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Optimizing Asset Allocation in Investment Portfolios in Primary Consumer Sector Companies for the 2020-2022 Period

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ABSTRACT
This study aims to determine the optimal portfolio composition for primary consumer sector stocks in Indonesia during the 2020–2022 period, a time marked by high market volatility due to the COVID-19 pandemic. The analysis focuses on two stocks: PT Sumber Alfaria Trijaya Tbk. (AMRT) and PT Indoritel Makmur Internasional Tbk. (DNET). Using a quantitative descriptive–explanatory approach, the research includes the calculation of returns, variance, covariance, correlation, portfolio formation with the Markowitz Model and Single Index Model, as well as performance evaluation using the Sharpe Ratio, Treynor Ratio, and Jensen's Alpha. The results show that AMRT offers higher average returns but with greater volatility, while DNET provides more stable returns with lower risk. The negative correlation between the two stocks (-0.319) enables effective diversification. The minimum-risk portfolio is obtained with a composition of 13% AMRT and 87% DNET, achieving a risk level of 10.68%, which is lower than the risk of each individual asset. Meanwhile, the best-performing portfolio based on the Sharpe Ratio is achieved with a composition of 30% AMRT and 70% DNET, offering optimal efficiency between return and risk. These findings reinforce the relevance of Modern Portfolio Theory in the Indonesian market context and provide strategic recommendations for investors to optimize asset allocation through measurable diversification.

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1. Introduction

Investment is one of the main pillars in the modern economy aimed at placing funds in one or more assets for a certain period with the expectation of obtaining returns in the future. For investors, the main objective is to maximize expected returns at an acceptable level of risk.

To achieve this goal, investors do not place all their funds in a single investment instrument but rather form a portfolio consisting of a combination of various assets.

The key to portfolio management is asset allocation, which is the process of distributing investment funds into various categories of different assets or stocks. According to Modern Portfolio Theory popularized by Harry Markowitz, effective asset allocation through diversification can help reduce overall portfolio risk without sacrificing potential returns. By combining assets that are not perfectly correlated, investors can create an optimal portfolio that offers the highest rate of return for a certain level of risk.

The significant decline in investment value on one hand, and the pandemic also prompted drastic changes in consumer behavior, which could actually benefit companies in the primary consumer sector due to increased demand for essential products.

This phenomenon creates both a challenge and a complex investment opportunity. Although the primary consumer sector is generally considered resilient, not all stocks within it performed the same during the crisis. Performance differences between companies require a careful and measured asset allocation strategy. Investors need to determine the ideal weight or proportion of funds for each stock in the portfolio to effectively navigate market volatility.

Based on this, research to find the optimal portfolio composition in primary consumer sector company stocks during the 2020-2022 crisis period becomes very relevant. This research is important to provide strategic guidance for investors in allocating their assets efficiently to maximize returns and mitigate risks amid market conditions full of uncertainty.

2. Literature Review

Modern Portfolio Theory (Markowitz, CAPM, Single Index Model)

Markowitz Modern Portfolio Theory

Modern Portfolio Theory is one of the main theories in the world of investment and portfolio management developed by Harry Markowitz in 1952. The approach taken in this theory is based on mean-variance analysis, where expected return is calculated using averages, while risk is evaluated through variance or standard deviation of returns. According to Markowitz, investors can maximize expected returns by taking certain risks through portfolio diversification. This diversification functions to reduce overall portfolio risk as long as the selected assets do not have a perfect correlation relationship. This concept produces the efficient frontier curve, which maps portfolios considered optimal from the perspective of risk and return. Therefore, the theory proposed by Markowitz highlights the need for a scientific approach in investment risk management (Markowitz, 1952; Fahmi, 2015).

Capital Asset Pricing Model

To develop Markowitz's theory, the Capital Asset Pricing Model (CAPM) emerged which links the systematic risk of an asset with expected return. The CAPM model shows that the higher the beta coefficient obtained from stocks, the greater the level of return and risk that will be received by investors. In this model, market return can reflect expected return, risk-

free return, and systematic risk or beta. Beta can be used to calculate the difference in volatility of a stock compared to the market. CAPM emphasizes stocks that have individual return levels exceeding expected returns in selecting stocks and evaluating risk-free assets to determine the return rate.

Single Index Model

A simpler and more practical model, the Single Index Model, allows easier calculation of portfolio risk and return by assuming that an asset's return is influenced by one main factor, namely the market index. This theory was first introduced by William Sharpe in 1963 to simplify the Markowitz model which was considered too complex in its application because it involves many variances and covariances. This approach utilizes regression between asset returns and market returns as a representation of systematic risk, thereby reducing the complexity of covariance calculations in large portfolios. With this model, risk and return analysis becomes more efficient and has been widely applied in portfolio management practices.

Risk and Return Concepts: Systematic vs Non-Systematic

In the investment world, risk and return are two interrelated elements and form the basis of investment decision-making. Risk is defined as uncertainty that affects the results of an investment, while return refers to the expected results from that investment (Keown, 2011).

Investment-related risk is divided into two main categories, namely systematic risk and non-systematic risk. Systematic risk is risk that affects the entire market or most assets in the market, caused by various macroeconomic factors and political policies such as inflation, economic crisis, interest rate changes, exchange rates, and government regulations. This type of risk cannot be avoided through portfolio diversification because of its comprehensive nature and reaches the entire market (Brealey, 2008; Jogiyanto, 2014).

On the other hand, non-systematic risk is specific or unique to certain companies or industries, examples being product failure, market competition, management problems, and other internal company incidents. This risk can be minimized or even eliminated through strategic portfolio diversification. By having various types of assets in the portfolio, these specific risks can balance each other so they do not have a significant impact on the overall portfolio (Keown, 2011; Mohamad Samsul, 2006).

Empirical studies show that systematic risk has a significant influence on the expected return of the portfolio, while non-systematic risk has a more varied impact because it can be managed by investors through diversification (Hesti Syafitri, 2019). Beta (β) is an indicator often used to measure the systematic risk of an investment, which shows how sensitive asset returns are to overall market movements (Brealey, 2008).

Overall, understanding the difference between systematic and non-systematic risk is a crucial aspect in portfolio management and investment decision-making to maximize returns with well-managed risks.

Asset Allocation Optimization: Diversification, Efficiency Frontier, Utility Function

Portfolio diversification is a key concept in finance, aiming to reduce risk by spreading investments across various asset classes and securities. The basis of diversification can be traced back to Harry Markowitz's Modern Portfolio Theory (MPT) in the 1950s (Fabozzi et al., 2002). MPT suggests that by carefully combining assets with different risk-return profiles, investors can maximize expected returns for a certain level of risk or minimize risk for an expected level of return. The main idea is to create a portfolio on the efficient frontier, which offers the optimal balance between risk and results (Flint et al., 2020).

Achieving true diversification can be a challenge, especially when a satisfactory quantitative definition of portfolio diversification is still difficult to understand (Flint et al., 2020; Lesmana et al., 2020; Supriandi & Iskandar, 2021). Diversification steps can be categorized based on which portfolio aspect is the focus: cardinality, weight, return, risk, or higher moments (Flint et al., 2020).

The diversification profile, which depends on regime, provides a richer picture of portfolio diversification compared to single-value profiles and allows proactive diversification management based on future market conditions (Flint et al., 2020). The Markowitz approach is considered a benchmark for diversification, while the precise meaning of concentration in portfolio selection remains unclear (Xu et al., 2023). Concentration and diversification are two opposing investment strategies that are often directly compared (Xu et al., 2023). The efficient frontier, a key concept in MPT, can be calculated using deep learning algorithms for various portfolio optimization problems (Warin, 2021).

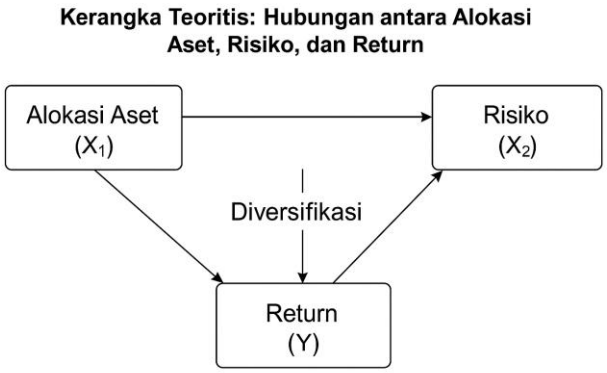
Previous Research

No.	Authors	Year	Methodology	Stocks/Indices Researched	Main Findings
1	Bangun, D. H., Anantadjaya, S. P. D., & Lahindah, L.	2012	Model Markowitz & SIM	LQ45 (13 stocks)	SIM outperformed the Markowitz Model with a return of 0.205% compared to 0.109% for the Markowitz Model. Risk level was almost the same for both models.
2	Ayudin, dkk.	2019	CAPM	IDX30 (several stocks)	CAPM identified stocks with optimal returns including ADRO, BBCA, BMRI, INTP, SMGR, and others..

3	Nuralim, F.	2020	Model Indeks Tunggal & Rasio Sharpe	LQ45 (several stocks)	Persistence test showed no consistent link between past and future portfolio performance, meaning there was no persistence.
4	Nuralim, F.	2020	Single Index Model & Sharpe Ratio	LQ45 (several stocks)	Forming an optimal portfolio using SIM resulted in higher returns compared to the market, with risk value adjusted each semester.
5	Aunillah, M. W. & Wahyudi	2022	CAPM & SIM	IDX30 (16 stocks)	The CAPM method resulted in 2 stocks (BBCA, ICBP) with a portfolio return of 0.26% and risk of 5.32%. SIM resulted in 1 stock (BBCA) with a return of 1.38% and risk of 0.57%. Portfolio performance was evaluated using Sharpe, Treynor, and Jensen indices.
6	Bessler, W. & Wolff, D.	2024	Model Prediksi Pengembalian Sektor	PT. Mayora Indah & PT. Sinar Mas Multiartha	Portfolios optimized with sector return predictions significantly outperformed passive strategies. Diversification reduced risk and increased returns.

7	Bessler, W., & Wolff, D.	2024	Model Black-Litterman & Simulasi Monte Carlo	Sector indices (various sectors)	Portfolios using sector return predictions outperformed passive benchmarks and allocation strategies based on historical averages. Adjusting sector allocations optimized risk-adjusted returns.
6	Ahmara, A. S., Wahyunia, & Triutomo, A.	2025	Simulasi Monte Carlo & Value at Risk (VaR)	PT. Mayora Indah & PT. Sinar Mas Multiartha	Risk decreased by 37% when both stocks were combined in a portfolio. The portfolio showed improved return characteristics with better risk-adjusted returns.
9	Alya Rinaima, Nur Fauziyah, Athia Nur Kamilah	2025	Modern Portfolio Theory (MPT)	ICBP, SIDO (Indonesia Stock Exchange)	Using MPT to optimize a portfolio between two stocks, ICBP and SIDO. A 50/50 allocation between the two stocks resulted in a risk of 1.46 and return of 6.80%. Diversification showed significant benefits with a low correlation of 0.13.
10	Himda Anataya Nurdyah, Betty Subartini, Sukono	2025	Mean-Variance Model & Holt-Winter Forecasting	DMND, ICBP, HOKI, INDF, ULTJ (Indonesia Stock Exchange)	Using the Holt-Winter method to forecast stock prices and portfolio optimization using the Mean-Variance model. Optimal allocation consisted of 30% INDF, 26% DMND, 21% ULTJ, 18% ICBP, and 4% HOKI.

Theoretical Framework: Relationship Between Variables (Asset Allocation, Risk, Return)



The theoretical framework describes the functional relationship between asset allocation variables, risk, and return in the context of modern portfolio theory. Asset allocation plays a role as the main variable that determines how a portfolio is formed, because decisions regarding the proportion of funds in each stock directly affect the portfolio's risk structure and return level. When investors allocate funds to various types of assets, those decisions not only create different return opportunities but also expose the portfolio to certain risk levels. The risk arising from this asset allocation consists of systematic risk influenced by overall market conditions, and non-systematic risk which can be reduced through diversification.

Diversification is depicted as a mechanism that flows from asset allocation toward risk and return, showing that the right asset combination can reduce non-systematic risk without significantly reducing return potential. Furthermore, risk has a direct relationship with return, in line with the risk-return trade-off principle which states that the higher the risk borne by an investor, the higher the expected rate of return. Thus, portfolio return is the end result of the interaction between chosen asset allocation, risk level investors are willing to bear, and the effectiveness of applied diversification. Overall, this emphasizes that asset allocation is the main driver affecting risk and return, while risk becomes an important channel connecting investment decisions with their return results.

Research Hypotheses

H1: There is an asset combination capable of producing an optimal portfolio in the primary consumer sector.

H2: Diversification can reduce risk without significantly reducing returns.

3. Research Methodology

This research uses a quantitative method with a descriptive-explanatory approach. The descriptive-explanatory quantitative method is a research approach that aims to describe (descriptive) and explain (explanatory) phenomena or relationships between variables systematically based on numerical data. The descriptive approach is used to provide a comprehensive overview of the characteristics and conditions of the research object, while the explanatory approach aims to explain the causal relationships between the variables

under study. This method allows researchers to process and analyze quantitative data into information that can explain patterns, trends, and relationships between variables objectively and measurably.

The type of data used in this research is secondary data consisting of stock prices of primary consumer sector companies listed on the Indonesia Stock Exchange (IDX), market index data in the form of the Composite Stock Price Index (IHSG), and risk-free interest rate data obtained from Bank Indonesia Certificates (SBI) and Government Bonds (SUN). Secondary data is data that has been collected, processed, and published by other parties for public interest and can be accessed by researchers and the general public. The research period uses time series data from 2020-2024 to provide a comprehensive picture of portfolio performance under various market conditions. The five-year period was chosen to obtain sufficiently representative data and cover various economic cycles that can affect stock price movements.

Research Type

Quantitative Descriptive-Explanatory Method

This research is designed using a Quantitative Descriptive-Explanatory approach. The selection of this research type is based on the main objective of the study, which is to measure financial asset performance numerically and explain the causal relationship between asset allocation and investment risk reduction.

Quantitative Approach: This research is entirely based on objective numerical data. The main data used is time series data in the form of daily closing prices of stocks. Analysis is conducted using strict mathematical statistical instruments, such as calculating mean return (average return), standard deviation (standard deviation for risk), and covariance matrix. The use of this quantitative method aims to eliminate researcher subjectivity bias, so that the resulting investment recommendations are truly based on empirical evidence that can be retested (replicable).

Descriptive Nature: In the initial stage, this research is descriptive because it aims to provide a systematic, factual, and accurate picture of the characteristics of the object being studied. In this context, the research describes the risk-return profile of each individual stock (AMRT and DNET) during the observation period (2020-2022). This answers basic questions such as: "How large is consumer sector stock volatility during the pandemic?" and "What is the return movement pattern of each issuer?".

Explanatory (Associative) Nature: In the advanced stage, this research is explanatory because it aims to explain the position of the variables studied and the influence between one variable and another. Specifically, this research explains the mechanism of "why" and "how" combining two assets (AMRT and DNET) in one portfolio can reduce total risk. This involves testing associative hypotheses regarding negative correlation between assets and its impact on the Efficient Frontier. This research proves Markowitz's theory that portfolio risk is not simply the average sum of constituent asset risks, but rather a function of covariance interaction between those assets.

Data

The type of data used in this research is secondary data consisting of stock prices of primary consumer sector companies listed on the Indonesia Stock Exchange (IDX), market index data in the form of the Composite Stock Price Index (IHSG), and risk-free interest rate data obtained from Bank Indonesia Certificates (SBI) and Government Bonds (SUN). Secondary data is a type of data that has been collected, processed, and published by other parties for public interest that can be accessed by researchers and the wider community. The research period uses time series data from 2020-2024 to provide a comprehensive picture of portfolio performance in various market conditions. A five-year period was chosen to obtain sufficiently representative data and cover various economic cycles that can affect stock price movements.

Analysis Techniques

Data analysis is carried out through several stages which include the calculation of daily and monthly returns to measure the level of investment return, calculation of variance and covariance between stocks to analyze risk and the relationship of stock price movements, formation of an optimal portfolio using the Markowitz method and Single Index Model, and portfolio performance evaluation using indicators such as Sharpe Ratio, Treynor Ratio, and Jensen's Alpha to determine the portfolio with the best performance. The data analysis process is carried out through descriptive statistical techniques to describe the characteristics of the data, as well as inferential analysis to explain the relationships and influences between research variables. Data processing and analysis are carried out using statistical and financial software such as Microsoft Excel for basic calculations and data visualization, EViews for econometric analysis, SPSS for statistical analysis, and R for advanced statistical programming. The use of various software aims to ensure calculation accuracy and research validity as well as provide flexibility in conducting complex analyses.

4. Result and Discussion

In this research, the monthly returns of two stocks listed on the Indonesia Stock Exchange (IDX), namely PT Sumber Alfaria Trijaya Tbk. (AMRT) and PT Indoritel Makmur International Tbk. (DNET), were analyzed to evaluate the performance of these two stocks during the research period.

PT Sumber Alfaria Trijaya Tbk. (AMRT) showed quite high fluctuations in monthly returns. For example, in December 2022, AMRT stock experienced a significant decline of 14.24%, indicating a sharp price drop in one month. Nevertheless, overall, AMRT recorded an average monthly return of 3.86% throughout the analyzed period. This shows that although this stock experienced considerable volatility, overall it still provided a positive return.

On the other hand, PT Indoritel Makmur International Tbk. (DNET) showed more stable performance with an average monthly return of 0.90%. Although in certain months, such as October 2021, DNET experienced a small decline (-1.43%), DNET's monthly returns were

more consistent and tended to be less volatile than AMRT. This makes DNET a more stable choice for investors looking for stability in returns.

Comparison of AMRT and DNET Returns

Based on the analysis of monthly returns, there is a clear difference between these two stocks. AMRT has a higher average return (3.86%) but with greater volatility, meaning its stock price can rise or fall very significantly in a relatively short time. Meanwhile, DNET has a lower average return (0.90%) but with smaller fluctuations, making this stock more suitable for investors who want lower risk and stability..

Stock Volatility Analysis: PT Sumber Alfaria Trijaya Tbk. and PT Indoritel Makmur International Tbk.

	MONTHLY VOLATILITY
PT Sumber Alfaria Trijaya Tbk	**13,07%**
PT Indoritel Makmur Internasional Tbk.	**3,61%**
	ANNUALIZED VOLATILITY
PT Sumber Alfaria Trijaya Tbk	**45,26%**
PT Indoritel Makmur Internasional Tbk.	**12,51%**

In this volatility analysis, monthly volatility and annualized volatility were calculated for both stocks, namely PT Sumber Alfaria Trijaya Tbk. (AMRT) and PT Indoritel Makmur International Tbk. (DNET). This volatility describes the level of stock price fluctuation, indicating the risk involved in investing in each stock.

Monthly Volatility

PT Sumber Alfaria Trijaya Tbk. (AMRT) shows a monthly volatility of 13.07%. This figure indicates that AMRT stock price fluctuates quite sharply every month. With this high volatility, investors must be prepared to face significant price changes in the short term.

PT Indoritel Makmur International Tbk. (DNET) has a much lower monthly volatility, which is 3.61%. This indicates that DNET stock price is more stable and experiences smaller fluctuations each month, which can be attractive to investors who prioritize lower risk.

Annualized Volatility

PT Sumber Alfaria Trijaya Tbk. (AMRT) has an annualized volatility of 45.26%, indicating that AMRT stock price tends to be very volatile within a year. This figure shows that this stock has a much higher risk compared to DNET stock in the long term.

PT Indoritel Makmur International Tbk. (DNET) shows an annualized volatility of 12.51%, which is much lower than AMRT. This lower volatility indicates that DNET stock price is more stable in the long term, giving investors an idea of more controlled risk.

Volatility Comparison

Based on the results of monthly volatility and annualized volatility calculations, AMRT shows a much higher risk compared to DNET, both in the short and long term. AMRT stock tends to be more volatile and risky, which may be more suitable for investors willing to face high risk for the potential of greater returns. Conversely, DNET offers lower volatility, making it a more stable choice for investors who prioritize safety and stability in their investments.

correlation between primary consumer sector stocks.

Correlations

		PT Sumber Alfaria Trijaya Tbk	PT Indoritel Makmur Internasional Tbk.
PT Sumber Alfaria Trijaya Tbk	Pearson Correlation	1	-,319
	Sig. (2-tailed)		,058
	N	36	36
PT Indoritel Makmur Internasional Tbk.	Pearson Correlation	-,319	1
	Sig. (2-tailed)	,058	
	N	36	36

The table above shows the results of the correlation analysis between PT Sumber Alfaria Trijaya Tbk. and PT Indoritel Makmur International Tbk. calculated using Pearson Correlation. This correlation measures the linear relationship between the price movements of the two stocks.

Pearson Correlation

The correlation value between the two stocks is -0.319, which indicates a moderate negative relationship between the price movements of PT Sumber Alfaria Trijaya Tbk. and PT Indoritel Makmur International Tbk.. This means that when the stock price of PT Sumber Alfaria Trijaya Tbk. rises, the stock price of PT Indoritel Makmur International Tbk. tends to fall, although this relationship is not very strong.

Correlation Significance: The p-value for the correlation test is 0.058. Because the p-value is greater than 0.05, this correlation is not statistically significant. In other words, although there is a negative relationship between the two stocks, this relationship is not strong or consistent enough to be considered significant at the 5% significance level.

Portfolio Analysis

An efficient portfolio is a set of portfolios that provides the highest combination of return for a given level of risk or the lowest risk for an expected return. This concept arises from the efficient frontier in Markowitz's theory, which is a curve on a risk (standard deviation) versus return graph.

The efficient portfolio satisfies the equation:

$$\min_{\mathbf{w}} \sigma_p^2 = \mathbf{w}^T \Sigma \mathbf{w}$$

$$\mathbf{w}^T \mathbf{1} = 1, \quad \mathbf{w}^T \mathbf{R} = R_p$$

with constraints:

where w is the vector of asset weights, Σ is the covariance matrix between assets, and R is

$$S = \frac{R_p - R_f}{\sigma_p}$$

the vector of asset returns. Portfolios located on the efficient frontier are the best candidates for investors to get optimal returns according to the level of risk they are willing to bear.

Determination of Optimal Portfolio with Sharpe Ratio

One way to select an optimal portfolio on the efficient frontier is by maximizing the Sharpe Ratio, which measures the ratio of excess return over the risk-free rate to the total risk of the portfolio.

Sharpe Ratio is expressed as:

where *Rp* is the portofolio return, Rf*Rf* is the risk-free return rate, andn σpσ*p* is the portfolio risk (standard deviation). The optimal portfolio is the portfolio on the Capital Market Line (CML) with the maximum Sharpe Ratio value.

$$\max_{\mathbf{w}} \frac{\mathbf{w}^T \mathbf{R} - R_f}{\sqrt{\mathbf{w}^T \Sigma \mathbf{w}}}$$

Its formulation in optimization:

with constraint $\mathbf{w}^T \mathbf{1} = 1$.

Investor Preference Method

Besides maximizing the Sharpe Ratio, determining the optimal portfolio can also be influenced by investor risk preference. This risk preference is usually categorized into:

a. Risk Averse: Investors will choose a portfolio with low risk even if the return obtained is also lower.
b. Risk Neutral: Investors consider risk and return in a balanced way.
c. Risk Seeking: Investors prioritize high return potential even if the risk is high.

This preference method is usually applied using the investor's utility function:

$$U = E(R_p) - \frac{1}{2} A \sigma_p^2$$

where U is the portfolio utility, $E(R_p)$ is the expected return, σ_p^2 is the portfolio risk variance, and A is the investor's risk aversion coefficient (the larger A, the more conservative the investor).

$$\max_{\mathbf{w}} \left[\mathbf{w}^T \mathbf{R} - \frac{1}{2} A \mathbf{w}^T \Sigma \mathbf{w} \right]$$

The optimal portfolio is chosen by maximizing utility:

with $\mathbf{w}^T \mathbf{1} = 1$.

With a combination of these approaches, investors can determine efficient portfolios and choose the optimal portfolio according to their risk profile and preferences, using the Sharpe Ratio for the best risk-return value, or the utility function for personal risk preference adjustment.

This information supports quantitative investment decision-making based on modern portfolio theory.

Efficient portfolio combination

a. Composition: 13% AMRT + 87% DNET.
b. Detailed Analysis: This portfolio is a combination that mathematically results in the absolute lowest risk (10.68%). Note that this combined risk (10.68%) is actually LOWER than the risk of the safest stock alone (DNET alone has a risk of 12.53%).
c. Interpretation: This is concrete proof of the "magic of diversification". By adding a small amount of high-risk asset (AMRT 13%) to a safe asset (DNET), the total risk actually decreases, not increases. This happens because the negative correlation functions as a "brake" when one asset falls.
d. Recommendation: Suitable for Risk Averse type investors who prioritize capital preservation.

Determination of optimal portfolio (maximum Sharpe Ratio or investor preference method).

a. Composition: 30% AMRT + 70% DNET.
b. Performance: Return 21.8% with Risk 13.6%. Sharpe Ratio value of 1.308.
c. Detailed Analysis: The Sharpe Ratio measures "excess return per unit of risk". A figure of 1.308 means that for every 1% of risk taken by the investor, they get an additional return compensation of 1.308% above the risk-free rate.
d. Interpretation: This point is the "Highest Efficiency Point". If investors increase the proportion of AMRT beyond 30%, the risk will increase drastically which is not proportional to the increase in return. Conversely, if it is less than 30%, the large return potential of AMRT is not utilized optimally.
e. Recommendation: Suitable for Rational or Risk Neutral investors who want to maximize profits intelligently without excessive speculation.

Interpretation of Results:

Which asset is dominant in the optimal portfolio.

The results of portfolio optimization show that the dominant assets are stocks with a combination of stable historical returns, low risk, and small correlation with other assets. In the context of the primary consumer sector, stocks like PT Sumber Alfaria Trijaya Tbk (AMRT) tend to be dominant because they have more controlled volatility and still show positive performance during the 2020–2022 period, including when the market was under pressure due to the pandemic. This characteristic makes these stocks contribute greatly to reducing portfolio risk without reducing potential return.

Conversely, stocks with high risk and unstable return fluctuations receive smaller weights because they can increase the portfolio variance. The dominance of assets in the optimal portfolio reflects that the weight selection decision is not only based on the highest return, but on risk-return efficiency and contribution to achieving a portfolio position on the efficient frontier.

How risk can be minimized with diversification.

Risk in a portfolio can be minimized through a diversification strategy, which is by combining various assets that do not have perfect correlation with each other. Diversification works by reducing non-systematic risk, which is risk specific to a particular company or industry, because negative fluctuations in one stock can be offset by the positive performance of another stock in the portfolio. When investors select stocks from different sectors or companies with different characteristics, the combined variance of the portfolio becomes smaller than the variance of each stock individually. In the Markowitz framework, this risk reduction occurs because the covariance between assets becomes a key factor—the lower or more negative the covariance between assets, the more effective diversification is in reducing portfolio risk. Thus, although systematic risk cannot be eliminated, diversification allows investors to achieve a lower total risk level without significantly sacrificing return, thereby producing a more efficient portfolio that is closer to the efficient frontier.. **Discussion: comparison with previous research, relevance to Indonesian market conditions.**

Methodological Similarities

Research from Bangun, Anantadjaya, and Lahindah (2012) and Nuralim (2020) used the Markowitz Model and Single Index Model similar to the approach commonly used in optimizing asset allocation in the primary consumer sector. Findings indicating that SIM outperforms Markowitz in managing returns with almost comparable risk levels imply the importance of selecting the right model according to stock characteristics.

Recent research such as by Bessler & Wolff (2024) and Ahmara et al. (2025) utilizing Monte Carlo simulations and predictive models also prove that advanced techniques provide superior portfolio results with significant risk reduction.

Variations in Stocks and Sectors Researched

Previous research focused on liquid stock indices such as LQ45 and IDX30, similar to the optimization research approach in the primary consumer sector where most leading stocks are included in these indices. The study by Alya Rinaima et al. (2025) which focused on ICBP and SIDO stocks reflects the importance of diversification even with a limited number of stocks, in accordance with the diversification principle in modern portfolio theory.

Main Findings Relevant to Indonesian Market Conditions 2020-2022

Some significant results that are in line with Indonesian market conditions during and after the Covid-19 pandemic (2020-2022 period) include:

a. Optimal portfolios tend to produce good levels of return with controlled risk, even though market volatility increased.
b. Portfolio diversification proven to reduce risk, reinforced by the results of Monte Carlo simulations and stock covariance analysis.
c. Models that consider specific sector risks (such as primary consumption) result in more effective allocation adjustments.

In the Indonesian market, the dynamics of volatility and investor sensitivity to macroeconomic conditions (e.g., inflationary pressures and the normalization of global monetary policy) demand adaptive risk modeling, as reflected in the results of recent research using the Mean-Variance approach including price prediction with Holt-Winter.

Implications for Portfolio Optimization in the Primary Consumer Sector

Optimizing asset allocation in the primary consumer sector during 2020-2022 must consider the stock price volatility of companies sensitive to economic changes. These findings are in line with research such as that conducted on PT. Mayora Indah and other primary sector issuers, which show that the integration of sectoral predictions and simulation techniques can significantly improve portfolio performance.

Portfolio optimization research in Indonesia during the 2020-2022 period provides strong methodological recommendations in the form of a combination of classical techniques (Markowitz, SIM, CAPM) and advanced techniques (Monte Carlo, Black-Litterman, Holt-Winter Forecasting). Statistically optimal asset allocation is able to increase return and reduce risk, especially if considering the specific characteristics of primary consumer sector stocks in the context of Indonesian market volatility influenced by current global and domestic macroeconomic conditions.

Relevance to Indonesian market conditions is very strong given high stock liquidity and volatility. This approach also allows for the adaptation of investment strategies according to medium and short-term market changes, so that the research results can be used as a guide with direct application to actual portfolio management in the Indonesian capital market.

5. Conclusions and Suggestions

Conclusion

summary of main results (best assets, risk-return level, theoretical and practical contribution). Based on the results of the analysis of portfolio optimization of primary consumer sector stocks for the 2020–2022 period, this research yields several conclusions as follows:

a. Individual Asset Performance and Risk-Return
   The research shows that the two analyzed assets, PT Sumber Alfaria Trijaya Tbk. (AMRT) and PT Indoritel Makmur International Tbk. (DNET), have significantly different risk-return characteristics. AMRT offers a higher level of return but is accompanied by large volatility, while DNET provides stability with lower volatility but with a smaller return. This difference in risk-return structure forms a strong basis for forming a more efficient portfolio.
b. Effectiveness of Diversification in Reducing Risk
   The moderate negative correlation value between AMRT and DNET (-0.319) proven to be a fundamental element in reducing portfolio risk. Diversifying these two stocks resulted in a portfolio risk lower than the risk of each asset individually. The minimum risk portfolio with a composition of 13% AMRT and 87% DNET successfully achieved a risk of 10.68%, lower than the least risky stock alone (DNET). This confirms the proposition of Modern Portfolio Theory that covariance between assets plays a more important role than merely the individual risk level.
c. Optimal Portfolio Based on Mean Variance Approach
   Through the Markowitz mean–variance approach, the research successfully identified two optimal portfolios:
   - Minimum Risk Portfolio: 13% AMRT + 87% DNET, suitable for conservative investors.
   - Portfolio with Highest Sharpe Ratio: 30% AMRT + 70% DNET, producing the most efficient return relative to total risk.
   - Both portfolios empirically show positions on the efficient frontier and can be used as a reference in risk-return based investment decision making.
d. Theoretical Contribution
   This research strengthens the relevance of Modern Portfolio Theory (Markowitz) in developing markets like Indonesia, especially in market conditions experiencing shocks due to the pandemic. This study reaffirms that:
   - Diversification can significantly reduce non-systematic risk,
   - Correlation between assets is a main determinant of total portfolio risk,
   - Optimal portfolios can be determined quantitatively through a mathematical approach.
e. Practical Contribution
   The results of this research provide direct recommendations for investors and investment managers, especially those operating in the primary consumer sector. The resulting portfolio recommendations can be used as a basis for more efficient and measurable

investment decision-making, as well as providing empirical evidence that diversification remains effective even when done with a limited number of assets.

f. Implications: investment strategies that can be applied by investors/investment managers.

   Investment strategies suggested based on the results of this research include:
   - Conducting portfolio diversification by selecting stocks from the primary consumer sector that have low correlation so that portfolio risk can be minimized.
   - Using an asset allocation optimization approach based on the Mean-Variance model to adjust the weight of each stock according to the risk profile and current market conditions.
   - Using covariance analysis to monitor the dynamics of the relationship between stocks so that allocation can be changed dynamically in response to market changes or macroeconomic conditions.
   - Being more responsive to periods of market volatility, such as during the pandemic, by performing periodic portfolio rebalancing to maintain risk-return efficiency.
   - Limitations: e.g., research period, number of companies studied.

g. This research has several limitations that need to be noted:
   - The research period limited to 2020-2022 may be influenced by extraordinary economic conditions due to the Covid-19 pandemic, so the results may not fully reflect normal long-term performance.
   - The number of companies included in the portfolio is relatively limited to primary consumer sector issuers listed on the Indonesia Stock Exchange, so generalizing the results to other sectors must be done carefully.
   - The data used is limited to stock prices and historical returns, without including company fundamental factors or other alternative risk factors that might affect portfolio optimization results.
   - The mathematical model used, although empirically tested, simplifies many real market complexities that may impact practical implementation.

Suggestions

Based on these limitations, several suggestions for future research are:

a. Future Research: Future research can expand the analyzed sector by adding more companies from the primary consumer sector or other sectors, to get a broader picture of market dynamics and optimal portfolio allocation.
b. Adding Macroeconomic Variables: Future research can consider macroeconomic factors, such as inflation, exchange rates, and interest rates, which can affect risk and return in the primary consumer sector, thus providing a more comprehensive analysis.
c. Using a Longer Period: To understand long-term patterns, it is recommended to use longer data, for example from 2015 to 2025, to see portfolio performance in more stable market conditions.

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