Did COVID-19 Change the Bullish Momentum of Tech Stocks?

An Empirical Analysis of Apple, Amazon, Google, Microsoft, and Nvidia(2016–2024)

Team Members:

Omar Wafa 23-10128

Omar Shafiy 23-201356

Omar Sharaf 24-101236

Eiad Essam 23-101108

جامعة مصر للمعلوماتية
EGYPT UNIVERSITY OF INFORMATICS

FACULTY OF COMPUTING & INFORMATION SCIENCES

Introduction

The COVID-19 pandemic, starting in early 2020, disrupted global markets and investor sentiment. Major tech companies—Apple, Amazon, Google, Microsoft, and Nvidia—became focal points for market resilience and innovation. This study explores two key questions:

1. Did the volatility (risk) of these companies' daily returns significantly change post-COVID?
2. Did the proportion of days where they closed higher than they opened change significantly?

Hypothesis Tests

Test 1: Volatility Comparison

- Test Used: Levene's Test for Equality of Variances
- Null Hypothesis (H_0): $\sigma^2\_pre = \sigma^2\_post$
- Alternative Hypothesis (H_1): $\sigma^2\_pre \neq \sigma^2\_post$

Statistically significant volatility increases were observed for most companies post-COVID, especially Nvidia and Amazon

Test 2: Proportion of Daily Gains

- Test Used: Two-Proportion Z-Test
- Metric: % of days with Close > Op
- Null Hypothesis (H_0): Proportion_pre = Proportion_post
- Alternative Hypothesis (H_1): Proportion_pre ≠ Proportion_post

Google and Amazon showed significant changes in bullish day frequency, suggesting a shift in short-term market sentiment.

Analysis 1: Growth & Volatility

Nvidia outpaced all peers in percentage growth, particularly after COVID, turning a hypothetical $1000 investment in 2020 into over $17,000 by 2024.

Microsoft emerged as a balanced performer, combining strong returns with lower volatility. Daily return analysis confirmed that higher returns came with greater risk—especially for Nvidia.

Key Visuals:

- Normalized price chart (Base 100)
- Volatility vs. Annualized return
- 30-day rolling volatility

Analysis 2: Market Behavior & Prediction

Daily return correlations across these tech stocks were high, suggesting limited diversification benefits when investing solely within this group.

Using Facebook's Prophet model, we attempted to forecast future prices. While trends were captured reasonably, short-term price movements remained unpredictable due to market noise and external events.

Key Visuals:

- Correlation matrix
- Prophet forecast samples
- $1000 investment growth chart

Forecasting the Future – Stock Price Prediction

Objective:

To explore whether historical stock patterns could help predict future movements, we employed Facebook's Prophet—a time series forecasting model.

Method:

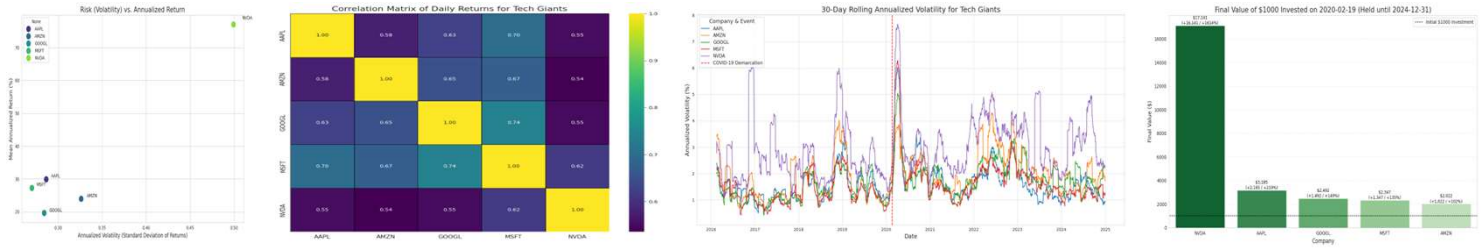
We trained individual models on historical closing prices for each tech stock, reserving the final 6 months for testing. The model attempted to capture long-term trends and seasonality.

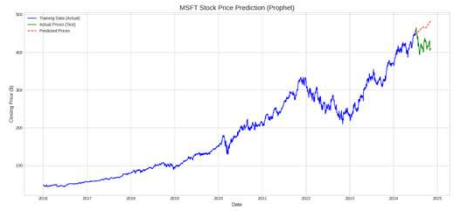
Findings:

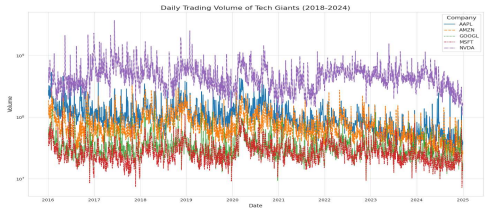
- The models successfully captured general trends for all companies.
- Nvidia and Microsoft forecasts aligned closely with actual movements, highlighting consistent growth momentum.
- However, the models struggled with short-term volatility and sharp price swings—reinforcing the inherent difficulty of accurate stock prediction.

Key Visuals:

- Prophet forecast Charts (e.g., NVDA, MSFT)







Conclusion

COVID-19 significantly altered the behavior of tech stocks—volatility rose, trading patterns shifted, and growth accelerated. Nvidia stood out for explosive gains, while Microsoft balanced strong returns with stability. Forecasting models captured trends but fell short on precision. Overall, the pandemic reshaped both risk and opportunity in the tech sector.

Hypothesis Test Summary

Volatility Change (Levene's Test):

✅ Confirmed — Most companies showed a significant increase in volatility post-COVID.

Proportion of Up Days (Z-Test):

➖ Mixed — Google and Amazon showed significant change, others did not.