



Comparison of Optimal Portfolio Before and During the Covid-19 Pandemic: Testing on LQ45

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Abstract. This study forms an optimal portfolio using a single index model on LQ45 index stocks and compares its performance before and during the Covid-19 pandemic. Return, risk, Sharpe ratio, and Treynor ratio are compared between the period before and during the pandemic. The calculation of excess return to beta results obtains three stocks that make up the optimal portfolio (2016 to 2021), namely ANTM, BBCA, and INCO, with sequential proportions of 89.87%, 1.96%, and 8.17%. The different paired sample t-test results show differences in risk and Sharpe ratio performance in the portfolio before and during the Covid-19 pandemic. The risk is higher during than before the pandemic, with a higher Sharpe ratio value before the pandemic, even though both are negative. Meanwhile, the paired sample t-test comparison results for returns and Treynor ratio show no difference in portfolio performance before and during the Covid-19 pandemic.

Keywords: portfolio · treynor · sharpe · LQ45 · investment

1 Introduction

Compares return, risk, Sharpe ratio, and Treynor ratio between optimal and proportional portfolios. Difference in the risk of the two portfolios, while the return, Sharpe Ratio, and Treynor Ratio have no significant difference. Binangkit and Savitri [1] examine a significant difference between the returns on two different optimal portfolios. Nurhayati et al. [2] state significant differences in the risk of stocks before and during the 2008 economic crisis. Nurhayati et al. [2] posit significant differences in risk before and during the 2008 economic crisis. Nurhayati et al. [2] conduct a performance comparison through the Sharpe Ratio on stocks classified as optimal portfolios before and during the pandemic. The results prove differences in portfolios before and during the Covid-19 pandemic. Nurhayati et al. [3] conclude a significant difference in the Treynor Ratio performance before and during the Covid-19 pandemic. Safitri et al. [4] compare the Sharpe Ratio performance in agriculture companies before and during the economic crisis and reveal significant differences between the two periods.

Portfolio theory is based on the assumption that investors do not always invest their funds in one type of stock, but they will divide it into several types of stocks. According

to Chakraborty and Patel [5], a portfolio combines securities such as stocks, bonds, and money market instruments. Diversification aims to reduce the level of risk and maximize the rate of return. Therefore, it is necessary to form an optimal portfolio. According to Permata and Suryawati [6], two methods can be used to form an optimal stock portfolio, including (a) the Markowitz method; and (b) Single Index model. In addition, according to Margana and Artini [7], the optimal [8] portfolio is an efficient portfolio that provides maximum benefits for investors. Hardjopranoto [9] and Kefi et al. [8] examine the maximum benefit of portfolios based on crisis conditions, including Covid-19 in Indonesia, and show differences in optimal portfolios before and during the crisis. Tandelin [10] states several ways to measure portfolio performance by considering risk and return. The purpose of measuring portfolio performance is to make investment decisions. The methods for measuring portfolio performance include (1) Sharpe Ratio; (2) Treynor Ratio; and (3) Jensen’s Alpha.

2 Research Methods

This study is basic research using conclusive description by examining differences in return, risk, Sharpe ratio, and Treynor ratio in the period before and during the Covid-19 pandemic on the LQ45 Index over August 1, 2018–January 31, 2019 to February 1, 2020–July 31, 2021.

The data source used secondary data obtained from the Indonesian stock exchange website. In addition, the study also obtained consistency in the list of stocks belonging to the LQ45 Index over the period August 1, 2018–January 31, 2019, to February 1, 2020–July 31, 2021. The stock price used the closing price of each stock trading day.

The population was all companies listed in the LQ45 stock index on the Indonesia Stock Exchange over the period August 1, 2018–January 31, 2019, to February 1, 2021–July 31, 2021. In addition, there are criteria including the target sample: stocks listed on the Indonesia Stock Exchange over the period 2018–2021; stocks included in the LQ45 Index consistently over the period August 1, 2018–January 31, 2019, to February 1, 2021–July 31, 2021; and the required stock data is available during the observation period.

The steps used for calculating stock data to generate stock returns, risk, and performance replicate Mahadwartha and Gunawan [11]:

Stock Return

$$Realized\ Return = \ln \frac{P_t}{P_{t-1}}$$

Expected Return

$$(R_i) \frac{\sum R_{t(i)}}{n}$$

Risk

$$= \sqrt{\sum_{i=1}^n \frac{(x_i - \bar{x})^2}{n - 1}}$$

Stock Variance

$$\text{Variance} = \sum_{i=1}^n \frac{(x_i - \bar{x})^2}{n - 1}$$

Beta

$$\beta = \frac{\sigma_i}{\sigma_m}$$

Stock Alpha

$$\alpha_i = R_i - \beta_i \times R_m$$

Residual

$$R_i = \alpha_i + \beta_i \times R_m + e_i$$

Variance Residual

$$\sigma_i^2 = \beta_i^2 \times \sigma M^2 + \sigma_{ei}^2$$

Excess Return to Beta

$$RB = \frac{E(R_i) - R_{BR}}{\beta_i}$$

Cut-off Point

$$A_i = \frac{(E(R_i) - R_{BR}) \times \beta_i}{\sigma_{ei}^2}$$

$$B_i = \frac{\beta_i}{\sigma_{ei}^2}$$

$$C_i = \frac{\sigma_M^2 \sum_{j=1}^i A_j}{1 + \sigma_M^2 \sum_{j=1}^i B_j}$$

Weight of fund

$$W_i = \frac{X_i}{\sum_{j=1}^k X_i}$$

$$X_i = \frac{\beta_i}{\sigma_{ei}^2} (ERB_i - C^*)$$

Expected Return Portfolio

$$E(R_p) = \sum_{i=1}^n W_i \times E_i$$

Portfolio Risk

$$= \beta_p \times \sigma_m + \left(\sum_{i=1}^n \sigma_i^2 \times W_i \right)$$

Sharpe Ratio

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p}$$

Treynor Ratio

$$\text{Treynor Ratio} = \frac{R_p - r_f}{\beta_p}$$

Independent samples t-test compares the mean of two unrelated data groups or independent samples. The test aims to find differences in the average return, risk, and performance of the Sharpe ratio and Treynor ratio in the optimal portfolio during the period before and during the pandemic. If the results of the parametric test produce the value of Sig. (2-tailed) < alpha significance level, then H1 is accepted and H0 is rejected.

On the other hand, if the parametric test results produce a Sig. (2 tailed) > alpha significance level, then H0 is accepted and H1 is rejected.

Meanwhile, the hypotheses of this present research are as follows:

H1: There are differences in optimal portfolio returns.

H2: There are differences in optimal portfolio risk.

H3: There is a difference in the average performance of the Sharpe ratio.

H4: There is a difference in the average performance of the Treynor ratio.

3 Discussion

Table 1 shows 4 stocks with positive ERB: Aneka Tambang (Persero) Tbk. (ANTM), Bank Central Asia Tbk. (BBCA), Bank Rakyat Indonesia (Persero) Tbk. (BBRI), and Vale Indonesia Tbk. (INCO) (Tables 2, 3, 4 and 5).

The cut-off point (C*) is C_i's highest value, which is used as a limit for a stock to be included in the optimal portfolio. With the cut-off point, the stock has a high ERB and an optimal rate of return and minimal risk.

From Table 4, it can be seen that Return B (before) – Return D (during) is below the alpha significance level of 0.05, with an average difference (Mean dif.) of -0.004021049. These results conclude that H1 is accepted and H0 is rejected. There is a significant difference between portfolio returns before and during the pandemic. The government applies several policies, resulting in the company's operations being hampered. As a result, the company's performance has decreased and investors perceive it as negative news. However, a few months later, a stimulus from the government triggered a boom in the economy, restoring investor confidence in the Indonesian capital market.

For risk B (before) – risk D (during), have Sig. 2-tailed below the alpha significance level with an average difference of -0.012977526. It is concluded that H1 is accepted

Table 1. Excess Return to Beta

Tick	ERB	Tick	ERB
ADRO	-0.00036	INCO	0.00012
AKRA	-0.00026	INDF	-0.00013
ANTM	0.00096	INKP	-0.00107
ASII	-0.00060	INTP	-0.00060
BBCA	0.00032	ITMG	-0.00053
BBNI	-0.00057	JSMR	-0.00039
BBRI	0.00016	KLBF	-0.00022
BBTN	-0.00074	MNCN	-0.00053
BMRI	-0.00021	PGAS	-0.00060
BSDE	-0.00062	PTBA	-0.00077
EXCL	-0.00011	PTPP	-0.00094
GGRM	-0.00142	SMGR	-0.00020
HMSP	-0.00188	TLKM	-0.00011
ICBP	-0.00028	UNTR	-0.00080

Table 2. Cut-off point with positive ERB

Tick	ERB	A _i	B _i	C _i
ANTM	0.000965	1.9223	1,794.4	0.000330 (C*)
BBCA	0.000318	2.5439	5,211.8	0.000275
INCO	0.000118	0.4162	1,755.0	0.000072

Table 3. Optimal Portfolio and Weight of Fund

Tick	ERB	X _i	W _i
ANTM	0.0009650	0.8986904	89.87%
BBCA	0.0003185	-0.0784150	1.96%
INCO	0.0001185	-0.3277186	8.17%

and H₀ is rejected. There is a significant difference between portfolio risk before and during the pandemic. There have been economic crises in 1998, 2008, and 2013 but due to the Covid-19 pandemic, the crisis may only happen once in 200 years. The crisis also shows a significant difference in risk for several stocks before and during the economic crisis.

Table 4. The Independent Samples t-test

	F	Sig.	t	df	Sig.	Mean Difference
Return	9.135	0.003	-1.476	153	0.142	-0,00402105
Risiko	26.009	0.000	-4.450	153	0.000	-0,01297753

Table 5. The Results of The Independent Samples t-test

	F	Sig.	t	df	Sig.	Mean Difference
Sharpe	0.557	0.457	-3.682	153	0.000	-0.506374
Treynor	1.400	0.238	-.576	153	0.565	-0.007778

Sharpe B (before) – Sharpe D (during) has Sig. 2- tailed below the alpha significance level with an average difference of -0.506374022 . It is concluded that H1 is accepted and H0 is rejected. There is a significant difference between the performance of the Sharpe Ratio in the portfolio before and during the pandemic. This difference is because most of the stocks included in the optimal portfolio tend to have negative performance in the early days of the Covid-19 pandemic. However, a few months later, the company managed to show positive and stable performance.

Meanwhile, Treynor Ratio B (before) – Treynor Ratio D (during), has Sig. 2-tailed above the alpha significance level with an average difference level of -0.007778031 (H0 is accepted and H1 is rejected). There is no significant difference between the Treynor ratio performance in the portfolio before and during the Covid-19 pandemic. Treynor ratio compares market performance against market risk or systematic risk (beta). The movement of these stocks is also followed by negative market movements, which causes no significant difference before and during the pandemic.

4 Conclusion

This research can be used as a reference in future investments for investors and potential investors. Investors can form an optimal portfolio with a composition of 3 stocks: ANTM (Aneka Tambang (Persero), Tbk.), BBCA (Bank Central Asia, Tbk.), and INCO (Vale Indonesia, Tbk.), reflecting an optimal portfolio with low risk and high returns. Investors can also invest in accordance with the proportion of funds in this study to reduce the level of risk. Further research can compare the single-index model with Markowitz's research, such as the research of Yuwono and Ramdhani [12], to get the results of a comparison of portfolio formation schemes.

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