

Analyzing Gold vs S&P 500 During the 2008 Financial Crash

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Executive Summary

Summary of methodologies

- Collected historical daily price data:
 - Gold: from Kaggle (2004-present)
 - S&P 500: using Python's yfinance package
- Cleaned and Preprocessed both data sets
- Calculated daily returns using .pct_change() to quantify day to day performance.
- Computed 30-day rolling volatility, annualized.
- Zoomed in on October 2008 to analyse asset behaviour during peak crises week.
- Created comparative plots of price movement, return behaviour, and volatility

Summary of Results

- Both assets experienced volatility during the crisis
- S&P 500 exhibited sharper and more extreme price swings.
- Gold prices fluctuated but with less severe movement.
- Rolling volatility for the S&P 500 spiked significantly, while gold's increase was more moderate
- Gold and Silver&P 500 showed weak or inverse correlation during periods of market stress especially the October 2008 period.

Introduction

Project Background and Context

During financial crises, investors often seek safer investment options to protect their portfolios. While equities like the S&P 500 tend to react sharply to market turmoil, gold is commonly believed to act as a safe-haven asset, offering protection by preserving value during downturns.

The 2008 global financial crisis was one of the most severe economic collapses in modern history. This project uses it as a case study to explore how gold and equities responded during this high-volatility period.

Problem Statement / Questions to Answer

This project aims to investigate the following question:

- How did gold and the S&P 500 behave during the 2008 financial crisis?
- Was gold less volatile than equities during the peak of the crisis?
- Did gold act as relatively stable asset while the stock market declined?
- Can we support or challenge the belief that gold is a safe-haven asset in times of economic distress?

Section 1

Methodology



Data Collection

- Gold Data: Downloaded from Kaggle - “XAUUSD Gold Price Historical Data (2004–present)”
- S&P 500: Pulled using the yfinance Python library with ticker $^{\text{GSPC}}$, covering the same time frame.

Data Cleaning and preparation

- Converted date columns to “datetime” format for time-based analysis.
- Selected relevant columns (Date, Close, etc).
- Renamed columns for consistency between datasets.
- Filtered both datasets to focus on the year 2008, especially October, the most volatile period.

Feature Engineering

- Daily returns: calculated using `.pct_change()` to measure daily price movement.
- Rolling volatility: 30-day rolling standard deviation of returns, annualized using $\sqrt{252}$ (standard number of trading days in a year)

Visualization

- Plotted closing prices for the Gold and the S&P 500 for comparison.
- Created line plot for daily returns and rolling volatility.
- Zoomed in on October 2008 for a focused crisis snapshot.

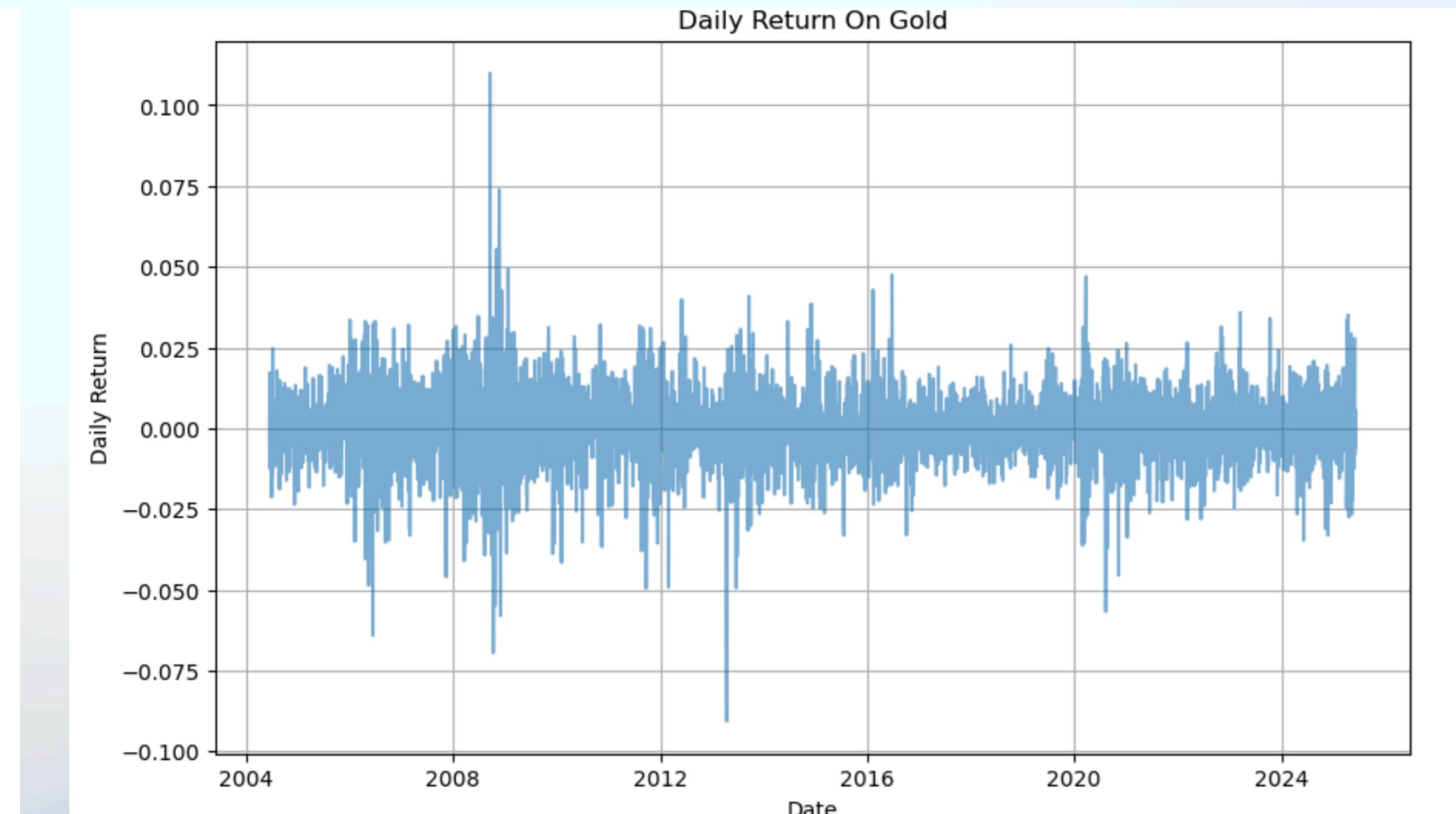
Section 2

Insights Drawn
From EDA



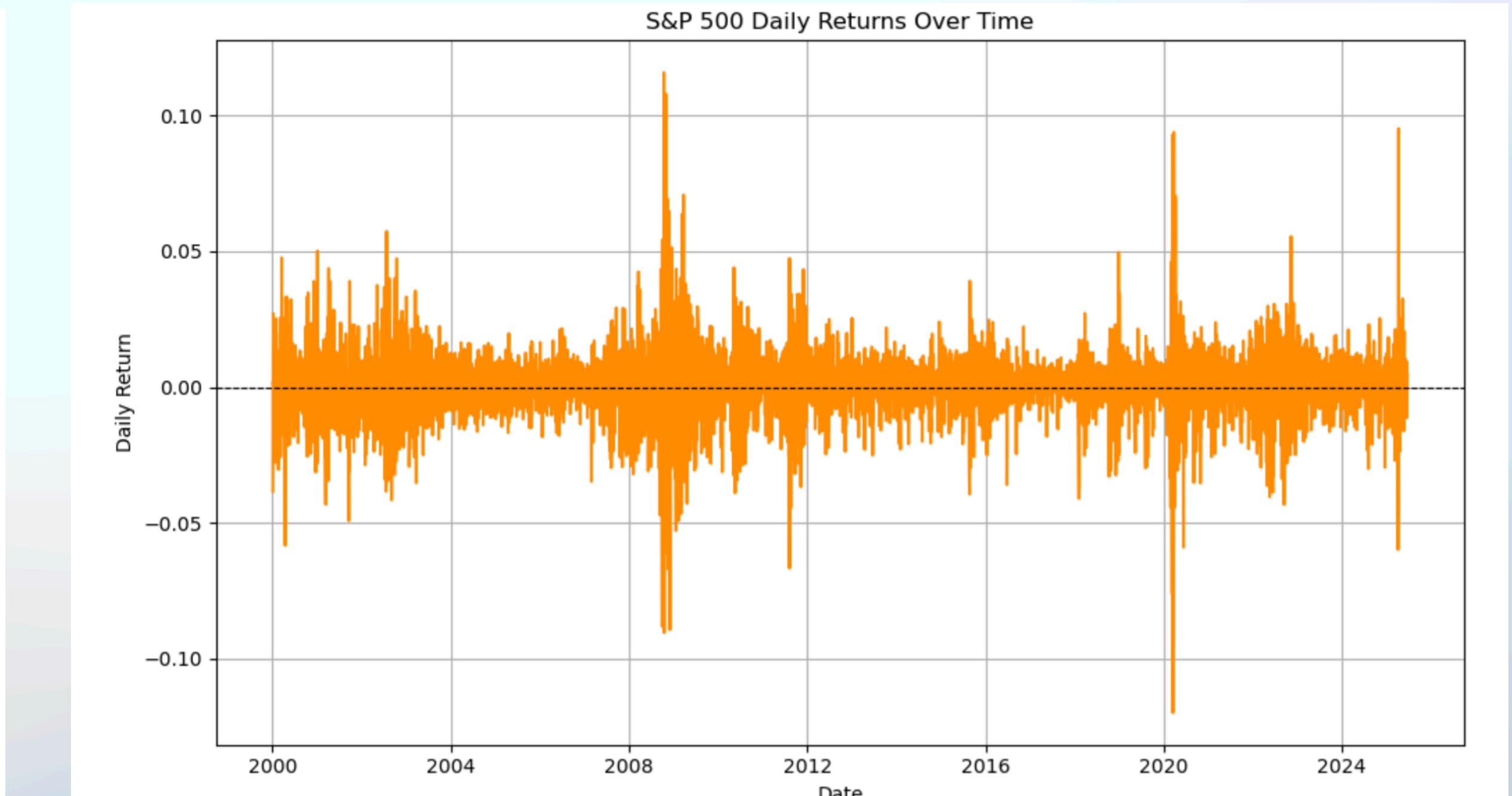
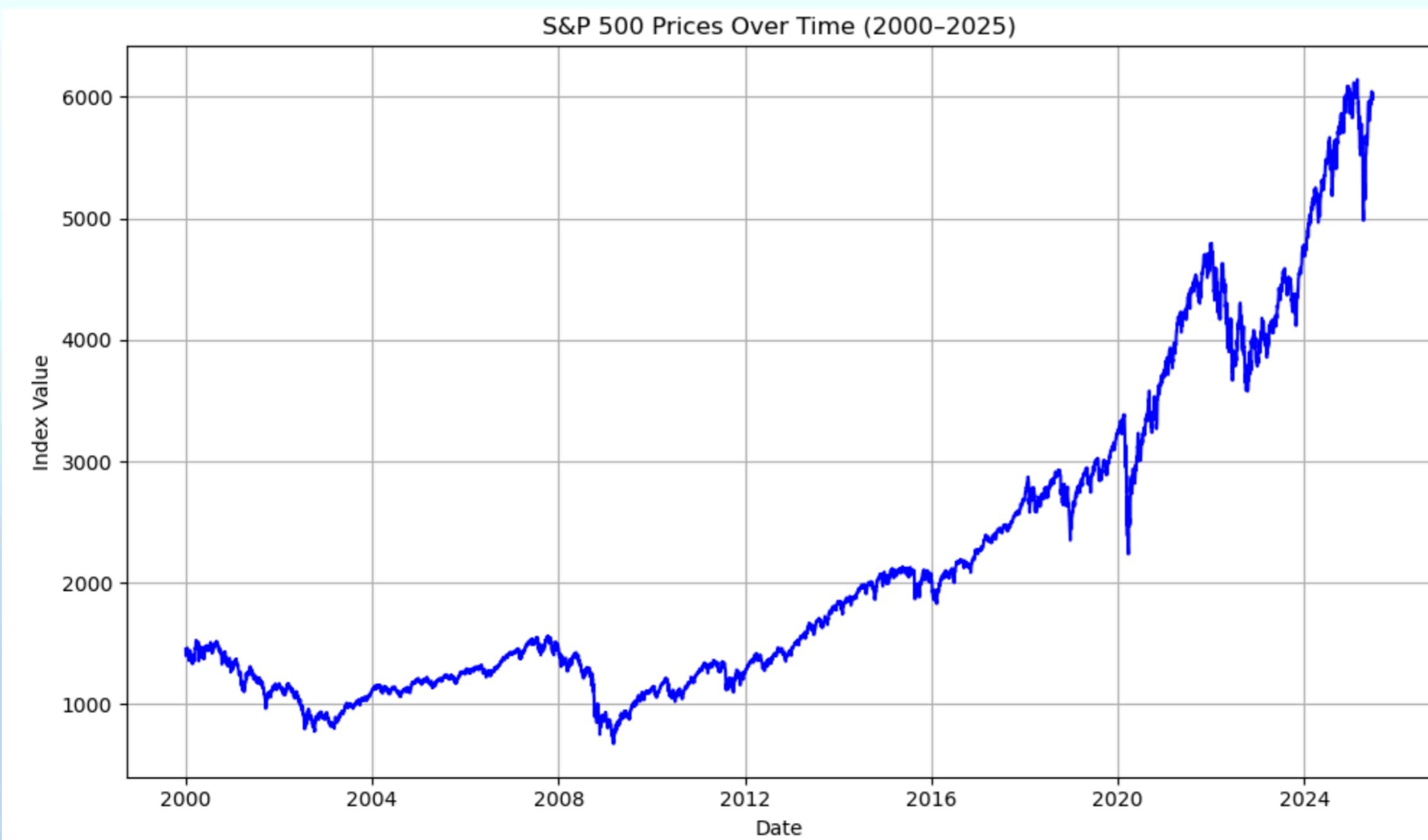
Gold Price Behaviour

- Gold prices show a steady upward trend over the years with notable volatility spikes during major crises like the 2008 financial crisis.
- The Daily returns exhibit relatively moderate fluctuations, indicating gold's stability compared to equities.



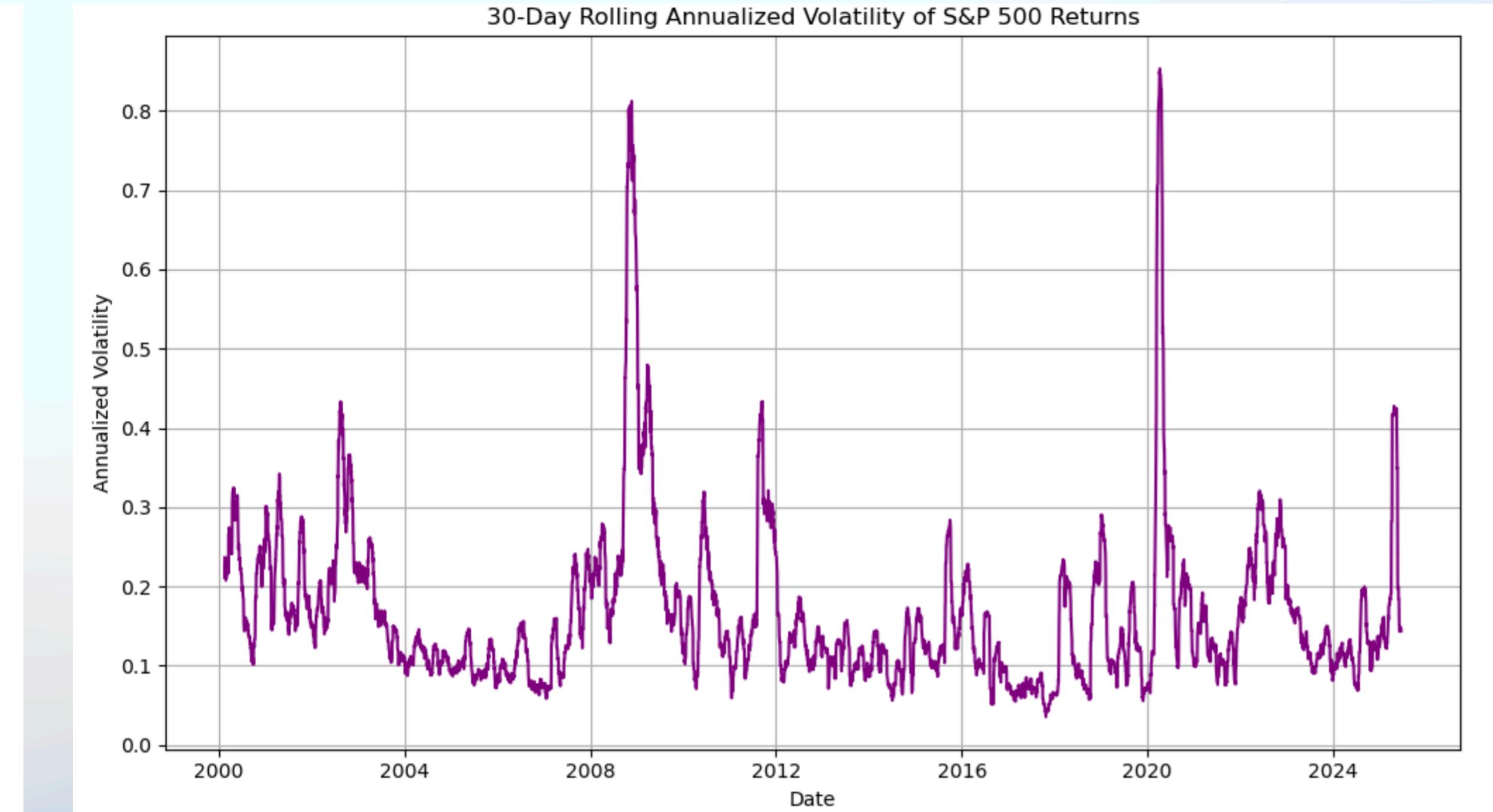
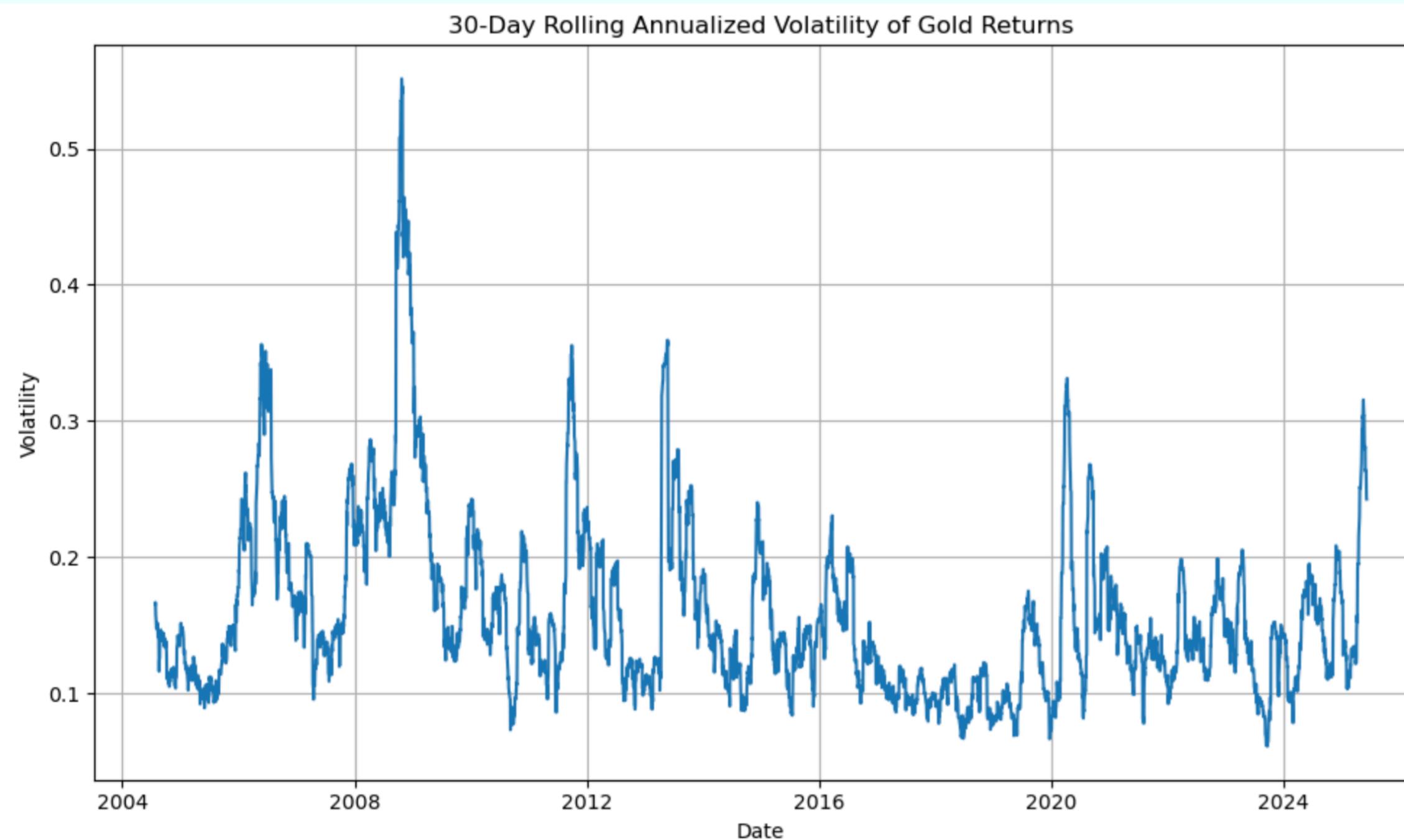
S&P 500 Behaviour

- The S&P 500 shows significant price volatility, especially during market crashes (2008, 2020).
- The Daily reflect sharp and frequent up-and-down swings, illustrating higher short-term risk.



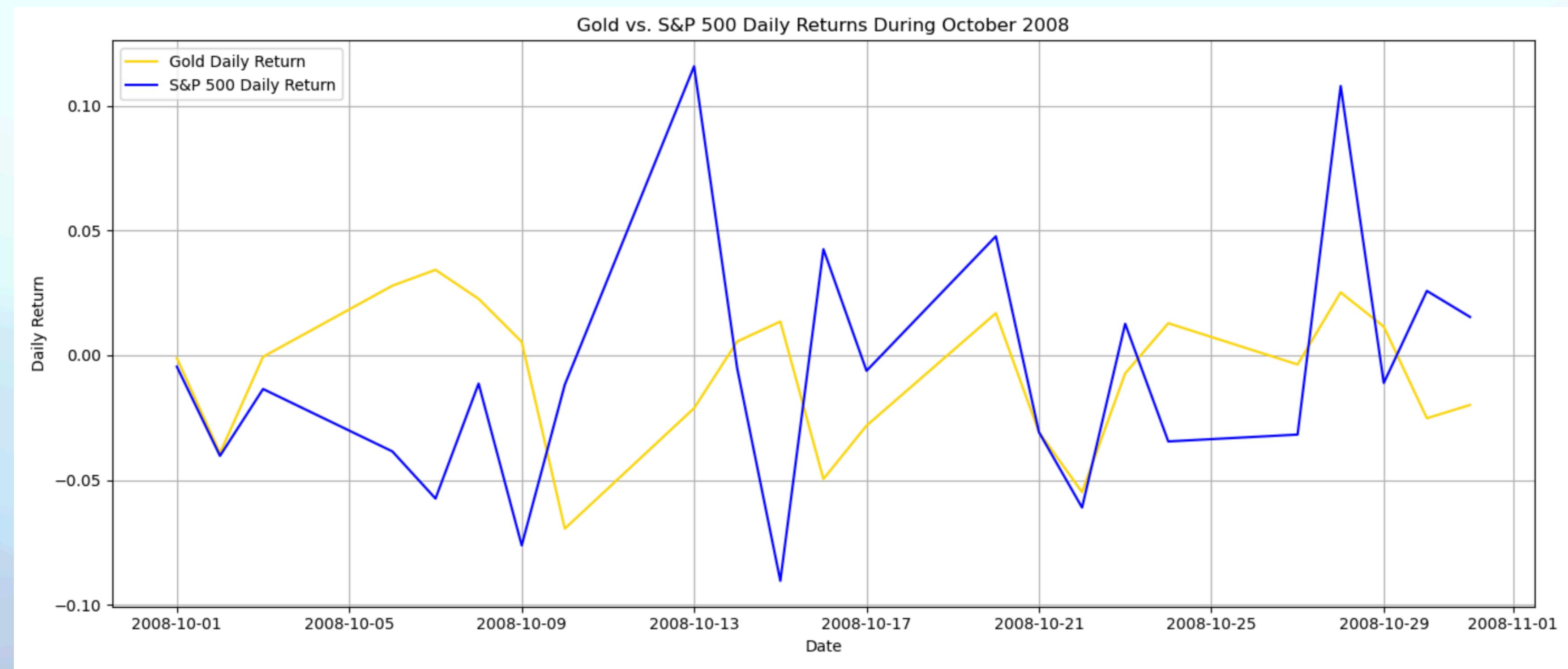
Volatility Comparison

- Rolling 30-day annualized volatility for gold remains consistently lower than that of the S&P 500.
- The Volatility spikes in S&P 500 during crises are more pronounced and frequent than in gold, highlighting higher market uncertainty.



Behaviour During 2008 Crisis

- In October 2008, gold's volatility rose but was still significantly lower than S&P 500's peak volatility.
- The S&P 500 experienced sharp drops and rapid swings, while gold showed more moderate movements.



Correlation Analysis

- The daily return correlation between gold and the S&P 500 is very low (~0.05), indicating that gold and equities move largely independently.
- This supports the idea that gold is a safe haven, providing diversification benefits during stock market turbulence.

```
corr = merged['daily_return_Gold'].corr(merged['daily_return_SP500'])
print(f"Correlation: {corr:.3f}")
```

Correlation: 0.053

Conclusion



Objective

This project analyzed the behaviour of gold and the S&P 500 during the 2008 financial crisis to understand their volatility, stability, and correlation.”

Key Findings

- Gold prices remained relatively stable during crisis periods, with smaller daily fluctuations.
- S&P 500 showed higher volatility and sharper price swings.
- Rolling volatility graphs showed that S&P 500's risk levels spiked more dramatically.
- Correlation between gold and S&P 500 daily returns was very low (~0.05), indicating independent movement.

Insights and Takeaways

These findings support the common belief that gold behaves as a ‘safe-haven’ asset during times of financial stress. Investors may use gold as a hedge when markets are volatile.