Zakat Payment by Metal Backed Cryptocurrencies: Are They Allowed?

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Abstract
This study aims to provide a scientific contribution to the feasibility of metal backed cryptocurrencies as a medium of exchange to pay *zakat*. To understand the dynamics and mechanisms of metal backed cryptocurrencies, the autoregressive conditional heteroscedasticity and generalized conditional heteroscedasticity (Arch Garch) methods were used. The metal backed cryptocurrencies used for this research are Bitcoin Gold, GoldFinch, Gold Coin, Digix Gold Token, E-Dinar Coin, Gold-Money, and E-Gold. Our analysis finds that even though these are metal backed cryptocurrencies, the volatility is high. Gold-Money has a long-term volatility 67 times higher than the volatility of gold, while E-Gold has eight times the volatility of gold. As a result, due to high levels of volatility, metal backed cryptocurrencies are not suitable as a medium for *zakat* payment.

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1. Introduction

The development of information technology supports digital transformation. In the financial sector, digitalization led to the first digital currency, Bitcoin, being created in 2012. The development of Bitcoin was very significant, as it has given rise to a huge variety of other cryptocurrencies. Currently, there are 850 different cryptocurrencies that are using for transactions in the international digital financial system (Quest, 2018). There are 35 million Bitcoins in circulation, with the cryptocurrency widely accepted as a medium of online payment transactions. Bitcoin trading reached USD 930 million as of January 2020 (Brauneis et al., 2021).

In several Islamic countries, several types of cryptocurrencies are circulating in Blockchain technology that claim to meet the standards of syariah rules. James (2019) reports that more than 62 companies have promoted cryptocurrencies that are backed by gold and are in accordance with syariah principles, including E-Dinar, which operates through the E-Dinar Wallet, an online system with a gold base and managed by the Central Bank of United Arab Emirates (UAE). In Jersey and Canada, Gold Money is backed by 100% gold and combined with Mastercard, and has been evaluated as meeting shariah compliance standards from Amanie Advisors, in line with AAOIFI standards related to gold development with the World Gold Council (Habib, 2021).

There is an ongoing debate regarding the use of cryptocurrencies in financial transactions Several reseachers and islamic finance experts such as Shariyah Review Bureau, 2018; Amilin, 2018; Haruna, MA & ABubakar, 2020; Abdul et al., 2019; Arsov, 2017; Naqvi, Shafique & Khan, 2019 allow the use of cryptocurrencies under various conditions. Meanwhile, Mills & Nower, 2019; Bouri et al., 2019; Bakar et al., 2017, Asif, 2018; and Siswantoro et al., 2020 reject the use of cryptocurrencies in the financial system because of the very high volatility of cryptocurrency transactions.

The authors tracked videos that mention the use of donations to Islamic organizations using cryptocurrency transactions. We found that the East London Mosque was the first mosque in Britain to do so, accepting donations via cryptocurrency transactions as early as 2017. We ultimately identified that there are only three Islamic organizations that receive donations in the form of cryptocurrencies, despite the huge the potential for zakat and other donations via crytocurrency transactions. If the Muslim population makes up approximately one-third of the world's population, and even if just one percent islamic fund circulated in the form of cryptocurrency, around 2.5% of zakat potential is equivalent to GBP 24.5 million for the use of economic development and the Islamic community.

Abeldayem & Aldulaimi (2018) argue that zakat applies to gold and silver as well as paper money because of its function as a standard medium of payment that has a standard value, therefore other currencies that are backed by gold and silver should also apply zakat. Abubakar et al. (2019) conducted a cryptocurrency research and concluded that cryptocurrencies in general have three advantages over other types of money, including building a unified financial system rarer than gold so tshat it can mitigate inflation. Abubakar et al. (2019) recommends that Islamic finance stakeholders be proactive rather than passive towards the technical development processes, standards, and operational guidelines for cryptocurrencies.

This study aims to provide a scientific contribution to the feasibility of metal backed cryptocurrencies as a medium of exchange to pay zakat. This study also contributes to the body of knowledge regarding Islamic transactions through metal backed cryptocurrencies. To see the dynamics and mechanism of metal backed cryptocurrencies, autoregressive conditional heteroscedasticity and generalized conditional heteroscedasticity (Arch Garch) methods are used on metal backed cryptocurrency research samples including Bitcoin Gold, GoldFinch, Gold Coin, Digix Gold Token, E-Dinar Coin, GoldMoney, and EGold, as well as gold and silver.

2. Literature Review

In the Islamic perspective, money is formed based on the theory of value through the concept of exchange value. Based on Islamic monetary theory, the intrinsic value of money is the same as its nominal value (Abdullah, 2016). At the time of the Prophet, the money used by the Muslim community was Roman and Persian money such as the Herculean gold dinar, the Byzantines dynasty, and the Sasanid dynasty silver dinar from Iraq. During the time of the Caliph Umar bin Khattab, in 18 H Muslims began to print their own dirhams with forging techniques. Caliph Umar set the standard for the Dirham based on the Dinar, where 1 Dirham is equivalent to 7/10 Dinars or 2.97 grams of pure silver, while 1 Dinar is equiaveltn to 4.25 grams of gold with a gold content of 22 karats. At the time of Caliph Uthman bin Affan, Persian dinars were modified with Islamic symbols (International Shariah Research Academy for Islamic Finance, 2011).

During the reign of the Umayyad State, in 76H Caliph Abdul Malik bin Marwan printed Dinars and Dirhams with his own Islamic model and without Byzantine and Persian markings. Through this policy he was able to realize political and economic stability and reduce counterfeit money and currency manipulation. The Dinar of the Umayyad era was known to be smooth, pure and accurate, showing evidence of

the development of money at that time. During the Abbasid era, printing of money continued as in the Umayyad era. In 132 H, Al-Saffah scored the first Dinar of the Abbasids. However, during the Abbasid period (23 – 803 H) there was a reduction in the quantity of Dinar and Dirham with the value calculated according to the original size (International Shariah Research Academy for Islamic Finance, 2011).

During the Fatimid dynasty (909 – 1171 H), mixed Dirhams were so large that their prices fell. The price of one Dinar was equal to 34 Dirhams, even though the original ratio between a Dinar and a Dirham was 1:10. During the time of Saladin Al-Ayubi, due to war, there was insufficient raw material (gold) to print Dinars. The Dirham instead became the main currency, as it was a mixture of silver and copper. The printing of this mixed money continued throughout the reign of Bani Ayyub in Egypt and Sham (modern Syria) (International Shariah Research Academy for Islamic Finance, 2011).

During Mamalik's reign (1250 – 1382), the printing of copper notes (fulus) was widespread and became the main currency. The printing of the Dirham stopped due to the sale of silver to Europe, the increasing consumption of silver for the manufacture of saddles and vessels, and the large number of copper imports from Europe. During the Ottoman Dynasty (955 AH/1534 AD), the official Ottoman financial system was based on gold and silver, with a value ratio of 1:15. In 1839 AD, a new currency was issued in the form of a banknote called the Gaima. However, because its value continued to decline, the community did not trust the Gaima, and as a result of this and the war,, Turkey imposed paper money and canceled the validity of gold and silver coins (International Shariah Research Academy for Islamic Finance, 2011).

Classical Muslim scientists have consistently disagreed with modern scientists over issues surrounding currency. Classical Muslim scientists chose gold and silver as Islamic currency. Ibn Khaldun (732 - 808 H) in his book *Mukadima* mentions the function of gold and silver as money, with the value used by everyone for trading, while Al Ghazali (1058 – 1111 H) mentions in his book *Awakening of Religious Knowledge* that Allah created gold and silver as a medium of exchange and established it by law. Al Ghazali argues that currency cannot be used as a traded commodity, but only as a medium of exchange, because Allah created gold and silver to be circulated among humans and become a benchmark for various assets or goods and services (Alzubaidi & Abdullah, 2017). Ibn Taimiyah (1995) said that the Dinar and Dirham are the media of exchange to obtain goods and services, so they are also the medium of exchange in transactions. In contrast to other types of assets, such as goods and services, the purpose of purchase is only to make a profit.

In the Islamic perspective, money is used as a standard of value, as media for exchanging transactions, and as storage media. The classical Muslim scientist Abu

Ubaid (1988) stated that the Dinar and the Dirham are the value of the price of everything, while everything cannot be the value of the price of both. Meanwhile Ibn Rushd (527 – 599 H) stated that the Dinar and the Dirham are equal values between different goods. The second function of money is money as a legal transaction medium that is accepted by anyone and determined by the state. Imam Nawawi (631 – 676 H) even emphasized that it is legal for ordinary people to print their own Dinars and Dirhams as long as they are made of pure materials. Finally, money is a medium of value storage, as confirmed by Al-Ghazali and Ibn Khaldun (732 - 808 H).

3. Previous Research

Our literature study finds that there is ample evidence that gold is accepted in financial markets to contain inflation and pressure from financial crises in the long term, as well as to stabilize the financial system in the short term. Thus, cryptocurrencies that are backed by gold, are in accordance with *syariah* rules, meet regulations, and are transparent become alternative forms of currency that may be capable of mitigating the volatility that currently occurs in conventional paper money and cryptocurrency systems.

The Shariah Review Bureau (2018) identifies cryptocurrencies and tokens as permitted forms of money because they meet the requirements as a medium of exchange for transactions. Cryptocurrency uses terms such as assets, benefits, rights (*haq*), and obligations (*dayn*). Amalin (2018) adds that transactions using cryptocurrencies have transparency and clear regulations in trading, and do not contain elements of usury.

Haruna & Abubakar (2020) conducting research related to cryptocurrencies backed up by metal in the context of the Islamic economy. Their research explores the suitability of cryptocurrencies backed by metals and whether they can provide stability to the financial and banking system.

Cryptocurrencies that are in accordance with Islamic *syariah* can become a filter if they are able to overcome cryptocurrency vulnerabilities related to money creation methods and regulation. Islamic cryptocurrencies can symbolize globalization and revolutionize the economy if they are optimally developed with a value storage function that is in accordance with *syariah* principles and maqashid (Arsov, 2017; Naqvi, Shafique & Khan, 2019). Abdul et al. (2019) researched the dynamics and mechanisms of digital currency in the context of Islamic finance and concluded that it is necessary to develop and improve the architecture of the framework of cryptocurrencies against traditional fiat currencies not backed by commodities.

(Abubakar et al., 2019)) conducted research related to cryptocurrencies and issues of Islamic economic development and found that, in general, cryptocurrencies have three advantages over other types of money, including gold: building a unified financial system with decentralized standards, being more scarce than gold, and significantly mitigating inflation. Consequently, Islamic financial and banking institutions, as well as central banks, should promote syariah-backed cryptocurrencies, and Muslim governments and individuals should introduce halal coins.

Several academics argue that cryptocurrency should not be considered as a form of currency. Mills & Nower (2019) argue that cryptocurrency transactions are just like gambling transactions. Bouri et al. (2019) argue that there is a high degree of uncertainty in cryptocurrency transactions, while Bakar et al. (2017) conclude that three main conditions mean cryptocurrencies cannot be categorized as money, including a) no intrinsic value, b) cryptocurrency holders cannot be recognized as anomymous, and c) unstable. Asif (2018) argues that cryptocurrencies and tokens are halal but some cryptocurrencies can be distinguished as to whether they are syariah-compliant or not. Siswantoro et al. (2020) evaluate the suitability of cryptocurrencies from an Islamic perspective, which holds that money has special characteristics and requirements such as stability and basic assets. From an Islamic perspective, cryptocurrencies thus do not qualify as money. Their research, using a sample of 23 cryptocurrencies, concluded that cryptocurrencies have very high volatility so they are unlikely to be categorized as money because they contain speculation. Based on this conclusion, cryptocurrency has not developed in some Muslim countries.

This study tests the suitability of cryptocurrency against syariah principles using the method carried out by Siswantoro et al. (2020), specfically ARCH GARCH, in measuring long-term and short-term volatility on Bitcoin Gold, GoldFinch, Gold Coin, Digix Gold Token, E-Dinar Coin, GoldMoney, EGold, gold and silver.

4. Methodology

4.1. Data

In this study, we used mixed methods, including literature description, data study, and empirical research. In the literature study, we study information about the ideal currency model from an Islamic perspective and apply it to the context of digital currencies. The data used in this study is daily data from Bitcoin Gold, GoldFinch, Gold Coin, Digix Gold Token, E-Dinar Coin, GoldMoney, EGold, gold and silver. Our data is obtained from historical cryptocurrency data published on coinmarketcap.com from various points in 2019-2022 as noted in Table 1.

Table 1. Variables

Definition	Daily Data	Source
Bitcoin Gold	01 Jan 2019 – 22 Feb 2022	Coinmarketcap.com
GoldFinch	11 Jan 2019 – 22 Feb 2022	Coinmarketcap.com
Gold Coin	01 Jan 2019 – 22 Feb 2022	Coinmarketcap.com
Digix Gold Token	01 Jan 2019 – 22 Feb 2022	Coinmarketcap.com
E-Dinar Coin	27 Oct 2020 – 22 Feb 2022	Coinmarketcap.com
GoldMoney	29 Oct 2021 – 22 Feb 2022	Coinmarketcap.com
EGold	4 Sept 2020 – 22 Feb 2022	Coinmarketcap.com
Gold	1 Jan 2019 – 18 Feb 2022	Worldgoldcouncil.org
Silver	22 Feb 2021 – 22 Feb 2022	Yahoofinance.com

Source: coinmarketcap.com

Table 2. Descriptive Statistics of Daily Return Metal Backed Cryptocurrency, Gold, and Silver

	BitCoinGold	Digix Gold Token	E-Dinar Coin	E-Gold	Gold Coin
Observation	1.148	1.148	483	536	1.148
Mean	0.0027886	0.0025190	0.0135456	0.0067485	0.0215132
Std. Dev	0.0692918	0.0753515	0.2270399	0.0743708	0.2420700
Minimum	-0.4201313	-0.7796639	-0.5488731	-0.3267771	0.6955706
Maximum	1.0474140	1.1826310	2.1940980	0.4626741	3.7217500
Variance	0.0048013	0.0056778	0.0515471	0.0055310	0.0585979
Skewness	4.0277680	4.3044270	3.8616020	0.4378466	6.1817370
Kurtosis	58.22767	82.352760	30.132270	6.7763190	76.873030

Source: Researcher, Data Processed

	Gold Finch	Gold Money	Gold	silver
Observation	42	116	655	201
Mean	-0.333928	0.0757244	0.0005584	-0.0054997
Std. Dev	0.0880359	0.2352775	0.0097005	0.0723549
Minimum	0.2196262	-0.6969212	-0.0512839	-1.00000000
Maximum	0.2220183	0.9470934	0.0526747	0.0368509
Variance	0.0077503	0.0553555	0.0000941	0.0052352
Skewness	0.4829523	1.3738570	-0.2930118	-13.012080
Kurtosis	3.7999460	7.8439860	7.5295480	179.35470

Source: Researcher, Data Processed

Bitcoin Gold, Digix Gold Token, and Gold Coin was observed 1,148 times. Meanwhile, E-Dinar Coin 483 times, E-Gold 536 times, Gold Finch 42 times, and Gold Money 116 times. The differences because the type of metal backed cryptocurrencies are created at different time. From the skewness and kurtosis analysis, it was more than +/- 2.8 so we can conclude that the data is normal.

5. Method

In this study, the ARCH method developed by Engle (1982) and the GARCH method used by Bollerslev (1986) were employed. Before performing the ARCH GARCH analysis, the data stationarity test was carried out using the augmented Dickey Fuller test. Data stationarity needs to be carried out on time series data because the variance in time series data has no effect on changes in time and therefore disrupts the stability of data in statistics (Gujarati, 2003). The augmented Dickey Fuller test is a unit root test to test the stationary of data. With hypothesis as follows:
Ho : data contains unit root or non-stationary data
H1: data does not contain unit roots or data is stationary

$$t = \frac{\acute{\varphi} - 1}{\sigma(\acute{\varphi})}$$

Data transformation
Log return value at time t: : Where the data at time t, while the data at time

$$\text{t-1.} r_t = \ln\left(\frac{Z_t}{Z_{t-1}}\right) Z_t Z_{t-1}$$

Optimal lag determination

By using the swatch criterion, the optimal lag determination is carried out using the following formula:

$$SC = -2\frac{\lambda}{T} + \frac{\ln(T)}{T}K$$

Where T is the number of data, k is the number of variables, and is a log probability function.

Granger causality test

Next, the Granger causality test is conducted to look at the causal relationship between stablecoins (cryptocurrencies where the price is designed to be pegged to a reference asset) and the currencies that underpin them, as well as with the volatility of other cryptocurrencies.
Ho : the lag variable X does not affect the lag variable Y
H1 : lag variable X affects variable Y

$$F = \frac{\left(\sum \acute{u}_r^2 - \sum \acute{u}_{ur}^2\right)/P}{\sum \acute{u}_{ur}^2/(T-v)}$$

Partial autocorrelation function (PACF)

The partial autocorrelation between rt and rt-1 is as follows: $\varphi_{11} = Corr\left((r_t, r_{t-1} | r_{t-1}, r_{t-2}, \ldots . r_{t-1+1})\right)$

$$= \frac{p_1 \sum_{j=1}^{i-1} \varphi_{i-1,jp_{i-1}}}{1 - \sum_{j=1}^{i-1} \varphi_{\ i\ ,jp_{i-1}}}$$

The AR model is written as follows: $r_t = \varphi_1 r_{t-1} + \varphi_2 r_{t-2} + \cdots + \varphi_p r_{t-p} + \varepsilon_t$

ARIMA is a constant volatility model. However, there are economic data that have non-constant volatility, resulting in heteroscedasticity in the residuals. In this case the model used is the GARCH model. is the transformation value at time t at the AR model. ε_t is the AR model residual at time t. The GARCH model was first introduced by Bolerslev in 1986. This model is a model in which the variance changes over time. The GARCH(m,s) model is written as follows:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \cdots + \alpha_m \varepsilon_{t-m}^2 + \beta_1 \sigma_{t-1}^2 + \cdots + \beta_s \sigma_{t-s}^2$$

In this model, there is one period where the volatility is very high and another period where the volatility is very low. Such a volatility pattern indicates the existence of heteroscedasticity because there is an error variance whose magnitude depends on the volatility of past errors.

The autoregressive vector model (VAR) was first introduced by Christopher A. Sims in 1980.

$$r_t = c + \sum_{i=1}^{p} \Phi_i r_{t-1} + a_t$$

MS GARCH

The MS GARCH model can be formulated as follows:

$$\sigma_{t,st}^2 = \alpha_{0,st} + \alpha_{1,st} \varepsilon_{t-1}^2 + \cdots + \alpha_{m,st} \varepsilon_{t-m}^2 + \beta_{1,st} \sigma_{t-1}^2 + \cdots + \beta_{s,st} \sigma_{t-s}^2$$

Where st is the state at time t, > 0, 0, 0. $\alpha_{0,st} \alpha_{i,st} \beta_{1,st}$

The DCC-GARCH model is generally formulated as follows:

$$Q_t = (1 - \theta_1 - \theta_2)\bar{Q} + \theta_1 Q_{t-1} + \theta_2 (\varepsilon_{t-1} \varepsilon_{t-1}')$$

with $\bar{Q} = \frac{1}{T}\sum_{i=1}^{T} \varepsilon_{t-1}\varepsilon'_{t-1}$, is an unconditional covariance matrix, and must satisfy >0 and <1. $\bar{Q}\theta_1\theta_2\theta_1\theta_2 > 0\theta_1 + \theta_2$

The MS-DCC-GARCH model can be formulated as follows:

$$Q_{t,st} = \left(1 - \theta_{1,st} - \theta_2\right)\bar{Q}_{st} + \theta_{1,st}Q_{t-1,st} + \theta_{2,st}(\varepsilon_{t-1}\varepsilon'_{t-1})$$

Where is a conditional correlation matrix with time varying at time t in state st. $Q_{t,st}$

Normality test

The normality test using the Kolmogorov Smirnov test can be written as follows:

Ho : normal distributed model residual

H1 : model residues are not normally distributed;

Test statistics:

$D = max|F_T(X) - F_o(X)|$ where is the normal cumulative probability, T is the number of data and is the empirical cumulative probability. The null hypothesis is rejected if the probability value is less than $.F_T(X)F_o(X)D|D > D_{(\alpha T)}\alpha.$

Autocorrelation test

Hypothesis

Ho : $_{1=}$2=...= m=0 (no autocorrelation between residues)

H1 : there is at least one$_1$0 for i = 1,2,3 ..., m (there is an autocorrelation between residues)

Test statistics: $Q = T(T+2)\sum_{l=1}^{m}\frac{\bar{\rho}_l^2}{T-l}$

Where T = the amount of data, l = the number of lags, is the autocorrelation of the sample lag 1, while m is the maximum lag tested. The null hypothesis is rejected if Q > or the probability value is less than $\bar{\rho}_l X_m^2\ \alpha.$

Heteroscedasticity test

Hypothesis

Ho : there is no effect of heteroscedasticity on the model residue

H1 : there is an effect of heteroscedasticity on the model residue

Langrange multiplier test statistics: $\xi = TR^2$ where T is the amount of data and is the coefficient of determination. The hypothesis is rejected if > or the probability value is less than $R^2\xi\ X_m^2\alpha.$

Smoothed probability

Smoothed probability according to Kim and Nelson (1999) is as follows:

$$\mathrm{P} = (S_t = i|\Psi_T) = \sum_{j=1}^{K} P(S_t = i|S_{t+1} = j, \Psi_T)$$

The predicted value of smoothed probability according to Guidolin and Pedio (2018) at t+1 can be written as follows:

$$\mathrm{P} = (S_{t+1} = i|\Psi_T) = \sum_{j=1}^{K} p_{ij}\mathrm{P}(S_t = j|\,\Psi_T)$$

6. Model

In this study we estimate long-term volatility using the GARCH method described by Danielsson (2011). In the GARCH model, the conditional variance is related to the previous period's period of squared error and the previous period's conditional variance. The GARCH model is as follows:

$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + Vt,$$

Equation for each cryptocurrency and gold variable:

$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma_1 \text{Bitcoin Gold}$$
$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma_1 \text{GoldFinch}$$
$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma_1 \text{GoldCoin}$$
$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma_1 \text{Digix Gold Token}$$
$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma_1 \text{EDinar Coin}$$
$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma_1 \text{Gold Money}$$
$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma_1 \text{EGold}$$
$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma_1 \text{gold}$$
$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma_1 \text{silver}$$

7. Results and Discussion

This study uses an analysis based on a literature review related to the feasibility of paying *zakat* using metal backed cryptocurrencies. Below are the results of metal backed cryptocurrencies using ARCH GARCH.

Table 3. Estimation Results of Variables

	BitCoinGold	Digix GoldToken	E-Dinar Coin	E-Gold	Gold Coin
Coef	-0.0023606***	0.0002892	0.0032846	0.0026773	0.0113391***
AR	0.5967591***	0.2996393***	0.614626***	0.5845637	0.7919218***
MA	-0.7694790***	-0.7309797***	-0.7642935***	-0.5213247	-0.9002891***
Coef	0.000502***	-0.00052***	0.00001098*	0.0015546***	0.0005422***
ARCH	0.7710816***	0.2059282***	0.169543***	0.1920646***	0.5199619***
GARCH	0.495338***	0.8783102	0.8818714***	0.523928***	0.7565713***

, *, * indicate significance level of 1%, 5% and 10%

	Gold Finch	Gold Money	Gold	Silver
Coef	-	-0.0608929***	0.0002363	
AR		0.0021138	-0.048427**	
MA		-0.2365723	-0.0973585***	
Coef		0.0204724***	0.0000187***	
ARCH		0.8800946***	0.3331525***	
GARCH		0.066546	0.446574***	

, *, * indicate significance level of 1%, 5% and 10%

Source: Researcher, Data Processed

Table 4. Unit Root Test for Metal Backed Cryptocurrency, Gold, and Silver

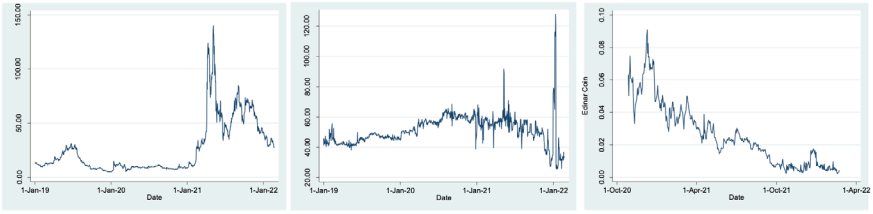
Dickey Fuller Test	Bitcoin Gold	Digix Gold Token	E-Dinar Coin	E-Gold	GoldCoin
Level z(t)	0.2691	0.0000	0.2476	0.4950	0.0303
1st Difference	0.0000	0.0000	0.0000	0.0000	0.0000

Dickey Fuller Test	Gold Finch	Gold Money	Gold	silver
Level z(t)	0.0567	0.0004	0.4021	0.0000
1st Difference	0.0000	0.0000	0.0000	0.0000

Source: Researcher, Data Processed

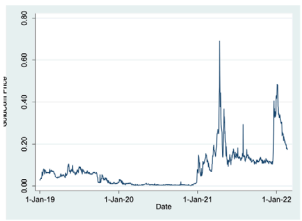
Based on unit test root, Digix Gold Token, Gold Finch, Gold Money, Gold Coin and silver are stationary on level z(t). Meanwhile, Bitcoin Gold, E-Dinar Coin, E-Gold, and gold are stationary at the first difference.

Graphics. 3: Price Volatility of Metal Backed Cryptocurrency, Gold, and Silver



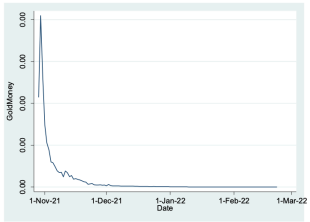
Bitcoin Gold | Digix GoldToken | E-Dinar Coin

EGold



Gold Coin

GoldFinch



GoldMoney

Silver

Gold

Source: Coinmarkercap.com/cryptocurrency historical price
Source: world Gold council.org

We can see that the value of the majority of metal backed cryptocurrencies declined in the year of 2022. On the other hand, the price of gold rose over the year. It means that the metal backed cryptocurrencies prices do not depend on the gold price, even though these currencies are allegedly backed by gold. The metal backed cryptocurrencies prices instead depend on the supply and demand of transactions performed through blockchain.

Table 5. Parameters, long run variance, long run volatility Garch (1,1) estimates Metal Backed Cryptocurrency, Gold, and Silver

	BitCoinGold	Digix GoldToken	E-Dinar Coin	E-Gold	Gold Coin
Parameter ω	0.0005020	-0.0000520	0.0000109	0.0015546	0.0005422
Parameter α	0.7710816	0.2059280	0.1695430	0.1920646	0.5199619
Parameter s	0.4953380	0.8783100	0.8818714	0.5239280	0.7565713
Parameter γ	-0.2664196	-0.0842380	-0.0514140	0.2840074	-0.2765332
Long run variance (V_{LR})	-0.0018842	0.0006173	-0.0002140	0.0054738	-0.0019607
Long run volatility() σ_{LR}	[]	0.0248454	[]	0.0739851	[]
Relative LR to gold	[]	2.6965404	[]	8.0298018	[]

* period August 2019 – May 21, 2021; ** period 1 Jan 2015-2 July 2021

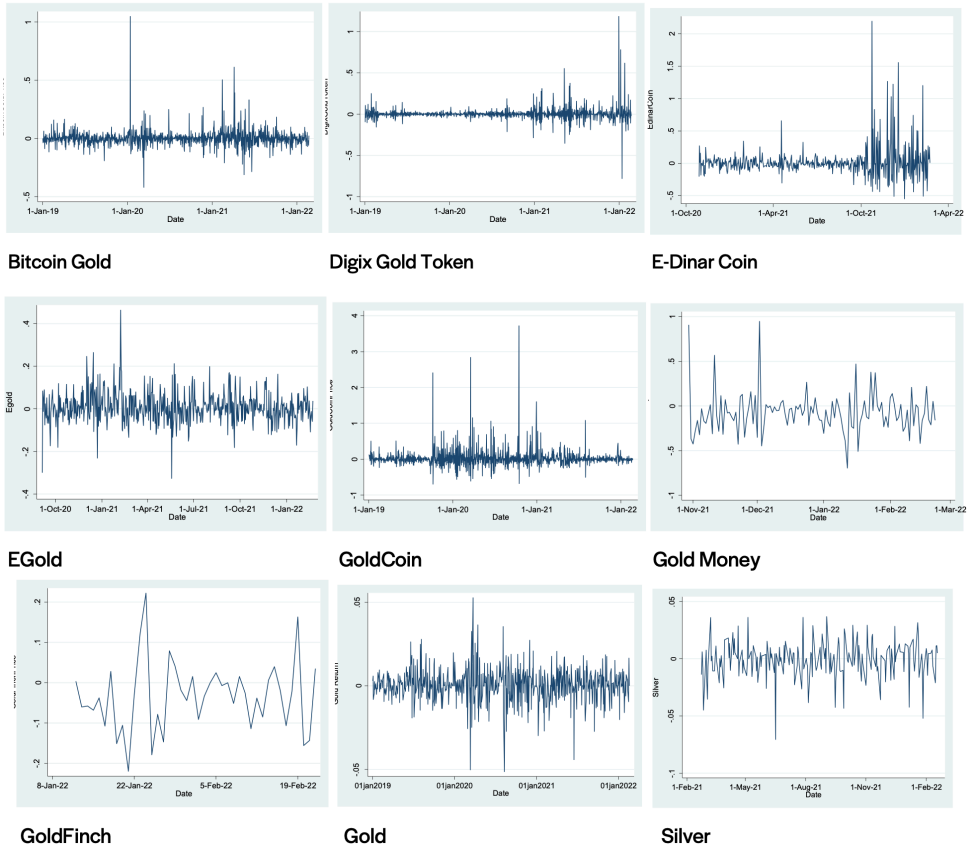
	Gold Finch	Gold Money	Gold	Silver
Parameter (ω)	-	0.0204724	0.0000187	-
Parameter (α)	-	0.8800946	0.3331525	-
Parameters (β)	-	0.0665460	0.4465740	-
Parameter (γ)	-	0.0533594	0.2202735	-
Long run variance (V_{LR})	-	0.3836699	0.0000849	-
Long run volatility(R) σ_{LR}	-	0.6194109	0.0092138	-
Relative LR to gold	-	67.226304	1.0000000	-

Source: Researcher, Data processed

$\omega = \gamma V_{LR}$ and $\gamma + \alpha + \beta = 1$ and $\alpha + \beta < 1$ where σ_t and σ_{t-1} is denoted as the estimated volatility of time t and t-1. In Garch's model, past volatility contributes to future volatility. β is the estimation parameter. σ_{LR} is the long-run variance. is long-term volatility. The long run volatility amount was obtained from (ω) divided by (γ) while σ_{LR} was obtained from the square root of VLR. The value relative to gold was obtained from long run volatility of metal backed cryptocurrencies divided by gold volatility.

In this study, gold price volatility is the lowest. Even though the cryptocurrencies studied here are metal backed cryptocurrencies, their volatility is quite high. GoldMoney has a long-term volatility of 67 times the volatility of gold, while E-Gold has eight times the volatility of gold. Some types of metal back cryptocurrencies produce a negative result, meaning that negative pressure has a higher effect than pressure on positive returns.

Graphics 4: Volatility of Return Metal Backed Cryptocurrency, Gold, and Silver



Source: Coinmarketcap.com/cryptocurrency historical price
Source: world Gold council.org

8. Conclusion

This study examines the feasibility of metal backed cryptocurrencies in *zakat* payment transactions. The cryptocurrencies used are Bitcoin Gold, GoldFinch, Gold Coin, Digix Gold Token, E-Dinar Coin, GoldMoney, and EGold, as well as gold and silver. Based on the results of our analysis, we find that even though these cryptocurrencies are metal backed cryptocurrencies, the volatility is quite high. GoldMoney has a long-term volatility of 67 times the volatility of gold, while E-Gold has eight times the volatility of gold. Some types of metal backed cryptocurrencies even produce negative results, meaning that negative pressure has a higher effect than pressure on positive returns. Therefore we can conclude that due to high volatility, metal backed cryptocurrencies are not suitable as a means of paying *zakat*. This is in accordance with a study conducted by Antonakakis et al. (2019), Siswantoro et al. (2020), and Akcora et al. (2018).

This research contributes to *zakat* regulators and donors by encouraging a review of the use of metal backed cryptocurrencies in paying *zakat*, *infaq*, and alms. We suggest to future researchers to study other types of metal backed cryptocurrencies to enrich the research conclusions.

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