum	1360.420	8364.000	71.75000	2067.150	63410.29
Minimum	659.2100	2.000000	19.33000	1474.250	4904.480
Std. Dev.	165.2349	1396.641	12.81020	117.3216	17806.82
Skewness	0.354584	2.219245	-0.026778	-0.351398	0.990297
Kurtosis	2.051687	9.728710	2.201673	2.505958	2.402618
Jarque-Bera	20.68271	958.3921	9.442861	10.88549	63.12435
Probability	0.000032	0.000000	0.008902	0.004328	0.000000
Sum	346558.5	470270.0	17162.54	633564.1	7900441.
Sum Sq. Dev.	9637807.	6.89E+08	57927.78	4858818.	1.12E+11
Observations	354	354	354	354	354

Source: The results of the author's research data analysis

Table 3: Unit Root Tests

Variables	At Level I(0)		At first difference I(1)	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
Augmented Dickey-Fuller test statistic - t-Statistic (p - value)				
VNINDEX	-10.7915 (0.000)	-10.7622 (0.000)		
Gold	-15.1353 (0.000)	-15.1402 (0.000)	-19.216*** (0.000)	-19.213*** (0.000)
Oil	-10.8842 (0.000)	-10.8543 (0.000)	-17.391*** (0.000)	-17.600*** (0.000)
Bitcoin	-0.7231 (0.8381)	-1.4216 (0.8533)	-19.0364*** (0.0000)	-19.0090*** (0.0000)
Elliott – Rothenberg – Stock DF – GLS test statistic				
VNINDEX	-10.6435 (0.000)	-10.7348 (0.000)		
Gold	-1.4430***	-12.4023	-0.3267***	-1.5685***
Oil	-9.6583 (0.000)	-10.5650 (0.000)		
Bitcoin	0.0017 (0.9986)	-1.1589 (0.2473)	-18.9963*** (0.0000)	-18.6404*** (0.0000)
Phillips–Perron test statistic				
VNINDEX	-10.7569 (0.000)	-10.7260 (0.000)		
Gold	-15.2548 (0.000)	-15.2258 (0.000)		
Oil	-10.6779 (0.000)	-10.6435 (0.000)		
Bitcoin	-0.7867 (0.8209)	-1.5610 (0.8064)	-19.1093*** (0.0000)	-19.0844*** (0.0000)

Notes: With significance level $\alpha = 0.05$, if H_0 is accepted, the time series is not stationary, if H_0 is rejected, the time series is stationary. Then applying the Augmented Dickey - Fuller, Elliott - Rothenberg - Stock DF - GLS, Phillips - Perron test statistic unit root test method to test the stationarity for the data series: VNINDEX, Covid, Bitcoin, Gold, and Oil, respectively.

*, **, *** refer to level of significance at 10%, 5%, and 1% respectively.

Source: Analyzed by authors

Stationarity is essential for analyzing the NARDL model, especially stationarity can make the model that is avoided the empirical results may be spurious. For checking the stationarity, in this study we applied four common unit root tests, for example, Augmented Dickey-Fuller test, Phillips-Perron

test statistic, Elliott - Rothenberg - Stock DF - GLS test, and Kwiatkowski - Phillips - Schmidt - Shin test. Empirical studies further explain that the most common series are station at the level I(0) or the first difference I(1) or their mixture that will not threaten the application of ARDL model. In the case of

the second difference $I(2)$, the F-statistic value of the cointegration test becomes invalid, therefore, ARDL model cannot be applied in the case of $I(2)$. Table 3 depicts the results of unit root test. It is found that all series are stationary at the $I(0)$ or $I(1)$ or all series have unit root. The outcomes demonstrate that there is no presence of $I(2)$ variables, hence the study can use the ARDL model. Therefore, the order of cointegration of the series is a mixture of the level and first difference, that is, $I(0)$ and $I(1)$. Nonlinear ARDL model is accepted.

In order to test structural breaks, we use unit root with includes structural breaks according to Zivot-Andrews structural break, and Minimize Dickey Fuller structural break. Table 4 indicates that there is a structural break in between Nov 2020 to Jan 2021. The existence of a structural break demonstrates that the relationship of Covid - 19, and all independent variables on stock exchange performance is different in the period before and after the structural break.

Table 4: Results of Zivot-Andrews and Minimize Dickey Fuller structure break unit root tests

Items	Zivot-Andrews structural break unit root test				Minimize Dickey Fuller structural break unit root test			
	Intercept		Trend and intercept		Intercept		Trend and intercept	
	T-statistic	Break	T-statistic	Break	T-statistic	Break	T-statistic	Break
VNINDEX	-3.8227	11 Jun 2020	-3.6638	17 Nov 2020	-1.5644	6 Nov 2020	-4.2687	6 Mar 2020
Gold	-3.1696	6 Jan 2021	-3.8909	20 Jul 2020	-3.5484	19 Mar 2020	-3.4023	5 Jan 2021
Oil	-3.4960	9 Nov 2020	-3.4608	18 Apr 2020	-3.0569	11 Jun 2020	-5.4264	4 Mar 2020

Note: Zivot-Andrews test having critical values are, respectively, -5.34, -4.93, and -4.58 at the level of significance of, respectively, 1%, 5%, and 10% at the structural break in the intercept; and respectively, -5.57, -5.08, and -4.82 at the level of significance of, respectively, 1%, 5%, and 10% at the structural break in the intercept and trend. Further, the Minimize Dickey Fuller structural break unit root test having a critical value of -4.94, -4.44, -4.19 at the level of significance of 5% at the structural break in the intercept; and respectively, -5.34, -4.85,

and -4.60 at the level of significance of, respectively, 1%, 5%, and 10% at the structural break in the intercept and trend.

Table 5: Bounds Test co-integration Results

Model	F-stat	Up. Bound	Low. Bound
VNINDEX/(Covid, Bitcoin, Gold, Oil)	2.4856		
k	9		
Critical Value			
0.1		1.88	2.99
0.05		2.14	3.3
0.025		2.37	3.6
0.001		2.65	3.97

Source: Analyzed by authors

Bounds testing method is applied to find the long run relationship among variables. The critical value has a lower bound FL and upper bound FU. In the case if $F\text{-stat} < FL$ no cointegration relationship exists, when $F\text{-stat} > FU$ a cointegration relationship exists. In addition, when $F\text{-stat}$ is inside the between

FL and FU, the cointegration of the underlying variables is needed and should be further analyzed. According to Table 5, the critical value of bound testing approach at 5 percent the $I(0)$ value is 2.14, and the $I(1)$ value is 3.3 while $F\text{-stat}$ value is 2.4856, that is lower as compared to $I(1)$ and higher as compared to $I(0)$, indicating that the cointegration analysis continues to be proceeded.

Table 6 explains the long and short - run asymmetric relationship among variables based on the optimal lag length NARDL (3, 3, 3, 0, 0, 0, 1, 3).

Table 6: *Dynamic Asymmetric Estimation of Economic Growth and Long-run coefficients*

Variables	Coef.	Std. Err.	t-Statistic	Sig.
D(VNINDEX(-1))	0.0464	0.0547	0.8479	0.3971
D(VNINDEX(-2))	0.1036	0.0542	1.9109	0.0569
D(VNINDEX(-3))	-0.0766	0.0535	-1.4303	0.1536
D(BITCOIN_POS)	0.0001	0.0010	0.0267	0.9787
D(BITCOIN_POS(-1))	0.0041	0.0014	2.8259	0.0050
D(BITCOIN_POS(-2))	0.0014	0.0014	0.9739	0.3309
D(BITCOIN_POS(-3))	-0.0022	0.0010	-1.1287	0.2841
D(BITCOIN_NEG)	-0.0003	0.0009	-0.3620	0.7161
D(BITCOIN_NEG (-1))	-0.0041	0.0013	-3.1856	0.0016
D(BITCOIN_NEG (-2))	0.0004	0.0013	0.3442	0.7309
D(BITCOIN_NEG (-3))	0.0019	0.0009	0.9064	0.3475
D(DUM)	1.7730	4.3855	0.4042	0.6863
D(GOLD_POS)	-0.1102	0.0593	-1.8589	0.0640
D(GOLD_NEG)	-0.0142	0.0144	-0.9858	0.3250
D(COVID_POS)	-0.0326	0.0296	-1.0986	0.2728
D(COVID_NEG)	0.0520	0.0554	0.9376	0.3491
D(OIL_POS)	-1.5740	1.0075	-1.5622	0.1192
D(OIL_POS(-1))	2.6095	1.0014	2.6058	0.0096
D(OIL_NEG)	3.5077	0.7704	4.5529	0.0000
D(OIL_NEG (-1))	-0.1538	1.1912	-0.1291	0.8974
D(OIL_NEG (-2))	-1.7922	1.1010	-1.6277	0.1046
D(OIL_NEG (-3))	2.4471	0.7506	3.2600	0.0012
CointEq(-1)	-0.0681	0.0210	-3.2379	0.0013
BITCOIN_POS	0.0011	0.0030	0.3966	0.6919
BITCOIN_NEG	-0.0006	0.0043	-0.1316	0.8954
DUM	26.0263	61.9149	0.4203	0.6745
GOLD_POS	0.0510	0.2071	0.2465	0.8054
GOLD_NEG	-0.2083	0.1949	-1.0686	0.2861
COVID_POS	0.8003	0.8118	0.9857	0.3250
COVID_NEG	0.7637	0.8525	0.8957	0.3711
OIL_POS	1.1133	3.1446	0.3540	0.7235
OIL_NEG	4.3937	2.0181	2.1771	0.0302
C	966.2329	49.3787	19.5677	0.0000

Source: Analyzed by authors

The stock index is considered as dependent variable while other factors are used as independent variables such as Covid - 19, price of bitcoin, gold, and oil. Estimated results show that CointEq (-1) is - 0.00681 at the 1% significance level. This implies that stock performance is able to adjust the long - run equilibrium after each short - run fluctuations created by the pandemic of Covid - 19, and oil, gold and bitcoin price.

Table 6 includes the NARDL long - run coefficients. The examined results indicate that when there is a negative and significant impact from negative shocks in oil prices and stock performance. A 1\$ decrease in prices of oil adversely affect the stock performance in Ho Chi Minh City stock exchange that causes to decrease the stock performance about 4.3937 points. Our results are as same as previous studies of Abuolien et al. (2019) on a study in Jordan. Perhaps, the economic conditions of Vietnam are similar to Jordan in every aspect of per capita GDP, stock exchange size. Degiannakis et al. (2018) further indicated that oil price volatility will easily spill over into the stock exchange in numerous economies, and this transmit is dependent on of each country, industry, oil-importing country or oil-exporting country. Raza et al. (2016) also confirmed that emerging countries have developed their economies based mainly on energy consumption, especially fossil energy and crude oil, when oil prices fall will have a stimulating effect on the economy and growth of financial market. However, a few of developed economies

have gradually used clean energy, renewable energy for economic activities, which make these economies gradually reduce the influence of oil prices on economic growth and stock exchange.

Table 6 also indicates the NARDL short - run coefficients. Empirical results demonstrate that raise in gold price causes to decrease the stock performance about 0.11 points against a 1\$ raise in gold price. The examined results of short run NARDL are

same with previous studies of Raza et al. (2016) in the case of Mexico, Malaysia, Thailand, Indonesia and China, especially a negative impact for all emerging economies because gold has been known as a safe heaven during extreme stock exchanges fluctuations (Mensi, 2018). In addition, Vietnam's people always consider gold as a good asset to hold against risk and instability of other financial assets, and real estate.

Shocks of oil price in the wave of increasing or decreasing cause to increase stock performance. It explains that a 1\$ increase in oil prices causes to increase stock performance about 2.60 points and 3.50 points. Adversely, a 1\$ decrease in prices of oil positively affect the stock performance in Ho Chi Minh City stock exchange that causes to increase the stock performance about 2.44 points, and slightly slower than a raise in oil prices. The results can be explained that Vietnam is both importer and exporter of oil, especially Vietnam has been importing high volume of crude oil in recent years. The main importing of oil products comprises gasoline, jet fuel, fuel oil. According to Chung (2014), a change in oil prices shows a positive effect on the economy due to resource reallocation efficiency in the economy. In addition, a huge number of oil related firms listed in the Vietnam stock exchange, the changes of oil related firms are highly associated with the global oil fluctuations. Meanwhile, the recovery of the Chinese economy, followed a positive economic growth rate for Vietnam, which has created lots of profit for oil - related firms and therefore accelerated stock exchange growth (Vietnam Plus, 2021).

The examined results of NARDL short - run coefficients further points out that a 1\$ increase in bitcoin prices is positively associated with a growth of 0.0041 points of stock performance. Adversely, a 1\$ decrease in bitcoin prices is negatively associated with a growth of 0.0041 points of stock performance. It concludes that the impact of bitcoin prices on stock performance is somewhat limited. In fact, although Vietnamese laws have not accepted the cryptocurrency trading in the financial market, but investors are looking to enter the market related to plenty of online resources where bitcoin investors can interact while some shops also agree payments in bitcoin (Coinlist, 2021). Further, Ministry of Finance has established a research team that has begun an in-depth study on cryptocurrency, and virtual assets with a view to formally propose changes in laws related to these issues. At present, the cur-

rent transition of Vietnam offers a favor of cryptocurrencies, especially cashless payment on QR codes, e-wallets, and apps (Vietnam Briefing, 2021).

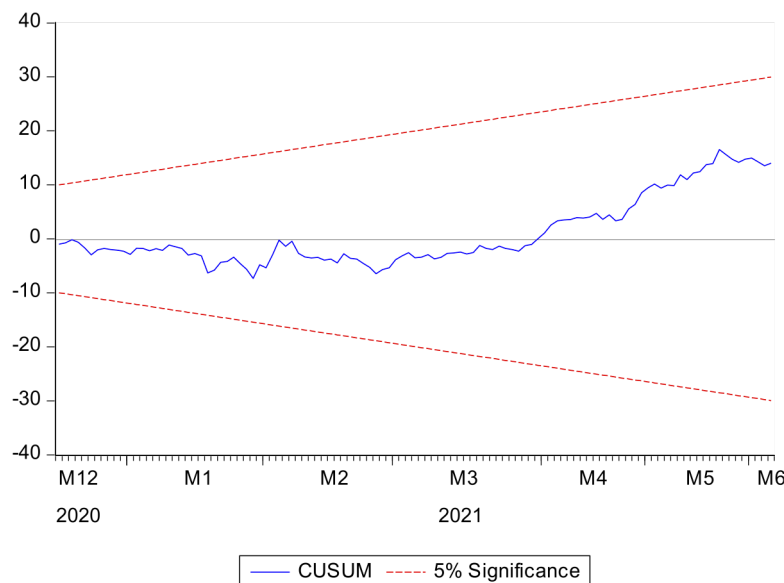
The adjusted R squares value of 26.54%, indicating that 26.54% variation in daily stock index is caused by Covid - 19 pandemic and price volatility of financial instruments. Durbin - Watson statistics test shows that no autocorrelation problem is present in the model. The p-value of F-statistics is 0.000 that depicts the model is fit.

Diagnostic tests should be performed in this study. First, the normality of residuals is checked by deploying the serial autocorrelation LM test, and checked Breusch/Pagan test for heteroskedasticity problem. The diagnostic statistics of NARDL is presented in Table 8. At this case, the p-value of Ramsey RESET test is similarly more than 0.10, indicating that the model is specified, and thus non-linear combinations of the fitted values help explain the response variables. The LM test for serial autocorrelation problem, the p-value is also similarly more than 0.10, which confirms that there is no serial autocorrelation. In addition, there is no heteroskedasticity according to Breusch/Pagan heteroskedasticity test when p-value of the test is 0.192, and more than 0.10.

Stability of the coefficients is checked through CUSUM (cumulative sum) and CUSUMSQ (cumulative sum of square). The Figure 1, and Figure 2 indicate that CUSUM and CUSUM are inside the critical lines at the level of significance of 5 percent, recommending that the model is stable.

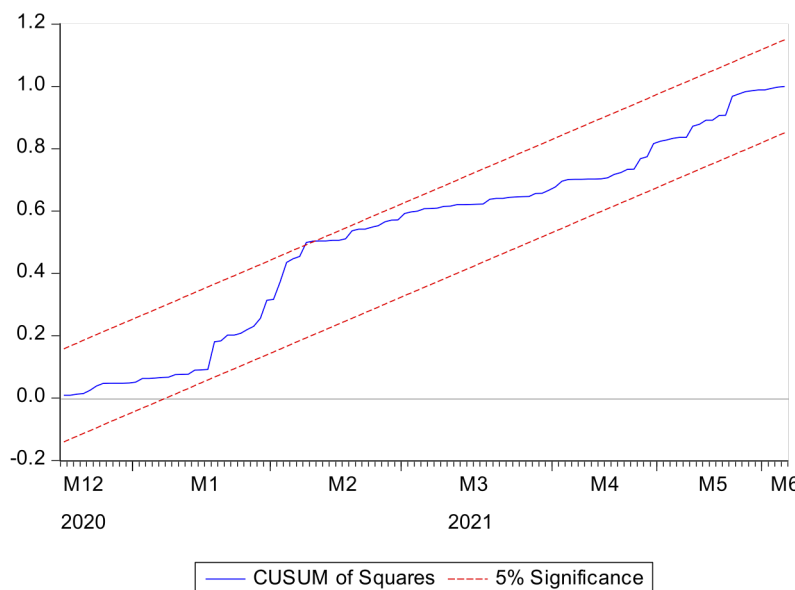
5. Conclusions and Implications

The pandemic has significantly caused a great harm to the economy as well as their financial markets in many countries. Most of governments are acting quickly and aggressively to overcome the coronavirus and its economic impact on the financial market. In addition, the economy in general and the stock exchange in particular is often affected by external shocks, which can come from changes in oil prices and financial asset prices. Investigated the impact of external and internal shocks on stock exchange and using a daily time - series data covering in the period of Jan 23rd 2020 to Jun 4th 2021, research results demonstrate that there is a negative and significant impact from negative shocks in oil prices and stock performance in the long run. For short - run relationship, raise in gold price causes to decrease the stock performance while the fluctuations of oil prices have positively impacted on



Source: Analyzed by authors

Figure 1: Cumulative sum



Source: Analyzed by authors

Figure 2: Cumulative sum of squares

growth of stock exchanges. In terms of cryptocurrency and its fluctuations on stock exchange, it is evident that an increase or a decrease in bitcoin prices is positively/ negatively correlated with a growth of stock exchange but this effect is some-

what small. The research has some recommendations. First, although the pandemic has not had a negative impact on the market yet, but the Government should still respond to the pandemic through adaptive macroeconomic management. Furthermore, the government needs to limit the impact of oil price shocks and financial assets on the stock exchange through increasing transparency and accountability in the financial market. Furthermore, the Government has improved its governance and governance capacity.

The study also has some limitations, the study has not assessed the impact of fourth wave of pandemic on the stock exchange. In addition, this study also did not assess the impact of other financial assets on the Vietnamese stock exchange, as well as the dependence structure between Vietnamese stock exchanges and other giant stock exchanges.

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Summary

Bài báo này nhằm xem xét tác động của đại dịch Covid-19 và các cú sốc bên ngoài, có thể đến từ những thay đổi của giá dầu và giá tài sản tài chính đối với hoạt động của sàn chứng khoán trong một nền kinh tế mới nổi. Bằng cách vẽ dữ liệu chuỗi thời gian hàng ngày trong khoảng thời gian từ ngày 23 tháng 1 năm 2020 đến ngày 4 tháng 6 năm 2021 và độ trễ phân phối tự động hồi quy phi tuyến tính (NARDL) để phân tích các biến động tích hợp dương và âm, kết quả nghiên cứu chỉ ra rằng có không có tác động của đại dịch Covid-19 đến hoạt động của thị trường chứng khoán Việt Nam. Ngoài ra, phát hiện của chúng tôi hỗ trợ mối quan hệ lâu

dài giữa biến động giá dầu và biến động thị trường chứng khoán. Trao đổi sâu hơn về mối quan hệ ngắn hạn, có thể thấy rằng việc tăng giá vàng làm giảm hiệu quả kinh doanh trong khi biến động của giá dầu có tác động tích cực và đáng kể đến tăng trưởng của các sản phẩm chứng khoán. Xét về tiền điện tử và những biến động của nó trên sàn giao dịch chứng khoán, việc tăng hoặc giảm giá tiền điện tử là tích cực / tiêu cực phù hợp với sự tăng trưởng của thị trường chứng khoán nhưng ảnh hưởng này là khá nhỏ. Cuối cùng, nghiên cứu có một số ý nghĩa đối với các nhà đầu tư trong việc đầu tư vào các sản phẩm giao dịch chứng khoán trong thời kỳ đại dịch.

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