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## The Analysis of the Roles of Bitcoin, Ethereum, and Gold as Hedge and Safe-Haven Assets on the Indonesian Stock Market before and during the COVID-19 Pandemic

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# INDONESIAN CAPITAL MARKET REVIEW

## The Analysis of the Roles of Bitcoin, Ethereum, and Gold as Hedge and Safe-Haven Assets on the Indonesian Stock Market before and during the COVID-19 Pandemic

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*The uncertainty due to the COVID-19 outbreak has encouraged investors to look for value hedging instruments to minimize risk, which can be in the form of hedging assets or safe-haven assets. In response to it, this study aims to find out whether Bitcoin, Ethereum, and gold can behave as hedging and safe-haven assets before and amid the pandemic in Indonesia. The strategy is by observing the effects of volatility and return of Bitcoin, Ethereum, and gold on the Indonesian stock market. This study employed both quantile regression and simple linear regression models on data of daily closing price taken before and during COVID-19. This study finds that they can be hedge and safe-haven assets during the COVID-19 pandemic in Indonesia. The findings show some significant correlations between assets that can help investors determine which assets can be hedging instruments.*

**Keywords:** Cryptocurrency; Gold; Hedging; Safe-Haven; Pandemic; Quantile Regression; Finance

**JEL Classification:** G01, G11, Q02

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### Introduction

The stability of financial markets is important for the safety and security of investments. Since the emergence of the COVID-19 pandemic at the end of 2019, there has been an increase in research on the impact of the coronavirus in nearly all areas in the global economy. This is supported by a previous study which states that large-scale events can affect financial market conditions and stock returns (Zach, 2003). The COVID-19 virus has taken away many lives and has been a challenge for countries around the world. Today's global financial markets show that the level of risk is increasing substantially. The uncertainty of the pandemic and the deteriorating economic conditions re-

sult in an unstable and unpredictable market (Zhang et al., 2020). Therefore, investors need to diversify their portfolios to minimize risk (Tandelilin, 2010). Assets that are suitable for portfolio diversification are hedged assets and safe-haven assets. An asset is regarded a weak (strong) hedge if it does not have any negative correlations with the average of other assets under normal market conditions. An asset is considered a weak safe haven (strong) if it is not negatively correlated with other assets amid the market financial crisis (Baur & Lucey, 2010).

Precious metals, especially gold, are alternative assets for portfolio diversification. According to previous research, gold can be used as a hedge asset during an economic crisis. This is evidenced by the fact that gold has no cor-

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relation with market prices and other types of assets. Gold is also declared a hedge asset in several developed countries, such as the US and the UK in 2010 (Baur & Lucey, 2010). Other studies also state that gold is regarded to be both a hedge and safe-haven asset for the American and European stock markets but not for markets in the developing countries (Baur & McDermott, 2010).

Due to the loss of public confidence in the financial system and the global financial crisis in 2007, the world economy has begun to recognize a new type of money, namely digital currency known as cryptocurrency which was first introduced by Nakamoto. Bitcoin is the pioneer in the emergence of cryptocurrencies. The increase in Bitcoin's value has motivated researchers to develop literature on the factors that influence Bitcoin price changes. Several studies have shown that during the unstable economic condition, the attractiveness of Bitcoin increases which can be seen from the rapidly increasing price movement (Paule-Vianez et al., 2020). It does not stop at Bitcoin; there are several other coin alternatives, one of which is Ethereum. It was first launched in 2015 and is the second largest cryptocurrency after Bitcoin based on the capitalization rate. The development of Bitcoin as a digital currency and Ethereum as a decentralized application network aims to eliminate third-party institutions (Beneki et al., 2019). Several research suggest that Bitcoin and Ethereum can be used as hedge assets and/or safe-haven assets in certain states and periods (Beneki et al., 2019; Mariana et al., 2021; Paule-Vianez et al., 2020). However, some studies argue that cryptocurrencies are not suitable to be considered as hedging assets because of their speculative characteristics (Baur et al., 2018), tendency to form bubbles (Bouri et al., 2019), high price volatility (Aalborg et al., 2019), and scandals and fraud (Selmi et al., 2018).

Volatility transmission is considered pivotal for portfolio managers, including the level of volatility of Bitcoin and Ethereum in the framework of asset allocations. Exploring the volatility transmission enables one to understand the extent to which these cryptocurrencies of-

fer advantages of risk management and diversification to investors (Beneki et al., 2019). If an asset has a high level of volatility, the level of volatility of other assets such as hedge and/safe-haven assets will also be high, following other assets in the portfolio. When investors are faced with uncertain times, hedge or safe-haven assets will boost their volatility and returns (Paule-Vianez et al., 2020). The resilience of the market for precious metals, such as gold, to financial crises has also been emphasized by some academics. The research results indicate that reducing the investment's systematic risk and boosting the benefits of diversification can be done through the inclusion of precious metals in an equity portfolio, especially during periods of high volatility (Antonakakis & Kizys, 2015).

Since the COVID-19 pandemic took place in Indonesia, the development of crypto trading has grown very rapidly. Based on the data obtained from the Commodity Futures Trading Regulatory Agency (CoFTRA), the number of crypto investors in Indonesia reached 9.5 million investors as of October 2021. Meanwhile, the number of crypto investment transactions in Indonesia reached IDR 478.5 trillion as of July 2021. This indicates that Indonesia is a potential market for the crypto asset industry. Although cryptocurrencies are prohibited as investment instruments in Indonesia, cryptocurrency transactions continue to grow and even exceed transactions on the Indonesian stock exchange (Putriadita, 2021).

Due to the current state of the COVID-19 pandemic, several studies have compared the risk taking before and during the pandemic and the related market correlations. This is supported by the existence of countercyclical risk aversion which is one of the factors that investors are less risk averse during the boom period compared to the bust period, so that individuals who have experienced low stock market returns show a lower willingness to take financial risks (Malmendier & Nagel, 2011). Therefore, it is possible that there will be differences in the roles of cryptocurrencies and gold before and during the COVID-19 pandemic. This is evidenced by previous research that has been con-

ducted in Indonesia. At different periods, the results of this study state that by using return data of the variables, cryptocurrencies such as Bitcoin, Ethereum, and ripple as well as gold cannot be used as either hedge or safe-haven assets from 2015 to 2018 (Hartono & Rubiyanto, 2021). Meanwhile, during the COVID-19 pandemic, January to June 2020, Bitcoin, Ethereum, ripple, and tether can act as hedging assets (Yuhanitha & Robiyanto, 2021).

This study is beneficial for financial advisors and investors in determining hedge assets and safe-haven assets as those that can be used for portfolio diversification, by determining whether Bitcoin, Ethereum, and gold can protect investors' funds in both normal and crisis market conditions. This study employed simple quantile regression and linear regression models on daily closing price data taken before the COVID-19 pandemic (10 March 2018 to 10 March 2020) and amid the COVID-19 outbreak (11 March 2020 to 30 August 2021). Different from previous studies, these methods and data were used to examine the effects of the Indonesian stock market on Bitcoin, Ethereum, and gold during normal and crisis conditions using the volatility and return data of each variable. This study finds that Bitcoin, Ethereum, and gold can be hedge and safe-haven assets during the COVID-19 pandemic in Indonesia.

## Literature Review

### *Diversification Theory*

According to Tandelilin (2010), combining assets whose characteristics are different can minimize risks. This is called portfolio diversification. However, diversification cannot eliminate all risks. A portfolio with an optimum expected return must not always result in minimum variance. There is a point to which an investor may achieve the expected return by taking or reducing the variance through "giving back" the expected return. Markowitz (1952) also explains that investors need to diversify their portfolios which can be structured by choosing several different industries or types of

assets and avoiding investing in securities with high covariance values.

### *Volatility*

Studies on volatility are used as a measure of financial uncertainty, risk, or pressure regarding financial investments (Zaremba et al., 2020). One of the hypotheses in a study of volatility spillovers is contagion. The contagion hypothesis explains that the level of volatility in the market increases when a crisis occurs (Kenourgios et al., 2011). This hypothesis can be observed simultaneously among the movement in stock prices, exchange rates, and capital flows. On the other hand, economic uncertainty may bring about an unpredictable future. Therefore, when people start talking about uncertainty, it is more likely that a negative economic event will occur. In consequence, when investors are facing uncertainty due to fiscal policies, regulations, monetary policies, or even a crisis, hedge or safe-haven assets could improve the returns and volatility (Paule-Vianez et al., 2020).

### *Hedge*

Hedge is classified to be assets that have no correlation or a negative correlation with other assets under normal market conditions (Baur & Lucey, 2010). These assets are divided into two categories, namely strong hedge assets and weak hedge assets. Strong hedge assets have a negative correlation with other assets, while weak hedge assets do not have a correlation with other assets under normal market conditions (Hood & Malik, 2013). A strong hedge asset will generate positive returns if the value of the hedge asset declines, whereas a weak hedge asset only reduces the investors' losses when the price of the hedge asset is dropping (Baur & Lucey, 2010).

### *Safe-Haven*

Safe-haven is classified to be assets that has no correlation or a negative correlation with other assets during times of crisis (Baur & Lucey, 2010). Similar to hedge assets, safe haven

assets have two categories, namely strong and weak safe-haven assets. An asset is considered strong if there is evidence of negative predictability of the stock index against assets in the low quintile of asset returns and shares. On the other hand, safe-haven assets are categorized as weak if they have no predictable evidence from the stock index to those assets in the low quintile of stocks and asset returns (Shahzad et al., 2019).

### *Cryptocurrency*

A cryptocurrency is a form of digital currency that was publicly introduced along with Bitcoin which was developed by Satoshi Nakamoto. This currency is a form of transaction that is regarded to be more secure and verified and uses a cryptographic protocol in a peer-to-peer system that produces a distributed ledger. Cryptocurrencies typically use decentralized control with the use of technologies such as blockchain. Besides Bitcoin, there are other types of cryptocurrencies, namely Ethereum, dash, monero, and others that are controlled by distributed consensus and a system used to maintain an outline of digital currency and ownership units (Sharma et al., 2020).

### *Bitcoin*

Since the global financial crisis in 2008 because of the loss of public confidence in the financial system, the world economy has begun to recognize a new type of money, namely digital currency or cryptocurrency which was first introduced by Nakamoto (Beneki et al., 2019b). This type of cryptocurrency is known as Bitcoin. The currency has a proprietary decentralized payment system based on blockchain technology, independence of the government, institutions, and centralized banking systems. Therefore, people can use Bitcoin as an economic alternative when times of uncertainty occurs and hedge or safe-haven instrument may be utilized to face the loss of confidence in the economic system (Bouri et al., 2017). However, the price of Bitcoin using the standard financial theory is difficult to elucidate. The price is also

considered unpredictable even though its volatility is predictable because of historical prices. According to the research conducted by Paulevianez et al. (2020), by using simple quantile regression and linear regression models, Bitcoin returns and volatility are seen to increase over uncertain periods. Thus, Bitcoin becomes a means of payment exhibiting the characteristics of investment assets, particularly safe-haven.

### *Ethereum*

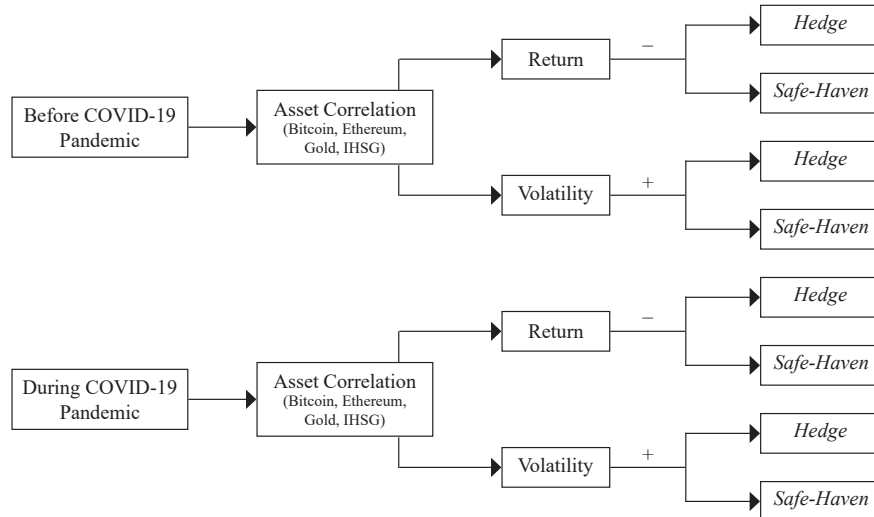
Ethereum was launched in 2015 and is the second largest cryptocurrency after Bitcoin based on the capitalization value (Beneki et al., 2019b). Ethereum is a blockchain platform that has its own cryptocurrency known as Ether (ETH) or Ethereum and has a programming language or the so-called Solidity. Ethereum was purposefully invented to allow its developers to build and issue smart contracts and decentralized applications (DAPPS) without the threat of fraud or interference from third parties (Buterin, 2014). There have been many discussions about the possibility of Ethereum that can replace Bitcoin. However, until now Bitcoin is still ranked first and higher than Ethereum. Functionally speaking, Bitcoin and Ethereum can coexist rather than compete, as Bitcoin was invented as a digital currency while Ethereum was developed as a decentralized network of applications. This development aims to eliminate third-party institutions (Beneki et al., 2019b). Some research supports that Bitcoin and Ethereum can be the short-term safe-haven assets in American markets, and Ethereum outperforms Bitcoin. This research was conducted using the DCC-GARCH methodology (Mariana et al., 2021).

### *Gold*

Prior to the emergence of cryptocurrencies, gold was used as an investment alternative as it offers a higher sense of certainty during market uncertainty (Baur & McDermott, 2010). Economists reveal several facts about gold; one of which is that gold has some intrinsic values



Figure 1. Conceptual Framework



that most likely do not reflect its current market value. Gold derives most of its value from scarcity and is also difficult to cultivate. Gold has no citizenship or is not controlled by the government, because it is obtained in certain areas by independent mining companies (Dyhrberg, 2016).

Some studies mention that gold can be used as a hedge asset for a certain period of time. Research conducted by Baur & McDermott (2010) using the GARCH model states that gold's behavior has the tendency to increase concerning negative shocks in markets. Therefore, gold is regarded as both a hedge and safe-haven for the American and European stock markets. However, this statement does not apply to markets in developing countries. In line with Baur & Lucey (2010), they explained that gold is also declared as a hedge asset in several developed countries, such as the US and the UK in 2010. Other studies have shown that gold plays a role as a safe-haven asset in several developed and developing countries (Shahzad et al., 2019).

### **Financial Behavior**

Behavioral finance explains the economic decisions made by society by combining behavioral and cognitive psychological theories with classical economics and finance. The basic assumption underlying this theory is the structure of information and the characteristics of market behavior that will influence investment decisions systematically, on each individual and

market conditions (Baker & Nofsinger, 2010). Extreme shocks and events can have profound and lasting effects on our behavior and decisions (Hertwig et al., 2004). In finance, individuals who have experienced low stock market returns show a lower willingness to take financial risks, are less likely to participate in the stock market, and are more pessimistic about the future of the stock market (Malmendier & Nagel, 2011). Based on research conducted by Huber et al. (2021) there was a difference in investment activities by investors between the period before and during COVID-19, which was 12 percent lower during the pandemic compared to before the COVID-19 pandemic. Declining investment activity during a crisis can be supported by risk aversion, not a change in belief.

Based on the previous research, cryptocurrencies and gold could be utilized as hedge and safe-haven assets in certain periods and regions. Therefore, this study aims to analyze whether Bitcoin, Ethereum, and gold act as safe-haven and hedge assets before and throughout the COVID-19 pandemic in Indonesia.

## **Research Methods**

### **Data**

This study used secondary data for daily data on Bitcoin, Ethereum, gold, and the IDX Composite before (10 March 2018 to 10 March

2020) and throughout the COVID-19 pandemic (11 March 2020 to 31 August 2021). To analyze the volatility and returns of Bitcoin, Ethereum, and IDX Composite, we collected the daily closing price data on rupiah through *investing.com*. For gold, we collected the closing price data on rupiah through *Logammuila.com*.

The formula for calculating the returns of Bitcoin, Ethereum, gold, and the IDX Composite is as follows.

$$R_{m,t} = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (1)$$

$$R_{i,t} = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (2)$$

$R_{m,t}$  and  $R_{i,t}$  represent market returns and asset  $i$  on day  $t$ . Meanwhile,  $P_t$  represents the daily closing price of the market and asset  $i$  on day  $t$ .

As a volatility measurement, this study used two proxy formulas. The first formula is the standard deviation, which compares the relative dispersion data with its average (Sugiyono, 2013). This formula was calculated based on the square root of the variance by determining the deviation of each relative data point towards the mean. The formula is as follows.

$$S_{i,t} = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{(n-1)}} \quad (3)$$

$S_{i,t}$  shows the market standard deviation (volatility) and asset  $i$  on day  $t$ ,  $x_i$  indicates the value of the data set  $i$ ,  $\bar{x}$  shows the average value of the data set, and  $n$  represents the number of data over a predetermined time.

The second formula is ranged-based volatility by Chen & Zheng (2008). This formula was predicted to be the difference between the highest and lowest quoted prices for the day, and it was divided by the average of the two. The formula is as follows.

$$V_{i,t} = \frac{P_{i,t}^H - P_{i,t}^L}{(P_{i,t}^H + P_{i,t}^L) / 2} \quad (4)$$

$V_{i,t}$  indicates the market volatility of asset and asset  $i$  on day  $t$ ,  $P_{i,t}^H$  is the highest price on market and asset  $i$  on day  $t$ , and  $P_{i,t}^L$  shows the lowest price on market and asset  $i$  on day  $t$ .

### Methodology

This study used the simple linear regression model as well as the Ordinary Least Squares (OLS) to analyze effects of market returns (volatility) on conditional expectations of returns (volatility) for Bitcoin, Ethereum, and gold. This method shows whether Bitcoin, Ethereum, and gold can be used as hedge assets. It can be seen from the return rate (volatility) of assets that has a significant negative (positive) correlation with the return rate (volatility) of the market. The following is the simple linear regression model with OLS to analyze the effects of the IDX Composite on returns (volatility) of Bitcoin, Ethereum, and gold:

$$R_{i,t} = \alpha + \beta R_{m,t} + \varepsilon_t \quad (5)$$

$$V_{i,t} = \alpha + \beta R_{m,t} + \varepsilon_t \quad (6)$$

$R_{i,t}$  shows the return on asset  $i$  on day  $t$ ,  $V_{i,t}$  shows the volatility of asset  $i$  on day  $t$ ,  $\beta$  shows the sensitivity of the influences of market returns (volatility) on returns (volatility) on  $R_{i,t}$  and  $V_{i,t}$  and  $\varepsilon_t$  shows the standard deviation.

In addition to using simple linear regression, this study used the quantile regression to see the effects of market returns (volatility) on the movement of returns (volatility) of Bitcoin, Ethereum, and gold at extreme quantile points. Koenker & Bassett (1978) introduced the quantile regression that functions to overcome the limitations of linear regression that do not meet the classical assumption test requirements, such as irregularly-distributed and unsymmetrical data. In addition, the benefit of quantile regression is that the estimates are more strongly associated with extreme values (Koenker, 2005). Thus, the quantile regression model to analyze the effects of market returns (volatility) on Bitcoin, Ethereum, and gold returns (volatility) is as follows.

Table 1. Descriptive Statistics before the COVID-19 Pandemic

	Before the COVID-19 Pandemic (March 10 <sup>th</sup> , 2018-March 10 <sup>th</sup> , 2020)											
	R <sub>Bitcoin</sub>	V <sub>1,Bitcoin</sub>	V <sub>2,Bitcoin</sub>	R <sub>Ethereum</sub>	V <sub>1,Ethereum</sub>	V <sub>2,Ethereum</sub>	R <sub>Gold</sub>	V <sub>1,Gold</sub>	V <sub>2,Gold</sub>	R <sub>IHSG</sub>	V <sub>1,IHSG</sub>	V <sub>2,IHSG</sub>
Mean	0,000313	0,029639	0,040874	-0,000778	0,040725	0,057016	0,000373	0,005257	0,005257	-0,000254	0,006919	0,010207
Median	0,000900	0,028400	0,031230	-0,001050	0,040400	0,044615	0,000000	0,004590	0,004590	0,000000	0,006450	0,008730
Maximum	0,150300	0,067100	0,384460	0,172900	0,075600	0,241760	0,037600	0,011380	0,011380	0,029400	0,162000	0,044100
Minimum	-0,152500	0,006000	0,003060	-0,188500	0,016800	0,002090	-0,030100	0,002160	0,002160	0,065800	0,003400	0,003070
Std. Deviation	0,031631	0,011059	0,033281	0,043197	0,011144	0,038870	0,005741	0,002120	0,002120	0,007777	0,002041	0,005652
Observation	732	732	732	732	732	732	732	732	732	732	732	732

Source: Data processed by researchers (2021)

Table 2. Descriptive Statistics during the COVID-19 Pandemic

	During the COVID-19 Pandemic (March 11 <sup>th</sup> , 2020 -August 31 <sup>th</sup> , 2021)											
	R <sub>Bitcoin</sub>	V <sub>1,Bitcoin</sub>	V <sub>2,Bitcoin</sub>	R <sub>Ethereum</sub>	V <sub>1,Ethereum</sub>	V <sub>2,Ethereum</sub>	R <sub>Gold</sub>	V <sub>1,Gold</sub>	V <sub>2,Gold</sub>	R <sub>IHSG</sub>	V <sub>1,IHSG</sub>	V <sub>2,IHSG</sub>
Mean	0,004085	0,033611	0,033013	0,006578	0,047734	0,045694	0,000213	0,006841	0,006841	0,000369	0,010311	0,015977
Median	0,002260	0,030560	0,023460	0,005390	0,043140	0,035770	0,000000	0,005800	0,005800	0,000000	0,008240	0,011580
Maximum	0,201770	0,087100	0,430390	0,262650	0,109700	0,505490	0,054680	0,018070	0,018070	0,101910	0,034560	0,104680
Minimum	-0,340520	0,007050	0,000000	-0,403510	0,016070	0,000080	-0,033800	0,003430	0,003430	-0,052010	0,003850	0,003610
Std. Deviation	0,037318	0,016194	0,037445	0,051547	0,021183	0,044265	0,007383	0,002966	0,002966	0,011613	0,006250	0,013011
Observation	539	539	539	539	539	539	539	539	539	539	539	539

Source: Data processed by researchers (2021)

$$R_{i,t} = \alpha_{\tau} + \beta_{\tau} R_{m,t} + \varepsilon_t \quad (7)$$

$$V_{i,t} = \alpha_{\tau} + \beta_{\tau} R_{m,t} + \varepsilon_t \quad (8)$$

$R_{i,t}$  shows the return on asset  $i$  on day  $t$ ,  $V_{i,t}$  shows the volatility of asset  $i$  on day  $t$ ,  $\beta$  shows the sensitivity effects of market returns (volatility) on returns (volatility) on  $R_{i,t}$  and  $V_{i,t}$ ,  $\tau$  represents the quantile points with the most extreme values (0.01, 0.05, 0.1, 0.25, 0.75, 0.9, 0.95, 0.99), and  $\varepsilon_t$  indicates the standard error.

## Validity Tests

Data used in this study was a time series. Therefore, before doing the analysis using simple linear regression and quantile regression methods, it was necessary to perform several tests, for instance, the stationarity test using the Augmented Dickey Fuller (ADF) test and also another validity tests like the classical assumption test such as the normality test, autocorrelation test, and heteroscedasticity.

## Results

After conducting the stationarity test and classical assumptions, it was found that the research data performed stationary, and does not have autocorrelation and heteroscedasticity.

This determines the data as valid and stable, there is no equation of variance with residuals from one observer to another, then it is feasible to be processed. The research results are in accordance with the research method to be carried out in this study, namely the quantile regression, which can overcome the limitations of linear regression which does not meet the requirements of the classical assumption test which showed the non-normal data distribution.

Based on the descriptive statistical findings in tables 1 and 2, the cryptocurrency Ethereum experienced an increase in the average value of daily returns during the COVID-19 period (0.74%). Corresponding to the standard deviation rate based on daily returns, Ethereum experienced the highest change compared to other assets and the Indonesian Stock Market (0.84%) during the COVID-19 pandemic. The highest average volatility value is based on the calculation of standard deviation. Moreover, the range-based volatility is also owned by Ethereum (4.07% and 5.70%). The results of these descriptive statistics show that among all Indonesian assets and stock markets, Ethereum has the highest level of risk and return.

Based on table 3, Ethereum plays a role as a hedge asset before and during the COVID-19 pandemic in Indonesia, seen from the results of a significant positive correlation between Ethe-



Table 3. Results of Simple Linear Regression

	Before COVID-19 Pandemic (March 10, 2018 - March 10, 2020)			During COVID-19 Pandemic (March 11, 2020 - August 31 2021)		
	Return	Volatility 1	Volatility 2	Return	Volatility 1	Volatility 2
<b>Bitcoin</b>						
Coefficient	0,0003 (0,0012)	0,0356*** (0,0014)	0,0383*** (0,0025)	0,0041 (0,0016)	0,0185*** (0,0011)	0,0184*** (0,0024)
IHSG	-0,2233 (0,1503)	-0,8643*** (0,1979)	0,2472 (0,2178)	-0,0635 (0,1386)	1,4628*** (0,0923)	0,9162*** (0,1177)
Adj. R-Squared	0,0017	0,0241	0,0004	-0,0015	0,3175	0,0997
Prob (F-Statistic)	0,1377	0,0000	0,2562	0,647	0,0000	0,0000
n	732	732	732	539	539	539
<b>Ethereum</b>						
Coefficient	-0,0009 (0,0016)	0,0343*** (0,0014)	0,0476** (0,0029)	0,0007 (0,0022)	0,0301*** (0,0015)	0,0309*** (0,0029)
IHSG	-0,2961 (0,2053)	0,9271*** (0,1991)	0,9181*** (0,2523)	0,1145 (0,1915)	1,7126*** (0,1262)	0,9243*** (0,1413)
Adj. R-Squared	0,0015	0,0275	0,0165	-0,0012	0,2539	0,0721
Prob (F-Statistic)	0,1497	0,0000	0,0003	0,5520	0,0000	0,0000
n	732	732	732	539	539	539
<b>Gold</b>						
Coefficient	0,0004 (0,0002)	0,0080*** (0,0003)	0,0062*** (0,0002)	0,0021 (0,0003)	0,0028*** (0,0001)	-0,0007 (0,0005)
IHSG	0,0038 (0,0273)	-0,4001*** (0,0355)	-0,0928*** (0,0135)	0,0369 (0,0274)	0,3966*** (0,0112)	0,0563** (0,0244)
Adj. R-Squared	-0,0013	0,1473	0,0599	0,0015	0,6978	0,0080
Prob (F-Statistic)	0,8879	0,0000	0,0000	0,1787	0,0000	0,0212
n	732	732	732	539	539	539

Source: Data processed by researchers (2021)

Notes: \*, \*\*, \*\*\* indicate significance at the 10%, 5%, and 1% levels

Table 4. Quantile Regression Results based on Return Calculations

	Before COVID-19 Pandemic (March 10, 2018 - March 10, 2020)				During COVID-19 Pandemic (March 11, 2020 - August 31 2021)			
	0,75	0,90	0,95	0,99	0,75	0,90	0,95	0,99
<b>Bitcoin</b>								
Coefficient	0,0120*** (0,0012)	0,0308*** (0,0021)	0,0505*** (0,0044)	0,0929*** (0,0058)	0,0200*** (0,0020)	0,0443*** (0,0031)	0,0609*** (0,0043)	0,1054*** (0,0091)
IHSG	-0,3111 (0,2341)	-0,7513*** (0,2419)	-1,2259** (0,5658)	-1,8011*** (0,4474)	-0,1646 (0,1148)	-0,3911*** (0,0940)	-0,4527*** (0,0790)	-0,3192* (0,2231)
Adj. R-Squared	0,0007	0,0157	0,0124	0,0421	0,0012	0,0142	0,0139	0,0268
n	732	732	732	732	539	539	539	539
<b>Ethereum</b>								
Coefficient	0,0188*** (0,0022)	0,0473*** (0,0034)	0,0668*** (0,0047)	0,1205** (0,0203)	0,0301*** (0,0026)	0,0604*** (0,0047)	0,0858*** (0,0050)	0,1559*** (0,0271)
IHSG	-0,6380 (0,4372)	-1,1873*** (0,3825)	-1,7302*** (0,4059)	-0,3857 (1,4910)	-0,2050 (0,1294)	-0,2160 (0,3674)	-0,6424*** (0,1055)	-1,2344*** (0,1369)
Adj. R-Squared	0,0041	0,0226	0,0285	0,0029	0,0030	0,0005	0,0045	0,0151
n	732	732	732	732	539	539	539	539
<b>Gold</b>								
Coefficient	0,0026*** (0,0004)	0,0066** (0,0005)	0,0092*** (0,0006)	0,0178*** (0,0010)	0,0026*** (0,0005)	0,0082*** (0,0006)	0,0109*** (0,0006)	0,0208*** (0,0040)
IHSG	0,0144 (0,0346)	-0,0498** (0,0207)	-0,0213 (0,0162)	-0,1331* (0,0773)	0,0271 (0,0198)	-0,0279** (0,0137)	-0,0538*** (0,0140)	-0,1511*** (0,0501)
Adj. R-Squared	-0,0011	-0,0005	0,0009	0,0080	0,0004	0,0011	0,0019	0,0112
n	732	732	732	732	539	539	539	539

Source: Data processed by researchers (2021)

Notes: \*, \*\*, \*\*\* indicate significance at the 10%, 5%, and 1% levels

reum volatility and market volatility. This is in line with studies by Yuhanita & Robiyanto

(2021) and Mariana et al. (2021) revealing that Ethereum can be utilized as a hedge amid the

Table 5. Quantile Regression Results based on Formula 1 Volatility Calculations

	Before COVID-19 Pandemic (March 10, 2018 - March 10, 2020)				During COVID-19 Pandemic (March 11, 2020 - August 31 2021)			
	0,01	0,05	0,75	0,90	0,01	0,05	0,75	0,90
<b>Bitcoin</b>								
Coefficient	0,0153*** (0,0042)	0,0256*** (0,0037)	0,0476*** (0,0026)	0,06556*** (0,0031)	0,0038 (0,0024)	0,0027 (0,0023)	0,0023*** (0,0014)	0,0340*** (0,0011)
IHSG	-0,9412 (0,5822)	-2,0571*** (0,5585)	-1,4423*** (0,2886)	-2,9492*** (0,3362)	0,6077** (0,2382)	1,0197*** (0,1766)	1,8545*** (0,0683)	1,7144*** (0,0823)
Adj. R-Squared	0,0118	0,0357	0,0272	0,1018	0,0784	0,0532	0,1869	0,3669
n	732	732	732	732	539	539	539	539
<b>Ethereum</b>								
Coefficient	0,0024 (0,0024)	0,0164*** (0,0032)	0,0433*** (0,0016)	0,0591*** (0,0025)	0,0168** (0,0073)	0,0091*** (0,0024)	0,0355*** (0,0015)	0,0590*** (0,0080)
IHSG	2,9412*** (0,2933)	1,4444*** (0,4694)	0,5538*** (0,1814)	-0,4194* (0,2508)	-0,0410 (0,9013)	1,4726*** (0,1623)	2,1016*** (0,0769)	1,7274*** (0,4732)
Adj. R-Squared	0,0328	0,0389	0,0135	0,0024	-0,0015	0,0435	0,1792	0,1907
n	732	732	732	732	539	539	539	539
<b>Gold</b>								
Coefficient	0,0023*** (0,0002)	0,0033*** (0,0002)	0,0101*** (0,0003)	0,0141*** (0,0005)	0,0026*** (0,0003)	0,0025*** (0,0004)	0,0031*** (0,0001)	0,0044*** (0,0003)
IHSG	0,0000 (0,0247)	-0,0556** (0,0275)	-0,5500*** (0,0363)	-0,8143*** (0,6933)	0,1456*** (0,0315)	0,2081*** (0,0495)	0,4420*** (0,01222)	0,4152*** (0,0138)
Adj. R-Squared	-0,0014	0,0047	0,1454	0,1439	0,1653	0,1593	0,4829	0,5314
n	732	732	732	732	539	539	539	539

Source: Data processed by researchers (2021)

Notes: \*, \*\*, \*\*\* indicate significance at the 10%, 5%, and 1% levels

uncertainty of the Indonesian stock market before and during the COVID-19 periods. Meanwhile, Bitcoin and gold can become hedge assets only during the COVID-19 pandemic, indicating Bitcoin and gold can become a hedge during uncertain times due to the pandemic in Indonesia. These results support the research by Bouri et al. (2020), Wu et al. (2019), Demir et al. (2018), and Wang et al. (2019).

Table 4 shows a significant negative effect of Indonesian stock market returns on the returns on the three assets at the high quantile point. This indicates that the three assets will provide positive returns to investors when the Indonesian stock market experiences a return decline or when market conditions are normal. The results of this regression show that Bitcoin, Ethereum, and gold can be used as hedge assets both before and during the COVID-19 pandemic in Indonesia.

Tables 5 and 6 show the results of the quantile regression in the calculation of volatility using standard deviation and range-based volatility. Based on these two calculations, it is known that Ethereum can act as both a hedge and safe-haven asset before and during the COVID-19 pandemic in Indonesia, shown through

a significant positive correlation between Indonesian stock market volatility and Ethereum volatility at high and low quantile points. This indicates that Ethereum acts as a hedge against uncertainty in normal market conditions. Also, it is a safe haven from the occurrence of market uncertainty during extreme conditions in the Indonesian stock market. When uncertainty occurs, Ethereum increases its volatility. On the other hand, Bitcoin and gold can act as both hedge and safe-haven assets only during the COVID-19 pandemic. This is indicated by the significant positive correlation between the regression between market volatility and the volatility of Bitcoin and gold at the high and low quantile points.

## Discussion

The Bitcoin, Ethereum, gold, and Indonesian stock market have experienced an increase in standard deviation before the pandemic (10 March 2018 – March 10, 2020) and amid the COVID-19 pandemic (11 March 2020 – 31 August 2021). This indicates that the Indonesian stock market is currently experiencing uncertainty, followed by increased volatility for

Table 6. Results of Quantile Regression based on Formula 2 Volatility Calculations

	Before COVID-19 Pandemic (March 10, 2018 - March 10, 2020)				During COVID-19 Pandemic (March 11, 2020 - August 31 2021)			
	0,1	0,25	0,75	0,90	0,1	0,25	0,75	0,90
<b>Bitcoin</b>								
Coefficient	0,0131*** (0,0016)	0,0184*** (0,0016)	0,0481*** (0,0030)	0,0753*** (0,0091)	0,0023** (0,0012)	0,0072*** (0,0019)	0,0259*** (0,0039)	0,0446*** (0,0048)
IHSG	0,0292 (0,1541)	0,1819 (0,1505)	0,3207 (0,2030)	0,0597 (0,8871)	0,2133*** (0,0690)	0,3302* (0,1293)	1,0626*** (0,2879)	1,4771*** (0,2173)
Adj. R-Squared	-0,0012	-0,0001	0,0016	-0,0013	0,0137	0,0167	0,0622	0,0829
n	732	732	732	732	539	539	539	539
<b>Ethereum</b>								
Coefficient	0,0173*** (0,0022)	0,0233*** (0,0020)	0,0649*** (0,0078)	0,0853*** (0,0075)	0,0051*** (0,0016)	0,0109*** (0,0020)	0,0475*** (0,0042)	0,0576*** (0,0048)
IHSG	0,3276 (0,2232)	0,7307*** (0,1905)	1,0720 (0,6908)	2,0214*** (0,7005)	0,3099*** (0,0965)	0,5429*** (0,1116)	0,7751*** (0,2732)	1,8470*** (0,3396)
Adj. R-Squared	0,0016	0,0058	0,0065	0,01854	0,0275	0,0268	0,2352	0,0642
n	732	732	732	732	539	539	539	539
<b>Gold</b>								
Coefficient	0,0036*** (0,0002)	0,0045*** (0,0002)	0,0080*** (0,0004)	0,0105*** (0,0002)	0,0041*** (0,0002)	0,0044*** (0,0006)	0,0052*** (0,0002)	0,0063*** (0,0009)
IHSG	-0,0399*** (0,0128)	-0,0708*** (0,0168)	-0,1419*** (0,0227)	-0,1508*** (0,0146)	0,0345*** (0,0105)	0,0559*** (0,0148)	0,1384*** (0,0073)	0,2393*** (0,0711)
Adj. R-Squared	0,0253	0,0176	0,0375	0,0737	0,0263	0,0498	0,1666	0,2526
n	732	732	732	732	539	539	539	539

Source: Data processed by researchers (2021)

Notes: \*, \*\*, \*\*\* indicate significance at the 10%, 5%, and 1% levels

the three assets led by Ethereum. According to Paule-Vianez et al., (2020), when the stock market is hit by uncertainty, hedge and safe-haven assets will increase the returns and volatility. The research findings support that statement and suggest that Bitcoin, Ethereum, and gold can provide positive returns when market returns are declining. This statement supports several previous studies such as Baur & Lucey, (2010), Baur & McDermott (2010); Mariana et al. (2021), Yuhanitha & Robiyanto (2021). In addition, this study proved that three assets can act as both hedge and safe-haven assets during the COVID-19 pandemic in Indonesia. Observing the effect of the volatility of the Indonesian stock market on the volatility of the three assets may result in a significant positive correlation at the extreme and high quantile points. This shows that Bitcoin, Ethereum, and gold can be a safe haven and hedge during both usual and unusual stock market conditions. This could be due to the increased volatility experienced by the three assets as a result of uncertainty during the COVID-19 pandemic. This also supports previous research by Paule-Vianez et al. (2020), Bouri et al. (2020), Wu et al. (2019), Demir et al. (2018), and Wang et al. (2019).

## Conclusion

Investors need alternative hedging instruments in compiling their portfolios in unprecedented times due to COVID-19. Based on previous research, this study analyzed whether assets such as Bitcoin, Ethereum, and gold can play roles as hedge and safe-haven assets on the Indonesian stock market during the COVID-19 pandemic in Indonesia. The research results revealed that Bitcoin, Ethereum, and gold act as both hedge and safe-haven assets during the COVID-19 pandemic in Indonesia. This study also shows that Ethereum can be used as a hedge asset before COVID-19 in Indonesia.

## Implication

This is useful for investors as it provides alternative hedging instruments for portfolio diversification during the global financial crisis. However, it is also worth noting that these three assets are not the only alternatives for investors to avoid high levels of risk during uncertainty. Furthermore, investors need to pay attention to the country's regulations regarding investment licensing in cryptocurrencies. Related to the

growth of trade, it is necessary for regulators to pay more attention to the activities of cryptocurrency trading, which are still considered

unsafe. A recommendation for further research is to add the research time span and the number of alternative hedging instruments.

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