

Dynamic Risk-Reward Calculator for Young Assets and Limited Data

From my experience analyzing financial markets, I have learned that the most critical first step, before any attempt at price forecasting, is a deep and objective understanding of an asset's inherent risk. I believe that jumping directly to price prediction without first quantifying historical volatility, the potential for significant losses (drawdown), and true risk-adjusted performance can lead to misguided investment decisions. This conviction, born from personal experience, was the catalyst for this project. My goal was to build a comprehensive Python-based program that could serve as a robust foundational tool in any investment analysis process, focusing first and foremost on creating a clear, data-driven overview of an asset's risk and reward profile.

A Quantitative Approach to Investment Analysis

This project was developed as a user-interactive command-line tool in Python. Its core philosophy is to acknowledge the limitations of short-term data head-on. Rather than producing a simple numerical output, the tool's primary function is to serve as an "interpretive engine." It calculates key risk-reward metrics and immediately translates them into a detailed narrative analysis, complete with qualitative assessments and crucial warnings about data scarcity.

I. System Architecture & Key Features

To tackle the challenge of limited data, I designed the program with several key features that differentiate it from standard analysis tools:

- **Flexible, Interactive Data Input:** A core design feature is its manual data input system, built to handle assets without a public data feed or with very short histories. The process is straightforward and flexible:
 1. First, the program prompts the user to select the data frequency—either **monthly (1)** or **daily (2)**. This choice is critical as it sets the correct annualization factor (12 for monthly, 252 for daily) for all subsequent metric calculations.
 2. Next, the user enters a loop where they can input data points **one by one**, providing a date and a price for each entry (e.g., '2025-01 26.96').
 3. This process continues until the user types 'selesai' to signal the end of data entry. This flexible, entry-by-entry method allows for the rapid analysis of any custom dataset, no matter how small, making it ideal for evaluating new projects or private assets.
- **The Interpretive Engine (Dynamic Analysis):** This is the program's most innovative feature. After calculating the metrics (CAGR, MDD, Volatility, Sharpe Ratio, Sortino Ratio), it automatically generates detailed, qualitative analysis in plain language. It provides context by comparing the CAGR to user-defined targets, explaining what a specific MDD percentage *feels* like for an investor, and highlighting the crucial difference between the Sharpe and Sortino ratios.
- **Built-in Extrapolation Warning:** Recognizing the danger of annualizing short-term data, I built a critical safeguard into the tool. It automatically detects if the input data

spans less than a year and, if so, issues a clear **warning** that all annualized figures are **extrapolations** and should be interpreted with caution.

II. Implementation & Case Study on a Young Asset

To demonstrate the tool's capabilities, I ran a case study on "Asset Y," a hypothetical young asset with only six months of monthly performance data. After selecting the 'monthly' frequency, I entered the six data points one by one. The tool then generated the following detailed analysis:

- **Performance Analysis:**
 - The extrapolated **CAGR was an exceptional 118.59%**, which the program interpreted as "Luar Biasa," as it significantly exceeded the user's defined MAR of 5.00%.
 - However, the program also noted that the **annualized volatility was even higher at 155.19%**, adding the crucial context that this indicates "a very 'bumpy' ride."
- **Risk Profile Assessment:**
 - The **Maximum Drawdown (MDD) was 51.82%**, which the tool flagged as "Risiko sangat tinggi," explaining that an investor would need a very high risk tolerance to be comfortable with such a drop.
- **Risk-Adjusted Return Ratios:**
 - The **Sharpe Ratio was 0.72**, interpreted as "**Cukup**" (**Adequate**). This showed that while returns were positive after accounting for the risk-free rate, they were not exceptional when measured against the asset's total volatility.
 - In stark contrast, the **Sortino Ratio was an outstanding 5.34**, interpreted as "**Luar Biasa.**" The program's interpretive engine then added the key insight: the large gap between the high Sortino and modest Sharpe ratio is a strong sign that most of the asset's volatility came from positive price movements, not "bad" downside risk.
- **Final Warning:** As the data spanned only six months, the program correctly triggered and displayed the **extrapolation warning**, cautioning that the annualized figures should be interpreted with care.

Project Conclusion

This project resulted in a specialized and highly practical tool for the rapid analysis of young or data-scarce assets. Its unique contribution is not merely the calculation of metrics, but its **interpretive engine**, which translates complex quantitative data into an immediate, contextualized narrative. By combining a flexible data input system with automated analysis and built-in safeguards, the tool empowers a user to make more informed and risk-aware decisions, even when faced with the uncertainty of new investment opportunities.

Skills & Competencies Demonstrated

This project showcased my ability in several key areas:

- **Quantitative Financial Modeling:** Building a calculator for a suite of essential risk-reward metrics.
- **Risk Metric Interpretation:** Designing a system that can translate quantitative results into qualitative, actionable insights.
- **Python Programming:** Developing a robust, user-interactive command-line interface (CLI) with clear logic and user-friendly output.
- **Handling Data Scarcity:** Specifically designing a tool to manage and provide warnings for limited datasets and data extrapolation.
- **Financial Analytics Communication:** Structuring a program to effectively communicate the character and risk profile of an asset in a clear, narrative format.