Optimal Portfolio Analysis of LQ-45 Stocks Based on Capital Asset Pricing Model

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Article Info	ABSTRACT
	Using the Capital Asset Pricing Model (CAPM) to analyse the best possible portfolio structure for LQ-45 equities is an intriguing and intricate area of financial management. The purpose of this study is to determine the systematic risk and expected return of each LQ-45 stock, as well as to assess how well these stocks work together to create an ideal portfolio. By using CAPM and Modern Portfolio Theory (MPT), this study can provide a comprehensive framework to understand the risk-return dynamics of stock investment. Despite the limitations of CAPM, this study shows that CAPM remains an important tool in investment analysis. Recommendations for future research are to conduct further empirical analysis to test the effectiveness of CAPM in various market conditions and develop models that combine CAPM with additional factors to improve return prediction.

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1. INTRODUCTION

The Capital Asset Pricing Model (CAPM) analysis of the optimal portfolio structure for LQ-45 stocks is a significant area of study in financial management. The LQ-45 index, which consists of the 45 most liquid stocks on the Indonesia Stock Exchange, serves as a benchmark for investors looking to maximise their investment portfolio. The CAPM provides a theoretical framework for understanding the relationship between projected returns and systemic risk, which is necessary for making informed investment decisions.

The Capital Asset Pricing Model (CAPM) states that the expected return of a stock is equal to its risk-free rate plus a risk premium proportional to its beta, which measures the stock's sensitivity to market fluctuations. Using this relationship, investors may assess the risk-return trade-off of each LQ-45 index stock and build a portfolio that maximises returns for a given risk tolerance [1]. Research has shown that portfolios constructed using the CAPM can yield different performance metrics compared to portfolios constructed using alternative models, such as the Single Index Model, which highlights the importance of selecting an appropriate model for portfolio optimization [1].

Additionally, using CAPM in conjunction with Markowitz's Modern Portfolio Theory (MPT) makes it easier to determine the best weights for each security in a portfolio. By using this strategy, investors can create a diversified portfolio that maximises projected returns while lowering

risk [2]. Research has shown that the integration of CAPM with MPT can result in better portfolio performance, as it allows for systematic evaluation of risk and return across different stocks in the LQ-45 index [3].

The best stock combination that produces the highest Sharpe ratio—a metric that gauges a portfolio's risk-adjusted return—has been found through empirical examination of Applying the Capital Asset Pricing Model for LQ-45 equities. Regression analysis provides a numerical basis for investment choices. is frequently used in this research to estimate beta values and evaluate the predicted returns of the chosen stocks [3]. These results imply that although the CAPM is an excellent tool for portfolio optimisation, its efficacy may be impacted by external events and market situations, necessitating a rigors assessment of its underlying assumptions [4].

But it's critical to understand the CAPM's limits, particularly in light of the market's dynamic changes and outside uncertainties. Numerous studies have demonstrated that adding more risk factors to the classic CAPM can increase its predictive capacity and yield more precise estimates of expected returns [4]. This demonstrates how portfolio optimisation methods are constantly evolving and how investors must modify their plans in response to shifting market conditions.

In conclusion, the Capital Asset Pricing Model research of the optimal portfolio building for LQ-45 equities provides a comprehensive framework for understanding the risk-return dynamics of stock investments. By combining CAPM with Modern Portfolio Theory, investors can effectively optimise their portfolios to achieve desired financial outcomes. Despite these limitations, the Capital Asset Pricing Model (CAPM) remains an essential tool in the field of investment analysis, assisting investors in making educated decisions by systematically assessing risk.

The goal of this research is to identify the optimal portfolio of LQ-45 stocks using the Capital Asset Pricing Model (CAPM). The CAPM will be used in this study to calculate each LQ-45 stock's expected return and systematic risk (beta). Additionally, it will evaluate how these stocks could be paired to form the perfect portfolio. Stocks that provide the highest return for a given level of risk or the lowest risk for an expected level of return make up an optimal portfolio in this sense.

2. LITERATURE REVIEW

2.1 Investment

An investment is a commitment of money or other resources today in the hope of earning a return in the future. For example, a person buys a stock with the expectation of future earnings from the stock at the expense of time and money that he or she keeps in line with the risks of the investment.

2.2 Shares

Securities known as shares are available for purchase or sale on the market by both individuals and institutions. A person or business entity's ownership or involvement in a company or limited liability company is shown by their shares, which are equity instruments.

2.3 Capital Asset Pricing Model (CAPM)

CAPM is the result of a study by William F. Sharpe in 1964 and separately by John Lintner in 1965. CAPM is the name given to a position of principles that explain how investors behave in the market. These principles refer to explicit statements about the equilibrium price, profit, and risk for a security. The CAPM formula according to [5] is:

$$E(R_i) = Rf + \beta_i\ [E(R_m) - Rf]$$

Description:
$E(R_i)$ = *Expected return of* the stock
Rf = *Risk free rate* / Risk free rate of return
β_i = Systematic risk (beta)
$E(R_m)$ = Market average rate of return

2.4 Investment Return

A return is the result of an investment. Expected returns, which have not yet occurred but are predicted to do so in the future, are one type of return, or realised returns, which have already happened. The

following make up the rate of return that is used to predict the return:

2.4.1 Individual stock rate of return (R_i)

Realised returns, often known as individual stock returns, are returns that have already taken place. Historical data is used to compute the realised return. By dividing the difference between the current stock price and the price of the previous period by the price of the previous period, the realised return is determined. According to [5], the following formula is used to determine the rate of return on individual shares:

$$R_i = \frac{P_t - P_{t-1}}{P_{t-1}}$$

Description:

R_i = Rate of return of stock i in period t
P_t = Share price i in period t
P_{t-1} = Price of stock i at t_{-1}

2.4.2 Market rate of return (Rm)

The market rate of return is the rate of return that is established by the changes in the stock price index. The market rate of return is calculated using the following method, according [5]:

$$R_m = \frac{IHSG_t - IHSG_{t-1}}{IHSG_{t-1}}$$

Description:

R_m = Market rate of return
JCI_t = Stock price index period t
JCI_{t-1} = Stock price index period t_{-1}

2.5 Beta Coefficient

The volatility, or fluctuation of returns over time, of a securities or portfolio in relation to the market return is measured by beta.

$$\beta_i = \sum_{t=1}^{N} \frac{(R_i - \bar{R}_i)(R_m - \bar{R}_m)}{(R_m - \bar{R}_m)^2}$$

Description:

β_i = Beta of security i
R_i = Realized *return of* i-th security
$\bar{R}_i$ = Average realized *return of* the i-th security
R_m = Market *return*
$\overline{R_m}$ = Average market *return*
N = Number of data

2.6 Investment Risk

Risk is defined as the variability of *returns* relative to expected *returns*. Standard deviation is a measurement used to quantify risk. Risk can also be expressed as the square of the standard deviation or variance.

Sharpe defines *systematic risk* as a measure of asset variability that can be symbolized by a common factor. Systematic risk is the result of general market and economic conditions that are not *diversifiable* while a diversifiable measure of asset variability is *nonsystematic risk*.

The rate of return on financial assets that are not at risk is known as the risk-free rate of return. The benchmark interest rate that Bank Indonesia issues, specifically the Bank Indonesia Certificate (SBI), serves as the foundation of measurement for this rate of return. The risk-free rate of return is computed using the following formula:

$$Rf = \frac{\sum_1^n = tingkat\ suku\ bunga\ SBI}{n}$$

2.7 Markowitz Model Optimal Portfolio

The foundation of contemporary portfolio theory is Harry Markowitz's 1952 introduction of the Markowitz Optimal Portfolio Model. By weighing risk, which is measured using a mean-variance framework, against predicted returns, the model offers a methodical approach to portfolio selection. The model's primary goal is to create an efficient frontier, which is a representation of the collection of ideal portfolios that provide the highest expected return at a specific risk level or the lowest risk at a specific expected return level.

The optimal portfolio based on the Markowitz model uses the concept of minimizing the objective function, namely the portfolio risk function based on the Markowitz method.

Minimum:

$$var(P) = \sum_{i=1}^{n} w_i^2 \cdot \sigma_i^2 + \sum_{i=1}^{n}\sum_{j=1}^{n} w_i \cdot w_j \cdot cov(r_i, r_j)$$

With constraints

$$\sum_{i=1}^{n} w_i = 1$$

$$\sum_{i=1}^{n} w_i \cdot r_i = r_P$$

$$w_i \geq 0, \text{ for } i = 1 \text{ to } n$$

3. METHODS

Using the Capital Asset Pricing Model (CAPM) model, this study uses a quantitative technique to evaluate historical data on LQ-45 stocks in order to characterise the relationship between risk (beta) and projected return. Because it seeks to clarify and give a summary of how CAPM is used to identify the ideal portfolio, this study is also descriptive.

3.1 Data Used

In this research, data is collected through official sources such as the Indonesia Stock Exchange (IDX), Yahoo Finance, Bloomberg, or other financial institutions. This data will be processed to calculate daily stock returns, market returns, and systematic risk (beta) of each stock. The types of data required include:

a. Historical stock prices of the stocks in the LQ-45.
b. Market returns are calculated based on the composite stock price index (JCI).
c. Risk-free return taken from the BI Rate.

3.2 Data Analysis Technique

The steps used in this research are:

a. Collecting data on stocks included in the LQ45 Stock Index in the period July 2024 - September 2024, namely *closing price* data at the end of the month.
b. Calculate the profit rate of each stock.

$$R_i = \frac{P_t - P_{t-1}}{P_{t-1}}$$

c. Calculate the market rate of return.

$$R_m = \frac{IHSG_t - IHSG_{t-1}}{IHSG_{t-1}}$$

d. Calculating the Beta of the stock.

$$\beta = \sum_{t-1}^{N} \frac{(R_i - \bar{R}_i)(R_m - \bar{R}_m)}{(R_m - \bar{R}_m)}$$

e. Calculating the risk-free rate of return (Rf) through the monthly BI Rate.

f. Calculating the expected rate of return according to CAPM.

$$E(R_i) = R_f + \beta_i [E(R_m) - R_f]$$

3.3 Conceptual Framework
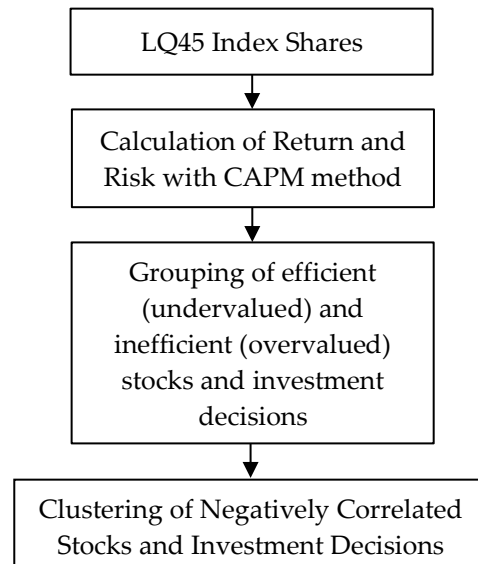
Figure 1. Conceptual Framework

This conceptual framework describes the investment decision-making process based on CAPM and correlation analysis. It starts with selecting stocks from the LQ45 Index, then calculating return and risk to assess whether the stocks are undervalued or overvalued. After that, negatively correlated stocks are grouped to maximize the benefits of risk diversification in the investment portfolio.

4. RESULTS AND DISCUSSION

4.1 Calculating Individual Stock Return

The amount of profit that investors really make when they invest in stocks is known as the individual stock rate of return. The rate of return for each individual stock is calculated by dividing the closing price of the current month (month t) by the closing price of the preceding month (t-1). Instead of July 2024-September 2024, the individual stock rate of return (R_i) for 45 LQ45 index stocks was calculated as follows:

Table 1. Calculation Results of Stock *Return* (R_i) July 2024 - September 2024

No.	Code	Issuer Name	Ri

1	ACES	Ace Hardware Indonesia Tbk	0.09023164336
2	ADRO	Adaro Energy Tbk	0.08790739061
3	AKRA	AKR Corporindo Tbk	0.01179398876
4	AMMN	Amman Mineral International	-0.1142368659
5	AMRT	Sumber Alfaria Trijaya Tbk	0.05539096649
6	ANTM	Aneka Tambang Tbk	0.06089121099
7	ARTO	Bank Jago Tbk	0.0628403665
8	ASII	Astra International Tbk	0.0353522765
9	BBCA	Bank Central Asia Tbk	0.002433090024
10	BBNI	Bank Negara Indonesia Tbk	0.03822937626
11	BBRI	Bank Rakyat Indonesia Tbk	0.03197438723
12	BBTN	Bank Tabungan Negara Tbk	0.05030607017
13	BMRI	Bank Mandiri Tbk	0.04260553728
14	BRIS	Bank Syariah Indonesia Tbk	0.07753991292
15	BRPT	Barito Pacific Tbk	-0.01625535836
16	OPEN	Bukalapak.com Tbk	0.01285672896
17	CPIN	Charoen Pokphand Indonesia Tbk	-0.05138913501
18	ESSA	Elnusa Tbk	0.026952916
19	EXCL	XL Axiata Tbk	0.02727779959
20	GGRM	Gudang Garam Tbk	0.005337453047
21	GOTO	GoTo Gojek Tokopedia Tbk	0.1251814224
22	HRUM	Harum Energy Tbk	0.07795058322
23	ICBP	Indofood CBP Sukses Makmur Tbk	0.06220866175
24	INCO	Vale Indonesia Tbk	0.04461898396
25	INDF	Indofood Sukses Makmur Tbk	0.07378221362
26	INKP	Indah Kiat Pulp & Paper Tbk	0.0189805574
27	INTP	Indocement Tunggal Prakarsa Tbk	-0.03138430785
28	ISAT	Indosat Tbk	-0.004946814284
29	ITMG	Indo Tambangraya Megah Tbk	0.003811446648
30	JSMR	Jasa Marga Tbk	-0.05727035447
31	KLBF	Kalbe Farma Tbk	0.04159519726
32	MAPI	Mitra Adiperkasa Tbk	0.1041460039
33	MBMA	Marga Abhinaya Tbk	-0.005996944232
34	MDKA	Merdeka Copper Gold Tbk	0.05594598319
35	MEDC	Medco Energi Internasional Tbk	-0.02063714838
36	MTEL	Smartfren Telecom Tbk	-0.04037972629
37	PGAS	Perusahaan Gas Negara Tbk	-0.05284090909
38	PGEO	PGE Geothermal Tbk	-0.0690055955
39	PTBA	Bukit Asam Tbk	0.07343092231
40	SIDO	Sido Muncul Tbk	-0.04103970742
41	SMGR	Semen Indonesia Tbk	-0.01464369766
42	TLKM	Telekomunikasi Indonesia Tbk	0.0198120915
43	TOWR	Tower Bersama Infrastructure Tbk	0.03713328061
44	UNTR	United Tractors Tbk	0.02607323504

| 45 | UNVR | Unilever Indonesia Tbk | -0.0480519246 |

4.2 Market Return (Rm) Analysis Result

Stock In this study, market returns are calculated using prices from the Composite Stock Price Index (CSPI) as the data source. The market return is the rate of return that is established by the stock index's evolution. The market return acts as a standard for the average rate of return of all shares of companies listed on the IDX, whereas the JCI is believed to be the most representative of all stock prices in the capital market. Market return is necessary in order to calculate beta. The difference between the closing price of the JCI monthly for the current month (month t) and the closing price of the previous month (t_{-1}) is divided by the closing price of the previous month (t_{-1}) to determine the market return.

Table 2. *Return Market* **(Rm) Results July 2024 - September 2024**

No.	Code	Issuer Name	Var (Rm)
1	ACES	Ace Hardware Indonesia Tbk	0.0007827684134
2	ADRO	Adaro Energy Tbk	0.0007827684134
3	AKRA	AKR Corporindo Tbk	0.0007827684134
4	AMMN	Amman Mineral International	0.0007827684134
5	AMRT	Sumber Alfaria Trijaya Tbk	0.0007827684134
6	ANTM	Aneka Tambang Tbk	0.0007827684134
7	ARTO	Bank Jago Tbk	0.0007827684134
8	ASII	Astra International Tbk	0.0007827684134
9	BBCA	Bank Central Asia Tbk	0.0007827684134
10	BBNI	Bank Negara Indonesia Tbk	0.0007827684134
11	BBRI	Bank Rakyat Indonesia Tbk	0.0007827684134
12	BBTN	Bank Tabungan Negara Tbk	0.0007827684134
13	BMRI	Bank Mandiri Tbk	0.0007827684134
14	BRIS	Bank Syariah Indonesia Tbk	0.0007827684134
15	BRPT	Barito Pacific Tbk	0.0007827684134
16	OPEN	Bukalapak.com Tbk	0.0007827684134
17	CPIN	Charoen Pokphand Indonesia Tbk	0.0007827684134
18	ESSA	Elnusa Tbk	0.0007827684134
19	EXCL	XL Axiata Tbk	0.0007827684134
20	GGRM	Gudang Garam Tbk	0.0007827684134
21	GOTO	GoTo Gojek Tokopedia Tbk	0.0007827684134
22	HRUM	Harum Energy Tbk	0.0007827684134
23	ICBP	Indofood CBP Sukses Makmur Tbk	0.0007827684134
24	INCO	Vale Indonesia Tbk	0.0007827684134
25	INDF	Indofood Sukses Makmur Tbk	0.0007827684134
26	INKP	Indah Kiat Pulp & Paper Tbk	0.0007827684134
27	INTP	Indocement Tunggal Prakarsa Tbk	0.0007827684134
28	ISAT	Indosat Tbk	0.0007827684134
29	ITMG	Indo Tambangraya Megah Tbk	0.0007827684134
30	JSMR	Jasa Marga Tbk	0.0007827684134
31	KLBF	Kalbe Farma Tbk	0.0007827684134
32	MAPI	Mitra Adiperkasa Tbk	0.0007827684134
33	MBMA	Marga Abhinaya Tbk	0.0007827684134
34	MDKA	Merdeka Copper Gold Tbk	0.0007827684134

No.	Code	Issuer Name	Var (Rm)
35	MEDC	Medco Energi Internasional Tbk	0.0007827684134
36	MTEL	Smartfren Telecom Tbk	0.0007827684134
37	PGAS	Perusahaan Gas Negara Tbk	0.0007827684134
38	PGEO	PGE Geothermal Tbk	0.0007827684134
39	PTBA	Bukit Asam Tbk	0.0007827684134
40	SIDO	Sido Muncul Tbk	0.0007827684134
41	SMGR	Semen Indonesia Tbk	0.0007827684134
42	TLKM	Telekomunikasi Indonesia Tbk	0.0007827684134
43	TOWR	Tower Bersama Infrastructure Tbk	0.0007827684134
44	UNTR	United Tractors Tbk	0.0007827684134
45	UNVR	Unilever Indonesia Tbk	0.0007827684134

4.3 Risk Free Rate of Return (Rf) Analysis Results

The rate of return on risk-free investments calculated using the BI benchmark interest rate, often known as the BI rate, is known as the risk-free rate (Rf). Monthly benchmark interest rate, or BI rate, data is used.

Table 3. *Risk Free Rate* (Rf) July 2024 - September 2024

No.	Code	Issuer Name	Rf
1	ACES	Ace Hardware Indonesia Tbk	0.06125
2	ADRO	Adaro Energy Tbk	0.06125
3	AKRA	AKR Corporindo Tbk	0.06125
4	AMMN	Amman Mineral International	0.06125
5	AMRT	Sumber Alfaria Trijaya Tbk	0.06125
6	ANTM	Aneka Tambang Tbk	0.06125
7	ARTO	Bank Jago Tbk	0.06125
8	ASII	Astra International Tbk	0.06125
9	BBCA	Bank Central Asia Tbk	0.06125
10	BBNI	Bank Negara Indonesia Tbk	0.06125
11	BBRI	Bank Rakyat Indonesia Tbk	0.06125
12	BBTN	Bank Tabungan Negara Tbk	0.06125
13	BMRI	Bank Mandiri Tbk	0.06125
14	BRIS	Bank Syariah Indonesia Tbk	0.06125
15	BRPT	Barito Pacific Tbk	0.06125
16	OPEN	Bukalapak.com Tbk	0.06125
17	CPIN	Charoen Pokphand Indonesia Tbk	0.06125
18	ESSA	Elnusa Tbk	0.06125
19	EXCL	XL Axiata Tbk	0.06125
20	GGRM	Gudang Garam Tbk	0.06125
21	GOTO	GoTo Gojek Tokopedia Tbk	0.06125
22	HRUM	Harum Energy Tbk	0.06125
23	ICBP	Indofood CBP Sukses Makmur Tbk	0.06125
24	INCO	Vale Indonesia Tbk	0.06125
25	INDF	Indofood Sukses Makmur Tbk	0.06125
26	INKP	Indah Kiat Pulp & Paper Tbk	0.06125
27	INTP	Indocement Tunggal Prakarsa Tbk	0.06125
28	ISAT	Indosat Tbk	0.06125

No.	Code	Issuer Name	Rf
29	ITMG	Indo Tambangraya Megah Tbk	0.06125
30	JSMR	Jasa Marga Tbk	0.06125
31	KLBF	Kalbe Farma Tbk	0.06125
32	MAPI	Mitra Adiperkasa Tbk	0.06125
33	MBMA	Marga Abhinaya Tbk	0.06125
34	MDKA	Merdeka Copper Gold Tbk	0.06125
35	MEDC	Medco Energi Internasional Tbk	0.06125
36	MTEL	Smartfren Telecom Tbk	0.06125
37	PGAS	Perusahaan Gas Negara Tbk	0.06125
38	PGEO	PGE Geothermal Tbk	0.06125
39	PTBA	Bukit Asam Tbk	0.06125
40	SIDO	Sido Muncul Tbk	0.06125
41	SMGR	Semen Indonesia Tbk	0.06125
42	TLKM	Telekomunikasi Indonesia Tbk	0.06125
43	TOWR	Tower Bersama Infrastructure Tbk	0.06125
44	UNTR	United Tractors Tbk	0.06125
45	UNVR	Unilever Indonesia Tbk	0.06125

4.4 Results of Analysis of Systematic Risk Level (β_i) of Each Stock

Beta (β) is the term used to describe the systematic risk associated with a stock. The relationship between a stock's rate of return and the market rate of return is demonstrated by beta, which is the quotient of stock covariance and stock return variance. Investors should consider a company's beta value since it affects both the amount of the predicted rate of return and stock price fluctuations. While a stock with a beta of less than one indicates that it is defensive or that the price of the company has little bearing on market movements, a stock with a beta of greater than one indicates that it is aggressive, indicating that it is sensitive or easily impacted by changes in the market. The table below displays the findings of the beta 45 stock calculation from July 2024 to September 2024.

Table 4. Results of Systematic Risk Level (β_i) of Each Stock
July 2024 - September 2024

No.	Code	Issuer Name	β_i
1	ACES	Ace Hardware Indonesia Tbk	-9.931625467
2	ADRO	Adaro Energy Tbk	0.893812102
3	AKRA	AKR Corporindo Tbk	-1.263446509
4	AMMN	Amman Mineral International	0.751695402
5	AMRT	Sumber Alfaria Trijaya Tbk	-1.731964648
6	ANTM	Aneka Tambang Tbk	-0.1949606282
7	ARTO	Bank Jago Tbk	0.006196925799
8	ASII	Astra International Tbk	2.282525935
9	BBCA	Bank Central Asia Tbk	0.1229862415
10	BBNI	Bank Negara Indonesia Tbk	1.932393481
11	BBRI	Bank Rakyat Indonesia Tbk	3.579224091
12	BBTN	Bank Tabungan Negara Tbk	1.108871056
13	BMRI	Bank Mandiri Tbk	3.572469654
14	BRIS	Bank Syariah Indonesia Tbk	-2.947372419
15	BRPT	Barito Pacific Tbk	3.372219331

No.	Code	Issuer Name	β_i
16	OPEN	Bukalapak.com Tbk	-1.078240851
17	CPIN	Charoen Pokphand Indonesia Tbk	-0.9334742185
18	ESSA	Elnusa Tbk	1.646372201
19	EXCL	XL Axiata Tbk	0.01880209574
20	GGRM	Gudang Garam Tbk	1.736052953
21	GOTO	GoTo Gojek Tokopedia Tbk	-7.281312074
22	HRUM	Harum Energy Tbk	2.431319066
23	ICBP	Indofood CBP Sukses Makmur Tbk	-0.5997650935
24	INCO	Vale Indonesia Tbk	-0.9038378918
25	INDF	Indofood Sukses Makmur Tbk	2.253660128
26	INKP	Indah Kiat Pulp & Paper Tbk	-2.47281036
27	INTP	Indocement Tunggal Prakarsa Tbk	-0.8538232236
28	ISAT	Indosat Tbk	-3.051467465
29	ITMG	Indo Tambangraya Megah Tbk	1.58514736
30	JSMR	Jasa Marga Tbk	1.073338425
31	KLBF	Kalbe Farma Tbk	-0.195079806
32	MAPI	Mitra Adiperkasa Tbk	-3.695593304
33	MBMA	Marga Abhinaya Tbk	-3.519778856
34	MDKA	Merdeka Copper Gold Tbk	-4.882691062
35	MEDC	Medco Energi Internasional Tbk	-1.445920756
36	MTEL	Smartfren Telecom Tbk	-0.1408118289
37	PGAS	Perusahaan Gas Negara Tbk	0.7754422287
38	PGEO	PGE Geothermal Tbk	-3.046588131
39	PTBA	Bukit Asam Tbk	-2.768690698
40	SIDO	Sido Muncul Tbk	-2.457382695
41	SMGR	Semen Indonesia Tbk	2.032971021
42	TLKM	Telekomunikasi Indonesia Tbk	2.15776045
43	TOWR	Tower Bersama Infrastructure Tbk	0.6662738993
44	UNTR	United Tractors Tbk	1.131066473
45	UNVR	Unilever Indonesia Tbk	-1.092844045

4.5 Expected Rate of Return Analysis Results [E(Rᵢ)]

The expected rate of return [E(R_i)] is the amount of profit an investor expects from an investment. The CAPM technique itself calculates the expected rate of return using variables such as beta (β), risk free rate (Rf), and average market return [E(Rm)]. The results of calculating the expected rate of return [E(R_i)] are shown in the table below.

Table 5. Expected Rate of Return Results [E(Rᵢ)] July 2024 - September 2024

No.	Code	Rf	β_i	E(Rm)	E(Rm)-Rf	β*E(Rm) - Rf	E(Ri)
1	ACES	0.0613	-9.9316	0.0139	-0.0474	0.4703	0.5316
2	ADRO	0.0613	0.8938	0.0139	-0.0474	-0.0423	0.0189
3	AKRA	0.0613	-1.2634	0.0139	-0.0474	0.0598	0.1211
4	AMMN	0.0613	0.7517	0.0139	-0.0474	-0.0356	0.0257
5	AMRT	0.0613	-1.7320	0.0139	-0.0474	0.0820	0.1433
6	ANTM	0.0613	-0.1950	0.0139	-0.0474	0.0092	0.0705
7	ARTO	0.0613	0.0062	0.0139	-0.0474	-0.0003	0.0610
8	ASII	0.0613	2.2825	0.0139	-0.0474	-0.1081	-0.0468

No.	Code	Rf	β_i	E(Rm)	E(Rm)-Rf	β*E(Rm) - Rf	E(Ri)
9	BBCA	0.0613	0.1230	0.0139	-0.0474	-0.0058	0.0554
10	BBNI	0.0613	1.9324	0.0139	-0.0474	-0.0915	-0.0303
11	BBRI	0.0613	3.5792	0.0139	-0.0474	-0.1695	-0.1082
12	BBTN	0.0613	1.1089	0.0139	-0.0474	-0.0525	0.0087
13	BMRI	0.0613	3.5725	0.0139	-0.0474	-0.1692	-0.1079
14	BRIS	0.0613	-2.9474	0.0139	-0.0474	0.1396	0.2008
15	BRPT	0.0613	3.3722	0.0139	-0.0474	-0.1597	-0.0984
16	OPEN	0.0613	-1.0782	0.0139	-0.0474	0.0511	0.1123
17	CPIN	0.0613	-0.9335	0.0139	-0.0474	0.0442	0.1055
18	ESSA	0.0613	1.6464	0.0139	-0.0474	-0.0780	-0.0167
19	EXCL	0.0613	0.0188	0.0139	-0.0474	-0.0009	0.0604
20	GGRM	0.0613	1.7361	0.0139	-0.0474	-0.0822	-0.0210
21	GOTO	0.0613	-7.2813	0.0139	-0.0474	0.3448	0.4061
22	HRUM	0.0613	2.4313	0.0139	-0.0474	-0.1151	-0.0539
23	ICBP	0.0613	-0.5998	0.0139	-0.0474	0.0284	0.0897
24	INCO	0.0613	-0.9038	0.0139	-0.0474	0.0428	0.1041
25	INDF	0.0613	2.2537	0.0139	-0.0474	-0.1067	-0.0455
26	INKP	0.0613	-2.4728	0.0139	-0.0474	0.1171	0.1784
27	INTP	0.0613	-0.8538	0.0139	-0.0474	0.0404	0.1017
28	ISAT	0.0613	-3.0515	0.0139	-0.0474	0.1445	0.2058
29	ITMG	0.0613	1.5851	0.0139	-0.0474	-0.0751	-0.0138
30	JSMR	0.0613	1.0733	0.0139	-0.0474	-0.0508	0.0104
31	KLBF	0.0613	-0.1951	0.0139	-0.0474	0.0092	0.0705
32	MAPI	0.0613	-3.6956	0.0139	-0.0474	0.1750	0.2363
33	MBMA	0.0613	-3.5198	0.0139	-0.0474	0.1667	0.2279
34	MDKA	0.0613	-4.8827	0.0139	-0.0474	0.2312	0.2925
35	MEDC	0.0613	-1.4459	0.0139	-0.0474	0.0685	0.1297
36	MTEL	0.0613	-0.1408	0.0139	-0.0474	0.0067	0.0679
37	PGAS	0.0613	0.7754	0.0139	-0.0474	-0.0367	0.0245
38	PGEO	0.0613	-3.0466	0.0139	-0.0474	0.1443	0.2055
39	PTBA	0.0613	-2.7687	0.0139	-0.0474	0.1311	0.1924
40	SIDO	0.0613	-2.4574	0.0139	-0.0474	0.1164	0.1776
41	SMGR	0.0613	2.0330	0.0139	-0.0474	-0.0963	-0.0350
42	TLKM	0.0613	2.1578	0.0139	-0.0474	-0.1022	-0.0409
43	TOWR	0.0613	0.6663	0.0139	-0.0474	-0.0316	0.0297
44	UNTR	0.0613	1.1311	0.0139	-0.0474	-0.0536	0.0077
45	UNVR	0.0613	-1.0928	0.0139	-0.0474	0.0518	0.1130

4.6 Analysis Results of Stock Grouping and Investment Decision

The grouping of stocks is grouped into efficient (*undervalued*) and inefficient stocks (*overvalued*). Based on the results of the analysis of the calculation of realized *return* (R_i) and expected *return* E(R_i) 45 LQ45 index stocks in July 2024-September 2024 which became the research sample, the grouping of efficient (*undervalued*) and inefficient (*overvalued*) stocks is as follows.

Table 6. Results of Stock Grouping and Investment Decision
July 2024 - September 2024

No.	Code	Issuer Name	Ri	E(Ri)	Description
1	ACES	Ace Hardware Indonesia Tbk	0.09023164336	0.5315775774	Inefficient
2	ADRO	Adaro Energy Tbk	0.08790739061	0.01892213716	Efficient
3	AKRA	AKR Corporindo Tbk	0.01179398876	0.1210824753	Inefficient
4	AMMN	Amman Mineral International	-0.1142368659	0.02565229462	Inefficient
5	AMRT	Sumber Alfaria Trijaya Tbk	0.05539096649	0.1432698808	Inefficient
6	ANTM	Aneka Tambang Tbk	0.06089121099	0.0704826639	Inefficient
7	ARTO	Bank Jago Tbk	0.0628403665	0.06095653494	Efficient
8	ASII	Astra International Tbk	0.0353522765	-0.04684256722	Efficient
9	BBCA	Bank Central Asia Tbk	0.002433090024	0.05542579517	Inefficient
10	BBNI	Bank Negara Indonesia Tbk	0.03822937626	-0.03026150007	Efficient
11	BBRI	Bank Rakyat Indonesia Tbk	0.03197438723	-0.108249726	Efficient
12	BBTN	Bank Tabungan Negara Tbk	0.05030607017	0.00873768575	Efficient
13	BMRI	Bank Mandiri Tbk	0.04260553728	-0.1079298591	Efficient
14	BRIS	Bank Syariah Indonesia Tbk	0.07753991292	0.2008274069	Inefficient
15	BRPT	Barito Pacific Tbk	-0.01625535836	-0.09844669351	Efficient
16	OPEN	Bukalapak.com Tbk	0.01285672896	0.1123117732	Inefficient
17	CPIN	Charoen Pokphand Indonesia Tbk	-0.05138913501	0.1054561241	Inefficient
18	ESSA	Elnusa Tbk	0.026952916	-0.0167165173	Efficient
19	EXCL	XL Axiata Tbk	0.02727779959	0.0603595975	Inefficient
20	GGRM	Gudang Garam Tbk	0.005337453047	-0.02096348883	Efficient
21	GOTO	GoTo Gojek Tokopedia Tbk	0.1251814224	0.4060678628	Inefficient
22	HRUM	Harum Energy Tbk	0.07795058322	-0.05388889745	Efficient
23	ICBP	Indofood CBP Sukses Makmur Tbk	0.06220866175	0.08965280922	Inefficient
24	INCO	Vale Indonesia Tbk	0.04461898396	0.1040526497	Inefficient
25	INDF	Indofood Sukses Makmur Tbk	0.07378221362	-0.04547558202	Efficient
26	INKP	Indah Kiat Pulp & Paper Tbk	0.0189805574	0.1783537822	Inefficient
27	INTP	Indocement Tunggal Prakarsa Tbk	-0.03138430785	0.1016841273	Inefficient
28	ISAT	Indosat Tbk	-0.004946814284	0.2057569898	Inefficient
29	ITMG	Indo Tambangraya Megah Tbk	0.003811446648	-0.0138171197	Efficient
30	JSMR	Jasa Marga Tbk	-0.05727035447	0.01042038878	Inefficient
31	KLBF	Kalbe Farma Tbk	0.04159519726	0.07048830775	Inefficient
32	MAPI	Mitra Adiperkasa Tbk	0.1041460039	0.2362605712	Inefficient
33	MBMA	Marga Abhinaya Tbk	-0.005996944232	0.2279346044	Inefficient
34	MDKA	Merdeka Copper Gold Tbk	0.05594598319	0.2924774326	Inefficient
35	MEDC	Medco Energi Internasional Tbk	-0.02063714838	0.1297238272	Inefficient
36	MTEL	Smartfren Telecom Tbk	-0.04037972629	0.06791836326	Inefficient
37	PGAS	Perusahaan Gas Negara Tbk	-0.05284090909	0.02452772669	Inefficient
38	PGEO	PGE Geothermal Tbk	-0.0690055955	0.2055259214	Inefficient
39	PTBA	Bukit Asam Tbk	0.07343092231	0.192365656	Inefficient
40	SIDO	Sido Muncul Tbk	-0.04103970742	0.1776231811	Inefficient
41	SMGR	Semen Indonesia Tbk	-0.01464369766	-0.03502450594	Efficient
42	TLKM	Telekomunikasi Indonesia Tbk	0.0198120915	-0.04093410353	Efficient
43	TOWR	Tower Bersama Infrastructure Tbk	0.03713328061	0.02969756279	Efficient

No.	Code	Issuer Name	Ri	E(Ri)	Description
44	UNTR	United Tractors Tbk	0.02607323504	0.00768658727	Efficient
45	UNVR	Unilever Indonesia Tbk	-0.0480519246	0.1130033302	Inefficient

Of the 45 equities being examined, 17 fall into the efficient category (undervalued), and 28 fall into the inefficient category, according to table 4.6 above. (*overvalued)*. The decision made on stocks in the efficient category (*undervalued)* is to consider buying these stocks or holding these stocks until the stock price rises, while the decision made on stocks in the inefficient category (*overvalued)* is to consider selling these stocks before the stock price drops.

The following is a list of 17 stocks that fall into the efficient (*undervalued*) category:

Table 7. List of 17 stocks categorized as efficient (*undervalued*)
July 2024 - September 2024

No.	Code	Issuer Name	CV
1	ADRO	Adaro Energy Tbk	0.6763220392
2	ARTO	Bank Jago Tbk	2.178731063
3	ASII	Astra International Tbk	-1.674264398
4	BBNI	Bank Negara Indonesia Tbk	-1.081617751
5	BBRI	Bank Rakyat Indonesia Tbk	-3.869101827
6	BBTN	Bank Tabungan Negara Tbk	0.3123056024
7	BMRI	Bank Mandiri Tbk	-3.857669025
8	BRPT	Barito Pacific Tbk	-3.518718205
9	ESSA	Surya Esa Perkasa Tbk	-0.5974879566
10	GGRM	Gudang Garam Tbk	-0.7492847872
11	HRUM	Harum Energy Tbk	-1.926116945
12	INDF	Indofood Sukses Makmur Tbk	-1.625405106
13	ITMG	Indo Tambangraya Megah Tbk	-0.4938566131
14	SMGR	Semen Indonesia Tbk	-1.251858872
15	TLKM	Telekomunikasi Indonesia Tbk	-1.463081899
16	TOWR	Tower Bersama Infrastructure Tbk	1.061461296
17	UNTR	United Tractors Tbk	0.274736851

From the table above, the three stocks with the smallest negative correlation value that will be formed into a portfolio are BBRI, BMRI, and BRPT stocks.

4.7 Forming an Optimal Portfolio

After obtaining three stocks that will be formed into a portfolio, then look for the variance-covariance value between stocks. The value of the variance-covariance between stocks is an *input* in the calculation of finding the optimal value of the portfolio variance.

5. CONCLUSIONS

In order to assess the relationship between systematic risk and projected returns, this study effectively used the Capital Asset Pricing Model (CAPM) to analyse the optimal portfolio of LQ-45 stocks. The results show that CAPM is effective in identifying the combination of stocks that can maximize returns according to the specified risk level. By applying Markowitz's Modern Portfolio Theory (MPT), this study reveals the importance of diversification in building an optimal portfolio. The use of CAPM allows investors to calculate beta and expected return, providing a quantitative basis for investment decision making.

However, the study also identified the limitations of the CAPM in the face of

rapidly changing market dynamics. To improve accuracy, it is recommended that future research consider additional risk factors and alternative models. Overall, the study confirms that CAPM remains an important tool in investment analysis, assisting investors in formulating better portfolio strategies although it needs to be adapted to different market conditions.

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