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OPTIMAL PORTFOLIO FORMATION ANALYSIS USING THE SINGLE INDEX MODEL DURING THE COVID-19 PANDEMIC: A Study on The LQ 45 Index on the Indonesian Stock Exchange (IDX)

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Abstract

This study aims to determine the optimal portfolio formation using the single index model method on LQ 45 Index stocks for the period from March 2020 to December 2021. The population in this study consists of all company shares included in the LQ 45 Index during the specified period, totaling 45 stocks. A sample of 36 companies was selected using a nonprobability sampling technique with a purposive sampling method. Data collection was carried out using documentation techniques, primarily focusing on collecting closing stock price data. The data analysis process involved collecting the closing stock price data and utilizing the single index model method to identify an optimal portfolio. The results of this study indicate that 18 company shares were included in the optimal portfolio. These companies are ADRO (7.46%), AKRA (14.51%), ANTM (7.97%), ASII (4.42%), BBNI (3.3%), BBTN (1.8%), BMRI (4.55%), CPIN (1.45%), ERAA (11.14%), EXCL (3.19%), INCO (8.55%), INKP (3.98%), ITMG (5.08%), JPFA (4.86%), JSMR (3.37%), KLBF (8.3%), TKIM (1.85%), and TOWR (4.23%). The expected return for the portfolio is 4.38% per month, with a portfolio risk borne by investors of 0.29% per month. The study suggests that constructing a portfolio with the identified stocks can yield favorable returns. However, it is crucial to regularly reassess and adjust portfolios due to changing market conditions and individual risk preferences. The implications highlight the benefits of using the single index model for portfolio formation. By considering the relationship between individual stocks and the LQ 45 Index, investors can make informed decisions to maximize returns while managing risk. These specific stocks can serve as a starting point for further research in portfolio management.

Keywords: *Optimal Portfolio, Single Index Model, LQ 45 Index*

1. INTRODUCTION

The increasing economic needs and consumptive attitudes of individuals necessitate the search for ways to augment income to meet daily expenses (Amiri et al., 2020). One method of achieving this is through investment activities, which can be conducted in the capital market. The capital market offers an avenue for individuals to invest in financial instruments with the objective of attaining future profits (Ocampo & Stiglitz, 2008).

Investment in various forms typically involves an element of uncertainty (Kasmir, 2015). Investors are uncertain about the exact amount of return or profit they will receive from their investments. Generally, individuals prefer to minimize risks while seeking returns (Amiri et al., 2020). However, investing inherently involves various unforeseen risks. One such risk is the impact of the COVID-19 pandemic on the capital market in Indonesia.

Coronavirus disease 2019 (COVID-19) is a novel viral disease that originated in Wuhan, China, and spread globally. It entered Indonesia in March 2020. Besides posing a threat to public health, COVID-19 also affected the capital market in Indonesia. The

announcement of the first positive COVID-19 case on March 2, 2020, triggered a significant decline in the Indonesian capital market. On that day, based on data from Yahoo Finance, the Jakarta Composite Index (JCI) closed at 5,361, reflecting a decline of 91 points or approximately 1.7% (Punagi & Fauzi, 2022). The JCI continued to decrease, reaching a low of 3,937 on March 24, 2020. By the end of 2020, the JCI closed at 5,979, recording a decline of 57.1 points or 0.95% (Permana et al., 2022). However, in 2021, the JCI exhibited signs of recovery since the initial outbreak of the COVID-19 pandemic.

The COVID-19 pandemic also had an impact on the LQ-45 Index. The LQ 45 index comprises 45 highly liquid stocks selected based on specific criteria, making it a low-risk investment option compared to other stocks due to the liquidity of the constituent companies (Fajarsari et al., 2020; Martini & Djohan, 2020). However, the LQ-45 index was not immune to unexpected risks, such as the COVID-19 pandemic.

The performance of the LQ-45 index declined at the onset of the COVID-19 pandemic. The following table presents the development of the LQ-45 Index for the period of 2020-2021:

Table 1. Development of the LQ 45 Index for 2020-2021

Month	Index Development (2020)	Index Development (2021)	Month	Index Development (2020)	Index Development (2021)
January	961.98	911.98	July	803.01	823.04
February	879.53	944.75	August	824,19	866,49
March	691,13	902.79	September	737,15	894.68
April	713,64	893.73	October	790.5	952.59
May	725,83	888.65	November	883.06	930.98
June	756.2	844.85	December	934.89	931.41

Source: Financial Services Authority (OJK)

Based on Table 1, it is evident that the performance of the LQ-45 index in the period of 2020-2021 has been volatile. Despite being an index with large market capitalization and high liquidity, the LQ-45 index was not immune to the impact of the COVID-19 pandemic, which resulted in a decline in the performance of LQ-45 shares and affected overall stock performance (Martini & Djohan, 2020).

However, data from PT. The Indonesian Central Securities Depository (KSEI) indicates a consistent increase in the number of investors year after year. In 2020, there was a significant increase of 56.21% compared to the previous year, and by the end of 2021, the number of investors experienced a rapid surge of 92.99%. This demonstrates a growing interest among the Indonesian population in investing in the capital market.

Every investment carries its own set of risks, particularly in the face of the COVID-19 pandemic, which has had a significant impact on the Indonesian economy. When making investment decisions under uncertain conditions, investors need to consider the expected returns and the associated risks. Portfolio formation offers a way to minimize investment risk.

An optimal portfolio is selected from a range of efficient portfolios. "A portfolio is considered efficient if it can deliver the expected rate of return with the same level of risk, or provide the lowest risk for the same expected rate of return" (Ekananda, 2019). The

primary challenge in portfolio formation is determining the most optimal portfolio that offers the best combination of return and risk.

Portfolio formation involves various calculations, including the Markowitz model and the single index model. The Markowitz model, introduced by Harry M Markowitz in 1950, allows investors to select portfolios based on their preferences regarding expected return and portfolio risk (Tandelilin, 2017). The Markowitz model focuses on portfolios consisting of risky assets and limits the investor's choices accordingly. On the other hand, the single index model, introduced by William Sharpe in 1963, simplifies the calculations from the Markowitz model and reduces the number of variables needed for portfolio analysis (Syam et al., 2021). The single index model also allows for the inclusion of risk-free assets in a portfolio. Due to its simplicity, many investors prefer the single index model as it is considered easier to use and represents a streamlined version of the Markowitz model (Ariasih & Mustanda, 2018).

2. RESEARCH METHODS

This study adopts a descriptive research design with a quantitative approach. The data collection technique employed is documentation, involving the analysis and collection of existing documents relevant to the research topic. The required data for this study include the monthly closing prices of shares and the closing prices of IHGS, obtained from www.yahoo.finance.co.id, as well as the BI Rate obtained from www.bi.go.id. The collected data for the formation of the optimal portfolio are then analyzed using the single index model method.

The population for this study comprises all company shares included in the LQ 45 index from March 2020 to December 2021. The sampling technique employed is non-probability sampling, specifically purposive sampling. The sample criteria include companies belonging to the LQ 45 index during the specified period (March 2020 to December 2021), and the required data being fully accessible and available for the same period. Based on these criteria, a sample of 36 company shares that meet the research criteria is obtained.

The research process utilizing the single index model method consists of the following stages:

1. Calculation of realized returns, expected returns, and risk (variance and standard deviation) for each individual stock. The formulas for these calculations are as follows:

Realized returns:

$$\text{Rit} = \frac{\text{Pit} - \text{Pit}-1}{\text{Pit}-1}$$

Expected returns:

$$\text{E(Rits)} = \frac{\sum_{j=t}^{t2} \text{Rit}}{t}$$

Risk (variance and standard deviation) of individual stocks:
Variance formula:

$$\sigma i2 = \frac{\sum_{i=1}^{n} (\text{Rit} - \text{E(Rit)})^2}{n}$$

Standard deviation formula:

$$\sigma i = \sqrt{\sigma i^2}$$

2. Calculation of realized returns, expected return, and market risk (variance and standard deviation) for the market. The formulas for these calculations are as follows:

Realized returns market:

$$\text{Rom} = \frac{\text{IHSGt} - \text{IHSGt}-1}{\text{IHSGt}-1}$$

Expected return market:

$$\text{E(Rits)} = \frac{\sum_{j=t}^{t2} \text{Rit}}{t}$$

Market risk (variance and standard deviation):
Variance formula:

$$\sigma m2 = \frac{\sum_{i=1}^{n} (\text{Rm} - \text{E(Rm)})^2}{n}$$

Standard deviation formula:

$$\sigma m = \sqrt{\sigma m^2}$$

3. Calculation of alpha, beta, and residual error variance for each individual stock. The formulas for these calculations are as follows:

Alpha formula:

$$\alpha i = \text{E(Rit)} - \beta i \, . \, \text{E(rmt)}$$

Beta formula:

$$\beta i = \frac{\sigma im}{\sigma m^2}$$

Residual error variance formula:
$\sigma 2ei = \sigma i2 - (\beta i2 \times \sigma m2)$

4. Calculation of the Excess Return to Beta (ERB) for individual stocks. The formula for calculating the ERB is as follows:

$$\text{ERB} = \frac{\text{E(Ri)} - \text{Rf}}{\beta i}$$

5. Calculation of the cut-off rate and determination of the cut-off point. The formulas for calculating Ai and Bi values are as follows:

$$\text{Ai} = \frac{[E(Ri) - (Rf)] \, . \, \beta i}{\sigma ei^2}$$

$$\text{Bi} = \frac{\beta i^2}{\sigma ei^2}$$

After calculating Ai and Bi values for each security, the cut-off rate (Ci) can be calculated using the formula:

$$Ci = \frac{\sigma M^2 \sum_{i=1}^{i} Ai}{1+ \sigma M^2 \sum_{i=1}^{i} Bi}$$

6. Determination of the stocks included in the optimal portfolio by comparing the Excess Return to Beta (ERB) value with the cut-off point value.

7. Calculation of the proportion of funds allocated to each individual stock in the optimal portfolio. The formula for calculating the proportion of funds is as follows:

$$Wi = \frac{Zi}{\sum_{j=1}^{k} Zj}$$

The value of Zi can be calculated using the formula:

$$Zi = \frac{\beta i}{\sigma ei^2} (ERBi - C^*)$$

8. Calculation of alpha and beta for the portfolio. The formulas for calculating alpha and beta portfolios are as follows:

Alpha portfolio:

$$\alpha p = \sum_{i=1}^{n} Wi.\alpha i$$

Beta portfolio:

$$\beta p = \sum_{i=1}^{n} Wi.\beta i$$

9. Calculation of the expected return and risk (variance and standard deviation) of the optimal portfolio. According to Hartono (2022), the formulas for calculating the expected return and risk (variance and standard deviation) of the optimal portfolio are as follows:

Expected return of the portfolio:

$$E(Rp) = \alpha p + \beta p \, . \, E(rm)$$

Variance of the portfolio:

$$\sigma p2 = \beta p2 \, . \, \sigma m2 + (2 \sum_{i-1}^{n} Wi. \sigma ei)$$

Standard deviation of the portfolio:

$$\sigma p = \sqrt{\sigma p^2}$$

3. RESULTS AND DISCUSSION

3.1. Analysis Result

1) Realized Return and Expected Return of Individual Shares

Table 2. Realized Return and Expected Return of Individual Shares Result

No	Stock code	Ri	E(Ri)	No	Stock code	Ri	E(Ri)
1	ACES	0.0567	0.0027	19	INKP	0.9088	0.0433
2	ADRO	1.0063	0.0479	20	INTP	0.0988	0.0047
3	AKRA	0.8273	0.0394	21	ITMG	1.1657	0.0555
4	ANTM	2.0080	0.0956	22	JPFA	0.7790	0.0371
5	ASII	0.4690	0.0223	23	JSMR	0.5349	0.0255
6	BBCA	0.3226	0.0154	24	KLBF	0.3410	0.0162
7	BBNI	0.7068	0.0337	25	MNCN	0.1187	0.0057
8	BBRI	0.3875	0.0185	26	PGAS	0.8184	0.0390
9	BBTN	1.0779	0.0513	27	PTBA	0.3313	0.0158
10	BMRI	0.4776	0.0227	28	PTPP	0.8901	0.0424
11	CPIN	0.2573	0.0123	29	PWON	0.5244	0.0250
12	ERAA	1.3568	0.0646	30	SMGR	0.0974	0.0046
13	EXCL	0.5873	0.0280	31	TBIG	1.3999	0.0667
14	GGRM	-0.1724	-0.0082	32	TKIM	0.9892	0.0471
15	HMSP	-0.3071	-0.0146	33	TLKM	0.3134	0.0149
16	ICBP	-0.1138	-0.0054	34	TOWR	0.6663	0.0317
17	INCO	0.9285	0.0442	35	UNVR	-0.5072	-0.0242
18	INDF	0.0431	0.0021	36	WIKA	0.4781	0.0228

The analysis of Table 2 reveals notable trends in the performance of LQ 45 company shares from March 2020 to December 2021. Among the observed stocks, Aneka Tambang Tbk (ANTM) stands out with the highest expected return of 9.56%, indicating a potential profit of 9.56% for every 100% invested in their shares. Conversely, Unilever Indonesia Tbk (UNVR) exhibits the smallest expected return of -2.42. Out of the 36 samples, 32 stocks exhibit positive realized returns and expected returns, while the remaining 4 stocks are excluded from further calculations since the optimal portfolio only considers stocks with positive expected returns.

2) Risk (Variance and Standard Deviation) of Individual Shares

Table 3. Risk (Variance and Standard Deviation) of Individual Shares

No	Stock code	Variant	Standard Deviation	No	Stock code	Variant	Standard Deviation
1	ACES	0.0069	0.0831	17	INTP	0.0131	0.1145
2	ADRO	0.0182	0.1348	18	ITMG	0.0259	0.1609
3	AKRA	0.0081	0.0898	19	JPFA	0.0180	0.1341
4	ANTM	0.0393	0.1983	20	JSMR	0.0106	0.1031
5	ASII	0.0087	0.0932	21	KLBF	0.0042	0.0646
6	BBCA	0.0040	0.0631	22	MNCN	0.0118	0.1085
7	BBNI	0.0133	0.1153	23	PGAS	0.0233	0.1525
8	BBRI	0.0075	0.0868	24	PTBA	0.0116	0.1078

9	BBTN	0.0378	0.1945	25	PTPP	0.0312	0.1766
10	BMRI	0.0066	0.0811	26	PWON	0.0111	0.1052
11	CPIN	0.0071	0.0843	27	SMGR	0.0145	0.1203
12	ERAA	0.0167	0.1294	28	TBIG	0.0201	0.1419
13	EXCL	0.0119	0.1090	29	TKIM	0.0345	0.1857
14	INCO	0.0129	0.1135	30	TLKM	0.0066	0.0811
15	INDF	0.0046	0.0679	31	TOWR	0.0156	0.1248
16	INKP	0.0236	0.1536	32	WIKA	0.0199	0.1412

Table 3 provides insights into the risk levels associated with various company shares. Aneka Tambang Tbk (ANTM) emerges as the most risky stock, with a variance value of 3.93% and a standard deviation of 19.83%. Conversely, Bank Central Asia Tbk (BBCA) exhibits the lowest risk, with a variance value of 0.4% and a standard deviation of 6.31%. These figures indicate that Aneka Tambang Tbk (ANTM) carries higher risk due to its larger variance and standard deviation, implying a greater deviation between the realized return and the expected return.

3) Realized return, Expected Return and Market Risk (Variance and Standard Deviation)

Table 4. Realized return, Expected Return and Market Risk (Variance and Standard Deviation)

Expected Return (E(Rm))	0.0185
Variant	0.0014
Standard Deviation	0.037

Referring to table 4, the expected market return is observed to be 1.85% per month, with a risk indicated by a variance of 0.14% and a standard deviation of 3.7%. These figures suggest a positive expected return, indicating that investing in the capital market can yield a favorable return for investors.

Moving on to calculating the BI Rate (Risk-Free), the calculations reveal that the average interest rate on risk-free assets, as set by Bank Indonesia, during the period from March 2020 to December 2021, is 0.32% per month. Consequently, investing in SBI offers investors an average return of 0.32% per month, with zero risk.

4) Alpha, Beta, and Individual Stock Residual Variance Error

Table 5. Alpha, Beta, and Individual Stock Residual Variance Errors

No	Stock code	αi	βi	$\sigma 2ei$	No	Stock code	αi	βi	$\sigma 2ei$
1	ACES	-0.0092	0.644	0.0063	17	INTP	-0.0195	1.3044	0.0108
2	ADRO	0.0387	0.5002	0.0178	18	ITMG	0.0203	1.8986	0.0209
3	AKRA	0.0078	1.7068	0.0041	19	JPFA	0.0209	0.8733	0.0169
4	ANTM	0.0321	3.4256	0.0232	20	JSMR	0.0022	1.2585	0.0085
5	ASII	0.0072	0.8187	0.0078	21	KLBF	0.011	0.2845	0.0041
6	BBCA	-0.0065	1.1786	0.0021	22	MNCN	-0.035	2.195	0.0052
7	BBNI	-0.0061	2.1471	0.007	23	PGAS	-0.0252	3.4648	0.0068
8	BBRI	-0.0118	1.6321	0.0039	24	PTBA	-0.008	1.285	0.0094
9	BBTN	-0.0085	3.2285	0.0235	25	PTPP	-0.0269	3.7411	0.012

10	BMRI	0.0001	1.2238	0.0045	26	PWON	-0.0116	1.9758	0.0057
11	CPIN	0.0018	0.5656	0.0067	27	SMGR	-0.0218	1.4264	0.0117
12	ERAA	0.0469	0.9571	0.0155	28	TBIG	0.0678	-0.0628	0.0201
13	EXCL	0.0002	1,498	0.0088	29	TKIM	-0.0048	2.8021	0.0237
14	INCO	0.0094	1.8812	0.008	30	TLKM	-0.0111	1.4037	0.0039
15	INDF	-0.003	0.2712	0.0045	31	TOWR	0.0137	0.9754	0.0143
16	INKP	0.0171	1.4144	0.0208	32	WIKA	-0.0245	2.5527	0.011

Referring to table 5, it is evident that Tower Bersama Infrastructure Tbk (TBIG) has the highest alpha value of 0.0678, while Media Nusantara Citra Tbk (MNCN) has the smallest alpha value of -0.0350. Positive alpha values indicate that these shares can contribute to the expected return of individual securities beyond market returns, whereas negative alpha values imply that these shares can lead to losses compared to the expected return of individual securities relative to market returns.

Moving on to beta values, PP (Persero) Tbk (PTPP) has the highest beta value of 3.7411, whereas Tower Bersama Infrastructure Tbk (TBIG) has the smallest beta value of -0.0628. Among the 32 candidate portfolios, 21 companies have a beta value greater than 1, signifying that these companies are sensitive to market return fluctuations. On the other hand, the remaining 11 stocks have a beta value less than 1, indicating that stock returns in these companies are less influenced by market returns.

Additionally, based on the table above, Timah Tbk (TKIM) exhibits the highest residual error variance or unsystematic risk of 2.37%, while Bank Central Asia Tbk (BBCA) has the lowest unsystematic risk of 0.21%. This suggests that the stock returns of Timah Tbk are more influenced by factors independent of market returns, whereas Bank Central Asia Tbk experiences a lower degree of unsystematic risk.

5) ERB value (excess return to beta) of individual stocks

Table 6. ERB (excess return to beta) of individual stocks

No	Stock code	ERB	17	Stock code	ERB
1	ACES	-0.0007	18	INTP	0.0012
2	ADRO	0.0895	19	ITMG	0.0276
3	AKRA	0.0212	20	JPFA	0.0389
4	ANTM	0.0270	21	JSMR	0.0177
5	ASII	0.0235	22	KLBF	0.0460
6	BBCA	0.0104	23	MNCN	0.0011
7	BBNI	0.0142	24	PGAS	0.0103
8	BBRI	0.0094	25	PTBA	0.0098
9	BBTN	0.0149	26	PTPP	0.0105
10	BMRI	0.0160	27	PWON	0.0111
11	CPIN	0.0161	28	SMGR	0.0011
12	ERAA	0.0642	29	TBIG	-1.0117
13	EXCL	0.0166	30	TKIM	0.0157
14	INCO	0.0218	31	TLKM	0.0084
15	INDF	-0.0040	32	TOWR	0.0293
16	INKP	0.0284	33	WIKA	0.0077

Referring to table 6, it is evident that Adaro Energy Tbk (ADRO) has the highest ERB value of 0.0895, indicating a favorable excess return to beta ratio. Conversely, Tower Bersama Infrastructure Tbk (TBIG) has the smallest ERB value of -1.0117, suggesting a negative excess return to beta ratio. It is worth noting that three stocks exhibit negative ERB values and, therefore, are excluded from the optimal portfolio and subsequent calculations.

6) The value of the cut-off rate (Ci) and determine the cut-off point (C*)

Table 7. Ai, Bi, cut-off rate (Ci), and cut-off point (C*)

No	Stock code	Ai	Mrs	ci	C*
1	ADRO	1.2558	14.0271	0.0017	0.0111
2	AKRA	15.2426	717,521	0.0105	0.0111
3	ANTM	13.6482	505,523	0.0111	0.0111
4	ASII	2.0232	86.2754	0.0025	0.0111
5	BBCA	6.9554	670.54	0.005	0.0111
6	BBNI	9.4121	662,081	0.0068	0.0111
7	BBRI	6.4531	687,665	0.0046	0.0111
8	BBTN	6.6183	443,362	0.0056	0.0111
9	BMRI	5.305	331,073	0.005	0.0111
10	CPIN	0.7726	47.9127	0.001	0.0111
11	ERAA	3.8008	59,174	0.0048	0.0111
12	EXCL	4.2307	255,21	0.0043	0.0111
13	INCO	9.6168	440,387	0.0082	0.0111
14	INKP	2.7238	95.9705	0.0033	0.0111
15	INTP	0.1901	157,998	0.0002	0.0111
16	ITMG	4.7514	172,239	0.0053	0.0111
17	JPFA	1.7499	45.0002	0.0023	0.0111
18	JSMR	3.3222	187,184	0.0036	0.0111
19	KLBF	0.9169	19.9123	0.0012	0.0111
20	MNCN	1,073	935,416	0.0006	0.0111
21	PGAS	18.3163	1770.96	0.0073	0.0111
22	PTBA	1.7364	176,483	0.0019	0.0111
23	PTPP	12.2725	1169.68	0.0065	0.0111
24	PWON	7.5508	683,258	0.0053	0.0111
25	SMGR	0.1839	174,361	0.0002	0.0111
26	TKIM	5.1948	331,029	0.0049	0.0111
27	TLKM	4.2732	508,89	0.0035	0.0111
28	TOWR	1.9541	66.6577	0.0025	0.0111
29	WIKA	4.5636	593,457	0.0035	0.0111

Referring to table 7, it is observed that the highest cut-off rate (Ci) or cut-off point (C*) value is associated with Aneka Tambang Tbk (ANTM) with a value of 0.0111. The determination of the optimal portfolio involves comparing the excess return to beta (ERB) values with the cut-off point value (C*) as a criterion.

Table 8. comparison of ERB values with cut-off point (C*)

Stock code	ERB		C*
ADRO	0.0895	>	0.0111
AKRA	0.0212	>	0.0111
ANTM	0.0270	>	0.0111
ASII	0.0235	>	0.0111
BBCA	0.0104	<	0.0111
BBNI	0.0142	>	0.0111
BBRI	0.0094	<	0.0111
BBTN	0.0149	>	0.0111
BMRI	0.0160	>	0.0111
CPIN	0.0161	>	0.0111
ERAA	0.0642	>	0.0111
EXCL	0.0166	>	0.0111
INCO	0.0218	>	0.0111
INKP	0.0284	>	0.0111
INTP	0.0012	<	0.0111
ITMG	0.0276	>	0.0111
JPFA	0.0389	>	0.0111
JSMR	0.0177	>	0.0111
KLBF	0.0460	>	0.0111
MNCN	0.0011	<	0.0111
PGAS	0.0103	<	0.0111
PTBA	0.0098	<	0.0111
PTPP	0.0105	<	0.0111
PWON	0.0111	<	0.0111
SMGR	0.0011	<	0.0111
TKIM	0.0157	>	0.0111
TLKM	0.0084	<	0.0111
TOWR	0.0293	>	0.0111
WIKA	0.0077	<	0.0111

Based on table 8, it can be concluded that 18 stocks have an ERB value exceeding the cut-off point value, indicating their inclusion in the optimal portfolio. These 18 shares consist of Adaro Energy Tbk (ADRO), AKR Corporindo Tbk (AKRA), Aneka Tambang Tbk (ANTM), Astra International Tbk (ASII), Bank Negara Indonesia (Persero) Tbk (BBNI), State Savings Bank (Persero) Tbk (BBTN), Bank Mandiri (Persero) Tbk (BMRI), Charoen Pokphand Indonesia Tbk (CPIN), Erajaya Swasembada Tbk (ERAA), XL Axiata Tbk (EXCL), Vale Indonesia Tbk (INCO), Indah Kiat Pulp & Paper Tbk (INKP), Indo Tambangraya Megah Tbk (ITMG), Japfa Comfeed Indonesia Tbk (JPFA), Jasa Marga (Persero) Tbk (JSMR), Kalbe Farma Tbk (KLBF), Timah Tbk (TKIM), and Sarana Menara Nusantara Tbk (TOWR).

The proportion of funds allocated to each share included in the optimal portfolio is presented in Table 9, along with the corresponding weighted scale.

Table 9. Proportion of funds and the weighted scale of each share

Stock code	Zi	Wi	Wi (%)
ADRO	2.2004	0.0746	7,46
AKRA	4.2814	0.1451	14.51
ANTM	2.3522	0.0797	7.97
ASII	1.3058	0.0442	4,42
BBNI	0.9735	0.0330	3.30
BBTN	0.5313	0.0180	1.80
BMRI	1.3432	0.0455	4.55
CPIN	0.4292	0.0145	1.45
ERAA	3.2876	0.1114	11,14
EXCL	0.9401	0.0319	3,19
INCO	2.5232	0.0855	8.55
INKP	1.1754	0.0398	3.98
ITMG	1.4994	0.0508	5.08
JPFA	1.4340	0.0486	4.86
JSMR	0.9950	0.0337	3.37
KLBF	2.4488	0.0830	8.30
TKIM	0.5474	0.0185	1.85
TOWR	1.2476	0.0423	4,23
	29.5153	1,000	100

Based on the table above, we can observe the following percentages for the respective companies: Japfa Comfeed Indonesia Tbk (JPFA) with 0.0486 or 4.86%, Jasa Marga (Persero) Tbk (JSMR) with 0.0337 or 3.37%, Kalbe Farma Tbk (KLBF) with 0.0830 or 8.3%, Timah Tbk (TKIM) with 0.0185 or 1.85%, and Sarana Menara Nusantara Tbk (TOWR) with 0.0423 or 4.23%. Among these, AKR Corporindo Tbk (AKRA) has the highest proportion of funds, accounting for 0.1451 or 14.51% of the total funds to be invested. This means that investing in AKRA requires allocating 14.51% of the total investment funds. On the other hand, the shares of Charoen Pokphand Indonesia Tbk (CPIN) have the smallest proportion of funds, representing only 0.0145 or 1.45% of the total funds allocated for investment.

7) Calculating Expected Return and Optimal Portfolio Risk

Table 10. Expected Return and Optimal Portfolio Risk

Stock code	α_p	β_p	σ^2_{ep}
ADRO	0.0029	0.0373	0.0013
AKRA	0.0011	0.2476	0.0006
ANTM	0.0026	0.2730	0.0018
ASII	0.0003	0.0362	0.0003
BBNI	-0.0002	0.0708	0.0002
BBTN	-0.0002	0.0581	0.0004
BMRI	0.0000	0.0557	0.0002
CPIN	0.0000	0.0082	0.0001
ERAA	0.0052	0.1066	0.0017

EXCL	0.0000	0.0477	0.0003
INCO	0.0008	0.1608	0.0007
INKP	0.0007	0.0563	0.0008
ITMG	0.0010	0.0964	0.0011
JPFA	0.0010	0.0424	0.0008
JSMR	0.0001	0.0424	0.0003
KLBF	0.0009	0.0236	0.0003
TKIM	-0.0001	0.0520	0.0004
TOWR	0.0006	0.0412	0.0006
Total	0.0168	1.4565	0.0121
E(Rp)	0.0438		
σ2p	0.0029		

Based on table 10, the optimal portfolio demonstrates an expected return of 4.38% with a portfolio risk of 0.29%. This expected return is higher than the market's expected return (IHSG), which can influence investors' decisions to invest in LQ 45 stocks. Additionally, in this study, market returns surpass risk-free returns, indicating that stock investments offer a higher rate of return compared to risk-free assets.

Furthermore, when comparing the expected return of individual stocks to the portfolio's expected return, there are several companies (ADRO, ANTM, BBTN, ERAA, INCO, ITMG, and TKIM) that exhibit a higher individual expected return with greater individual risk. However, through diversification and the formation of an optimal portfolio, the portfolio's risk becomes smaller than that of individual stocks. This aligns with the findings of Sukartini (2016), which highlight that constructing a portfolio allows for risk reduction without compromising expected profits.

The findings of this study have several implications for investors and market participants. Firstly, the identification of specific stocks with favorable expected returns within the LQ 45 market provides valuable investment opportunities. Investors can use this information to make informed decisions and potentially achieve higher returns by investing in these selected stocks.

Secondly, the formation of an optimal portfolio, as suggested by the study, has important implications for portfolio optimization. By diversifying their investments across multiple stocks, investors can reduce the overall risk of their portfolio. This diversification helps to mitigate the impact of individual stock risks and potentially enhance the risk-return profile of their investment portfolio.

Moreover, the study highlights that the expected return of the optimal portfolio exceeds the market's expected return (IHSG). This implies that investing in the selected stocks can potentially outperform the broader market. This finding can be of interest to investors seeking higher returns and looking to capitalize on the identified investment opportunities.

However, it is important to acknowledge the limitations of this study. Firstly, the findings are based on historical data from a specific period, and market conditions and stock performances may have changed since then. Therefore, the accuracy and applicability of the results in the current market environment may be limited.

Additionally, the study relies on certain assumptions and employs specific models, such as the CAPM, to estimate expected returns and risk. These models have their own limitations and may not fully capture all factors influencing stock performance. It is

crucial for investors to be aware of these limitations and consider them when interpreting and applying the study's findings.

Lastly, the findings are specific to the LQ 45 market and may not be generalizable to other markets or investment contexts. Different markets have unique characteristics and dynamics that may impact the performance and behavior of stocks. Therefore, caution should be exercised when applying these findings to other investment scenarios.

4. CONCLUSION

The data analysis conducted using the single index model method on LQ 45 index stocks for the period of March 2020 to December 2021 resulted in the identification of 18 optimal stocks out of the 36 company shares sampled. These stocks form the optimal portfolio, with each stock allocated a proportion of funds. The stocks included in the optimal portfolio are Adaro Energy Tbk (ADRO) with a proportion of 7.46%, AKR Corporindo Tbk (AKRA) with 14.51%, Aneka Tambang Tbk (ANTM) with 7.97%, Astra International Tbk (ASII) with 4.42%, Bank Negara Indonesia (Persero) Tbk (BBNI) with 3.3%, Bank State Savings (Persero) Tbk (BBTN) with 1.8%, Bank Mandiri (Persero) Tbk (BMRI) with 4.55%, Charoen Pokphand Indonesia Tbk (CPIN) with 1.45%, Erajaya Swasembada Tbk (ERAA) with 11.14%, XL Axiata Tbk (EXCL) with 3.19%, Vale Indonesia Tbk (INCO) with 8.55%, Indah Kiat Pulp & Paper Tbk (INKP) with 3.98%, Indo Tambangraya Megah Tbk (ITMG) with 5.08%, Japfa Comfeed Indonesia Tbk (JPFA) with 4.86%, Jasa Marga (Persero) Tbk (JSMR) with 3.37%, Kalbe Farma Tbk (KLBF) with 8.3%, Timah Tbk (TKIM) with 1.85%, and Sarana Menara Nusantara Tbk (TOWR) with 4.23%. The expected return for the portfolio is 4.38% per month, with a portfolio risk of 0.29% per month.

However, it is crucial to note that investment decisions should not solely rely on historical data. Other factors such as individual risk tolerance, investment goals, and current market conditions should also be considered. Investors are advised to regularly reassess their portfolios and adjust them accordingly to adapt to changing market dynamics and personal risk preferences. The expected return of the optimal portfolio is 4.38% per month, with a portfolio risk of 0.29% per month. These figures provide an indication of potential returns and risks associated with the identified portfolio. Nonetheless, it is essential for investors to exercise due diligence and consider their unique circumstances before making any investment decisions.

REFERENCES

Amiri, M. M., Naoui, K., Derbali, A., & Sassi, M. Ben. (2020). Investor sentiment and the risk-return tradeoff. *International Journal of Financial Engineering*, *7*(04), 2050043.

Ariasih, N., & Mustanda, I. K. (2018). Pembentukan Portofolio Optimal Menggunakan Model Indeks Tunggal Pada Saham Indeks LQ45. *E-Jurnal Manajemen Unud*, *7*(8), 1–30.

Ekananda, M. (2019). *Manajemen Investasi*. Erlangga.

Fajarsari, H., Djohan, H. A., Setiawan, A., & Martini, M. (2020). Evaluasi Sistem Informasi Akuntansi atas Penjualan Kredit PT. XYZ (Dealer Resmi Mitsubishi

Cabang Semarang). *Jurnal AkunStie (JAS)*, *6*(2), 111–124.
Hartono, J. (2022). *Portofolio Dan Analisis Investasi: Pendekatan Modul (Edisi 2)*. Penerbit Andi.
Kasmir. (2015). *Studi kelayakan Bisnis*. Prenada Media.
Martini, M., & Djohan, H. A. (2020). Analisis kinerja saham LQ45 sebelum dan selama pandemi coronavirus disease (Covid-19) di Indonesia. *Jurnal Interprof*, *6*(2), 156–167.
Ocampo, J. A., & Stiglitz, J. E. (2008). *Capital market liberalization and development*. OUP Oxford.
Permana, A., Nurpiana, I., Kosim, B., & Hidayat, R. (2022). Perbedaan Kinerja Saham Indonesia Sebelum dan Selama Masa Pandemi COVID-19. *MOTIVASI: Jurnal Manajemen Dan Bisnis*, *7*(1), 31–41.
Punagi, M., & Fauzi, A. (2022). Analysis Of Factors Affecting Of Return On Assets Of Banking Companies Before And During Covid-19 Pandemic. *Journal Of Management, Accounting, General Finance And International Economic Issues (MARGINAL)*, *2*(1), 86–99. https://doi.org/https://doi.org/10.55047/marginal.v2i1.357
Sukartini, M. (2016). *Portofolio Optimal Saham Syariah dengan Single Index Model Pada Jakarta Islamic Index (JII) Tahun 2011-2015*. UII.
Syam, S., Rauf, A., & Musa, C. I. (2021). Analisis Pembentukan Portofolio Optimal Dengan Single Index Model Untuk Proyeksi Investasi Pada Saham Indeks LQ45 Di Bursa Efek Indonesia. *Jurnal Ilmu Manajemen Retail Universitas Muhammadiyah Sukabumi*, *2*(2), 109–121.
Tandelilin, E. (2017). *Portfolio & Investment Management Capital Market*. Kanisius.

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