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CALENDAR ANOMALIES AND WEAK-FORM MARKET EFFICIENCY ACROSS INDONESIAN ESG INDICES

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Abstract

This study examines whether calendar anomalies provide predictable return patterns in two Indonesian ESG-based stock indices, SRI-KEHATI and IDX ESG Leaders, during 2023–2024. The sample comprises 23 SRI-KEHATI constituents and 29 IDX ESG Leaders constituents observed over 475 trading days, yielding 10,925 and 13,775 firm-day observations, respectively. Random-effects panel regressions are used to test Turn of the Month (TOM) and Turn of the Year (TOY) effects, while Wilcoxon–Mann–Whitney tests compare return distributions between the two indices. TOM at the beginning and end of the month is not statistically significant in either index. The beginning-of-year TOY effect is also not significant, whereas the final seven trading days of the year show a positive and statistically significant association with returns in both indices. The cross-index comparisons do not indicate statistically significant differences in TOM or TOY return distributions. The findings therefore provide broad, but conditional, consistency with weak-form market efficiency: predictable calendar patterns are largely absent, while a localized year-end effect remains. The study contributes by comparing two ESG-based indices in an emerging market and by identifying whether calendar predictability is common or index-specific within a clearly defined period.

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INTRODUCTION

Calendar anomalies provide a direct empirical setting for evaluating weak-form market efficiency because predictable returns associated with recurring calendar positions would imply that historical market information contains incremental forecasting content. Fama (1970) formalized the weak-form view that security prices should incorporate information contained in past prices, while Lo (2004) later proposed the Adaptive Markets Hypothesis (AMH), under which market efficiency can vary as investors, institutions, competition, and market environments evolve. Recent evidence supports this dynamic perspective: calendar effects can weaken, disappear, or re-emerge across markets and regimes (Bassiouny et al. 2023; Shehadeh and Zheng 2023; Adam et al. 2025; Hasan and Al-Najjar 2025). Indonesian evidence likewise indicates that calendar effects differ across index structures and volatility regimes (Ghallabi et al. 2026). The relevant question is therefore not simply whether calendar anomalies exist,

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but whether they remain detectable in a particular market segment and period.

The question is increasingly relevant for sustainability-oriented equities because ESG investing has become a visible component of the Indonesian capital market. OJK reported that ESG-based mutual-fund assets under management reached Rp8.21 trillion by June 2024, covering 34 products managed by 19 investment managers, while OJK data also show ESG passive-fund AUM rising from Rp7.16 trillion in 2023 to Rp7.596 trillion in 2024. This growth indicates that ESG-oriented investment is no longer a peripheral market segment. The SRI-KEHATI and IDX ESG Leaders indices are therefore relevant settings for examining whether calendar-based predictability persists when investors operate within sustainability-screened portfolios. The SRI-KEHATI index and IDX ESG Leaders index represent distinct ESG-oriented selection frameworks, making their comparison useful for assessing whether calendar effects are common across ESG indices or dependent on index construction.

Prior Indonesian studies provide a useful but incomplete foundation. Yasya et al. (2023) compare the risk and return characteristics of SRI-KEHATI with a conventional benchmark, while Tjun et al. (2024) find that ESG performance is not consistently associated with SRI-KEHATI returns. Anggraini and Sari (2024) examine ESG-related attributes among IDX ESG Leaders constituents. For calendar anomalies, Argantha and Rahyuda (2023) show that the turn-of-the-month effect varies between pre-pandemic and pandemic periods, and Ghallabi et al. (2026) document differences in calendar effects across conventional and Islamic Indonesian indices. International evidence also shows that Turn of the Month effects are sensitive to market structure, investor type, and market regime (Irtiza et al. 2021; Lee and Kim 2022; Tadepalli et al. 2022; Wuthisatian 2022). However, these studies do not directly compare calendar predictability across two ESG-based Indonesian indices using identical event-window definitions.

The research gap therefore concerns the intersection of ESG-oriented index construction and calendar-based return predictability. It remains unclear whether simple month-end and year-end timing rules can predict daily returns in Indonesian ESG indices, whether such patterns are shared by SRI-KEHATI and IDX ESG Leaders, and whether an apparent anomaly is concentrated in a particular part of the calendar transition. This study focuses on 2023–2024 because it captures a period in which ESG investment products and ESG-oriented market infrastructure were expanding in Indonesia, while both indices were already established investable benchmarks. The study therefore tests whether calendar predictability remained detectable during a period of increasing ESG investment relevance rather than assuming that evidence from conventional indices generalizes to ESG-screened portfolios.

The principal novelty is the direct comparison of two ESG-based indices in an emerging market, rather than the technical separation of early and late event windows. The study compares SRI-KEHATI and IDX ESG Leaders under a common firm-day framework and asks whether calendar anomalies are present within each index and whether the return distributions differ across the two ESG segments. The early- and late-month/year windows are used as identification devices that help localize any anomaly, not as the primary contribution. This design links calendar-anomaly evidence to weak-form efficiency and the Adaptive Markets Hypothesis while recognizing that ESG screening does not automatically imply complete informational efficiency.

Theoretical expectations for the hypotheses follow from the weak-form efficiency and AMH perspectives. If calendar information is already incorporated into prices, TOM

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and TOY coefficients should not be systematically different from zero. Conversely, persistent effects may arise when institutional trading, portfolio rebalancing, or investor behavior produces temporary predictability. In ESG-oriented indices, stronger information environments and institutional monitoring may weaken simple calendar patterns, but the possibility of localized seasonal effects remains an empirical question.

For the Turn of the Month Effect (TOM), recurring liquidity needs, portfolio rebalancing, and institutional cash-flow cycles may concentrate trading around month-end, while arbitrage and information incorporation may reduce the persistence of the pattern. The expected direction is therefore positive for a conventional anomaly, but the weak-form efficiency benchmark predicts no systematic effect.

H1: The Turn of the Month Effect significantly and positively affects stock returns in the SRI-KEHATI Index.

H2: The Turn of the Month Effect significantly and positively affects stock returns in the IDX ESG Leaders Index.

Turn-of-the-year effects may arise from year-end portfolio rebalancing, reporting cycles, and institutional portfolio management. Given the positive anomaly commonly examined in the literature, the expected direction is positive, while weak-form efficiency predicts no systematic effect.

H3: The Turn of the Year Effect significantly and positively affects stock returns in the SRI-KEHATI Index.

H4: The Turn of the Year Effect significantly and positively affects stock returns in the IDX ESG Leaders Index.

Because SRI-KEHATI and IDX ESG Leaders use different constituent-selection structures, their investor clientele, liquidity, and information environments may differ. If these differences influence seasonal trading behavior, the calendar-period return distributions may differ. The expected direction of the cross-index hypotheses is non-directional because the literature does not establish that either ESG index should systematically dominate the other in calendar-period returns.

H5: Turn of the Month returns differ significantly between the SRI-KEHATI Index and the IDX ESG Leaders Index.

H6: Turn of the Year returns differ significantly between the SRI-KEHATI Index and the IDX ESG Leaders Index.

Accordingly, this study aims to test TOM and TOY effects on daily stock returns within each ESG index and to compare the calendar-period return distributions between SRI-KEHATI and IDX ESG Leaders. The contribution is the comparison of two ESG-based indices in an emerging market and the identification of whether any calendar predictability is common across the ESG segment or localized to particular windows.

RESEARCH METHOD

This quantitative study uses secondary daily closing-price data for companies included in the SRI-KEHATI Index and IDX ESG Leaders Index from January 2023 through December 2024. The unit of analysis is a firm-trading-day observation. Purposive sampling retained firms that were consistently represented in the relevant index over the observation period and had complete daily price data. The final sample consists of 23 SRI-KEHATI companies and 29 IDX ESG Leaders companies observed over 475 trading days, producing 10,925 and 13,775 firm-day observations, respectively. This structure directly combines the cross-sectional dimension (firms) with the time-series dimension (trading days).

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Table 1. Sample Selection Criteria

No.	Sample Selection Criteria	SRI-KEHATI	IDX ESG Leaders
1	Companies included in the index and listed on the Indonesia Stock Exchange during 2023–2024.	25	30
2	Companies consistently included during 1 January 2023–31 December 2024.	25	30
3	Companies excluded because daily stock-price data were incomplete.	(2)	(1)
	Total sample companies	23	29
	Trading days	475	475
	Total firm-day observations	10,925	13,775

The constituent-stability criterion must be checked against the official periodic review histories of SRI-KEHATI and IDX ESG Leaders. The current counts (25/30 initial constituents and 23/29 final obervations) should not be presented as evidence of continuous membership until the review records are reconciled. Source: Research data compiled from Indonesia Stock Exchange records and official index information (2026).

Daily stock return is the dependent variable. It is measured as the percentage change in closing price from trading day t−1 to trading day t:

$$R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}}$$

$R_{it}itP_{it}tP_{i,t-1}$where R_it is the daily return of firm i on trading day t, P_it is the closing price on day t, and P_i,t−1 is the closing price on the preceding trading day. The calendar variables are coded as binary indicators. The three-day TOM windows isolate trading sessions closest to the month transition, while the seven-day TOY windows isolate the final and first trading sessions around the year transition. These event windows are reported explicitly to make the analysis replicable.

Table 2. Operational Definition and Dummy Coding

Variable	Operational definition	Dummy coding
Stock return (R_it)	Daily change in closing price, calculated using Equation (1).	Continuous ratio
TOM Beginning	First three trading days of each month.	1 = observation falls in the first three trading days; 0 = otherwise
TOM End	Last three trading days of each month.	1 = observation falls in the last three trading days; 0 = otherwise
TOY Beginning	First seven trading days of the calendar year (January window).	1 = observation falls in the first seven trading days of the year; 0 = otherwise
TOY End	Last seven trading days of the calendar year (December window).	1 = observation falls in the last seven trading days of the year; 0 = otherwise

The primary inferential analysis uses panel-data regression. Common Effect, Fixed Effect, and Random Effect specifications were evaluated using the Chow, Hausman, and Lagrange Multiplier tests. The model estimated separately for each index is:

$$\boldsymbol{R_{it} = a + B_1 TOM_{_B_{egit}} + B_2 TOM_{End_{it}} + B_3 TOY_{_B_{egit}} + B_4 TOY_{_End_{it}} + \mu_i + \epsilon_{it}}$$

$$\boldsymbol{R_{it}it\alpha\beta_1\beta_4 TOM_{Beg,it} TOM_{End,it} TOY_{Beg,it} TOY_{End,it} \mu_i \varepsilon_{it}}$$

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where R_it represents the daily stock return of firm i on trading day t; α is the intercept; β1–β4 are the coefficients of the calendar-effect variables; TOM_B and TOM_E denote the beginning- and end-of-month dummies; TOY_B and TOY_E denote the beginning- and end-of-year dummies; u_i is the firm-specific random effect; and ε_it is the idiosyncratic error term.

The panel regression is used as the primary test for H1–H4 because it estimates the direction and statistical significance of each calendar-effect variable on stock returns within each index while accounting for both cross-sectional and time-series dimensions. The Wilcoxon–Mann–Whitney rank-sum test is used as a supplementary comparative test for H5–H6 to determine whether the distributions of Turn of the Month and Turn of the Year returns differ significantly between the SRI-KEHATI and IDX ESG Leaders groups. Thus, the nonparametric test complements, rather than replaces, the panel regression analysis.

Daily financial returns can be vulnerable to heteroskedasticity and serial correlation. The reported REM is estimated using generalized least squares (GLS). The diagnostic statistics reported in the manuscript are supplementary checks, but they do not eliminate the possibility that observations from the same trading date are correlated across firms. Therefore, the robustness analysis requested by the reviewers should additionally use standard errors clustered by trading date and a time-series regression of daily index returns with market return as a control. These robustness tests require the underlying firm-day observations and the corresponding market-return series and should be reported before the final empirical conclusions are submitted.

RESULT AND DISCUSSION

Model Selection and Diagnostic Results

The model-selection results require careful interpretation because the tests do not point to the same specification. For both indices, the Chow test has a high p-value (0.9218 for SRI-KEHATI and 0.9192 for IDX ESG Leaders), so there is no evidence that fixed effects improve on the common-effect specification. The LM test is highly significant (p=0.0000 for both indices), indicating statistically detectable random effects relative to the common-effect model. The Hausman test returns p=1.0000 for both indices, so the null hypothesis that the random-effects estimator is consistent is not rejected. Taken together, these results justify retaining the Random Effect Model rather than interpreting the Chow test alone as decisive. However, the Hausman value of 1.0000 also suggests that the estimated random-effects variance component should be reported explicitly because it may be close to zero.

Table 3. Panel-Data Model Selection

Index	Chow p-value	Hausman p-value	LM p-value	Final model
SRI-KEHATI	0.9218	1.0000	0.0000	Random Effect Model
IDX ESG Leaders	0.9192	1.0000	0.0000	Random Effect Model

The diagnostic evidence is consistent with the reported baseline specification. For SRI-KEHATI, the Durbin–Watson statistic is 2.1035; for IDX ESG Leaders it is 2.1133. Glejser probabilities for the calendar dummies are above 0.05 and centered VIF values are close to one. These diagnostics do not indicate a conventional heteroskedasticity or

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multicollinearity problem within the reported specification. Nevertheless, because firms are observed on common trading dates, the robustness procedures described above are necessary to assess whether the baseline standard errors are understated.

Calendar-Effect Regression Results

Table 4 reports the estimated effects for each calendar window separately. The interpretation is therefore window-specific: a significant coefficient in the final seven trading days of the year cannot be generalized to all TOM or TOY windows.

Table 4. Partial Regression Results for Calendar Windows

Index	Calendar window	Coefficient	p-value	Decision (α=0.05)
SRI-KEHATI	TOM Beginning	0.000681	0.2087	Not significant
SRI-KEHATI	TOM End	-0.000748	0.1676	Not significant
SRI-KEHATI	TOY Beginning	-0.001592	0.1596	Not significant
SRI-KEHATI	TOY End	0.002658	0.0189	Significant (+)
IDX ESG Leaders	TOM Beginning	0.000650	0.3400	Not significant
IDX ESG Leaders	TOM End	0.000293	0.6676	Not significant
IDX ESG Leaders	TOY Beginning	-0.002435	0.0874	Not significant
IDX ESG Leaders	TOY End	0.001822	0.0200	Significant (+)

Turn of the Month Effect and Weak-Form Efficiency

For the SRI-KEHATI Index, TOM Beginning (p=0.2087) and TOM End (p=0.1676) are both statistically insignificant. H1 is therefore rejected. For the IDX ESG Leaders Index, TOM Beginning (p=0.3400) and TOM End (p=0.6676) are also insignificant, so H3 is rejected. The signs of the coefficients differ across windows, but those directions should not be interpreted as reliable effects because the corresponding probabilities exceed 0.05. The results provide no empirical support for a repeatable turn-of-the-month return pattern in either ESG index during 2023–2024.

This absence of TOM is compatible with the time-varying nature of calendar anomalies documented in recent markets. Bassiouny et al. (2023) show that anomalies can alternate between periods of efficiency and inefficiency, while (Ferrouhi et al. 2021; Shehadeh and Zheng 2023) report substantial differences across markets and anomaly types. The Indonesian evidence of Ghallabi et al. (2026) likewise emphasizes that seasonal effects depend on index structure and volatility dynamics. In the present ESG sample, the lack of statistically significant TOM coefficients is broadly consistent with weak-form efficiency because a simple rule based only on the beginning or end of the month does not systematically predict return.

The ESG context offers a plausible, but not directly causal, explanation. More structured sustainability information can improve price discovery and mandatory ESG disclosure can change the information environment and investor response (Krueger et al. 2024). Socially responsible institutions also process conventional trading signals differently. These mechanisms could reduce the persistence of simple calendar regularities. However, the present design does not estimate a causal effect of ESG quality on market efficiency; it only shows that TOM is not statistically detectable within the two ESG indices examined.

Recent evidence shows why the null TOM result should not be interpreted as a universal disappearance of the anomaly. (Irtiza et al. 2021) identify TOM in Pakistan, (Lee and Kim 2022) link TOM in Korea partly to foreign-investor trading, and (Tadepalli et al. 2022) document persistence that changes across Indian market reforms. (Wuthisatian 2022) likewise reports calendar seasonality in Thailand. In contrast, the

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current ESG-index sample yields no statistically detectable TOM coefficient. The cross-market contrast supports a segment-specific interpretation: calendar effects depend on investor composition, market structure, and sample regime, while this study does not directly observe the order-flow channels that could explain those differences.

Turn of the Year Effect: A Localized Year-End Anomaly

The TOY results are more nuanced. In SRI-KEHATI, TOY Beginning is not significant (β=-0.001592; p=0.1596), whereas TOY End is positive and significant (β=0.002658; p=0.0189). In IDX ESG Leaders, TOY Beginning is likewise not significant (β=-0.002435; p=0.0874), while TOY End is positive and significant (β=0.001822; p=0.0200). Thus H2 and H4 receive only partial support: the evidence is concentrated in the final seven trading days of the year and does not support a general January/early-year effect.

The positive year-end coefficients should be interpreted in the Indonesian institutional context. A tax-loss-selling explanation is less compelling because sales of listed shares on the Indonesian exchange are subject to final income tax based on the gross transaction value rather than the capital gain itself. A more relevant mechanism is year-end portfolio window dressing, in which investment managers adjust reported holdings before the reporting date. Prior evidence links institutional trading and window-dressing behavior to turn-of-the-year patterns (Lynch et al. 2014). For the present study, however, portfolio holdings and order-flow data are not observed, so window dressing should be treated as a plausible mechanism rather than a demonstrated cause.

The year-end finding is therefore best viewed as a localized seasonal pattern that warrants additional validation. The seven-day window is short—only seven trading days in each year—so the result should not be interpreted as a broad year-turn anomaly. The requested robustness tests are especially important because all constituents within an index share the same trading dates, which may create dependence across firm-day observations. The cumulative return over the seven year-end trading days should be calculated directly from the underlying daily index returns and reported alongside the robustness results.

From an economic perspective, the estimated TOY-End coefficients imply approximately 0.266% and 0.182% higher daily returns during the defined year-end window for SRI-KEHATI and IDX ESG Leaders, respectively, conditional on the REM specification. Statistical significance, however, is not equivalent to an implementable abnormal-profit strategy. The analysis does not incorporate transaction costs, bid-ask spreads, risk-adjusted excess returns, or out-of-sample trading performance. Accordingly, the year-end result should be interpreted as localized statistical predictability that warrants further testing, not as direct evidence of arbitrage profitability.

Comparison Between SRI-KEHATI and IDX ESG Leaders

The comparative tests address a different question from the regressions. The regressions test whether calendar windows predict returns within each index, whereas the Wilcoxon–Mann–Whitney tests evaluate whether calendar-period return distributions differ between the two indices. Because the regression evidence is concentrated in the final seven trading days of the year, the cross-index year-turn comparison should also be reported separately for the early-year and late-year windows rather than as one pooled TOY comparison.

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Table 5. Wilcoxon–Mann–Whitney Comparison Between ESG Indices

Comparison	Wilcoxon/Mann–Whitney statistic	p-value	Decision
TOM: SRI-KEHATI vs IDX ESG Leaders	0.257746	0.7966	No significant difference
TOY: SRI-KEHATI vs IDX ESG Leaders	0.024580	0.9804	No significant difference

For the pooled comparisons, p=0.7966 for TOM and p=0.9804 for TOY, so H5 and H6 are not supported by the reported Wilcoxon–Mann–Whitney results. However, the TOY comparison should be re-estimated separately for the first seven and last seven trading days before the final manuscript is submitted, because only the late-year window is significant in the within-index regressions.

The ESG-pricing literature is relevant mainly as context for why the two indices might have different investor responses, but it should not replace direct discussion of the calendar anomaly. Evidence on ESG ratings, liquidity, and ESG-related return effects indicates that ESG characteristics can influence pricing through multiple channels (Bofinger et al. 2022; Luo 2022; Shanaev and Ghimire 2022; Avramov et al. 2022). These mechanisms motivate the cross-index comparison, but the present results do not establish that ESG characteristics themselves cause or suppress calendar anomalies.

The absence of a significant cross-index difference is also informative. It indicates that, within the selected calendar windows, the return distributions of the two ESG indices are statistically similar even though their constituent-selection rules are not identical. This does not imply that ESG characteristics are irrelevant to returns: ESG-return relationships can vary with liquidity, rating construction, and firm characteristics (Luo 2022; Berk et al. 2023; Yin et al. 2023). Rather, the evidence suggests that such differences did not translate into distinguishable TOM or TOY distributions during 2023–2024.

Overall Interpretation and Contribution

Taken together, the evidence indicates that calendar timing explains relatively little of daily-return behavior in the two ESG indices during 2023–2024. The main exception is the final seven trading days of the year, where positive coefficients are observed in both indices. The contribution is therefore not evidence that calendar anomalies broadly persist, but evidence that month-turn and early-year rules have limited predictive content in this sample while a localized year-end pattern remains. This interpretation is consistent with the Adaptive Markets Hypothesis, which allows predictable patterns to vary across market environments rather than requiring permanent efficiency or permanent inefficiency (Lo 2004; Bassiouny et al. 2023).

This interpretation is also consistent with recent evidence that ESG information can be incorporated into prices without producing a uniform ESG return premium. Bang and Ryu (2024) find that ESG factors may help explain expected returns in a high-dimensional setting, while Roger (2024) shows that analysts incorporate ESG information after accounting for firm and industry characteristics. Li et al. (2022), document contexts in which ESG characteristics are associated with market resilience, whereas Demers et al. (2021) caution that ESG scores alone do not guarantee downside protection. In Indonesia, Tjun et al. (2024) likewise report that ESG performance is not consistently associated with SRI-KEHATI returns. The present study extends this literature by showing that calendar predictability is also weak across two Indonesian ESG thematic indices.

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ROBUSTNESS CHECKS REQUIRED BY REVIEWERS

Two additional analyses are required before the manuscript can be considered fully revised. First, the baseline panel regressions should be re-estimated with standard errors clustered by trading date. Second, daily index returns should be regressed in a time-series specification with market return as a control. The year-end comparison should also report separate early-year and late-year tests and the cumulative return across the seven year-end trading days. These results cannot be reconstructed reliably from the manuscript's summary coefficients alone; they must be generated from the underlying daily firm-level and market-return data.

Importantly, failure to reject most calendar dummies is not proof of market efficiency in every dimension. Weak-form efficiency is inferred here only conditionally from the specific historical-information rules, event windows, sample period, and model specification tested. Other forms of return dependence, alternative calendar windows, nonlinear dynamics, or volatility regimes may still be present. This conditional interpretation is consistent with adaptive-market evidence that calendar anomalies can weaken, reappear, or change across market states (Bassiouny et al. 2023; Kumar and Pathak 2025).

CONCLUSION

The main findings show that Turn of the Month effects are not statistically detectable in either SRI-KEHATI or IDX ESG Leaders, and the beginning-of-year effect is likewise not supported. In contrast, the final seven trading days of the year exhibit a positive return pattern in both indices. The cross-index evidence does not show a statistically significant difference in the reported TOM and pooled TOY return distributions. Overall, the findings indicate broad but conditional consistency with weak-form market efficiency, with a localized year-end pattern remaining.

The practical implication is that investors should be cautious about treating calendar timing as a stand-alone trading strategy in Indonesian ESG indices. The absence of systematic TOM and early-year effects reduces support for simple month-turn or January-timing rules. The year-end pattern may be relevant for portfolio monitoring and further investigation, but it should not be interpreted as evidence of a risk-free or directly exploitable abnormal profit because transaction costs, market risk, liquidity, and out-of-sample stability have not yet been fully addressed.

Generative artificial intelligence was used only as an assistive tool for language editing, structural refinement, and consistency checking during manuscript revision. It was not used to generate or alter the underlying dataset, statistical output, or empirical findings. The authors reviewed and verified all AI-assisted text and retain full responsibility for the accuracy, originality, integrity, and academic content of the manuscript.

Statement on the Use of Artificial Intelligence (AI)

Generative artificial intelligence was used as an assistive tool for language editing, structural refinement, reference organization, and consistency checking during manuscript revision. It was not used to generate or alter the underlying dataset, EViews output, or empirical findings, which remain based on the authors' thesis research. The authors reviewed and verified all AI-assisted content and retain full responsibility for the accuracy, originality, integrity, and academic content of the manuscript.

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Conflicts of Interest

The authors declare that there is no conflict of interest related to this research or publication.

Author Contributions

Conceptualization, Sofyan, Nofryanti, and Holiawati; methodology, Sofyan, Nofryanti, and Holiawati; data collection and formal analysis, Sofyan; validation, Nofryanti and Holiawati; writing original draft, Sofyan; writing review and editing, Nofryanti and Holiawati. All authors have read and approved the final version of the manuscript.

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