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An Analysis of Investment Decision-Making for IDX30 Stocks (2022–2023) Using the Capital Asset Pricing Model (CAPM)

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Abstract

While stock-based investment portfolios can yield attractive expected returns, they inherently involve significant risk. Consequently, investors must undertake a rigorous analysis to construct an optimal portfolio that maximizes returns through prudent stock selection and asset allocation. This study applies the Capital Asset Pricing Model (CAPM) to develop an optimal portfolio using data from 30 IDX-listed stocks over the period January 2022 to December 2023. The analysis identifies ESSA as the most efficient stock, whereas CPIN is deemed the least efficient, characterized by the lowest average return and beta. Based on CAPM-derived calculations, the optimal portfolio consists of the following asset allocations: BRPT (6.65%), INKP (6.40%), AMRT (6.99%), ASII (8.02%), BMRI (8.08%), BBNI (8.96%), PTBA (9.01%), INCO (11.24%), UNTR (13.19%), and ESSA (20.41%). Overall, the proposed portfolio is designed to strike an optimal balance between risk and return, providing investors with a strategic allocation model to maximize returns per unit of risk.

Keywords: *Stock; Investment; Risk; IDX30; Capital Asset Pricing Model.*

Introduction

In today's increasingly complex financial markets, a sound understanding of investment is essential for individuals and organizations to manage wealth effectively and ensure long-term financial stability. Investment refers to the allocation of funds or resources with the expectation of generating future profits (Tandelilin, 2010). Among various investment instruments, stocks are among the most popular choices due to their potential to deliver higher returns compared to more conservative options such as bonds or time deposits. As a vital component of the capital market, the stock market plays a crucial role in facilitating investments by providing a platform for companies to raise capital and for investors to trade financial assets.

Investment decisions inherently involve risk, which is often positively correlated with return. Higher returns typically imply greater risk, making it essential for investors to carefully analyse market conditions and make informed decisions. One of the most effective ways to mitigate investment risk is through the construction of a well-diversified stock portfolio. Diversification, which involves spreading investments across a range of distinct assets, reduces vulnerability to the volatility of individual stocks, thus lowering the overall risk of the portfolio. Given that financial markets are influenced by macroeconomic factors, corporate performance, and global events, diversification remains a cornerstone of modern risk management. Therefore, the initial step in sound investment strategy is understanding how to construct an optimal portfolio.

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Over time, several models have been developed to assist investors in achieving optimal portfolio allocation. These include the Mean-Variance Model (Markowitz, 1952), the Single Index Model, and the Multi-Index Model (Elton & Gruber, 1995). In response to the increasing complexity of financial markets, more advanced approaches such as the Arbitrage Pricing Theory (Ross, 1976) and machine learning-based portfolio optimization techniques (Lyu, 2024) have also emerged. Among these, the Capital Asset Pricing Model (CAPM) remains one of the most widely used due to its simplicity and effectiveness in estimating expected returns based on systematic risk. Empirical studies affirm CAPM's utility in conceptualizing the trade-off between risk and return, making it an appropriate tool for analysing stock efficiency and constructing optimal portfolios (Fama & French, 2004).

Numerous studies have validated the application of CAPM in identifying efficient stocks and developing optimal portfolios. For instance, Aprialinita et al. (2022) found a linear relationship between systematic risk and expected return in LQ-45 stocks, identifying 31 efficient and 14 inefficient stocks over the August 2020–January 2021 period. Kurniawan (2023) examined IDX30 stocks during the COVID-19 pandemic and recommended a portfolio comprising TBIG (23%), MDKA (45%), and UNTR (32%). Puspitasari (2024) analyzed five stocks in the food and beverage sector during 2022 and concluded that only KINO met the efficiency criteria. Similarly, Komara (2021) assessed 33 LQ-45 stocks from 2016 to 2018 and identified a portfolio of seven stocks that yielded a 26.07% return with an associated risk of 11.83%. These findings collectively underscore the robustness and adaptability of the CAPM across different sectors and market conditions, reaffirming its relevance in portfolio selection and risk management.

Building on these previous studies, this research aims to construct an optimal portfolio using updated data from the IDX30 index, covering the period from January 2022 to December 2023. This time frame provides a fresh dataset that enhances the study's originality and contributes to the literature by evaluating the applicability of CAPM in the current market environment. By examining the latest IDX30 stocks, the study also explores whether previously observed relationships between risk, return, and stock efficiency remain consistent over time. The findings are expected to offer valuable insights for investors seeking to develop optimal portfolios in alignment with prevailing market dynamics.

Literature Review

Investment

Tandelilin (2010) states that investing entails committing a specific sum of money or other resources now in order to make a specific amount of profit later on. This definition places a strong emphasis on the future-focused aspect of investing, in which capital is committed now with the hope of profiting later. Drawing from the views of various experts, it can be concluded that investment involves allocating funds now with the expectation of achieving profits in the future. One type of investment is investing in securities like stocks, aiming to generate additional or profitable returns through trading these stocks on the stock exchange.

Stock

Stocks are financial instruments representing ownership in a company, granting shareholders rights to the company's profits and assets after obligations are settled (Tandelilin, 2010). Wira (2015) defines investment as any activity involving time, money, or effort with the expectation of future returns, including the purchase of assets like stocks. Stocks can be classified based on

transfer methods and claim rights. Bearer stocks are easily transferable and not tied to an individual's identity, while registered stocks are recorded in the company's official registry. Furthermore, stocks can be classified into common and preferred stocks. Common stocks provide voting rights but are last in line for dividends and asset claims during liquidation. Preferred stocks offer priority in dividends and asset claims but may not always provide voting rights, depending on the jurisdiction. In Indonesia, however, preferred stocks do grant voting rights. Additionally, preferred stocks are categorized as cumulative, non-cumulative, and participating, with varying dividend distribution structures.

Capital Market

The capital market, as defined by Law Number 8 of 1995 on the Capital Market (UUPM), encompasses activities related to public offerings, securities trading, public companies, and institutions connected to securities. Sunariyah (2006) describes it as a marketplace for trading stocks, bonds, and other securities through brokers, offering varying levels of risk and return. Similarly, Bodie et al. (2006) highlight that capital market instruments typically have longer time frames and higher risks than money market instruments. Tandelilin (2010) emphasizes the capital market as a platform facilitating transactions between those with surplus funds and those in need of funds through securities.

IDX30 Index

Indonesia Stock Exchange 30 (IDX30) refers to an index on the Indonesian stock market that includes the 30 largest stocks by market capitalization listed on the Indonesia Stock Exchange (IDX), representing the most liquid stocks on the IDX. Tandelilin (2010) explains the importance of liquidity in stock selection and portfolio management, which is very important for individual and institutional investors. IDX is used as an indicator or representation of the overall performance of the Indonesian stock market. Investors and stakeholders can gain a better understanding of market trends and the performance of key stocks on the Indonesian stock exchange by monitoring the movements of the IDX30.

Risk

Investors aim for high returns but must consider the associated risks. Tandelilin (2010) highlights interest rate risk, where rising rates may lead investors to shift from stocks to deposits, reducing stock prices. Halim (2005) identifies market risk as a macroeconomic risk, influenced by economic conditions and recessions, which cannot be mitigated through diversification. Fahmi (2012) categorizes risks into systematic risk, arising from market-wide factors; unsystematic risk, specific to individual companies and mitigable through diversification; and total risk, a combination of both. Halim (2005) also classifies investors by risk profiles: risk-seeking investors favor high-risk, high-return strategies; risk-neutral investors balance returns with risk; and risk-averse investors prioritize safety and stable returns.

Beta

Beta measures the risk of a stock by assessing its sensitivity to market movements, with values indicating whether a stock is aggressive, defensive, or neutral. Aggressive stocks are more volatile and carry higher risk, while defensive stocks are less volatile. High beta stocks may yield higher returns in a growing market but are riskier during market downturns. The stability of beta reflects its consistency across estimation periods, with CAPM linking higher beta to

higher expected returns. Beta is calculated using the covariance between stock and market returns divided by market variance, as shown in the formulas provided.

Expected Rate of Return

The primary goal of investing is to generate profit, often referred to as return in investment management. Hartono (2016) defines return as the outcome of investment activities, while Tandelilin (2010) emphasizes that return motivates investors to invest and serves as a reward for taking on investment risks. Owning company shares offers benefits such as dividends (a share of company profits), capital gains (profit from selling shares at a higher price than the purchase price), and non-economic benefits like voting rights and a sense of pride. Calculating the expected rate of return involves specific steps to estimate potential investment profits.

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

Individual Stock Rate of Return

The rate of return on individual shares is one of the indicators of investors in making investments. The rate of return on individual shares is the amount of profit actually received by investors when investing in shares. Return is one of the factors that motivate investors to invest and is also a return on the courage of investors to take risks (Tandelilin, 2010). The formula used to calculate individual stock returns is as on equation 2.3.

$$R_i = \frac{(P_t - P_{t-1} + D)}{P_{t-1}}$$

where R_i is individual stock returns, P_t is stock price in period t, P_{t-1} is Stock price in period t-1, and D is Dividend

Market Rate of Return

The rate of return derived from the movement of a stock index is known as the market rate of return. All stock trading activity on the Indonesia Stock Exchange (IDX) in this study is represented by the Market Index. To evaluate the performance of investments in a portfolio, this rate of return becomes the benchmark. A portfolio investment is considered successful if the market rate of return exceeds the risk-free rate of return, whereas if the market rate of return is less than the risk-free rate of return, the portfolio investment is considered unsuccessful.

$$R_m = \frac{JCI_t - JCI_{t-1}}{JCI_{t-1}}$$

where R_m is market rate of return, JCI_t is composite stock price index period t, JCI_{t-1} is Composite stock price index period t-1.

Risk Free Rate of Return

The risk-free rate (R_f) refers to the return on investments considered free of risk, using data from the BI rate. This rate represents the minimum return expected when there is no risk, serving as a benchmark for determining the minimum acceptable return since the return on

investments in risky assets should exceed this rate. The measurement basis for this rate is the interest rate on government-issued securities, such as the Bank Indonesia Certificate or SBI (Husnan, 2005). The formula used to calculate the rate of return on risk is as below.

$$\bar{R}_f = \frac{\Sigma R_f}{n}$$

where R_f is risk-free rate of return, ΣR_f is average risk-free rate of return, n is observation time (month).

Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) is an equilibrium model that simplifies the relationship between return and risk by using beta as the sole risk variable (Zulfikar, 2016). CAPM is widely used by investors to estimate the expected return of a stock based on its risk level. As developed by Elton (1995), the CAPM formula states that the expected return of a stock E(Ri) is the sum of the risk-free rate (Rf) and the risk premium (Rm−Rf) multiplied by beta (β).

Beta

Beta (β) represents systematic risk, indicating the relationship between a stock's return and the market's return. It is calculated as the ratio of the stock's covariance with the market to the market's variance. The CAPM method highlights the role of beta in determining a stock's price volatility and its expected return. By relying on historical data such as past average returns and risk-free rates, CAPM provides a framework to predict future returns based on the stock's risk profile.

$$\beta_i = \frac{\sigma_{im}}{\sigma_m^2}$$

where βi is systematic risk level of each stock, σ_{im} is covariance between stock returns and market returns, and $\sigma_m^2$is market variance.

The beta formula above can be described as follows on below.

$$\beta i = \frac{\Sigma_{t=1}^{n}(R_{it} - \overline{R_{\imath t}})\ .\ (R_{mt} - \overline{R_{mt}})}{\Sigma_{t=1}^{n}(R_{it} - R_{mt})^2}$$

where βi is systematic risk level of each stock at a certain time, $\overline{R_{\imath t}}$ is average rate of return of individual stocks at time *t*, R_{it} is rate of return of individual stocks at time *t* , R_{mt} is market rate of return at time *t*, $\overline{R_{mt}}$ is average rate of return of individual stocks at time *t*

Optimal Portfolio

Tandelilin (2010) emphasizes three key concepts for creating an optimal portfolio: efficient portfolios, the excess return to beta (ERB) ratio, and the cut-off point (C*). The following steps detail how to determine this cut-off point:

From the largest ERB value to the smallest ERB value, sort the securities. The best portfolio should contain the securities that have the highest ERB values. This is the formula that is applied.

$$ERB = \frac{E(R_i) - R_f}{\beta_i}$$

where ERB is excess return to beta, $E(R_i)$ is expected rate of return, R_f is risk free rate, β_i is *i*-th stock beta. For selection the stock, calculate the values of A_i, B_i and C_i using the following formula.

$$A_i = \frac{\left((R_i) - R_f\right).\beta_i}{\sigma ei^2}$$

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

$$C_i = \frac{\sigma^2 m \sum_{j=1}^{i} [\frac{E(R_i) - R_f.\beta_i}{\sigma ei^2}]}{1 + \sigma^2 m \sum_{j=1}^{i} [\frac{\beta_i^2}{\sigma ei^2}]}$$

An efficient portfolio offers the best balance between return and risk, either maximizing returns for a given level of risk or minimizing risk for a desired return. Husnan (2001) describes efficient portfolios as those providing either higher returns for the same risk or the same return with reduced risk. Hartono (2016) highlights that the optimal portfolio delivers the highest return with the least risk. Using the ERB ratio, which measures the relationship between return and risk, helps identify which securities to include in the optimal portfolio. Securities with high ERB values are included, while those with lower values are excluded. The cut-off point (C*) is determined as the highest Ci value, where Ci reflects the relationship between market variance, return premium, stock sensitivity, and error variance.

The following is the proportion for the *i*-th security, according to Hartono (2016):

$$W_i = \frac{Z_i}{\sum_{j=1}^{k} Z_i} \text{ where } Z_i = \frac{\beta_i}{\sigma ei^2}(ERB_i - C*)$$

After determining the securities for the optimal portfolio, the next step is to calculate the proportion of each security in the portfolio. This is done using formulas for Zi and Wi, where Zi represents the weighting scale for each stock, and Wi determines the allocation of funds to each stock. By combining these calculations, investors can construct an ideal portfolio that maximizes returns while managing risk effectively.

Research Methodology

The researcher leveraged publicly accessible big data from *www.yahoo.com* for this study. The research sample includes 21 stocks from companies listed in the IDX30 index during the 2022–2023 period. The criteria for selecting the sample were as follows: the stocks must be listed on the Indonesia Stock Exchange (IDX) and consistently belong to the Consumer Goods Industry (CGI) sector from January 2022 to December 2023. Additionally, the stocks needed to provide the required data for the research process. A two-year timeframe was chosen to ensure a

comprehensive analysis of stock investment risks. Based on these criteria, the list of companies is written in the Table 1.

Table 1.
Companies listed in IDX30 index within 2022-2023

No.	Stock Code	Company Name
1	AMRT	Sumber Alfaria Trijaya Tbk
2	ANTM	Aneka Tambang Tbk.
3	ARTO	Bank Jago Tbk
4	ASII	Astra International Tbk.
5	BBNI	Bank Negara Indonesia (Persero) Tbk.
6	BMRI	Bank Mandiri (Persero) Tbk.
7	BRPT	Barito Pacific Tbk.
8	CPIN	Charoen Pokphand Indonesia Tbk
9	ESSA	ESSA Industries Indonesia Tbk.
10	ICBP	Indofood CBP Sukses Makmur Tbk.
11	INCO	Vale Indonesia Tbk.
12	INDF	Indofood Sukses Makmur Tbk.
13	INKP	Indah Kiat Pulp & Paper Tbk.
14	KLBF	Kalbe Farma Tbk.
15	PGAS	Perusahaan Gas Negara Tbk.
16	PTBA	Bukit Asam Tbk.
17	SMGR	Semen Indonesia (Persero) Tbk.
18	TINS	Timah Tbk
19	TLKM	Telkom Indonesia (Persero) Tbk.
20	UNTR	United Tractors Tbk.
21	UNVR	Unilever Indonesia Tbk.

The process begins with claiming the dataset, followed by calculating the individual stock rate of return (R_i). Next, the market rate of return (R_m) and the risk-free rate of return (R_f) are determined. Subsequently, the systematic risk of each individual stock (β_i) is calculated. Using these values, the expected rate of return ($E(R_i)$) is computed. Based on this information, the optimal portfolio is determined, and finally, the proportions for the optimal portfolio are established.

Research Results

Calculation of Individual Stock Returns

The individual stock rate of return (R_i) is a key variable in the CAPM method for stock analysis. It represents the percentage change in stock value between two periods, reflecting the profit or loss earned by investors from holding shares over a specific time frame. From January 2022 to December 2023, the closing share prices of companies fluctuated monthly, experiencing both

positive and negative changes, which in turn affected the rate of return for individual stocks. The return of the stocks is shown in Table 2.

Table 2.
Average of Individual Stock rate of Return (Ri) for the period 2022-2023

No.	Stock Code	Company Name	E(Ri)
1	AMRT	Sumber Alfaria Trijaya Tbk	0,043360666
2	ANTM	Aneka Tambang Tbk.	-0,002720991
3	ARTO	Bank Jago Tbk	-0,055473504
4	ASII	Astra International Tbk.	0,00715173
5	BBNI	Bank Negara Indonesia (Persero) Tbk.	0,024325712
6	BMRI	Bank Mandiri (Persero) Tbk.	0,028406538
7	BRPT	Barito Pacific Tbk.	0,026228727
8	CPIN	Charoen Pokphand Indonesia Tbk	-0,003587128
9	ESSA	ESSA Industries Indonesia Tbk.	0,024569914
10	ICBP	Indofood CBP Sukses Makmur Tbk.	0,012257061
11	INCO	Vale Indonesia Tbk.	0,005196737
12	INDF	Indofood Sukses Makmur Tbk.	0,001876648
13	INKP	Indah Kiat Pulp & Paper Tbk.	0,007420438
14	KLBF	Kalbe Farma Tbk.	0,002327492
15	PGAS	Perusahaan Gas Negara Tbk.	0,002309813
16	PTBA	Bukit Asam Tbk.	0,022265784
17	SMGR	Semen Indonesia (Persero) Tbk.	0,000958191
18	TINS	Timah Tbk	-0,026000352
19	TLKM	Telkom Indonesia (Persero) Tbk.	0,003548851
20	UNTR	United Tractors Tbk.	0,018672778
21	UNVR	Unilever Indonesia Tbk.	-0,003002426

Throughout the 2022–2023 study period, the results of the calculation of monthly returns for individual stocks yielded results that indicate certain stocks have an average rate of return that is positive ((R_i> 0) and some that is negative (R_i< 0). Based on Table 2, it is evident that the shares of Sumber Alfaria Trijaya Tbk (AMRT) have the highest average rate of return, at 0.043360666, or 4.33%, while the shares of Bang Jago Tbk (ARTO) have the lowest average rate of return, at -0.055473504 or -5.54%.

Calculation of Market Rate of Return

In this research, the JCI was selected for its comprehensive coverage; it includes all stocks listed on the Indonesia Stock Exchange (IDX), making it representative of the overall market direction in Indonesia. The JCI reflects price movements of every stock on the IDX, providing a broad perspective on market trends. Table 3 provide market rate of return for the years 2022 until 2023.

Table 3.
Composite Stock Price Index (JCI) 2022-2023

Year/Month		JCI	Rm
2021	Dec	6581	-
2022	Jan	6631	0,00759763
	Feb	6888	0,038757352
	Mar	7071	0,026567944
	Apr	7228	0,022203366
	May	7148	-0,011068069
	Jun	6911	-0,033156128
	Jul	6951	0,005787874
	Aug	7178	0,032657172
	Sep	7040	-0,019225411
	Oct	7098	0,008238636
	Nov	7081	-0,002395041
	Dec	6850	-0,032622511
2023	Jan	6839	-0,001605839
	Feb	6843	0,000584881
	Mar	6805	-0,00555312
	Apr	6915	0,016164585
	May	6633	-0,040780911
	Jun	6661	0,004221318
	Jul	6931	0,040534454
	Aug	6953	0,003174145
	Sep	6939	-0,002013519
	Oct	6752	-0,026949128
	Nov	7080	0,048578199
	Dec	7272	0,027118644
Total			**0,106816523**
Average			**0,004450688**

Calculation Risk-free Rate of Return

The return on a risk-free investment is represented by the risk-free rate (R_f), which is normally based on the BI rate. It is a key component of the CAPM model, which calculates the expected

return on an investment in stocks. By boosting the risk-free rate with a risk premium, the CAPM calculates the expected return. The minimal return on an investment, assuming no risk, is measured against the risk-free rate. The risk-free rates (R_f) for each month between 2022 and 2023 are available at Table 4.

Table 4.
Risk-free Rate of Return (Rf) January 2022-December 2023

No.	Month	Year 2022	Year 2023
1	Jan	0,035	0,0575
2	Feb	0,035	0,0575
3	Mar	0,035	0,0575
4	Apr	0,035	0,0575
5	May	0,035	0,0575
6	Jun	0,035	0,0575
7	Jul	0,035	0,0575
8	Aug	0,0375	0,0575
9	Sep	0,0425	0,0575
10	Oct	0,0475	0,06
11	Nov	0,0525	0,06
12	Dec	0,05	0,06
Average Risk-Free Per Year		0,0396	0,0581
Total Risk-Free Across Years		0,0489	
Maximum		0,06	
Minimum		0,035	

Calculation of Systematic Risk Level of Each Stock

A stock is considered high-risk if its beta is greater than one (β>1), which indicates that investors expect higher returns to compensate for the increased risk. Otherwise, stocks with a beta less than one (β<1) are considered lower-risk, reflecting their reduced sensitivity to market changes. Thus, the beta value (β_i) indicates the extent to which a stock is influenced by market risk. Each stock's beta is listed in the Table 5.

Table 5.
Systematic Risk Level of Each Stock (β_i) 2022-2023

No.	Stock Code	Company Name	βi
1	AMRT	Sumber Alfaria Trijaya Tbk	1,1708
2	ANTM	Aneka Tambang Tbk.	2,1806
3	ARTO	Bank Jago Tbk	-0,3118
4	ASII	Astra International Tbk.	1,3925

5	BBNI	Bank Negara Indonesia (Persero) Tbk.	1,6115
6	BMRI	Bank Mandiri (Persero) Tbk.	1,4277
7	BRPT	Barito Pacific Tbk.	1,0954
8	CPIN	Charoen Pokphand Indonesia Tbk	-1,4335
9	ESSA	ESSA Industries Indonesia Tbk.	4,2475
10	ICBP	Indofood CBP Sukses Makmur Tbk.	-0,6944
11	INCO	Vale Indonesia Tbk.	2,0972
12	INDF	Indofood Sukses Makmur Tbk.	-0,8486
13	INKP	Indah Kiat Pulp & Paper Tbk.	1,0545
14	KLBF	Kalbe Farma Tbk.	-0,2274
15	PGAS	Perusahaan Gas Negara Tbk.	0,6396
16	PTBA	Bukit Asam Tbk.	1,6216
17	SMGR	Semen Indonesia (Persero) Tbk.	0,7838
18	TINS	Timah Tbk	2,1966
19	TLKM	Telkom Indonesia (Persero) Tbk.	1,2829
20	UNTR	United Tractors Tbk.	2,5529
21	UNVR	Unilever Indonesia Tbk.	-0,8079
Total			21,0315
Average			1,0015

Calculation of Expected Rate of Return

The expected rate of return ($E(R_i)$) analysis's findings show how much investors are likely to profit from their stock investments. The risk-free rate of return variable (R_f), the average market rate of return ($E(R_m)$), and the systematic risk of each stock are taken into account when calculating the expected rate of return using the CAPM method.

The results of the calculation of the risk-free (R_f), the average market rate of return ($E(R_m)$), and the beta of each stock (β_i), or the systematic risk of the 21 company stocks were entered into the calculation and applied to the CAPM formula. The expected rate of return calculations for 21 sample companies for the years 2022–2023 are shown in the Table 6.

Table 6.
Expected Rate of Return for the Period 2022-2023

No.	Stock Code	Ri [1]	E(Rm) [2]	Rf [3]	Bi [4]	E(Ri) 3+4*[2-3]
1	AMRT	0,043360666	0,004450688	0,0041	1,1708	0,004510601
2	ANTM	-0,002720991	0,004450688	0,0041	2,1806	0,004864707
3	ARTO	-0,055473504	0,004450688	0,0041	-0,3118	0,003990644
4	ASII	0,00715173	0,004450688	0,0041	1,3925	0,004588325
5	BBNI	0,024325712	0,004450688	0,0041	1,6115	0,004665121
6	BMRI	0,028406538	0,004450688	0,0041	1,4277	0,004600666
7	BRPT	0,026228727	0,004450688	0,0041	1,0954	0,004484142
8	CPIN	-0,003587128	0,004450688	0,0041	-1,4335	0,003597296
9	ESSA	0,024569914	0,004450688	0,0041	4,2475	0,005589555
10	ICBP	0,012257061	0,004450688	0,0041	-0,6944	0,003856487
11	INCO	0,005196737	0,004450688	0,0041	2,0972	0,004835472
12	INDF	0,001876648	0,004450688	0,0041	-0,8486	0,003802392
13	INKP	0,007420438	0,004450688	0,0041	1,0545	0,004469804
14	KLBF	0,002327492	0,004450688	0,0041	-0,2274	0,00402025
15	PGAS	0,002309813	0,004450688	0,0041	0,6396	0,004324305
16	PTBA	0,022265784	0,004450688	0,0041	1,6216	0,004668661
17	SMGR	0,000958191	0,004450688	0,0041	0,7838	0,004374867
18	TINS	-0,026000352	0,004450688	0,0041	2,1966	0,004870325
19	TLKM	0,003548851	0,004450688	0,0041	1,2829	0,004549914
20	UNTR	0,018672778	0,004450688	0,0041	2,5529	0,004995272
21	UNVR	-0,003002426	0,004450688	0,0041	-0,8079	0,003816676
Total						**0,093475483**
Average						**0,004451213**

Stock Investment Classification

In the CAPM Method, the determination of candidate forming stocks is focused on stocks with an individual rate of return greater than the expected rate of return ($R_i > E(R_i)$). Stocks that meet this category can be referred to as efficient stocks. These stocks can be thought of as stocks that deliver better returns than anticipated by investors.

Table 7.
Classification of Efficient and Inefficient Stocks

No.	Stock Code	Company Name	Ri	E(Ri)	Stock Evaluation
1	AMRT	Sumber Alfaria Trijaya Tbk	0,04336	0,004510601	Efficient
2	ANTM	Aneka Tambang Tbk.	-0,00272	0,004864707	Inefficient
3	ARTO	Bank Jago Tbk	-0,05547	0,003990644	Inefficient
4	ASII	Astra International Tbk.	0,00715	0,004588325	Efficient
5	BBNI	Bank Negara Indonesia (Persero) Tbk.	0,02433	0,004665121	Efficient
6	BMRI	Bank Mandiri (Persero) Tbk.	0,02841	0,004600666	Efficient
7	BRPT	Barito Pacific Tbk.	0,02623	0,004484142	Efficient
8	CPIN	Charoen Pokphand Indonesia Tbk	-0,00359	0,003597296	Inefficient
9	ESSA	ESSA Industries Indonesia Tbk.	0,02457	0,005589555	Efficient
10	ICBP	Indofood CBP Sukses Makmur Tbk.	0,01226	0,003856487	Efficient
11	INCO	Vale Indonesia Tbk.	0,00520	0,004835472	Efficient
12	INDF	Indofood Sukses Makmur Tbk.	0,00188	0,003802392	Inefficient
13	INKP	Indah Kiat Pulp & Paper Tbk.	0,00742	0,004469804	Efficient
14	KLBF	Kalbe Farma Tbk.	0,00233	0,00402025	Inefficient
15	PGAS	Perusahaan Gas Negara Tbk.	0,00231	0,004324305	Inefficient
16	PTBA	Bukit Asam Tbk.	0,02227	0,004668661	Efficient
17	SMGR	Semen Indonesia (Persero) Tbk.	0,00096	0,004374867	Inefficient
18	TINS	Timah Tbk	-0,02600	0,004870325	Inefficient
19	TLKM	Telkom Indonesia (Persero) Tbk.	0,00355	0,004549914	Inefficient
20	UNTR	United Tractors Tbk.	0,01867	0,004995272	Efficient
21	UNVR	Unilever Indonesia Tbk.	-0,00300	0,003816676	Inefficient

Efficient stocks are candidates for the optimal portfolio. However, ICBP stocks, despite having an individual return (R_i) greater than the expected return ($E(R_i)$), are excluded due to factors like negative beta, which indicates movement opposite to the market. Negative beta stocks can reduce portfolio returns and may conflict with the objective of maximizing returns in a bullish market. Below is a table of efficient stocks meeting the optimal portfolio criteria.

Table 8.
Classification of Efficient Stocks

No.	Stock Code	Company Name	Classification
1	AMRT	Sumber Alfaria Trijaya Tbk	Efficient
2	ASII	Astra International Tbk.	Efficient
3	BBNI	Bank Negara Indonesia (Persero) Tbk.	Efficient
4	BMRI	Bank Mandiri (Persero) Tbk.	Efficient
5	BRPT	Barito Pacific Tbk.	Efficient
6	ESSA	ESSA Industries Indonesia Tbk.	Efficient
7	INCO	Vale Indonesia Tbk.	Efficient
8	INKP	Indah Kiat Pulp & Paper Tbk.	Efficient
9	PTBA	Bukit Asam Tbk.	Efficient
10	UNTR	United Tractors Tbk.	Efficient

Calculation of Stock Variance and Market Variance

The difference between the stock return and the average stock return is known as the stock variance (σ^2). It displays the degree of uncertainty or risk related to stock returns. Formula:

$$\sigma_i^2 = \sum_{i-1}^{n} \frac{(R_i - E(R_i))^2}{n-1}$$

where σ_i^2 is stock variance *I* and n is the amount of data

Table 9.
Stock Variance Calculation Results

Stock Code	Ri	E(Ri)	σ_i^2
AMRT	0,043360666	0,004072309	0,005868166
ANTM	-0,002720991	0,00408333	0,006140676
ARTO	-0,055473504	0,004773963	0,006429276
ASII	0,00715173	0,00428905	0,006445068
BBNI	0,024325712	0,004402931	0,00680957
BMRI	0,028406538	0,004303745	0,007235044
BRPT	0,026228727	0,004344154	0,007715371
CPIN	-0,003587128	0,004208232	0,008265685
ESSA	0,024569914	0,004222926	0,008847473
ICBP	0,35341424	0,004064962	0,009584534
INCO	0,005196737	0,004410279	0,000525978
INDF	0,001876648	0,004112719	0,000547176

INKP	0,007420438	0,004505792	0,000558787
KLBF	0,002327492	0,004138434	0,000598619
PGAS	0,002309813	0,004435994	0,000623577
PTBA	0,022265784	0,004090677	0,000656732
SMGR	0,000958191	0,004347828	0,000787994
TINS	-0,026000352	0,004560895	0,000864449
TLKM	0,003548851	0,004182517	0,000354974
UNTR	0,018672778	0,004189864	0,000344905
UNVR	-0,003002426	0,004116392	0,000671799

Furthermore, market variance (σ_m^2) is a measure of how far the market return is from the average market return. It indicates the level of uncertainty or risk associated with market returns. Market variance is calculated using the formula:

$$\sigma_m^2 = \sum_{i-1}^{n} \frac{(R_m - E(R_m))^2}{n-1} \quad (4.7)$$

where σ_m^2 is market variance and n is the amount of data

Calculation of Residual Error Variance and Excess Return to Beta (ERB)

Realized returns are returns that have already occurred, so they have a definite value without any measurement errors. In contrast, the expected return is the return that is expected to be obtained but has not yet occurred. The difference between the expected return and the realized return represents the estimation error, which is indicated by the variance error residuals (Hartono, 2016).

Table 10.
Market Variance Calculation Results

Date		Rm	E(Rm)	σ_m^2
Year	**Month**			
2022	Jan	0,00759763	0,004450688	0,000565301
	Feb	0,038757352	0,004450688	0,000565301
	Mar	0,026567944	0,004450688	0,000565301
	Apr	0,022203366	0,004450688	0,000565301
	May	-0,011068069	0,004450688	0,000565301
	Jun	-0,033156128	0,004450688	0,000565301
	Jul	0,005787874	0,004450688	0,000565301
	Aug	0,032657172	0,004450688	0,000565301
	Sep	-0,019225411	0,004450688	0,000565301
	Oct	0,008238636	0,004450688	0,000565301

	Nov	-0,002395041	0,004450688	0,000565301
	Dec	-0,032622511	0,004450688	0,000565301
2023	Jan	-0,001605839	0,004450688	0,000565301
	Feb	0,000584881	0,004450688	0,000565301
	Mar	-0,00555312	0,004450688	0,000565301
	Apr	0,016164585	0,004450688	0,000565301
	May	-0,040780911	0,004450688	0,000565301
	Jun	0,004221318	0,004450688	0,000565301
	Jul	0,040534454	0,004450688	0,000565301
	Aug	0,003174145	0,004450688	0,000565301
	Sep	-0,002013519	0,004450688	0,000565301
	Oct	-0,026949128	0,004450688	0,000565301
	Nov	0,048578199	0,004450688	0,000565301
	Dec	0,027118644	0,004450688	0,000565301

Residual error variance (σ_{ei}^2) is a measure of how far the stock return is from the average stock return. It indicates the unique or unsystematic risk associated with the stock.

A measure of excess return relative to a risk unit that cannot be diversified, as determined by beta, is called Excess Return to Beta. Return and risk are two investment determinants, and this ERB ratio illustrates their relationship (Hartono, 2016). Residual error variance can be calculated using the following formula:

$$\sigma_{ei}^2 = \sigma_i^2 - (\sigma_m^2(\alpha_i))^2$$

where σ_{ei}^2 is residual error variance i, σ_i^2 is stock variance i, σ_m^2 is market variance I and $\alpha_i$is stock alpha I, the formula for finding alpha (α_i) is as follows:

$$\alpha_i = E(R_i) - \beta_i . E(R_m)$$

Table 11.
Calculation Results of Residual Error Variance and Excess Return to Beta

No.	Stock Code	Company Name	σ_{ei}^2	ERB
1	AMRT	Sumber Alfaria Trijaya Tbk	-0,00339	0,000365
2	ASII	Astra International Tbk.	-0,00369	0,000363
3	BBNI	Bank Negara Indonesia (Persero) Tbk.	-0,00395	0,000361
4	BMRI	Bank Mandiri (Persero) Tbk.	-0,00416	0,000362
5	BRPT	Barito Pacific Tbk.	-0,00456	0,000366
6	ESSA	ESSA Industries Indonesia Tbk.	-0,00539	0,000355
7	INCO	Vale Indonesia Tbk.	-0,00341	0,000359

8	INKP	Indah Kiat Pulp & Paper Tbk.	-0,00305	0,000366
9	PTBA	Bukit Asam Tbk.	-0,00446	0,000361
10	UNTR	United Tractors Tbk.	-0,00637	0,000357

Determining the Cut-off Rate (C_i)

The values of Ai and Bi are calculated to get the values of aj and bj, both of which are needed to calculate Ci (Hartono, 2016). The limiting point (Ci) is the value of C for the first security, which is determined by adding the values of Ai to Ai and Bi to Bi. The equation in use is:

Table 12.
Calculating Result of Cut-off Rate

No.	Stock Code	Ai	Bi	Cumulative of Ai	Cumulative of Bi	Ci
1	BRPT	0,112387	295,4586	0,112387	295,4586	5.44398×10^{-5}
2	INKP	0,108169	273,7510	0,220556	569,2096	9,4328E-05
3	AMRT	0,120168	337,6602	0,340724	906,8699	0,000127333
4	ASII	0,177476	478,3229	0,518200	1385,1927	0,000164291
5	BMRI	0,181996	502,9033	0,700195	1888,0960	0,000191464
6	BBNI	0,245511	641,5771	0,945706	2529,6732	0,000220001
7	PTBA	0,247064	649,6802	1,192770	3179,3534	0,000241045
8	INCO	0,372490	1090,0214	1,565260	4269,3748	0,00025922
9	UNTR	0,582202	1621,4172	2,147462	5890,7920	0,000280356
10	ESSA	1,630847	4567,2582	3,778309	10458,0502	**0,000309013**

Determining the Unique Cut-off Rate Point ($C*$)

Which stocks can be included in the ideal portfolio is determined by setting a limit of the C* value. The Ci value at which the last ERB value is still higher than Ci is the magnitude of the cut-off point (C*) (Hartono, 2016). As the table below illustrates.

Table 13.
Comparation of Excess Return to Beta (ERB) Value with Cut-off Rate (Ci)

No.	Stock Code	ERB	Ci	Classification
1	BRPT	0,000366	5.44398×10^{-5}	Optimal
2	INKP	0,000366	9,4328E-05	Optimal
3	AMRT	0,000365	0,000127333	Optimal
4	ASII	0,000363	0,000164291	Optimal
5	BMRI	0,000362	0,000191464	Optimal
6	BBNI	0,000361	0,000220001	Optimal
7	PTBA	0,000361	0,000241045	Optimal

8	INCO	0,000359	0,00025922	Optimal
9	UNTR	0,000357	0,000280356	Optimal
10	ESSA	0,000355	**0,000309013**	Optimal

Stocks that have an ERB value higher than C* (ERB>C*) or ERB equal to C* (ERB=C*) are considered candidates for the optimal portfolio. The cut-off point value formed is 0.000309.

Calculating the Z-Score (Zi) and Proportion of Funds or Weight (Wi)

The Z-Score (Zi) and Proportion of Funds or Weight (Wi) are two important concepts in portfolio analysis used to determine the asset allocation in an optimal portfolio. Calculating the proportion of funds (Wi) is done by calculating the z-score (Zi) first. The formulas used are as follows:

Table 14.
Calculation Results of Z-Score (Zi) and Fund Proportion (Wi)

No.	Stock Code	Zi	Wi
1	BRPT	0,015371	0,066559
2	INKP	0,014794	0,064058
3	AMRT	0,016145	0,069909
4	ASII	0,018544	0,080295
5	BMRI	0,018665	0,080820
6	BBNI	0,020696	0,089613
8	PTBA	0,020826	0,090175
9	INCO	0,025981	0,112497
10	UNTR	0,030474	0,131953
11	ESSA	0,049451	0,214121

The proportion of funds (Wi) that make up the IDX30 index's optimal portfolio can be seen in Table 15. The table shows the results of the fund proportion in tabular form.

Table 15.
Results of Proportion of Funds

No.	Stock Code	Proportion of Funds (Wi)
1	BRPT	6.65%
2	INKP	6.40%
3	AMRT	6.99%
4	ASII	8.02%
5	BMRI	8.08%
6	BBNI	8.96%
8	PTBA	9.01%
9	INCO	11.24%

10	UNTR	13.19%
11	ESSA	20.41%

Conclusion

The Capital Asset Pricing Model (CAPM) was applied to analyze the performance of IDX30 stocks during the 2022–2023 period by linking systematic risk (beta) to expected returns. This approach effectively identified stocks whose returns are proportional to the risk undertaken. The optimal portfolio derived from this analysis consists of 11 stocks selected from the initial 21, namely: BRPT, INKP, AMRT, ASII, BMRI, BBNI, PTBA, ICBP, UNTR, and ESSA. Their respective portfolio weights are 6.65%, 6.4%, 6.99%, 8.02%, 8.08%, 8.96%, 9.01%, 11.24%, 13.19%, and 20.41%.

This portfolio composition reflects stocks that offer returns commensurate with their systematic risk as estimated by the CAPM model. Stocks with higher portfolio weights correspond to higher expected returns relative to the associated risk. These findings provide valuable guidance for investors aiming to construct efficient portfolios by carefully balancing risk and return.

Recommendations

This study is limited to a specific set of stocks within a defined timeframe, and it does not examine the CAPM's performance across different industries or varying market conditions. Future research could expand the scope by incorporating a broader and more diverse sample of stocks to better evaluate CAPM's effectiveness in different contexts.

Additionally, exploring CAPM's applicability in varied scenarios may reveal deeper insights into its strengths and limitations, making it more relevant for different investment environments. Future studies are also encouraged to combine CAPM with other asset pricing models such as the Arbitrage Pricing Theory (APT) or multifactor models. This integration could provide a more comprehensive framework for portfolio management, thereby enriching academic knowledge and offering more practical guidance for investors navigating increasingly volatile financial markets.

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