Volatility and Investment Risk Analysis of BMRI Stock:

A Value at Risk (VaR) and Monte Carlo Simulation Approach

BY INDRA MUSTAFA

About me

I am a Web Developer transitioning into a Data Analyst, with a strong foundation built through an intensive 3-month bootcamp focused on Excel, SQL, Python, Power BI, and Exploratory Data Analysis (EDA). I excel at bridging the gap between technical IT aspects and business needs by translating complex data into actionable insights that support informed decision-making.

1. Data Cleaning and EDA

2. Volatility Estimation

3. Risk Analysis (VaR)

4. Interpretasi

Problem

In this project, I conducted an analysis of BMRI stock volatility and investment risk using Exploratory Data Analysis (EDA), volatility estimation, and Value at Risk (VaR). The main objective of this analysis was to answer the following question:
How can the volatility and investment risk of BMRI stock be analyzed through closing price trends, return estimation, and Value at Risk (VaR) measurement using Historical, Parametric, and Monte Carlo methods, and what are the implications for investment risk management?
The dataset used was BMRI stock data from Kaggle. The analysis was carried out using Python (libraries: Pandas, NumPy, Matplotlib, SciPy, OS, Sys) on Google Colab.
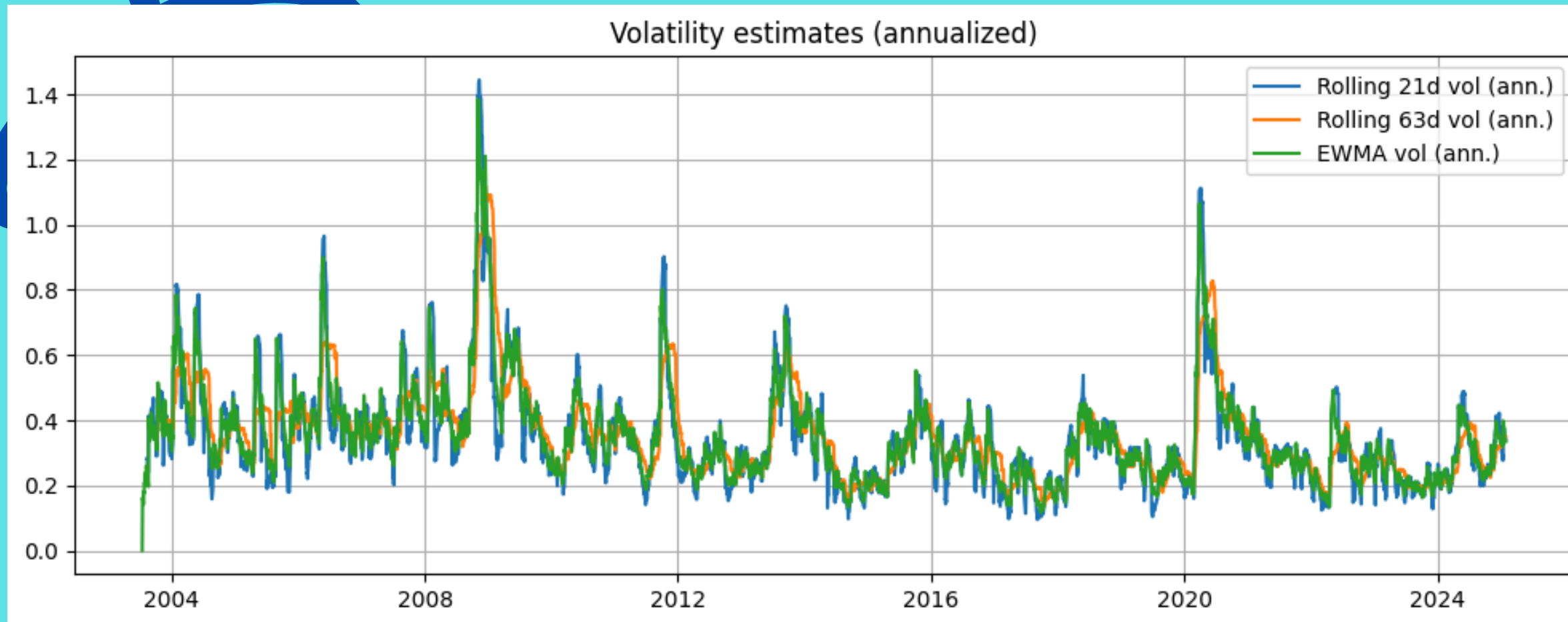
BMRI Close Price

Disclaimer

⚠️ **This analysis is for educational purposes and data analysis practice only, not an investment recommendation.**

Interpretation of BMRI Stock Price Chart

- A strong uptrend is observed since the beginning of the period (2003, price < IDR 500) until it peaked above IDR 7,000 in 2024.
- This indicates that BMRI stock has provided significant long-term capital gains.
- 2008–2009: A sharp decline occurred due to the global financial crisis.
- 2020: A downturn was recorded during the COVID-19 pandemic.
- Afterward, the stock recovered quickly and reached a new all-time high.

Volatility estimates (annualized)

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Volatility Interpretation of BMRI Stock

- **2008–2009: Peak above 1.4 during the global financial crisis.**
- **2020: Significant spike caused by the COVID-19 pandemic.**
- **These reflect turbulent market periods that sharply increased investment risk.**
- **Normal periods (2013–2019): Volatility remained around 0.2–0.4, indicating relatively moderate risk.**
- **2023–2024: Volatility started to rise again (0.3–0.4), signaling market uncertainty despite BMRI stock reaching record highs.**

Monte Carlo simulated 10-day returns (distribution)
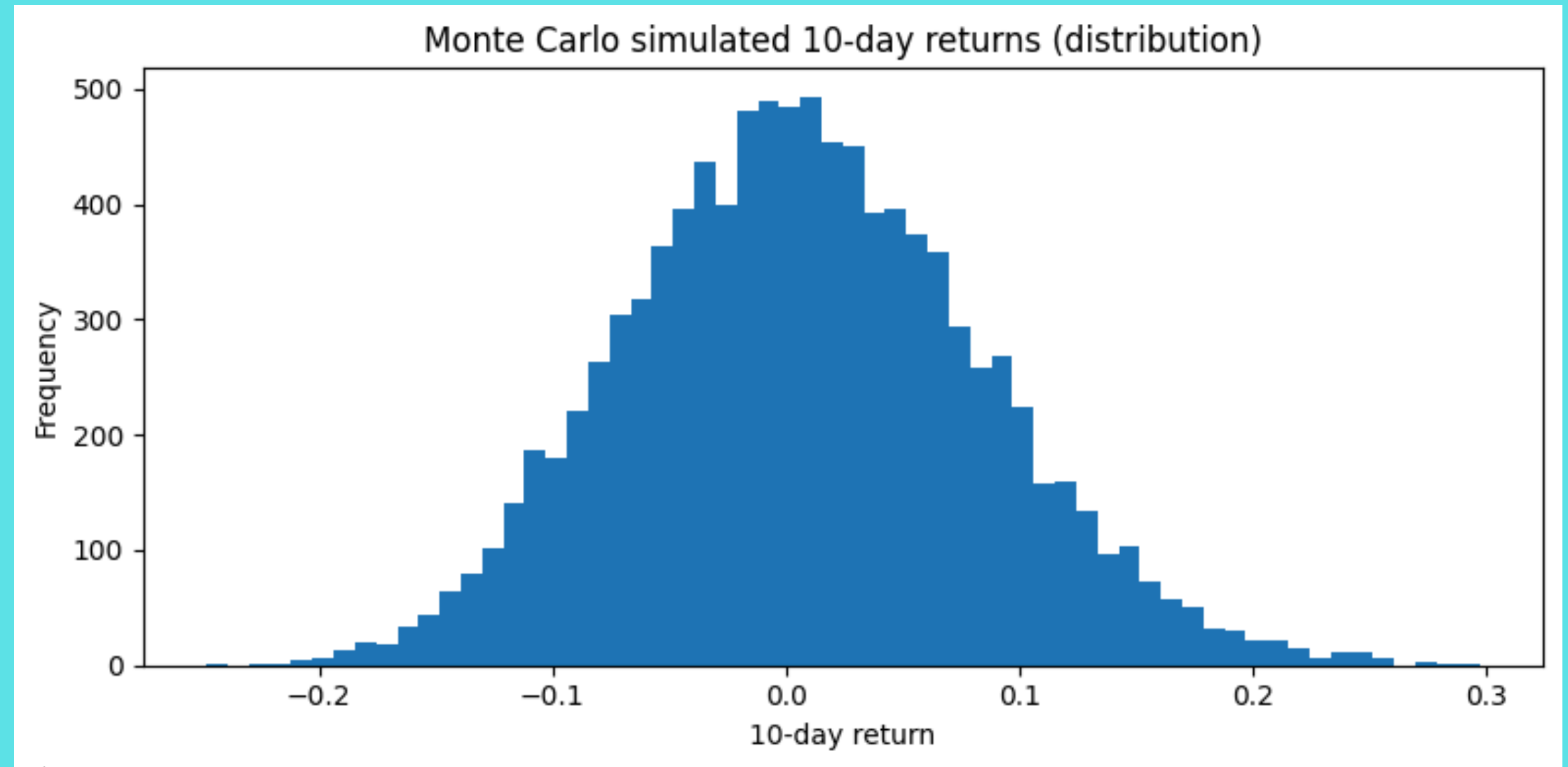
Distribution Shape of BMRI Stock Returns

- **Shape: The distribution is close to a normal curve (symmetric around 0), suggesting that most short-term returns are relatively stable.**
- **Majority outcomes: 10-day returns are concentrated between -5% and +5%, with the highest frequency around 0%.**
- **Tail risk:**
- **Extreme losses (≤ -20%) are rare, but still possible.**
- **Large gains (≥ +20%) may also occur, though infrequently.**

Conclusion: Volatility & Risk Analysis of BMRI Stock

- alue at Risk (VaR) analysis using Historical, Parametric, and Monte Carlo methods produced consistent results. Estimated potential 1-day losses ranged between 3–6%, while 10-day losses ranged between 11–17% at 95%–99% confidence levels. This provides a quantitative view of short-term investment risk.
- The distribution of 10-day returns is roughly normal, with most returns concentrated between -5% and +5%. However, there is still tail risk—extreme losses ($\geq$ -20%) are rare but possible.
- Overall, BMRI stock has a positive long-term growth trend but comes with significant market risk, particularly during crisis periods. Volatility and VaR analysis offer valuable insights for investors and analysts to better understand risk and develop more informed portfolio management strategies.

Terima Kasih

SUMBER

https://www.kaggle.com/datasets/cgyputra/bmri-jk-stock-data

PORTOFOLIO

https://github.com/inmus/Dibimbing_Protofolio/blob/main/analisis_volatil_BMRI

https://www.linkedin.com/in/indra-mustafa/