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Article

A Study on Relationship Between Crypto Currency, Commodity and Foreign Exchange Rate

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ABSTRACT - Bitcoin is one of the crypto currencies which is increasingly popular as a digital currency. Bitcoin is a digital asset that can be accepted by global modern society nowadays. Bitcoin can be used in online transactions either for the purchase of goods or services. This study aims to find out the significant relationship between Bitcoin, gold, crude oil, and USD. In addition, this study also examines the causal relationship that exists between Bitcoin with each variable, whether bitcoin affects the variable or independent variable affects bitcoin. The data used is secondary data obtained from historical data in investing.com starting from September 2015 until September 2020. This data was analyzed using Regression and Correlation, Unit Root Test and Pairwise Granger Causality to see the relationship and influence between variables. The results show that there is a significant relationship between bitcoin, gold, and crude oil. While there is an insignificant relationship with the USD. The study also shows that there is a positive correlation impact between Bitcoin, gold, and crude oil. There is a negative correlation impact between Bitcoin and the USD. That is, when there is an increase in gold and crude oil, it will also increase the Bitcoin. As for the USD currency, if the USD increases, Bitcoin will decrease and vice versa. Based on the analysis of granger causality shows that gold, crude oil, and USD do not cause Bitcoin, but Bitcoin, gold and crude oil cause the USD.

INTRODUCTION

The development and advancement of science and technology in the industry has led to the world of digital revolution. In line with that, the existence of this revolution also affected developments in the world of financial technology. Digital revolution is an industry transition process that makes every system implemented very flexible and systematic that can be adapted to more challenging situations (Morrar et al., 2017). Cryptocurrency is a digital currency and a thriving investment with a famous currency namely Bitcoin (BTC) which is a digital asset using a computer network called a blockchain. The most popular cryptocurrencies in the market today are Bitcoin. Bitcoin is the first currency to use an online payment system based on open-source software-based using blockchain technology. The peer-to-peer (P2P) transactions happen without the need for approval from the central bank or single central repository. BTC is secured since every transaction has been recorded in a shared public ledger. Thus, it began to be known as a decentralized virtual currency that could be used without a name (Abdul Hamid & Talib, 2019).

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According to the International Monetary Fund, Digital currency is a virtual currency, in which, in digital value it is electronic money. The difference between virtual currency and electronic money is the issuer, which is the issuance of electronic money regulated by the state of the country and controlled by the central bank using the currency of the country such as paypal. The digital representation of a value issued by a private developer with the determination of denomination in a separate unit is called a virtual currency. According to Habermeier (2016), virtual currency will be recognized and valuable when all parties agree to keep, access, and transmit electronically for various transactions. The relationship between electronic money and fiat money is guaranteed through the law and the value of the funds stated in the same unit of account such as USD, Euro, Ringgit, and other world currencies. But digital currency schemes use their own account units such as Bitcoin, Ethereum, Litecoin and so on which are used as an alternative to fiat currency and converted to the value of a currency according to a country.

The growth of BTC is remarkable and creates opportunities for investors, hedgers, and speculators, but at the same time poses challenges to policy makers and regulators (Dyhrberg, 2016b). Based on this growth, economists will conduct a study of BTC price fluctuations in interpreting economic conditions as explaining the prices of BTC formed and its volatility. According to Chu et al. (2017) most literature determines cryptocurrencies as a digital asset, many traders holding and trading the BTC for investment purposes. BTC and gold have similarities as alternative assets with high price fluctuations, this can attract investors and speculators to invest in BTC and gold (Dyhrberg, 2016a). The widespread use of the internet database and technology influenced the money concept (European Central Bank, 2012). However, Bitcoin is also the best accepted investment tool. Bitcoin investment does not limit the market as it provides an open market with no restrictions imposed on it. Bitcoin facilitates online shopping, and it is impossible to duplicate Bitcoin. Bitcoin is highly protected by blockchain technology.

Gold investment can provide returns and guarantees compared to other conventional investments. Gold is an investment asset that is highly valued as a savings for investment, a COVID-19 outbreak emergency fund and a currency hedge. Gold is one of the hedging tools, as an asset with value in the future, just as Bitcoin is more efficient for individuals to keep gold than keeping stocks or fiat money during the financial crisis. Crude oil produced by plants and animals, buried underground, and exposed to extreme heat and stress then it becomes crude oil or called liquid fossil fuel. Crude oil is one of the most demanded commodities and the prices have risen significantly in recent times. This study used a West Texas Intermediate (WTI) USA. Crude oil prices are usually measured in US dollars. Although there have been discussions of replacing the US dollar with other trading currencies for crude oil, no final action has been taken to replace that currency.

The U.S. dollar, as a modern paper currency is declared as fiat currencies. Fiat currency or money which is issued by a government is not backed by a commodity such as gold. This fiat money will be controlled by central banks because they can control how much money is printed. Money is no longer just a means of exchange, but it is also functioning as a unit of accounts, a store of value, a standard of deferred payments and serves as a commodity item (Indra, 1992).

The aim of this study is to identify the relationship of BTC with other variables and hope to contribute to the knowledge of investors in the world of digital currency. With the different characteristics between the variables studied it is hoped that investors can make a wise decision. Under severe economic conditions, BTC investment will be affected which will have a negative impact on BTC prices in the short and medium term. However, this will not be a problem in the long run. The best scenario is that people recognize BTC as a safe asset with better returns than traditional assets such as stocks. If this happens, BTC will become one of the largest asset classes in the world in just a few months. The uncertainty triggered by this COVID-19 provides BTC with the first real test. BTC's performance at a time filled with these extreme volatilities will prove its value as a truly global asset.

LITERATURE REVIEW

The BTC was introduced by Satoshi Nakamoto in 2008. In 2009, the open-source software was released with the first transaction taking place between Satoshi and early adopters of BTC. During that period BTC was designed for the public and it is an open source, nobody controls or owns the crypto currency, and everybody can participate (Nakamoto, 2009). Since that period, BTC has been accepted as an investment alternative among the investors. The price of BTC has risen significantly in a short period of time and it makes BTC per US dollar pair very popular among traders and active investors. One of the factors that contributed to this development is due to BTC is a safe currency as it was developed based on a cryptographic system and this is very different from the traditional fiat currency system (Nakamoto, 2009). Nurhisham (2017) stated that bitcoin is an increasingly popular digital currency and is constantly changing its form over time. Besides that, BTC is also used in traditional money transfers around the world not only in certain countries because this currency will be converted according to the currency of a country.

As an alternative investment, BTC has shown good performance and recorded high profit margin. The high profit or return of BTC showed this investment came with higher risk and therefore needed further investigation. The higher risk is not only affected by investors, but this also may affect the world economy as well. Kurihara and Fukushima (2018) stated that the fluctuation of BTC prices may influence the efficient allocation of resources in the economy and this also may affect the other commodities such as gold, crude oil, and exchange rate. The study of price movement of bitcoin is interesting as one of the factors that may influence price fluctuation is the prediction of future demand in the market but there is no value attached to any physical assets. Kristoufek (2015) argued that it is interesting to study the prediction of future bitcoin price due to the nature of transaction and as new commodities or investment alternatives, the relationship of BTC with other commodities are interesting to explore such as gold and crude oil.

Garcia et al. (2014) found that the drivers of bitcoin process resulted from social interactions between market actors. They base their work on the idea of Fama et al. (1969) and Grossman and Stiglitz (1976) which found that the ability of economic factors to integrate the same source of information quickly including those related to the price of an investment in determining the price of goods. The relationship between economic recession and volatility increases has been widely proven by empirical research (Schwert, 1990). Thus, in their study, they integrated macro-economic variables such as interest rate, inflation, gross domestics product (GDP) as indicators that may predict the future movement of bitcoin. This is further supported by Poyster (2017) who found that the determining price of a crypto currency is determined by external and internal factors (demand and supply).

Reoboredo (2013) studied the volatility price movement between gold and bitcoin. By applying the GARCH model, he found that gold and bitcoin as hedges and unstable shelters over time. In the short run, Bitcoin acts as a weak haven, while in the long run it acts as a good hedge asset. Bouoiyour and Selmi (2015) that conducted a similar study also found the same findings. In the other studies, Kristoufek (2015) conducted on how bitcoin reacts towards economic variables particularly in the China market. The study found that, in the long run, the price of bitcoin is influenced by the money supply and basic economics factors such as GDP, interest rates and price index. On the other studies, Sariannidis et al. (2009), Wong (2017) and Baur et al. (2018) conducted price movement study between bitcoin, gold, and US dollars by applying GARCH volatility analysis and found that bitcoin differs from gold and US dollars in terms of return over time, volatility, and correlation characteristics.

As a conclusion, bitcoin has been accepted widely as a main investment alternative among the investors. As a new investment alternative there have been many studies conducted on how the relationship between bitcoin with other commodities or economics variables is. By that, the

price movement and changes of bitcoin can be predicted and understood. As the journal discusses, many studies have been conducted between bitcoin with gold, exchange rate, stock market performance and economic variables such as GDP, inflation rate and price index. By that this study is conducted to explore such relationships.

METHODOLOGY

The data used is secondary data obtained from historical data in investing.com starting from September 2015 until September. In 2009, BTC was considered an alternative currency and a value that can be stored as a digital gold. At the beginning, bitcoin was not widely used and well known. The price of this cryptocurrency is volatile, for example, starting in July 2013 with a minimum BTC price of between $ 65.53 and then this price soared to the minimum price of $ 20,089 in December 2017 (Coin Market Cap, 2018). The volatility of BTC price has attracted wide investors of younger to the elderly people. The concept of BTC is freely owned by the public and no one controls the ownership of that currency, this situation making the demand for BTC soaring upward. Figure 1 and Figure 2 shows the evolution rates of return and price in quarterly transactions.
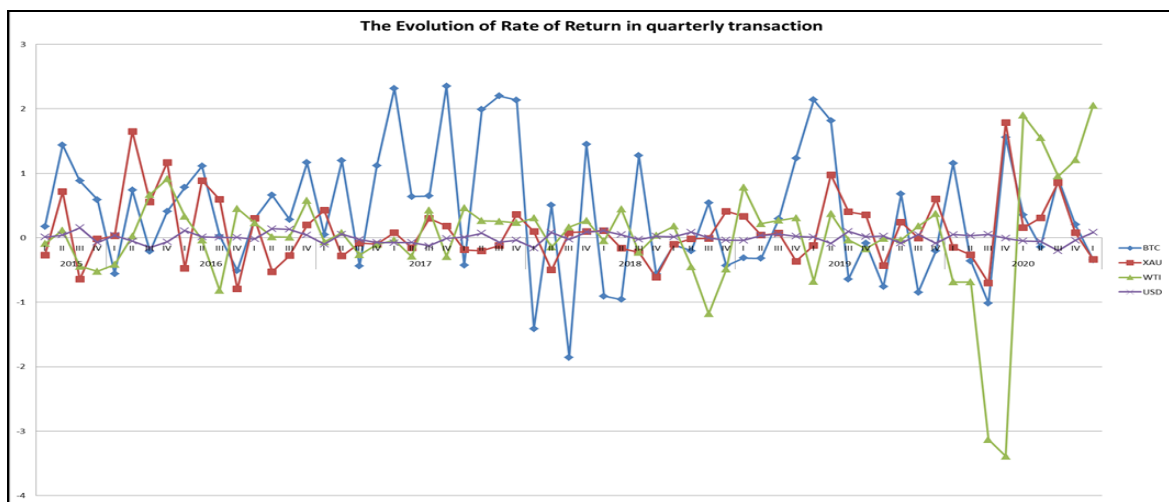

Figure 1: The Evolution of Rate of Return in Quarterly Transaction
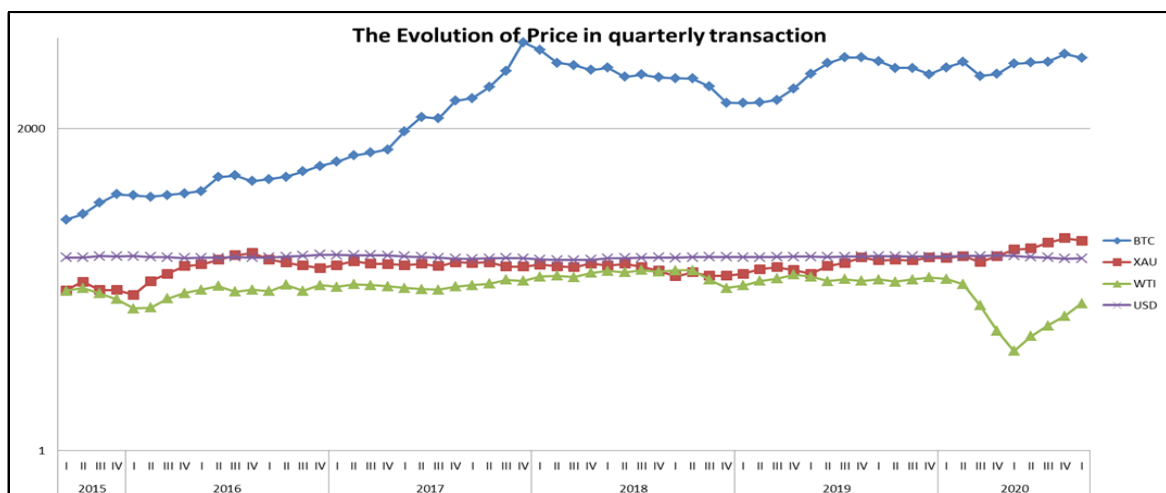

Figure 2: The Evolution of Price in Quarterly Transaction

Figure 2 shows the Evolution of Price and Rate of Return USD in daily transactions. The spread of COVID-19 in the United States (US) caused millions of people to lose their jobs and

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caused economic problems, but that did not affect the dollar. On the other hand, the value of the US currency has increased in September 2020, which was six percent from its lows compare to August 2020. The US dollar is the most traded currency in the world in the foreign exchange market. The graph above shows the US Dollar has a direct impact on world oil due to fluctuations in crude oil prices from September 2015 to September 2020. In 2015, Federal reserves had tightened monetary policy by raising interest rates to increase the value of the US dollar. The interest rate was raised at 1.25% in 2017 causing investors to shift investment to the US by buying US bonds. This made the position of the US dollar stronger in 2017.

However, in January 2018 the US dollar continued to weaken, then entering February 2018, the US dollar began to strengthen. US dollar price fluctuations occurred in 2019 in an upward trend. However, in 2020 the value of the US dollar plummeted to August 2020. The spread of COVID-19 in the United States (US) did not affect the economy and did not affect the value of the dollar, even though it caused millions of people to lose their jobs. On the other hand, the value of the US currency increased by the end of 2020, up six percent from its lowest level in August. According to the US dollar index, which measures its value against a basket of other currencies, it is due to its special position as a world reserve currency. This means that, during the crisis, investors want to put money in safe assets, even if the US economy is in trouble.

Regression and Correlation Analysis
The following is the linear equation of the regression line used in this study to describe the relationship between variables which of those variables can only be determined by the regression method.

Regression OLS equation
$$\mathrm{BTC}_t = \alpha + \beta_1 \mathrm{XAU} + \beta_2 \mathrm{WTI} + \beta_3 \mathrm{USD} + \varepsilon^t$$

Where α = estimated coefficient of the factor variable; ε^t = error; XAU=gold; WTI = crude oil; USD = US dollar. Therefore, the dependent variable is BTC and independent variables are XAU, WTI and USD.

Correlation is used to measure the strength of the relationship between two variables. Correlation coefficients are used to calculate the degree of change in one variable based on the change of another variable. In statistics, correlations are related to the concept of interrelationships between or dependence between two variables. Thus, it can be concluded that regression provides a form of relationship between two random variables, while correlation provides a degree of relationship strength. Regression analysis produces a regression function, which helps to extrapolate and predict outcomes while correlation can only provide information on directions that may change. Regression and correlation will answer the research hypotheses that are:

Hypothesis 1 (**H₁**): Gold positively affects Bitcoin.
Hypothesis 2 (**H₂**): The crude oil positively affects the Bitcoin.
Hypothesis 3 (**H₃**): The USD positively affects Bitcoin.

Unit Root Test
In this study, the researchers used the Augmented Dicker-Fuller (ADF) test to check a stationary result in the variables. The null hypothesis and the alternative hypothesis for the unit root test in the variable are as follows:
Null Hypothesis (**H₀**)   : Variable is not stationary or has unit root
Alternative hypothesis (**H₁**)   : Variable is stationary.

By using the ADF test, the above null and alternative were developed. The result of critical value after the evaluation of the test are:

- If the ADF test statistics < ADF critical value at the level of significance and prob value > the significance level of 5% then H_0 is accepted or there is a root unit so that the data is not stationary.
- If the ADF test statistics > ADF critical value at the level of significance and prob value < the significance level of 5% then H_0 is rejected or there is no root unit so that the data is stationary.

Pairwise Granger Causality Test

The determination of Lag-Length for Granger Causality is based on the determination of the lag length of the VAR. Various lag length selection criteria are defined by different authors, Akaike Information Criterion (AIC) suggested by Akaike (1974), Schwarz Information Criterion (SIC) (1978) and Hannan-Quinn Information Criterion (HQ) (1979). For this study, researchers choose the lowest value of AIC for optimal lag selection.

The Granger causality test aims to examine whether there is a causality between two variables. The Granger causality test shows whether past changes in the value of *x (y)* influence the current change in the value of *y (x)* over a specified period. In addition, this study identified the causality direction that exists between variables using Pairwise Granger Causality Test. Bivariate regressions of the form as below for all possible pairs of (*x,y*) series in the group.

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + _{...} + \alpha_l y_{t-j} + \beta_1 x_{t-1} + ... + \beta_l x_{t-i} + \varepsilon_t \ ....\text{First}$$
$$x_t = \alpha_0 + \alpha_1 x_{t-1} + _{...} + \alpha_l x_{t-j} + \beta_1 y_{t-1} + ... + \beta_l y_{t-i} + u_t \ .....\text{Second}$$

Granger Causality Model Equation $\beta_1 = \beta_2 = ... = \beta_l = 0$ for each equation. The null hypothesis is that *x* does not Granger-cause *y* in the first regression and that *y* does not Granger-cause x in the second regression.

RESULTS

In 2009, Satoshi Nakamoto released Bitcoin related programs as well as codes known as a blockchain. New Liberty Standard, a BitcoinTalk user has issued a Bitcoin exchange table with USD, and the first exchange value is USD $ 1 equal to 1,309.03 BTC where the value of USD is maintained as 1. The value of bitcoin currency continued to increase until 2011, then 2013 the value of bitcoin has decreased. Restrictions and pressure from the People's Bank of China caused many banks to issue deadlines to exchange platforms in the country, urging them to close operations before April 15, 2013. As a result, Bitcoin prices were declining, reflecting the declining of Bitcoin trading volumes, until it fell to USD $ 381.88 for the subsequent few months until the price of Bitcoin suddenly soared in 2017. Since that year, the price of Bitcoin rose slowly, and the price was relatively stable in the range of USD500 to 800 based on coinmarketcap.com. with detecting the price of Bitcoin ups and downs which is very important for investors so that this research has been done.

BTC has high margins of profit, so that in theory if it has high return, the risk facing also comes with a high level not only for investors but also for the global economy as well. According to Kurihara and Fukushima (2018), the fluctuations of BTC prices will damage the efficient allocation of resources in the economy and affect the others such as gold, crude oil, and USD. Clark (2018) found that investors will get high prices in bitcoin investments based on the belief that other investors will also pay at a higher price going forward but in fact it has no value attached to any physical assets.

Descriptive Analysis

The descriptive statistics of the returns of all variables for a sample period with 1324 observations, for returns sampled at five daily frequency a week, the Bitcoin returns during

weekends was discarded since there is no trading and hence, no observations of the other assets. The observations of data starting from September 2015 to September 2020. Table 1 below shows a descriptive analysis for the variables.

Table 1: Descriptive Analysis for BTC, XAU, WTI and USD

Variables		Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
Y	BTC	0.3606	0.2516	19.176	-21.630	3.834	0.1693	7.695
X_1	XAU	0.1038	0.0265	13.770	-9.790	2.034	0.0798	6.731
X_2	WTI	0.0245	0.0380	27.740	-31.699	2.700	-1.9106	46.631
X_3	USD	-0.0014	0.0101	1.886	-1.228	0.322	0.2063	5.333
				N = 1324 observations				

Table 1 shows the average return for BTC is 0.3606 ranges between 19.176 and -21.630. The average return for XAU and WTI is positive values 0.1038 and 0.0245 respectively, while the average return for USD is negative value 0.0014. Meanwhile all variables for median were positive values reaching 0.2516, 0.0265, 0.0380 and 0.0101 for BTC, XAU, WTI and USD respectively. However, the standard deviation is 3.834, 3.034, 2.700 and 0.322 for BTC, XAU, WTI and USD respectively. This indicates that BTC price fluctuation is higher than the other variables XAU, WTI and USD. This statement is contradicted by (Gkillas & Katsiampa, 2017) where the results that reported BTC and Litecoin were found to be least risky. While USD shows the small value of the standard deviation indicates that the dispersion of the data in the series is small. If the data obtained are far apart from each other, then there is a higher deviation in such data sets, the more data dissemination, the higher the standard deviation. This means BTC is more volatile than XAU, WTI and USD. Volatility is a statistical measure of the return spread for a particular security index or market. Volatility can be measured using standard deviation or variance between returns from the same security index or market. Usually, the higher the volatility, the higher the safety.

Regression and Correlation Analysis

Table 2 below shows a summary of regression analysis. The estimation of the model coefficient below table 2 is as follows by BTC as dependent variables, while XAU, WTI and USD were independent variables, the equation of BTC is as follows: BTC = 0.3379 + 0.1995XAU + 0.0969WTI + 0.2963USD

Table 2: Summary of the Regression Analysis

Dependent Variable: Bitcoin (BTC)			
Variable	Coefficient	t-stat	p-value
C	0.3379	3.2258	0.0013
XAU	0.1995	3.6082	0.0003
WTI	0.0969	2.4819	0.0132
USD	0.2963	0.8546	0.3929
Adjusted R^2		0.0163	
DW stat		1.4923	
F statistics		7.2905	
Prob (F stat)		0.000075	

Based on Table 2, the estimation of the model coefficient above shows that the predictors significantly predict BTC, F statistics= 7.2905, p = 0.000075 (p < 0.05). But the independent variables only can predict 1.63% (adjusted R^2 = 0.0163) toward the BTC. XAU (β = 0.1995, p = 0.0003), WTI (β = 0.0969, p = 0.0132), are significantly predicting BTC price. But USD is not significant (β = 0.2963, p = 0.3929) to the BTC. This result indicates that only 1.63% of the total variance in BTC was significantly explained by the three independent variables XAU, WTI and

USD. The remaining 98.37% of the total variance in y remains unexplained. The study also shows that, there are weak correlations between the variance since R-Squared is below 60%. Sometimes the value of R-squared can be negative for several reasons. Baur et al. (2018) found a negative correlation between the US Dollar Index and Bitcoin. Bitcoin prices are negatively correlated with financial assets in USD as they are influenced by US dollar volatility.

Table 3 shows that there is a positive correlation between bitcoin, gold, and crude oil with 0.105575 and 0.080384 respectively. Both variables gold and crude oil have a weak positive correlation because the value is closely related to 0.00. Positive correlation meaning that if gold and crude oil increased, the bitcoin will be increased too. However, there is a negative correlation between Bitcoin and US Dollar with 0.0147. This means that if Bitcoin increases, USD will decrease. The influence of BTC dependent variables on independent variables XAU, WTI and USD is due to partial and simultaneous influence. Here is an explanation of the influence of each variable based on the results of research that has been done.

Table 3: Correlation Analysis for Variables

VARIABLES	BTC	XAU	WTI	USD
BTC	1.000000			
XAU	0.105575	1.000000		
WTI	0.080384	0.123261	1.000000	
USD	-0.014669	-0.349460	-0.037714	1.000000

Hypothesis 1 (H_1): Gold positively affects Bitcoin.
The result of regression analysis with the OLS method found that the gold variable regression coefficient is 0.1995 with probability of 0.0003. The probability value is less than the significance level (0.0003<0.05). so, the research on this hypothesis was accepted.

Hypothesis 2 (H_2): The crude oil positively affects the Bitcoin.
The results of regression analysis by OLS method found that the coefficient of regression of crude oil variable is 0.0969 with a probability of 0.0132. Probability value is less than the level of significance (0.0132<0.05), so the research on this hypothesis was accepted.

Hypothesis 3 (H_3): The USD positively affects Bitcoin.
The result of regression analysis by OLS method found that the variable regression coefficient of gold price is 0.2963 with a probability of 0.3929. Probability value is less than the level of significance (0.3929>0.05). This analysis found the USD had a negative effect on Bitcoin, so research on this hypothesis was rejected. Baur et al. (2018) also found a negative correlation between the US Dollar Index and Bitcoin price. The Bitcoin price is negatively correlated with financial assets denominated in USD and is affected by fluctuations in the US dollar.

Augmented Dickey Fuller (ADF) for Unit Root Test
Table 4 presents Augmented Dickey-Fuller (ADF) tests at level with the result of the ADF test as below:

Table 4: Unit Root Test at Level Data

Variables	ADF test Statistics	Prob	Test critical values		
			1% level	5% level	10% level
BTC	-27.83174	0.0000	-3.435089	-2.863520	-2.567874
XAU	-31.05584	0.0000	-3.435089	-2.863520	-2.567874
WTI	-25.47482	0.0000	-3.435089	-2.863520	-2.567874
USD	-23.75033	0.0000	-3.435100	-2.863525	-2.567876

The results of Augmented Dickey-Fuller test above show that there is absence of unit root according to the p-values of all series are smaller than critical values at 1%, 5% and 10% level.

Therefore, the null hypotheses are rejected that all data series do not have a unit root. So, meaning that all the index data series are stationary at level intercept.

Pairwise Granger Causality Test

Since the values of computed ADF test-statistics shows the data series are stationary at level intercept. Lag length selection criteria was determined using the VAR lag order selection criteria model. The optimal selection of lag length for the time series model on Granger Causality is based on Table 5 as below.

Table 5: Optimal Lag Selection

Lag	LogL	AIC	SIC
1	-9700.575	14.72814	14.80671*
2	-9665.786	14.72198	14.86357
3	-9614.120	14.70132*	14.90622
4	-9593.649	14.70571	14.97382
5	-9561.037	14.70280	15.03440

According to the result, the researcher decides to choose lag 3 to examine the impact of Bitcoin, gold, crude oil, and US dollar price based on Akaike Information Criterion (AIC), the optimal lag order selection to perform pairwise Granger Causality test. The Granger (1969) causality test was used to examine the short-run and long-run causality direction between the relevant variables on Table 6.

Table 6: Pairwise Granger Causality Test

Direction of causality (Null Hypothesis)	F-Stat	Prob	Decision
XAU does not Granger Cause BTC	0.44026	0.7242	Accept
BTC does not Granger Cause XAU	0.50541	0.6786	Accept
WTI does not Granger Cause BTC	0.50791	0.6769	Accept
BTC does not Granger Cause WTI	1.83666	0.1386	Accept
USD does not Granger Cause BTC	0.69325	0.5562	Accept
BTC does not Granger Cause USD	3.03306	0.0284	Reject
WTI does not Granger Cause XAU	0.67044	0.5702	Accept
XAU does not Granger Cause WTI	1.55162	0.1994	Accept
USD does not Granger Cause XAU	6.49782	0.0002	Reject
XAU does not Granger Cause USD	5.22273	0.0014	Reject
USD does not Granger Cause WTI	1.36232	0.2527	Accept
WTI does not Granger Cause USD	3.86501	0.0091	Reject

The Pairwise Granger Causality test shows mutual interactions between Bitcoin, gold, Crude oil, and USD and is summarized in Table 10. The results are explained as follows, respectively. Firstly, the causality relationship between gold and Bitcoin was investigated. According to the results, there was no causality for gold and Bitcoin as well as Bitcoin and gold. Secondly, the causality relationship between crude oil and Bitcoin was investigated. The results indicate that there is no causality relationship between both variables whether crude oil and bitcoin vice versa. Thirdly, the causality relationship between USD and Bitcoin was investigated. The results found there are no causality relationships USD and Bitcoin. But there is granger causality between Bitcoin and USD.

According to the result above, Gold, Crude Oil and USD do not cause Bitcoin. Meanwhile Bitcoin, Gold and Crude Oil do cause the USD. Bitcoin and crude oil do not cause Gold, but USD does cause Gold and vice versa. Bitcoin, gold, and USD does not cause Crude oil, but crude oil does cause the USD. Thus, the increasing and decreasing of gold, crude oil and USD do not affect the bitcoin price. These results are consistent with the findings of Ciaian et al. (2016), which prove that the crude oil does not affect the bitcoin price. The result also supported

the findings of Atik et al. (2015) and Gulec et al. (2018) which indicates that the increasing and decreasing movement in USD do not significantly affect Bitcoin investors' decision. But, from the results, USD is affected by the increasing and decreasing of bitcoin, gold, and crude oil. Dwyer (2015) demonstrated that the monthly return volatility of Bitcoin, on average, was higher than gold or the USD. This shows that there is no causality relationship in the capital market and economic growth as evidenced by the study of Ali Basah (2007).

CONCLUSION

Based on the findings, results of the study suggest that there is a significant relationship between bitcoin, gold (t= 3.2258, p = 0.0013) and crude oil (t = 3.6082, p = 0.0003). This coincides with a study conducted by Kang et al., 2020, which found that Bitcoin can be used as an effective refuge for investors just like gold. With the right information, it can reduce risk in investment, and strengthen diversification profits in asset allocation, consequently portfolio risk management can be optimized. However, there is no significant relationship between bitcoin and USD (t = 0.8546, p= 0.3929). The insignificant relationship between bitcoin and USD shows Bitcoin is not influenced by USD.

The impact of price movements between variables indicates that there is a positive correlation between bitcoin, gold, and crude oil with 0.106 and 0.080 respectively. Both variables, gold and crude oil have a weak positive correlation as the value is closely related to 0.001. Positive correlation means that if gold and crude oil increased, the bitcoin will be increased too. However, there is a negative correlation between Bitcoin and the US Dollar with 0.0147. This means that if Bitcoin increases, USD will decrease. This coincides with the study found the US Dollar Index and Bitcoin in a negative correlation relationship exist. The Bitcoin price is negatively correlated with financial assets denominated in USD and is affected by fluctuations in the US dollar. There is asymmetry in the bitcoin market and its relation to the US dollar index which can be considered as a possible refuge for bitcoin, stocks, and gold.

The causal relationships show mutual interaction between variables found within Gold, Crude Oil and USD do not cause Bitcoin. Based on the results, it can be concluded that the return of gold, crude oil and USD does not affect Bitcoin. There are various factors that influence the relationship between variables. Therefore, the causal relationship is not found from Bitcoin return to gold, crude oil, and USD return. These results indicate that Bitcoin investors are not affected by the movement whether up and down the return in Gold, crude oil, and USD. Bitcoin does not cause gold, but crude oil and USD cause gold. Bitcoin and USD do not cause crude oil, but gold does produce crude oil. Many variables taken in this study affect the exchange rate in some way or another.

This study only focused on three independent variables which are gold (XAU), crude oil (WTI) and US dollar (USD). The independent variable is measured in terms of its relation to the BTC price. The results of this study hopefully will provide information to investors in making decisions in determining investment selection and setting investment strategies in the future. Various factors should be considered before making an investment decision in bitcoin as the acceptance of cryptocurrencies is still in the study stage. Factors in the internal and external environment of the country must also be considered in making judgments or decisions to be a wise investor. On behalf of the government, the government should take advantage of this study by improving and combating the black economy by controlling the country's economic inflation. The government needs to take serious steps to study and assess the needs of cryptocurrencies, as this situation will be detrimental to a country. The government needs to monitor and regulate cryptocurrencies so that the Bitcoin price mechanism should be monitored by the government, even if the government cannot control the BTC, but the government needs to draft laws on the BTC currency. If this situation is not controlled and curbed, the economy of a country will fail because this currency is increasingly accepted by the whole country.

Future researchers could incorporate other independent variables related to the macroeconomics factors that affect the BTC such as demand and supply, speculation factors, stock index, Forex Reserves, growth rate, and interest rate. It is suggested that such independent variables must analyze the relationship with the dependent variable (BTC) either for the short-term or long-term periods. This study used the crypto currency of Bitcoin (BTC) to be tested but for the future study, the researcher can use other top three selected crypto currencies such as Ethereum (ETH), Ripple (XRP) and Litecoin (LTC) conducted in this study.

Investment in digital currency is beginning to be accepted by today's society following the development of technology in finance. In the context of investment, to get high profits, investors need to be willing to face high risks. Bitcoin currency has very large and volatile price fluctuations. However, this Bitcoin Volatility should not be used as an excuse to ban this currency. This is because gold also has a very unstable value, but gold investment is not banned. Therefore, bitcoin investments need to be enacted with appropriate rules and regulations to control value stability and manage bitcoin transactions.

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