# Are gold and cryptocurrency a safe haven for stocks and bonds? Conventional vs Islamic markets during the COVID-19 pandemic

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## Abstract

**Purpose** – This study aims to identify the ability of gold and cryptocurrency (Cryptocurrency Uncertainty Index (UCRY) Price) as safe haven assets (SHA) for stocks and bonds in both conventional (i.e. stock indices and government bonds) and Islamic markets (i.e. Islamic stock indices and Islamic bonds (IB)).

**Design/methodology/approach** – The authors employed the nonadditive panel quantile regression model by Powell (2016). It measured the safe haven characteristics of gold and UCRY Price for stock indices, government bonds, Islamic stocks, and IB under gold circumstances and level of cryptocurrency uncertainty, respectively. The period spanned from 11 March 2020 to 31 December 2021.

**Findings** – This study discovered three findings, including: (1) gold is a strong safe haven for stocks and bonds in conventional and Islamic markets under bearish conditions; (2) UCRY Price is a strong safe haven for conventional stocks and bonds but only a weak safe haven for Islamic stocks under high crypto uncertainty; and (3) gold offers a safe haven in both emerging and developed countries, while UCRY Price provides a better safe haven in developed than in emerging countries.

**Practical implications** – Gold always wins big for safe haven properties during unstable economy. It can also win over investors who consider shariah compliant products. Therefore, it should be included in an investor's portfolio. Meanwhile, cryptocurrencies are more common for developed countries. Thus, the governments and regulators of emerging countries need to provide more guidance around cryptocurrency so that the societies have better literacy. On top of that, the investors can consider crypto to mitigate risks but with limited safe haven functions.

**Originality/value** – The originality aspects of this study include: (1) four chosen assets from conventional and Islamic markets altogether (i.e. stock indices, government bonds, Islamic stock indices and IB); (2) indicator countries selected based on the most used and owned cryptocurrencies for the SHA study; and (3) the utilization of UCRY Price as a crypto indicator and a further examination of the SHA study toward four financial assets.

**Keywords** Conventional assets, Cryptocurrency, Gold, Islamic assets, Safe haven, UCRY price

**Paper type** Research paper

## 1. Introduction

The beginning of the COVID-19 pandemic in 2020 was reported as the highest recorded instance of global uncertainty based on the world uncertainty index (WUI) (Ahir *et al.*, 2022). Hence, risk aversion continues to have a significant influence on investors in seeking safe haven assets (SHA) (Aharon *et al.*, 2021) due to infectious diseases (Ali *et al.*, 2022). SHAs move in the opposite direction of other assets in times of a market crisis (Shahzad *et al.*, 2019a).

In that case, investors take a long position on SHAs when uncertainty increases to preserve their wealth (Kaul and Sapp, 2006).

Gold is still the most popular and most used SHA. It is proven by the average annual prices for gold worldwide from 2015 to 2021, which increased from United States (US)\$ 1,161 to 1,795 (per troy ounce) [1]. Even before the COVID-19 pandemic, gold was found to be a SHA against conventional stocks and/or bonds (Baur and Lucey, 2010; Baur and Mcdermott, 2010; Lucey and Li, 2015; Li and Lucey, 2017; Shahzad et al., 2019a, 2020). Yet a very limited study of gold as a SHA against Islamic stock markets (Tirosh and Barkai, 2007; Chkili, 2017). Meanwhile, during the COVID-19 pandemic, most of the literature examined and confirmed gold as a SHA against conventional stock indices (Akhtaruzzaman et al., 2021; AlAli, 2020; Kristoufek, 2020; Chemkha et al., 2021; Lahiani et al., 2021; Esparcia et al., 2022).

Based on the above studies, gold has clearly been a favorable SHA throughout history. However, attention from gold has shifted to cryptocurrency. Bitcoin, the most popular digital cryptocurrency, is claimed to be "digital gold" (Disli et al., 2021; Koutmos et al., 2021). Cryptocurrencies have similar hedging and safe haven characteristics to gold (Antonakakis et al., 2019; Shahzad et al., 2019a). Before the COVID-19 pandemic, the studies only focused on Bitcoin which served as a safe haven against conventional stock indices (Kang et al., 2020; Shahzad et al., 2019a; Stensås et al., 2019). It was further studied during the COVID-19 pandemic by investigating more cryptocurrencies (i.e. Bitcoin and Ethereum) and revealed SHA properties against conventional stock indices (Mariana et al., 2021). Będowska-Sójka and Kliber (2021) conducted a comprehensive study and the results revealed that gold serves as a strong SHA, while Bitcoin and Ether have weak SHA properties against conventional stock indices. Disli et al. (2021) also investigated both gold and Bitcoin, but against Islamic equity indices, it was revealed that gold and Bitcoin do not possess safe-haven properties.

Notably, we identified that studies on investments which rely on Islamic faith are scarce, while this study has attracted scholars during a subprime crisis (Umar and Gubareva, 2021). It interests more investors' attention because of the ethical and social responsible features and can be highly considered by both conventional and faith-based investors (Umar et al., 2022a). Regarding the prior works above, we discovered several research gaps, including: (1) there is a dearth of SHA studies on conventional and Islamic bonds (IB) during the COVID-19 pandemic for both gold and cryptocurrency; (2) there are no SHA studies of cryptocurrency against Islamic stock indices during the COVID-19 pandemic; (3) most of the prior works were benchmarking to big stock markets and world-wide indices; and (4) the studies utilized price or return as the cryptocurrency indicator and only focused on the top two cryptocurrencies (i.e. Bitcoin and Ethereum).

Recently introduced by Lucey et al. (2021), the Cryptocurrency Uncertainty Index (UCRY) (UCRY Price) measured the size of unpredictable moves in the price of cryptocurrency. Bitcoin – the leading cryptocurrency – experienced an approximate 500% price hike since COVID-19 was declared as a pandemic [2]. However, it also could broadly decline by 30% in an hour [3]. Therefore, we conjecture that the UCRY price is an effective indicator of cryptocurrency volatility in determining SHAs when markets were in turmoil due to the COVID-19 pandemic. To our knowledge, there were only two recent studies discussing SHA by utilizing UCRY Price (Hassan et al., 2021; Karim et al., 2022).

Therefore, our study fills the research gap by contributing to the literature in threefold: (1) it covers four financial assets at once from both conventional and Islamic markets (i.e. stock indices, government bonds, Islamic stocks and IB); it provides better and more comprehensive portfolio investment strategies for investors, especially during market turbulence; (2) it takes a panel setting (i.e. countries' level over a period); of a SHA study for gold and cryptocurrency which are categorized as the highest cryptocurrency owners and users based on a Statista Global Consumer Survey [4]; hence, it represents a more reliable

depiction of the cryptocurrency market; and (3) it uses UCRY price as the crypto indicator and further examines the SHA properties of those four financial assets.

The rest of the paper is structured as follows. Section 2 provides the literature review. Section 3 describes the data and explains the research methodology. Section 4 presents and discusses the results. Section 5 presents the conclusion and recommendations.

## 2. Literature review

### 2.1 Conventional and Islamic markets

The conventional market disregards the "halal-haram" aspects [5] and does not align with the principles of *Shariah* or Islamic law. It uses the concept of interest containing usury, and speculative/manipulative transactions (Nurhayadi and Rito, 2019). Contrarily, the Islamic market follows the principles of *Shariah* or Islamic law, prohibiting the "halal-haram" aspects. It also applies asset-backed security and equity participation and limitations of investments on assets that are in accordance with Islamic law (Jawadi *et al.*, 2014).

### 2.2 The theory of safe haven assets

Markowitz (1952) pioneered the modern portfolio theory with the aim to create the most efficient portfolio possible reducing volatility and the risk of losses by choosing assets that are negatively correlated. Conceptually, a SHA is negatively correlated with another asset under extreme market pressure (Baur and Lucey, 2010). Therefore, investors tend to seek SHAs to minimize losses during critical periods such as the COVID-19 pandemic (Akhtaruzzaman *et al.*, 2021; AlAli, 2020; Haddad and Trabelsi, 2021). As a safe haven, an asset must hold its value during market turbulence to limit its exposure to extreme losses (Disli *et al.*, 2021). Apart from being a safe haven, an asset also can be a hedge if it is negatively correlated with another asset on average and a diversifier if it shows a positively correlation to another asset (Kliber *et al.*, 2019).

### 2.3 Gold as a safe haven asset

Gold has been considered as the most dependable SHA throughout history. For example, before the COVID-19 pandemic, gold was a SHA for the US, the United Kingdom (UK) and German stock indices but not a SHA for bonds in any market based on the GARCH (Generalized AutoRegressive Conditional Heteroskedasticity) model (Baur and Lucey, 2010). Using the cross-quantilogram, this depicted gold as a weak SHA in developed and emerging stock markets (Shahzad *et al.*, 2019a). Based on the MGARCH DCC (Multivariate GARCH Dynamic Conditional Correlation) model, gold performs as a SHA against the US stocks and bonds during most economic crisis events (Lucey and Li, 2015). Using an OLS (Ordinary Least Square) regression resulted in gold acting as a SHA for stocks (the US, the UK, Germany, Italy, Japan and India) and bonds (the UK, France, Italy and Canada) (Li and Lucey, 2017). The Islamic market was examined using the Markov switching approach and suggested gold as a SHA against the Islamic stock market at high volatility (Chkili, 2017). Another study also using the MGARCH DCC model found that gold is a SHA for Shariah-compliant equities (Tirosh and Barkai, 2007). Contrarily, a revisited study using the novel VAR (vector autoregressive) for the value at risk (VaR) approach and the cross-quantilogram method revealed that gold does not act as a SHA for the G7 stock and bond markets (Shahzad *et al.*, 2019b).

Gold has always been a superior SHA during periods of economic uncertainty and crisis (Hasan *et al.*, 2021; Huang and Chang, 2021; Ji *et al.*, 2020; Liu, 2020). The existing studies have scrutinized the role of gold as a SHA using the DCC GARCH model during two distinct phases of the COVID-19 pandemic. It was found that gold was a SHA for stock indices (i.e. S&P500, equity indices of the Eurozone (EURO) STOXX50, Nikkei225 and China FTSEA50) in Phase I (31 December 2019 to 16 March 2020), but it lost its SHA potential in Phase

II (17 March to 24 April 2020) (Akhtaruzzaman *et al.*, 2021). Moreover, using an OLS regression, gold was a SHA for the S&P 500, Shanghai SE, Nikkei 225, Germany stock index (DAX), Australia stock index (ASX) and UK stock exchange (FTSE) 100 over the period of 12 February to 9 April 2020 (AlAli, 2020). Another result applied an A-DCC model and found that gold served as a weak SHA for the S&P 500, EURO STOXX 50 and FTSE 100, except for the Nikkei 225 (Chemkha *et al.*, 2021). Another finding by applying an nonlinear ARDL (autoregressive distributed lag) (NARDL) model has confirmed gold as a SHA against the S&P 500 during the COVID-19 pandemic period (31 December 2019 to 25 June 2021) (Lahiani *et al.*, 2021). By scrutinizing several methodologies (i.e. VaR, wavelet methods and performance assessment), indeed, gold was remarkable as a safe haven property during a recession (Esparcia *et al.*, 2022). An opposite finding using a wavelet coherence analysis found that gold did not exhibit safe haven characteristics against Islamic equity indices during the COVID-19 crisis (Disli *et al.*, 2021). Additionally, new findings using the DCC-Multivariate Stochastic Volatility (MSV) model revealed that gold did not act as a SHA against several indices (i.e. S&P 500, DAX, STOXX 600 and FTSE 250) during the COVID-19 outbreak (Będowska-Sójka and Kliber, 2021).

### 2.4 Cryptocurrency as a safe haven asset

The emergence of Bitcoin, as the first and largest cryptocurrency, has shifted investors' attention (Bouri *et al.*, 2020; Shahzad *et al.*, 2020). Recently, researchers have started to question whether cryptocurrency (i.e. Bitcoin and Ethereum) is a better SHA than gold (AlAli, 2020; Kristoufek, 2020; Będowska-Sójka and Kliber, 2021; Chemkha *et al.*, 2021; Disli *et al.*, 2021). Before the COVID-19 pandemic, by using a Dynamic Equicorrelation Fractionally Integrated GARCH (DECO-FIGARCH) model, Bitcoin was an effective SHA for the case of the stock market (S&P 500) (Kang *et al.*, 2020). Moreover, by addressing a cross-quantilogram approach from 19 July 2010 to 22 February 2018, Bitcoin was a weak SHA for China stock indices (Shahzad *et al.*, 2019a).

Meanwhile, during the COVID-19 pandemic, cryptocurrency was claimed to be a SHA against several stock indices (i.e. S&P 500, DAX, FTSE 250 and STOXX 600). Using the DCC-MSV model, cryptocurrencies can be considered as SHAs occasionally; (1) Ether SHA against DAX, and S&P 500, and (2) Bitcoin SHA against FTSE 250, STOXX 600, and S&P 500 (Będowska-Sójka and Kliber, 2021). Another finding using the DCC model showed that Ethereum was a SHA against the S&P 500 from 1 July 2019 to 6 April 2020 (Mariana *et al.*, 2021). In contrast, during the COVID-19 pandemic, opposite findings using wavelet coherence revealed that Bitcoin was not a SHA against Islamic equity indices (Disli *et al.*, 2021). Apart from this, similar findings using a DCC model claimed that Bitcoin was not a safe haven property (Lavelle *et al.*, 2022). In addition, Bitcoin did not act as a SHA against the S&P 500 (Conlon and McGee, 2020). Also, a study focused on VaR, conditional value at risk (CVaR), modified value-at-risk (MVaR) and modified CVaR (MCVaR) showed that Bitcoin and Ethereum did not act as a SHA for international equity markets (Conlon *et al.*, 2020).

### 3. Data and methodology

#### 3.1 Data and sources

This study selected 10 out of 56 countries who owned and used the most cryptocurrencies for the independent variables (i.e. Stock Indices (SI), Government Bonds (GB) and Islamic Stock (IS)) as there was an unavailability of data as detailed in Table 1. Meanwhile, we employed

| No | Criteria | Countries |
| --- | --- | --- |
| 1 | Countries with the most used and owned cryptocurrencies | 56 |
| 2 | Countries with unavailable data of Islamic stocks | 46 |
|  | Countries selected as the sample of this research | 10 |

Table 1.
Selection countries

global data for IB (i.e. Dow Jones Sukuk World) (see Table A1). The conventional stock indices and government bond variables were proxied as the most common financial assets. For the Islamic stocks and bonds variables, they were also chosen as they were suggested to be invested along with cryptocurrency (Rehman *et al.*, 2020) in addition to functioning well during the COVID-19 pandemic (Nomran and Haron, 2021).The first declaration of COVID-19 as a global pandemic was announced by WHO (2020) on 11 March 2020. Therefore, the period of work spanned from 11 March 2020 to 31 December 2021 (i.e. until the paper being studied). Considering the availability of data, we used the weekly frequency prices for all variables. The asset prices used in this study were either given in United States dollar (USD) or converted to USD using applicable exchange rates. Thus, these prices were calculated into the return series $((p_1 - p_0)/p_0)$. As seen in Table 2, it portrays the overview of variables and descriptive statistics.

### 3.2 Quantile regression for panel data

Referring to prior works of safe haven studies (Jareño *et al.*, 2020; Kang *et al.*, 2020; Liu, 2020; Hasan *et al.*, 2021; Mokni *et al.*, 2021), we employed a panel quantile regression model to estimate between market and SHA assets. The panel quantile regression method has advantages to examine the various responses of the dependent variable to changes in the independent variables using their various quantiles instead of focusing on the mean effect (Cepoi, 2020; Khalid *et al.*, 2021; Liu, 2020) and is more robust when outliers and fat tails exist (Huang *et al.*, 2017; Jareño *et al.*, 2020). Therefore, the underlying model of the panel quantile regression is:

$$Q_{y_{i,t}}(\tau|x_{i,t}) = \alpha_i + x_{i,t}^T \beta(\tau), \tag{1}$$

Most quantile panel data estimators by Galvao (2011), Koenker (2004), and Ponomareva (2011) include the additive fixed effect ($\alpha_i$). They provide estimates about the distribution of ($Y_{it} - \alpha_i$) given $\boldsymbol{D}_{it}$ instead of $Y_{it}$ given $\boldsymbol{D}_{it}$. According to Powell (2016), it is undesirable in many empirical studies because observations close to the top of ($Y_{it} - \alpha_i$) distribution may be close to the bottom of the $Y_{it}$. In other words, the additive fixed effect model only shows information about the effect of the policy on the outcome relative to the fixed effect distribution because the disturbance term has been separated.

Hence, Powell (2016) proposed a panel quantile regressions estimator with the nonadditive fixed effect to uphold the nonseparable disturbance term linked with the quantile estimation that may be interpreted similarly to those obtained from a cross-section regression. The equation is as follows

$$Y_{i,t} = D'_{i,t} \beta U^*_{i,t} \text{ with } U^*_{i,t} \sim U(0,1), \tag{2}$$

where $D'_{i,t} \beta(\tau)$ is strictly escalating in quantile $\tau$, and $U^*_{i,t}$ serve as the function of the disturbance term and proneness for the outcome (Doksum, 2007). In equation (2),

| Variable | Obs | Mean | Std. Dev | Min | Max | CD-test | CADF | Westerlund |
|---|---|---|---|---|---|---|---|---|
| Gold | 950 | 0.002 | 0.0236 | −0.0587 | 0.1063 | 65.3835*** | 309.6210*** | −2.3524*** |
| UCRY Price | 950 | 0.0003 | 0.0125 | −0.0322 | 0.0401 | 65.3835*** | 355.9230*** | −3.4083*** |
| SI | 950 | 0.0035 | 0.0333 | −0.2072 | 0.2019 | 33.8250*** | 304.0610*** | |
| GB | 950 | −0.0008 | 0.0178 | −0.1624 | 0.1413 | 14.4747*** | 218.5160*** | |
| IS | 950 | 0.0038 | 0.0343 | −0.2135 | 0.1773 | 25.9048*** | 297.9690*** | |
| IB | 950 | 0.0006 | 0.0062 | −0.0677 | 0.0457 | 49.3389*** | 173.6580*** | |

**Table 2.**
Summary statistics, cross section dependency, panel unit root and Westerlund tests

**Note(s):** Data for Gold, SI, GB, IS, and IB are from www.investing.com, while UCRY price from https://brianmlucey.wordpress.com/; *** stands for 1% level of significance

the structural quantile function (SQF) outlines the quantile outcome variable $Y_d = d'\beta(U^*)$ for randomly selected $U^* \sim U(0,1)$. This SQF is similar to Chernozhukov and Hansen's (2008) terminology which can be illustrated by the following specification:

$$S_Y(\tau|d) = d'\beta(\tau) \text{ with } \tau \in (0,1),\qquad(3)$$

Consequently, this study designates the panel quantile regression to estimate the response of Gold and UCRY Price against SI, GB, IS and IB under the different market conditions and uncertainties. Thus, the enhancement of equation (1) becomes:

$$(Gold|UCRY\ Price)_{i,t}(\tau|\alpha_i, \delta_i, x_{i,t}) = \alpha_i + \delta_i + \beta_{1,\tau}SI_{i,t} + \beta_{2,\tau}GB_{i,t} + \beta_{3,\tau}IS_{i,t} + \beta_{4,\tau}IB_{i,t},\qquad(4)$$

where $\alpha_i$ signifies "the non-adaptive fixed effects" and $x_{i,t}$ signifies the matrix of the regressors at individual countries $i$ and time $t$.

Considering the quantile, we followed previous research (Das *et al.*, 2020; Zhu *et al.*, 2020) and classify them into three phases: lower (5%–25%), middle (50%) and upper (75%–95%) quantiles. As for gold, it represents the bearish, normal and bullish markets, respectively (Das *et al.*, 2020). A negative significant (insignificant) coefficient signifies (1) a strong (weak) safe haven under bearish, (2) a strong (weak) hedge under normal and bullish condition. A positive coefficient signifies a diversifier. Meanwhile, it represents low, normal and high uncertainty, respectively for UCRY Price (Hasan *et al.*, 2021). Therefore, it has a reverse meaning to gold circumstances. A positive significant (insignificant) coefficient signifies (1) a strong (weak) safe haven under high uncertainty, (2) a strong (weak) hedge under low and normal uncertainty. A negative coefficient signifies a diversifier. This will be able to study the heterogeneous responses of gold return and UCRY Price uncertainty to changes in SI, GB, IS and IB at diverse points of the conditional distribution of Gold and UCRY Price.

Accordingly, the implementation of the panel quantile regression approach required that first we applied the cross-section dependency test based on Pesaran (2004) to ensure that there was cross-sectional dependency. Second, we checked the panel unit root test following Pesaran (2007) for each variable whether they were stationary at the level or first difference. Third, we estimated the cointegration test to identify the long-run relationship among the variables using a Westerlund (2005) test. Overall, the three required tests indicated there was cross-section dependency within the data sets across the countries, the unit root was not present on all of the variables, and both panels (i.e. gold and UCRY Price), showing that the variables had a long-run relationship (see Table 2). Finally, we ran the panel quantile regression using the nonadditive fixed effect model of Powell (2016) to analyze the potential SHA, especially during a bearish market (lower quantile) and high uncertainty (upper quantile) for gold and UCRY price, respectively.

## 4. Results and discussion
### 4.1 Panel quantile regression results
*4.1.1 Results on gold.* In referring to Table 3, we found negative gold coefficients to SI in all market conditions (5%–95%) but these were not significant under bearish (5%) and bullish (90%) markets. This signifies that gold offered a strong safe haven in bearish conditions (10% and 25%) and a weak safe haven in extremely bearish conditions (5%), while there was a strong hedge on normal and bull markets (50%, 75% and 95%). This confirmed Baur and Lucey's (2010) results. The coefficient of gold was significantly negative under bearish (5% and 10%) markets that proved a strong safe haven for GB. It was consistent with the results of Lucey and Li (2015). Meanwhile, there was a strong hedge under a bullish (90%) market. Besides that, it could function as a diversifier on average, reflecting positive results under distinct conditions (i.e. bear: 25%; normal: 50%; bull: 75% and 95%).

| Quantiles | DV: Gold | | | | DV: UCRY price | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | SI | GB | IS | IB | SI | GB | IS | IB |
| 0.05 | −0.0001 | −0.0854*,*** | −0.0039*,*** | −0.4539*,*** | −0.0594*,*** | −0.0674*,*** | 0.0542*,*** | 0.4817*,*** |
| 0.1 | −0.1305*,*** | −0.1238*,*** | 0.0659*,*** | −0.0843 | −0.8872*,*** | −0.0252*,*** | 0.071*,*** | 0.5561*,*** |
| 0.25 | −0.3187*,*** | 0.0685*,*** | 0.1830*,*** | 0.5262*,*** | −0.0310*,*** | 0.0503*,*** | 0.0050*,*** | 0.3082*,*** |
| 0.5 | −0.1997*,*** | 0.0063*,*** | 0.1853*,*** | 0.1036*,*** | 0.0024*,*** | 0.0093*,*** | −0.0017*,*** | 0.0069** |
| 0.75 | −0.2736*,*** | 0.0031*,*** | 0.2417*,*** | 0.1951*,*** | *0.0010*,*** | *0.0003*,*** | −0.0019*,*** | −0.1663*,*** |
| 0.9 | −1.1085 | −0.0798** | 0.902 | −0.9777**,*** | 0.0191 | −0.3842 | 0.0094 | −0.3189**,*** |
| 0.95 | −0.8001*,*** | 0.2613 | 0.6311*,*** | −0.6864 | 0.0552 | −0.1098 | −0.2058 | −0.8272*,*** |

**Note(s):** ***, ** , * stands for 1% and 5% level of significance; The significance in italics implied safe haven assets

For IS, it was found that gold outlines a negative significant coefficient in an extremely bearish (5%) market. Other conditions showed positive significant coefficients, excluding the bullish (90%) market. This implied that gold acted as a safe haven and diversifier against IS as found earlier by Chkili (2017) and Raza *et al.* (2016), respectively. As for IB, gold was negative and significant under bearish (5%) and bullish (90% and 95%) markets. It implied that gold could be a safe haven for IB in market crises and a hedge on average. Gold was also presented as a diversifier to IB during the various gold market conditions (25%, 50% and 75%), as evidenced by Maghyereh *et al.* (2019).

*4.1.2 Results of the UCRY price.* Based on Table 3, UCRY price exhibited positive coefficients to SI from normal (50%) to high (75%–95%) uncertainty. UCRY Price could act as a strong hedge during normal times. It also could be a strong (weak) safe haven against SI under high (extreme high) crypto uncertainty, confirming the findings of Mariana *et al.* (2021). Furthermore, we found that UCRY Price had a negative significant coefficient at low (5%–25%) uncertainty, acting as a diversifier against stock indices which was similar to Kristoufek (2020). Regarding the UCRY price-GB relationship, it was likely to be a positive and significant coefficient under various cryptocurrency levels (i.e. low: 25%; normal: 50% and high: 75%). This suggested that UCRY Price could function as a safe haven for GB during high uncertainty. It was also in line with Mokni *et al.* (2021), in which the cryptocurrency also offered a hedge on average. Moreover, the linkage was negative when uncertainty was low (5% and 10%) and high (90% and 95%) implying cryptocurrency could act as a diversifier as it moved in the same direction as bonds (Baur *et al.*, 2018).

In the case of IS, UCRY price had a positive coefficient under low (5%–25%) and high (90%) uncertainty. Thus, the results corroborated Chkili *et al.* (2021) who showed that Bitcoin offered a strong hedge on average and could perform as a weak safe haven at high uncertainty. Additionally, UCRY price revealed a negatively significant coefficient to IS at normal (50%) and high (75%) uncertainty, suggesting cryptocurrency could function as a good diversifier against IS. If we considered the coefficients of UCRY Price to IB, we noted significance at all levels of uncertainty. Meanwhile, it was positive on lower (5%–25%) to normal (50%) uncertainty while negative in high (75%–95%) uncertainty. The coefficient also decreased as UCRY Price moved from low to high uncertainty. This finding exhibited that UCRY price served as a strong hedge on average instead of being a SHA against IB, confirming the results of Mensi *et al.* (2020).

## 4.2 Robustness analysis

We estimated the results for (1) different periods by separating the full sample into two subsample periods: 2020 and 2021 (2) different country categories for emerging (i.e. Nigeria, Thailand, Indonesia, Malaysia, India and China), and developed countries (i.e. United States, Canada, Taiwan and Japan) [6], and (3) the utilization of CRYPTO CURRENCIES INDEX 30 (CCI30) index to examine whether or not the results changed compared to UCRY Price.

*4.2.1 Results of different periods.* In the case of Gold, it was consistent with the full sample result (see Table 4). Specifically, it was negative to SI, GB, IS and IB in the bearish market in 2020, denoting a SHA characteristic. However, the dependence of gold and GB in 2021 has changed as it does not show any safe haven characteristics. As for UCRY Price, it had a positive and significant coefficient to GB and SI under high cryptocurrency uncertainty both in 2020 and 2021 (see Table 5). Meanwhile, we found UCRY Price also provided a SHA to IS in 2020 by exhibiting a positive coefficient. This confirmed the above results which offered a potential safe haven role.

*4.2.2 Results of different country categories.* Gold behaved negatively toward SI, GB, IS, and IB during the downside conditions of emerging countries which pointed it out as a SHA (see Table 6). This was contrary to Baur and Mcdermott's (2010) findings, who found a minor

| Quantiles | 2020 | | | | 2021 | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | SI | GB | IS | IB | SI | GB | IS | IB |
| 0.05 | −0.1637*** | −0.1736*** | 0.0772*** | 0.0051*** | −0.0019*** | 0.0843*** | 0.0084*** | −2.2011*** |
| 0.1 | −0.0549** | −0.0726*** | −0.0219*** | −0.1044*** | −7.497 | 5.2484 | 4.0636 | 5.954 |
| 0.25 | −0.2895*** | −0.0204*** | 0.1393*** | 1.1285*** | 0.0017 | 0.1071*** | −0.0069*** | 0.5875*** |
| 0.5 | −0.3588*** | 0.0019 | 0.2864*** | −0.0533*** | 0.0874*** | 0.0501*** | 0.0018 | −0.9891** |
| 0.75 | −0.1198*** | −0.2450*** | 0.0737*** | −1.8785*** | −0.0095*** | 0.0338*** | −0.0070*** | 1.2900*** |
| 0.9 | −37.3179 | −7.1728 | 27.4871 | −59.1972 | −0.0078*** | 0.0446*** | −0.0640*** | 1.0366*** |
| 0.95 | −0.2070*** | −0.2675*** | 0.1828 | −0.2743*** | −1.1718 | 0.9815 | 3.8437 | −20.5905 |

**Note(s):** ***, ** stands for 1% and 5% level of significance; The significance in italics implied safe haven assets

**Table 4.**
Results of gold in 2020 and 2021

| Quantiles | 2020 | | | | 2021 | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | SI | GB | IS | IB | SI | GB | IS | IB |
| 0.05 | −0.0214*** | 0.0247*** | −0.0014*** | 0.0787*** | −0.0135*** | −0.1055*** | −0.0569*** | 0.6862*** |
| 0.1 | −0.0024*** | 0.0067*** | −0.0006*** | 0.0278*** | −0.9155** | −0.1119** | 0.0149 | 0.6820 |
| 0.25 | 0.0005*** | 0.0021*** | −0.0003*** | 0.0588*** | −0.0809*** | −0.0350*** | 0.0152*** | 0.1599*** |
| 0.5 | −0.0214*** | −0.0006 | −0.0014*** | 0.0787*** | −0.0393*** | −0.0255*** | −0.0066*** | 0.2802*** |
| 0.75 | −0.0009*** | 0.0009*** | 0.0003*** | −0.1917*** | −0.0062*** | −0.0035*** | −0.0020*** | −0.6926*** |
| 0.9 | 0.0063*** | 0.0128*** | 0.0047*** | −0.1752*** | 0.0647*** | −0.1610*** | −0.0032 | −4.6093*** |
| 0.95 | 0.0313*** | 0.0119*** | 0.0006 | −0.2416*** | 0.1379*** | 0.5275*** | −0.0524*** | −4.4943*** |

**Note(s):** ***, **, * stands for 1% and 5% level of significance; The significance in italics implied safe haven assets

**Table 5.**
Results of UCRY price
in 2020 and 2021

| | Emerging | | | | Developed | | | |
|---|---|---|---|---|---|---|---|---|
| Quantiles | SI | GB | IS | IB | SI | GB | IS | IB |
| 0.05 | 0.0049*** | 0.0447*** | -0.0416*** | -0.4198*** | -0.0251*** | -0.3755*** | 0.1577*** | -0.8651*** |
| 0.1 | -0.0178*** | -0.0185*** | -0.0473*** | -0.0428*** | -0.1255*** | -0.1341*** | 0.0548*** | 0.8777*** |
| 0.25 | -0.0685*** | -0.0056*** | -0.0190*** | 0.6779*** | -1.3250*** | 0.1306*** | 0.1739*** | 1.0561*** |
| 0.5 | -1.2582 | 0.4952 | 1.478 | 0.6771 | -0.3444 | 0.0478 | 0.3001 | 0.6738 |
| 0.75 | -0.2569*** | -0.0004 | 0.2325*** | 0.2956*** | -0.2561*** | -0.1953*** | 0.1745*** | 0.0982*** |
| 0.9 | 0.4540* | -0.0484*** | 0.4410*** | -1.0211*** | -0.1355*** | -0.3808*** | 0.0963*** | -1.2963*** |
| 0.95 | -0.5574 | 0.0483 | 0.4352 | -2.1872*** | -0.0529*** | -0.1735*** | 0.1230*** | -2.0225*** |

**Note(s):** ***, ** stands for 1% and 5% level of significance; The significance in italics implied safe haven assets

Table 6.
Results of gold in emerging and developed countries

SHA ability of Gold in emerging markets. Gold also acted as a SHA to SI, GB and IB except for IS in developed countries. We determined that UCRY Price reacted positively under high uncertainty (1) to SI in emerging and developed countries, and (2) to GB, IS and IB in developed countries (see Table 7). However, it performed as a strong (weak) safe haven for SI in emerging (developed) countries. This denoted that UCRY Price could only offer a better SHA to GB, IS and IB in the developed countries compared with emerging countries during uncertain times.

*4.2.3 Results of the CCI30 index.* Compared to UCRY price, we employed the CCI30 index as another representative of the cryptocurrency market (Rivin and Scevola, 2017). It represents the growth as well as daily and long-term movement of the blockchain sector [7]. This index has also been utilized in prior works (Jalal *et al.*, 2020; Dutta and Bouri, 2022; Vidal-Tomás, 2022). The results exhibited that the CCI30 index performed negatively significant to GB under a bearish condition, implying it as a SHA (see Table 8) which is in line with the UCRY price results, but contrary with Lavelle *et al.* (2022). For the rest of the results under a low quantile (i.e. bearish), it only showed crypto as a diversifier.

*4.3 Discussion*
Our findings consisted of gold and UCRY price results. Gold was a SHA against stocks and bonds for conventional and Islamic markets during the COVID-19 pandemic because risk-averse investors prefer gold in their portfolios. This was predictable because gold has maintained its value throughout various critical times. Uncertain times triggered gold demand and hence price increase since more investors would be searching for safer options (Gubareva *et al.*, 2022).

For UCRY Price, we discovered that cryptocurrency can serve as a strong (weak) SHA for conventional stocks and bonds (Islamic stocks) under high crypto uncertainty. The beginning of the COVID-19 pandemic caused lower returns or even losses to most conventional assets (Nomran and Haron, 2021) and Islamic stocks (Chkili *et al.*, 2021). Meanwhile, the pandemic also impacted cryptocurrency to gain positive media attention. Positive sentiment toward the crypto market increased crypto prices (Gurdgiev and O'Loughlin, 2020). Thus, if the assets decreased in price under high uncertainty, investors could get a higher return from cryptocurrency to cover their losses. Moreover, UCRY Price qualified to serve as a weak SHA for Islamic stocks during the high uncertainty of crypto states.

Our robustness check confirmed that both gold and UCRY Price could serve more potential SHA characteristics during the pandemic in 2020 than 2021. Notably, the world faced the greatest economic damage in the year 2020 at a time which plunged most countries into a recession due to the spread of the COVID-19 pandemic [8]. UCRY price faded in its ability as a SHA in 2021 as the global economy started to recover. Additionally, we inferred gold could be used as a SHA for conventional and Islamic markets in both emerging and developed countries as proven earlier by Baur and Mcdermott (2010). Historically, gold is the most trustable asset for world-wide investors in times of a crisis. Next, UCRY price had more potential to be a SHA for conventional (i.e. GB) and Islamic markets (i.e. IS and IB) in developed (i.e. China, Canada, the US and Japan) than emerging countries, supporting the results of Stensås *et al.* (2019). Developed countries have higher literacy in utilizing the cryptocurrency than emerging countries. In addition, both UCRY price and the CCI30 index provide a SHA for conventional bonds (i.e. GB) in times of a market crisis, while the rest of the results revealed dissimilar findings. This may be caused by having divergence in the index's base construction; UCRY price is constructed based on news, while the CCI30 index is constructed based on the top 30 cryptocurrencies by market capitalization.

| Quantiles | Emerging | | | | Developed | | | |
|---|---|---|---|---|---|---|---|---|
| | SI | GB | IS | IB | SI | GB | IS | IB |
| 0.05 | −0.1760*** | 0.0149*** | 0.1060*** | 0.2437*** | −0.0141*** | −0.0428*** | −0.0029*** | 1.1229*** |
| 0.1 | −0.0684*** | −0.0017*** | 0.0286*** | 0.3436*** | 0.0064*** | −0.0762*** | 0.0116*** | 0.7584*** |
| 0.25 | −0.0231*** | 0.0375*** | 0.0025*** | 0.2535*** | −0.0141*** | −0.0372*** | −0.0040*** | 0.4149*** |
| 0.5 | 0.0041*** | 0.0107*** | −0.0020*** | 0.0193*** | 0.0664 | −0.5571 | −0.0646 | −0.4204 |
| 0.75 | *0.0166*** | −0.0004*** | −0.0297*** | −0.1106*** | −0.0129*** | *0.0051*** | −0.0039*** | −0.1102*** |
| 0.9 | *0.1338*** | −0.1318* | −0.1278*** | −0.3766*** | 0.001 | −0.0044*** | *0.0135*** | −1.0061*** |
| 0.95 | 4.9393 | −0.6334 | −4.1953 | −7.9924 | −0.5192*** | *0.3278*** | *0.4848*** | *0.3745*** |

**Note(s):** *** stands for 1% level of significance; The significance in italics implied safe haven assets

**Table 7.**
Results of UCRY price
in emerging and
developed countries

## 5. Conclusion and future research

We found that gold was a SHA for conventional and Islamic investors during the COVID-19 pandemic period. Gold was preferable as it was a stable asset in times of a crisis as well as Shariah-compliant. Besides that, cryptocurrency could be another strong safe haven option for conventional assets but only a weak safe haven for Islamic assets (i.e. IS) under high uncertainty. High crypto uncertainty often leads to highly volatile prices which allow investors to potentially have a higher reward (return). In that sense, conventional investors are likely to invest in crypto as they are more open to speculative elements compared with Islamic investors. We confirmed the safe haven characteristics of the results that the assets were negatively correlated during a market crash but could be positively or negatively correlated on average (Baur and Lucey, 2010) by distinguishing between the first and second year of the COVID-19 pandemic. In addition, gold offered a SHA for emerging and developed countries because it was the most popular choice for safe investments. Despite cryptocurrencies being widely used in emerging countries, cryptocurrency was a better SHA for developed countries as there are more developed countries whose governments classify cryptocurrency as legal [9].

Overall, our results could benefit investors in diversifying their portfolios to mitigate losses as the COVID-19 pandemic has an inconclusive end. Our findings suggest implications for conventional and Islamic investors to add gold and consider cryptocurrency as their SHA during uncertain conditions. For policymakers, regulators and the government, they could provide more discussions on cryptocurrency as an alternative investment opportunity. Notably, it is still essential for them to stay aware and devise guidelines as cryptocurrency has speculative and fluctuating aspects. Specifically, it must warn amateur investors who are more attracted to invest in cryptocurrency during high volatility (Jalal *et al.*, 2020).

We provide recommendations for future studies. First, our method disregards the dependency between the quantile of independent (i.e. financial assets) and dependent (i.e. gold and crypto market) variables. Therefore, future studies could use a quantile-on-quantile method as the quantiles of the independent variable may have different impacts on the quantiles of the dependent variable which has been applied in previous research (Hasan *et al.*, 2021; Bossman *et al.*, 2022). They can benefit from seeing more accurate and clearer relationships between the variables in certain conditions. Second, instead of utilizing only one cryptocurrency index, future studies can compare the SHA ability in various crypto indexes: CCI30, UCRY Price, UCRY Policy and cryptocurrency environmental policy index (ICEA) for different countries or regions in conventional and Islamic markets. Therefore, it can capture different perspectives from each index. It can also be extended to other financial markets: NFTs that show a significant increase of interest among investors recently (Umar *et al.*, 2022b, c; Vidal-Tomás, 2022) and fiat currencies (Umar and Gubareva, 2020; Umar *et al.*, 2021).

| Quantiles | SI | GB | IS | IB |
| --- | --- | --- | --- | --- |
| | | DV: CCI30 index | | |
| 0.05 | 0.3118*** | 0.3505*** | 0.3457*** | 8.8046*** |
| 0.1 | 0.7711*** | 0.7528*** | 0.6157*** | 1.8627*** |
| 0.25 | 0.4544*** | −0.0936*** | 0.4752*** | 1.1259*** |
| 0.5 | 128.8496 | −59.1893 | 18.4729 | −339.8276 |
| 0.75 | 0.2817*** | −0.4286*** | 0.1548*** | −4.2725*** |
| 0.9 | 0.2320*** | −1.2036*** | 0.1326*** | −3.5178*** |
| 0.95 | 0.8861*** | −1.0370*** | −0.4560*** | −5.9591*** |

**Note(s):** ***, **stands for a 1% and 5% level of significance; interpretation is similar with gold; The significance in italics implied safe haven assets

Table 8.
Results of the
CCI30 index

Third, many predictions have stated that in the year of 2023, it is heading towards a recession. As a result, it would be interesting for future studies to forecast whether gold or crypto can still potentially be SHAs during the recession.

## Notes

1. For the average prices for gold worldwide from 2014 to 2025, see: https://www.statista.com/statistics/675890/average-prices-gold-worldwide/

2. When the pandemic emerged, Bitcoin could be purchased at $7,900 but today it costs $46,000 based on https://coinmarketcap.com/

3. See: https://www.forbes.com/sites/nicolelapin/2021/12/23/explaining-cryptos-volatility/

4. See: https://www.statista.com/statistics/675890/average-prices-gold-worldwide/

5. It includes interest rates from lending money or investments in businesses which are engaged in alcohol production, pork-related products and ammunition.

6. We categorize the countries by the gross national income (GNI) per capita per year. An upper high-income country (GNI >$12.695) is classified as a developed country and a middle to lower-income country (GNI<$12.695) is listed as a developing country. See: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

7. See: https://cci30.com/

8. See: https://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world

9. See: https://www.thomsonreuters.com/en-us/posts/wp-content/uploads/sites/20/2022/04/Cryptos-Report-Compendium-2022.pdf

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**Appendix**
The supplementary material for this article can be found online.

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