University of Tehran Press

Interdisciplinary Journal of Management Studies (IJMS)
Home Page: https://ijms.ut.ac.ir

Online ISSN: 2981-0795

The Portfolio Management Properties of Bitcoin During the Coronavirus Crisis

Mohamed Ali Azouzi[1*] | **Nidhal Mghadmi**[2]

1. Corresponding Author, Department of Finance and Accounting Methods, Institute of Higher Commercial Studies of Sfax (IHEC), University of Sfax, Sidi Mansour-sfax-. Email: mohamed_azouzi@yahoo.fr
2. Department of Quantitative Methods, Faculty of Economics and Management Mahdia-Tunisia, University of Monastir Sidi Messaoud - Mahdia. Email: nidhalmgadmii@gmail.com

ARTICLE INFO

Article type:
Research Article

Article History:
Received 27 April 2024
Revised 12 December 2024
Accepted 24 January 2025
Published Online 01 March 2025

Keywords:
Bitcoin,
BDS Test,
COVID-19,
DCC-GARCH,
Diversification,
Efficiency,
GARCH,
Hedging,
Safe Haven,
Speculation.

ABSTRACT

This study raises concerns about the potential of Bitcoin as a new alternative investment. This article aims to analyze the properties of Bitcoin in terms of speculation, diversification, hedging, safe haven, and it is qualified as efficient in a well-diversified portfolio during the COVID-19 epidemic using the GARCH model, the DCC model -GARCH, and the BDS test for the period from March 1, 2019 to March 31, 2022. The results indicate that Bitcoin can play an important role in portfolio diversification and that it can serve as a speculative asset. However, the authors argue that Bitcoin is a safe haven, a hedge, and is efficient. The conclusions of our results have important implications for investors and market participants who are deeply concerned about investment strategies and risk management.

JEL Classification: A, D, G

Cite this article: Azouzi, M. A. & Mghadmi, N. (2025). The Portfolio Management Properties of Bitcoin During the Coronavirus Crisis. *Interdisciplinary Journal of Management Studies* (*IJMS*), 18 (2), 333-347. http//doi.org/10.22059/ijms.2024.375551.676692

 Publisher: University of Tehran Press.
DOI: http//doi.org/10.22059/ijms.2024.375551.676692

1. Introduction

The recent coronavirus epidemic has revealed a general bear market for traditional assets. The current situation is unusual, complicating assessments and increasing market volatility. Despite the involvement of governments and central banks, fears remain. Financial markets have certainly been affected by the social and economic turmoil caused by the coronavirus outbreak. The financial crisis is the result of a health crisis, and the virus is also affecting various stock markets. The real impact will be felt by the economy and individual investors. During a crisis, people often invest in so-called safe havens or access to liquidity to reduce risk.

Since the launch of Bitcoin (BTC) in October 2008, numerous academics have become interested in digital, decentralized currencies. One of the most well-known and important cryptocurrencies is Bitcoin (BTC), which is based on blockchain technology and utilizes cryptography. Peer-to-peer (P2P) transactions assumes that this transaction will take place. In particular, BTC mining is the most important method to obtain additional coins, and due to the calculation of a unique algorithm, BTC is independently issued by all financial institutions. Instead, it uses a distributed ledger and decentralized transaction mechanism with multiple nodes on the BTC network to record each node's own transaction information. Furthermore, it uses cryptography to ensure the security of the decentralized system in Bitcoin transactions. Furthermore, the number of Bitcoins that can be mined on the BTC network is limited to approximately 21 million. As such, this development is comparable to the prospecting of gold, which is why Bitcoin is sometimes referred to as "digital gold." Bitcoin (BTC) has been likened to digital gold for its impressive recent financial performance. Hence, a study has been conducted focused on the properties of Bitcoin as an asset class.

Bitcoin has received a lot of attention recently from investors, analysts and researchers alike, as it is a new form of investment that offers the potential for very high profits while also presenting the risk of substantial losses. The main characteristic of Bitcoin is its decentralized nature and its resistance to any form of control and intervention. Bitcoin is often part of discussions regarding potential investments in safe-haven speculation, hedging, diversification, efficiency, and liquidity. However, empirical research on its relevance prior to the coronavirus crisis did not consider a period of turbulence in global equity markets.

Despite the enormous interest in Bitcoin, as a digital asset, the current study contributes to the existing literature in several ways. First, we contribute to the literature on the appropriate role Bitcoin should or could play in portfolio management in terms of speculation, diversification, hedging, safe haven, and efficiency (Loukil & al,2021, Abdelmalek, 2024). In fact, this analysis provides detailed information about the interaction of this new financial asset within a well-diversified portfolio and the position that Bitcoin occupies in relation to other assets. Moreover, this analysis is carried out during the recent COVID-19 health crisis, which spread rapidly and caused a worldwide epidemic. The study of the effects of the COVID-19 pandemic is considered a pertinent topic.

The investment side of this cryptocurrency will be examined in this work, specifically its effectiveness during the coronavirus crisis and its qualities of speculation, diversification, hedging, safe haven and effect on the price due to the liquidity ratio. Several scholars have previously addressed the issue, including numerous academics and professionals who see Bitcoin as just another speculative asset (Glaser et al. 2014; Baek & Elbeck 2015; Yermack 2015; Williamson, 2018). However, several experts have looked into Bitcoin's hedging and safe haven features (Kliber et al 2019; Chan et al 2019; Conlon et al 2020; Bouri et al 2017). While Carpenter (2016), Guesmi et al. (2019), and Wong et al. (2018) investigated the capability of Bitcoin to diversify. The effectiveness of Bitcoin was investigated by Nadarajah and Chu (2017), Tiwari et al. (2018), Kyriazis(2019, and Nan and Kaizoji (2019). Last but not least, some studies have explored how liquidity affects the pricing of Bitcoin (Symitsi, and Chalvatzis , (2019);Wei, 2018; Brauneis and al, 2022; Al-Yahyaee et al., 2020; Zhang and Li, 2022). Therefore, by extending the analysis period until 2022, it will be feasible to evaluate the role of Bitcoin in terms of portfolio management and liquidity and to determine whether the earlier findings remain valid.

The article is organized as follows: The second section reports related literature. The third section describes the methodological approach used. In the fourth section, we detail the data and descriptive statistics studied. The empirical results are illustrated in the fifth section, and the last section concludes the article.

2. Research Literature

As Bitcoin gained popularity and experts' interest in the midst of the ongoing economic and financial crisis, the related literature developed quickly. Researchers interested in learning more about the characteristics of Bitcoin as an asset class are showing significant interest. Since Bitcoin is mostly utilized in speculative markets as an asset rather than as a method of payment, its extreme volatility has a significant negative impact on its performance. According to Yermack et al. (2013), who compare the daily exchange rates of bitcoin with those of gold and fiat currencies, bitcoin is more akin to a speculative investment. Studies reveal that Bitcoin is predominantly utilized as a speculative asset rather than a medium of exchange, and it has no correlation with traditional assets such as stocks and bonds (Baur et al., 2018).

The researchers aim to explore how Bitcoin would be a good addition to a portfolio of investments due to its risk and return characteristics as well as its inverse connection to other currencies. Brière et al. (2015) investigated the diversification of portfolios using Bitcoin. The authors combined traditional assets (stocks, bonds, and fiat currencies) with unconventional investments (commodities, hedge funds, and real estate) in their portfolio analysis. They suggested that the risk-reward ratio in both short-term and long-term options improved with the inclusion of a small percentage of Bitcoin. Bouri et al. (2017) explored the correlation between BTC and other financial assets using a dynamic conditional correlation model. They discover that Bitcoin is deemed a potent diversifier. Kajtazi and Moro (2019) studied the diversification characteristics of three different portfolios as well as Bitcoin, while taking into account three different geographic areas, namely the US, European, and Chinese markets. With Bitcoin included, they examined the performance of naive, long-only, and semi-constrained portfolios in all three markets. The findings suggested that Bitcoin may have actively contributed to the diversification of already well-diversified portfolios, primarily by enhancing returns rather than lowering portfolio risk. Using the wavelet transformation and the Multivariate Autoregressive Generalized Conditional Heteroskedasticity (GARCH) model, the researchers conducted a thorough analysis. Pavkovi et al. (2019) explored the direction and intensity of the correlation between some cryptocurrencies and significant financial indicators in the market in the European Union. The findings demonstrate that Bitcoin and Ripple can be utilized as a tool for diversification in most of the European markets under study, as the related unconditional correlation coefficients are negative. The results indicate that certain cryptocurrencies can be effectively used to diversify portfolios, as the relationship between the values of cryptocurrencies and the selected indices is often weak and even occasionally negative. Incorporating Bitcoin into a traditional hedging portfolio consisting of gold, oil, and stocks would likely reduce overall risk, enhancing the portfolio's resilience to market fluctuations. Dyhrberg (2016) examined Bitcoin's hedging potential. The GARCH asymmetric technique was utilized from 19 July 2010 until 22 May 2015. Against the Financial Times Stock Exchange (FTSE) index stocks and the US dollar, he suggests using bitcoin as a hedging technique. Selmi et al. (2018) compared the hedging, safe haven, and diversified qualities of Bitcoin to those of gold and oil price patterns in a range of market scenarios. To address their research question, they employed the quantile-on-quantile regression method. The results indicated that both Bitcoin and gold serve as effective hedges, safe havens, and sources of diversification in the context of oil price fluctuations. However, this quality seems to be sensitive to the various market circumstances (bearish, normal, or bullish). The relationships between large cryptocurrencies during the COVID-19 pandemic were examined by Corbet et al. (2019), who discovered evidence of strength in both returns and volumes traded, suggesting that large cryptocurrencies served as a store of value during this period of intense financial market turmoil. Although the data suggested that these digital assets offered investors benefits of diversification, it also showed that, much like precious metals during the historic crisis, they functioned as a safe haven.

To find arbitrage opportunities that might occur as a result of inefficiencies in the Bitcoin market, researchers have also analyzed price efficiency for those marketplaces. Between July 18, 2010, and June 16, 2017, Tiwari et al. (2018) reexamined the information efficiency of Bitcoin using a range of robust long-term dependence estimators. Their results indicated that the Bitcoin market is indeed efficient. Furthermore, in testing for weak form efficiency in the Bitcoin markets against the US dollar and euro, Sensoy (2019) found that these markets exhibited signs of efficiency, with Bitcoin trades in US dollars displaying a higher level of efficiency compared to those conducted in euros. According to

Nadarajah and Chu (2017), Bitcoin returns were efficient. In a similar vein, Tiwari et al. (2018) discovered evidence pertaining to the Bitcoin market's informational efficiency. The existence of persistent variation in cryptocurrency prices exchanged across several online exchanges that could last for several days was established by Makarov and Schoar (2020). Moreover, they stated that this inefficiency was particularly evident in alternative cryptocurrency marketplaces.

3. Empirical Strategy

We evaluate Bitcoin's function as a diversification, hedging, or safe-haven asset during the COVID-19 epidemic using the paradigm outlined by Baur and Lucey (2010). Additionally, we analyze our major research topic using a number of cutting-edge methodological approaches. Each of these techniques is described in detail in the following subsections.

3.1. DCC–GARCH Model

To broaden conventional econometric models that assume constant variance for one period in advance, Engle (1982) introduced the Autoregressive Conditional Heteroskedasticity (ARCH) model. He originally developed this framework in 1970 while assessing the median and variance of inflation in the UK, providing the first ARCH-like model that served as a foundation for subsequent research. In 1986, Bollerslev expanded upon Engle's ARCH model by generalizing it, leading to the development of the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model.

The interaction between the many components, which is important for the risk analysis of a portfolio made up of numerous assets, cannot be captured by a traditional GARCH or a univariate GARCH. It is, therefore, proposed to use a multivariate GARCH that considers the conditional correlation between the assets to capture the dynamic links.

To capture both the conditional variance and the conditional correlation, we select the GARCH DCC (Dynamic Conditional Correlation) model developed by Engle (2002), and Tse and Tsui (2002). The GARCH CCC serves as the foundation for this three-part technique (Constant Conditional Correlation). Estimating each portfolio's conditional variance (H), using a univariate (linear or not) GARCH process, constitutes the first step. The second step is to construct the diagonal matrix comprising the conditional variances that have already been calculated. The conditional standard deviations matrix, denoted as D, is then obtained by taking the square root of this matrix. In the third and final step, we generate the correlations in an autoregressive manner, using the residuals from the first step's regressions. This results in a conditional correlation matrix that changes over time. The first step estimates a GARCH (1, 1) model:

$$\sigma_t = \omega + \alpha\varepsilon_{t-1}{}^2 + \sigma_{t-1}{}^2$$

$$\omega > 0, \alpha \geq, \beta \geq 0, \beta \leq 1$$

The second step estimates the DCC parameters:

Let X_t a vector (n×1) of stationary process, $X_t \sim$ DCC-GARCH if:

$$X_t = u_t + \varepsilon_t$$

$$\varepsilon_t = H^{1/2}{}_t \varepsilon_t$$

$$H_t = D_t R_t D_t$$

with

$$D_t = \begin{bmatrix} \sqrt{H_{1,t}} & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \ldots & \sqrt{H_{1,t}} \end{bmatrix}$$

and

$$R_t = \begin{bmatrix} 1 & \rho_{12,t} & \cdots & \rho_{1n,t} \\ \rho_{21,t} & 1 & \ldots & \rho_{2n,t} \\ \vdots & \vdots & \ddots & \vdots \\ \rho_{n1,t} & \rho_{2n,t} & \ldots & 1 \end{bmatrix}$$

where:

$$H_{i,t} = \alpha_{0i} + \sum_{q=1}^{Qi} \alpha_{iq} \varepsilon^{2}_{i,t-q} + \sum_{p=1}^{Pi} \beta_{ip} H_{i,t-p}$$

u_t : Vector (n×1) of conditional expectation of Xt at t,

ε_t : Vector (n×1) of conditional errors for n assets at t, with E (ε_t) = 0 and Cov (ε_t) = H_t ,

H_t : Matrix (n×n) of conditional variances and covariances of ε_t at t

D_t : Diagonal matrix (n×n) of conditional standard errors of ε_t at t, which is always positive

R_t : Matrix (n×n) of conditional correlations of ε_t at t

ε_t : Vector (n×1) of errors i, i, d., with E (ε_t) = 0 and $E\left(\varepsilon_t \varepsilon_t'\right) = I_n$

It is important to note that R_t is the dynamic matrix.

H_t : Must be always positive

R_t : Should be positive, and its elements must be less than or equal to one ($\rho_i \leq 1 \forall i$). To address this, we break down R_t into two matrices:

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1}$$

with

$$Q_t^* \begin{bmatrix} \sqrt{q_{11,t}} & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \sqrt{q_{nn,t}} \end{bmatrix}$$

and

$$Q_t = \begin{bmatrix} q_{11,t} & \sqrt{q_{11,t} q_{22,t}} & \cdots & \sqrt{q_{11,t} q_{nn,t}} \\ \sqrt{q_{11,t} q_{22,t}} & q_{22,t} & \cdots & \sqrt{q_{22,t} q_{nn,t}} \\ \vdots & \vdots & \ddots & \vdots \\ \sqrt{q_{11,t} q_{nn,t}} & \sqrt{q_{22,t} q_{nn,t}} & \cdots & q_{nn,t} \end{bmatrix}$$

for a DCC (p, q)

$$Q_t = \left[1 - \sum_{i=1}^{p} \alpha_{DCC,i} - \sum_{j=1}^{Q} \beta_{DCC,j}\right] \bar{Q} + \sum_{i=1}^{p} \alpha_{DCC,i} \left(\varepsilon_{t-i} \varepsilon_{t-i}'\right) + \sum_{j=1}^{Q} \beta_{DCC,j} Q_{t-j}$$

for a DCC (1, 1)

$$Q_t = \left(1 - \alpha_{DCC} - \beta_{DCC}\right) \overline{Q} + \alpha_{DCC} \varepsilon_{t-1} \varepsilon_{t-1}' + \beta_{DCC} Q_{t-1}$$

with α_{DCC} and β_{DCC} as scalars. R_t > 0 if and only if Q_t > 0. Thus, Ht is positive, it is necessary that the following conditions are satisfied: $\alpha_{DCC} \geq 0$; $\beta_{DCC} \geq 0$; avec (α_{DCC}+β_{DCC}) <1

3.2. The BDS Test

To address the research question of whether Bitcoin is considered efficient by researchers, we conducted a test of its informational market efficiency by examining the weak form efficiency of Bitcoin using the BDS test, as outlined by Nadarajah and Chu (2017).

The BDS test, developed by Brock et al. (1996), is a statistical tool designed to assess whether a time series follows a random walk. This test aims to detect the potential presence of linear or nonlinear dependence within the series. If the null hypothesis is rejected, we can conclude that the time series does not behave like a random walk.

H0: independently identically distributed series

4. Data and Descriptive Statistics

4.1. Data

The data for this study was collected from March 1, 2019, to March 31, 2022. The dependent variable is the yield of Bitcoin, while the independent variables include GOLD, WTI, the S&P 500, natural gas, and S&P 500 Sharia. Data for all variables was sourced from the website https://www.investing.com/, presented in daily frequency and expressed in US dollars. The intensity of the Covid-19 health crisis is quantified using two variables: the "Cases" variable, which represents the total (cumulative) confirmed cases, and the "Deaths" variable, which indicates the total (cumulative) number of deaths. These data (cases and deaths) are collected on the site https://www.worldometers.info/. This article analyzes the role Bitcoin should or could play in portfolio management in terms of speculation, diversification, hedging, safe haven, and efficiency during COVID-19.

4.2. Descriptive Statistics

A number of statistical tests will be used to analyze the variables including our sample. Table 1 presents the results of a descriptive analysis of our series of daily returns. According to this Table, the average profitability for the different variables ranges from GOLD at 0.00056 to Bitcoin at 0.0033. The minimum and maximum returns for Bitcoin, however, indicated that its price fluctuations were more erratic than those of other assets.

The standard deviation risk analysis indicates that GOLD has the lowest risk (0.011) while Bitcoin has the highest standard deviation (0.049). We can test the idea that the highest return is correlated with the highest risk by comparing the returns to the associated risk for each variable.

The Skewness coefficients are different from 0 for these variables and they are shifted either to the right or to the left.

Concerning the Kurtosis coefficients, their values are different from the normal value 3 for all the variables, and there is no parabolic branch of asymptotic direction towards the abscissa axis for these variables.

The Jarque-Bera normality test for all variables confirms the non-normality of our series, rejecting the null hypothesis at the 1% significance level.

Table 1. Descriptive Statistics

	Average	Median	Maximum	Minimum	Std, Dev	Skewness	Kurtosis	Jarque-Bera
R Bitcoin	0.0034	0.0028	0.2007	-0.4973	0.0489	-1.3517	19.1268	8155.1
R gold	0.0006	0.0008	0.0589	-0.0511	0.0109	-0.3988	7.0740	525.62
R WTI	0.0008	0.0027	0.4035	-0.8223	0.0452	-7.5305	161.295	771160
R natural gas	0.0009	0.0000	0.1980	-0.1288	0.0373	0.4143	7.3377	360.70
R S&P 500	0.0007	0.0013	0.1012	-0.1278	0.0150	-0.9888	19.8826	8812.4
R S&P 500 Sharia	0.0008	0.0014	0.8483	-0.8484	0.0471	-0.0825	289.71	250712
R cases	0.0190	0.0045	14.1647	-5.8916	0.7026	11.0545	251.82	19031
R deaths	0.0189	0.0059	2.8332	-0.7044	0.1174	17.9388	426.74	55156

Figure 1 below depicts the price movement of all assets along with Bitcoin, emphasizing the volatile price movement of Bitcoin relative to other assets.

The normalized price change chart (Figure 2) also illustrates that the volatility of Bitcoin’s price increased after the 2021 price surge and, again, in early 2022. It indicates that during the study period, Bitcoin’s price experienced the most significant fluctuations. However, due to its rising popularity thereafter, Bitcoin has exhibited extraordinary volatility, with varying degrees of association with other asset classes. In contrast to the period from 2019 to 2020, Bitcoin prices have remained relatively stable.

As noted in Figure 2, Bitcoin has generally moved in tandem to varying degrees with the primary asset classes under examination; however, it has a tendency to be adversely associated with some asset classes during market downturns, as the one experienced during the COVID-19 crisis. Further analysis was done to represent Bitcoin's limits as an alternative investment to better acknowledge its potential to function as a portfolio hedge, safe haven, or diversifier.

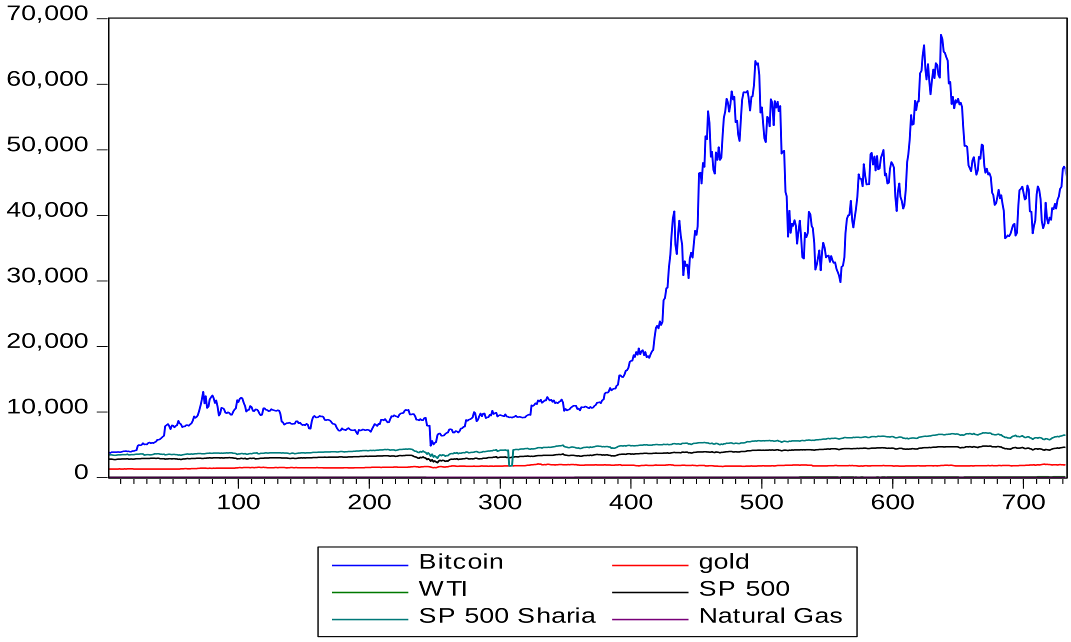

Fig. 1. Price Changes for All Assets

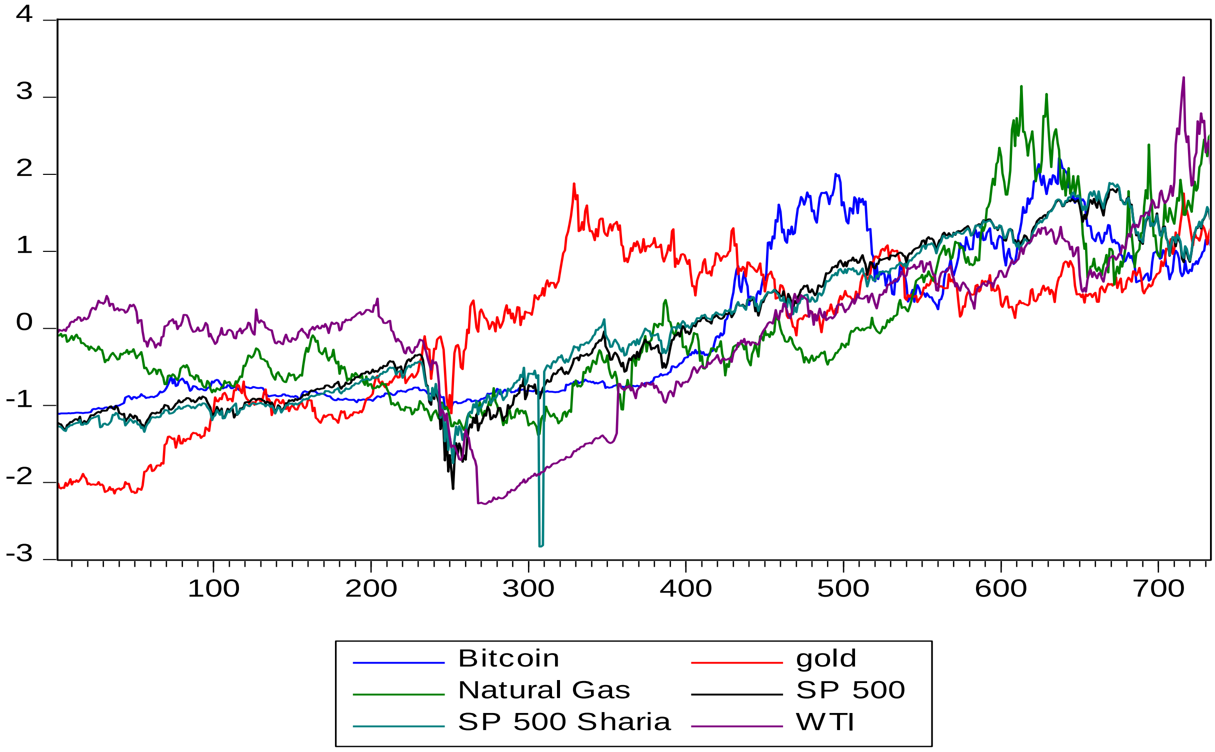

Fig. 2. ***Normalized Price Growth (All Assets)***

4.2.1. Correlation Matrix of Asset Returns

The pairwise correlation coefficients shown in Table 2 provide a preliminary understanding of the average correlations between the various financial holdings. It is important to remember that, nearly, all correlation coefficients between Bitcoin and other assets are less than 0.260. According to Baur and Lucey's (2010) definition of a hedge, a diversifier, and a safe haven, Bitcoin could be considered a diversifier due to its low to moderate correlation with gold, WTI crude oil, the S&P 500, and the S&P 500 Sharia index. Additionally, it could serve as a hedge given its negative to moderate correlation with natural gas.

The S&P 500 index also showed the highest positive correlation with Bitcoin (= 0.260), making it the asset with which Bitcoin resembles most closely in terms of price changes and price patterns. However, the correlation coefficient may be too low to categorize Bitcoin as belonging to the same asset class as the S&P 500 index.

Table 2. Correlation Matrix of Asset Returns

Correlation matrix								
	R Bitcoin	**R gold**	**R WTI**	**R natural gas**	**R S&P 500**	**R S&P 500_Sharia**	**R cases**	**R deaths**
R Bitcoin	1	0.123	0.091	-0.006	0.260	0.098	-0.010	-0.041
R gold	0.123	1	0.048	0.019	0.029	-0.024	0.004	0.016
R WTI	0.091	0.048	1	0.031	0.259	0.091	-0.075	-0.025
R natural gas	-0.006	-0.019	0.031	1	0.134	0.008	0.017	-0.030
R S&P 500	0.260	0.029	0.259	0.134	1	0.370	0.059	-0.004
R S&P 500 Sharia	0.098	-0.024	0.091	0.008	0.370	1	0.030	0.001
R cases	-0.010	0.004	-0.075	0.017	0.059	0.030	1	0.036
R deaths	-0.041	0.016	-0.025	-0.030	-0.004	0.001	0.036	1

Further analysis was conducted to examine the dynamic conditional correlation between Bitcoin and other assets because the point estimate of correlation may not always accurately reflect the nature of the correlation. This method was used by Ngene et al. (2018) to investigate the existence of time-invariant interactions in the volatility between assets.

5. Empirical Results

5.1. GARCH

Checking the prerequisites is crucial before using the GARCH model on a dataset. To determine if the transformed time series is stationary, a unit root test of log returns is performed. The Augmented Dickey-Fuller test (ADF test), where the null hypothesis states that there is a unit root at a certain level of confidence, can determine if a unit root is present in a time series. Table 3 presents the test results.

Table 3. The Results of the ADF Test of the Stationarity of the "Level" Series

Dickey-Fuller tests (1979-1981)				
	In level		**In first difference**	
	T-Stat	**Critical Values**	**T-Stat**	**Critical Values**
R Bitcoin	0.215471	-1.941256	-27.17514	-1.941257
R WTI	0.835143	-1.941256	-14.33979	-1.941265
R gold	1.061152	-1.941256	-27.68078	-1.941257
R Natural gas	0.861021	-1.941259	-15.69705	-1.941259
R S&P 500	1.484396	-1.941257	-31.68407	-1.941257
R S&P 500_Sharia	1.184586	-1.941260	-15.40723	-1.941260
Cases	-1.327928	-1.941256	-26.92795	-1.941257
Deaths	-0.143385	-1.941256	-27.18863	-1.941257

From the results of the unit root test, it can be observed that the value of t is greater than the critical value at the 1% level for all variables. Thus, H0 has been accepted, indicating the presence of a single unit root in our time series.

The results of the first differentiation show that all the values of the series are below the threshold at the 1% level. As a result, H0 has been rejected, which proves that a stationary time series does not have a unit root.

We then see that our first two conditions for developing the GARCH model (non-normality and stationarity) are satisfied.

5.1.1. ARCH Effect Analysis and Determination of the GARCH Model

In general, ARCH models (Auto Regressive Conditional Heteroscedasticity) allow for dynamic forecasting in terms of means and variances as well as the estimation of instantaneous chronic volatilities that depend on the past (Engel, 1982). The traditional Fisher test or the Lagrange multiplier test is used to determine whether this heteroscedasticity exists (LM).

Table 4. ARCH Heteroscedasticity Test

ARCH heteroscedasticity test				
	T-Stat	**Prob. F**	**Obs*R-squared**	**Prob. Chi Square**
R Bitcoin	115.4996	0.0000	99.93977	0.0000
R WTI	167.5669	0.0000	136.5536	0.0000
R gold	43.58718	0.0000	41.23486	0.0000
R Natural gas	26.95047	0.0000	26.05860	0.0000
R S&P 500	212.7212	0.0000	165.0210	0.0000
R S&P 500 Sharia	239.0218	0.0000	180.4364	0.0000
R cases	43.27936	0.0000	40.96001	0.0000
R deaths	33.04910	0.0000	31.69900	0.0000

The ARCH heteroscedasticity test results (Table 4) are significant for all return series, supporting the null hypothesis that the ARCH effect exists in our time series.

Therefore, it is possible to use the ARCH (1) and GARCH (1, 1) models to simulate the volatility of variable returns. However, because the GARCH model is more frugal (uses fewer parameters) than the ARCH model, we shall choose it.

Table 5. GARCH Model

GARCH model coefficients (1,1)						
	R Bitcoin	**R gold**	**R WTI**	**R S&P 500**	**R S&P 500 Sharia**	**R natural gas**
ω	5.9172 (0.0001)	0.3424 (0.0000)	0.8288 (0.0000)	0.1097 (0.0000)	0.6064 (0.0000)	0.1260 (0.0095)
Α	0,6141 (0.0000)	0,5902 (0.0000)	0,7707 (0.0000)	0,6150 (0.0000)	0,1602 (0.0000)	0.0748 (0.0000)
Β	0,2241 (0.0000)	0,2247 (0.0000)	0,2817 (0.0000)	0,3817 (0.0000)	2.0925 (0.0000)	0,9238 (0.0000)
$\alpha+\beta$	0.8382	0.8149	1.0524	0.9967	2.2527	0.9986

The fact that the constant in the conditional variance equation for Bitcoin's return is very high suggests that Bitcoin is an asset that could be considered speculative. This reasoning aligns with Baek and Elbeck (2014), who consider Bitcoin to be a highly speculative asset due to its internally generated volatility.

The year 2019 was one of relative stability. This explains why our variables' volatility was minimal and, approximately, comparable over this time.

The outbreak of the COVID-19 epidemic served as one of the most significant shocks in the past decade, making 2020 the quintessential year of stock market crisis. The financial markets, including the cryptocurrency Bitcoin market, were not exempt from the institutional, economic, financial, social, and human effects of this health crisis. The first wave of the epidemic profoundly impacted all the resources in our study. Bitcoin demonstrated to be far more volatile than other assets during this period, nevertheless, in terms of volatility. This finding is consistent with findings from Katsiampa (2017), Selmi et al. (2018), Baur and Hoang (2018).

The health crisis did, indeed, begin with significant volatility; however, as we can see, by the end of the first quarter of 2020, the volatility had decreased about 50%. It should also be noted that Bitcoin's volatility has decreased significantly since it first began to increase. The Bitcoin critics who anticipate a sharp decline in the price of what they believe to be a speculative bubble, have fertile ground to work with thanks to this exceptionally high volatility. Therefore, Bitcoin is a speculative instrument. Based on our analysis, the results are in line with those of Cheung et al. (2015), Cheah and Fry (2015), Corbet et al. (2019), and Bouri et al. (2017).

In times of crisis, gold is regarded as an investment and a haven (Baur & Lucey, 2010; Charfeddine et al., 2020; Abdelmalek, 2024; Mgadmi et al, 2024). Although gold typically has lower volatility than other commodities, this particular instance implies that it has not been a hedge or safe haven during the COVID-19 pandemic. Using GARCH models, Gronwald (2014) compared the markets for gold and Bitcoin, discovering that the latter's price fluctuations were incredibly significant and that the market in which it trades is in its infancy.

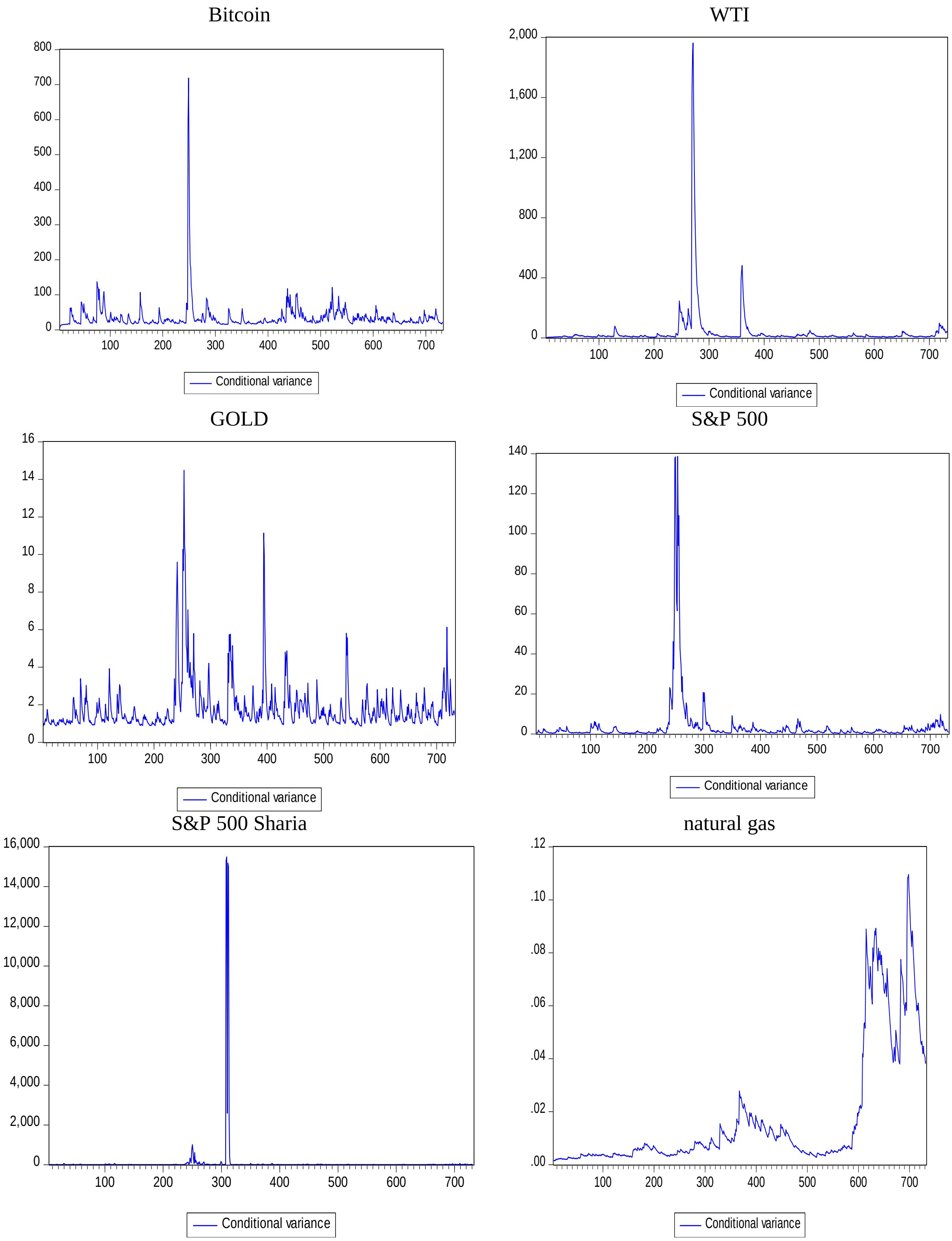

Fig. 3. Daily Evolution of the Volatility of Variable Returns During the Period 2019-2022

5.2. DCC-GARCH Results

Figure 4 illustrates how the dynamic link between Bitcoin and gold, the WTI, the S&P 500, the S&P 500 sharia, and natural gas have changed over time.

The dynamic correlation of Bitcoin and gold is mostly positively correlated. Hence, Bitcoin appears to act as a diversifier for gold during the covid-19 period. The temporal correlation of Bitcoin with gold is constant throughout the analyzed sample period, implying that Bitcoin is a strong diversifier, similar to Bitcoin and S&P 500 Sharia.

The dynamic correlation between Bitcoin and S&P 500 indicates an upward trend, implying that Bitcoin is acting as a diversifier for the S&P 500.

There is evidently a very volatile conditional dynamic correlation between Bitcoin and natural gas on average. Although, sometimes, the coefficient is large and, sometimes small, the significant positive correlation implies that Bitcoin is a diversifier for natural gas.

The results revealed that Bitcoin exhibits diversification properties, while no safe haven and hedging properties during the COVID-19 outbreak are revealed. The findings are consistent with Ji et al.'s (2020), implying that the safe haven role becomes less effective for most cryptocurrencies during the COVID-19 outbreak.

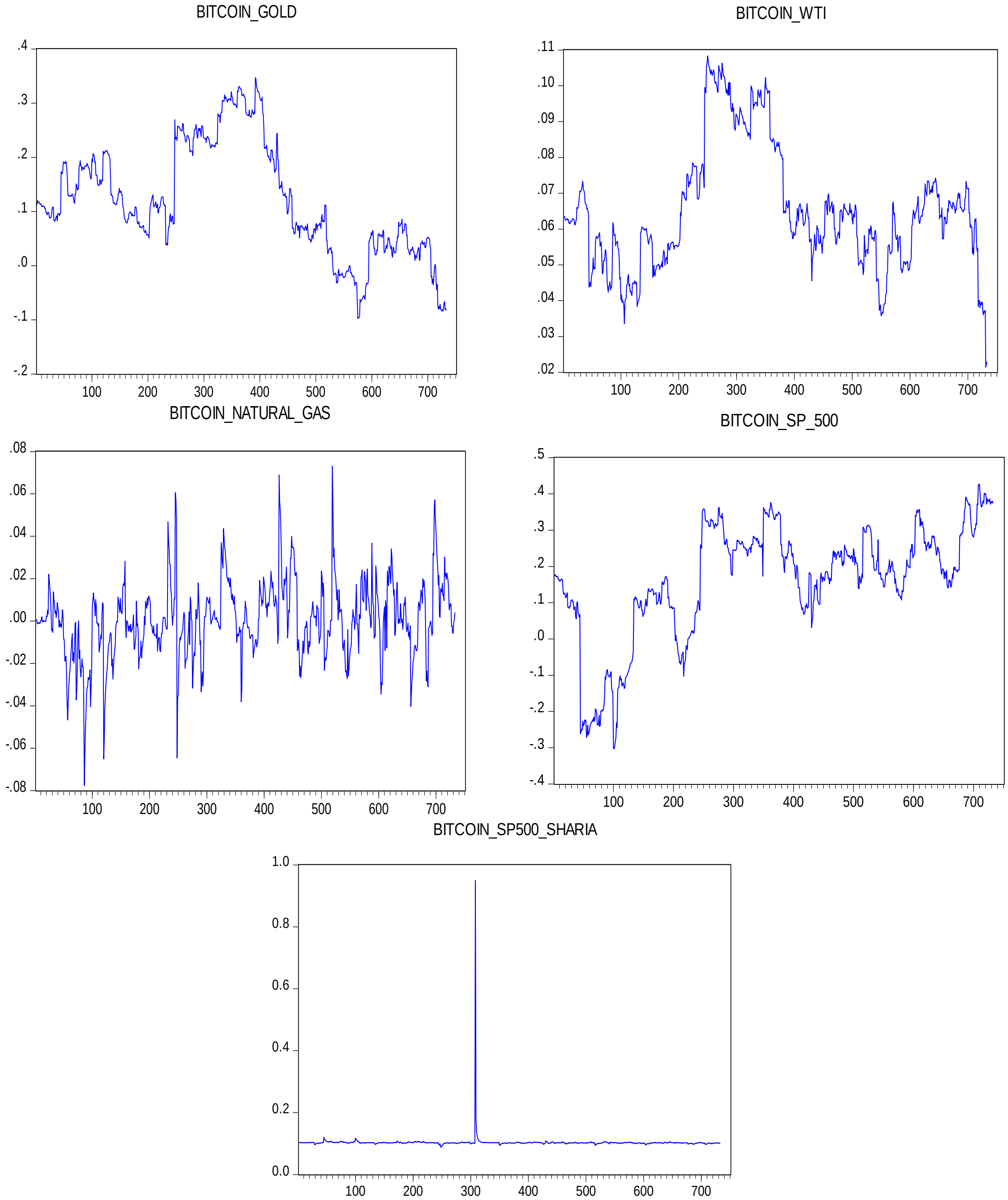

Fig. 4. Conditional Correlation Graphs

5.3. BDS Test Result

Table 6 presents the results of the z-statistic of the BDS test. The z-statistics must be taken in absolute value, to be compared with the value of the centered normal law reduced to 95%, i.e., 1.96. We note that the z-statistic is greater than 1.96. Therefore, the different series of returns are not independent and identically distributed (i. i.d.). Indeed, it was found that Bitcoin returns do not follow a random behavior, and, therefore, the market is not efficient in the weak sense, confirming previous studies (Urquhart, 2016; Al-Yahyaee et al. 2020; Naeem et al. 2021). It should be noted that regulators must intervene in the market to ensure the dissemination of information for it to be reflected in the price.

Table 6. ***BDS test***

	Dimension				
	2	3	4	5	6
R Bitcoin	15.10944	16.00234	16.13393	16.32329	16.64763

6. Conclusion

The current research study focused on those properties of Bitcoin which could play roles in management of the portfolio in terms of speculation, diversification, hedging, safe haven, and being qualified as efficient.

This article deals with the speculative, hedging, safe haven, diversification and efficiency properties of Bitcoin as well as the influence of the illiquidity ratio on the yield of Bitcoin during the coronavirus crisis. The daily data runs from March 01, 2019 to March 31, 2022.

The conditional volatility of Bitcoin is measured, and their evolution over time is examined using the conventional GARCH model, as part of the examination of Bitcoin in terms of speculation. To determine volatility, this model has consistently shown to be more useful, especially for high-frequency data. Our empirical analysis revealed that Bitcoin has generated substantial volatility and is, thus, a highly speculative asset (Katsiampa, 2017; Katsiampa et al., 2019; Yi et al., 2018; Balcilar et al., 2017; Bouri et al., 2017; Kristoufek, 2015; Yermack, 2015; Zhu et al., 2017).

Second, we examine how Bitcoin can provide a well-diversified portfolio with benefits, such as diversification, hedging, and safe havens. This study suggests that Bitcoin is a useful diversifier for investors during COVID-19, using the dynamic conditional correlation model developed by Engle (2002).

As a result, we analyze the efficiency of the weak form of Bitcoin using Nadarajah and Chu's (2017) BDS test. The results revealed that Bitcoin is inefficient in the weak sense, demonstrating that past returns are not indicative of future ones.

Innovative forms of currency, such as Bitcoin, are causing central governments, investors, and academics to become increasingly concerned. Finally, using OLS regression to evaluate the influence of the illiquidity ratio on the yield of Bitcoin, the result indicates a positive and significant link. This explains why Bitcoin prices shift downward as market illiquidity increases to generate larger future yields.

Overall, the outbreak of pandemics seems to play a significant role in changing investor behavior in financial markets. In this regard, the findings could be of great interest to investors seeking to invest in digital markets and collect information during crisis periods. Thus, financial market participants and those in the cryptocurrency market are encouraged to take into account information disclosed through the media and social networks to make better decisions regarding the information related to Bitcoin dynamics.

In conclusion, the findings indicate that the number of confirmed cases and deaths from COVID-19 have no bearing on the prices of natural gas, gold, Bitcoin, WTI, S&P 500, and S&P 500 Sharia.

References

Abdelmalek, W. (2024). Cryptocurrencies and portfolio diversification before and during COVID-19. *EuroMed Journal of Business*, *19*(4), 1084-1120. https://doi.org/10.1108/EMJB-10-2022-0182

Al-Yahyaee, K. H., Mensi, W., Ko, H.U., Yoon, S.M., Kang, S.H, 2020. "Why cryptocurrency markets are inefficient: The impact of liquidity and volatility," The North American Journal of Economics and Finance, Elsevier, vol. 52, .DOI: 10.1016/j.najef.2020.101168.

Baek, C. and Elbeck M. (2015). Bitcoins as an investment or speculative vehicle? A first look. Applied Economics Letters, 2015, vol. 22, issue 1, 30-34. DOI: 10.1080/13504851.2014.916379.

Balcilar, M., Bouri, E., Gupta, R. and Roubaud, D. (2017). Can volume predict Bitcoin returns and volatility? A quantiles-based approach. Economic Modelling, 64, 74-81. https://doi.org/10.1016/j.econmod.2017.03.019.

Baur, D. G., & Lucey, B. M. (2010). Is gold a hedge or a safe haven? An analysis of stocks, bonds and gold. *The Financial Review*, *45*(2), 217-229. https://doi.org/10.1111/j.1540-6288.2010.00244.x.

Baur, D. G., Lee, A. D., & Hong, K. (2018). Bitcoin: Medium of exchange or speculative assets? *Journal of International Financial Markets, Institutions & Money*, *54(c)*, 177–189. http://dx.doi.org/10.1016/j.intfin.2017.12.004

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics*, *31*(3), 307–327. https://doi.org/10.1016/0304-4076(86)90063-1.

Bouoiyour, J., & Selmi, R. (2016). Bitcoin: A beginning of a new phase? *Econ Bulletin*, *36*(3), 1430-1440. https://econpapers.repec.org/scripts/redir.pf?u=http%3A%2F%2Fwww.accessecon.com%2FPubs%2FEB%2F2016%2FVolume36%2FEB-16-V36-I3-P142.pdf;h=repec:ebl:ecbull:eb-16-00372.

Bouri, E., Azzi, G., & Dyhrberg, A. H. (2017). On the return-volatility relationship in the Bitcoin market around the price crash of 2013. *Open Access Open Assess E-Journal of Economics*, *11*(2), 1-16. DOI: 10.5018/economics-ejournal.ja.2017-2

Brauneis, A., Mestel, R., Riordan, R., & Theissen, E. (2022). Bitcoin unchained: Determinants of cryptocurrency exchange liquidity. Journal of Empirical Finance, 69, 106-122. https://doi.org/10.1016/j.jempfin.2022.08.004.

Brière, M., Oosterlinck, K., & Szafarz, A. (2015). Virtual currency, tangible return: Portfolio diversification with Bitcoin. *Journal of Asset Management*, *16*(6), 365–373. http://dx.doi.org/10.2139/ssrn.2324780

Broock, W. A., Scheinkman, J. A., Dechert, W. D., & LeBaron, B. (1996). A test for independence based on the correlation dimension. Econometric reviews, 15(3), 197-235 . https://doi.org/10.1080/07474939608800353.

Carpenter, A. (2016). Portfolio diversification with Bitcoin. *Journal of Undergraduate Research in Finance*, *6*(1), 1-27. https://jurf.org/wp-content/uploads/2017/01/carpenter-andrew-2016.pdf

Chan, N. H., Yau, C. Y., & Zhang, R.-M. (2014). Group LASSO for structural break time series. *Journal of the American Statistical Association*, *109*(506), 590–599. https://econpapers.repec.org/scripts/redir.pf?u=http%3A%2F%2Fhdl.handle.net%2F10.1080%2F01621459.2013.866566;h=repec:taf:jnlasa:v:109:y:2014:i:506:p:590-599.

Charfeddine, L., Benlagha, N., Maouchi, Y. (2020).Investigating the dynamic relationship between cryptocurren-cies and conventional assets: implications for financial investors. Econ. Model. 85, 198–217 https://doi.org/10.1016/j.econmod.2019.05.016.

Cheah, E.-T., & Fry, J. (2015). Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin. *Economics Letters, 130*, 32–36. http://dx.doi.org/10.1016/j.econlet.2015.02.029

Cheung, A.-K., Roca, E., & Su, J.-J. (2015). Crypto-currency bubbles: an application of the Phillips-ShiYu (2013) methodology on Mt. Gox bitcoin prices. Applied Economics, 47(23), 2348-2358. doi:https://doi.org/10.1080/00036846.2015.1005827.

Conlon, T., & McGee, R. (2020). Safe haven or risky hazard? Bitcoin during the COVID-19 bear market. *Finance Research Letters*, *35*, 101607. http://dx.doi.org/10.2139/ssrn.3560361

Corbet, S., Lucey, B., Urquhart, A., & Yarovaya, L. (2019). Cryptocurrencies as a financial asset: A systematic analysis. *International Review of Financial Analysis*, *62*, 182–199. https://doi.org/10.1016/j.irfa.2018.09.003

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*(366a), 427–431. https://doi.org/10.2307/2286348.

Dyhrberg, A. H. (2016). Bitcoin, or et dollar - une analyse de volatilité GARCH. *Finance Research Letters*, *16*(2), 85–92. http://dx.doi.org/10.1016/j.frl.2015.10.008

Engle, R. (2002). Dynamic conditional correlation: A simple class of multivariate generalized autoregressive conditional heteroskedasticity models. *Journal of Business & Economic Statistics*, *20*(3), 339–350. https://www.jstor.org/stable/1392121.

Engle, R.F., (1982). Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation, Econometrica, 50(4), 987-1007. https://doi.org/10.2307/1912773.

Glaser, F., Zimmermann, K., Haferkorn, M., Weber, M. C., & Siering, M. (2014). Bitcoin-asset or currency? revealing users' hidden intentions. *Revealing Users' Hidden Intentions (April 15, 2014). ECIS*. https://ssrn.com/abstract=2425247

Gronwald, M. (2014). The Economics of Bitcoins-Market characteristics and price jumps (No. 5121). CESifo Group Munich. Working Paper Series No. 5121, Available at SSRN: https://ssrn.com/abstract=2548999 or http://dx.doi.org/10.2139/ssrn.2548999

Guesmi, K., Saadi, S., Abid, I., & Ftiti, Z. (2019). Portfolio diversification with virtual currency: Evidence from Bitcoin. *International Review of Financial Analysis*, *63*, 431–437. DOI: 10.1016/j.irfa.2018.03.004.

Kajtazi, A., & Moro, A. (2019). The role of Bitcoin in well-diversified portfolios: A comparative global study. *International Review of Financial Analysis*, *61*, 143–157. http://dx.doi.org/10.1016/j.irfa.2018.10.003

Katsiampa, P. (2017). Volatility estimation for Bitcoin: A comparison of GARCH models. *Economics Letters*, *158*, 3–6. https://doi.org/10.1016/j.econlet.2017.06.023.

Katsiampa, P., Corbet, S., & Lucey, B. (2019). High frequency volatility co-movements in cryptocurrency markets. Journal of International Financial Markets, Institutions and Money, 62, 35–52. DOI: 10.1016/j.intfin.2019.05.003.

Kliber, A., Marszałek, P., Musiałkowska, I., & Świerczyńska, K. (2019). Bitcoin: Safe haven, hedge or diversifier? Perception of bitcoin in the context of a country's economic situation—A stochastic volatility approach. *Physica A: Statistical Mechanics and Its Applications*, *524*, 246-257. DOI: 10.1016/j.physa.2019.04.145.

Kristoufek, L., (2015). "What are the main drivers of the Bitcoin price? Evidence from wavelet coherence analysis". In: PloS one 10.4, e0123923. DOI: 10.1371/journal.pone.0123923.

Kyriazis, N. A. (2019). Une enquête sur les résultats empiriques sur les retombées sur les marchés de la crypto-monnaie. *Journal of Risk and Financial Management*, *12*(4), 170.

Loukil, S., Aloui, M., Jeribi, A., & Jarboui, A. (2021). Are digital assets backstops for GCC stock markets in COVID-19-led financial crisis? *International Journal of Electronic Finance*, *10*(4), 232–259. DOI: 10.1504/IJEF.2021.10043433

Makarov, I., & Schoar, A. (2020). Trading et arbitrage sur les marchés des crypto-monnaies. *Journal of Finance and Economics*, *135*(2), 293–319. 10.1016/j.jfineco.2019.07.001.

Mgadmi, N., Moussa, W., Mohammedi, W., Abidi, A., & Wahada, M. (2024). The impact of social media on the cryptocurrency markets during the COVID-19 pandemic and the Russia-Ukraine conflict. *Knowledge and Information Systems*. 1-18. https://doi.org/10.1007/s10115-024-02236-x

Nadarajah, S., & Chu, J. (2017). Sur l'inefficacité du Bitcoin. *Economics Letters*, *150*(c), 6–9. https://doi.org/10.1016/j.econlet.2016.10.033

Naeem, M. A., Mbarki, I., Alharthi, M., Omri, A., & Shahzad, S. J. H. (2021). Did COVID19 Impact the Connectedness Between Green Bonds and Other Financial Markets? Evidence From Time-Frequency Domain With Portfolio Implications. Frontiers in Environmental Science, 9, 180. https://doi.org/10.3389/fenvs.2021.657533.

Nan, Z., and Kaizoji, T. (2019). Market efficiency of the Bitcoin exchange rate: Weak and semi-strong form tests with the spot, futures and forward foreign exchange rates. International Review of Financial Analysis, 64, 273-281. https://doi.org/10.1016/j.irfa.2019.06.003.

Ngene, G., Post, J., & Mungai, A. (2018). Volatility and shock interactions and risk management implications: Evidence from the US and frontier markets. Emerging Markets Review, 37, 181–198. https://doi.org/10.1016/j.ememar.2018.09.001.

Pavković, A., Anđelinović, M., & Pavković, I. (2019). Achieving Portfolio Diversification through Cryptocurrencies in European Markets. Business Systems Research, 10(2). https://doi.org/10.2478/bsrj-2019-020.

Selmi, R., Mensi, W., Hammoudeh, S., & Bouoiyour, J. (2018). Is Bitcoin a hedge, a safe haven or a diversifier for oil price movements? A comparison with gold. Energy Economics, 74, 787-801. 10.1016/j.eneco.2018.07.007.

Sensoy, A. (2019). L'inefficacité du Bitcoin revisitée: Une analyse à haute fréquence avec les monnaies alternatives. *Finance Research Letters*, *28*(c), 68–73. DOI: 10.1016/j.frl.2018.04.002.

Symitsi, E., & Chalvatzis, K. J. (2019). The economic value of Bitcoin: A portfolio analysis of currencies, gold, oil, and stocks. *Research in International Business and Finance*, *48*, 97–110. http://dx.doi.org/10.2139/ssrn.3127534

Tiwari, A. K., Jana, R. K., Das, D., & Roubaud, D. (2018). Efficacité informationnelle de Bitcoin - une extension. *Economics Letters*, *163*, 106–109. 10.1016/j.econlet.2017.12.006.

Tse., Y. K., and Tsui., K.C. (2002). A multivariate generalized autoregressive conditional heteroscedasticity model with time-varying correlations. Journal of Business and Economic Statistics, 20, 351–362. 10.1198/073500102288618496.

Urquhart, A. (2016). The inefficiency of Bitcoin. Economics Letters, 148, 80-82. https://doi.org/10.1016/j.econlet.2016.09.019.

Wang, G.-J., Xie, C., Wen, D., & Zhao, L. (2018). When Bitcoin meets economic policy uncertainty (EPU): Measuring risk spillover effect from EPU to Bitcoin. Finance Research Letters. https://doi.org/10.1016/j.frl.2018.12.028.

Wei, W. C. (2018). Liquidity and market efficiency in cryptocurrencies. Economics Letters, 168, 21–24. https://doi.org/10.1016/j.econlet.2018.0 4.003.

Williamson, S. (2018). Is Bitcoin a Waste of Resources? Rev. Federal Reserve Bank St.Louis 100: 107–15. https://doi.org/10.20955/r.2018.107-15.

Yermack, D. (2015). Is Bitcoin a real currency? An economic appraisal. In D. L. K. Chuen & S. Diego (Eds.), *Handbook of digital currency* (pp. 31–43). Academic Press. https://doi.org/10.1016/B978-0-12-802117-0.00002-3.

Yi, S., Xu, Z. and Wang, G.J. (2018) .Volatility connectedness in the cryptocurrency market: Is Bitcoin a dominant cryptocurrency?', International Review of Financial Analysis, Vol. 60, pp.98-114. https://doi.org/10.1016/j.irfa.2018.08.012.

Zhang, W., & Li, Y. 2023. Liquidity risk and expected crypto returns. International Journal of Finance & Economics, 28(1), 472-492. DOI: 10.1002/ijfe.2431.

Zhu, Y., Dickinson, D., & Li, J. (2017). Analysis on the influence factors of Bitcoin's price based on VEC model. *Financial Innovation*, *3*(1), 1–13. https:// doi. org/ 10. 1186/ s40854- 017- 0054-0