

Influence of the Price of Gold, The Price of Crude Oil, and Exchange Rate to Bitcoin Prices During the Covid-19 Pandemic

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Abstract

The covid 19 pandemic has a negative impact globally, such as financial crisis, political crisis, high unemployment rate, disruption supply chain. This study is examining the relationship between the price of gold, the price of crude oil, and exchange rate (USD/IDR) to Bitcoin during the Covid-19. A time series analysis by using ADCC-GARCH method and a simple linear regression are conducted in this research. The result shows that USD/IDR exchange rate doesn't have a significant relationship to Bitcoin, while there's a significant relationship between the price of gold and Bitcoin price. In addition, the price of crude oil has a significant relationship to Bitcoin price.

Keywords: Gold, Crude Oil, Exchange Rates, Bitcoin, Macroeconomy

1.1 Research Background

The global economy is certainly progressing, alongside technological developments caused by globalization. Cryptocurrency is one of the emerging new financial assets. Bitcoin is a cryptocurrency asset that was first introduced in 2008 by a figure known as Satoshi Nakamoto. Bitcoin was introduced as a decentralized peer-to-peer electronic payment instrument (Nakamoto, 2008). Since the introduction of Bitcoin in 2008, approximately more than 1,600 crypto assets have been listed on crypto exchanges, both local and global crypto exchanges. The goal of developing Bitcoin as a cryptocurrency asset is to address the need for a system that accepts and charges low fees for transactions without the use of trusted third-party intermediaries such as banks (Rejeb *et al.*, 2021).



Figure 1.2 Bitcoin Price During Covid-19

In March 2020, the price of Bitcoin the price of Bitcoin fell by -63.39%, however it increased peaking at \$ 69,000 (IDR 1,035,000,000), or a gain of about 1,358.07% and reaching its new all time high. The Covid 19 pandemic also led to high volatility in Bitcoin prices. As a result, investors are looking for a safe place to protect the value of their investments against market fluctuations that affect Bitcoin prices.

The pandemic has caused a significant economic contraction in the United States, with the country experiencing its worst recession since the Great Depression. The US economy contracted by 3.5% in 2020, compared to 2.2% growth in 2019 (US Bureau of Economic Analysis, 2021). The pandemic has caused widespread unemployment, with millions of Americans losing their jobs due to business closures and reduced demand. The US government has implemented various economic stimulus packages, including direct cash payments to individuals and businesses, to support the economy during the pandemic (Congressional Research Service, 2021).

Gold and crude oil are two commodities that play an important role in the global economy and have a large impact on financial markets. Gold is often seen as a safe haven asset that is in high demand during times of uncertainty and economic stress. Gold prices surged during the COVID-19 pandemic as investors sought safe-haven assets amid market volatility. Similarly, crude oil prices have been hit hard by the pandemic, with demand collapsing due to slowdowns in travel and economic activity. This led to a significant drop in crude oil prices, with April 2020 West Texas Intermediate (WTI) crude oil futures trading below zero for the first time in history.

The US Dollar against Indonesian Rupiah currencies have also been heavily impacted by the COVID-19 pandemic. Many countries are experiencing currency volatility and devaluation as a result of the pandemic. In Indonesia, the pandemic led to a significant devaluation of the Indonesian rupiah in 2020, with the currency depreciating by about 5% against the US dollar. Similarly, the US Dollar has fluctuated significantly during the pandemic as investors sought a safe haven currency amid market volatility.

In summary, the COVID-19 pandemic has severely impacted the global economy, resulting in lower GDP, stock market volatility, and changes in commodity prices and the USD/IDR currencies. Understanding the relationships between these variables is critical for investors and policymakers trying to navigate the uncertain economic environment created by the pandemic.

2. Literature Review

Cryptocurrency, described in a study titled “Cryptocurrency Analysis of Indonesian Market Educational Institutions” by Widyastuti & Hermanto (2021), uses strong cryptography to avoid central banking and digital currency systems to secure financial transactions, regulate the creation of new units, act as a medium of exchange, and validate wealth transfers. To summarize, the fundamental idea of Bitcoin is a decentralized, no-third-party verification using the concept of digital signatures for each transaction, originally outlined in Satoshi Nakamoto's Bitcoin whitepaper Muriant (2015).



Figure 2.1 Gold Reactions to Crisis Event (Monthly Timeframe)

Gold has two important roles, as a hedge against inflation and as a long-term strategic investment. This makes gold price volatility a concern for various stakeholders, including policy makers, investors, financial institutions and central banks. The price of gold tends to rise every year and is considered a low-risk investment. This could influence the stock price movements as investors may consider switching their investments to gold commodities (Syahri & Robiyanto, 2020).

According to Kyriazis (2022), Bitcoin has a long way to go before it can be considered a safe-haven asset like gold. However, the study discovered that although having some characteristics with traditional assets, Bitcoin is an excellent hedging asset in portfolios containing gold. Furthermore, research shows that gold is a better and more reliable safe-haven investment than Bitcoin. A research conducted by Maghrebi and Abid (2021) identifies that investors can replace gold in their investment portfolio with cryptocurrencies assets such as Bitcoin, Litecoin, and Dash. Although gold is traditionally seen as a safe-haven asset, digital money appears to be emerging as a new type of safe-haven value in a dangerous climate.



Figure 2.2 Oil Reactions to Crisis Event (Monthly Timeframe)

Crude oil is one of the most important commodities in the world. Its price fluctuations have a significant impact on global economic growth, inflation, trade balances, and fiscal and monetary policy decisions. The importance of oil to the global economy is reflected in high levels of investment and attention to oil exploration, extraction and production.

A research conducted by Kaabie *et al.* (2020) discovered a direct positive relationship between Bitcoin and all crude oil prices, with crude oil prices remaining sensitive to any shift in Bitcoin prices. As a result, a Bitcoin crisis would have an impact on the whole energy business. In addition, a research conducted by Heikal *et al.* (2022) also discovered that changes in crude oil prices have a positive impact on cryptocurrency return.

An exchange rate is an important economic indicator that influences the international trade and investment. A country's exchange rate affects that country's imports and exports, which in turn affects economic growth. Exchange rates are determined by supply and demand factors in the foreign exchange market, which are influenced by various macroeconomic variables such as inflation, interest rates, and political stability. Exchange rates can also be influenced by the government in various ways. The nature of government intervention in the foreign exchange market determines alternative exchange rate regimes, and these regimes have different effects on the economy (Koroma *et al.*, 2023).

A research conducted by Almansour *et al.* (2020) shows that there is a positive but not significant association between USD/EUR and Bitcoin returns, whereas negative correlations between USD/JPY, USD/GBP, and USD/AUD and Bitcoin returns were discovered. A research conducted by Mallick and Mallik (2021) was studying the connection between cryptocurrencies and official Indian foreign exchange rates; It reveals that the Indian foreign currency exchange rates (ICX) has no significant relationship to cryptocurrencies.

3. Methodology

This study is a quantitative study aimed at examining the influence between the price of gold, the price of crude oil, the US Dollar against Indonesian Rupiah currencies, and Bitcoin price. This study examines data collected by Investing.com using a time series data analysis approach. Daily data were collected from January 2018 to December 2022.

This data will be examined by using descriptive statistics and Augmented Dickey-Fuller Unit Root Test in order to identify the influence between the price of gold, the price of crude oil, exchange rate (USD/IDR), and Bitcoin. Stata software will be used in this study in order to process the data that has been collected.

This research will be conducted in ADCC/ GARCH Models. This model can explore opportunities for changing conditional correlations over time, tracking the dynamic response of investor behavior to news and innovation, as well as to identify how each the variables react to each other (Rajwani & Kumar, 2016).

4. Results

4.1 Descriptive Statistics.

Descriptive statistics are essentially specific methods that help calculate, describe and summarize collected research data in a logical, meaningful and efficient way. Descriptive statistics are presented numerically in the manuscript and/or its tables or graphically in its figures (Vetter, 2017).

Variable	Obs	Mean	Std. Dev.	Min	Max
Gold	1,325	0.0002968	0.0094448	-0.0499	0.0595
Crude Oil	1,325	-0.0020478	0.0969027	-3.0597	0.3766
US Dollar Against Indonesia Rupiah	1,325	0.0001104	0.0039822	-0.0275	0.0457
Bitcoin	1,325	0.0010295	0.0415866	-0.3717	0.18746

Figure 4.1 Descriptive Analytics

According to descriptive statistics, the average return of gold price is 0.02968%, the lowest return of gold is -4.99% on March 2020 and the highest return of gold is 5.95% on July 2020, while the standard deviation value of 0.94448% is greater than the average value, which means that the data is well distributed. The return of crude oil averagedly -0.20478%, with a low return of of -305.97% on April 2020 and high return of 37.66% on May 2020, while the standard deviation value of 9.69027 is greater than the average value, which means that the data is well distributed. The exchange rate from US Dollar against Indonesian Rupiah shows an average return of 0.01104%, with the lowest return of -2.75% on March 2020 and the highest return of 4.57% on April 2020, while the standard deviation value of 0,39822% is greater than the average value, which means that the data is well distributed. Bitcoin shows the mean value return of 0.10295%, with the lowest return is -37.17% on March 2020 and the highest return is 18.746% on April 2020, while the standard deviation value of 4.15866% is greater than the average value, which means that the data is well distributed.

4.2 Augmented Dickey-Fuller Unit Root Test

Variable	Augmented Dickey-Fuller	Test Critical Values			P value
		1%	5%	10%	
Gold Price	-33.721	-3.430	-2.860	-2.570	0.00000
Crude Oil Price	-61.053	-3.430	-2.860	-2.570	0.00000
US Dollar to	-28.441	-3.430	-2.860	-2.570	0.00000

Indonesian Rupiah Currencies					
Bitcoin	-35.663	-3.430	-2.860	-2.570	0.00000

Figure 4.2 Augmented Dickey-Fuller Unit Root Analysis

The Augmented Dickey-Fuller (ADF) test or Augmented Dickey-Fuller Unit Root Test is used to identify time series to test whether a time series has a unit root, which indicates that the time series is not stationary and has a trend that can cause unreliable results in statistical analysis. The P value shows that all variables have the value of 0 ($P < 0.05$), which indicates that the time series is high-likely to be stationary. It means that the variables of gold price, crude oil price, the US Dollar against Indonesia Rupiah currencies, and Bitcoin don't have consistent trend or pattern over time. Therefore, a time series analysis will be conducted on this research.

4.3 ADCC-GARCH Analysis, Time-Varying Asymmetric Dynamic Conditional Correlation, and Simple Linear Regression Analysis

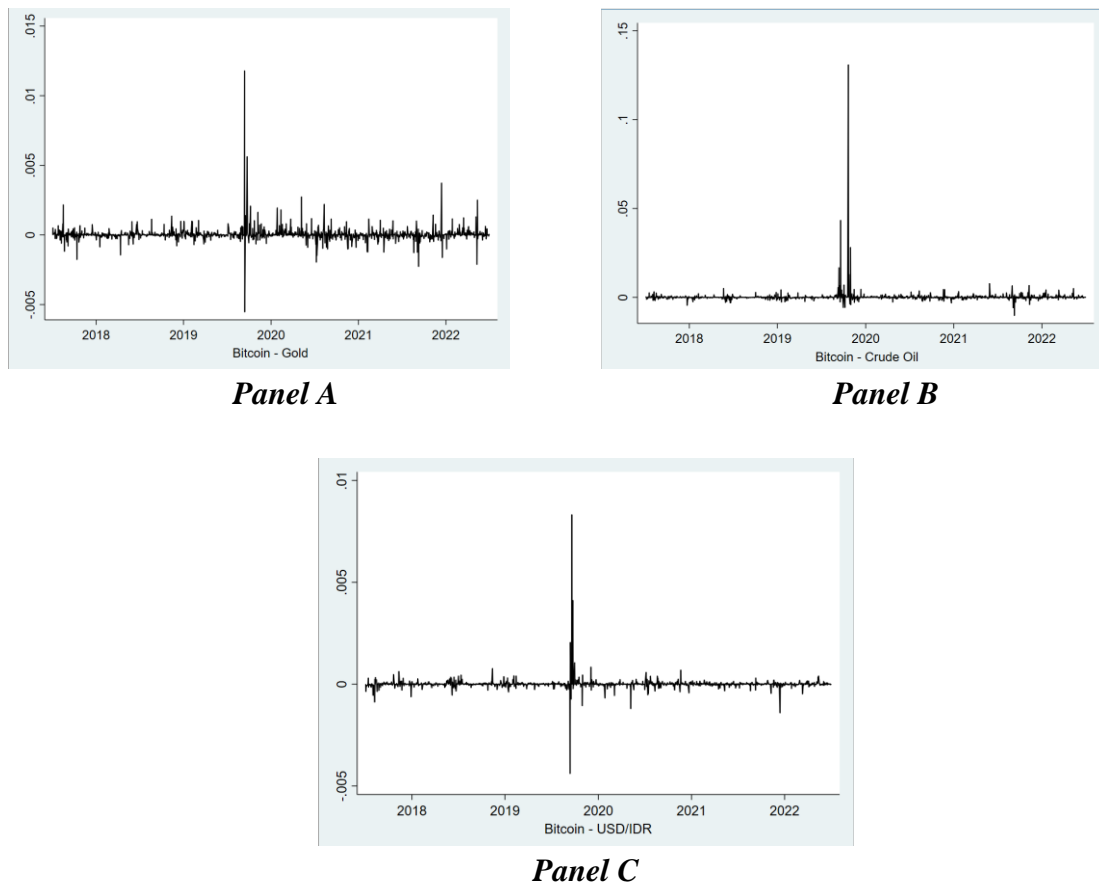


Figure 4.3.1 ADCC - GARCH Analysis

Figure 4.3.1 shows that the standard deviation shock of Bitcoin to the US Dollar against Indonesia Rupiah currencies significantly stable during 2018 to 2019, however in between the end of 2019 and entering

2020 it shows an significant increased , and stabilized until at the end of 2022. The Bitcoin standard deviation shock to gold prices from 2018 to 2019 period as charted is significantly stable, then increases steadily to become positive and remains stable through the 2022 period. The Bitcoin standard deviation shock to crude oil prices remained stable during 2018, but at the end of 2019 it was significantly increased to a positive position when preparing to enter 2020, it continue to be stable until 2022.

In addition, we could also see and conclude how volatile the variable on this research when the Covid-19 strikes, and affecting each variables behavior, However after the Covid-19 pandemic, we could see the figure above that all variables are remain stable.

Variable	Mean	Min	Max
BITCOIN - GOLD	0.0000435	-0.0055227	0.0117827
BITCOIN - CRUDE OIL	0.0002571	-0.0101633	0.1308526
BITCOIN - USD/IDR	0.00000527	-0.004386	0.0083118

Figure 4.3.2 Time-Varying Asymmetric Dynamic Conditional Correlation

R-Squared: 0.0173

Bitcoin	Coefficient	Standard Error	T	P Value	95% Conf. Interval
Gold	0.4864279	0.1204962	4.04	0.000	0.250043 0.7228128
Crude Oil	0.0259989	0.0117154	2.22	0.027	0.0030161 0.0489817
US Dollar Against Indonesian Rupiah	0.4177563	0.2855931	1.46	0.144	-0.1425093 0.9780219
_cons	0.0008923	0.0011352	0.79	0.432	-0.0013347 0.00311192

Figure 4.3.3. Linear Regression of Gold, Crude Oil, USD / IDR, and Bitcoin

The Time-Varying Asymmetric Dynamic Conditional Correlation on table 4.3.2 above represent the relationship between different variables changes over time, especially during market fluctuations. The Linear Regression analysis on table 4.3.3 describes the relationship between gold, crude oil, the Indonesian Rupiah currencies, and Bitcoin.

The value of R-Squared on the linear regression analysis of gold, crude oil, and USD/IDR to the Bitcoin is 0.0173 (1.73%), indicating that about 1.73% of the Bitcoin performance can be explained by

price changes in gold, crude oil, and the US Dollar against Indonesian Rupiah, while 98.27% may be influenced by variables that are not considered in this study.

The result on table 4.3.2 shows that Bitcoin is positive correlated gold prices, crude oil prices, and the USD/IDR exchange rates. The P value of gold and crude oil on table 4.3.3 are lower than 0.05 ($P < 0.05$), which indicate that there is a significant relationship between gold and crude oil price to Bitcoin. However, the US Dollar against Indonesia Rupiah exchange rate variable in table 4.3.3 indicates the P value higher than 0.05 ($P > 0.05$). It means that the US Dollar against Indonesia Rupiah exchange rate doesn't have a significant relationship to the Bitcoin.

The gold price seems to be the most stable in terms of averages against Bitcoin compared to crude oil prices against Bitcoin. Table 4.3.2 illustrates that the Gold variable shows a positive correlation to Bitcoin, in addition Table 4.3.3 shows a results that gold price does have a significant relationship to Bitcoin. Kayral *et al.* (2023) explains that Bitcoin is rather a diversifier during times of stress or uncertainty for investors and an effective hedging tool during stable times, which also similar to gold as an effective hedge and diversifier during the pandemic. In addition, Barson *et al.* (2022) describes that gold offers safety value and diversification benefits, but Bitcoin also serves as a safe haven and diversification for most cryptocurrencies across diverse investment horizons.

Table 4.3.2 shows that there is a positive correlation between crude oil and Bitcoin. Table 4.3.3 shows that there's a significant relationship on crude oil to Bitcoin. It is supported by a research conducted by Heikal *et al.* (22) that the price changes crude oil shows a significant relationship to cryptocurrency return. In addition, Ren *et al.* (2022) with the research entitled "Dynamics of the sheltering role of Bitcoin against crude oil market crash with varying severity of the COVID-19: A comparison with gold", described that The Bitcoin-oil price relationship shows a gradual drop as the severity of the COVID-19 pandemic increases, indicating that Bitcoin serves as an increasingly enhanced safe haven for oil market crashes as the severity of the pandemic increases.



Figure 4.3.4 The US Dollar Against Indonesian Rupiah Reaction During Covid-19 Pandemic

Table 4.3.2 shows that there is a positive correlation between the US Dollar against Indonesia Rupiah exchange rate to Bitcoin. However, table 4.3.3 shows that there's an insignificant relationship on the US Dollar against Indonesia Rupiah to Bitcoin. It is supported by a research conducted by Mallick & Mallik (2021), which describe that there is no significant relationship between Indian foreign currency exchange rates (ICX) and cryptocurrencies.. However, a research conducted by Dumitrescu *et al.* (2023) discovered that an increase in the price of Bitcoin leads to an appreciation of the currencies, whereas during the COVID-19 pandemic, the relationship reversed. The Indonesia Rupiah currency rates depreciated up to 23.55%. As a result, rather of retaining fiat currency, some investors will allocate their resources by diversifying to more stable assets, such as Gold or Bitcoin as a safe have assets.

5. Conclusion & Recommendations

5.1 Conclusion

The emerging COVID-19 pandemic around the world has caused many countries to experience a financial crisis. This has caused great concern in investing in cryptocurrency market and it is interesting to observe an alternative investment assets. Using the ADCC-GARCH model, this study examines the asymmetric dynamic correlation between Bitcoin against Gold, Crude Oil, and The USD/IDR currencies. From the results, it is found that gold does have a positive correlation and significant relationship to Bitcoin.

The result shows that crude oil shows a positive correlation and has a significant relationship to Bitcoin.

The result shows the USD/IDR has a insignificant relationship to Bitcoin, however it is found that Bitcoin is positive correlated to the USD/IDR. If the US Dollar is strengthening, the Indonesian Rupiah currencies will be depreciated, resulting a negative performance on the Bitcoin. Furthermore due to the depreciation of fiat money which is the USD/IDR currency rate, investor are most likely will do a hedging and diversifying strategy their portfolio asset to either Gold or Bitcoin as a safe haven assets.

5.2 Recommendations

These results can be used as a reference for the government to assess financial strategies and risks related to gold, oil and exchange rates to stabilize any conditions occurring domestically or globally .Furthermore, the results of this study are also useful for investors as a diversifying strategy on their portfolios assets, especially if the crisis occurs again. In addition, this study can be used as a reference for further research activities related to gold, crude oil, local exchange rates and Bitcoin. Since Bitcoin as a cryptocurrency is used in this research, further research should be conducted on other cryptocurrency assets such as Ethereum, Binance, Ripple, Litecoin, and other cryptocurrency assets.

References

1. Al-Ameer, Maryam, Hammad, Walaa, Ismail, Areej, & Hamdan, Allam, 2018, The Relationship of Gold Price with the Stock Market: The Case of Frankfurt Stock Exchange, International Journal of Energy Economics and Policy, ISSN: 2146-4553
2. Almansour, Bashar Yaser, Almansour, Ammar Yaser, & In'airat, Mohammad, 2020, The Impact Of Exchange Rates On Bitcoin Returns: Further Evidence From A Time Series Framework,

INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH, Volume 9,, Issue 02.

3. Ahmed, Farhan, Kashif, Dr. Muhammad, & Farjad, Feroz, 2016, Dynamic Relationship Between Gold Prices, Oil Prices, Exchange Rate and Stock Returns: Empirical Evidence from Pakistan, International Journal of Business & Management, Vol. 12 .
4. Astuti, Rini, Lopian, Joyce, & Rate, Paulina Van, 2016, Pengaruh Faktor Ekonomi Terhadap Indeks Harga Saham Gabungan (IHSG) di Bursa Efek Indonesia (BEI) Periode 2006 - 2015, Jurnal Berkala Ilmiah Efisiensi, Volume 16 No. 02.
5. Artini, Luh Gede Sri , Aryati, Nyoman Tri, Lestari, Putu Vivi , Darmayanti, Ni Putu Ayu, & Sudiarta, Gede Merta, 2017, Analisis Fundamental Makro dan Integrasi Pasar Saham Dunia Dengan Bursa Efek Indonesia, Jurnal Manajemen, Strategi Bisnis dan Kewirausahaan Vol. 11, No. 2
6. Castro, César, Rebeca Jiménez-Rodríguez, and Renatas Kizys. 2023. Time-Varying Relation between Oil Shocks and European Stock Market Returns. *Journal of Risk and Financial Management* 16: 174.
7. Congressional Research Service. (2021). COVID-19 Relief Assistance to Small Businesses: Issues and Policy Options. Retrieved from <https://crsreports.congress.gov/product/pdf/IF/IF11641>
8. Drake, Pamela Peterson , 2022, The gold-stock market relationship during COVID-19 , Finance Research Letter,
9. Dumitrescu, B.A.; Obreja, C.; Leonida, I.; Mihai, D.G.; Trifu, L.C. The Link between Bitcoin Price Changes and the Exchange Rates in European Countries with Non-Euro Currencies. *J. Risk Financial Manag.* 2023, 16, 232. <https://doi.org/10.3390/jrfm16040232>.
10. Fadipe, Ebenezer Olufemi & Ogunlenye, Ebenezer Olufemi PhD, 2021, Oil Price Shocks and Stock Market Performance: A Non-Linear Approach (1986-2019) , *Journal of Economics and Sustainable Development* , Vol.12, No.14.
11. Han, Yan, 2021, Study Oil Price with Market Sentiments:A Literature Review, *International Journal of English Literature and Social Sciences*, Vol. 6, Issue 4
12. Heikal, Mohd. , Saragih, Maulana Majied Sumatrani, Ilham, Rico Nur, Khaddafi, Muammar,& Rusydi, 2022, Effect of World Oil Prices on Cryptocurrency Return. *Journal of Accounting Research, Utility Finance and Digital Assets*
13. Indonesia Investments. (2021). Indonesia's Economy in 2020: The Impact of COVID-19. Retrieved from <https://www.indonesia-investments.com/news/monthly-letter/indonesia-s-economy-in-2020-the-impact-of-covid-19/item9295>
14. Kaabia, Olfa & Abid, Ilyes & Sahut, Jean-Michel. (2020). How Do Bitcoin Price Fluctuations Affect Crude Oil Markets ?. *Gestion* 2000. 37. 47. [10.3917/g2000.371.0047](https://doi.org/10.3917/g2000.371.0047).
15. Kayral IE, Jeribi A, Loukil S. Are Bitcoin and Gold a Safe Haven during COVID-19 and the 2022 Russia–Ukraine War? *Journal of Risk and Financial Management.* 2023; 16(4):222. <https://doi.org/10.3390/jrfm16040222> .
16. Koroma, Philip Sulaiman, Jalloh, Abubakarr, & Squire, Andrew, 2023, An Empirical Examination of the Impact of Exchange Rate Fluctuation on Economic Growth in Sierra Leone, *Journal of Mathematical Finance*, 13, 17-31.
17. Kyriazis, Nikolaos A., 2022, Is Bitcoin Similar to Gold? An Integrated Overview of Empirical Findings, *Journal of Risk and Financial Management*, 2020, 13(5), 88; <https://doi.org/10.3390/jrfm13050088>

18. Lakshmanasamy, T., 2021, The Relationship Between Exchange Rate and Stock Market Volatilities in India: ARCH-GARCH Estimation of the Causal Effects, *International Journal of Finance Research*, Vol. 2 No. 4
19. Le. Thai-Ha & Chang, Youngho, 2011, The Impact of Oil Price Fluctuations on Stock Markets in Developed and Emerging Economies, *Economic Growth Centre*.
20. Liu, Xiaoxing, Shehzad, Khurram, Kocak, Emrah, & Zaman, Umer, 2022, Dynamic Correlations and Portfolio Implications Across Stock and Commodity Markets Before and During the COVID-19 Era: A Key Role of Gold, *Resources Policy* 79 (2022)
21. Maghrebi, Asma & Abid, Fathi, 2021, The Investors' Behavior towards the Relationship between Bitcoin, Litecoin, Dash Coins, and Gold: A Portfolio Modeling Approach, *Journal of Mathematical Finance*, Vol.11 No.3.
22. Mallick, Santosha & Mallik, Dr. (2021). A study on the relationship between Crypto-currencies and official Indian foreign exchange rates. *Materials Today: Proceedings*.
23. Ren X, Wang R, Duan K, Chen J. Dynamics of the sheltering role of Bitcoin against crude oil market crash with varying severity of the COVID-19: A comparison with gold. *Res Int Bus Finance*. 2022 Dec;62:101672. doi: 10.1016/j.ribaf.2022.101672. Epub 2022 May 5. PMID: 35530254; PMCID: PMC9068601.
24. Shaik, Muneer, Jamil, Syed Ahsan, Howaldar, Iqbal Thonse, Sahabuddin, Mohammad, Rabbani, Mustafa Raza, & Atif, Mohd, 2023, mpact of geo-political risk on stocks, oil, and gold returns during GFC, COVID-19, and Russian – Ukraine War, *ogent Economics & Finance* (2023), 11: 2190213.
25. South, Christina Mikhaila, 2023, The relationship between oil prices and energy sector stocks in the global recession issue, *The Contrarian: Finance, Accounting, and Business Research*, Volume 2, Issue 2, Page 36-40.
26. Supardi, Eviana Marvina & Rasyid, Rosmita, 2023, The Influence of Inflation, Crude Oil Prices, and The Ramadhan Effect On Stock Return, *International Journal of Application on Economics and Business (IJAEB)*, Volume 1, Issue 2, 2023
27. Syahri, Alfi & Robiyanto, Robiyanto, 2020, The Correlation Of Gold, Exchange Rate, and Stock Market on Covid-19 Pandemic Period, *Jurnal Keuangan dan Perbankan*, 24(3): 350–362.
28. Tripathy, Dr. Naliniprava, 2016, A study On Dynamic Relationship Between Gold Price and Stock Market Price in India, *European Journal of Economics, Finance and Administrative Sciences*, Issue 88.
29. US Bureau of Economic Analysis. (2021). National Income and Product Accounts. Retrieved from <https://www.bea.gov/news/glance>
30. Vetter, Thomas R. MD, MPH, 2017, Descriptive Statistics: Reporting the Answers to the 5 Basic Questions of Who, What, Why, When, Where, and a Sixth, So What?, *Anesthesia & Analgesia* 125(5):p 1797-1802 .
31. Widyastusti, Maria & Hermanto, Y Budi, 2021, Cryptocurrency Analysis of Indonesian Market Education Facilities, *International Journal of Economics, Business and Accounting Research (IJEBAER)*, Vol-5, Issue-2, 2021.
32. Wong, Hock Tsen, 2022, The impact of real exchange rates on real stock prices, *Journal of Economics, Finance and Administrative Science*, Vol. 27 No. 54, pp. 262-276.
33. World Bank. (2021). Indonesia Economic Prospects. Retrieved from <https://www.worldbank.org/en/country/indonesia/publication/economic-prospects>

34. Zhao, Wang & Wang, Yu-Dong, 2022, On The Time-Varying Correlations Between Oil-, Gold-, and Stock Markets: The Heterogeneous Roles Of Policy Uncertainty In The US and China, *Petroleum Science* (19) 2022, 1420 - 1432.
35. Zynobia Barson, Peterson Owusu Junior, Anokye M. Adam, Emmanuel Asafo-Adjei, "Connectedness between Gold and Cryptocurrencies in COVID-19 Pandemic: A Frequency-Dependent Asymmetric and Causality Analysis", *Complexity*, vol. 2022, Article ID 7648085, 17 pages, 2022. <https://doi.org/10.1155/2022/7648085>

Appendix

	Test statistic	Dickey-Fuller critical value		
		1%	5%	10%
Z(t)	-33.721	-3.430	-2.860	-2.570

Mackinnon approximate *p*-value for Z(t) = 0.0000.

Appendix 1 Gold ADF Unit Root Test

	Test statistic	Dickey-Fuller critical value		
		1%	5%	10%
Z(t)	-61.053	-3.430	-2.860	-2.570

Mackinnon approximate *p*-value for Z(t) = 0.0000.

Appendix 2 Crude Oil ADF Unit Root Test

	Test statistic	Dickey-Fuller critical value		
		1%	5%	10%
Z(t)	-28.441	-3.430	-2.860	-2.570

Mackinnon approximate *p*-value for Z(t) = 0.0000.

Appendix 3 USD/IDR Exchange Rate ADF Unit Root Test

Test statistic	Dickey-Fuller critical value			
	1%	5%	10%	
Z(t)	-35.663	-3.430	-2.860	-2.570

MacKinnon approximate *p*-value for Z(t) = 0.0000.

Appendix 4 Bitcoin ADF Unit Root Test

Variable	Obs	Mean	Std. dev.	Min	Max
Bitcoin	1,325	.0010296	.0415866	-.3716954	.1874647
Gold	1,325	.0002968	.0094448	-.0499	.0595
Oil	1,325	-.0020478	.0969027	-3.0597	.3766
ExchangeRate	1,325	.0001104	.0039822	-.0275	.0457

Appendix 5 Descriptive Statistics of Gold, Crue Oil, USD/IDR Exchange Rate, and Bitcoin

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. regress Bitcoin Gold Oil ExchangeRate
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Source	SS	df	MS	Number of obs	=	1,325
Model	.039612656	3	.013204219	F(3, 1321)	=	7.75
Residual	2.25017778	1,321	.00170339	Prob > F	=	0.0000
Total	2.28979043	1,324	.001729449	R-squared	=	0.0173
				Adj R-squared	=	0.0151
				Root MSE	=	.04127

Bitcoin	Coefficient	Std. err.	t	P> t	[95% conf. interval]
Gold	.4864279	.1204962	4.04	0.000	.250043 .7228128
Oil	.0259989	.0117154	2.22	0.027	.0030161 .0489817
ExchangeRate	.4177563	.2855931	1.46	0.144	-.1425093 .9780219
_cons	.0008923	.0011352	0.79	0.432	-.0013347 .0031192

Appendix 6 Linear Regression on Gold, Crude Oil, USD/IDR Exchange Rate, and Bitcoin

Variable	Obs	Mean	Std. dev.	Min	Max
GoldBitcoin	1,325	.0000435	.0005389	-.0055227	.0117827
OilBitcoin	1,325	.0002571	.0040415	-.0101633	.1308526
ExchangeRate	1,325	5.27e-06	.0003164	-.004386	.0083118

Appendix 7 Time-Varying Asymmetric Dynamic Conditional Correlation