

Stock Market Trend Analysis

DSCI 510 - Fall 2025

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December 13, 2025

Abstract

This project analyzes stock price behavior across three major sectors of the U.S. stock market—Technology, Financials, and Consumer Goods—performed over the past three years. Historical price data was collected using the Yahoo Finance API `yfinance`. After cleaning the data set, the project aims to analyze closing prices, moving averages, volatility, correlations and sector-level trends. An additional market benchmark, the S&P 500, is included to evaluate how each sector compares to the broader market. The results provide a clearer understanding of the long- and short-term patterns that may help new investors better understand the stock market.

1 Problem Introduction

1.1 Research Question

How do stocks in the Technology, Financial, and Consumer Goods sectors compare in terms of trends, returns, moving averages, volatility, and correlation over the past three years, and how do they perform relative to the market index (S&P 500)?

1.2 Description

This project will analyze historical stock data across three sectors to understand differences in performance, risk, and price movement patterns. Using an API and Python, the project will examine nine major companies within these sectors as well as the S&P 500 as a baseline.

2 Methods

2.1 Data Collection and Source

Data was collected using the Python `yfinance` library, which accesses Yahoo Finance data through API-based requests. The data was downloaded for the date range December 2022 to December 2025. Each stock has roughly 750 trading days of data which is about 3 years of daily observations. With 10 different stocks being observed, there is around 7,500 rows of data. Originally, the plan was to collect data from only three different stocks and look at their 7-day, 30-day, and 90-day

moving averages. The problem that was faced was that there wasn't enough data to look at and there was nothing really to compare those stock with. Instead, including 3 different stocks from 3 different sectors will give us a clearer understanding of the stock market as well as including a base market index stock to help compare our stocks to the general market. The following data fields were collected for each stock:

- Date
- Open, High, Low, Close prices
- Volume
- Daily percent return (computed)
- 50-day moving average (computed)
- 200-day moving average (computed)
- Dividends
- Stock Splits

2.2 Stocks and Sectors

This project examined three sectors, each with three representative stocks:

- **Technology:** NVidia (NVDA), Apple (AAPL), Microsoft (MSFT)
- **Financials:** JPMorgan Chase (JPM), Visa (V), Bank of America (BAC)
- **Consumer Goods:** Walmart (WMT), Costco (COST), Procter & Gamble (PG)

The S&P 500 index (^GSPC) was also collected as a market benchmark.

3 Analysis and Visualization

Once data was collected, the project used various metrics of analysis to not only show overall performance, but also stability, sector dynamics, and relationships between stocks. These metrics include the starting and ending prices over the three years, average daily return, volatility, total return over the three-year period, and alpha relative to the benchmark. These results are shown in Table 1, which provides a clear comparison across all ten stocks. It is clear that although all stocks performed generally better within the past 3 years, Nvidia seems to be the outlier, with returns far higher than any other stock.

Ticker	Sector	Start Price	End Price	Daily Return (%)	Volatility (%)	Total Return (%)	Alpha (%)
^GSPC	Benchmark	3941.26	6857.12	0.0785	0.9606	73.9829	—
NVDA	Technology	15.97	183.38	0.3758	3.1987	1048.278	0.2974
AAPL	Technology	140.79	280.70	0.1053	1.6439	99.3750	0.0269
MSFT	Technology	239.40	480.84	0.1037	1.4758	100.8521	0.0253
JPM	Financial	122.21	316.10	0.1369	1.4382	158.6531	0.0585
V	Financial	204.41	327.10	0.0693	1.1564	60.0215	-0.0091
BAC	Financial	30.66	54.16	0.0887	1.6067	76.6471	0.0103
WMT	Consumer Goods	48.09	114.84	0.1238	1.2544	138.8022	0.0454
COST	Consumer Goods	461.80	895.86	0.0962	1.2581	93.9931	0.0177
PG	Consumer Goods	138.39	145.36	0.0117	1.0176	5.0365	-0.0667

Table 1: Summary of Stock Performance Metrics for All Stocks from Dec. 2022 to Dec. 2025

Sector-level return trends was evaluated by calculating the cumulative returns over the three-year period. As shown in Figure 1, all three technology stocks strongly outperformed the S&P 500 with Nvidia stock completely dominating all other stocks with an increase performance of over 1000%. This is primarily due to the recent AI and GPU demand boom. In the financial sector, JPM showed a strong and consistent performance, balancing growth and risk. BAC and V did not perform as well, but exhibited higher volatility. WMT and COST both had strong and consistent performance in the consumer goods sector, whereas PG seemed to underperformed only gaining 5% increase within the last 3 years.

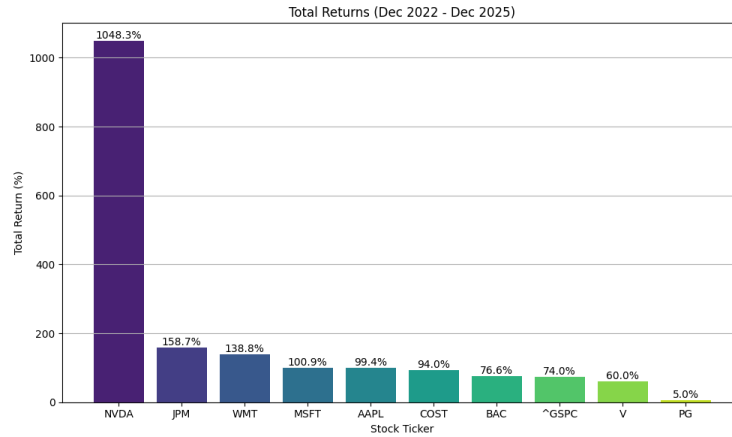


Figure 1: Total Return

To show a more visualized relationship between each stock, a correlation matrix heatmap was created to show daily returns of all stocks and the S&P 500. As shown in Figure 2, as expected, all three stocks in the technology sector showed strong positive correlations with one another and including with the S&P 500. The financial sector stocks showed a more mixed relationship with one another with JPM and BAC showing similar correlations, which is primarily due to their similar industry conditions. The consumer goods showed a weaker correlation overall with PG showing the lowest correlation with other stocks. Overall, there is clear clustering among each sectors, thus providing more insight into risk management and portfolio construction.

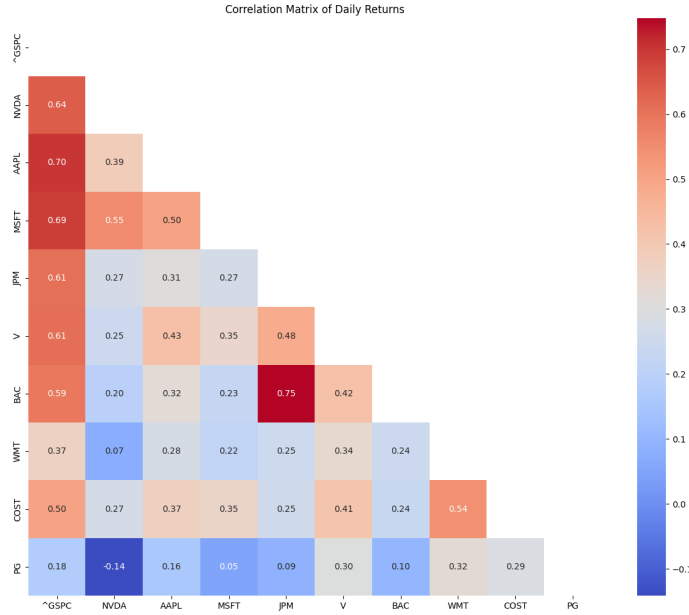


Figure 2: Correlation Matrix Heatmap

Additionally, an alpha comparison plot was created to show which stock outperformed or underperformed the S&P 500 on a daily average basis. As shown in Figure 3, positive alpha values indicate excess return relative to the benchmark and negative values indicates underperformance relative to the benchmark. Once again, Nvidia showed to outperformed positively in compared to the all other stocks including the S&P 500. JPM, WMT, AAPL, MSFT, COST, and BAC also all showed positive performance relative to the alpha value. However, V and PG showed underperformance relative to the alpha indicating that it has rather low-volatility and does not perform as great as the other stocks.

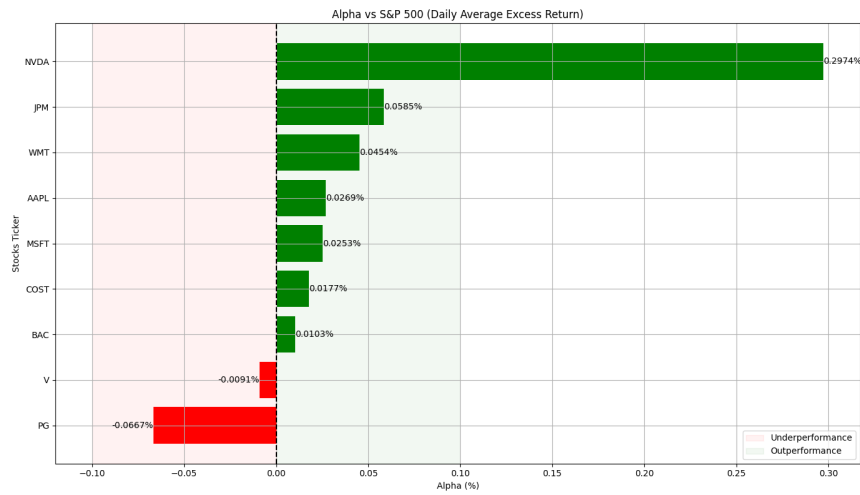


Figure 3: Alpha Distribution

50-day and 200-day moving averages were calculated to identify medium- and long-term trends as well as risk-return analysis to measure the risk of a stock. The 50- and 200-day moving averages was measured based on the metric whether a stock was either Bullish, meaning it is expected that the stock rises or bearish, meaning it is expected for it to drop. Based on the results, the technology and financial sector stocks are bullish and showed long-term bullish trends. Stocks like V, COST, and PG showed bearish signs of trends, showing consistency with their weaker relative performance. In the risk-return analysis, daily returns were used to compute annualized volatility. In Figure 4, it showed that stocks like NVDA showed very high volatility and returns indicating that it is a higher-risk stock with greater return. Stocks like JPM and WMT provide more attractive results for most investors with strong returns and moderate volatility. Stocks like PG has both low volatility and low returns. Other stocks like AAPL, MSFT, COST, and BAC falls in between and generally have moderate returns and volatility relative to the index.

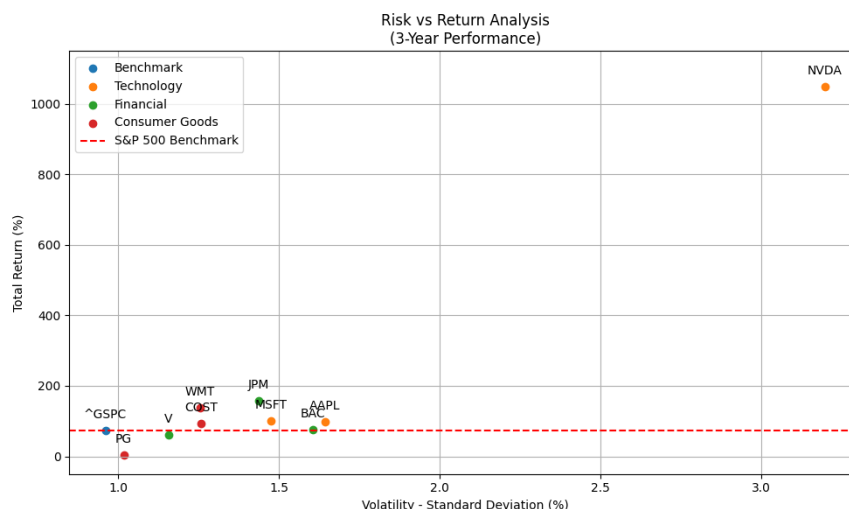


Figure 4: Risk-Return Analysis

4 Future Exploration

While the analysis provides meaningful insight into performance, volatility, alpha, and correlations, there are many other ways in which future iterations could be explored. Given more time, further exploration in additional stocks across multiple sectors like healthcare, energy, and industrial would provide a wider view of the market and enhance correlations and insight on trends among sectors. Additionally, including more macroeconomic factors such as interest rates, inflation, GDP growth, etc. could also further explain why certain stocks or sectors performed the way it did. Including a machine learning model like a regression model or time series model could help predict future return or identify which features most strongly influence performance. Including such factors will ultimately help potential new and casual investors have a better understanding in the stock market trends and patterns.