Optimization Of Stock Investment Portfolio Listed In IDX ESG Leaders (2018-2023)

Optimalisasi Portofolio Investasi Saham Yang Listed Di ESG Leaders BEI (2018-2023)

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ABSTRACT
This study aims to analyze how optimal portfolios of ESG stocks are formed from the ESG Leaders index and then compare them with the optimal portfolios of stocks from the LQ45 index using two methods, namely the Single Index Model and the Markowitz Model, where the Single Index Model uses a single index as the basis for forming the optimal portfolio, while the Markowitz Model optimizes portfolio diversification by considering the relationships between the stocks. The results of the study show that for the ESG Leaders portfolio in the Single Index Model, the composition consists of TBIG (13.41%), BBCA (79.33%), and TOWR (7.26%), with an expected return of 1.23% per month or 15.7% per year, and a standard deviation of 5.21% per month or 18.0% per year. The Sharpe Ratio value is 0.1624. For the Markowitz Model, the optimal ESG Leaders portfolio consists of BBCA (74.11%), TBIG (12.34%), and TOWR (13.55%), with an expected return of 1.212% per month or 15.56% per year, and a standard deviation of 4.9% per month or 15.6% per year. The Sharpe Ratio value is 0.167. The practical implication of this research is the availability of diverse investment strategy options for investors interested in ESG Leaders. Choosing the appropriate model will assist investors in forming an optimal portfolio according to their goals and preferences.
Keywords: ESG Risk, Portfolio, Single Index, Markowitz

ABSTRAK
Penelitian ini bertujuan untuk menganalisis bagaimana pembentukan portofolio optimal saham-saham ESG dari indeks ESG Leaders kemudian membandingkannya dengan portofolio optimal saham-saham dari indeks LQ45 dengan menggunakan dua metode yaitu Single Index Model dan Markowitz Model, dimana Single Index Model menggunakan satu indeks sebagai dasar pembentukan portofolio optimal, sedangkan Markowitz Model mengoptimalkan diversifikasi portofolio dengan mempertimbangkan hubungan antar saham. Hasil kajian menunjukkan bahwa untuk portofolio ESG Leaders dalam Single Index Model, komposisinya terdiri dari TBIG (13,41%), BBCA (79,33%), dan TOWR (7,26%), dengan ekspektasi return sebesar 1,23% per bulan atau 15,7% per tahun, dan standar deviasi sebesar 5,21% per bulan atau 18,0% per tahun. Nilai Sharpe Ratio adalah 0,1624. Untuk Model Markowitz, portofolio Pemimpin ESG yang optimal terdiri dari BBCA (74,11%), TBIG (12,34%), dan TOWR (13,55%), dengan pengembalian yang diharapkan sebesar 1,212% per bulan atau 15,56% per tahun, dan standar deviasi 4,9% per bulan atau 15,6% per tahun. Nilai Sharpe Ratio adalah 0,167. Implikasi praktis dari penelitian ini adalah tersedianya pilihan strategi investasi yang beragam bagi investor yang tertarik dengan ESG Leaders. Pemilihan model yang tepat akan membantu investor dalam membentuk portofolio yang optimal sesuai dengan tujuan dan preferensi mereka.
Kata Kunci: Risiko ESG, Portofolio, Indeks Tunggal, Markowitz

1. Introduction
      The new generation of investors is showing a different pattern of investing, driven by an increased awareness of environmental, social, and governance (ESG) issues. They are more interested in sustainable and responsible investments, making the performance of companies based on ESG criteria increasingly important to them. In Indonesia, the Financial Services Authority (OJK) regulations require listed companies to publish Sustainability Reports starting from 2020. The Indonesia Stock Exchange (IDX) has also provided the ESG Leaders index as a

tool for investors to engage in sustainable investing. Investors use this index to identify companies with strong ESG performance and sustainable practices. ESG investments have attracted interest from both institutional and retail investors. While developed countries have seen significant portfolio benefits from ESG investments, adding ESG stocks to portfolio diversification in developing countries has shown limited benefits. Nonetheless, ESG practices can influence investment portfolio performance as ESG factors impact a company's financial performance and help predict investment risks. Investors are drawn to companies with good ESG practices because they are seen as indicators of long-term quality and stability. However, investors need to consider that ESG factors also include risk considerations, potentially leading to lower expected returns for companies with high ESG ratings. To optimize stock selection in portfolios, investors can use two primary models: the Single Index Model and the Markowitz Model. The Single Index Model uses one index as a benchmark for analyzing stock performance (Sharpe, 1994), while the Markowitz Model considers the correlation between stocks in the portfolio and systematic and unsystematic risks. The choice of approach depends on the investor's risk profile and preferences. Some investors may prefer a simple approach like the Single Index Model to gain a general understanding of the stock market performance, while others may opt for the Markowitz Model to achieve more efficient diversification and optimize their portfolios based on risk preferences and investment goals (Markowitz, 1959).

Literature Review

The Stakeholder Theory proposes that analyzing businesses through the lens of relationships between the business and groups or individuals who can impact or be impacted by it offers a more effective approach to address three key issues. In terms of stakeholders' perspective, businesses can be viewed as a network of relationships among groups with a vested interest in the business activities (Freeman, 1984; Jones, 1999). The Signalling Theory, an economic theory, elucidates how individuals or companies utilize information or signals to convey qualities or attributes that may not be readily observable or quantifiable. This theory is commonly employed to explain how companies or individuals employ signals to indicate their expertise, product quality, or financial capability (Spence, 1973). Legitimacy theory, on the other hand, is a sociological theory that elucidates how companies or institutions maintain and acquire support from their social environment. It focuses on how companies establish and uphold legitimacy in the eyes of the public, and how legitimacy influences organizational behavior and actions (Tilling, 2004).

International ESG standards are utilized to evaluate and rank companies based on ESG factors. These standards encompass the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), Task Force on Climate-related Financial Disclosures (TCFD), and Dow Jones Sustainability Index (DJSI). Various institutions are responsible for assessing and ranking companies in terms of ESG factors. Notable institutions involved in ESG measurement include Sustainalytics, MSCI ESG Research, ISS ESG, and Thompson Reuters ESG Data. These institutions play a critical role in influencing and managing ESG factors within companies (Aouaidi, 2018).

A shift is occurring in the investor landscape, characterized by a new generation of individuals who approach investing in a distinct manner. This emerging cohort demonstrates a heightened consciousness of environmental, social, and governance (ESG) concerns, emphasizing the importance of non-financial objectives. As a result, investors are actively seeking out investments that align with principles of sustainability and responsibility. In light of this trend, the ESG performance of companies has gained significant significance not only for investors but also for policy makers. The growing emphasis on ESG factors reflects a broader recognition of the importance of integrating environmental, social, and governance

considerations into investment decision-making processes (Nekhili et al., 2017). Specifically, investors, managers, and other stakeholders can evaluate and measure a company's performance based on ESG reports and ratings (Miralles-Quirós et al., 2018). Therefore, reputable rating agencies are highly focused on developing indicators that can reflect the level of a company's social and environmental responsibility, and academics are increasingly focused on the impact of ESG on companies.

Lins et al. (2017) found in their study of financial data during the 2008-2009 financial crisis that companies with high CSR intensity experienced higher stock returns than those with low CSR intensity. Companies with high CSR have a good reputation among society and investors, leading to high levels of trust and loyalty. Additionally, companies with high CSR tend to have good management and responsible business processes, which make them more stable and resilient to financial crisis pressures. Therefore, companies with high CSR often have more stable stock values and generate higher stock returns compared to those with low CSR intensity. Brunetti *et al*. (2022) stated that climate change is likely to increase market volatility, while reducing equity returns and economic growth, as climate change can lead to some unpredictable risks such as more frequent natural disasters and greater losses, which can cause market volatility. Therefore, climate change can affect investor confidence and trigger mass buying or selling of stocks, leading to higher market volatility.

However, Hübel & Scholz (2020) revealed that exposure to material ESG risks increases portfolio risk. This risk can be measured by ESG ratings (Champagne et al., 2021). Differences in ESG ratings can occur due to variations in coverage and measurement among rating agencies, and is strengthened if ESG disclosure is greater. Furthermore, Gibson et al. (2019) identified a positive correlation between stock returns and agreeing over ESG ratings driven by environmental dimensions, indicating a risk premium for companies facing stronger ESG rating agreements. Based on prior research, it has been indicated that a portfolio focused on green logistics exhibits superior performance in the stock market when compared to a portfolio without such a green emphasis. This implies that allocating investments towards green stocks, with optimized weightings within the portfolio, leads to greater returns compared to investments in non-green stocks (Randionova, 2022).

3. Methods

This research utilizes secondary data obtained online from the website https://finance.yahoo.com for each stock listed in the ESG Leaders index for the period from March 2018 to April 2023. Two models are then employed to find the optimal portfolio: the Single Index Model and the Markowitz Model. The Single Index Model is a stock return model that divides returns into systematic and specific factors for each company, the single index method is a simplification model by reducing the theoretical input of portfolio analysis and reducing the number of variables that need to be estimated., while the Markowitz Model introduces the concept of diversification, which involves selecting stocks with low correlation levels among them. Diversification allows investors to reduce specific stock risks and focus on systematic risks related to the overall market. The Sharpe Ratio is an indicator of portfolio or investment performance by considering the expected return and associated risks. The higher the value of the Sharpe Ratio, the better the investment efficiency. A positive value indicates that the return generated is greater than the risk taken. In this case, the higher the Sharpe Ratio, the better the investment is in generating profits relative to the risk taken.

Table 1. ESG Leaders Companies

No	Company Name	Code
1	PT. Tower Bersama Infrastructure Tbk	TBIG
2	Bank Central Asia	BBCA

| No	Company Name	Code
3	PT. Mitra Adiperkasa Tbk	MAPI
4	Bank Rakyat Indonesia	BBRI
5	PT. AKR Corporindo Tbk	AKRA
6	Bank Mandiri	BMRI
7	PT. Erajaya Swasembada Tbk	ERAA
8	PT. Sarana Menara Nusantara Tbk	TOWR
9	PT. Telkom Indonesia (Persero) Tbk	TLKM
10	Bank Negara Indonesia	BBNI
11	PT. XL Axiata Tbk	EXCL
12	PT. Astra International Tbk	ASII
13	Ciputra Group	CTRA
14	PT Pakuwon Jati Tbk	PWON
15	PT Jasa Marga Persero Tbk.	JSMR
16	PT Indocement Tunggal Prakarsa Tbk.	INTP
17	PT. Semen Indonesia (Persero)	SMGR
18	PT Bumi Serpong Damai Tbk	BSDE
19	PT. Matahari Department Store Tbk	LPPF
20	PT. Unilever Indonesia Tbk	UNVR
21	PT. Media Nusantara Citra Tbk	MNCN
22	PT. Hanjaya Mandala Sampoerna Tbk	HMSP
23	Bank Tabungan Negara	BBTN
24	PT Surya Citra Media Tbk	SCMA
25	PT Ace Hardware Indonesia Tbk	ACES
26	PT Bekasi Fajar Industrial Estate Tbk	BEST
27	PT Buana Lintas Lautan Tbk	BULL
28	Puradelta Lestari	DMAS
29	PT. Ramayana Lestari Sentosa Tbk	RALS
30	PT. Integra Indocabinet Tbk	WOOD

4. Result
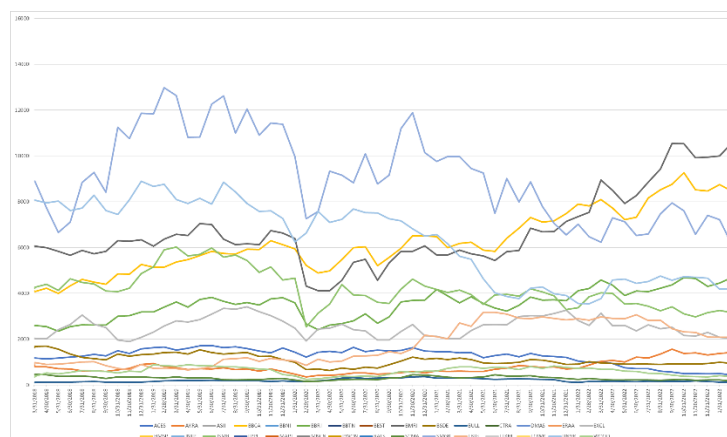
Figure 1. Adjusted Closed Price ESG Stocks

Figure 1 shows that stock prices on the ESG Leaders index tend to experience an upward trend in general after 2020. Even so, there are certain periods when share prices experience a decline. One of the significant periods of decline occurred in 2020, where the Indonesian stock market faced enormous pressure due to the COVID-19 pandemic that hit the whole world. In March 2020, there was a drastic decline in the Jakarta Composite Index (CSPI), which reached its lowest level since October 2018. This decline was triggered by investor concerns about the economic impact caused by the COVID-19 pandemic. This situation affected market sentiment and caused stock prices to drop significantly...
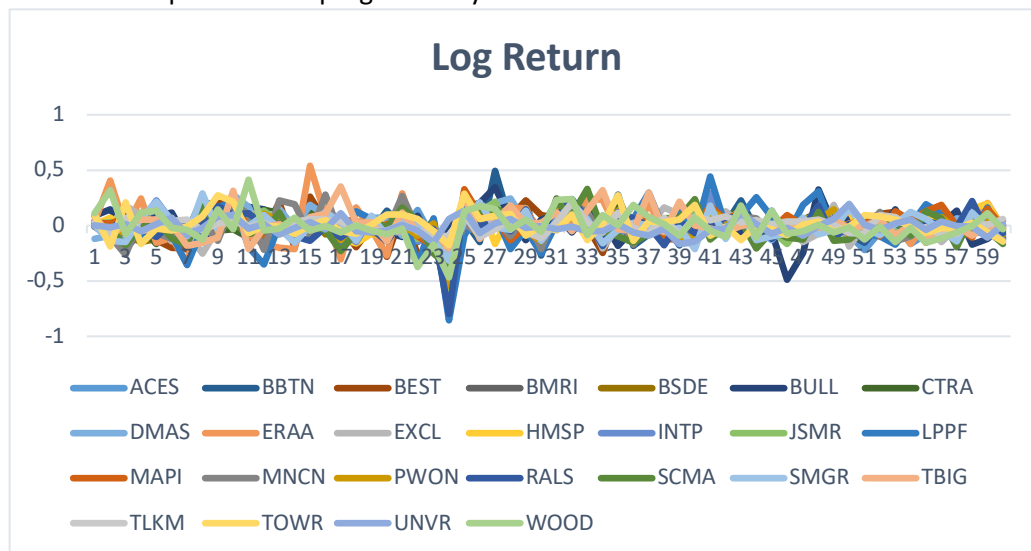

Figure 2. Log Return ESG Stocks

Based on Figure 2, it can be seen that the ESG Leaders stock log return experienced the most significant volatile period during the Great Recession and the COVID-19 pandemic. reflects a high level of uncertainty in financial markets. Investors face higher risks and greater price fluctuations. This shows the importance for investors to manage risk wisely and use appropriate strategies in dealing with volatile markets. Overall, the greatest volatility in 2020 was due to a combination of external factors such as the pandemic, political uncertainty and global economic tensions. It is important for investors to stay alert to market changes, understand the risks involved, and adopt the right strategy in the face of high volatility.
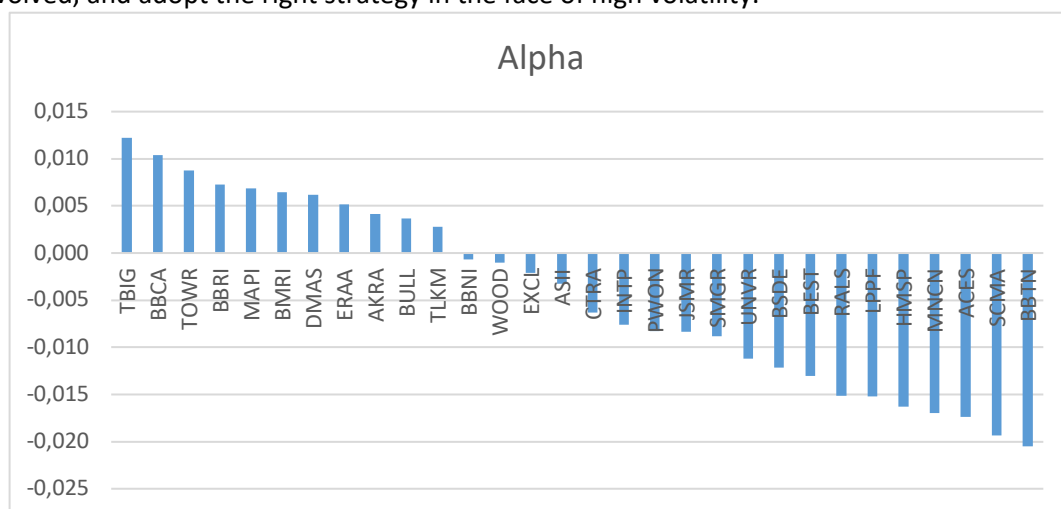

Figure 3. Alpha of Individual Stocks in ESG Leaders

Based on Figure 3, it can be observed that of the 30 stocks on the ESG Leaders index, there are 11 stocks that have a positive value while 19 stocks have a negative value. The highest positive alpha value is TBIG issuer (0.12) while the lowest alpha value is BBTN (-0.02). A negative Alpha value can describe a lack of stock management ability to outperform the market performance or benchmark index. The tendency of investors usually wants a positive Alpha value, because it shows that the stock is capable of generating excess returns compared to the existing systematic risk.
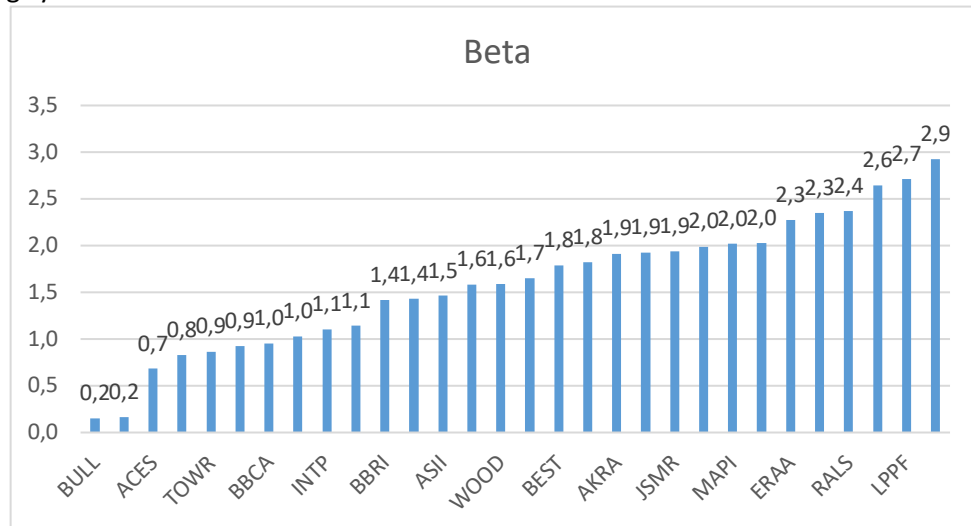

Figure 4. Beta of Individual Stocks in ESG Leaders

In Figure 4, it can be seen the beta coefficient of the stocks on the ESG Leaders index. It can be seen that the issuers with the lowest Beta values are BULL and UNVR (0.2) while the issuers with the highest beta values are BBTN (2.9)

Single Index Model

The Single Index Model utilizes historical stock price data in its analytical method. This data is used for calculations, and the selected data period is 5 years with a monthly frequency. After the data is tabulated, initial variables are computed, including return, expected return, alpha, beta, and Excess Return to Beta (ERB) of stocks in each period. The Risk-Free rate is 4.55% (0.37% per month) based on the 7-day Repo rate, and the Expected return of the market (IHSG) is 0.19% per month.

Table 2. Calculation Excess Return to Beta for Low ESG Risk Stocks

No	Stock	E(Ri)	Alpha (i)	Beta (i)	ERB
1	TBIG	0.0139	0.0122	0.9274	0.0109
2	BBCA	0.0121	0.0104	0.9511	0.0088
3	TOWR	0.0104	0.0088	0.8665	0.0076
4	BBRI	0.0099	0.0072	1.4193	0.0043
5	BMRI	0.0091	0.0065	1.4288	0.0037
6	MAPI	0.0106	0.0069	2.0185	0.0034
7	DMAS	0.0098	0.0062	1.9271	0.0031
8	ERAA	0.0094	0.0052	2.2765	0.0025
9	AKRA	0.0077	0.0042	1.9119	0.0021
10	BULL	0.0039	0.0037	0.1507	0.001
11	TLKM	0.0044	0.0028	0.832	0.0007

No	Stock	E(Ri)	Alpha (i)	Beta (i)	ERB
12	BBNI	0.0037	-0.0007	2.3469	-0.0001
13	WOOD	0.0019	-0.001	1.5927	-0.0012
14	CTRA	-0.0014	-0.0063	2.6445	-0.002
15	ASII	-0.0005	-0.0032	1.4633	-0.0029
16	EXCL	0	-0.0021	1.1408	-0.0033
17	PWON	-0.0045	-0.0083	2.0298	-0.0041
18	JSMR	-0.0047	-0.0083	1.9376	-0.0044
19	LPPF	-0.0102	-0.0152	2.7157	-0.0051
20	SMGR	-0.0059	-0.0088	1.582	-0.0061
21	RALS	-0.0108	-0.0152	2.3681	-0.0061
22	BBTN	-0.015	-0.0205	2.9248	-0.0064
23	BEST	-0.0097	-0.013	1.7897	-0.0075
24	BSDE	-0.0091	-0.0122	1.6517	-0.0078
25	INTP	-0.0056	-0.0076	1.1021	-0.0085
26	MNCN	-0.0136	-0.017	1.8209	-0.0096
27	SCMA	-0.0156	-0.0193	1.9873	-0.0098
28	HMSP	-0.0144	-0.0163	1.0278	-0.0177
29	ACES	-0.0161	-0.0174	0.6838	-0.0291
30	UNVR	-0.0109	-0.0112	0.1641	-0.0894

Based on Table 2, it can be seen that the ERB values (i) vary, and there are 11 Issuers with positive ERB values. The highest ERB value is owned by TBIG issuers and the lowest ERB is owned by UNVR issuers. These stocks have been sorted according to the highest and lowest ERB values, for the next stage of calculation, namely calculating the values of Ai, Bi, and Ci.

Table 3. Calculation of Ai, Bi, Aj, Bj, Ci and Candidate Stocks.

No	Stock	Ai	Bi	Aj	Bj	Ci	ERB -C*
1	TBIG	0.6881	63.0241	0.6881	0.6881	0.0011	0.0058
2	BBCA	5.3193	605.7777	6.0073	606.4658	0.005	0.0037
3	TOWR	0.5644	74.0986	6.5717	680.5644	0.0051	0.0025
4	BBRI	3.1851	743.0158	9.7568	1423.5802	0.0048	-0.0008
5	BMRI	2.2729	609.2782	12.0297	2032.8584	0.0046	-0.0014
6	MAPI	1.5771	465.7673	13.6068	2498.6257	0.0044	-0.0017
7	DMAS	1.4254	460.2679	15.0322	2958.8936	0.0042	-0.002
8	ERAA	0.5456	221.1444	15.5778	3180.0379	0.0041	-0.0027
9	AKRA	1.1495	560.6874	16.7273	3740.7254	0.0039	-0.0031
10	BULL	0.0013	1.3237	16.7286	3742.0491	0.0039	-0.0041
11	TLKM	0.1587	233.8374	16.8873	3975.8865	0.0037	-0.0044
12	BBNI	-0.0545	1083.594	16.8328	5059.4805	0.003	-0.0052
13	WOOD	-0.1854	157.744	16.6473	5217.2245	0.0029	-0.0063

No	Stock	Ai	Bi	Aj	Bj	Ci	ERB -C*
14	CTRA	-1.5687	801.2104	15.0786	6018.4349	0.0023	-0.0071
15	ASII	-1.4601	496.7806	13.6186	6515.2155	0.0019	-0.0081
16	EXCL	-0.4472	135.1169	13.1713	6650.3324	0.0018	-0.0084
17	PWON	-3.3582	824.6741	9.8131	7475.0065	0.0012	-0.0092
18	JSMR	-2.4843	564.721	7.3289	8039.7274	0.0008	-0.0095
19	LPPF	-1.4731	286.4392	5.8557	8326.1666	0.0007	-0.0103
20	SMGR	-1.5942	260.6784	4.2616	8586.8449	0.0005	-0.0112
21	RALS	-3.3042	538.0154	0.9573	9124.8603	0.0001	-0.0113
22	BBTN	-5.1045	793.3759	-4.1471	9918.2362	-0.0004	-0.0116
23	BEST	-2.0906	277.9134	-6.2378	10196.1496	-0.0006	-0.0126
24	BSDE	-4.402	564.193	-10.6398	10760.3426	-0.0009	-0.0129
25	INTP	-1.4347	169.0054	-12.0745	10929.348	-0.001	-0.0136
26	MNCN	-2.8706	300.5306	-14.945	11229.8786	-0.0013	-0.0147
27	SCMA	-3.7416	383.1392	-18.6867	11613.0177	-0.0015	-0.0149
28	HMSP	-3.367	190.2687	-22.0537	11803.2864	-0.0018	-0.0228
29	ACES	-2.1397	73.6129	-24.1933	11876.8993	-0.0019	-0.0342
30	UNVR	-0.5446	6.0919	-24.7379	11882.9912	-0.002	-0.0945

The Ai and Bi values are calculated after the stocks are sorted from the highest to the lowest ERB value, then the cumulative calculation for each Ai and Bi denoted by Aj and Bj calculates the value of C(i). In the single index model, the value of C(i) is a specific risk referring to the stock risk component that cannot be explained by the movement of the reference index. Next, select the Cut-Off Point (C*) value. The value of "Cut-off point" in the single index model refers to the cut-off point or limit set to decide whether a stock will be included in the portfolio or not. The C* value is the highest C(i) value. In this study, the stocks included in the candidate portfolio are stocks that have an ERB value greater than C*, in this calculation the C* point value is 0.0051. After that, the calculation is continued by reducing the ERB and C* values, if the ERB value exceeds the C* These stocks include TBIG, BBCA, and TOWR In the single index model, stock weight refers to the relative proportion of funds allocated to each stock in the portfolio based on the Z Score to calculate the weight of each stoks. The result is shown on the table below.

Table 4. Optimal Portfolio for Single Index Model

No	Stock	ERB -C*	Status	Z (i)	W(i)
1	TBIG	0.0057	Candidate	0.3936	13.4%
2	BBCA	0.0036	Candidate	2.3283	79.3%
3	TOWR	0.0024	Candidate	0.2130	7.3%

Based on the Table 4 results above, it can be seen that of the 30 stocks on the ESG Leaders index, there are 3 stocks that can be included in the optimal portfolio to maximize the rate of return and risk of each stock. Furthermore, the results of the weight calculation using a single index model show that the most weight diversification is BBCA shares of 79.3%, followed by TBIG 13.41%, and TOWR 7.26%. While the performance of optimal portfolio is shown on Table 5.

Table 5. Optimal Portfolio Performance for Single Index Model

Performances		
Beta P	0.9418	
Alpha P	0.0105	
Expected Return	1.2% Monthly	15.7% Annual
Variance	0.3%	
ST Dev	5.2% Monthly	18.0% Annual
Sharpe Ratio	0.1625	

Table 5 shows the composition of three selected stocks with a portfolio beta lower than one, indicating that the stocks or portfolio have lower volatility compared to the overall market. In other words, when the market experiences changes, a portfolio with a beta below 1 tends to experience lower rate changes. Furthermore, the positive alpha value indicates that the portfolio performs better than expected based on the level of systematic risk represented by beta. A positive alpha indicates that the stocks or portfolio generate greater profits than expected given the level of risk faced. The monthly portfolio risk is 5.3%, which indicates the extent of fluctuations or volatility that can occur in the portfolio value from month to month. However, to understand the annual risk level, we need to annualize it. In this case, the portfolio's annual risk level reaches 18% per year. With a portfolio return of 15.7% per year and an annual risk level of 18%, we can see that the potential profits generated by this portfolio are quite significant. A return exceeding the risk level indicates that the portfolio can provide higher returns compared to the risk borne by the investors.

Additionally, the Sharpe Ratio of 0.1625 also indicates the portfolio's efficiency in generating returns relative to the risk taken. The Sharpe Ratio is a comparison between the portfolio return and the risk it faces. The higher the Sharpe Ratio, the better the portfolio's performance in generating returns proportionally to the level of risk taken. In this case, a positive Sharpe Ratio indicates that the portfolio has the potential for higher returns compared to the risk faced.

Markowitz Model

The Markowitz Method, which is also known as the Modern Portfolio Model is a mathematical approach used to assist investors in optimizing their asset allocation in a portfolio. In searching for a good portfolio using the Solver simulation, there are several portfolio choices used in the Markowitz Method, consisting of: Maximum Return Portfolio, Minimum Variance Portfolio, and Maximum Sharpe Ratio (Optimal) Portfolio. The result is shown on Table 6.

Table 6. Portfolio Simulation using Solver Add-in

Socks	Min Return	Max Return	Max SR
	Weight	Weight	Weight
ACES	0.73%	0.00%	0.00%
AKRA	0.00%	0.00%	0.00%
ASII	0.00%	0.00%	0.00%
BBCA	40.11%	72.65%	74.11%
BBNI	0.00%	0.00%	0.00%
BBRI	0.00%	0.00%	0.00%
BBTN	0.00%	0.00%	0.00%

BEST	0.00%	0.00%	0.00%
BMRI	0.00%	0.00%	0.00%
BSDE	0.00%	0.00%	0.00%
BULL	4.94%	0.00%	0.00%
CTRA	0.00%	0.00%	0.00%
DMAS	0.00%	0.00%	0.00%
ERAA	0.00%	0.00%	0.00%
EXCL	0.00%	0.00%	0.00%
HMSP	3.49%	0.00%	0.00%
INTP	0.00%	0.00%	0.00%
JSMR	0.00%	0.00%	0.00%
LPPF	0.00%	0.00%	0.00%
MAPI	0.00%	0.00%	0.00%
MNCN	0.00%	0.00%	0.00%
PWON	0.00%	0.00%	0.00%
RALS	0.00%	0.00%	0.00%
SCMA	0.00%	0.00%	0.00%
SMGR	0.00%	0.00%	0.00%
TBIG	3.10%	27.35%	12.25%
TLKM	15.95%	0.00%	0.00%
TOWR	5.65%	0.00%	13.65%
UNVR	25.09%	0.00%	0.00%
WOOD	0.94%	0.00%	0.00%
Total	**100%**	**100%**	**100%**
E(r_p)	0.35%	1.26%	1.21%
σ_p	3.80%	5.52%	4.82%
SR	-0.00901	0.16007	0.17279

The simulation results in Table6 can be seen that the optimal portfolio based on the Markowitz model (Column Max SR) is indicated by 3 stock compositions namely, BBCA shares of 74.1%, TOWR shares of 13.6% and TBIG shares of 12.2%. This composition will provide a return of 1.21.6% per month or 15.5% per year with a risk level of 4.82% per month or 15.6% per year. It can be seen that the return and risk of the optimal portfolio can be said to be comparable. The optimal portfolio in the Markowitz Method can be adjusted according to the preferences and objectives of investors. An investor can have different risk preferences, which is reflected in the preference for the expected rate of return and the level of risk that can be tolerated. By using the Markowitz Method, investors can choose the optimal portfolio according to their preferences to achieve the desired balance between return and risk.

Efficient Frontier – **Markowitz Model**

Efficient Frontier shows the combination of assets that optimizes the rate of return and risk. The Efficient Frontier describes the relationship between the expected rate of return and

the level of risk as measured by the standard deviation or return volatility. In this study, 10,000 portfolios were simulated with various weights from a combination of three stocks in the optimal portfolio-Markowitz Model. The simulation results can be seen in Figure 5.
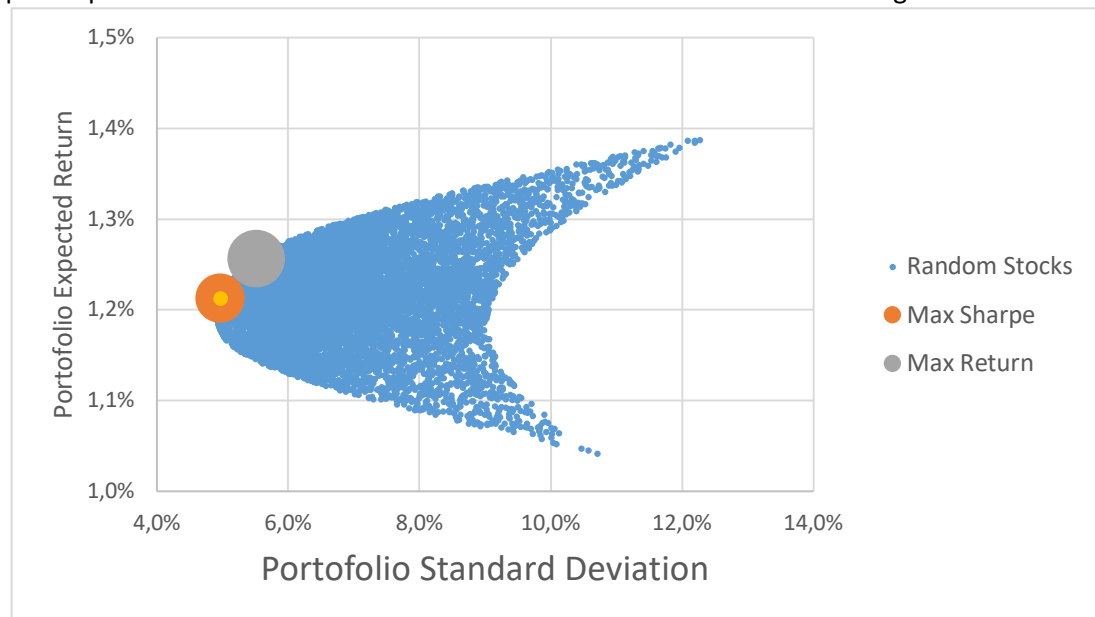

Figure 5. Efficient Frontier

Based on the simulation results in Figure 5, it can be seen that the most optimal portfolio allocation is when it is on the curved line of the efficient frontier curve. It can be seen that there are several points which are referred to as the optimal portfolio. It is a combination of assets that provides the optimal rate of return for a certain level of risk. The optimal portfolio can vary depending on the risk preference of the investor. These optimal portfolios are the points along the curve that offer the best combination of returns and risks. In addition to the Maximum Efficient Point, this point is the highest point on the Efficient Frontier which shows the portfolio with the maximum rate of return for a certain level of risk. This portfolio represents the best combination that optimizes profits with the risks taken in this study indicated by the Maximum Sharpe Ratio portfolio

5. Conclusion

In the Single Index Model, the optimal portfolio of the ESG Leaders index has the composition of TBIG (13.41%), BBCA (79.33%), and TOWR (7.26%) shares. This portfolio generates an expected return of 1.23% per month or 15.7% per year, with a risk (ST Dev) of 5.21% per month or 18.0% per year. Sharpe Ratio value is 0.1624. Meanwhile, in the Markowitz Model, the optimal portfolio of the ESG Leaders index has a composition of BBCA (74.11%), TBIG (12.34%), and TOWR (13.55%) stocks. This portfolio generates an expected return of 1.212% per month or 15.56% per year, with a risk of 4.9% per month or 15.6% per year. Sharpe Ratio value is 0.167. In addition, in optimal portfolio construction, BBCA shares are stocks that are always included in the portfolio structure, this shows that BBCA shares are an attractive choice for stock portfolio diversification. Bank BCA has a good reputation, with consistent revenue growth over the last 5 years, despite experiencing a decline in net profit in 2020. BBCA shares have a stable price, low risk, and have achieved a good ESG rating. With a combination of these factors, BBCA stock is suitable for investors with a long investment horizon and also for a portfolio of ESG based stocks. Overall, the difference in stock composition and portfolio performance between the Single Index model and the Markowitz model shows a relatively small difference, so that the

selection of the optimal composition can be returned to investors to choose which approach is most suitable for the investor profile.

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