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Formation of Optimal Portfolio Using A Single Index in Pharmaceutical Companies

Sara Nurdia Rosa[1]
Ledia Tereza[2]
Efa Agustina[3]
Yulana Desilfa[4]
Dian Puji Puspita Sari[5]

Universitas Muhammadiyah Riau, Fakultas Ekonomi dan Bisnis, Indonesia[1,2,3,4,5]
[1]saranurdia16@gmail.com [2]lediatereza@gmail.com [3]efaagustina5@gmail.com
[4]Desilfa20ifa@gmail.com

The purpose of this study is to identify optimal portfolio stocks using the Single Index Model. This research applies a descriptive method with a quantitative approach. The population and sample consist of all pharmaceutical companies listed on the Indonesia Stock Exchange (IDX), including: PT Merck Indonesia Tbk, PT Kalbe Farma Tbk, PT Tempo Scan Pacific Tbk, PT Darya Varia Laboratoria Tbk, PT Indofarma (Persero) Tbk, PT Kimia Farma Tbk, PT Pyridam Farma Tbk, PT Sido Muncul Tbk, and PT Pharos Tbk. The data used are secondary data obtained from sources such as www.idx.co.id, www.yahoofinance.co.id, and www.bi.go.id through documentation and literature review techniques. The results show that three companies—SIDO, PYFA, and DVLA—are considered optimal for portfolio formation, as their Excess Return to Beta (ERB) values are higher than the corresponding cut-off point (Ci).

Keywords: *Investment; Return; Risk; Single Index; Optimal Portfolio*

1. Introduction

Stock investment carries high risks, yet it has gained significant attention from investors, as evidenced by the rising number of stock market participants in recent years (Hudi et al., 2021; Sunaryono, 2021). The capital market serves as a platform for trading financial instruments such as stocks, bonds, and mutual funds, playing a vital role in a nation's economy by bridging investors with fund-seeking companies (Khairul & Astuti, 2021). While awareness of stock investment is growing, many individuals in Indonesia remain hesitant due to misconceptions, such as the belief that large capital is required (Ariasih & Mustanda, 2018; Wardah, 2019). In reality, investing in stocks is now accessible with minimal funds, starting as low as IDR 100,000. However, the lack of financial literacy and understanding of market dynamics continues to hinder broader participation (Handayani & Purnama, 2019; Hudi et al., 2021).

Stock prices fluctuate daily due to a mix of internal and external factors. Internal factors include company management, operational efficiency, and product offerings, while external influences encompass interest rates, economic conditions, and political stability (Ariasih & Mustanda, 2018; Saputra & Ramadhani, 2022). Investors often struggle to select the right stocks amid these complexities, leading to suboptimal investment decisions (Rachmayani & Hidayat, 2020; Andriana & Setyawan, 2020). To mitigate risks, portfolio management becomes essential. A well-structured portfolio combines diverse assets to balance risk and return, aligning with the investor's financial goals (Agustina & Kurniawan, 2020; Pratama & Budiyanto, 2016). Despite the availability of various investment strategies, many retail investors lack the expertise to form efficient portfolios, resulting in missed opportunities or unnecessary exposure to market volatility (Nurul & Pratama, 2021; Satria & Astuti, 2021).

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One effective strategy to reduce investment risk is diversification, which involves allocating funds across different asset classes such as stocks, bonds, and real estate (Marissa & Kurniawan, 2019; Widodo & Suryani, 2020). However, diversification alone is insufficient; investors must also aim for an optimal portfolio that maximizes returns for a given level of risk (Rahman & Gunawan, 2020). The concept of an efficient portfolio, derived from modern portfolio theory, emphasizes selecting assets that offer the highest expected return for a defined risk level or the lowest risk for a targeted return (Umam et al., 2017). Achieving this requires analytical tools, such as the Single Index Model, to evaluate securities based on metrics like excess return to beta (ERB) and cut-off rates (Arisandy et al., 2017; Titi & Susanto, 2021).

Despite the theoretical foundation of portfolio optimization, practical challenges persist. Many investors, particularly retail participants, lack access to advanced analytical tools or rely on incomplete information, leading to subpar portfolio performance (Agustina & Kurniawan, 2020; Ariasih & Mustanda, 2018). Additionally, sector-specific risks, such as those in the pharmaceutical industry, demand specialized strategies due to unique market dynamics, regulatory changes, and competitive pressures (Hartono, 2021). Existing research often focuses on broad market applications, leaving gaps in sector-specific portfolio optimization methodologies (Satria & Astuti, 2021; Titi & Susanto, 2021).

This study addresses these gaps by examining the formation of an optimal portfolio using the Single Index Model, specifically targeting pharmaceutical companies listed on the Indonesia Stock Exchange from 2019 to 2020. The pharmaceutical sector is chosen due to its resilience during economic fluctuations and growing demand, making it a compelling area for investment analysis (Sunaryono, 2021; Widodo & Suryani, 2020). By applying rigorous quantitative methods, this research aims to provide actionable insights for investors seeking to minimize risk while maximizing returns in this sector (Andriana & Setyawan, 2020; Rachmayani & Hidayat, 2020).

The novelty of this study lies in its focused approach to sector-specific portfolio optimization, offering a practical framework for retail and institutional investors alike (Nurul & Pratama, 2021; Saputra & Ramadhani, 2022). By bridging the gap between theoretical models and real-world application, this research contributes to the broader discourse on investment strategies and empowers investors with data-driven decision-making tools (Umam et al., 2017; Agustina & Kurniawan, 2020). The findings are expected to enhance financial literacy, improve portfolio performance, and encourage informed participation in the capital market (Hudi et al., 2021; Khairul & Astuti, 2021).

2. Literature Review

Capital Market and Investment Behavior

The capital market serves as a critical platform for economic development, enabling companies to raise funds while offering investors opportunities to grow their wealth. An increase in public awareness of capital market instruments has led to a notable rise in investor participation, particularly in equity investments (Hudi et al., 2021; Khairul & Astuti, 2021). Despite the growing interest, misconceptions—such as the notion that stock investment requires substantial capital—persist among novice investors, resulting in underutilized investment opportunities (Ariasih & Mustanda, 2018; Wardah, 2019). In reality, technological advancements and market accessibility have made it possible to start investing with minimal capital, which aligns with government and financial institution efforts to promote financial inclusion (Handayani & Purnama, 2019).

Portfolio Theory and Optimization

The foundation of modern investment analysis lies in **Modern Portfolio Theory (MPT)**, which emphasizes the trade-off between risk and return and encourages diversification to reduce unsystematic risk (Markowitz, as cited in Marissa & Kurniawan, 2019). While diversification spreads risk across various assets, it does not eliminate all market risks. To address this, portfolio optimization methods such as the **Single Index Model** have been developed to help investors build efficient portfolios based on risk-adjusted returns (Arisandy et al., 2017; Umam et al., 2017). This model relies on evaluating securities using metrics like **Excess Return to Beta (ERB)** and a **cut-off rate**, facilitating the selection of assets that offer superior performance relative to their risk exposure (Rahman & Gunawan, 2020).

The Single Index Model in Practice

Numerous studies have applied the Single Index Model in various market contexts to identify optimal portfolios that align with investor preferences (Agustina & Kurniawan, 2020; Satria & Astuti, 2021). This model simplifies portfolio construction by assuming that a single market index, such as the LQ45 or Jakarta Islamic Index (JII), represents the systematic risk of all assets (Sunaryono, 2021; Wardah, 2019). Research also highlights that the model is suitable for both conventional and sharia-compliant stocks, particularly when data and analytical capabilities are limited (Titi & Susanto, 2021). While the model offers a structured approach to asset selection, investors must still consider industry-specific factors, such as regulatory changes and operational risks, especially in dynamic sectors like pharmaceuticals (Widodo & Suryani, 2020; Andriana & Setyawan, 2020).

Sector-Specific Portfolio Analysis

Focusing on a specific sector allows for a more precise understanding of asset behavior and risk exposure. In particular, the pharmaceutical sector has shown resilience during economic downturns, making it an attractive investment option during uncertain times (Sunaryono, 2021). However, sector-based portfolios demand tailored strategies that account for unique market dynamics and volatility patterns (Rachmayani & Hidayat, 2020). Previous research has primarily focused on broad market indices; therefore, this study addresses a research gap by applying portfolio optimization methods to a specific and timely sector, providing insights that are both academically relevant and practically valuable (Nurul & Pratama, 2021; Saputra & Ramadhani, 2022).

3. Methodology

This research was conducted using data from pharmaceutical companies listed on the Indonesia Stock Exchange (IDX) during the 2019–2020 period. The study focused specifically on nine pharmaceutical firms: PT. Sido Muncul Tbk (SIDO), PT. Pyridam Farma Tbk (PYFA), PT. Darya-Varia Laboratoria Tbk (DVLA), PT. Tempo Scan Pacific Tbk (TSPC), PT. Kalbe Farma Tbk (KLBF), PT. Merck Indonesia Tbk (MERK), PT. Phapros Tbk (PEHA), PT. Indofarma (Persero) Tbk (INAF), and PT. Kimia Farma (Persero) Tbk (KAEF). These companies were selected because of their active listing and financial data availability within the observation window.

The research employs a **descriptive quantitative approach**, aiming to describe the characteristics of each variable without testing causal relationships. Descriptive research is used to understand the value of variables independently, and a quantitative approach was chosen to analyze numerical data systematically. The sampling technique applied in this study is **saturated sampling** (census sampling), where the entire population of nine companies is used as the research sample due to the limited number of pharmaceutical firms listed on the IDX during the period.

Secondary data is utilized in this study, obtained from official sources such as www.idx.co.id, www.bi.go.id, and Yahoo Finance. The data includes monthly closing stock prices, the Composite Stock Price Index (IHSG) for market return calculations, and Bank Indonesia's interest rate (BI Rate) as a proxy for the risk-free return. Data collection methods involved documentation techniques—such as recording and copying from online databases—and literature review to support the conceptual framework and analytical model applied.

The data analysis technique used is the **Single Index Model**, which identifies an optimal portfolio by measuring each stock's excess return relative to its beta (risk) and comparing it to a cut-off rate. Analysis was conducted using Microsoft Excel to compute stock returns, risk (standard deviation), beta, alpha, residual variance, and covariance. The process includes calculating the Excess Return to Beta (ERB), determining the cut-off point (Ci), and selecting stocks with ERB values above the cut-off for portfolio inclusion. This systematic approach helps determine which stocks should be included in the optimal portfolio based on their risk-adjusted performance.

4. Results

This study examined pharmaceutical companies listed on the Indonesia Stock Exchange (IDX) during the 2019–2020 period. Out of the total population, nine pharmaceutical firms were selected as the research sample, including PT. Merck Indonesia Tbk, PT. Kalbe Farma Tbk, PT. Tempo Scan Pacific Tbk, PT. Darya Varia Laboratoria Tbk, PT. Indofarma (Persero) Tbk, PT. Kimia Farma (Persero) Tbk, PT. Pyridam Farma Tbk, PT. Sido Muncul Tbk, and PT. Phapros Tbk. Data gathered from IDX was processed and analyzed using the Single Index Model to identify stocks that could form an optimal investment portfolio.

Table 1. ERB dan Ci

Emiten	α	β	σ_{ei}^2	ERB	C_i	C*	Conclusion
SIDO	0.0306	0.1358	0.0070	0.1951	0.0016	0.0036	**Optimal**
PYFA	0.0930	0.9635	0.0711	0.0924	0.0036	0.0036	**Optimal**
DVLA	0.0105	0.0835	0.0025	0.0763	0.0006	0.0036	**Optimal**
TSPC	0.0048	1.0276	0.0128	0.0008	0.0002	0.0036	-
KLBF	0.0015	0.5833	0.0065	-0.0044	-0.0006	0.0036	-
MERK	-0.0034	1.2971	0.0219	-0.0057	-0.0011	0.0036	-
PEHA	-0.0133	0.6305	0.0167	-0.0275	-0.0019	0.0036	-
INAF	0.0495	-1.0940	0.2019	-0.0413	-0.0007	0.0036	-
KAEF	0.0708	-1.0395	0.1400	-0.0640	-0.0015	0.0036	-

Source : Processed Data (2022)

From the table above, it can be seen that three companies were included in the optimal portfolio because their Excess Return to Beta (ERB) values were greater than their respective cut-off rates (Ci). These companies are SIDO, PYFA, and DVLA. When investing, investors are inherently exposed to risk; therefore, it is crucial to form an optimal portfolioto achieve the best possible combination of maximum return with minimum risk.

The cut-off point (C*) represents the highest Ci value among all the analyzed stocks. This value serves as the threshold for determining which stocks qualify as candidates for the optimal portfolio. The optimal portfolio comprises stocks whose ERB values are greater than or equal to the corresponding Ci. In this study, the calculated cut-off point (C*) is 0.0036, which corresponds to the PYFA stock.

The goal of forming an optimal stock portfolio is to reduce risk through diversification. In this study, three stocks were identified as portfolio candidates. Once these stocks were selected, it became necessary to calculate the fund allocation proportion for each stock in order to maximize return at a given level of risk, or alternatively, minimize risk at a targeted return. These fund proportions are calculated through a mathematical process. The weighted scale (Zi) is first computed to ensure accurate allocation. This scale is derived by dividing each stock's individual beta by its residual variance, then multiplying the result by the difference between its ERB and the cut-off point. After calculating the weighted scale for each stock, the proportion of funds (Wi) is determined by dividing each stock's weighted value by the total sum of all weighted values.

1. Stocks Forming the Optimal Portfolio: After comparing the ERB and Ci values of the nine stocks analyzed, three stocks were found to have ERB values higher than their respective Ci, making them eligible for inclusion in the optimal portfolio. These stocks are SIDO (PT. Sido Muncul Tbk), PYFA (PT. Pyridam Farma Tbk), and DVLA(PT. Darya Varia Laboratoria Tbk).
2. Proportion of Stocks in the Optimal Portfolio: For the three selected stocks, the next step is to calculate the fund allocation proportion (Wi) for each. To do so, the weighted scale (Zi) for each stock must first be computed.

Table 2. Calculation of Fund Allocation Proportion for Each Stock

Emiten	Z_i	W_i	α_p	β_p	σ_{ei}^2
SIDO	3,6930	0,5075	0,0155	0,0689	0,0036
PYFA	1,2038	0,1654	0,0154	0,1594	0,0118
DVLA	2,3807	0,3271	0,0034	0,0273	0,0008
TSPC	-0,2224	-0,0306	-0,0001	-0,0314	-0,0004
KLBF	-0,7116	-0,0978	-0,0001	-0,0570	-0,0006
MERK	-0,5490	-0,0754	0,0003	-0,0979	-0,0016
PEHA	-1,1734	-0,1612	0,0021	-0,1017	-0,0027
INAF	0,2432	0,0334	0,0017	-0,0366	0,0067
KAEF	0,5020	0,0690	0,0049	-0,0717	0,0097
	7,2776	0,7374	0,0343	0,2556	0,0162
			$E(R_m)$	**0,0001**	
			E(Rf)	**0,0041**	
		SIM =	**$E(R_p)$**	**0,0344**	
		CAPM =	**$E(R_p)$**	**0,0031**	
		Variance Market	$\frac{\sigma_m^2}{\sigma_p^2}$	**0,0031**	
		Variance Portofolio		**0,0164**	

Table 2 shows the fund allocation proportions that form the optimal stock portfolio. It can be seen that the highest fund proportion is allocated to SIDO, with a value of 3.6930, while the lowest fund proportion is allocated to PEHA, with a value of -1.1734. Stocks with the highest fund proportions are considered more favorable investment alternatives and should be prioritized by rational investors.

5. Discussion

The findings of this study reaffirm the effectiveness of the Single Index Model (SIM) in selecting optimal portfolios within the pharmaceutical sector listed on the Indonesia Stock Exchange. By applying the SIM approach, it was observed that not all stocks contribute equally to portfolio efficiency; only those with favorable excess return-to-beta ratios relative to the cut-off rate were included. This is consistent with the findings of Agustina and Kurniawan (2020), who emphasized that the SIM helps investors filter stocks that deliver superior returns in proportion to the risk they carry.

The inclusion of only a subset of stocks into the optimal portfolio supports the notion that diversification is not merely about increasing the number of assets but selecting the right assets that align with return-maximizing and risk-minimizing strategies. This aligns with Andriana and Setyawan (2020), who highlighted that the key to an optimal portfolio lies in the quality—not the quantity—of assets chosen based on systematic risk considerations.

A notable insight from the analysis is the central role of systematic risk (beta) in investment decision-making. Stocks with high excess returns but lower beta values emerged as more favorable candidates. This reinforces the principle that minimizing exposure to market-wide fluctuations, while maximizing returns, remains a cornerstone of modern portfolio theory, as supported by the research of Khairul and Astuti (2021).

Another important implication is the necessity for rational investors to base their decisions on quantified financial indicators rather than assumptions. As emphasized by Rahman and Gunawan (2020), the Single Index Model allows investors in emerging markets to make more informed decisions amid uncertain market conditions by leveraging objective calculations like ERB and beta.

Moreover, the study illustrates how a mathematically grounded approach—such as calculating weighted scales for fund allocation—ensures that capital is distributed efficiently among selected assets. This is in line with the work of Ariasih and Mustanda (2018), who argue that SIM not only simplifies the portfolio selection process but also strengthens the reliability of fund distribution.

In conclusion, the research findings underscore the practical relevance of the Single Index Model in constructing a well-diversified and efficient portfolio. It empowers investors to navigate market volatility by focusing on systematic risk-adjusted returns and offers a robust framework particularly suited for markets like Indonesia, as also suggested by Saputra and Ramadhani (2022).

6. Conclusion

This study concludes that there are three pharmaceutical companies—PT. Sido Muncul Tbk (SIDO), PT. Pyridam Farma Tbk (PYFA), and PT. Darya Varia Laboratoria Tbk (DVLA)—whose stocks meet the criteria for inclusion in an optimal portfolio using the Single Index Model. These stocks are considered optimal because their Excess Return to Beta (ERB) values exceed the cut-off point (Ci), indicating strong performance relative to systematic risk. The investment proportion for each of these stocks was also determined, with SIDO receiving the largest allocation, followed by DVLA and PYFA. These proportions suggest that diversification among these three stocks can offer investors a well-balanced portfolio with potentially higher returns

at minimized risk. However, this study is limited to analyzing pharmaceutical companies without evaluating their financial efficiency or operational performance during the observed period.

For investors, it is recommended to consider these three optimal stocks in future investment strategies, particularly if similar market conditions persist. Nonetheless, investors should not rely solely on portfolio models; incorporating a thorough analysis of company fundamentals and market trends will support better-informed decisions. For companies whose stocks were not included in the optimal portfolio, this should serve as an opportunity for reflection and improvement. They are encouraged to evaluate their stock performance and take strategic actions to enhance shareholder value, which could increase their attractiveness in future portfolio selections. Finally, future researchers are advised to extend the scope of analysis by incorporating more diverse indicators and lengthening the observation period to produce more comprehensive and robust findings.

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