JRSSEM 2026, Vol. 5, No. 12, July
E-ISSN: 2807 - 6311
P-ISSN: 2807 - 6494

Measuring Stock Investment Risk Using Expected Shortfall with the Gramcharlier Expansion at PT. Energi Mega Persada Tbk

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Keywords:
expected shortfall; gram–charlier expansion; stock investment risk; energy sector stocks; risk management

Abstract

Stock investment provides attractive return opportunities but is also accompanied by significant risks due to price volatility, especially in the energy sector. This study aims to measure the investment risk of PT Energi Mega Persada Tbk (ENRG) shares using the Expected Shortfall (ES) method with the Gram–Charlier Expansion approach. The research uses a quantitative approach based on secondary data consisting of daily closing prices of ENRG shares during the period January 2020 to December 2025, obtained from Investing.com. The analysis process included stock return calculation, descriptive statistical analysis, normality testing, and risk measurement using Value at Risk (VaR) and Expected Shortfall under both normal distribution assumptions and the Gram–Charlier Expansion approach. The results indicate that ENRG stock returns do not follow a normal distribution, characterized by positive skewness and high kurtosis, which reflects asymmetric behavior and heavy-tailed distribution. The risk measurement using normal distribution at a 95% confidence level produces an Expected Shortfall value of −0.0771, while the Gram–Charlier Expansion approach generates a higher absolute Expected Shortfall value of −0.2493. These findings demonstrate that the Gram–Charlier Expansion approach provides a more conservative and realistic estimation of extreme loss risks because it incorporates skewness and kurtosis characteristics of stock returns. Therefore, the application of Expected Shortfall based on Gram–Charlier Expansion is considered more appropriate for measuring investment risk in highly volatile energy sector stocks, particularly for investors requiring more accurate risk management information.

INTRODUCTION

Stock investment is one of the most popular financial instruments by investors because it provides relatively higher profit potential compared to other investment instruments, such as deposits or bonds (Hanif et al., 2023; Jiang et al., 2025; Parameswaran, 2022; Rats & Alfimova, 2023; Samuels, 2024). Profits can be earned through Capital gains as well as dividends distributed by the company (Hia, 2023; Maqsood et al., 2024; Putri et al., 2022; Ukpong & Ukpe, 2023). However, high profits are always accompanied by large risks due to stock price fluctuations influenced by macroeconomic conditions, political situations, and the company's internal performance. Data from the Financial Services Authority (OJK) shows that the number of Indonesian capital market investors continues to increase, with the total number of stock investors reaching more than 12 million in 2024, up about 15% compared to the previous year

(OJK, 2024).

This growth indicates the increasing public interest in stocks, but on the other hand it demands a deeper understanding of risk. Therefore, risk analysis is important so that investment decisions are not solely speculative, but based on more comprehensive information (Fadilah et al., 2020).

The energy sector is one of the strategic sectors in the global and national economy because it plays a key role in supporting industrial activities, transportation, and household needs. However, energy prices, especially oil and gas, are highly volatile. According to the report International Energy Agency (2023) World crude oil prices had jumped to USD 94 per barrel in mid-2023 before falling back to the range of USD 77 per barrel in early 2024. These sharp price fluctuations are largely influenced by geopolitical dynamics, tensions in the Middle East, and the acceleration of the transition to new and renewable energies. These factors make energy stocks more volatile than other sectors (Lian et al., 2020). This condition causes investments in the energy sector to have higher risks, so investors need more accurate risk measures.

PT Energi Mega Persada Tbk (ENRG) is an issuer operating in the upstream sector of the oil and gas industry, especially in exploration and production activities. The company was established in 2001 and has been listed on the Indonesia Stock Exchange since 2004. ENRG manages a number of oil and gas blocks in various regions in Indonesia, such as the Kangean Block, Malacca Strait, Bentu, and Sengkang. ENRG is under the auspices of the Bakrie business group, the company is actively expanding its business activities through the acquisition and development of new oil and gas blocks. ENRG's financial performance reflects its reliance on global oil price dynamics as well as the company's internal policies. In the first quarter of 2024, ENRG posted a net profit of US$17.66 million with total revenue of approximately US$97 million (PT Energi Mega Persada Tbk, 2024).

With the characteristics of upstream oil and gas businesses that have a high level of risk and large capital needs, ENRG's share price movements tend to fluctuate in the market. This situation makes ENRG shares interesting to scrutinize from a market risk perspective. The use of ENRG's daily share price as a basis for measuring risk is based on its ability to represent the market's response to various information related to internal conditions and external factors of the company. In addition, data with daily frequency provides room for the application of more advanced statistical and econometric methods so that risk estimation can be carried out more accurately (Campbell et al., 2021). Therefore, measuring the risk on these stocks is very important to provide a more realistic picture for investors.

One method for risk measurement is Expected Shortfall (ES). ES is a measure of risk that calculates the average loss that occurs outside the limit Value and Risk (VaR). If the VaR only provides information on the minimum limit of losses at a certain confidence level, the ES is able to capture potential extreme losses or tail risk that has a big impact even though the probability of the occurrence is small Yang & Hamori (2020). With these advantages, ES is considered more comprehensive in describing investment risks, especially in high-volatility instruments such as energy sector stocks. This is in line with the global trend after the 2008 financial crisis, when international regulatory authorities such as Basel Committee recommend the use of ES as a standard for measuring market risk (Chang et al., 2015).

However, one of the main problems in measuring risk using data Return Stocks are

assumptions normal distributions are often not fulfilled. Return Stocks generally show Skewness (shuddering) and Kurtosis Excess (Fat Tails), so that the empirical distribution is heavy-tailed. If the risk analysis continues to use the assumption of normality, then the frequency and magnitude of extreme losses will be lower than the actual conditions, so that the VaR and ES measurements become biased and less reflective of actual market conditions (Cont, 2001). To address this issue, recent research recommends the use of Gram Charlier Expansion, which is a statistical approach that extends the normal distribution by adding the Skewness and Kurtosis into the probability density function. This approach allows for the formation of more flexible and realistic distributions, so that they can represent abnormal stock behavior (Jondeau & Rockinger, 2001). Thus, the use of Gram Charlier Expansion in the VaR and ES estimation is expected to be able to increase the accuracy of investment risk measurement in energy sector stocks that are volatile and have distribution characteristics heavy-tailed.

A number of previous studies have shown the advantages of ES over VaR. Fadilah et al. (2020) emphasized that ES is more representative in measuring the risk of the energy and mining sector portfolio in Indonesia. Irwandi (2021) also proves that ES provides a more conservative estimate of losses in the consumer sector. A number of international studies, including by Yang & Hamori (2020), Patra (2021) and Gutiérrez et al. (2023) indicates that ES is a superior measure of risk to VaR in representing extreme risk (tail risk) on the global oil market. Furthermore, with the findings Yang & Hamori (2020) and Gutiérrez et al. (2023) shows that the effectiveness of ES is increasing when combined with the GARCH-EVT approach, as it is able to capture the dynamics of conditional volatility as well as the characteristics of the return distribution tail more accurately, especially in periods characterized by market instability and shocks.

However, most of the research focuses on global energy commodities or market indices, not on stocks of specific energy issuers in Indonesia. Leon-Camacho et al. (2022) also demonstrated that modified variance with Gram-Charlier return approach provides a more reliable portfolio risk description by accommodating investor attitudes toward skewness and kurtosis. Additionally, Žiković & Filer (2012) and Žiković & Žiković (2016) confirmed that ES models with heavy-tailed distribution approaches perform superiorly in energy markets and emerging markets.

The research gap in this study lies in the fact that most previous studies on Expected Shortfall and Gram-Charlier Expansion have focused on global energy commodities or market indices, with few applying them specifically to individual energy issuer stocks in Indonesia. Fadilah et al. (2020) and Irwandi (2021) have applied ES to energy and consumer sector stocks in Indonesia, but have not used the Gram-Charlier Expansion approach. Meanwhile, international studies by Yang & Hamori (2020), Patra (2021), and Gutiérrez et al.

(2023) have combined ES with non-normal distribution approaches, but their research objects were global oil markets and indices, not specific stocks like ENRG. Recent research by Leon-Camacho et al. (2022) showed that modified variance with Gram-Charlier return approach provides a more reliable portfolio risk description, yet this research was conducted in the context of developed markets. Thus, no study has specifically measured the investment risk of ENRG shares using ES with Gram-Charlier Expansion during the 2020-2025 period.

The urgency of this research is based on several important considerations. First, energy

sector stocks in Indonesia have high volatility characteristics and non-normal return distributions, requiring more accurate risk measurement methods sensitive to tail risk. Second, the increasing number of capital market investors in Indonesia (OJK, 2024) demands the availability of more comprehensive risk information to support appropriate investment decision-making. Third, significant global oil price fluctuations (International Energy Agency, 2023) directly impact ENRG's stock performance, necessitating more realistic risk estimates for investors. Fourth, from a regulatory perspective, the Basel Committee (Chang et al., 2015) has recommended ES as a market risk measurement standard, yet its implementation in the Indonesian capital market still requires further investigation. Therefore, this research is urgently needed to provide empirical evidence on the effectiveness of ES with Gram-Charlier Expansion in measuring investment risk in Indonesian energy sector stocks.

The novelty of this research lies in three main aspects. First, this study is the first to apply the Expected Shortfall method with Gram-Charlier Expansion specifically to PT Energi Mega Persada Tbk (ENRG) shares as a representative of Indonesian energy issuers. Second, this study uses the 2020-2025 observation period, which covers various significant events such as the COVID-19 pandemic, economic recovery, and global oil price fluctuations, providing a more comprehensive risk overview.

Third, this study directly compares risk estimation results between the normal distribution approach and Gram-Charlier Expansion at different confidence levels, providing a methodological contribution to selecting the most appropriate risk measurement method for energy sector stocks. This novelty distinguishes this research from previous studies that generally only used VaR or ES without non-normal distribution corrections, or used research objects outside Indonesian energy stocks.

This research offers both theoretical and practical contributions. Theoretically, this research enriches the risk management and finance literature in the Indonesian capital market, particularly in the application of Expected Shortfall with Gram-Charlier Expansion to energy sector stocks. This research also contributes to the development of financial asset return distribution theory (Tsay, 2010) by empirically testing the characteristics of Indonesian energy stock returns that exhibit positive skewness and high kurtosis.

Practically, the results of this research are expected to provide guidance for investors in anticipating potential extreme losses in ENRG stock investments, assist risk managers in determining more appropriate risk mitigation strategies, and provide input for regulators in developing market risk measurement standards in the Indonesian capital market. For academics, this research can serve as a reference for developing risk measurement methods for financial instruments with non-normal return distributions.

Based on the description above, it is considered necessary to measure the risk of stock investment in PT ENRG in order to obtain accurate and in-depth data related to the risks that occur for investors.

Problem Limitations

This research is limited by the following aspects:

The data used is the daily closing price of ENRG shares during the period January 2020 to December 2025.The confidence level used in the calculation of Expected Shortfall with Gram Charlier Expansions is limited to 95% and 99% as a representation of conservative limits in risk management.

Problem Formulation

Based on the above research background, the formulation of the research problem is how to measure the investment risk of PT Energi Mega Persada Tbk (ENRG) shares during the period January 2020 - December 2025 based on the Expected Shortfall with Gram Charlier Expansions at a confidence level of 95%.

Research Objectives

This thesis aims to measure the level of risk of investment in PT Energi Mega Persada Tbk (ENRG) shares during the period January 2020 - December 2025 by using Expected Shortfall with Gram Charlier Expansions at a confidence level of 95%.

METHOD

Types of Research

The type of research used was applied research that utilizes numerical data to objectively assess the risk of stock investment. This approach was chosen because it supports the research objectives that analyze the data *Return* history of PT Energi Mega Persada Tbk (ENRG) using *Expected Shortfall* with Gram Charlier *Expansion*. The use of this approach helps to broaden understanding in the field of risk management and finance through empirical evidence regarding the effectiveness of alternative methods in measuring market risk.

Types and Sources of Research Data

This study uses a quantitative data approach that is analyzed through statistical methods to evaluate investment risk. The data used is secondary data, which is information that has been previously available and can be re-accessed. In this case, the data is in the form of the daily closing price of PT Energi Mega Persada Tbk (ENRG) shares, which is obtained from the *platform* https://www.investing.com/ with an observation period from January 2020 to December 2025.

Research Variables

The main variables in this study include the daily closing price of shares in PT Energi Mega Persada Tbk. This study uses data as many as 1447 data with data units used in United States dollars (USD).

Data Analysis Techniques

1. Collection of data on the closing of ENRG share prices.
2. Calculation of *stock return* based on equation (1).
3. Descriptive analysis of *stock returns.*
4. Test the normality of stock returns on equation (2).
5. Calculate *Value at Risk* and *Expected Shortfall* if the *returns* are normally distributed in equations (3) and (4).
6. Calculate *Value at Risk* and *Expected Shortfall* with Gram Charlier on equations (5), (6), (7) if not normally distributed.

7. Interpretation of Results

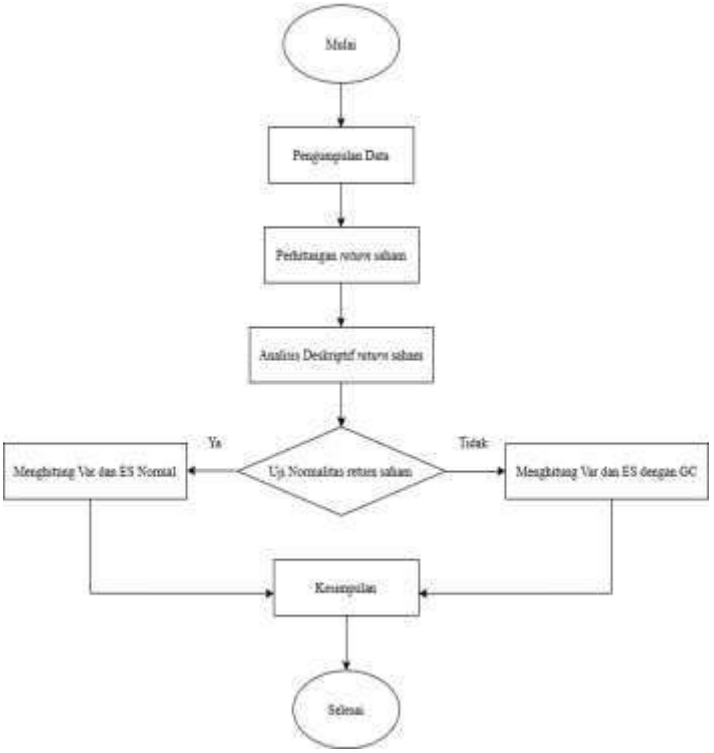

Image 1. Research Flow Diagram

Source: Prepared by the author (2026).

RESULTS AND DISCUSSION

Overview of Research Objects

The object of this research is the shares of PT Energi Mega Persada Tbk which are listed on the Indonesia Stock Exchange with the code ENRG. The company is engaged in the energy sector, particularly in oil and gas exploration and production activities, which inherently have a relatively high level of risk due to fluctuations in global energy prices and uncertainty in macroeconomic conditions. As an entity operating in a highly volatile sector, ENRG's share price movements tend to show significant fluctuations.

The selection of ENRG shares as the object of research is based on several key considerations. First, the relatively volatile nature of ENRG stock price movements makes it relevant to be analyzed using risk-sensitive methods that are sensitive to the form of return distribution. Second, the energy sector has exposure to extreme market risks, so the application of the Expected Shortfall and Gram Charlier *Expansion* methods is considered to be able to describe risks more comprehensively. Third, empirical studies on ENRG stocks are still limited, so this study is expected to make an additional contribution to the development of investment risk management literature on energy sector stocks.

Description of Research Data

This research utilizes secondary data in the form of the closing price of PT Energi Mega Persada Tbk (ENRG) shares observed during the period January 2020 to December 2025. The stock price data is then transformed into daily logarithmic returns to represent the relative

change in stock prices between periods. This transformation is carried out to reduce the influence of price scale differences and produce more stable statistical properties of data for risk analysis purposes.

The selection of the observation period is based on the consideration of significant capital market dynamics, both due to global economic factors and domestic conditions. Therefore, the data used is expected to be able to describe the characteristics of ENRG stock investment risk more comprehensively and representatively.

Stock *Return* Calculation

In this study, stock *returns* are calculated based on changes in closing prices between observation periods. *Daily returns* are used as the basis of analysis because they are able to represent the profits or losses of investors in the short term. The results of the calculation show that *the return* of ENRG shares fluctuates quite significantly, characterized by the existence of extreme positive and negative values, which reflect a relatively high level of volatility. In addition, the daily return chart shows an unstable pattern of fluctuations with some extreme spikes in certain periods, indicating *an asymmetrical* and potentially heavy-tailed *return distribution*.

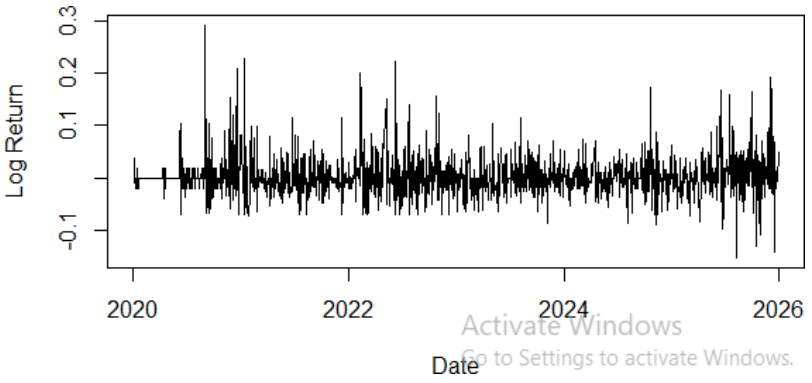

Image 1. ENRG Stock Return Log Chart

Source: Prepared by the author (2026).

The stock return log chart shows that the *value of the return* oscillates around zero without showing a systematic trend pattern. In addition, it is observed that there are extreme observations in certain periods accompanied by variability grouping, where the high volatility phase tends to be followed by the high volatility phase, and vice versa. This phenomenon indicates the presence of unstationary variance (conditional heteroscedasticity) in the *return* series, so further testing is needed to detect the presence of the ARCH effect.

Descriptive Statistical Analysis *of* Stock Returns

Descriptive statistical analysis was carried out to obtain an initial overview of the distribution characteristics of the log return of PT Energi Mega Persada Tbk (ENRG) shares. The analyzed statistics include mean value, minimum value, maximum value, skewness, and kurtosis as presented in Table 1.

Table 1. Descriptive Statistics of ENRG Stock Return Log

Red	Min	Max	Skewness	Kurtosis
0.002398	-0.152839	0.292670	1.395378	6.787332

Based on the results of the analysis, the log *Return* ENRG stock has an average value of 0.002398 which indicates a positive return trend during the observation period. A minimum value of −0.152839 and a maximum value of 0.292670 indicate a relatively wide range of return fluctuations. A skewness value of 1.395378 indicates a distribution *Return* which is asymmetrical with a stiffness to the right. In addition, the kurtosis value of 6.787332 which far exceeds the normal distribution kurtosis value indicates that the log distribution *Return* Is *Leptokurtic* or have a thick distribution tail. This characteristic reflects the high potential for extreme observations in *Return* ENRG.

Normality of *Stock* Return Test

Normality testing is performed to evaluate whether the log *return distribution of* ENRG shares follows the normal distribution. In this study, the normality test was carried out using the Jarque–Bera test which considered the value of skewness and kurtosis data *return*.

The test results showed that the statistical value of Jarque Bera (2023) significantly exceeded the critical value at the set significance level, so the null hypothesis stating that *the* return of the normally distributed stock was rejected. Thus, it can be concluded that the distribution *of* ENRG stock returns does not meet the assumption of normality. These findings reinforce the need for the use of alternative risk measurement methods that are able to accommodate asymmetrical and *heavy-tailed* characteristics in the *return distribution*.

Table 2. Results of the Jarque Bera Normality Test

Test Statistics	Value
Jarque-Bera	3242,6
p-value	< 0.001
Test Results	Rejected

The test results showed that the statistical value of Jarque Bera was 3242.6 with a p-value that was much smaller than the significance level of 5%. Thus, which states that H_0 *the* return of normal distributed shares is rejected. These findings indicate that the distribution of ENRG stock log *returns* does not meet the assumption of normality, so the use of risk measurement methods that assume normal distributions has the potential to result in inaccurate risk estimates.

Risk Measurement Using VaR and ES If Assuming Normal Distribution (95%)

The risk measurement of ENRG stock investment in the early stages was carried out using a normal distribution approach at a 95% confidence level. The normal VaR value obtained reflects the estimated maximum loss that an investor may incur in a single trading period under normal market conditions.

In addition to using VaR, risk analysis is also carried out through the ES approach. In contrast to VaR, which only shows a loss limit at a certain confidence level, ES measures the average value of the loss that is expected to occur when the actual loss has exceeded the VaR limit. Thus, ES is able to provide more comprehensive information about potential losses in the

tail part of the distribution (*tail loss*).

Table 3. Normal VaR Value of ENRG Shares at 95% Confidence Level

Confidence Level	Z-value	VaR Normal
95%	−1.6449	−0.06100

Based on the results of the calculations presented in Table 3, a VaR value of −0.06100 was obtained at a confidence level of 95%. The results indicate that, with a confidence level of 95%, the maximum potential loss that investors are expected to experience during an observation period is 6.10% of the total investment value, assuming that the stock returns are distributed normally.

A negative VaR value indicates the direction of the *change in return* representing a loss. Therefore, in interpreting the magnitude of the risk, the absolute value of VaR, which is 6.10%, is used as a measure of the potential losses that may be faced by investors.

Table 4. Normal ES Value of ENRG Shares at 95% Confidence Level

Confidence Level	α	ES Normal
95%	0,05	−0.0771

Based on the results of the calculation in Table 4, an ES value of −0.0771 was obtained at a confidence level of 95%. This value shows that if the realization of losses has exceeded the VaR limit, the average loss that is expected to be borne by investors reaches 7.71% of the investment value in one observation period.

As with VaR, a negative sign on the ES value indicates the direction of the loss so that the amount of risk is interpreted based on its absolute value. In this case, the absolute value of ES of 7.71% is higher than the absolute value of VaR of 6.10%. This difference indicates that the average loss that occurs under extreme conditions has an amount that exceeds the maximum loss limit estimated by the VaR.

The results of the comparison between the two risk measures show that the Expected Shortfall results in a more conservative risk estimate than the VaR. This is because ES not only takes into account the loss threshold value as VaR, but also accommodates all loss values that are outside the VaR limit at the tail of the distribution. Thus, ES is able to provide a more representative picture of the level of extreme loss risk that investors in ENRG shares potentially face.

Risk Measurement Using Gram Charlier Expansion (95%)

Refers to the results of the normality test and descriptive statistics, distribution *Return* ENRG shares have proven to be abnormal and have asymmetrical characteristics and a thick distribution tail. Therefore, risk measurement is continued using the Gram–Charlier Expansion approach which accommodates the influence *Skewness* and kurtosis in the calculation of risk.

The measurement results showed that the VaR and ES values with the Gram–Charlier approach at a confidence level of 95% were greater in absolute terms than the normal distribution approach. The Expected Shortfall value with the Gram–Charlier Expansion reflects

the potential for greater extreme losses, thus providing a more sensitive risk estimate to unfavorable market conditions.

Table 5. VaR Value of ENRG Shares with Gram Charlier Expansion (95%)

Confidence Level	z_{GC}	VaR GC
95%	-1,0747	−0.0390

Based on the calculation results in Table 5, a VaR value was obtained using the Gram Charlier *Expansion* approach of −0.0390 at a 95% confidence level. This value shows that, with a confidence level of 95%, the loss limit that is not expected to be exceeded in one observation period is 3.90% of the investment value. A negative sign on the VaR value indicates the direction of loss, so the interpretation of the magnitude of the risk is based on the absolute value, which is 3.90%. In this study, the VaR value is mainly used as a threshold value in the calculation of ES, so the next discussion of risk is focused on the interpretation of the ES value.

Table 6. ES Value of ENRG Shares with Gram Charlier Expansion (95%)

Confidence Level	ES Gram Charlier Expansions
95%	−0.2493

Based on the calculation results in Table 6, the ES value was obtained using the Gram Charlier *Expansion* approach of −0.2493 at a confidence level of 95%. This value shows that if the actual loss has exceeded the VaR limit, the average loss that investors are expected to experience reaches 24.93% of the investment value in one observation period.

A negative sign on the ES value indicates the direction of the loss so that the interpretation of the magnitude of the risk is made based on the absolute value. Thus, the absolute value of ES of 24.93% indicates that the potential for losses in extreme conditions is relatively high. Compared to the absolute value of ES on the normal distribution approach of 7.71%**,** the absolute value of ES Gram Charlier is greater. These results show that the Gram Charlier approach *Expansion* more sensitive in estimating the risk to the tail part of the distribution (*tail risk*) because it considers the influence of *Skewness* and *Kurtosis*. Therefore, this approach is considered to be more able to represent the potential for extreme losses in PT Energi Mega Persada Tbk (ENRG) shares which have abnormal return distribution characteristics.

Comparison of Risk Measurement Results

Comparison of risk measurement results shows that the Gram–Charlier Expansion approach results in greater absolute VaR and ES values than the normal distribution approach. This difference indicates that normal distribution assumptions tend to underestimate the risk of extreme losses in stocks with abnormal *return* characteristics.

These results confirm the importance of considering the form of return distribution in measuring the risk of stock investments, especially in stocks with high volatility such as ENRG.

Discussion

Based on the results of empirical analysis, risk measurement using ES with the Gram Charlier *Expansion* approach resulted in a greater extreme loss risk value than ES calculated based on the assumption of a normal distribution at a 95% confidence level. This difference shows that the distribution of PT Energi Mega Persada Tbk's (ENRG) share returns does not meet the assumption of normality perfectly, especially related to the asymmetry and thicker tail of the distribution.

This result is in line with the theory of return of financial assets put forward by Tsay (2010) which states that *Return* The market generally has characteristics *Skewness* and excessive kurtosis. Under such conditions, the use of risk measures that depend on normal distributions has the potential to result in downwardly biased risk estimates. Therefore, as explained in the theoretical foundation of Chapter II, ES is considered more appropriate than VaR because it takes into account the expected average loss under extreme conditions.

Uses of Gram Charlier *Expansion* In this study, it was proven to be able to accommodate the characteristics of the distribution *Return* that is abnormal by entering information *Skewness* and kurtosis into risk calculations. These findings are consistent with research Jondeau & Rockinger (2001), which suggests that the Gram Charlier approach can improve the accuracy of distribution estimates *Return* and resulting in more realistic risk measurements.

In addition, the results of this study also support the findings Patra (2021) and Yang & Hamori (2020) which concludes that ES with non-abnormal distribution corrections provides a more conservative risk estimate, especially in data with high volatility and the potential for extreme events. This reinforces the relevance of the non-normal approach in measuring the risk of energy sector stocks that tend to be sensitive to global market dynamics.

Thus, the results of this study strengthen the theoretical foundation that Expected Shortfall based on Gram Charlier *Expansion* is a more appropriate method to measure the risk of stock investment with abnormal *return* distribution . This approach provides a risk estimate that better reflects empirical market conditions than a method that assumes a normal distribution.

CONCLUSION

Based on the results of data processing and discussion, it can be concluded that the measurement of investment risk for PT Energi Mega Persada Tbk (ENRG) shares during the period January 2020 to December 2025, at a 95% confidence level, reveals a notable difference in risk estimation between the normal distribution approach and the *Gram-Charlier Expansion* approach: the *Expected Shortfall* value under the assumption of a normal distribution of −0.0771 reflects an estimated conditional average loss based on a symmetrical distribution that does not account in depth for the characteristics of the distribution tail, whereas the *Expected Shortfall* estimated using the *Gram-Charlier Expansion* approach yields a substantially greater risk value in absolute terms, at −0.2493, reflecting this method's capacity to accommodate deviations of stock return distributions from normality particularly with respect to skewness and kurtosis thereby indicating that the normal distribution approach tends to underestimate risk and may consequently overlook the potential for extreme losses; accordingly, at the 95% confidence level, *Expected Shortfall* based on the *Gram-Charlier Expansion* is considered more capable of comprehensively capturing stock investment risk than its normal-distribution counterpart, particularly under conditions of high volatility and non-normal return

distributions. Theoretically, this research contributes empirical evidence that the *Gram-Charlier Expansion* approach more effectively captures tail-risk characteristics in energy-sector stocks exhibiting non-normal return distributions, thereby extending the application of the *Gram-Charlier Expansion* method (Jondeau & Rockinger, 2001) to the context of the Indonesian capital market, specifically among energy-sector issuers. Practically, these findings suggest that investors and risk managers should adopt *Expected Shortfall* with *Gram-Charlier Expansion* to obtain more accurate and conservative risk estimates, particularly for highly volatile stocks such as those in the energy sector, while for regulators, this study offers input toward developing more appropriate market risk measurement standards that accommodate the characteristics of non-normal return distributions within the Indonesian capital market. This research is nonetheless subject to several limitations: first, it relies solely on data from a single issuer (ENRG), such that generalization to other energy-sector stocks or other sectors should be undertaken with caution; second, the observation period (2020–2025) spans the COVID-19 pandemic and subsequent economic recovery, which may have influenced the characteristics of stock returns; and third, the study is limited to 95% and 99% confidence levels, and thus does not encompass the full spectrum of investor risk preferences. For future research, it is recommended that the scope of issuers be expanded to include other energy-sector or cross-sector stocks, that the observation period be extended to capture a broader range of market cycles, that the *GARCH* approach be integrated to capture volatility dynamics, and that a range of confidence levels be employed to accommodate diverse risk preferences; future studies might also develop multivariate models to capture dynamics across assets within a risk portfolio, as suggested by Žiković & Filer (2012) and Žiković & Žiković (2016) in the context of energy markets.

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