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Danantara Effects on IDXESGL Stock Investment Strategies Using Single Index Model and VaR-Adjusted Sharpe Ratio

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Abstract

Danantara, established as Indonesia's sovereign wealth fund on February 24, 2025, has introduced new dynamics in the Indonesian capital market. This study examines differences in portfolio strategies among IDX ESG Leaders (IDXESGL) index between the pre- and post-Danantara periods by comparing stock composition with positive expected returns and portfolio performance across two periods using the Single Index Model (SIM) and the Value at Risk-Adjusted Sharpe Ratio (VaRSR). The analysis employs an integrated framework that combines SIM for identifying best-performing stocks, a portfolio combination approach, and performance evaluation using the Sharpe ratio and VaRSR. This study utilized daily closing price data covering August 23, 2024, to February 23, 2025, as the pre-Danantara period, and February 24, 2025, to August 24, 2025, as the post-Danantara period. The results indicate that prior to Danantara's establishment, optimal portfolios were dominated by digital-sector stocks, with higher performance than in the post-Danantara period. In contrast, the post-Danantara period is associated with greater exposure to conglomerates and state-owned enterprises with stronger fundamentals and lower downside risk. Overall, the findings suggest that the VaRSR yields a more conservative performance assessment and highlights a potential reorientation in investment strategies toward stability and resilience following Danantara's establishment.

Keywords: Combination; Diversification; ESG; Portfolio; Sharpe Ratio.

1. Introduction

On February 24, 2025, the Indonesian government established Daya Anagata Nusantara (Danantara), a sovereign wealth fund (SWF) mandated to manage nearly $900 billion of state-owned enterprise assets to support long-term national economic development [1, 2]. Given the unprecedented scale of assets and its strategic role, Danantara has been accompanied by public skepticism regarding nepotism, corruption, and political intervention [3–5]. These political dynamics and investors' distrust have the potential to alter the direction of the Indonesian capital market [1, 2, 6, 7]. This condition raises an important empirical question as to whether the establishment

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of Danantara reshapes investor preferences by altering risk perceptions and portfolio allocation strategies in the Indonesian capital market.

The relevance of Danantara to the Indonesian capital market extends beyond its role as an SWF. As an institution that explicitly incorporates Environmental, Social, and Governance (ESG) principles into its investment decisions [8], Danantara may reshape how investors evaluate ESG-oriented assets and strategic-sector firms. This issue is important within the IDX ESG Leaders (IDXESGL) Index, which consists of firms selected based on ESG performance [9]. While ESG Investing is commonly associated with sustainability screening, portfolio allocation is often shaped by high ESG scores, especially the governance component [10]. Accordingly, the establishment of Danantara may redirect ESG-oriented portfolio selection within the IDXESGL Index toward stocks perceived to offer governance quality and strategic-sector relevance.

Despite the potential implications of Danantara for investor behaviour and portfolio allocation, empirical evidence on how institutional policy shocks affect ESG-oriented portfolio construction remains limited. Earlier studies, including [11–15], have applied SIM in optimal portfolio construction and consistently reported superior performance in balancing portfolio return and risk. However, these studies generally generate a single optimal portfolio and therefore provide limited insight into alternative portfolio configurations under changing market conditions. To address this limitation, [16, 17] integrated portfolio construction with stock combination approaches and reported that this integration provides better optimal portfolio. This gap highlights the need to integrate SIM with a combinatorial approach to construct a better optimal portfolio in the context of institutional policy shocks.

In addition, portfolio performance is commonly evaluated using the Sharpe Ratio [18]. While widely adopted, the Sharpe Ratio may provide biased assessments under non-normal return distributions and extreme market conditions [19–21]. To address this limitation, [21] introduced the Value at Risk-Adjusted Sharpe Ratio (VaRSR), that integrates Value at Risk and Sharpe Ratio. Despite its potential relevance in periods characterized by structural market changes and heightened uncertainty, evidence combining SIM, stock combination approaches, Sharpe Ratio, and VaRSR remains limited.

Accordingly, this study investigates whether investment strategies among IDXESGL differ across the pre-Danantara and post-Danantara periods by employing the integration of Single Index Model, stock combination approaches, Sharpe Ratio, and Value at Risk-Adjusted Sharpe Ratio. This study contributes empirically by providing early evidence on how ESG-oriented portfolio reallocation is associated with the post-Danantara period. The study also contributes methodologically by integrating SIM, stock combination approaches, Sharpe Ratio, and VaRSR, enabling a more comprehensive assessment of portfolio performance under policy-related market uncertainty.

2. Methods

The analyses in this study are conducted using Python within the Google Colab environment. The methodological framework is fully detailed in the following subsections.

2.1. Single Index Model (SIM)

SIM proposed by William Sharpe simplifies Markowitz's portfolio theory by incorporating the relationship between market and individual stock movement [14]. SIM supports optimal portfolio construction targeting higher return with lower risk by identifying stocks with favorable excess return to beta and cut-off values, while determining portfolio weights based on return, risk, and beta [12, 13]. Since SIM requires many computations [11], the first step is the calculation of stock and market returns, where return represents the gain or loss experienced by investors [22]. This study adopts logarithmic returns rather than simple net returns because of their time-additive property and provide consistency across different time intervals [23]. The logarithmic returns of stock i and the market index at time t, denoted by $R_{i,t}$ and $R_{m,t}$, are calculated using Eq. (1)

[23]. Where $P_{i,t}$ and $P_{m,t}$ denote the closing prices of stock i and the market index at time t, while $P_{i,t-1}$ and $P_{m,t-1}$ denote the closing prices of stock i and the market index at time $t-1$

$$R_{i,t} = \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \quad \text{and} \quad R_{m,t} = \ln\left(\frac{P_{m,t}}{P_{m,t-1}}\right). \tag{1}$$

The next step is to calculate the expected return or average return of stock i and market m, denoted by $E(R_i)$ and $E(R_m)$, using Eq. (2) [13], where T denotes the number of return periods.

$$E(R_i) = \frac{1}{T}\sum_{t=1}^{T} R_{i,t} \quad \text{and} \quad E(R_m) = \frac{1}{T}\sum_{t=1}^{T} R_{m,t} \tag{2}$$

Stocks with a positive expected return are carried forward in the analysis, as their higher expected rate of return gives a greater potential to be profitable [15]. Standard deviation is a measure that shows how much the return of a stock fluctuates [14]. Then, the next step is to calculate the standard deviation of stock i and market m, denoted by s_i and s_m, using Eq. (3) [13]

$$s_i = \sqrt{\frac{1}{T-1}\left(\sum_{t=1}^{T}(R_{i,t} - E(R_i))^2\right)} \quad \text{and} \quad s_m = \sqrt{\frac{1}{T-1}\left(\sum_{t=1}^{T}(R_{m,t} - E(R_m))^2\right)}. \tag{3}$$

Covariance measures how stock and market move together [14]. The next step is to calculate the covariance of stock i to market m, denoted by $s_{i,m}$, using Eq. (4) [13]

$$s_{i,m} = \frac{1}{T-1}\sum_{t=1}^{T}(R_{i,t} - E(R_i))(R_{m,t} - E(R_m)). \tag{4}$$

Beta measures the sensitivity of stock relative to the market index [14]. The next step is to calculate the beta of stock i, denoted by β_i, using Eq. (5) [13]

$$\beta_i = \frac{s_{i,m}}{s_m^2}. \tag{5}$$

Alpha measures the value of the stock's return that is not explained by the market's movement. The next step is to calculate the alpha of stock i, denoted by α_i, using Eq. (6) [13]

$$\alpha_i = E(R_i) - \beta_i \cdot E(R_m). \tag{6}$$

Residual variance measures the unsystematic risk of a stock, representing the portion of total risk not explained by market movements. Since residual variance corresponds to the variance of the disturbance term in the single index model, it is non-negative by definition [24]. The next step is to calculate the residual variance of stock i, denoted by $s_{e_i}^2$, using Eq. (7) [12]

$$s_{e_i}^2 = s_i^2 - \beta_i^2 \cdot s_m^2. \tag{7}$$

Excess return to beta (ERB) measures the value of excess return relative to one unit of beta. The ERB of stock i, denoted by ERB_i, using Eq. (8) [12].

$$\mathrm{ERB}_i = \frac{E(R_i) - Rf}{\beta_i}. \tag{8}$$

where Rf is the average risk-free rate value or the return rate with no risk [13]. Risk-free rate is the daily average value of the yearly risk-free rate from Bank Indonesia's interest rate or BI-7 Day Reverse Repo Rate (BI7DRR). Average risk-free rate, denoted by Rf, is calculated using Eq. (9) [15]. Where V denotes the number of risk-free rate periods

$$Rf = \frac{1}{V}\sum_{v=1}^{V} Rf_v. \tag{9}$$

SIM has stages for selecting stock candidates based on ERB and cut-off values [14]. Stocks are first ranked in descending order of ERB. For the i-th ranked stock, the cut-off value is computed using all stocks from rank 1 to i. The optimal cut-off value $C^*_{\max}$ is the maximum C^*_i, and stocks with $ERB_i >= C^*_{\max}$ are selected. The cut-off values are calculated using Eq. (10) [12]

$$C_i^* = \frac{s_m^2 \sum_{j=1}^{i} \frac{\left[E(R_j) - Rf\right]\beta_j}{s_{e_j}^2}}{1 + s_m^2 \sum_{j=1}^{i} \frac{\beta_j^2}{s_{e_j}^2}}. \tag{10}$$

After the stock candidates are identified, stock weights are calculated. Stock weight is the proportion of funds invested in a portfolio [14]. The weight of stock in portfolio p, denoted by $W_{i,p}$, is calculated using Eq. (11) [11], where y denotes the number of stocks in portfolio p

$$D_i = \left(\frac{\beta_i}{s_{e_i}^2}\right)(\mathrm{ERB}_i - C^*_{\max}) \quad \text{and} \quad W_{i,p} = \frac{D_i}{\sum_{i=1}^{y} D_i}. \tag{11}$$

Then, based on the weight of stocks in a portfolio, the portfolio's expected return and risk will be calculated. The expected return and risk of portfolio p, denoted by $E(R_p)$ and s_p, are calculated using Eqs. (12) and (13) [11].

$$E(R_p) = \sum_{i=1}^{y} \alpha_i \cdot W_{i,p} + \left(\sum_{i=1}^{y} \beta_i \cdot W_{i,p}\right) E(R_m) \tag{12}$$

$$s_p^2 = \left(\sum_{i=1}^{y} s_{e_i}^2 \cdot W_{i,p}^2\right) + \left(\sum_{i=1}^{y} \beta_i \cdot W_{i,p}\right)^2 s_m^2 \quad \text{and} \quad s_p = \sqrt{s_p^2} \tag{13}$$

2.2. Combination

Combinations are enumeration rules that ignore the order of objects [25]. According to [26], the use of a combination in research can provide a broader perspective with different assumptions. This concept is formulated in two related equations, presented in Eq. (14), where C^x_y is used to calculate the number of ways to choose y objects (the number of observed objects) from x objects (the total number of objects) and C^x_{total} is the total number of possible combinations [25].

$$C^x_y = \frac{x!}{y!(x-y)!} \quad \text{and} \quad C^x_{\text{total}} = \sum_{y=2}^{x} C^x_y \tag{14}$$

In this study, combinations are used to generate all unique portfolios from the candidate stocks, where x denotes the total number of stocks and y denotes the number of stocks in each portfolio. These portfolios then serve as the basis for evaluating expected return, risk, and portfolio performance.

2.3. Portfolio Performance

Portfolio performance is defined in terms of return relative to risk, and one of the most well-known method is the Sharpe Ratio. Sharpe Ratio of portfolio p, denoted by SR_p is calculated using Eq. (15) [27].

$$\mathrm{SR}_p = \frac{E(R_p) - Rf}{s_p} \tag{15}$$

VaRSR is a new approach to the Sharpe Ratio introduced by [21] to overcome the limitations of the Sharpe Ratio, which is subject to estimation errors, ignores uncertainty, and relies on the assumption of independent and identically distributed normal returns. This often leads to biased estimation results when the return distribution has skewness, excess kurtosis, or contains autocorrelation and heteroscedasticity [19]. In line with the Sharpe Ratio approach, VaRSR is also based on the concept of portfolio excess return [21]. The excess return of portfolio p at time t, denoted by $EXR_{p,t}$, is calculated using Eq. (16).

$$EXR_{p,t} = \left(\sum_{i=1}^{y} W_{i,p} \cdot R_{i,t} \right) - Rf \tag{16}$$

Based on the excess return of each portfolio p for every time t, the average, standard deviation, skewness, and kurtosis of excess return for each portfolio p are calculated. The average of excess return portfolio p, denoted by $E(EXR_p)$, is calculated using Eq. (17), while the standard deviation of excess return portfolio p, denoted by $s(EXR_p)$, is calculated using Eq. (18) [21].

$$E(EXR_p) = \frac{1}{T} \sum_{t=1}^{T} EXR_{p,t} \tag{17}$$

$$s(EXR_p) = \sqrt{\frac{1}{T-1} \sum_{t=1}^{T} (EXR_{p,t} - E(EXR_p))^2} \tag{18}$$

Skewness measures the asymmetry of the return distribution [28]. The skewness of excess return portfolio p, denoted by $S(EXR_p)$, is calculated using Eq. (19) [27].

$$S(EXR_p) = \frac{\frac{1}{T} \sum_{t=1}^{T} (EXR_{p,t} - E(EXR_p))^3}{(s(EXR_p))^3} \tag{19}$$

Kurtosis measures the concentration of probability mass in the center and tails of the return distribution [28]. Then, the kurtosis of excess return portfolio p, denoted by $K(EXR_p)$, is calculated using Eq. (20) [27].

$$K(EXR_p) = \frac{\frac{1}{T} \sum_{t=1}^{T} (EXR_{p,t} - E(EXR_p))^4}{(s(EXR_p))^4} \tag{20}$$

Based on the average, standard deviation, skewness, and kurtosis of excess return for each portfolio p. Then, the estimated Sharpe Ratio of portfolio p, denoted by $\widehat{SR}_p$, is calculated using Eq. (21). Also, the standard deviation of estimated Sharpe Ratio of portfolio p, denoted by $s(\widehat{SR}_p)$, is calculated using Eq. (22) [21].

$$\widehat{SR}_p = \frac{E(EXR_p)}{s(EXR_p)} \tag{21}$$

$$s(\widehat{SR}_p) = \sqrt{\frac{1}{T-1} \left(1 + \frac{1}{2} \widehat{SR}_p^2 - \widehat{SR}_p^2 \cdot S(EXR_p) + \widehat{SR}_p^2 \left(\frac{K(EXR_p) - 3}{4} \right) \right)} \tag{22}$$

After obtaining the estimated Sharpe Ratio and the standard deviation of the estimated Sharpe Ratio for each portfolio, the VaRSR is calculated. VaRSR with confidence level of $(1-\gamma)$ for portfolio p, denoted by $VaRSR_{(1-\gamma),p}$, is calculated using Eq. (23) [21].

$$VaRSR_{(1-\gamma),p} = \widehat{SR}_p - Z_{(1-\gamma)} \cdot s(\widehat{SR}_p) \tag{23}$$

where $Z_{(1-\gamma)}$ denotes the z-value with confidence level of $(1-\gamma)$ or the result of the inverse function of the cumulative normal distribution at probability $(1-\gamma)$ [21].

3. Results and Discussion

This study employs daily closing price data of IDXESGL stocks as individual stocks and Jakarta Stock Exchange Composite (JKSE) as the market index obtained from finance.yahoo.com, covering the period from August 23, 2024, to February 23, 2025, as the pre-Danantara period and February 24, 2025, to August 24, 2025, as the post-Danantara period. These periods are structured around the establishment of Danantara as the institutional event date. The balanced six-month windows maintain a one-year total observation horizon commonly used in portfolio evaluation, provide sufficient daily return observations, and allow the study to capture portfolio reallocation and market adjustment while limiting bias from short-term price reactions and unrelated longer-term events [2, 6, 11]. In addition, the risk-free rate is proxied by the Bank Indonesia interest rate. The companies that consistently appeared in the IDXESGL major reports for both periods in this study are detailed in Table 1.

Table 1: List of Stocks

Ticker	Stock Name	Period	Ticker	Stock Name	Period
ACES	Aspirasi Hidup Indonesia	1 & 2	ERAA	Erajaya Swasembada	1 & 2
AKRA	AKR Corporindo	1 & 2	GOTO	GoTo Gojek Tokopedia	1 & 2
AUTO	Astra Otoparts	1	JSMR	Jasa Marga	1 & 2
AVIA	Avian	2	MAPI	Mitra Adiperkasa	1 & 2
BBCA	Bank Central Asia	1 & 2	MIKA	Mitra Keluarga Karyasehat	1 & 2
BBNI	Bank Negara Indonesia	1 & 2	MNCN	Media Nusantara Citra	1 & 2
BBRI	Bank Rakyat Indonesia	1 & 2	MPMX	Mitra Pinasthika Mustika	1
BMRI	Bank Mandiri	1 & 2	PGEO	Pertamina Geothermal Energy	1 & 2
BMTR	Global Mediacom	1	PWON	Pakuwon Jati	1 & 2
BNGA	Bank CIMB Niaga	2	SCMA	Surya Citra Media	1 & 2
BRPT	Barito Pacific	1	SIDO	Sido Muncul	1 & 2
BSDE	Bumi Serpong Damai	1 & 2	TBIG	Tower Bersama Infrastructure	1
CMRY	Cisarua Mountain Dairy	2	TLKM	Telekomunikasi Indonesia	1 & 2
CTRA	Ciputra Development	1 & 2	TOWR	Sarana Menara Nusantara	1 & 2
EMTK	Elang Mahkota Teknologi	1 & 2	UNVR	Unilever Indonesia	1 & 2

Based on Table 1, there are 22 stocks that consistently appear in both periods, five stocks that appear only in the pre-Danantara period, and three stocks that appear only in the post-Danantara period. From the stocks listed, the dataset was collected using the yfinance module in Python. The line plot of JKSE closing price movement was presented in Fig. 1.

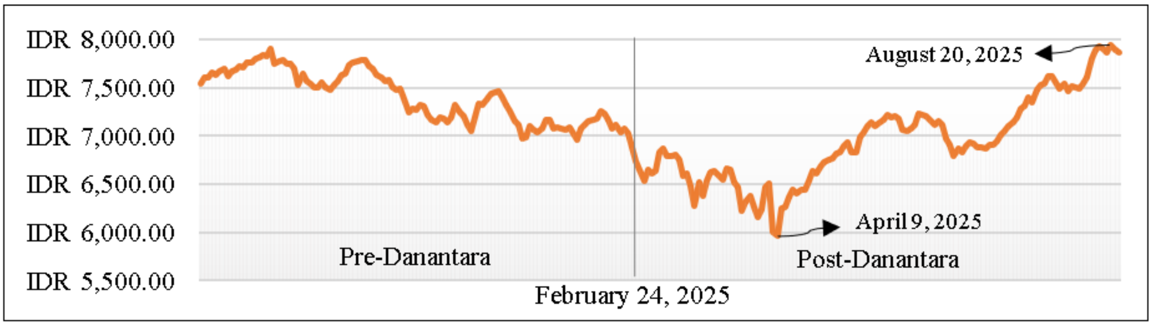

Fig. 1: Line Plot of JKSE Closing Price Movement

Based on Fig. 1, JKSE price declined during the first week after Danantara's establishment, then began to fluctuate over the following month. There was a significant decline from IDR 6,510.62 to IDR 5,996.14 on April 8, 2025. This decline continued until it reached the lowest point at IDR 5,967.98 on April 9, 2025, after a 7-day holiday for Nyepi and Eid al-Fitr. After this period, prices recovered and continued to strengthen, reaching a high price of IDR 7,943.82 on August 20, 2025. In addition to closing stock prices, risk-free rate data from BI7DRR were collected from August 2024 to August 2025 with the dataset presented in Table 2. Based on Table 2, there was a gradual decline in BI7DRR from 6.25% to 5%, which was implented by Bank Indonesia to encourage economic growth and maintain the stability of the rupiah exchange rate. These conditions provide a relevant setting to examine whether ESG-oriented portfolio allocation changed after Danantara's establishment.

Table 2: Dataset of Risk-free Rate[1]

Month	BI7DRR	Month	BI7DRR	Month	BI7DRR	Month	BI7DRR
Agt 2024	6.25%	Dec 2024	6.00%	Mar 2025	5.75%	Jun 2025	5.50%
Sep 2024	6.00%	Jan 2025	5.75%	Apr 2025	5.75%	Jul 2025	5.25%
Oct 2024	6.00%	Feb 2025	5.75%	May 2025	5.50%	Agt 2025	5.00%
Nov 2024	6.00%						

3.1. Single Index Model

Daily returns were calculated for 121 days and 112 days of closing price for each stock using Eq. (1). After that, the expected return, risk, and covariance of each stock and market index for each period were calculated by Eqs. (2), (3), and (4). The results were detailed in Table 3.

Table 3: Expected Return, Risk, and Covariance (Cov) of Stocks and Market Index

Pre-Danantara Period				Post-Danantara Period			
Ticker	Expected Return	Risk	Cov	Ticker	Expected Return	Risk	Cov
JKSE	-0.00085	0.00935	0.00009	JKSE	0.00136	0.01505	0.00023
ACES	0.00044	0.02319	0.00002	ACES	-0.00372	0.03462	0.00026
AKRA	-0.00136	0.02398	0.00005	AKRA	0.00081	0.03531	0.00024
AUTO	-0.00057	0.01827	0.00005	AVIA	0.00165	0.01953	0.00011
BBCA	-0.00109	0.01555	0.00008	BBCA	-0.00022	0.01805	0.00022
BBNI	-0.00196	0.02260	0.00014	BBNI	0.00116	0.02532	0.00027
BBRI	-0.00205	0.01961	0.00011	BBRI	0.00090	0.02654	0.00031
BMRI	-0.00272	0.02157	0.00014	BMRI	0.00061	0.02585	0.00029
BMTR	-0.00252	0.01598	0.00006	BNGA	0.00094	0.01298	0.00014
BRPT	-0.00224	0.03037	0.00017	BSDE	0.00039	0.02560	0.00024
BSDE	-0.00220	0.02145	0.00009	CMRY	0.00097	0.02365	0.00010
CTRA	-0.00340	0.02573	0.00009	CTRA	0.00188	0.02796	0.00023
EMTK	0.00388	0.03424	0.00007	EMTK	0.00590	0.04101	0.00029
ERAA	-0.00111	0.02968	0.00011	ERAA	0.00203	0.03724	0.00027
GOTO	0.00340	0.03432	0.00015	GOTO	-0.00231	0.03417	0.00028
JSMR	-0.00216	0.01630	0.00006	JSMR	-0.00157	0.02370	0.00019
MAPI	-0.00042	0.03141	0.00003	MAPI	-0.00075	0.03357	0.00031
MIKA	-0.00177	0.02045	0.00001	MIKA	-0.00015	0.02685	0.00013
MNCN	-0.00202	0.01656	0.00007	MNCN	0.00007	0.02527	0.00022
MPMX	-0.00051	0.00584	0.00002	PGEO	0.00394	0.03890	0.00023
PGEO	-0.00207	0.02268	0.00005	PWON	0.00004	0.02327	0.00023
PWON	-0.00163	0.02019	0.00008	SCMA	0.00310	0.04150	0.00028
SCMA	0.00525	0.03244	0.00001	SIDO	-0.00066	0.01885	0.00012
SIDO	-0.00108	0.01831	0.00004	TLKM	0.00264	0.02176	0.00018
TBIG	0.00138	0.01402	-0.00001	TOWR	0.00053	0.03223	0.00026
TLKM	-0.00089	0.02178	0.00010	UNVR	0.00327	0.03937	0.00026
TOWR	-0.00248	0.02250	0.00006	UNVR	-0.00478	0.02503	0.00007

Based on Table 3, the results show a clear expansion in the IDXESGL investment opportunity set after Danantara's establishment. Before Danantara's establishment, there were only five

[1] https://www.bi.go.id/id/statistik/indikator/BI-Rate.aspx

stocks that had positive expected returns. In contrast, after Danantara's establishment, the number of stocks with positive expected returns increased to 18. This increase is consistent with the movement of JKSE, which declined in the pre-Danantara period and rebounded in period the post-Danantara. This pattern indicates that Danantara's establishment was associated with improved market sentiment, supported by stock buybacks and greater institutional clarity, while also changing the type of ESG stocks considered attractive for portfolio formation. Subsequently, the value of beta, alpha, and residual variance for each stock with positive expected returns in each period was calculated by Eqs. (5), (6), and (7). The results were detailed in Table 4.

Table 4: Beta, Alpha, and Residual Variance of Stocks

Pre-Danantara Period							
Ticker	β_i	α_i	$s^2_{e_i}$	Ticker	β_i	α_i	$s^2_{e_i}$
ACES	0.23884	0.00065	0.00053	SCMA	0.09790	0.00533	0.00105
EMTK	0.85111	0.00461	0.00111	TBIG	-0.08954	0.00130	0.00020
GOTO	1.65781	0.00482	0.00094				
Post-Danantara Period							
Ticker	β_i	α_i	$s^2_{e_i}$	Ticker	β_i	α_i	$s^2_{e_i}$
AKRA	1.07748	-0.00066	0.00098	EMTK	1.29812	0.00413	0.00130
AVIA	0.47380	0.00101	0.00033	ERAA	1.20640	0.00040	0.00106
BBNI	1.17160	-0.00043	0.00033	MNCN	0.97616	-0.00126	0.00042
BBRI	1.37048	-0.00096	0.00028	PGEO	1.02091	0.00255	0.00128
BMRI	1.28378	-0.00113	0.00030	PWON	1.02589	-0.00135	0.00030
BNGA	0.63897	0.00007	0.00008	SCMA	1.24770	0.00141	0.00137
BSDE	1.05590	-0.00105	0.00040	TLKM	0.78558	0.00158	0.00033
CMRY	0.44907	0.00036	0.00051	TOWR	1.16293	-0.00105	0.00073
CTRA	1.03005	0.00048	0.00054	UNVR	1.13196	0.00173	0.00126

Based on the stock beta values reported in Table 4, stock sensitivities can be classified into several categories. Stocks with beta values greater than one are considered aggressive, as they exhibit higher volatility than the JKSE, such as GOTO in the pre-Danantara period and EMTK in the post-Danantara period. In contrast, stocks with beta values between zero and one are categorized as defensive, while beta values close to one indicates price movements that closely mirror the market [13], as observed for EMTK in Period 1 and MNCN in Period 2. Negative beta values indicate inverse movements relative to the market [14], as shown by TBIG in Period 1. Positive alpha values suggest that stocks outperform the market [13], and the results indicate that all stocks in Period 1 and 10 out of 18 stocks in Period 2 recorded positive alpha values. Higher residual variance reflects a greater influence of firm-specific factors that cannot be explained by market movements. In Period 1, EMTK exhibits higher idiosyncratic risk and is less predictable based on JKSE trends, whereas TBIG is relatively more predictable. In Period 2, SCMA shows strong firm-specific movements, while BNGA closely follows market dynamics. Before calculating the excess return to beta, the average risk-free rate is required and calculated for both periods using Eq. (9).

$$Rf^{(pre-Danantara)} = \frac{1}{7}(6.25\% + \cdots + 5.75\%) = 5.96\%$$

$$Rf^{(post-Danantara)} = \frac{1}{7}(5.75\% + \cdots + 5.00\%) = 5.50\%.$$

The average risk-free rates were then divided by 233, corresponding to the number of return observations in one year for both periods in this study. As a result, the daily risk-free rate was 0.0256% for pre-Danantara and 0.0236% for post-Danantara. The risk-free rate is then used for candidate selection based on ERB and cut-off values by Eqs. (8) and (10), detailed in Table 5.

Based on Table 5, during the pre-Danantara period, ACES records the highest cumulative cut-off value of 0.00059, resulting in four selected portfolio candidates, namely SCMA, EMTK,

Table 5: Portfolio Candidates Selection

Pre-Danantara Period							
Ticker	ERB_i	C_i^*	Selection	Ticker	ERB_i	C_i^*	Selection
SCMA	0.05101	0.00004	Candidate	ACES	0.00079	**0.00059**	Candidate
EMTK	0.00426	0.00027	Candidate	TBIG	-0.01256	0.00055	Not Candidate
GOTO	0.00190	0.00059	Candidate				
Post-Danantara Period							
Ticker	ERB_i	C_i^*	Selection	Ticker	ERB_i	C_i^*	Selection
EMTK	0.00436	0.00099	Candidate	BNGA	0.00110	0.00164	Not Candidate
PGEO	0.00363	0.00132	Candidate	BBNI	0.00079	0.00150	Not Candidate
TLKM	0.00306	0.00170	Candidate	AKRA	0.00053	0.00145	Not Candidate
AVIA	0.00299	0.00180	Candidate	BBRI	0.00049	0.00125	Not Candidate
UNVR	0.00268	0.00189	Candidate	BMRI	0.00029	0.00111	Not Candidate
SCMA	0.00230	**0.00193**	Candidate	TOWR	0.00025	0.00107	Not Candidate
CMRY	0.00164	0.00192	Not Candidate	BSDE	0.00014	0.00101	Not Candidate
CTRA	0.00160	0.00187	Not Candidate	MNCN	-0.00017	0.00095	Not Candidate
ERAA	0.00149	0.00184	Not Candidate	PWON	-0.00019	0.00087	Not Candidate

GOTO, and ACES. In the post-Danantara period, SCMA attains the highest cumulative cut-off value of 0.00193, resulting in six selected candidates, namely EMTK, PGEO, TLKM, AVIA, UNVR, and SCMA. The increase in selected candidates from four to six suggests a moderate broadening of portfolio eligibility in the post-Danantara period. This pattern is associated with a wider presence of positive excess return to beta values and a lower risk-free rate, which allowed more stocks to meet the selection threshold. Economically, the findings may reflect a gradual reorientation of investor preferences from digital-growth exposure toward stocks perceived as offering greater stability, institutional relevance, and lower downside risk.

3.2. Single Index Model Portfolio

From the portfolio candidates, the number of unique portfolios is calculated using Eq. (14).

$$C^4_{total} = \sum_{y=2}^{4} C^4_y = 11 \quad \text{and} \quad C^6_{total} = \sum_{y=2}^{6} C^6_y = 57 \tag{24}$$

Based on the calculation results, 11 and 57 portfolios were formed in the pre-Danantara period and post-Danantara period. This increase suggests a moderate broadening of portfolio alternatives to balance return-seeking objectives with portfolio resilience. For each portfolio, stock proportions (D_i) were calculated using Eq. (11). The results were detailed in Table 6.

Table 6: Stocks Proportion

Pre-Danantara Period				Post-Danantara Period					
Ticker	D_i	Ticker	D_i	Ticker	D_i	Ticker	D_i	Ticker	D_i
SCMA	4.69377	GOTO	2.31690	EMTK	2.42499	TLKM	2.66381	UNVR	0.67462
EMTK	2.82108	ACES	0.08891	PGEO	1.35726	AVIA	1.51555	SCMA	0.33375

Based on Table 6, SCMA has the highest stock proportion in the pre-Danantara period, while TLKM dominates in the post-Danantara period. Then, the portfolio weights, expected returns, and risks were calculated by Eqs. (11), (12), and (13). The results were detailed in Table 7.

Based on Table 7, the four-asset portfolio in the pre-Danantara period yields higher expected return with higher risk than the six-asset portfolio in the post-Danantara period, reflecting a clear return–risk trade-off by concentrated weights in positively performing stocks despite

Table 7: Portfolios Weight, Expected Return, and Risk

p	Portfolio Assets	$W_{i,p}$	$E(R_p)$	s_p^2	s_p
Pre-Danantara Period					
1	[SCMA, EMTK]	[62.46%, 37.54%]	0.00474	0.00058	0.02407
2	[SCMA, GOTO]	[66.95%, 33.05%]	0.00464	0.00061	0.02463
3	[SCMA, ACES]	[98.14%, 1.86%]	0.00516	0.00101	0.03184
4	[EMTK, GOTO]	[54.91%, 45.09%]	0.00367	0.00065	0.02557
5	[EMTK, ACES]	[96.94%, 3.06%]	0.00378	0.00110	0.03321
6	[GOTO, ACES]	[96.30%, 3.70%]	0.00329	0.00110	0.03310
7	[SCMA, EMTK, GOTO]	[47.74%, 28.69%, 23.57%]	0.00442	0.00042	0.02058
8	[SCMA, EMTK, ACES]	[61.73%, 37.10%, 1.17%]	0.00469	0.00057	0.02379
9	[SCMA, GOTO, ACES]	[66.11%, 32.63%, 1.26%]	0.00459	0.00059	0.02433
10	[EMTK, GOTO, ACES]	[53.97%, 44.33%, 1.70%]	0.00361	0.00063	0.02516
11	[SCMA, EMTK, GOTO, ACES]	[47.31%, 28.44%, 23.35%, 0.90%]	0.00439	0.00042	0.02041
Post-Danantara Period					
p	Portfolio Assets	$W_{i,p}$	$E(R_p)$	s_p^2	s_p
1	[EMTK, PGEO]	[64.12%, 35.88%]	0.00519	0.00102	0.03201
2	[EMTK, TLKM]	[47.65%, 52.35%]	0.00419	0.00063	0.02504
		⋮			
36	[EMTK, PGEO, TLKM, AVIA]	[30.46%, 17.05%, 33.46%, 19.03%]	0.00367	0.00040	0.02000
		⋮			
57	[EMTK, PGEO, TLKM, AVIA, UNVR, SCMA]	[27.03%, 15.13%, 29.70%, 16.90%, 7.52%, 3.72%]	0.00362	0.00038	0.01941

the negative JKSE return. Descriptively, Table 7 indicates that Portfolio 3 in Pre-Danantara and Portfolio 1 in Post-Danantara may appeal to return-oriented investors, whereas Portfolio 11 in Pre-Danantara and Portfolio 57 in Post-Danantara may better suit risk-averse investors. However, such comparisons remain preliminary and require confirmation through risk-adjusted performance measures, as discussed in the following subsection.

3.3. Portfolio Performance

Portfolio performance is evaluated by the Sharpe Ratio and VaRSR. To calculate VaRSR, daily excess returns were first calculated using stock returns and portfolio weights in Eq. (16), followed by the average, standard deviation, skewness, and kurtosis using Eqs. (17), (18), (19), and (20). As shown in Table 8, the four-asset pre-Danantara portfolio consisting of ACES, EMTK, GOTO, and SCMA records an average excess return of 0.00413, positive skewness of 0.81246, and kurtosis below 3 at 2.36355, indicating greater upside potential and a relatively stable return distribution [28]. In contrast, the six-asset post-Danantara portfolio consisting of EMTK, PGEO, TLKM, AVIA, UNVR, and SCMA records a lower average excess return of 0.0029, negative skewness of -1.0729, and kurtosis above 3 at 3.6798, indicating higher downside potential and greater exposure to extreme return movements [28]. These findings suggest that a larger number of selected assets in the SIM portfolio does not necessarily eliminate downside risk under non-normal return behavior, thereby supporting the relevance of VaRSR for portfolio performance evaluation.

The performance was evaluated by Sharpe Ratio using Eq. (15) and further assessed with VaRSR with the estimated sharpe ratio and its standard deviation using Eqs. (21), (22), and (23). The results are detailed in Table 9.

Subsequently, scatterplots were constructed between portfolio expected return and risk based on the results in Table 7, with the Sharpe Ratio and VaRSR from Table 9 used as color-coded legends to visualize the distribution of the constructed portfolio combinations across both periods.

Table 8: Average, Standard Deviation, Skewness, and Kurtosis of Excess Return Portfolio

p	Portfolio Assets	$E(EXR_p)$	$s(EXR_p)$	$S(EXR_p)$	$K(EXR_p)$
Pre-Danantara Period					
1	[SCMA, EMTK]	0.00448	0.02895	1.15025	3.45950
2	[SCMA, GOTO]	0.00438	0.02600	1.03156	3.45290
3	[SCMA, ACES]	0.00490	0.03191	1.50991	5.16294
4	[EMTK, GOTO]	0.00341	0.02694	0.27828	-0.08211
5	[EMTK, ACES]	0.00352	0.03324	0.64809	1.41153
6	[GOTO, ACES]	0.00304	0.03317	0.54499	0.47146
7	[SCMA, EMTK, GOTO]	0.00417	0.02510	0.81427	2.35109
8	[SCMA, EMTK, ACES]	0.00443	0.02865	1.14947	3.48122
9	[SCMA, GOTO, ACES]	0.00433	0.02573	1.03055	3.46479
10	[EMTK, GOTO, ACES]	0.00336	0.02653	0.26864	-0.09013
11	[SCMA, EMTK, GOTO, ACES]	0.00413	0.02491	0.81246	2.36355
Post-Danantara Period					
p	Portfolio Assets	$E(EXR_p)$	$s(EXR_p)$	$S(EXR_p)$	$K(EXR_p)$
1	[EMTK, PGEO]	0.00496	0.03096	-0.42995	1.14955
2	[EMTK, TLKM]	0.00396	0.02550	-0.60580	2.63427
	⋮				
36	[EMTK, PGEO, TLKM, AVIA]	0.00343	0.01984	-0.96215	2.89229
	⋮				
57	[EMTK, PGEO, TLKM, AVIA, UNVR, SCMA]	0.00338	0.02006	-1.07966	3.44525

Table 9: Portfolio Performance for Pre- and Post-Danantara Periods

p	Portfolio Assets	SR_p	$\widehat{SR}_p$	$s(\widehat{SR}_p)$	$\text{VaRSR}_{(95\%,p)}$
Pre-Danantara Period					
1	[SCMA, EMTK]	0.18620	0.15477	0.08350	0.01742
2	[SCMA, GOTO]	0.17796	0.16859	0.08384	0.03069
3	[SCMA, ACES]	0.15402	0.15370	0.08127	0.02003
4	[EMTK, GOTO]	0.13339	0.12662	0.08946	-0.02053
5	[EMTK, ACES]	0.10608	0.10600	0.08815	-0.03900
6	[GOTO, ACES]	0.09177	0.09157	0.08893	-0.05470
7	[SCMA, EMTK, GOTO]	0.20243	0.16602	0.08535	0.02564
8	[SCMA, EMTK, ACES]	0.18625	0.15464	0.08352	0.01727
9	[SCMA, GOTO, ACES]	0.17799	0.16832	0.08386	0.03038
10	[EMTK, GOTO, ACES]	0.13341	0.12651	0.08952	-0.02073
11	[SCMA, EMTK, GOTO, ACES]	0.20244	0.16586	0.08537	0.02544
Post-Danantara Period					
p	Portfolio Assets	SR_p	$\widehat{SR}_p$	$s(\widehat{SR}_p)$	$\text{VaRSR}_{(95\%,p)}$
1	[EMTK, PGEO]	0.15492	0.16018	0.09817	-0.00131
2	[EMTK, TLKM]	0.15802	0.15515	0.09972	-0.00888
	⋮				
36	[EMTK, PGEO, TLKM, AVIA]	0.17154	0.17286	0.10312	0.00323
	⋮				
57	[EMTK, PGEO, TLKM, AVIA, UNVR, SCMA]	0.17411	0.16851	0.10394	-0.00247

In addition, the portfolio size or the number of stocks within each portfolio is also incorporated as a distinctive visual shape in the scatterplots. The pre-Danantara scatterplot is presented in Fig. 2, while the post-Danantara scatterplot is presented in Fig. 3.

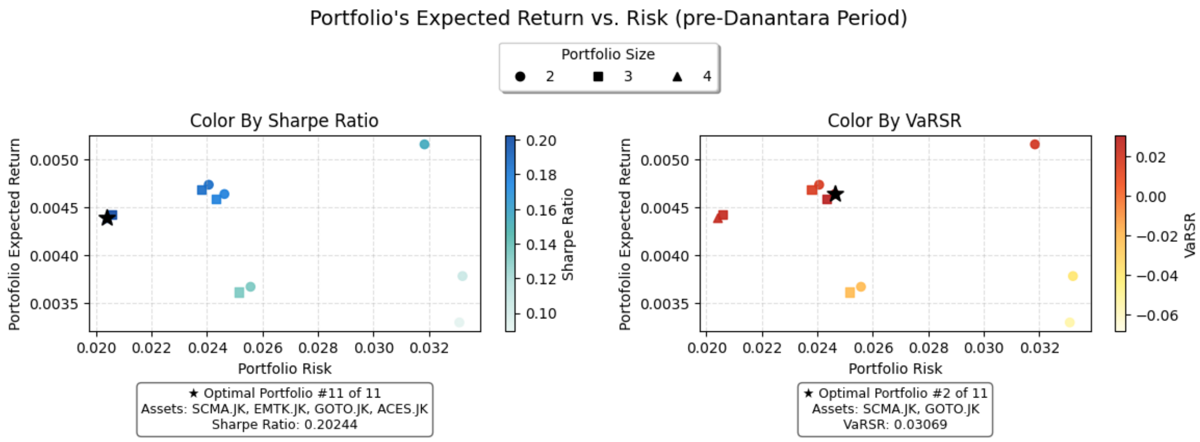

Fig. 2: Pre-Danantara Scatterplot

Based on Fig. 2, the best-performing portfolio according to the Sharpe Ratio consists of four stocks, namely SCMA, EMTK, GOTO, and ACES, with a Sharpe Ratio value of 0.20244. Based on Table 7, this portfolio allocates 47.31% to SCMA, 28.44% to EMTK, 23.35% to GOTO, and 0.90% to ACES, resulting in an expected portfolio return of 0.00439 and a portfolio risk of 0.02041. In contrast, based on the VaRSR criterion, the optimal portfolio consists of SCMA and GOTO, achieving the highest VaRSR value of 0.03069. This portfolio allocates 66.95% to SCMA and 33.05% to GOTO, with an expected portfolio return of 0.00464 and a portfolio risk of 0.02463.

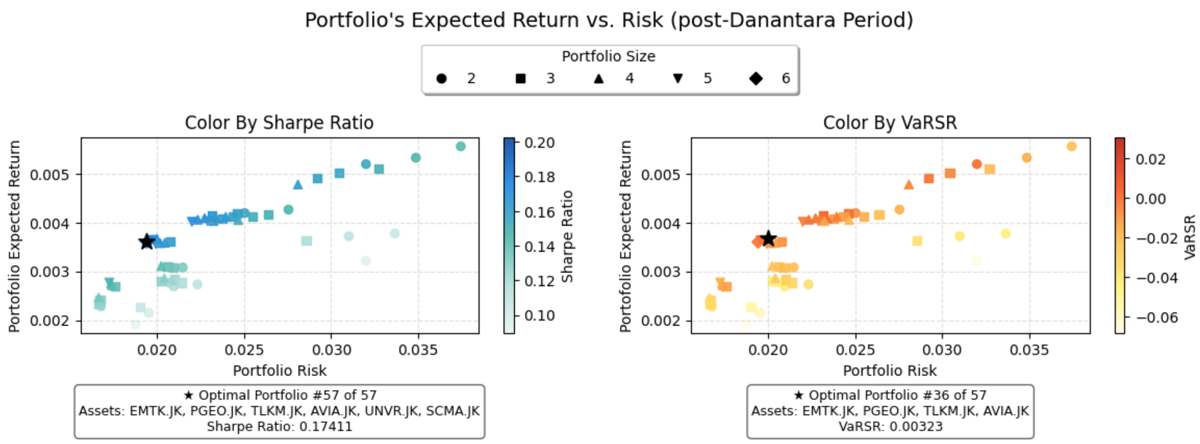

Fig. 3: Post-Danantara Scatterplot

Based on Fig. 3, the best-performing portfolio according to the Sharpe Ratio consists of six stocks, namely EMTK, PGEO, TLKM, AVIA, UNVR, and SCMA, achieving a Sharpe Ratio of 0.17411. Based on Table 7, this portfolio allocates 27.03% to EMTK, 15.13% to PGEO, 29.70% to TLKM, 16.90% to AVIA, 7.52% to UNVR, and 3.72% to SCMA, resulting in an expected portfolio return of 0.00362 and a portfolio risk of 0.01941. In contrast, based on the VaRSR criterion, the optimal portfolio consists of four stocks, namely EMTK, PGEO, TLKM, and AVIA, achieving the highest VaRSR value of 0.00323. This portfolio allocates 30.46% to EMTK, 17.05% to PGEO, 33.46% to TLKM, and 19.03% to AVIA, yielding an expected portfolio return of 0.00367 and a portfolio risk of 0.02000.

A comparison between the Sharpe Ratio and VaRSR shows that stocks excluded under the VaRSR criterion, such as EMTK and ACES in the pre-Danantara period and UNVR and SCMA in the post-Danantara period, have relatively lower estimated Sharpe Ratios and higher estimation uncertainty. A lower estimated Sharpe Ratio reflects weaker average excess returns relative to standard deviation, while a higher standard deviation of the estimated Sharpe Ratio indicates greater instability caused by downside potential of skewness and extreme movement of kurtosis. This result confirms that VaRSR provides a more conservative assessment by filtering portfolios that appear attractive under the Sharpe Ratio but remain exposed to downside risk.

The comparison between periods shows a noticeable change in optimal portfolio composition in the post-Danantara period. In the pre-Danantara period, optimal portfolios were mainly represented by SCMA, EMTK, GOTO, and ACES, indicating exposure to broadcasting, technology, digital media, and consumer-related stocks. This pattern suggests that investment strategies within the IDXESGL index prior to Danantara were largely associated with digitally oriented and growth-focused consumer stocks. In the post-Danantara period, portfolio composition becomes broader, including EMTK, PGEO, TLKM, AVIA, UNVR, and SCMA under the Sharpe Ratio criterion, while the VaRSR criterion retains EMTK, PGEO, TLKM, and AVIA. This composition indicates greater exposure to established firms with strategic-sector relevance, including energy-transition, telecommunications, defensive consumer goods, digital media, and building-materials-related stocks. State-owned enterprises typically have significant government ownership and operate in strategic sectors such as energy and telecommunications [29], which may support perceived stability through institutional and policy backing. Meanwhile, conglomerate firms are privately controlled business groups with diversified operations across industries [29], which may enhance resilience through internal capital markets and risk diversification.

These findings are consistent with a potential reorientation from digitally oriented and growth-focused exposure toward a more balanced allocation involving firms with stronger strategic-sector relevance, institutional links, and established market positions. The inclusion of PGEO and TLKM reflects exposure to energy-transition and telecommunications themes, while the continued presence of EMTK and SCMA suggests that digital-related stocks remained relevant. Overall, the post-Danantara portfolio does not indicate a complete departure from digital-growth exposure, but rather a more selective balance between return-seeking objectives and portfolio resilience.

4. Conclusion

This study successfully evaluates changes in optimal portfolio composition and performance under both normal and extreme risk conditions before and after Danantara's establishment by integrating the Single Index Model (SIM), stock combination approach, Sharpe Ratio, and Value at Risk-Adjusted Sharpe Ratio (VaRSR). The findings suggest a noticeable change in portfolio strategies following Danantara, where pre-Danantara optimal portfolios reflect a growth-driven preference accompanied by higher risk exposure, while the post-Danantara period shows improved diversification and a stronger emphasis on stability. Furthermore, a comparison between the Sharpe Ratio and VaRSR indicates that portfolio rankings differ once extreme risk is considered, with VaRSR identifying a more conservative portfolio by incorporating the return distribution.

For investors, portfolio construction should not rely only on historical return and conventional performance measures, but also consider policy signals, governance credibility, strategic-sector exposure, and downside risk. The post-Danantara results suggest that investors may consider rebalancing ESG-oriented portfolios from speculative digital-growth exposure toward firms with stronger fundamentals, institutional backing, and more stable risk-return profiles. For regulators and market authorities, the possible association between Danantara-related policy signals, investor preferences, and market structure highlights the need to strengthen transparency, governance disclosure, and communication regarding state-linked investment policies. Clearer information regarding Danantara's investment direction may reduce uncertainty, limit excessive speculation, support efficient price adjustment, and help monitor concentration risks in state-owned, conglomerate, and strategic-sector stocks.

This study has several limitations, such as the fact that the analysis is confined to the IDXESGL index and relies on a specific portfolio construction framework. Future research may extend this approach by applying alternative weighting methods, examining other major stock indices, or incorporating behavioral and sentiment-based indicators to better capture market psychology surrounding policy interventions. Such extensions would contribute to a deeper understanding of portfolio adaptation under evolving economic and institutional environments.

CRediT Authorship Contribution Statement

Risky Gunawan: Conceptualization, Methodology, Software, Formal Analysis, Visualization, Validation, Writing–Original Draft. **Evy Sulistianingsih:** Supervision, Validation, Writing–Review & Editing. **Shantika Martha:** Supervision, Validation, Writing–Review & Editing. **Yundari:** Supervision, Writing–Review & Editing. **Fida Fathiyah Addini:** Supervision, Writing–Review & Editing.

Declaration of Generative AI and AI-assisted technologies

During the preparation of this manuscript, generative AI tools such as ChatGPT and Grammarly were used solely for language refinement and grammatical editing. All analyses, data processing, and interpretations were conducted entirely by the author.

Declaration of Competing Interest

The authors declare no competing interests.

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Data and Code Availability

The dataset used in this study is publicly available on the Yahoo Finance and Bank Indonesia Website, while the dataset and Python analysis codes are accessible on GitHub[2].

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