# Are Bitcoin and Ethereum safe-havens for stocks during the COVID-19 pandemic?

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A R T I C L E   I N F O

A B S T R A C T

Utilizing the WHO COVID-19 pandemic statement, we test Bitcoin and Ethereum as safe-havens for stocks. We find that the two largest cryptocurrencies are suitable as short-term safe-havens. The DCC and cDCC results show that their daily returns tend to correlate with S&P500 return negatively during the pandemic. The regression results also robustly support the safe-haven features and uncover that Ethereum is possibly a better safe-haven than Bitcoin. However, we note that both coins exhibit high volatilities. Before (during) the pandemic daily volatilities of Bitcoin, Ethereum, gold, and the S&P500 are 3.44% (9.11%), 4.34% (10.96%), 0.89% (2.19%), and 1.27% (6.07%), respectively.

## 1. Introduction

On March 11, 2020, the World Health Organization (WHO) announces an unfortunate pandemic status of Coronavirus disease of 2019 (COVID-19). According to the Chinese government official report to the WHO, the first case was on December 8, 2019 (The-Guardian.com, 2020). As the pandemic epicenter, China transmits shocks to the financial and non-financial firms in G7 countries (Akhtaruzzaman et al., 2020) and even to brands carrying 'Corona' name such as Corona beer (Corbet et al., 2020). The WHO announcement has sent financial markets worldwide into tailspins, due to the predicted global economic recessions in years to come. One day after the declaration, the S&P500, FTSE-100, Nikkei-225 all plunge about 9.51%, 10.87%, and 4.41%. In the same period, gold as a safe-haven (Baur and Lucey, 2010) also drops, but only about 3.53%.

Before the cryptocurrency era, a strand of literature has documented the properties of safe-haven assets. For instance, Baur and Lucey (2010) state that an asset is a safe-haven if it is uncorrelated with stocks during a market crash. Therefore, gold is considered a safe-haven during an extreme stock market downturn. Sandoval and Franca (2012) also agree that assets that are uncorrelated with stocks are prospective safe-havens. The characteristic is important because, during the significant financial crisis such as 1987 (Black Monday), 1998 (Russian crisis), 2001 (The dot-com bubble and 911), and 2008 (GFC), financial markets tend to be highly interrelated with one another.

Since its inception, the cryptocurrencies market has grown tremendously. As the pioneer, Bitcoin has increased in value from nearly $0 in October 2009 to more than $7000 in April 2020 (CoinMarketCap.com, 2020). Chan et al. (2019) state that the dramatic Bitcoin price increase in December 2017 is pivotal to determine its hedging abilities. According to Bouri et al. (2017), an asset is a weak (strong) hedge if it is uncorrelated (negatively correlated) with another asset on average. An asset is a weak (strong) safe-haven if it is uncorrelated (negatively correlated) with another asset during distress times.

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Can Bitcoin be a safe-haven for stocks? Smales (2019) argues against it because of Bitcoin's high volatility, illiquidity, and transaction cost. Chaim and Laurini (2019) also point out the potential bubble in Bitcoin, albeit it is more probable for the period before December 2017 (Geuder et al., 2019). During the COVID-19 market downturn, Conlon and McGee (2020) state that Bitcoin is not a safe-haven since its price moves closely with S&P500. Bitcoin is not even a diversifier but an amplifier of contagion (Corbet et al., 2020).

In contrast, Dyhrberg (2016) points out the possibility of using Bitcoin as a hedging instrument. Bitcoin can even be a safe-haven, but its role depends on the stock market types, time horizons, and investment horizons (Bouri et al., 2017; Shahzad et al., 2020, 2019; Stensås et al., 2019). Gil-Alana et al. (2020) profess that cryptocurrencies are different from traditional financial and economic assets, and investors should include them to diversify their portfolios. Moreover, Bitcoin's safe-haven properties are even better than gold and commodities (Bouri et al., 2020).

The COVID-19 pandemic is the first global health that translates into economic shock since the GFC 2008 and Bitcoin's inauguration in 2009. The event provides a background to investigate whether Bitcoin exhibits short-term safe-haven features for stocks. We also investigate Ethereum because it is the second-largest cryptocurrency that may also show safe-haven properties (Beneki et al., 2019; Bouri et al., 2020). We choose the US market because it is the largest market, and coincidentally, the US has the highest number of COVID-19 infections (to proxy for the most significant distress) in the world. In this study, we use the term coins and cryptocurrencies interchangeably.

We find that both Bitcoin and Ethereum are suitable as short-term safe-havens during the extreme stock market plunges. We also learn that Ethereum is plausibly a better safe-haven than Bitcoin during the pandemic. However, we also uncover that before and during the pandemic, Ethereum exhibits the highest daily return volatility, followed by Bitcoin, S&P500, and gold.

## 2. Data and methodology

We collect the Bitcoin (BTC) and Ethereum (ETH) data from coindesk.com, while the S&P500 and gold spot prices data from DataStream. To control Bitcoin halving's potential impact on May 12, 2020 (Crawley, 2020), we deliberately utilize a short-term observation window from July 1, 2019, until April 6, 2020.

Following previous studies (see, for example, Akhtaruzzaman et al., 2020; Bouri et al., 2017; Corbet et al., 2020), we utilize the DCC-GARCH methodology (Engle, 2002) to examine the dynamic correlation of cryptocurrency, gold, and S&P500. Bouri et al. (2017) suggest that a weak (strong) safe-haven asset is uncorrelated (negatively correlated) with another asset during times of stress.

We select the mean equation based on the information criteria[1] and find that the MA (1) process is the most suitable specification for our DCC-GARCH (1,1) model, as presented in Eq. (1).

$$r_t = \mu_t + \omega\varepsilon_{t-1} + \varepsilon_t \tag{1}$$

Whereas $r_t$ is a vector of Bitcoin, Ethereum, gold, and S&P500 daily returns, $\mu_t$ is the conditional mean vector of $r_t$, and $\varepsilon_t$ is the vector of residuals. Meanwhile, the variance equation follows:

$$h_t = c + \alpha\varepsilon_{t-1}^2 + bh_{t-1} \tag{2}$$

Where $h_t$ is the conditional variance, c is the constant, $\alpha$ is the parameter that captures the short-run persistence or the ARCH effect, and b represents the long-run volatility persistence or the GARCH effect.

The DCC-GARCH (1,1) equation is then given by $Q_t$, which is the square positive definitive matrix as in Eq. (3).

$$Q_t = (1 - \alpha - \beta)\overline{Q} + \alpha\varepsilon_{t-1}\varepsilon_{t-1}' + \beta Q_{t-1} \tag{3}$$

Where $Q_t$ is the time-varying unconditional correlation matrix of $\varepsilon_t$; $\varepsilon_t$ is a vector of standardized residuals from the first-step estimation of the GARCH (1,1) process, and $\alpha$ and $\beta$ are parameters quantifying the effects of previous shocks and previous DCCs on the current DCC. To investigate whether the correlations are dynamic, we perform the Wald test. The Wald test suggests that the correlations are indeed dynamic since $\alpha$ (at one percent) and $\beta$ (at ten percent) are statistically different from zero. Also, the sum of $\alpha$ and $\beta$ is less than unity.[2]

The DCC between assets i and j is then calculated as in Eq. (4):

$$\rho_{ij,t} = \frac{q_{ij,t}}{\left(\sqrt{q_{ii,t}}\right)\left(\sqrt{q_{jj,t}}\right)} \tag{4}$$

Following Aielli (2013), we also estimate the corrected-DCC (cDCC) and compare the outcomes with the DCC results as a robustness test.

After investigating the dynamic correlations, we also adopt the method of Baur et al. (2018) and run OLS regressions with Newey-West robust estimator, as presented in Eq. (5).

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[1] We compare AR (1), MA (1), and ARMA (1,1) mean specifications based on Akaike, Bayes, Shibata, and Hannan-Quinn information criteria. All criteria consistently suggest that MA (1) process is the most suitable.

[2] The result is available upon request.

$$Coin_t = \alpha + \beta_0 Gold_t + \beta_1 Covid19 * Gold_t + \beta_2 Stock_t + \beta_3 Covid19 * Stock_t +$$
$$\lambda_0 Coin_{t-1} + \lambda_1 Gold_{t-1} + \lambda_2 Stock_{t-1} + \varepsilon_t \tag{5}$$

Where $Coin_t$ is the cryptocurrency (Bitcoin or Ethereum) return at day-t, $Gold_t$ is gold return at day-t, $Stock_t$ is stock return at day-t, and *Covid19* is a dummy variable that equals one if day-t is on the pandemic announcement date (March 11, 2020) or the subsequent days. If the cryptocurrency serves as a safe-haven in the pandemic, then the coefficient of $\beta_1$ is expected to be positive, while the coefficient of $\beta_3$ is negative (Baur et al., 2018).

## 3. Results and discussions

Based on Table 1, we learn that volatility inclines to increase during the pandemic. Before (during) the pandemic, the daily return standard deviations of Bitcoin, Ethereum, gold, and the S&P500 are 3.44% (9.11%), 4.34% (10.96%), 0.89% (2.19%), and 1.27% (6.07%), correspondingly. The increase in volatility is also visible from the return plot in Fig. 1. All returns throughout the pandemic are more volatile than before the pandemic.

Table 2 demonstrates that the pairwise correlations between gold and both coins tend to increase during the pandemic. Meanwhile, the correlations between the S&P500 and both coins turn negative. The correlation between S&P500 and Bitcoin (Ethereum) is −0.3790 (−0.3757). These are the initial signs that both cryptocurrencies are potential safe-havens for stocks. To inquire whether Bitcoin halving may affect this study's result, we compare Bitcoin and Ethereum returns. We learn that their correlation before (during) the pandemic is 0.8306 (0.9841). Since Ethereum does not face halving, the high correlation indicates that Bitcoin halving will not significantly impact this study's result.

### 3.1. Dynamic conditional correlation analysis

The S&P500 and gold dynamic correlations (Fig. 2(A)) before the pandemic are always negative between −0.3801 and −0.1479, with a median of −0.2909. During the pandemic, the correlations tend to be less negative, with a median of −0.1800. The S&P500 and Bitcoin dynamic correlations (Fig. 2(B)) before the pandemic are not always negative. The correlations vary between −0.0713 and 0.1007, with a median of −0.0047. However, they incline to become more negative during the pandemic, with a median of −0.0393. Hence, Bitcoin is a prospective safe-haven for stocks.

Before the pandemic, the S&P500 and Ethereum dynamic correlations (Fig. 2(C)) are often negative between −0.1259 and 0.1180, with a median of −0.0580. During the pandemic, the correlations still tend to be negative, with a median of −0.0499. Ethereum might be a better safe-haven than Bitcoin for three reasons. Firstly, for the whole period, the median correlation between Ethereum and S&P500 (−0.0570) is lower than the median correlation between Bitcoin and S&P500 (−0.0066). Secondly, different from Bitcoin and gold,[3] Ethereum and gold dynamic correlations (Fig. 2(D)) are always positive even before the pandemic, with a median of 0.1382. The correlations tend to increase during the pandemic, with a median of 0.1754. Finally, during the pandemic, the Ethereum and gold median correlation (0.1754) is higher than Bitcoin and gold (0.1466).

As a robustness check, we also estimate the corrected-DCC (cDCC) (Aielli, 2013) and superimpose the dynamic correlations on the DCC plot (Fig. 3). Fig. 3 shows the alignment between cDCC and DCC results. Both Bitcoin and Ethereum exhibit safe-haven traits because their returns tend to correlate with S&P500 negatively. The entire period median correlation between S&P500 and Ethereum (Bitcoin) is −0.0545 (−0.0085). Comparable to DCC, Ethereum is potentially a better safe-haven than Bitcoin because of three reasons. First, the median correlation of Ethereum and S&P500 is more negative than Bitcoin and S&P500 (−0.0545 vs. −0.0085). Second, different from Bitcoin and gold,[4] the dynamic correlations between Ethereum and gold are always positive, with a median before (during) the pandemic of 0.1364 (0.1818) (Fig. 3(D)). Third, in the pandemic, Ethereum and gold are more positively correlated, with a median of 0.1818 than Bitcoin and gold, with a median of 0.1552.

### 3.2. Regression analysis

We further investigate the safe-haven properties of Bitcoin and Ethereum during the COVID-19 pandemic by utilizing regressions as specified in Eq. (5). If a coin is a potential safe-haven, then the interaction between *Covid19*Gold_t* ($\beta_1$) should be positive while the interaction between *Covid19*Stock_t* ($\beta_3$) should be negative. In other words, during the pandemic, a safe-haven return should be positively associated with the gold return while negatively correlated with the stock return.

The results for Bitcoin are in Table 3(A). We use use three different scenarios based on the number of days in the pandemic: 7, 10, and 14 days. Based on the results, we learn that Bitcoin displays safe-haven characteristics. In all three scenarios, Bitcoin return is positively associated with gold return and negatively interrelated with stock return. The Bitcoin findings are in line with Gil-Alana et al. (2020) and Stensås et al. (2019) but different from Conlon and McGee (2020) and Corbet et al. (2020), who profess that Bitcoin is an imperfect hedge during COVID-19 pandemic.

We also find similar results for Ethereum, as presented in Table 3(B). For all 7, 10, and 14 days in the pandemic scenarios, we observe that Ethereum return correlates positively with the gold return but inversely correlated with stock return. Ethereum is

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[3] The result is available upon request.
[4] The result is available upon request.

**Table 1**

Descriptive statistics of Bitcoin (BTC), Ethereum (ETH), gold, and S&P500 daily returns before and during the COVID-19 pandemic.

| | (A) Before COVID-19 pandemic (July 1, 2019-March 10, 2020) | | | | (B) During COVID-19 pandemic (March 11, 2020-April 6, 2020) | | | |
|---|---|---|---|---|---|---|---|---|
| | Bitcoin | Ethereum | Gold | S&P500 | Bitcoin | Ethereum | Gold | S&P500 |
| Mean | −0.0027 | −0.0023 | 0.0009 | −0.00002 | 0.0062 | −0.0052 | 0.0006 | −0.0024 |
| Median | −0.0041 | −0.0032 | 0.0012 | 0.0009 | 0.0022 | −0.0018 | 0.0025 | −0.0151 |
| Maximum | 0.1276 | 0.1384 | 0.0308 | 0.0493 | 0.1747 | 0.2076 | 0.0370 | 0.0938 |
| Minimum | −0.1321 | −0.1623 | −0.0348 | −0.0759 | −0.2709 | −0.3453 | −0.0353 | −0.1198 |
| Std. Dev. | 0.0344 | 0.0434 | 0.0089 | 0.0127 | 0.0911 | 0.1096 | 0.0219 | 0.0607 |
| Observations | 174 | 174 | 174 | 174 | 19 | 19 | 19 | 19 |

### A. Bitcoin            B. Ethereum
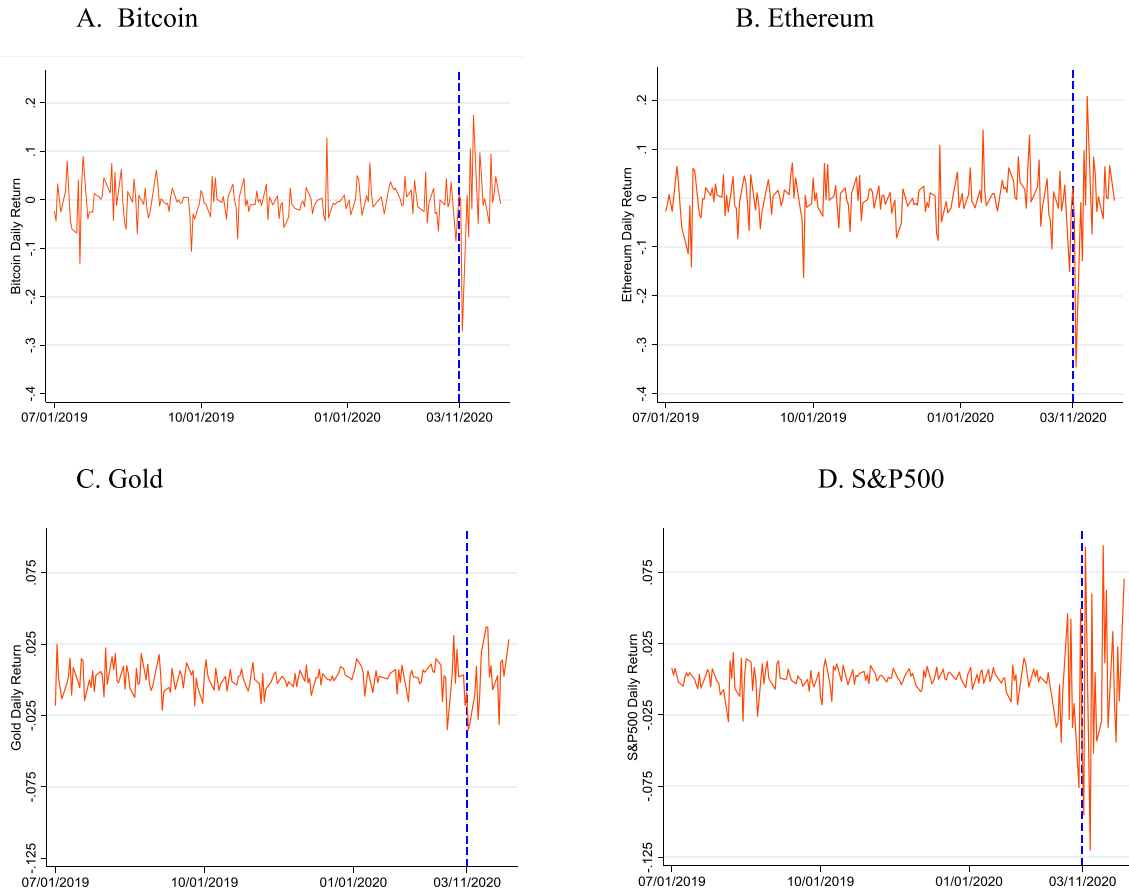
### C. Gold            D. S&P500



**Fig. 1.** The plot of daily returns from July 1, 2019, until April 6, 2020. The dashed line denotes the COVID-19 pandemic announcement (March 11, 2020).

**Table 2**

Pairwise correlations of Bitcoin (BTC), Ethereum (ETH), gold, and S&P500 daily returns before and during the COVID-19 pandemic.

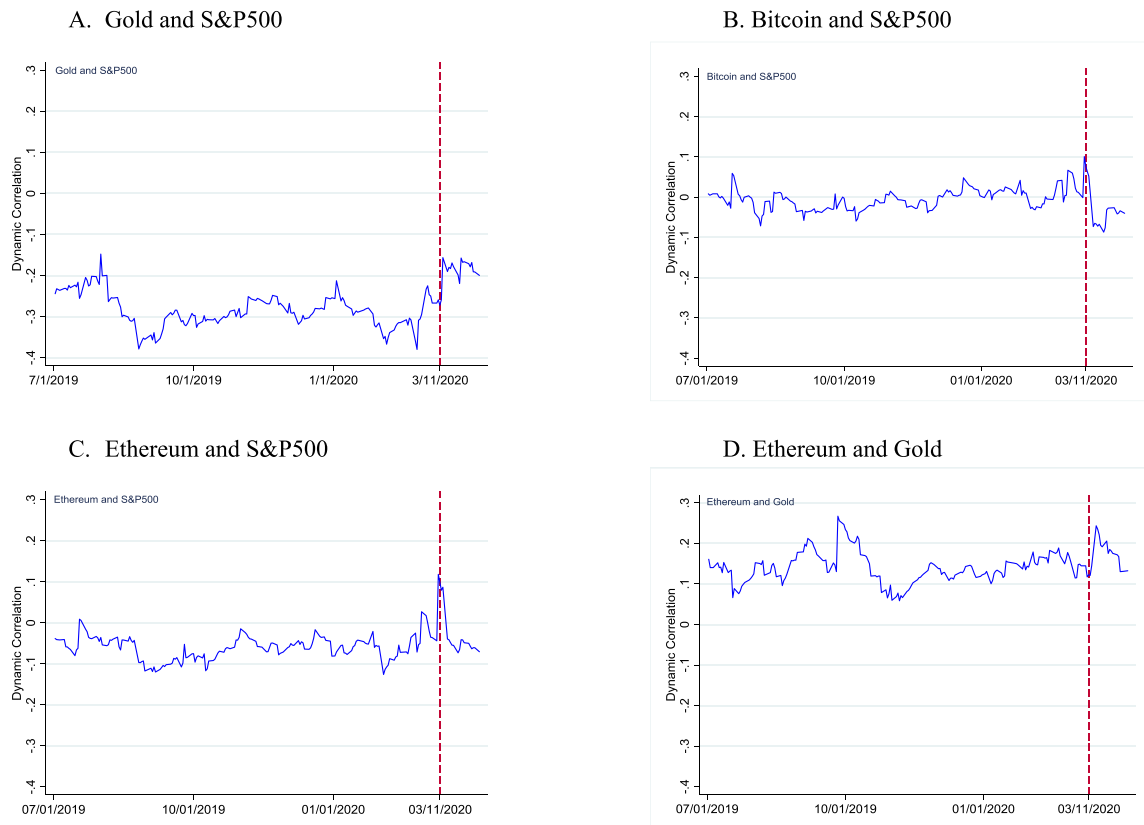| | (A) Before COVID-19 pandemic (July 1, 2019-March 10, 2020) | | | | | (B) During COVID-19 pandemic (March 11, 2020-April 6, 2020) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Bitcoin | Ethereum | Gold | S&P500 | | Bitcoin | Ethereum | Gold | S&P500 |
| Bitcoin | 1.000 | | | | Bitcoin | 1.000 | | | |
| Ethereum | 0.8306 | 1.000 | | | Ethereum | 0.9841 | 1.000 | | |
| Gold | 0.0513 | 0.1224 | 1.000 | | Gold | 0.1791 | 0.2345 | 1.000 | |
| S&P500 | 0.0729 | 0.0592 | −0.3333 | 1.000 | S&P500 | −0.379 | −0.3757 | 0.3705 | 1.000 |

**Fig. 2.** Daily Dynamic Conditional Correlation (based on DCC) from July 1, 2019, until April 6, 2020. The dashed line denotes the COVID-19 pandemic announcement (March 11, 2020).

plausibly a better safe-haven than Bitcoin since, in all scenarios, the $\beta_1$ and $\beta_3$ of Ethereum are consistently larger than Bitcoin. The Ethereum results are, to some extent, different from those of Bouri et al. (2020), who find that Ethereum is not a safe-haven for the US aggregate stocks.

We have also investigated FTSE-100 and find that Bitcoin and Ethereum coefficients are all as expected, but they are significant only for the 7-day settings.[5] The overall regression results support the notion that Bitcoin and Ethereum exhibit safe-haven qualities for stocks. However, we are also cognizant that both coins exhibit daily return volatilities higher than gold and stocks (Table 1). To alleviate the volatility problems, Baur and Hoang (2020) advise adding a stablecoin such as Tether, which acts as a safe-haven for both coins. We have also added Tether to the regressions, and the results still hold, except for the 10-day scenario.[6]

## 4. Concluding remarks

Based on the WHO COVID-19 pandemic proclamation on March 11, 2020, we test the Bitcoin and Ethereum as safe-havens for stocks. Our dynamic correlations and regressions results show that Bitcoin and Ethereum, as the two major cryptocurrencies, display short-term safe-haven characteristics for stocks. Moreover, we learn that Ethereum might be a better safe-haven than Bitcoin during a short extreme stock market downturn, but Ethereum exhibits higher return volatility than Bitcoin. Our results are in line with Gil-Alana et al. (2020) and Stensås et al. (2019) but are different from Bouri et al. (2020), Conlon and McGee (2020) and Corbet et al. (2020). The difference may arise because we focus on the short-term safe-haven properties and use a relatively shorter observation window.

Although both cryptocurrencies exhibit safe-havens features, we realize that their volatilities are higher than gold and S&P500. Before (during) the pandemic daily return volatilities of Bitcoin, Ethereum, gold, and S&P500 are 3.44% (9.11%), 4.34% (10.96%), 0.89% (2.19%), and 1.27% (6.07%), respectively. We are mindful that incorporating coins into a portfolio may not be easy due to the high transaction cost and illiquidity (Smales, 2019). Nevertheless, we hope that with additional future regulations, the coins' volatility could be lower. The regulations should increase market information availability and hinge on the fact that cryptocurrencies are

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[5] The result is available upon request.
[6] The result is available upon request.

### A. Gold and S&P500



### B. Bitcoin and S&P500



### C. Ethereum and S&P500
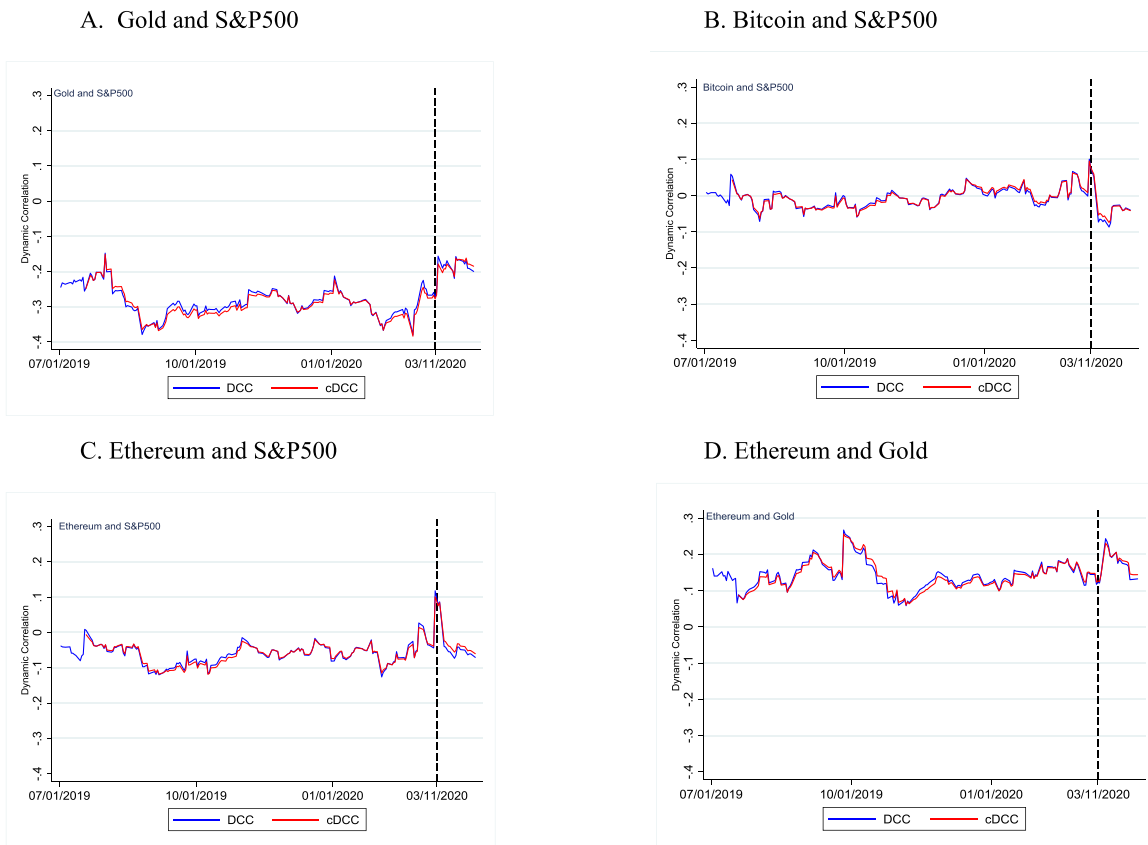


### D. Ethereum and Gold



**Fig. 3.** Daily Dynamic Conditional Correlation (based on DCC and cDCC) from July 1, 2019, until April 6, 2020. The dashed line denotes the COVID-19 pandemic announcement (March 11, 2020).

**Table 3**

Regression (OLS with Newey-West robust estimator) results analyzing Bitcoin and Ethereum as safe-havens based on Eq. (5). $Coin_t = \alpha + \beta_0 Gold_t + \beta_1 Covid19 * Gold_t + \beta_2 Stock_t + \beta_3 Covid19 * Stock_t + \lambda_0 Coin_{t-1} + \lambda_1 Gold_{t-1} + \lambda_2 Stock_{t-1} + \varepsilon_t Coin_t$ is cryptocurrency (Bitcoin or Ethereum) return at day-t. Goldt is gold return at day-t, Stockt is stock return at day-t, and Covid19 is a dummy variable equals to one if day-t is on the pandemic announcement date (March 11, 2020) or the subsequent days. If the cryptocurrency serves as a safe-haven, then $\beta_1$ ($\beta_3$) is expected to be positive (negative).

| | (A) Bitcoin | | | (B) Ethereum | | |
|---|---|---|---|---|---|---|
| # of Days in COVID-19 pandemic | 7 days | 10 days | 14 days | 7 days | 10 days | 14 days |
| Variable | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient |
| Constant | −0.0023 | −0.0026 | −0.0025 | −0.0025 | −0.0031 | −0.0029 |
| $Gold_t$ | 0.0597 | 0.0131 | 0.2132 | 0.3195 | 0.3575 | 0.5329 |
| $Covid19*Gold_t$ | 2.6193*** | 1.7693*** | 1.0079** | 3.6104*** | 2.041*** | 1.3699*** |
| $Stock_t$ | 0.2042 | 0.0900 | 0.1812 | 0.2609 | 0.1618 | 0.2774 |
| $Covid19*Stock_t$ | −1.3198*** | −0.7258*** | −0.7588*** | −1.5183*** | −0.8617*** | −0.9347*** |
| $Coin_{t-1}$(Bitcoin) | −0.0114 | −0.0822 | −0.0744 | | | |
| $Coin_{t-1}$ (Ethereum) | | | | 0.0558 | 0.0014 | 0.0083 |
| $Gold_{t-1}$ | 0.8254** | 0.8567*** | 0.9299*** | 0.4599 | 0.5374* | 0.5949** |
| $Stock_{t-1}$ | 0.2459*** | 0.4171*** | 0.4251*** | 0.4469*** | 0.6600*** | 0.6677*** |
| Adjusted R-square | 0.2697 | 0.2066 | 0.1889 | 0.2602 | 0.1893 | 0.1801 |
| No. of Observations | 193 | 193 | 193 | 193 | 193 | 193 |

different from the existing asset classes such as gold, commodities, or stocks (Gil-Alana et al., 2020; Yu et al., 2019). We also recognize that the coins' safe-haven characteristics are reliant on market conditions and investment horizons as described in prior studies (Bouri et al., 2017; Shahzad et al., 2020, 2019; Stensås et al., 2019).

## CRediT authorship contribution statement

**Christy Dwita Mariana:** Data curation, Writing - original draft, Investigation, Methodology. **Irwan Adi Ekaputra:** Conceptualization, Writing - review & editing, Funding acquisition, Methodology, Project administration. **Zaäfri Ananto Husodo:** Formal analysis, Methodology, Software.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.frl.2020.101798.

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