Macro Meets
Microchips
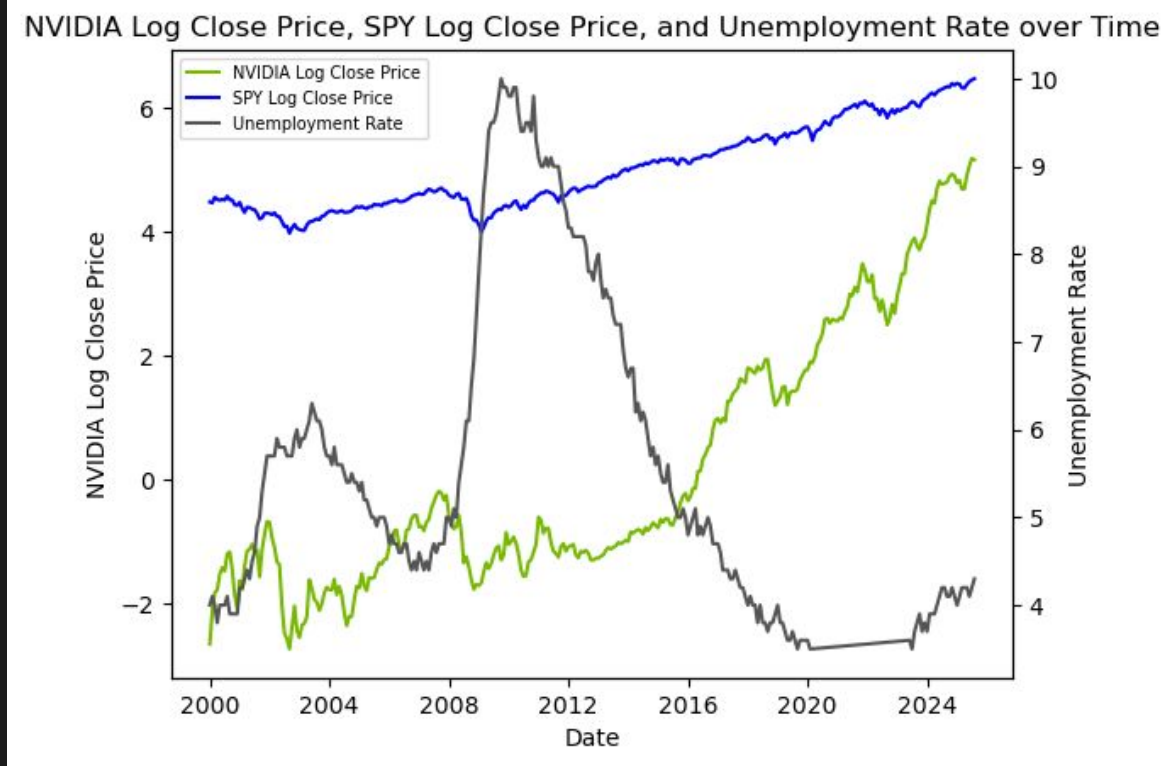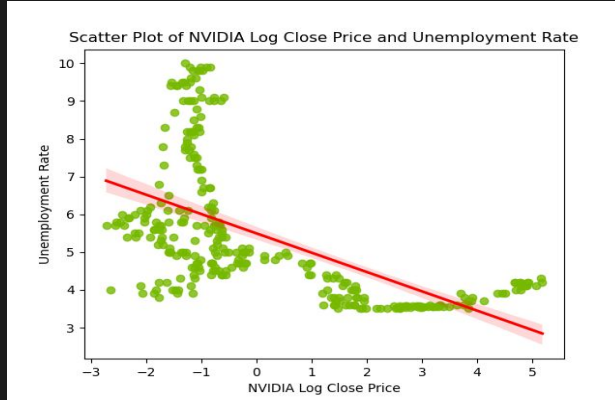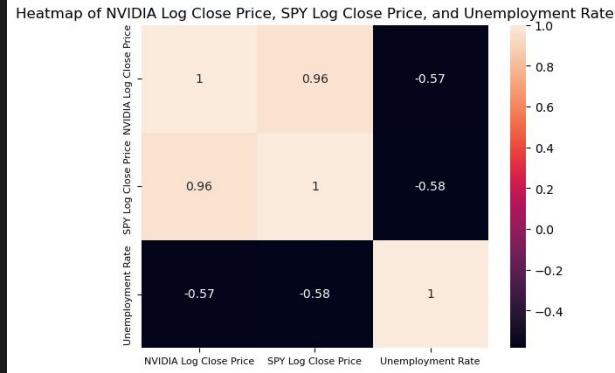
Analyzing the correlation between NVIDIA stock price and US Unemployment Rate (With SPY as US Economy Benchmark)

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DSCI 510

Data Sources

Dataset	Description	Fields	Type	Data Size
NVIDIA Historical Price (Yahoo Finance)	→ Monthly NVIDIA price data from 2000-01-01 to 2025-09-01	→ Date → Open → High → Close → Low	→ API Call to Yahoo Finance	→ 308
SPY Historical Price (Yahoo Finance)	→ Monthly SPY price data from 2000-01-01 to 2025-09-01	→ Date → Open → High → Close → Low	→ API Call to Yahoo Finance	→ 308
US Unemployment Rate (FRED)	→ Monthly US Unemployment Rates from 2000-01-01 to 2025-09-01	→ Date → Unrate	→ API call to Federal Reserve Bank	→ 308

Summary Overview (2000/01/01 – 2025/09/01)

[1]https://github.com/bwhong/bwhong-dsci510_fall2025_final_project/blob/main/src/results.ipynb
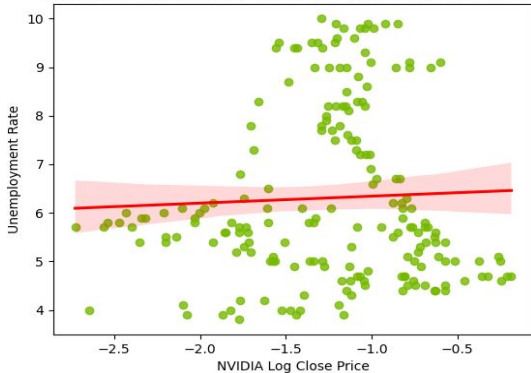
Summary Overview (2000/01/01 – 2025/09/01)

- Unlike expectations, we see a moderately negative correlation between Unemployment Rate and NVIDIA Log Stock Close Price.
- The correlation between NVIDIA and SPY is extremely positive.
  - When NVIDIA performs well, SPY also performs well.
  - NVIDIA makes up 7.5% of the S&P 500, so this makes sense.
- The time chart portrays interesting relationships even during Economic Crises
  - During the Global Financial Recession, Unemployment soars to record highs.
  - Meanwhile, stocks fall and take a longer time to recover.
- We also see the start of the AI boom in stocks.
  - As stocks soar, unemployment slowly starts to creep upwards.

Pre-AI Boom Summary Overview (2000/01/01 – 2015/12/01)

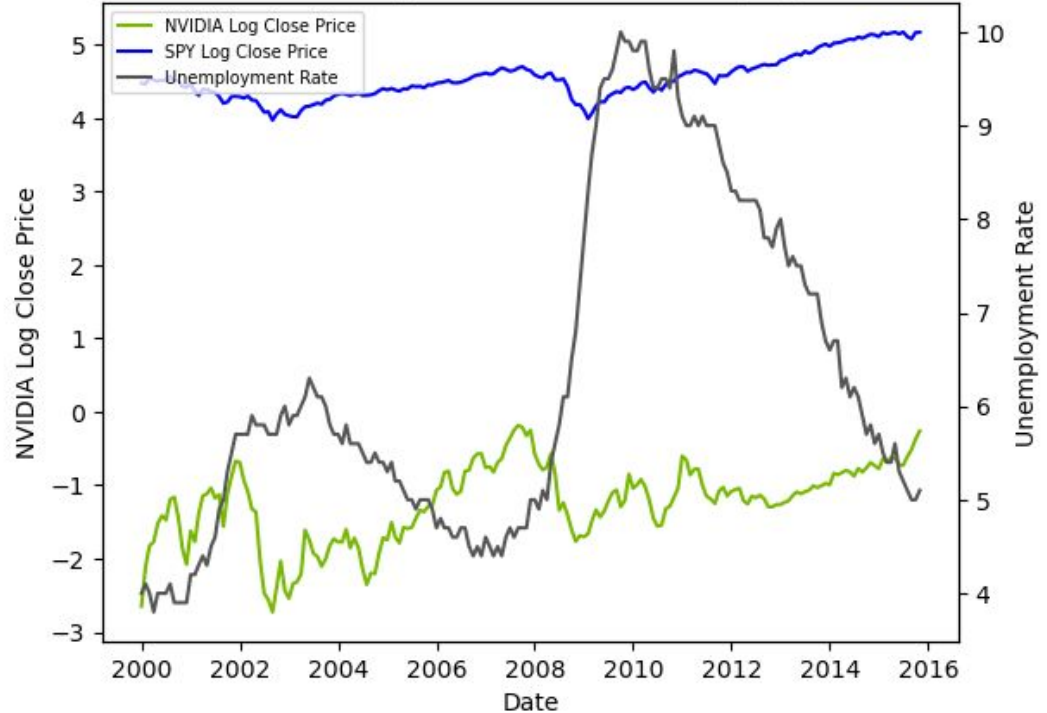# Post-AI Boom Summary Overview (2015/12/01 - 2025/12/01)

Heatmap of NVIDIA Log Close Price, SPY Log Close Price, and Unemployment Rate

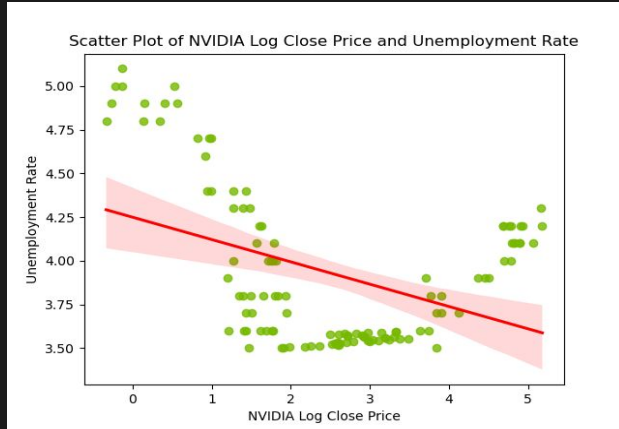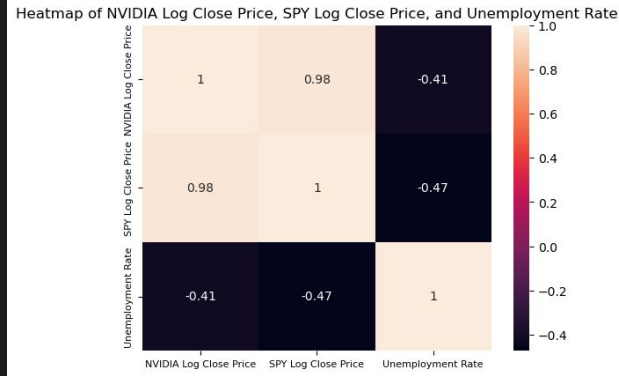Scatter Plot of NVIDIA Log Close Price and Unemployment Rate

NVIDIA Log Close Price, SPY Log Close Price, and Unemployment Rate over Time
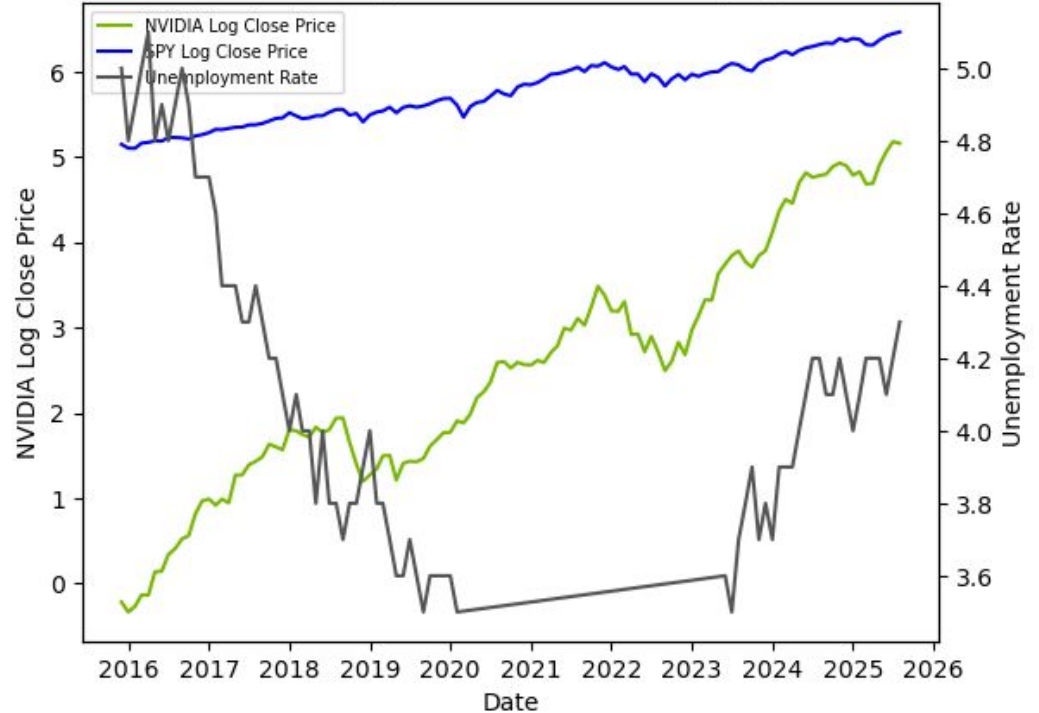
[1]https://github.com/bwhong/bwhong-dsci510_fall2025_final_project/blob/main/src/results.ipynb

Pre and Post-AI Boom Summary Overview

- When we split the data by the start of Open AI, we begin to see even more interesting relationships
    - Pre AI Boom, there is little to no correlation between NVIDIA and Unemployment Rate
    - Post AI Boom, we see a weak negative correlation between NVIDIA and Unemployment Rate
- NVIDIA and SPY do not have as strong as a correlation Pre AI Boom because NVIDIA was a smaller fraction of the S&P 500
- At the creation of ChatGPT (2022), we can actually begin to see a positive correlation between NVIDIA and Unemployment Rate

Challenges

- The most difficult portion of the project was determining the best method to normalize the data.

- If I standardized the Unemployment Rate data for every major economic event, the data would be unrealistic. Instead, I focused on removing any outliers.

- For the stock data, I initially tried to use raw stock prices, standardized the stock prices, and used monthly percent changes but quickly found that these approaches were not a good fit for my analysis. I found log transformations to be the most effective method for normalization.

THANK YOU