



The Formulation of a Dynamic Portfolio between Gold and Stocks on the Indonesia Stock Exchange during the COVID-19 Pandemic

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Abstract

COVID-19 pandemic has made investors to be careful in selecting a portfolio instrument. This is important because the portfolio formed using the appropriate instrument certainly has the ability to minimize risks and maximize returns. This research was conducted to analyze the dynamic portfolio formed by gold and leading stocks during the COVID-19 period which is better than those formed by stocks alone. This involved using secondary data in the form of LQ-45 index daily closing price data and world gold prices as well as the risk-free rate data obtained from *bi.go.id*. Meanwhile, the data were analyzed using the DCC-GARCH technique. **Findings.** The results showed the stock portfolios with gold has a good performance with variability-based measurement.

1. Introduction

COVID-19 virus, also known as SARS-CoV-2, originated from the city of Wuhan, China, and has now spread to different countries in the world with more than 3,9 million people reported to have contracted this deadly virus globally (Aida, 2020). The virus was first discovered at the end of 2019 and the first case in Indonesia was recorded in March 2020 with two residents of Depok, West Java (Yunita, 2020). The spread of this disease is certainly a threat to the global economy and its effect has been experienced by several sectors including the economic sector (Baharudin, Iksan, and Abdi, Nur, 2020).

The virus has also caused a shift in investors' predictions and this means several adjustments need to be made in responding to the current situation (Kiky, 2020). Moreover, investors tend to sell their investment portfolios in anticipation of unwanted risks and are also considered to have difficulty in measuring the risk caused by the virus, thereby, leading to the conversion of their assets to gold or cash (Intan and Zuraya, 2020).

It is, however, possible to cover the risks from the existence of COVID-19 by establishing a portfolio which as the ability to reduce potential risks in comparison with investing in just one security (Pardosi and Wijayanto, 2015; Azhar, 2016). A portfolio is defined as an asset with economic objectives which involve allocating funds in different types of investment to obtain optimal returns with a small level of risk (Pamilangan and Robiyanto, 2019; Oktaviani and Wijayanto, 2015). Kurniawan and Dewanti (2020) also explained the concept as the groups or mergers forming a unit containing financial assets or securities such as stocks, bonds, and cash equivalents.

A portfolio can be formed using varieties of instruments including LQ-45 stocks and gold. LQ-45 stocks are one of the investment options provided by the Indonesia Stock Exchange (IDX) (Effendi, 2018) and defined by Pamilangan and Robiyanto (2019) as the stocks with a high level of liquidity when compared to other types of investment. They are also considered to have a low-risk level and small price fluctuations (Hariyanto, 2018). Moreover, gold is another instrument of portfolio and described as a precious metal and an investment instrument which is long considered to be safe against inflation (Johari, 2017). It is also one of the most popular instruments because it is quite safe, has very little risk (Istamar, Sarfiah, and Rusmijati, 2019), and serve as a form of investment due to its high liquidity and acceptability in several regions and countries of the world (Agestiani and Sutanto, 2019).

Several previous studies have mostly used portfolios with a static method but this research specifically used a dynamic method which is based on the assumption that the stock market continues to change dynamically (El Hedi Arouri, Lahiani, and Nguyen, 2015). This method is considered to have a higher level of confidence than the static method (Chen and Pan, 2015). Moreover, Robiyanto, Ernayani, and Ismail (2019) have examined dynamic portfolios but focused on stocks and bonds while Pamilangan and Robiyanto (2019) used normal periods. This research, however, describes the formation of a dynamic portfolio through gold and stocks during the COVID-19 pandemic and this is novel considering the fact that there is no present study on this topic to the best of the researcher's knowledge.

This research was conducted to determine whether the dynamic portfolio formed from gold and leading stocks during the COVID-19 period has a better performance than investing in stocks alone. This means the purpose was to analyze the performance of the formation of a dynamic portfolio formed from gold and leading stocks during the COVID-19 period in comparison with investing in stocks alone. The findings are expected to provide theoretical benefits for academic purposes in adding to the literature from several existing journals on related topics and also to provide practical benefits for investors as a reference in considering the type of investment to be selected in portfolio formation.

1.1. Portfolio

A portfolio is an investment unit consisting of several assets in order to achieve the goals expected by investors (Hamdani, Murhadi, and Sutejo, 2015). It has also been interpreted as an activity to divide an asset into different types of investment (Arief, 2019) to help neutralize losses from one type of investment with the benefits obtained from the others (Effendi, 2018; Pamilangan and Robiyanto, 2019). Moreover, Markowitz provides very important advice in portfolio diversification which is "don't put all the eggs in one basket, because if the basket falls, all the eggs will break." (Azhar, 2016).

There is, therefore, the need to analyze portfolios to help investors reduce risks and maximize their returns and this is important to avoid speculative instinct in selecting the appropriate assets to include in a portfolio. It has also been reported that an investor needs an analytical method of calculating the amount of profit and level of risk from an investment (Hariyanto, 2018), and the dynamic portfolio measurement is considered necessary due to the ever-changing stock market conditions (Robiyanto, 2018). Meanwhile, it is possible to generally measure portfolios using a single index, Markowitz, Sharpe, Treynor, and several other methods (Mubarak, Darmawan, and Luailiyah, 2017; Oktaviani and Wijayanto, 2015).

1.2. LQ-45 Stock

LQ-45 stocks are a collection of 45 stocks considered to be the most liquid with high capitalization and observed to be active in transactions. The high stock value has been reported to make the LQ-45 stock an investment option (Egam, Ilat, and Pangerapan, 2017). The companies included in the LQ-45 stock index are considered to have high growth and good performance and these make investors have an interest in them. The nature of their stocks is liquid, making it easy to buy and sell, and this yields a more optimal portfolio (Oktaviani and Wijayanto, 2015).

Their stocks are continuously controlled by the IDX during the developmental stage and reviewed every 3 months with the members replaced every 6 months. The stocks deemed not to have met the predetermined criteria issued are usually replaced by new stocks that meet the criteria (Hariyanto, 2018). This means the companies included in the LQ-45 stock index need to improve their positive image continuously in order to attract investors (Fauziah, Irwanto, and Syamsun, 2016).

1.3. Gold

Gold is an investment instrument which has long been considered safe from inflation and profitable due to the continuous increase in its price (Iriani and Suprayogi, 2018). It is one of the most popular types of investment due to the tendency of its value to be stable, small risk level, and high liquidity level (Jannah and Nurfauziah, 2018; Istamar *et al.*, 2019). The sale of gold in Indonesia is in several ways and these include jewelry, gold coins, and gold bars (Habibah, 2017).

Gold investment has several advantages which are not in other investments and these include its tangibility, intrinsic value, and innateness. It is also considered to be more stable, has higher returns compared to stocks and deposits (Johari, 2017), and has the ability to ward off inflation which often occurs every year. Moreover, the world gold price is determined by the London gold market standard (London Gold Fixing) twice a day at 10.30 and 15.00 (Jannah and Nurfauziah, 2018).

1.4. Portfolio Performance Measurement

The modern portfolio theory introduced by Markowitz is an important basis for investment and before the introduction of this theory, investors only observed portfolio performance based on returns without focusing on the existing risks (Robiyanto, Wahyudi, and Pangestuti, 2017). The performance is, however, currently measured using different methods such as the Sharpe Index, Sortino Ratio, Jensen Index, Treynor Index, and Omega Ratio. The Sharpe Index has the ability to measure market performance by considering the standard deviation of returns with the risks observed through return on total risk (Mubarok *et al.*, 2017).

The Sortino Index is rated almost the same as the Sharpe Index but it only uses portfolio returns below the predetermined minimum return instead of standard deviation and also replaces the risk-free asset returns with the minimum expected return (Bukit, Suroho, and Astriana, 2019). Meanwhile, the Jensen Index shows the difference between the realization of return and the expected rate of return when the portfolio is in the capital market line and this means it measures the number of portfolios judged to be 'beating the market' (Hamdani *et al.*, 2015).

The Treynor Index evaluates the portfolio performance using a volatility ratio based on systematic risk and assumes the portfolio is well-diversified, therefore, the systematic risk (beta) is relevant (Mubarok *et al.*, 2017). Moreover, the Omega Ratio is the cumulative probability ratio above or below a predetermined threshold and this method helps investors in ranking funds in

order to compare prices with the performance which are later readjusted to existing risks (Rambo and Vuuren, 2017). This research, however, used the Sharpe Index, Sortino Ratio, Jensen Index, Treynor Index, and Omega Ratio in measuring the portfolio performance.

1.5. Portfolio Formation During COVID-19

The COVID-19 pandemic increases the risk of investing due to the uncertainty associated with the current situation which makes investors to be very careful in making investment decisions. Investors need to effectively understand every risk attached to different forms of investment (Hikam, 2020). It is important to note that every investment has a risk which is further divided into two, systematic and unsystematic with the systematic risk defined as the risk considered inherent in the market and related to the changes observed while the unsystematic risk is related to the condition of the company which cannot be lost only by diversification (Oktaviani and Wijayanto, 2015).

It is, therefore, important to compile a portfolio based on the risks involved in investing in order to minimize or even eliminate risks experienced by the investors. This involves spreading funds on several investments through the consideration of a good combination of instruments to obtain the expected return with a small level of risk (Azhar, 2016). Meanwhile, the best options during this pandemic are stocks and gold considering the falling stock prices which is an opportunity for investors to own shares of large companies as well as gold considered to be a mainstay for emergency funds or long-term investment (Hikam, 2020).

1.6. Gold and Stocks Portfolio during COVID-19

The global stock market is under intense pressure due to the prevalence of COVID-19 which causes very high market volatility and movements, thereby, causing mental panic for investors (Baharudin, Iksan, and Abdi, Nur, 2020). For example, Jakarta Composite Index (IHSG) has plunged 26,60% since the beginning of the year due to this pandemic and this is considered the right time for investors to invest in stocks with large market capitalization such as the LQ-45 which has high liquidity and supported by good company fundamentals (Sidik, 2020).

Gold is also currently an investment vehicle considered to be quite attractive to the public due to the continuous increment in its price despite the current situation with the highest increase over the past 7 years recorded in 2020 (Baharudin, Iksan, and Abdi, Nur, 2020) at 21% since the beginning of the year. People have made gold a safe haven during the pandemic and this investment is a wise decision due to its high profitability, liquidity, safety, and a small level of risk (Safitri, 2020).

According to Robiyanto (2018), a dynamic portfolio formed from gold and stocks has the ability to generate returns in accordance with existing risks. Moreover, portfolios with gold are believed to have the ability to produce significantly better performance (El Hedi Arouri *et al.*, 2015) and this is associated with the negative correlation of its nature to other assets which makes it a good factor in portfolio diversification due to the usual increase in its price when the price of other assets reduce (Hoang, Lean, and Wong, 2015). Robiyanto, Hadiyatno, Sudjnan, and Ernayani (2019) also found the performance of a stock portfolio to improve due to the inclusion of gold. These arguments, therefore, led to the formulation of the following hypothesis:

H₁: The performance of the dynamic portfolio formed from combining LQ-45 stocks and gold is better than those formed with LQ-45 stocks alone.

2. Research Method

This research was conducted using a quantitative method with the application of time series data obtainable sequentially over a predetermined period and classified into daily, weekly, monthly, and yearly (Pamilangan and Robiyanto, 2019). Meanwhile, gold and LQ-45 stock variables were used with daily data on world gold prices and daily closing price data for 10 stocks having the largest market capitalization in the LQ-45 index as shown in Table 1.

Table 1. Ten LQ-45 Members with The Highest Market Capitalization between August 2019 and January 2020

No	Company Name	Code	Market Capitalization
1	PT Bank Central Asia Tbk.	BBCA	Rp. 755,441,809,764,000
2	PT Bank Rakyat Indonesia (Persero) Tbk.	BBRI	Rp. 547,063,336,512,000
3	PT Telekomunikasi Indonesia (Persero) Tbk.	TLKM	Rp. 425,967,531,380,000
4	PT Bank Mandiri (Persero) Tbk.	BMRI	Rp. 368,444,999,984,050
5	PT H.M. Sampoerna Tbk.	HMSP	Rp. 352,443,773,007,000
6	PT Unilever Indonesia Tbk.	UNVR	Rp. 332,668,000,000,000
7	PT Astra International Tbk.	ASII	Rp. 283,384,871,980,000
8	PT Bank Negara Indonesia (Persero) Tbk.	BBNI	Rp. 156,466,889,843,175
9	PT Gudang Garam Tbk.	GGRM	Rp. 145,268,644,000,000
10	PT Indofood CBP Sukses Makmur Tbk.	ICBP	Rp. 124,782,415,600,000

Source: *idx.co.id*

The period observed in this research was from January to May 2020 which was the time Indonesia started experiencing the impact of COVID-19. Meanwhile, the data on the stock price of LQ-45 and the price of gold was obtained from Yahoo Finance while risk-free rate data from *bi.go.id* was used to measure the sub-ratio.

2.1. Analysis Technique

The analysis technique used in this research was the Dynamic Conditional Correlation-Generalized Autoregressive Conditional Heteroscedasticity (DCC-GARCH) which is a time-series data method usually used to determine the existence of a dynamic correlation between one variable and another using the E-Views test tool (Pamilangan and Robiyanto, 2019). The use of this method is also based on the fact regarding the non-normal distribution of the stock returns as stated by Chion, Veliz, and Carlos (2008), Kamath, Chakornpipat, and Chatrath (1998), and Ogata (2012). Moreover, the DCC-GARCH techniques were employed especially with the Generalized Error Distribution (GED) as suggested by Abdul Rahim, Zahari, and Shariff (2017) to deal with the non-normality error distribution.

Different tests were conducted in this study to compare and discover the differences from existing data. This involved the calculation of the return of the LQ-45 stock variable using the following formula:

$$\text{LQ45 Stock Return}_{it} = \frac{(\text{LQ45 Stock } P_{it} - \text{LQ45 Stock } P_{it-1})}{\text{LQ45 Stock } P_{it-1}}$$

Where:

LQ45 Stock P_{it} = LQ45 stock is the closing price on the time t

LQ45 Stock P_{it-1} = LQ45 stock is the closing price on the time $t-1$

Meanwhile, the return from the gold variable was calculated using the following formula:

$$\text{Gold Return} = \frac{(\text{Gold } P_t - \text{Gold } P_{t-1})}{\text{Gold } P_{t-1}}$$

Where:

Gold P_t = the daily closing price of gold on the time t

Gold P_{t-1} = the daily closing price of gold on the time $t-1$.

The Hedging Effectiveness (HE) was also calculated to measure the optimal hedging ratio performance with a large value reflecting the size of the risk reduction in the portfolio and this means the strategy implemented is good (M. P. S. Putra, Atahau, and Robiyanto 2018). This factor was calculated using the following equation.

$$\text{HE} = \frac{\text{var}_{\text{unhedged}} - \text{var}_{\text{hedged}}}{\text{var}_{\text{hedged}}}$$

Where:

$\text{var}_{\text{unhedged}}$ = LQ – 45 member stock variance .

$\text{var}_{\text{hedged}}$ = LQ – 45 member gold and stock variance .

Meanwhile, the Hedge Ratio formula is as follows:

$$\beta_t^{\text{Gs}} = \frac{h_t^{\text{SG}}}{h_t^{\text{G}}}$$

Where:

h_t^{SG} = gold covariance – LQ45 member on the time t .

h_t^{G} = gold conditional variance on the time t .

The Risk-Adjusted Return from the hedge and unhedged portfolio was calculated using the Sharpe Index as follows:

$$\text{Risk – Adjusted Return} = \frac{\text{Average Portfolio Return} - \text{Risk Free Rate}}{\text{Portfolio's Standard Deviation}}$$

Portfolio's standard deviation was evaluated using the following formula:

$$\text{Standard Deviation } (\sigma) = \sqrt{\frac{\sum [(R_{i,t} - E(R_{i,t}))]^2}{N}}$$

Meanwhile, the portfolio performance was measured using the Sharpe Index, Sortino Ratio, Jensen Index, Treynor Index, and Omega Ratio.

Adjusted Sharpe Index:

$$\text{Sharpe Index} \times \frac{\text{Number of Observations (N)}}{\text{Number of Observations (N)} + 0,75}$$

Sortino Ratio:

$$\frac{\text{Average Stock Return} - \text{Risk Free Rate}}{\text{Downside Deviation}}$$

Where:

σ = downside deviation.

R_p = Stock Return.

MAR = Minimum Acceptable Return = Risk – Free Rate.

N = Number of Observation.

This is based on the condition that the $(R_p - \text{MAR})$ value is used when the $(R_p - \text{MAR})$ is negative while 0 is used when it is positive. Meanwhile, an increment in the Sortino Index value is considered to cause a decrease in the loss rate.

Jensen Index:

$$R_p - (R_f + \beta_p (R_m - R_f))$$

Where:

R_p = Portfolio return on time t.

R_f = return on risk – free investment on the time t.

β_p = portfolio beta coefficient.

R_m = market return.

Treynor Index:

$$\frac{\text{Average Return of Portfolio} - \text{Risk Free Rate}}{\text{Beta of Portfolio}}$$

A positive and increasing Treynor Index shows the value of portfolio performance is getting better.

Omega Ratio:

$$\Omega(t) = \frac{\int_t^{\infty} (1 - F(x)) dx}{\int_{-\infty}^t F(x) dx}$$

Where:

$F(x)$ = cumulative probability distribution.

$\int_t^{\infty} (1 - F(x)) dx$ = probability of return above a given threshold.

$\int_{-\infty}^t F(x) dx$ = probability of return below a given threshold.

3. Results and Discussions

3.1. Descriptive Statistics Analysis

The analysis is presented in Table 2 to provide a description or general picture of the data and the results showed the stock with the highest average return is GGRM at a value of 0.002 while the lowest was -0.005 with BBNI. Meanwhile, CPIN is the stock with the highest risk level at 0.046 while BBKA and ICPB have the lowest risk level at 0.030.

Table 2. Stock Return Descriptive Statistic

No	Name	N	Minimum	Maximum	Average	Standard Deviation
1	BBCA	94	-0.079	0.173	-0.002	0.030
2	BBRI	94	-0.078	0.205	-0.002	0.042
3	TLKM	94	0.070	0.137	-0.001	0.031
4	UNVR	94	0.069	0.194	0.001	0.037
5	BMRI	94	0.130	0.158	-0.004	0.040
6	HMSP	94	0.069	0.165	0.001	0.036
7	ASII	94	0.071	0.127	-0.002	0.037
8	BRPT	94	0.999	0.208	-0.031	0.186
9	ICPB	94	0.070	0.145	-0.002	0.030
10	CPIN	94	0.116	0.166	0.001	0.046
11	BBNI	94	-0.090	0.136	-0.005	0.037
12	GGRM	94	-0.070	0.200	0.002	0.037

Source: Yahoo Finance, processed

3.2. Descriptive Statistics of the DCC between Stocks and Gold

The descriptive statistics of the DCC between stocks and gold are presented in Table 3 and the average yield was found to be weak with 0.060. This, therefore, means the portfolio formed from gold and stocks is relatively good due to the weak correlation between the two instruments. Meanwhile, the highest DCC average yield was 0.367 and found with GGRM-GOLD while the lowest was 0.095 with BBNI.

Table 3. Summary of the DCC between Stocks and Gold

	Maximum	Minimum	Average
BBCA	0.090	-0.215	-0.057
BBRI	1.000	-1.000	-0.051
TLKM	1.000	-0.392	0.110
UNVR	0.399	-0.184	0.106
BMRI	0.328	-0.217	0.053
HMSP	0.228	-0.138	0.072
ASII	0.237	-0.367	-0.071
BRPT	0.477	-0.238	-0.047
ICPB	0.239	0.017	0.147
CPIN	0.288	0.144	0.204
BBNI	0.105	-0.447	-0.095
GGRM	0.668	0.025	0.367
Average	0.422	-0.251	0.060

Source: Yahoo Finance, processed

3.3. DCC-GARCH and Weight Ratio Portfolio Analysis Result

The DCC-GARCH analysis of the portfolios formed from stocks and gold in the period of January to May 2020 is presented in Figure 1 and the results showed the portfolio weight between the stocks and gold tends to fluctuate and vary during the period.

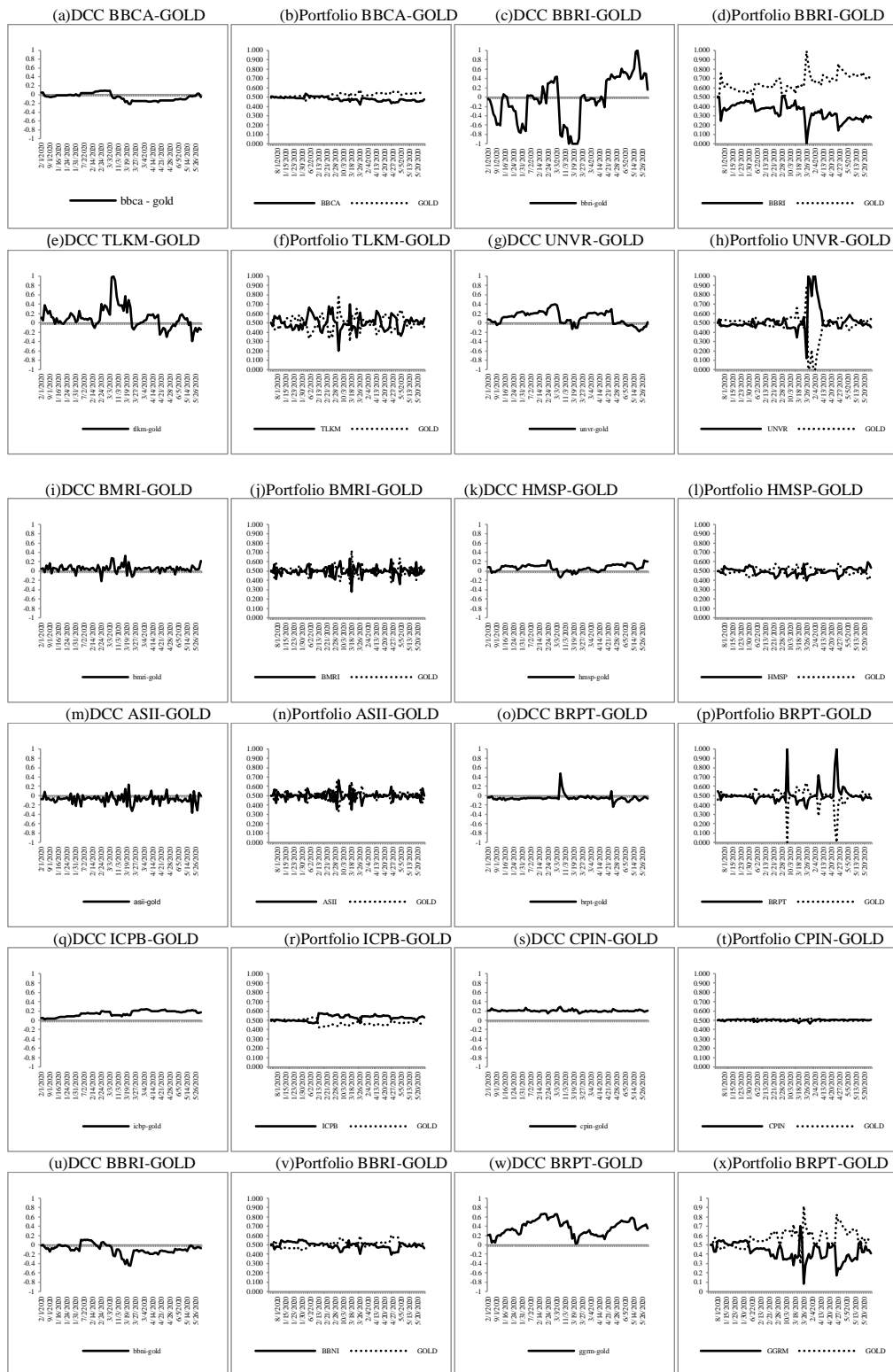


Figure 1. Stock-Gold DCC and Gold-Stock Portfolios

The optimal results of the hedge ratio, hedging effectiveness, and portfolio ratio for each stock and gold are, however, presented in Table 4.

Table 4. Optimal Hedge Ratio, Hedging Effectiveness, and Portfolio Ratio for Stock and Gold

Portfolio	Optimal Hedge Ratio	Hedging Effectiveness	Average Return (%)	Standard Deviation	Sharpe Ratio	Sortino Ratio	Jensen Ratio	Treynor Ratio	Omega Ratio
BBCA	-	-	-0.002	0.030	-0.059	-0.107	0.001	-0.001	0.822
BBRI	-	-	-0.002	0.042	-0.048	-0.087	0.001	-0.001	0.863
TLKM	-	-	-0.001	0.031	-0.034	-0.065	0.001	-0.001	-1.000
UNVR	-	-	0.001	0.037	0.012	0.025	0.003	0.000	1.039
BMRI	-	-	-0.004	0.040	-0.095	-0.155	-0.001	-0.022	0.755
HMSP	-	-	0.001	0.036	0.029	0.058	0.003	0.001	0.001
ASII	-	-	-0.002	0.037	-0.053	-0.093	0.001	-0.001	0.867
BRPT	-	-	-0.031	0.186	-0.168	-0.179	-0.029	-0.030	0.394
ICPB	-	-	-0.002	0.030	-0.071	-0.119	0.000	-0.002	0.796
CPIN	-	-	0.001	0.046	0.012	0.022	0.004	0.000	1.033
BBNI	-	-	-0.005	0.037	-0.146	-0.222	-0.003	-0.004	0.665
GGRM	-	-	0.002	0.037	0.045	0.094	0.004	0.001	1.166
GOLD	-	-	0.001	0.016	0.088	0.188	0.002	0.013	1.311
BBCA-GOLD	-0.060	0.689	0.000	0.012	-0.012	-0.024	0.001	0.000	0.965
BBRI-GOLD	-0.060	0.869	-0.001	0.015	-0.046	-0.080	0.000	-0.002	0.882
TLKM-GOLD	0.100	0.644	0.001	0.019	0.025	0.052	0.002	0.001	1.077
UNVR-GOLD	0.115	0.718	0.000	0.019	-0.003	-0.007	0.001	0.000	0.990
BMRI-GOLD	0.055	0.673	-0.001	0.023	-0.061	-0.101	0.000	-0.002	0.837
HMSP-GOLD	0.068	0.685	0.001	0.020	0.054	0.109	0.002	0.002	1.157
ASII-GOLD	-0.069	0.676	0.000	0.021	-0.028	-0.051	0.001	-0.001	0.930
BRPT-GOLD	-0.046	0.776	-0.013	0.088	-0.151	-0.163	-0.012	-0.024	0.456
ICPB-GOLD	0.140	0.644	0.000	0.018	-0.031	-0.058	0.001	-0.001	0.912
CPIN-GOLD	0.203	0.702	0.001	0.025	0.040	0.076	0.003	0.001	1.112
BBNI-GOLD	-0.085	0.712	-0.002	0.020	-0.107	-0.175	-0.001	-0.003	0.746
GGRM-GOLD	0.318	0.794	0.001	0.017	0.038	0.074	0.002	0.001	1.114
Average	0.057	0.715			-0.024	-0.029	0.000	-0.002	0.932

Source: Yahoo Finance and *bi.go.id*, processed

3.4. Optimal Hedge Ratio, Hedging Effectiveness, and Stock and Gold Portfolio Calculation Ratio

The results of the optimal hedge ratio, hedging effectiveness, and several types of portfolio ratios for stocks and gold are shown in Table 4 and the lowest value for the optimal hedge ratio was found to be in the BBNI-GOLD portfolio with 0.085 while the highest was in GGRM-GOLD with 0.318. This means investors having BBNI stocks also need to buy gold which serves as a hedge for their portfolio based on the comparison that every purchase of IDR1 in BBNI stock needs to be accompanied by the purchase of gold to the tune of IDR0.085. Meanwhile, investors owning GGRM stocks are considered to have to sell gold in order to protect their portfolios based on the comparison that every purchase of IDR1 in GGRM stock needs to be accompanied by the

sale of gold worth of IDR0.318. However, the optimal average value of the hedge ratio between the portfolio formed from stocks and gold was recorded to be 0.057.

3.5. Hedging Effectiveness

The average value of the hedging effectiveness of stocks protected by gold was found to be 0.715 as shown in Table 4 while the lowest was 0.644 out of 2 portfolios which are the ICPB-GOLD and TLKM-GOLD. This means the addition of gold to the ICPB and TLKM portfolios has the ability to reduce risk by 64.4%. Meanwhile, the highest value was in the BBRI-GOLD portfolio with a value of 0.869 and this means the addition of gold to the BBRI portfolio has the ability to reduce the risk by 86.9%. Moreover, all the value of stocks protected by gold showed hedging effectiveness which is more than 0 and this means gold has the capability to reduce risk in the portfolio by 0.644 to 0.869.

Table 5. T-Test Results

No	Description	Mean Difference	T	Probability	Conclusion
1	Sharpe Ratio	-0.024	-3.843	0.003	Different
2	Sortino Ratio	-0.040	-3.314	0.007	Different
3	Jensen Ratio	-0.001	-0.846	0.416	Indifferent
4	Treynor Ratio	-0.002	-1.613	0.135	Indifferent
5	Omega Ratio	-0.314	-1.699	0.117	Indifferent

Source: Yahoo Finance and *bi.go.id*, processed

3.6. T-Test Results

The T-test result regarding the average portfolio of stocks protected and not protected by gold determined using the Sharpe, Sortino, Jensen, Treynor, and Omega ratios are presented in Table 5. The Sharpe Ratio showed the t-count was -3.843 with a significance value of 0.3% which is lesser than 5% and this means there is a difference in the Sharpe Ratio between the stock portfolio and the stock and gold portfolio. In this case, the stock and gold portfolio was found to be better than only the stocks.

The t-count in the Sortino Ratio also showed a value of -3.314 with a significance of 0.7% which is smaller than 5% and this indicates a Sortino Ratio difference between the portfolios formed by the stocks alone and those by stocks and gold. Therefore, the stock and gold portfolio has better performance. Meanwhile, the t-count in Jensen Ratio was -0.46 with a significance of 41.6% which is greater than 5%, and indicates no difference in the Sortino Ratio between the stock portfolios and stock and gold portfolios.

Treynor Ratio was recorded to have a t-count of -1.613 and a significance value of 13.5% which is also greater than 5% and this also means there is no difference in the Treynor Ratio from the portfolio formed by stocks alone with those produced from combining stocks and gold. Moreover, the Omega Ratio had a t-count of -1.699 at a significance value of 11.7% which is greater than 5% and this also means there is no difference in Omega Ratio between stock portfolios and stock and gold portfolio.

The Sharpe and Sortino ratio portfolios formed between stocks and gold have a better performance than only stocks and this means the performance measurement using standard deviation showed the portfolios are different. Meanwhile, other methods such as the Jensen,

Treynor, and Omega Ratios did not show any difference in performance and this means the measurement using total risk was able to prove that the performance of the stock portfolio formed between stocks and gold is better than those of the total risk.

The average yield of a portfolio formed from stocks and gold is greater than the average recorded from using only the stock portfolio. The findings from the Sharpe and Sortino Ratios are in line with the results of Robiyanto (2018), El Hedi Arouri *et al.*, (2015), Hoang *et al.*, (2015), and Robiyanto, Hadiyatno, *et al.*, (2019) which showed the portfolio formed from stocks and gold to better than those obtained from stocks alone.

4. Conclusions

This research aimed to analyze the formation of a dynamic portfolio from gold and stocks in comparison with those formed using stocks alone and the results obtained using DCC-GARCH showed differences in the portfolio of stocks protected by gold and those not protected based on only two valuation ratios. Sharpe and Sortino Ratios have significance values which were below 5% and this indicates a difference between the portfolios with those formed from stocks and gold observed to have better performance. Meanwhile, Jensen, Treynor, and Omega Ratios indicated a significance level above 5% and this means there is no difference between the portfolios but the performance of a stock portfolio with gold was expected to have a good performance when measured using variability-based methods.

The limitation of this research is that it focuses only on dynamic portfolios formed from gold and stocks while there are several types of other asset instruments which can be included in the portfolio instrument such as cryptocurrencies, oil commodities, several other precious metals, and many more. Future research is, therefore, expected to consider several other investment instruments in the formation of a dynamic portfolio.

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