

Financial Investment Risk Comparison: Stock, Gold, and Cryptocurrency Evidence Transition Towards Endemic COVID-19 in Indonesia

Farah Amira Firdausia¹; Nasrudin²

¹ BPS-Statistics Indonesia Jembrana Regency

²Politeknik Statistika STIS

corresponding author: farahamira15@gmail.com

Abstract

Financial investment is an investment made by economic actors in financial markets through various financial instruments such as stocks, gold, and cryptocurrencies. During the COVID-19 pandemic, people were more interested in investing in financial instruments because financial investments have the attraction of liquidity. This study aims to know the conditions for stock, gold, and cryptocurrency returns and to model the volatility return of stock, gold, and cryptocurrency during the transition towards endemic COVID-19. This study used a quantitative approach with daily secondary data of the highest price during the transition towards endemic COVID-19, with the period May 1, 2022, to December 31, 2022, because this period can be good news for investment instruments. The contribution of this research to the existing literature is examining the COVID-19 pandemic specifically during the Transition Towards Endemic COVID-19, especially in Indonesia, on the three instruments. Price data was first converted into the return and then analyzed descriptively and inferentially. Data were analyzed by the EViews 10 Program. The descriptive results showed that during the transition towards endemic COVID-19, the three investment instruments had fluctuating returns. Based on ARMA modelling, those with ARCH effects are gold and cryptocurrency, so modelling using GARCH is continued. GARCH modelling during the transition period towards the COVID-19 endemic in gold and cryptocurrency using GARCH(1,1) and ARCH(1). Based on the estimated volatility, the results show that cryptocurrency is the riskiest instrument, followed by gold and stocks. For risk-seeker investor types can invest in cryptocurrency instruments. For the type of risk-averse investors who can invest in stock investment instruments.

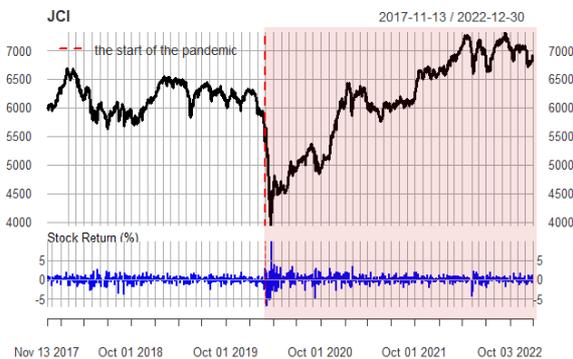
Keywords: GARCH, Volatility, Risk, Transition Toward Endemic COVID-19

JEL: C22, G11, G32

A. INTRODUCTION

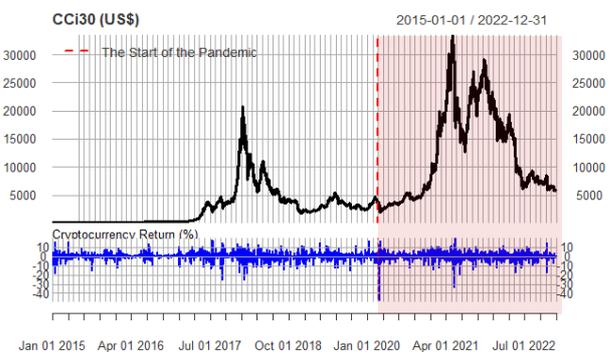
Coronavirus Disease-2019 (COVID-19) is defined by the World Health Organization (WHO) as an infectious disease caused by a newly discovered type of virus that has become a pandemic in several countries around the world. To prevent the spread of COVID-19, the government implemented many policies that can limit the population's activities outside the home. This can hamper economic activity because, based on Solow's economic growth theory in Mankiw (2019), investment can boost economic growth by increasing the capital stock. According to BPS (2022), financial investment is an investment made by economic actors in financial markets through various financial instruments such as stocks, gold, and cryptocurrency. The share of financial investment has increased from 38.91 percent in 2020 to 43.86 percent in 2021 (BPS, 2022). This shows that public sentiment/trust in financial market conditions in Indonesia has improved after the

*Financial Investment Risk Comparison Stock, Gold, and Cryptocurrency:
Evidence Transition Towards Endemic COVID-19 in Indonesia*



Red background: COVID-19 pandemic
Source: Yahoo Finance

Figure 1.1 Jakarta Composite Index (JCI) and daily stock returns 2017-2022



Red background: COVID-19 pandemic
Source: <https://cci30.com/>

Figure 1.2 The Cryptocurrencies Index 30 (CCi30) and daily cryptocurrency returns 2015- 2022.

COVID-19 pandemic crisis (BPS, 2022). During the COVID-19 pandemic, people were more interested in investing in financial instruments because financial investments attract liquidity, namely the ease of converting an asset into money with fairly low transaction costs (Ahmad, 2004).

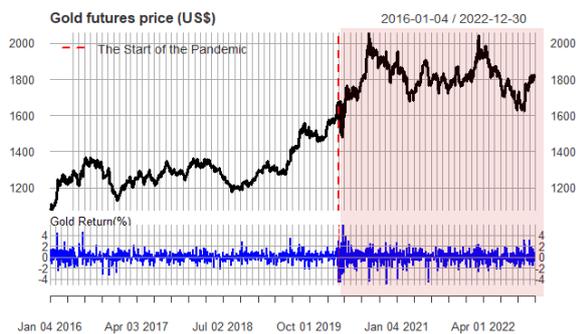
Stock is securities that signify the ownership of a person or entity in a company (Oei, 2009). In contrast to stock, another emerging investment instrument is cryptocurrency. Cryptocurrency can be called a new digital currency, which forms a new distributed payment system based on cryptographic protocols that can ensure anonymity, low costs, and fast peer-to-peer transaction speeds (Ghorbel, Loukil, & Bahloul, 2022). In addition to these two instruments, there is another instrument, gold, which is often a hedge against inflation, a safe haven investment, and a way to increase portfolio diversification (Henriques & Sadorsky, 2018).

The Indonesia Stock Exchange (IDX) measures the performance of stocks through the Jakarta Composite Index (JCI). Figure 1.1 shows the movement of the daily Composite Stock Price Index from 2017 to 2022. In general, the movement of the JCI is very volatile. In 2020, at the beginning of the COVID-19 pandemic, there

was a drastic decline in the JCI. With the existence of COVID-19, it worsened the state of the stock market, as shown by the drastically declining JCI. However, this condition did not persist. The stock market has increased even more than before the COVID-19 Pandemic. The increase in the JCI was caused by increased investors in the stock market. Citing the website of the Ministry of Finance of the Republic of Indonesia, KSEI data at the end of 2020 showed an increase in the number of investors by 56.21 percentage points when compared to the end of 2019. (Fadly, 2021). In addition, according to BPS (2021), financial investments made in equity instruments, which include stocks, increased in 3 quarters y-on-y until in the second quarter of 2022 it reached IDR 687.36 trillion. Apart from looking at the movement of the JCI, it can be seen through the stock return chart that stock returns are more volatile during the COVID-19 Pandemic.

The CCi30 is one of the popular indices that tracks the 30 largest cryptocurrencies by market capitalization (Shah, Chauhan, & Chaudhury, 2020). At the beginning of its release, cryptocurrency was not in great demand, so the CCi30 index captured cryptocurrency prices only ranging from 57.72 US\$ to 115.98 US\$, and the graph did not show any trends or fluctuations

*Financial Investment Risk Comparison Stock, Gold, and Cryptocurrency:
Evidence Transition Towards Endemic COVID-19 in Indonesia*



Source: investing.com

Figure 2. Gold futures price and daily gold returns 2016-2022

when compared to the following year. In 2016, it began to increase until 2019 because it was the heyday of cryptocurrency (Pamilangan & Robiyanto, 2019). During the COVID-19 pandemic period, there were fluctuations in cryptocurrency. In that period, there was an increase exceeding the period before the COVID-19 pandemic, and there was also a decrease. However, the decline was not too drastic and did not fall beyond the period before the COVID-19 pandemic. This shows that there are different conditions during the COVID-19 pandemic. Apart from looking at the movement of the index, it can be seen through the cryptocurrency return chart that returns are more volatile during the COVID-19.

The gold futures price is the price of gold traded on the futures market. The futures market is a market that trades futures contracts for various commodities, one of which is gold (Indriani & Harjahdi, 2013). Before the COVID-19 pandemic, gold futures prices did not fluctuate. Unlike during the COVID-19 pandemic, gold futures prices fluctuated and experienced a rapid increase. In addition to looking at price movements, it can be seen through the gold return chart that returns are more volatile during the COVID-19 Pandemic.

Portfolio theory by Markowitz (1952) states that return is the success of an investment and the consideration of investors in investing. In making investment decisions, in addition to maximizing

returns, investors must also consider the level of investment risk (Tandelilin, 2010). Risk is the possible difference between the actual return received and the expected return. The greater the difference, the greater the risk in investing (Tandelilin, 2010).

The three investment instruments have different levels of return and risk. Where stock has a risk between medium and high and is still classified as the highest-risk investment (Tandelilin, 2010). Meanwhile, gold futures include contracts including speculation with high risk. When compared to other financial investments, government bonds are still considered a low-risk investment, followed by a low rate of return. In addition, there are other financial investment instruments, such as corporate bonds, that tend to have moderate risk. Between stocks and futures contracts, options are speculative and have a high risk. Cryptocurrency, with high returns exceeding stock and gold futures, will have higher risks as well in accordance with the risk and return relationship.

The JCI reached its lowest point on September 21, 1998, when the index reached a price of 252 due to the monetary crisis that hit Indonesia (Oei, 2009). Subsequently, after the improvement of political and economic conditions, the JCI increased but again slipped dramatically due to the global financial crisis that hit the world. Within months, the JCI reached a low of Rp 1,111.00 on October 28, 2008. In addition, gold prices skyrocketed in 2006-2008 to a record US\$ 1,002.8 per troy ounce. This was triggered by the global financial crisis. It started with the decline in economic growth in the United States due to the housing credit crisis in the US. Then, a rise in world crude oil prices, which exceeded US\$150 per barrel. Then, the collapse of world stock prices. Finally, the bankruptcy of global companies. The bad news made investors shrouded in worries about investing their funds, making gold a solid hold. Bitcoin, as the first

cryptocurrency with the largest market capitalization, experienced several market conditions when the market declined or bear markets, namely on June 8, 2011, Bitcoin plummeted in value to only \$0.01, and in December 2013, the price of BTC fell below \$700 (Partz, 2022). The cryptocurrency continued to plummet over the next two years, reaching a low of around \$360 in April 2014 and then dropping further to a low of \$170 in January 2015. In 2018, Bitcoin crashed and lost more than 60% of its value in a few months, reaching a low of around \$3,200 in December 2018. This happened due to the risks that come with cryptocurrency as a financial investment.

Volatility analysis is one of the analyses to help investors make decisions. Volatility describes price fluctuations and is a proxy for investment risk (Sunaryo, 2019). Estimating volatility is done with the Autoregressive Conditional Heteroskedastic (ARCH) and Generalized Autoregressive Conditional Heteroskedastic (GARCH) models. Research that discusses the risk of an asset using a volatility proxy in the Pandemic COVID-19 (Firdausia & Nasrudin 2023; Firdausia & Nasrudin 2024; Rahmi & Nasrudin, 2023). While research outside the COVID-19 Pandemic exists (Putra, 2022; Puryandani & Robiyanto, 2019; Dyhrberg, 2015; Ibrahim, 2010).

The impact of COVID-19 on market volatility exceeds that caused by the 2008 global financial crisis and continues to be influential (Zhang & Hamori, 2021). News about the spread of the mutated COVID-19 pandemic generated sentiment and panic among investors, resulting in increased uncertainty and volatility in the financial markets (Haroon & Rizvi, 2020). Changes in world conditions are followed by a volatile business environment called VUCA (Purnamasari, Wulandari, & Siddik, 2023). VUCA stands for Volatile; Uncertain; Complex and Ambiguous. The transition towards endemic COVID-19 is good news for investors. Thus, volatility conditions

should be reduced. However, this does not mean that investors do not need to pay attention to the risks in investing. Because risks in investing will always exist. Moreover, the transition towards endemic COVID-19 is the latest condition of COVID-19, so it is interesting to do research.

Based on the problems and previous research, two objectives of this study are identified. First, to know the conditions for stock, gold, and cryptocurrency returns during the Transition toward endemic COVID-19. Second, modeling the volatility of stock, gold, and cryptocurrency returns during the transition toward endemic COVID-19. Through this volatility analysis, it is expected that investors will have an idea of which instruments are the riskiest. This can provide advice to two different types of investors in making the first investment, namely, risk seekers and risk averters.

B. LITERATURE REVIEW

Investment is the commitment of several funds or other resources made at this time to obtain some benefits in the future. (Tandelilin, 2010). Investment in BPS (2022) includes physical investment or non-financial investment, and financial investment. Non-financial investment is calculated by changes (addition - subtraction) in non-financial assets in the form of fixed capital goods or PMTB and inventories. Financial investment occurs due to financial transactions by economic actors in financial markets through various financial instruments, such as stocks, bonds, SBI, loans, forex, and so on. (BPS, 2022). The discussion of financial asset investment is investment related to the management of financial assets, especially tradable securities, where financial assets are ownership in the form of securities over several assets issued by the issuer of securities. (Tandelilin, 2010).

Return is one of the factors that motivate investors to invest and is a reward for the investor's courage to bear the risk of the

investment made (Tandelilin, 2010). The investor's goal in investing is to maximize returns without forgetting the investment risk factors that he must face. Risk can be said to be a potential loss; therefore, in an investment, in addition to calculating the results must also take into account the risks borne (Prowanta & Herlianto, 2016). Risk is a measure of uncertainty whenever making financial or investment decisions about what will happen in the future (Fabozzi & Peterson, 2003). According to Tandelilin (2010), the risk is the possible difference between the actual return received and the expected return. The greater the difference, the greater the investment risk. The concept of risk and return was first popularized by Markowitz (1952), who stated that investors should focus on two things, namely the expected return of an asset and the risk seen through the standard deviation of the asset's return.

Investors' portfolio selection is based on preferences for the expected return and risk of each portfolio option (Manurung, 2012). The objective of portfolio selection is the construction of a portfolio that maximizes expected returns consistent with an individually acceptable level of risk (Fabozzi, 2009). There are two concepts: efficient portfolio and optimal portfolio. An efficient portfolio is a portfolio that provides maximum return for investors with a certain level of risk or a portfolio that offers the lowest risk with a certain level of return (Fabozzi, 2009). Meanwhile, the optimal portfolio is the portfolio that investors choose from the many choices available in the efficient portfolio (Fabozzi, 2009). The portfolio selection theory formulated by Markowitz (1952) is also known as mean-variance portfolio analysis or mean-variance analysis (Fabozzi, 2009).

Instrument volatility can be interpreted as the speed at which returns rise and fall. A grouping of volatility, namely periods where prices show high or very low values for some period of time, followed by periods where prices

show no movement or are relatively calm (Gujarati, 2004). Volatility, measured by the standard deviation or variance of returns, is often used as a rough measure of total financial asset risk (Brooks, 2008). Volatility describes price fluctuations and is a proxy for investment risk (Sunaryo, 2019). To calculate volatility as a proxy for risk, you can calculate the variance or standard deviation of the data you want to study. However, the weakness is that the calculation only explains the unconditional variance, so it is necessary to model volatility that can capture the state of a market due to economic shocks that cause the price of the instrument to change easily (Nuzula, 2020). In investing, investors are faced with two conditions, namely return and risk (Oei, 2009). Investors make decisions in making investments when conditions of high returns with low risk exist (Wahyuni, 2014). However, these conditions rarely occur, so the decision to invest is based on the perspective of each investor. According to Prowanta & Herlianto (2016), there are two types of investor attitudes in making the first investment, namely risk seekers, who dare to bear great risks. The second type of investor is a risk averter, who tends to avoid high risk and prioritize safety.

Stock is a security that is a sign of ownership of a person or entity in a company (Oei, 2009). The Jakarta Composite Index (JCI), also known as the IDX composite, was first introduced on April 1, 1983, as an indicator of the movement of stock prices listed on the stock exchange (IDX, 2010). Financial derivatives are a kind of financial tool derived from financial assets of stocks, bonds, commodities, or various indices, namely JCI and LQ 45. (Musdalifah, A., Mintartri, S., & Nadir, 2015). According to Musdalifah, A., Mintartri, S., and Nadir (2015), a futures contract is an agreement or commitment between two parties to deliver or receive a financial instrument or commodity on a certain date in the future at a

price that has been determined at the time of signing the contract.

Cryptocurrency can be called a new digital currency, which forms a new distributed payment system based on cryptographic protocols that can ensure anonymity, low costs, and fast peer-to-peer transaction speeds (Ghorbel et al., 2022). In Indonesia, cryptocurrency is considered a commodity traded on futures exchanges according to the Coordinating Minister for Economic Affairs Letter Nomor S-302/M.EKON/09/2018 dated September 24, 2018, regarding the follow-up to the implementation of the coordination meeting on the regulation of crypto assets (BAPPEBTI, 2021). Several indices already exist to measure cryptocurrency-specific investments created and managed by companies, as well as derived from research. One of the existing indices, the CCI30, is an index that tracks the 30 largest cryptocurrencies by market capitalization, excluding stablecoins. This index essentially captures the coins that dominate the market and shows a good correlation with the total market capitalization (Shah et al., 2020). Digital Gold products can be categorized as commodities according to UU PBK No. 10 Tahun 2011, where commodities are all goods and services, rights, and other interests, and any derivatives of commodities, which can be traded and become the subject of futures contracts, sharia derivative contracts, and/or other derivative contracts.

Box-Jenkins (BJ) methodology is better known as ARIMA methodology; the emphasis of this method is on analyzing the probabilistic or stochastic nature of economic time series (Gujarati, 2004). If the time series is not stationary, it must be transformed first, one of which is to differentiate the time series d times so that the time series is stationary. Thus, the ARMA (p,q) model, after experiencing the different processes, can be written as ARIMA (p, d, q), where p indicates the number of autoregressive,

d the number of times the series must be differentiated before it becomes stationary, and q the number of moving averages. The following is the ARIMA(p,d,q) model (Makridakis, Wheelwright, & Hyndman, 1997).

$$\Delta^d Y_t = \alpha_0 + \sum_{i=1}^p \alpha_i \Delta^d Y_{t-i} + \sum_{j=1}^q \beta_j u_{t-j} + u_t \quad (1)$$

where α_0 is the intercept, α_i coefficient is the i th autoregressive coefficient, Δ^d where $i=1,2,\dots,p$, is the differencing order, that is $Y_t - Y_{t-d}$, β_j is the j th moving average coefficient, where $j=1,2,\dots,q$, u_t is the t -th white noise stochastic error equation, Y_t and is the t -time series variable.

According to Gujarati (2004), in conventional econometric models, the variance of the error term is assumed to be constant. However, many economic time series exhibit periods of unusually large volatility followed by periods of relative calm. Volatility can be detected through violations of the assumptions of homoscedasticity or heteroscedasticity. Modeling volatility can be done with ARCH. The following measures volatility.

$$u_t \sim N[0, \alpha_0 + \alpha_1 u_{t-1}^2] \\ var(u_t) = \alpha_0 + \alpha_1 u_{t-1}^2 \quad (2)$$

To capture dynamic patterns in conditional volatility through ARCH(r) models, the number r is often quite large. It turns out to be quite complicated to estimate the parameters in such models, due to the conditions that must be met to guarantee non-negativity and stationarity. As an alternative solution, Bollerslev (1986), in Franses et al. (2000), suggested adding the lagged conditional variance to the ARCH model instead. Thus, the resulting model is GARCH(r,s). The following is the GARCH(r,s) model:

$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 + \alpha_2 u_{t-2}^2 + \dots + \alpha_r u_{t-r}^2 \\ + \gamma_1 \sigma_{t-1}^2 + \dots + \gamma_s \sigma_{t-s}^2 \\ \sigma_t^2 = \omega + \sum_{i=1}^s \alpha_i u_{t-i}^2 + \sum_{j=1}^r \gamma_j \sigma_{t-j}^2 \quad (3)$$

which has the conditions $\omega > 0, 0 \leq \alpha_i < 1, 0 \leq \gamma_j < 1$ and $0 \leq \sum_{i=1}^s \alpha_i + \sum_{j=1}^r \gamma_j < 1$. Where σ_t^2 is the conditional error variance of the t-time variance equation, ω is the intercept coefficient, α_i is the i-ARCH coefficient, where $i=1,2,\dots,s$, u_{t-i} is the white noise lag error of the Autoregressive Moving Average (ARMA) equation at time-i, where $i=1,\dots,s$, γ_j is the jth GARCH coefficient, where $j=1,2,\dots,r$ and σ_{t-j}^2 is the conditional error variance from the time variance equation to tj, with $j=1,\dots,r$.

Research by Rahmi & Nasrudin (2023) using the EGARCH method provides results that the risk of stocks is highest in both periods, namely before and during the COVID-19 pandemic, while gold is the least risky. According to Putra (2022), using the GARCH / TGARCH method provides results that, before the COVID-19 pandemic, gold has the possibility of getting a fairly small loss, while bitcoin investment has a risk of experiencing large losses both before and during the COVID-19 pandemic.

Firdausia & Nasrudin (2024) used GARCH/EGARCH for univariate modeling and BEKK-GARCH/BEKK-Asymmetric GARCH for multivariate modeling. At the Peak of the Pandemic, from November 1, 2020, to April 30, 2022, and the Transition Towards the Endemic COVID-19, from May 1, 2022, to December 31, 2022. The findings reveal that cryptocurrencies are the most volatile assets during the peak of the pandemic and the transition towards the endemic COVID-19.

Firdausia & Nasrudin (2023) modeled the volatility of stock, gold, and cryptocurrency returns at the peak of the COVID-19 pandemic, from November 1, 2020, to April 30, 2022. The three investment instruments have a leverage effect, that is, bad news has a greater impact than good news, and the volatility estimation gives the result that cryptocurrency is the riskiest instrument, followed by gold and then stocks.

C. RESEARCH METHODS

1. Data and Data Sources

This study uses secondary data time series of the highest price (high) with daily observation units. The period used is the transition towards endemic COVID-19 from May 1, 2022, to December 31, 2022. Stock data uses the Composite Stock Price Index (JCI) approach obtained through Yahoo Finance, gold data uses gold futures prices obtained through investing.com, and cryptocurrency data uses the Cryptocurrencies Index 30 (CCI30) index approach obtained through the cci30.com website. JCI is a statistical measure reflecting the entire price movement of a set of stocks selected based on certain criteria and methodology and then evaluated regularly (IDX, 2021). CCI30 is an index that tracks the 30 largest cryptocurrencies by market capitalization, excluding stablecoins or cryptocurrencies designed to be protected from price volatility. The gold futures price is the price of gold traded on the futures market, which is a market that trades futures contracts for various commodities. As for the analysis, the price data is converted into the form of a return. The following is the formula for calculating returns according to Brooks (2008).

$$Return = Ln \left(\frac{P_t}{P_{t-1}} \right) \times 100\% \quad (4)$$

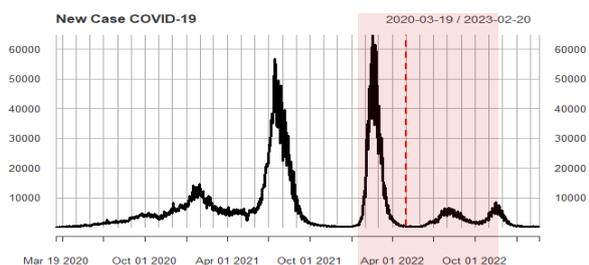
where the return is expressed in percentage form, P_t it is the t-time price. The following is a description of the variables being modelled.

Table 1. Variables and data sources

No	Variable	Symbol	Source
1	Stock Returns	Stock	Yahoo Finance
2	Gold Returns	Gold	investing.com
3	Return Cryptocurrency	crypto	cci30.com
4	Stock Return Volatility	$\sigma_{(stock)}^2$	Processing
5	Gold Return Volatility	$\sigma_{(gold)}^2$	Processing
6	Cryptocurrency Return Volatility	$\sigma_{(crypto)}^2$	Processing

2. Period

The bad news about COVID-19 is not only when COVID-19 entered Indonesia. However, the highest cases of COVID-19 have occurred in 3 waves. The period after the third wave can be referred to as the transition towards endemic COVID-19. The Ministry of Health Indonesia, in September 2022, announced that, according to the WHO, the whole world is facing signs of the disappearance of the COVID pandemic, including in Indonesia. This makes Indonesia currently preparing for a pandemic, or can be referred to as a transition period towards the endemic COVID-19, which is good news for investment instruments. Therefore, this research not only uses the COVID-19 period in general, but also the COVID-19 period only during the transition towards the endemic COVID-19.



Red background: Transition towards endemic COVID-19

Source: <https://covid19.go.id/>

Figure 3. Daily active cases of COVID-19

3. Analysis Method

In accordance with the research objectives, there are two methods of analysis used in this study, namely descriptive analysis and inferential analysis. Descriptive analysis to answer the first objective in the form of a line graph. Then, the second analysis method is an inference using ARCH/GARCH. The software used in modeling volatility is EViews 10. The following are the stages of ARCH/GARCH modeling.

1. The stationarity test uses the Augmented Dickey-Fuller (ADF) test with a random walk-

without-drift model (Gujarati, 2004). The following is a hypothesis and a test.

$H_0: \delta = 0$ (There is a unit root or non-stationary data return)

$H_a: \delta < 0$ (no unit root or stationary data return)

$$\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^m \omega_i \Delta Y_{t-i} + \varepsilon_t \quad (5)$$

The test statistic used is $\tau = \frac{\hat{\delta}}{se(\hat{\delta})}$. If rejected H_0 , then the time series is stationary.

2. In forming a model with Autoregressive Moving Average (ARMA), tentative identification is first carried out, namely, to find out the appropriate values of p and q by trial and error. Then determine the best model using several criteria, namely using the largest log-likelihood value, the smallest Akaike Info Criterion (AIC), and Schwarz Bayesian Criterion (SBC). After determining the best model using some of these criteria, estimate the ARIMA model. The following is the equation of the ARMA (p,q) model (Makridakis et al., 1997).

$$return_t = \alpha_0 + \sum_{i=1}^p \alpha_i return_{t-i} + \sum_{j=1}^q \beta_j u_{t-j} + u_t \quad (6)$$

3. The ARMA model diagnostic testing includes simultaneous tests, partial tests, and evaluation after estimation. Evaluation after estimation includes the residual ADF test and the ARCH-LM test (Gujarati, 2004). The following is the hypothesis and testing of the ARCH-LM.

$H_0: \alpha_1 = \dots = \alpha_n$ (There is no ARCH effect in the residual until the nth lag)

$H_1: \text{minimal } 1 \alpha_i \neq 0$ for $i=1,2,\dots,n$ (there is an ARCH effect in the residual until the n-th lag)

$$\hat{u}_t^2 = \alpha_0 + \alpha_1 \hat{u}_{t-1}^2 + \dots + \alpha_q \hat{u}_{t-n}^2 + v_t \quad (7)$$

Test $LM = TR^2$ statistics. Where T is the number of observations and R^2 is the coefficient

of determination of the model. If H_0 rejected, the residual has an ARCH effect. The analysis is continued using the GARCH/EGARCH model.

4. Formation of the ARCH/GARCH model for the ARMA model in which the residuals have the ARCH effect. The following is the general GARCH(r,s) model according to Enders (2014)

$$\sigma_t^2 = \lambda_0 + \sum_{t=i}^s \lambda_i u_{t-i}^2 + \sum_{t=j}^r \gamma_j \sigma_{t-j}^2 \quad (8)$$

5. Diagnostic tests such as ARMA modeling, namely simultaneous tests, partial tests, and evaluation after estimation, include residual ADF tests and ARCH-LM tests (Gujarati, 2004)

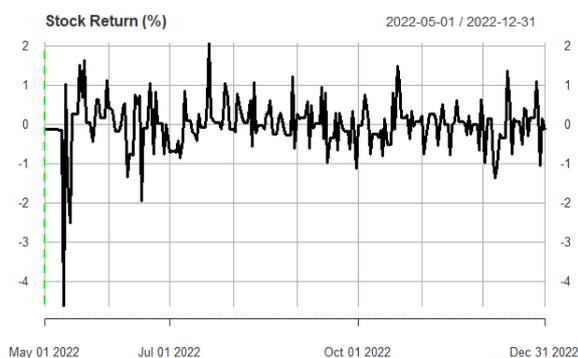
6. Estimated conditional variance as a proxy for risk.

7. Comparison of the risks of the three investment instruments uses statistical measures, namely average, standard deviation, and median volatility.

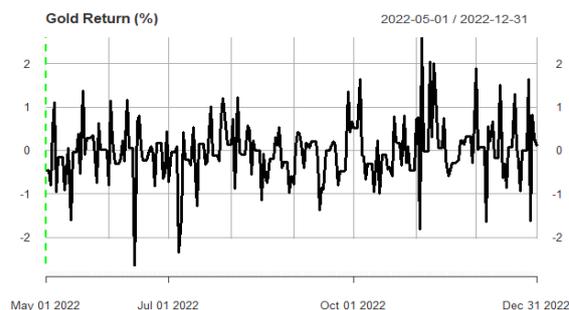
D. RESULTS AND DISCUSSION

Conditions for Stock, Gold, and Cryptocurrency Returns during the Transition Towards Endemic COVID-19

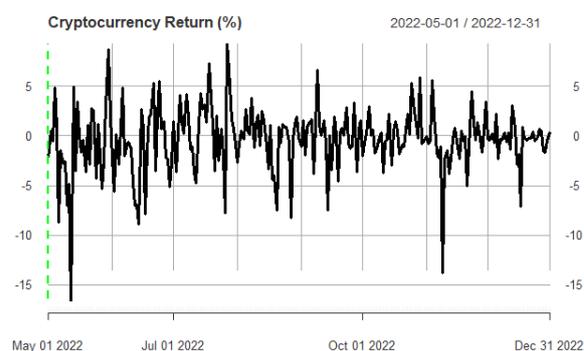
The following presents the condition of stock, gold, and cryptocurrency returns during the transition towards endemic COVID-19.



(a)



(b)



(c)

Source: Processing using RStudio.

Figure 4. Return Movements of (a) Stock, (b) Gold, and (c) Cryptocurrency during the Transition Towards Endemic COVID-19

Based on Figure 4a, it can be seen that stock returns during the transition towards endemic COVID-19 fluctuate every day. The movement of stock returns ranges from -4.639 to 2.066 percent. A positive return condition means that today's stock returns increase when compared to the previous day. Conversely, a negative return condition means that today's stock returns decrease when compared to the previous day.

On May 5, 2022, it was a shock, namely a decrease in returns. It was caused by a decrease in the JCI due to negative sentiment coming from the United States after the inflation report was released (Azwar, 2023). After the report, the Fed announced an interest rate hike of 50 basis points aimed at neutralizing US inflation conditions, which caused a shock decline in returns on May 10 of -4.639 percent (OJK, 2022). On June 15, 2022, the Fed still raised the benchmark interest rate by

0.75 percent, which caused a shock decline in returns on June 17 of -1.966 percent. On July 20, 2022, the Supreme Court officially inaugurated the Board Members of the Financial Services Authority for the period 2022-2027, which was immediately greeted by a shock increase in returns on the same day of 2.066 percent.

Table 2. Descriptive Summary of Stock, Gold, and Cryptocurrency Returns During the Transition Towards Endemic COVID-19

Statistical Size	Stock	Gold	Cryptocurrency
Average	-0.021	-0.017	-0.380
Median	0.013	-0.007	-0.155
Minimum	-4.639	-2.648	-16.590
Maximum	2066	2.595	9.235
Standard deviation	0.631	0.664	3.242
Skewness	-1.648	0.111	-0.857
kurtosis	12.590	2.900	3.710
Number of Observations	245	245	245

Source: Processing Results

Based on Figure 4b, it can be seen that gold returns during the transition towards endemic COVID-19 fluctuate every day. The movement of gold returns ranges from -2.648 to 2.595. Based on Figure 4c, it can be seen that cryptocurrency returns also fluctuate every day. The movement of cryptocurrency returns ranges from -16.59 to 9.235. On May 12, 2022, there was a shock, namely a decrease in cryptocurrency returns, which reached 16.59 percent (Browne, 2022). This was due to investors fleeing cryptocurrency at a time when the stock market was falling from the peak of the coronavirus pandemic amid fears of soaring prices and a worsening economic outlook. In addition, US inflation data released showed prices for goods and services jumped 8.3 percent in April, higher than analysts' estimates and near a 40-year high. In addition, the shock on

November 9, 2022, occurred as the stock of cryptocurrency and blockchain-related companies fell on Friday after one of the largest crypto exchanges, FTX, said it would begin bankruptcy proceedings in the United States, triggering a potential massive industry crash (Chang, 2022).

On average, investors gain more by investing in gold investment instruments. On average, investors earn more by investing in stocks. However, with the largest standard deviation, cryptocurrency investment instruments are riskier than stocks and gold.

Modeling the Return of Stock, Gold, and Cryptocurrency Volatility During the Transition Towards Endemic COVID-19

Before forming the ARMA model, a stationarity test was first carried out. The following is the ADF return test for the three investment instruments.

Table 3. The results of the Augmented Dickey-Fuller (ADF) return test for the three investment instruments

Investment instrument	Stock	Gold	Cryptocurrency
Test statistics	-14.356	-15.353	-13.098
P-values	0.000	0.000	0.000
Information	stationary	stationary	stationary

Source: Processing Results EViews 10

The results of the ADF test on the three instruments have a p-value less than the applied significance level of 5 percent. So, it can be concluded that with a significance level of 10 percent, reject H_0 . So, returns of stock, gold, and cryptocurrency are stationary at the level and do not require a differentiation process.

After the stationarity test was carried out, the formation of the ARMA model was carried out. According to Gujarati (2004), the Box-Jenkins (BJ) methodology consisted of three steps, namely tentative identification, estimation, and

diagnostic testing of the ARMA model. The following is a diagnostic test for the ARMA model.

Table 4. Best ARMA Model Results

Investment instrument	Model	ARCH -LM	Residual ADF
Share	MA(3)	0.341	0.000
Gold	ARMA(2,2)	0.077	0.000
Crypto-currency	AR(1)	0.070	0.000

Source: Processing Results EViews 10

The results of the diagnostic testing of the ARMA model on the three investment instruments show that the p-value for the residual ADF is 0.000. That is, with a significance level of 10 percent, reject H_0 the ARMA model for each investment instrument that has a constant average residual at zero. Based on the ARCH-LM test results, the results show that the ARMA model for gold and cryptocurrency has a p-value <0.1. That is, with a significance level of 10 percent in the transition towards endemic COVID-19, gold and cryptocurrency have an ARCH effect.

Thus, it is necessary to do ARCH/GARCH modeling during the transition towards endemic COVID-19 for gold and cryptocurrency. After that, diagnostic testing was carried out on the volatility model. The following are the results of diagnostic testing.

Table 5. ARCH/ GARCH Model Diagnostic Test Results

Investment instrument	Model	ARCH -LM	Residual ADF
Gold	GARCH(1,1)	0.489	0.000
Cryptocurrency	ARCH(1)	0.421	0.000

Source: Processing Results EViews 10

Based on Table 5, the results of the diagnostic testing of the volatility model on gold and cryptocurrency are that the p-value for the residual ADF is 0.000. That is, with a significance level of 10 percent having the decision of the test

of rejection H_0 or the volatility model of gold and cryptocurrency has a constant average residual at zero. Based on the results of the ARCH-LM test, the results show that the volatility model for gold and cryptocurrency has a p-value > 0.1. That is, with a significance level of 10 percent, gold and cryptocurrency have a failure test decision H_0 , or the volatility model of gold and cryptocurrency does not have the ARCH effect. Thus, the best volatility model estimation results are obtained in Table 6 as follows.

Table 6. Estimation Results of the Volatility Model

ARMA models		ARCH/GARCH models	
Parameter	Coefficient	Parameter	Coefficient
Gold			
ARMA(2,2)		GARCH(1,1)	
Intercepts	-0.025 (0.046)	Intercepts	0.191 (0.122)
AR(1)	0.577* (0.322)	λ_1	0.054 (0.033)
AR(2)	-0.652** (0.312)	γ_1	0.504* (0.292)
MA(1)	-0.587* (0.311)		
MA(2)	0.702** (0.284)		
Cryptocurrency			
AR(1)		ARCH(1)	
Intercepts	-0.337 (0.226)	Intercepts	6.896** (0.441)
AR(1)	0.156** (0.073)	λ_1	0.171** (0.055)

Source: Processing Results EViews 10

Information

***significant at 1% level

**significant at 5% level

*significance at 10% level

During the transition towards endemic COVID-19, gold and cryptocurrency investment instruments have an ARCH effect. To overcome the ARCH effect, volatility modelling was carried out with GARCH.

For gold instruments in Table 6, the ARMA Model is ARMA(2,2), meaning that during the transition towards endemic COVID-19, the current gold return is influenced by returns in the two previous periods and other information from the previous two periods. Furthermore, the GARCH volatility model is GARCH(1,1) means that the current volatility of gold returns is influenced by other information and the volatility of the previous period.

For cryptocurrency instruments in Table 6, AR(1) means that during the transition towards endemic COVID-19, current cryptocurrency returns are affected by returns in the previous period. The ARCH volatility model is ARCH(1), which means that the current volatility of gold returns is influenced by other information from the previous period.

Modelling the risk of stocks, gold, and cryptocurrency during the transition towards endemic COVID-19

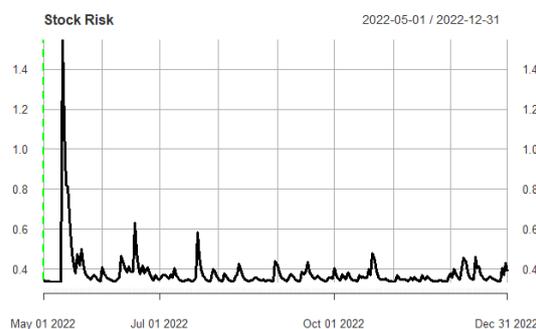
Comparison of risks between investment instruments is carried out by comparing the volatility of stock returns for each investment instrument. The volatility of gold and cryptocurrency returns is obtained from the estimated residual conditional variance of the ARMA equation for each investment instrument. The conditional variance estimate is obtained from the ARCH/GARCH conditional variance equation for each return. In carrying out a risk comparison analysis, three statistical measures are used, namely the average, standard deviation, and median of the volatility value. The instrument that has the highest volatility statistical measure is the instrument that has the highest risk. The following is a statistical measure of the volatility value for each investment instrument.

Table 7. Risks of investment instruments at the peak of the COVID-19 Pandemic

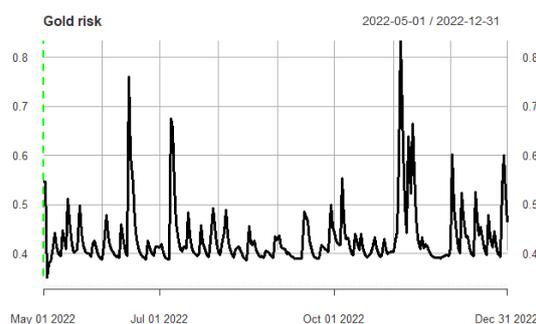
Instrument	Statistical measure of risk		
	Average	Standard deviation	Media n
Gold	0.432	0.004	0.412
Cryptocurrency	8.657	0.262	7.295

Source: Processing Results EViews 10

The highest volatility is in cryptocurrency investment instruments, with an average of 8.657. Meanwhile, the average risk of gold investment instruments is only 0.432. The average value is in line with the median and standard deviation. If you look at the chart, the most volatile instrument is cryptocurrency. This is consistent with the descriptive results that the highest standard deviation return is cryptocurrency, then gold, and the lowest is stocks.

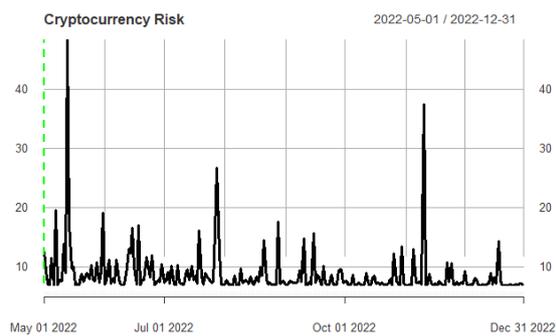


(a)



(b)

*Financial Investment Risk Comparison Stock, Gold, and Cryptocurrency:
Evidence Transition Towards Endemic COVID-19 in Indonesia*



(c)

Source: Processing using EViews 10 and RStudio.

Figure 5. Instrument Risks (a) Stocks, (b) Gold, and (c) Cryptocurrency During the Transition towards endemic COVID-19

Thus, during the transition towards endemic COVID-19, the most-risky instruments were cryptocurrency, followed by gold, then stocks. The findings of this study are in line with recent research from Firdausia & Nasrudin (2024), using the same three instruments with a slight difference in period but still COVID-19 provides results that cryptocurrency is the most volatile asset during the peak of the pandemic COVID-19, from November 1, 2020, to April 30, 2022 and the transition towards the endemic COVID-19, which is the same period as this study. According to Firdausia & Nasrudin (2023), the volatility estimation gives the result that cryptocurrency is the riskiest instrument, followed by gold and then stocks.

According to Putra (2022), cryptocurrency investment was the riskiest investment before and during the COVID-19 pandemic, marked by a higher standard deviation of bitcoin returns than other instruments. Cryptocurrency is the riskiest instrument because currently cryptocurrency is in a state of collapse due to the FTX bankruptcy on 28 October 2021 until now (Maheshwari, 2023). Stock investment instruments do not have volatility during the transition towards endemic COVID-19. Having no volatility means the risk is relatively low. This can be seen in the graph of

risks that are not volatile when compared to those that are at risk.

The type of risk-seeking investor can invest during the transition period towards endemic COVID-19 in cryptocurrency instruments. At times of high risk, most investors will sell their cryptocurrency, so that cryptocurrency prices will fall. This can be used by risk-seeker investors to buy at the lowest price. So, when the price rises, risk-seeker investors will get the maximum profit. However, this is very risky to do. So that only risk-seeking investors can do this. This is in accordance with Putra (2022), where cryptocurrency investment is suitable for investors who are risk-seeker types. This type of risk-averse investor will invest in stock instruments because the instrument has the smallest risk or even has no volatility.

E. CONCLUSION

This research has two objectives. The first objective is to see an overview of stock returns, gold, and cryptocurrency. The results showed that during the transition towards endemic COVID-19, the three investment instruments had fluctuating returns. On average, investors gain more by investing in gold investment instruments. On average, investors earn more by investing in stocks. However, with the largest standard deviation, cryptocurrency investment instruments are riskier than stocks and gold.

Based on ARMA modeling, gold and cryptocurrency have an ARCH effect, so modeling using GARCH is continued. GARCH modeling during the transition towards endemic COVID-19 in gold and cryptocurrency uses GARCH(1,1) and ARCH(1). Also based on GARCH modeling, an analysis of the difference in risk between investment instruments can be carried out, which gives the result that cryptocurrency is the most-risky instrument. This is consistent with the descriptive results that the highest standard deviation return is cryptocurrency, then gold, and

the lowest is stocks. Thus, during the transition towards the endemic COVID-19, the most-risky instrument was cryptocurrency, followed by gold, then stocks.

Advice that can be given is that investors are advised to be careful in cryptocurrency investments. For similar conditions, risk-seeker investor types can invest in cryptocurrency instruments. For the type of risk-averse investors who can invest in stock investment instruments. Suggestions for other researchers are to use volatility modeling on the three instruments with more recent data. That is, with the latest economic conditions in Indonesia, because the COVID-19 Pandemic is no longer there, it can be seen with other phenomena. Because every phenomenon will be good or bad news and have an impact on investment.

F. REFERENCES

- Ahmad, K. (2004). *Dasar-dasar Manajemen Investasi dan Portofolio*. Jakarta: Rineka Cipta.
- Azwar, M. (2023). *IHSG Loyo Banget, Ternyata Ini Penyebabnya*.
- BAPPEBTI. (2021). *Perdagangan Aset Kripto*. Jakarta.
- BEI. (2010). *Buku Panduan Indeks Harga Saham Bursa Efek Indonesia (BEI)*.
- BPS. (2021). *Neraca Arus Dana Indonesia Triwulanan*. Jakarta.
- BPS. (2022). *Neraca Arus Dana Indonesia Tahun 2017- 2021*. Jakarta.
- Brooks, C. (Cambridge). (2008). *Introductory Econometrics For Finance* (Second edi). New York: Cambridge University Press.
- Browne, R. (2022). More than \$200 billion erased from entire crypto market in a day as sell-off intensifies. Diperoleh dari 22 Februari 2023, dari <https://www.cnn.com/2022/05/12/bitcoin-btc-price-falls-below-27000-as-crypto-sell-off-intensifies.html>
- Chang, R. (2022). Crypto markets in turmoil over FTX bankruptcy. Diperoleh dari 22 Februari 2023, dari <https://www.reuters.com/technology/crypto-markets-turmoil-over-ftx-bankruptcy-2022-11-11/>
- Dyhrberg, A. H. (2015). Bitcoin, gold and the dollar - A GARCH volatility analysis. *Finance Research Letters*, 16, 85–92. <https://doi.org/10.1016/j.frl.2015.10.008>
- Enders, W. (2014). *Applied Econometric Time Series* (Fourth edi, Vol. 37). United States of America: John Wiley & Sons, Inc.
- Fabozzi, F. J. (2009). *Institutional Investment Management*. Institutional Investment Management. Canada: John Wiley & Sons, Inc. <https://doi.org/10.1002/9781118267059>
- Fabozzi, F. J. (2009). *Institutional Investment Management*. Canada: John Wiley & Sons, Inc. <https://doi.org/10.1002/9781118267059>
- Fabozzi, F. J., & Peterson, P. P. (2003). *Financial Management and Analysis* (Second edi, Vol. 5). Canada: John Wiley and Sons Inc.
- Fadly, S. R. (2021). *Aktivitas Pasar Modal Indonesia Di Era Pandemi*. Kementerian Keuangan Republik Indonesia.
- Firdausia, F. A., & Nasrudin, N. (2024). *Spillover Volatility Effect Return Of Stock, Gold, and Cryptocurrency: Evidence of Peak Pandemic and Transition towards Endemic COVID-19 in Indonesia*. *Journal of Economics and Financial Analysis*, 8(2), 89-113.
- Firdausia, F. A., & Nasrudin, N. (2023). *Pemodelan EGARCH Return Saham, Emas, dan Cryptocurrency*. In *Seminar Nasional Official Statistics* (Vol. 2023, No. 1, pp. 503-514).
- Franses, P. H., Dijk, D. van, & Opschoor, A. (2000). *Time Series Models for Business and Economic Forecasting* (Vol. 95). United Kingdom: Cambridge University Press. <https://doi.org/10.2307/2669428>
- Ghorbel, A., Loukil, S., & Bahloul, W. (2022). Connectedness between cryptocurrencies, gold and stock markets in the presence of the COVID-19 pandemic. *European Journal of Management and Business Economics*. <https://doi.org/10.1108/EJMBE-10-2021-0281>
- Gujarati, D. N. (2004). *Basic Econometrics* (Fourth). United States of America: McGraw-Hill Companies.

- Haroon, O., & Rizvi, S. A. R. (2020). COVID-19: Media coverage and financial markets behavior—A sectoral inquiry. *Journal of Behavioral and Experimental Finance*, 27. <https://doi.org/10.1016/j.jbef.2020.100343>
- Henriques, I., & Sadorsky, P. (2018). Can Bitcoin Replace Gold in an Investment Portfolio? *Journal of Risk and Financial Management*, 11(3), 48. <https://doi.org/10.3390/jrfm11030048>
- Hogan, N. (2017). *Yuk Belajar Saham Untuk Pemula*. Jakarta: PT Elex Media Komputindo Kompas Gramedia.
- Ibrahim, M. H. (2010). Financial market risk and gold investment in an emerging market: the case of Malaysia. *International Journal of Islamic and Middle Eastern Finance and Management*, 5(1), 25–34. <https://doi.org/10.1108/17538391211216802>
- IDX. (2021). *IDX Stock Index Handbook V1.2*. *IDX Stock Index Handbook V1.2*. Diperoleh dari https://www.idx.co.id/media/9816/idx-stock-index-handbook-v12-_januari-2021.pdf
- Ilham, R. N., & Sinurat, M. (2022). *Strategi Investasi Aset Digital Cryptocurrency*. Yogyakarta: CV. Bintang Surya Madani.
- Indriani, P., & Harjahdi. (2013). *Analisis Fundamental dan Teknikal Dalam Pengambilan Keputusan Untuk Transaksi Emas di Perdagangan Berjangka*. *Akuntansi & Keuangan*, 27(37)(1), 55–62.
- Maheshwari, R. (2023). Why Is The Crypto Market Down In July 2023? Diperoleh dari <https://www.forbes.com/advisor/in/investing/cryptocurrency/why-crypto-market-is-down/>
- Makridakis, S., Wheelwright, S., & Hyndman, R. (1997). *Forecasting Methods And Applications*. New York: John Wiley & Sons.
- Mankiw, N. G. (2019). *Macroeconomics*. New York: Worth Publishers.
- Manurung, A. H. (2012). *Teori Investasi: Konsep dan Empiris*. Jakarta: STIEP Press.
- Markowitz, H. (1952). Portfolio Selection. *Journal of Finance*, 7(1), 77–91.
- Musdalifah, A., Mintartri, S., & Nadir, M. (2015). *Manajemen Investasi Fundamental, Teknikal, Perilaku Investor dan Return Saham*, (October 2015).
- Nuzula, N. F. (2020). *Dasar-dasar Manajemen Investasi*. Malang: UB Press.
- Oei, I. (2009). *Kiat Investasi Valas, Emas dan Saham*. Jakarta: PT Gramedia Pustaka Utama.
- Pamilangan, A., & Robiyanto, R. (2019). *Perumusan Portofolio Dinamis Cryptocurrency Dengan Saham-Saham Lq45*. *Jurnal Ilmu Sosial dan Humaniora*, 8(2), 283. <https://doi.org/10.23887/jish-undiksha.v8i2.23065>
- Partz, H. (2022). A brief history of Bitcoin crashes and bear markets: 2009–2022. Diperoleh dari 22 April 2023, dari <https://cointelegraph.com/news/a-brief-history-of-bitcoin-crashes-and-bear-markets-2009-2022>
- Prowanta, E., & Herlianto, D. (2016). *Manajemen Investasi dan Portofolio*. Yogyakarta: Gosyen Publishing. Diperoleh dari <https://books.google.com/books?hl=en&lr=&id=O5JCEAAQBAJ&oi=fnd&pg=PA1&dq=manajemen+strategik+investasi&ots=CDTn8oGNpv&sig=DXxJ0vG3aw1MfGnFkN679PF4UVA>
- Purnamasari, E. D., Wulandari, T., & Siddik, R. (2023). Analisis Pergerakan Indeks Harga Saham Gabungan (IHSG) Pada Era Vuca, 6(1), 682–694.
- Puryandani, S., & Robiyanto, R. (2019). Gold: Hedge, Safe Haven or Diversifier for the Indonesian Capital Market. *Jurnal Ilmiah Ekonomi*, 14(2), 226–239. <https://doi.org/10.34152/fe.14.2.226-239>
- Putra, T. A. (2022). *Aplikasi Model Time Series dalam Investasi Emas, Valuta Asing, Saham, dan Cryptocurrency di Masa Sebelum dan Saat Pandemi COVID-19*. Politeknik Statistika STIS.
- Rahmi, F. M., & Nasrudin, N. (2023). The Effect of COVID-19 Pandemic on the Risks of Investments in Indonesia: Evidence From the Egarch Model. *Buletin Ekonomi Moneter dan Perbankan*, 25(4), 673–688. <https://doi.org/10.21098/bemp.v25i4.1758>
- Shah, A., Chauhan, Y., & Chaudhury, B. (2020). Principal component analysis-based construction and evaluation of cryptocurrency index. *Expert Systems with*

*Financial Investment Risk Comparison Stock, Gold, and Cryptocurrency:
Evidence Transition Towards Endemic COVID-19 in Indonesia*

- Applications*, 163.
<https://doi.org/10.1016/j.eswa.2020.113796>
- Sunaryo, D. (2019). *Buku Ajar Manajemen Investasi dan Portofolio*. Qiara Media.
- Syaifuddin, D. T. (2008). *Manajemen Keuangan*. Kendari: UNHALU PRESS.
- Tandelilin, E. (2010). *Portofolio dan Investasi Teori dan Aplikasi* (Pertama). Yogyakarta: Kanisius.
- Vose, D. (2008). *A quantitative guide third edition*.
- Wahyuni, A. N. (2014). Analisis Perbandingan Kinerja Investasi Emas dan Investasi Saham Selama Masa Inflasi 1994-2013, 23(2). Diperoleh dari dari <https://ejournal.undip.ac.id/index.php/jbs/article/download/14379/10973>
- Zhang, W., & Hamori, S. (2021). Crude oil market and stock markets during the COVID-19 pandemic: Evidence from the US, Japan, and Germany. *International Review of Financial Analysis*, 74(October 2020), 101702. <https://doi.org/10.1016/j.irfa.2021.101702>