CS210 - Project Step 2

“Graphing Growth: Evaluating NVIDIA's Price Relationships”

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1.Introduction - Exploring the Data

The objective of this project is to analyze whether there is a significant correlation between NVIDIA's stock price and the stock prices of its key competitors and partners within the technology and semiconductor sectors. This analysis begins with the question, "Which competitors and market factors most closely correlate with fluctuations in NVIDIA's stock price?"

Understanding these relationships is crucial as NVIDIA operates in a highly interconnected market where the performance of one company can significantly influence the performance of others. While tracking the minute-to-minute stock prices can be daunting, modern data science tools allow us to examine trends over time and identify patterns.

For this analysis, I have utilized historical stock price data of NVIDIA and its competitors, including AMD, ASUS, INTEL, and MSI, obtained from datasets from Kaggle that are following links https://www.kaggle.com/datasets/kapturovalexander/nvidia-amd-intel-asus-msi-share-prices?rvi=1 & https://www.kaggle.com/datasets/saketk511/2019-2024-us-stock-market-data?resource=download . The main reference point in our study is the visualization of these stock prices over time, reflecting how market movements in these companies are interlinked.

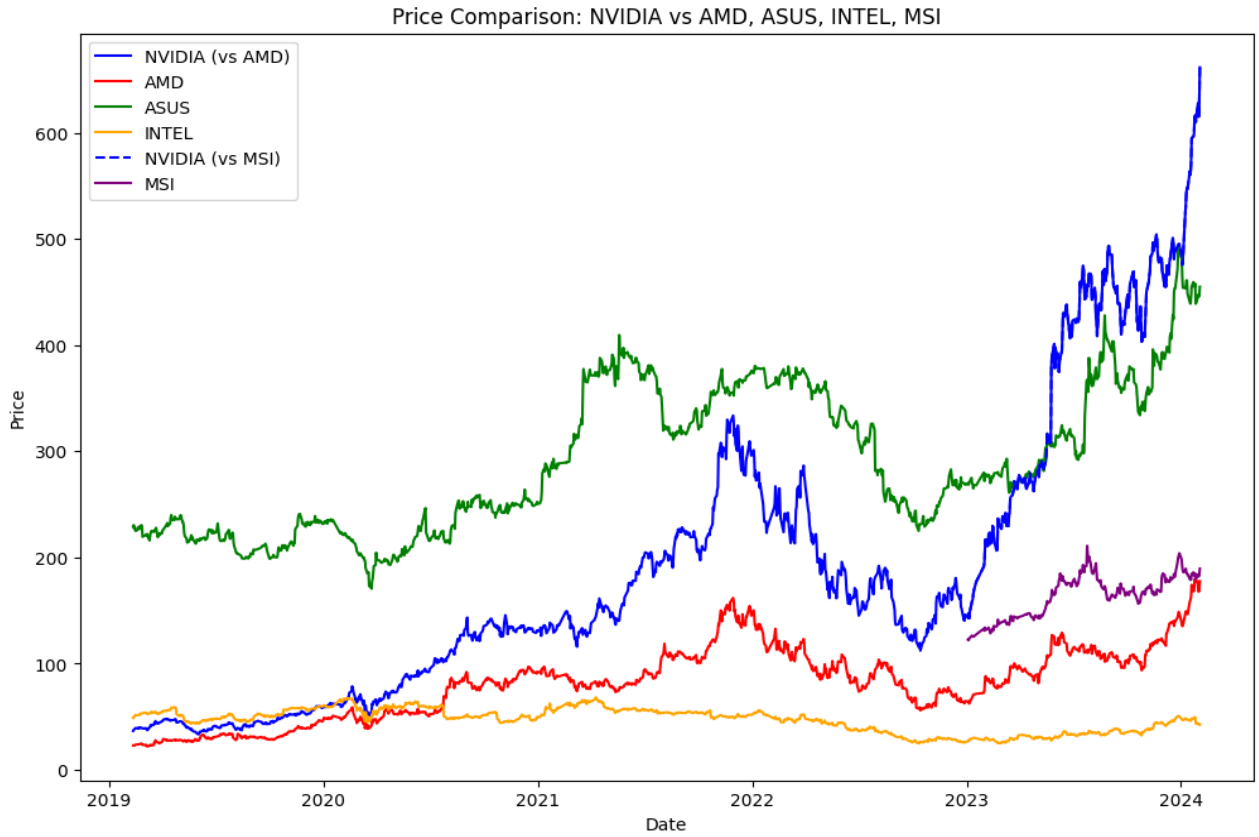

Figure 1: "Price Comparison: NVIDIA vs AMD, ASUS, INTEL, MSI"

This figure illustrates the comparative trajectory of stock prices for NVIDIA and its competitors, helping us to visualize potential correlations and causations behind market movements.

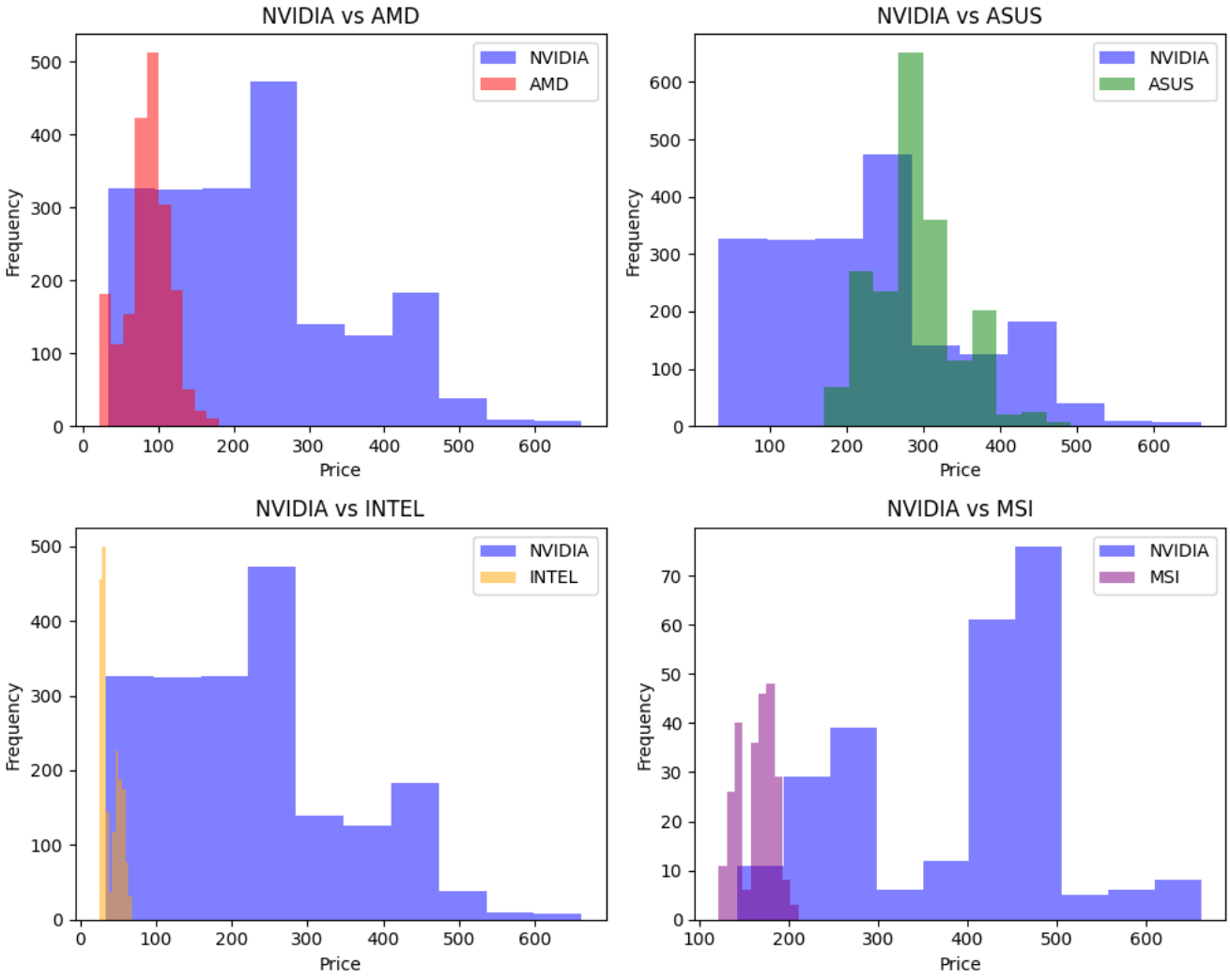

Figure 2: Histograms of Price Frequency Comparisons

The histograms provide a frequency distribution of prices, comparing NVIDIA with its competitors—AMD, ASUS, INTEL, and MSI. These visualizations help in identifying the most common price points and the spread of prices over the observed period. By analyzing these distributions, we can gain insights into the price volatility and stability of each company's stock.

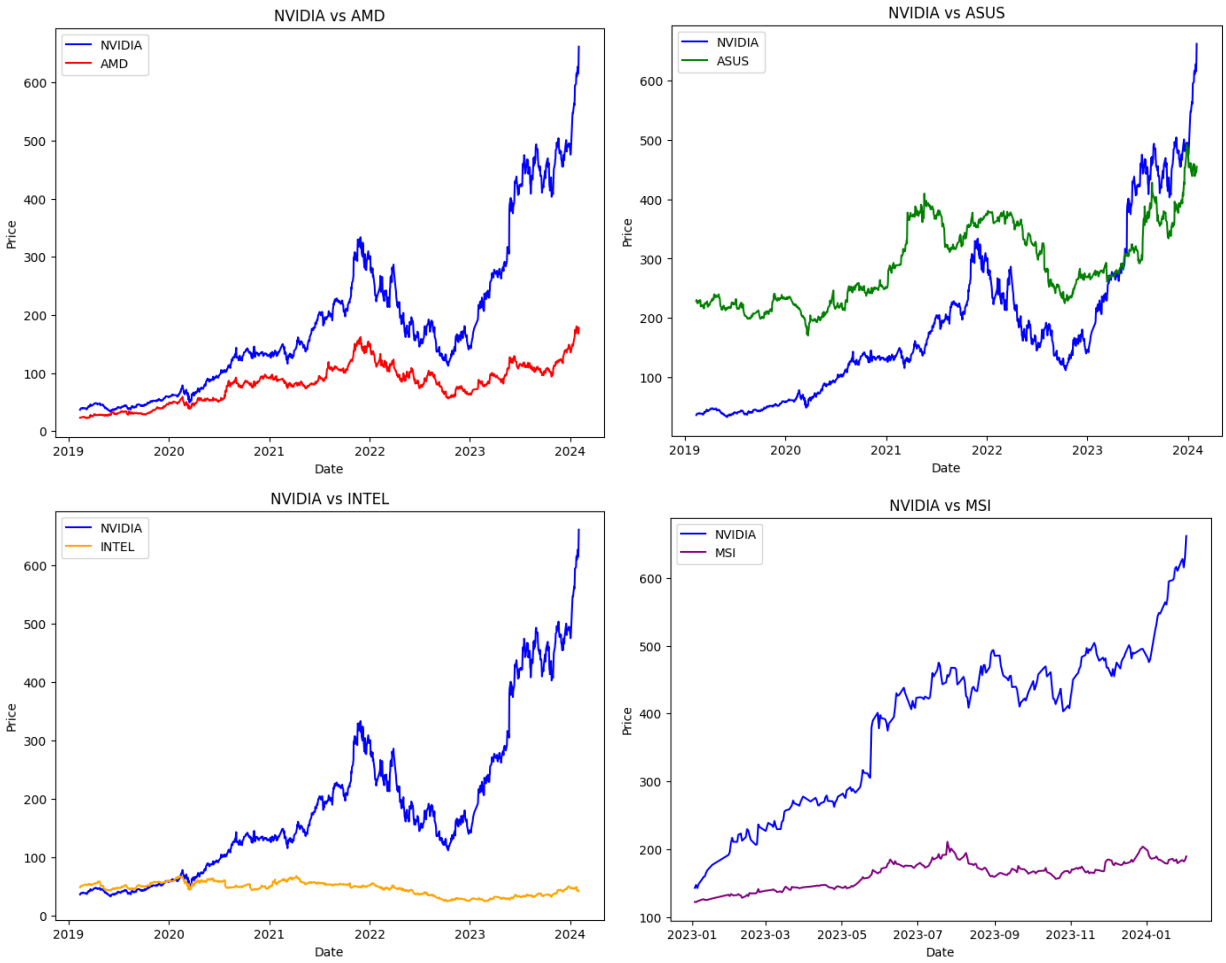

Figure 3: Time Series Analysis of NVIDIA vs Competitors

The time series graphs plot the stock price trends of NVIDIA against each competitor over a period from 2019 to 2024. These plots are instrumental in observing the dynamics of NVIDIA's growth in relation to key players in the technology sector. For instance, the graph showing NVIDIA vs AMD illustrates significant growth phases and potential market responses to industry events or technological advancements.

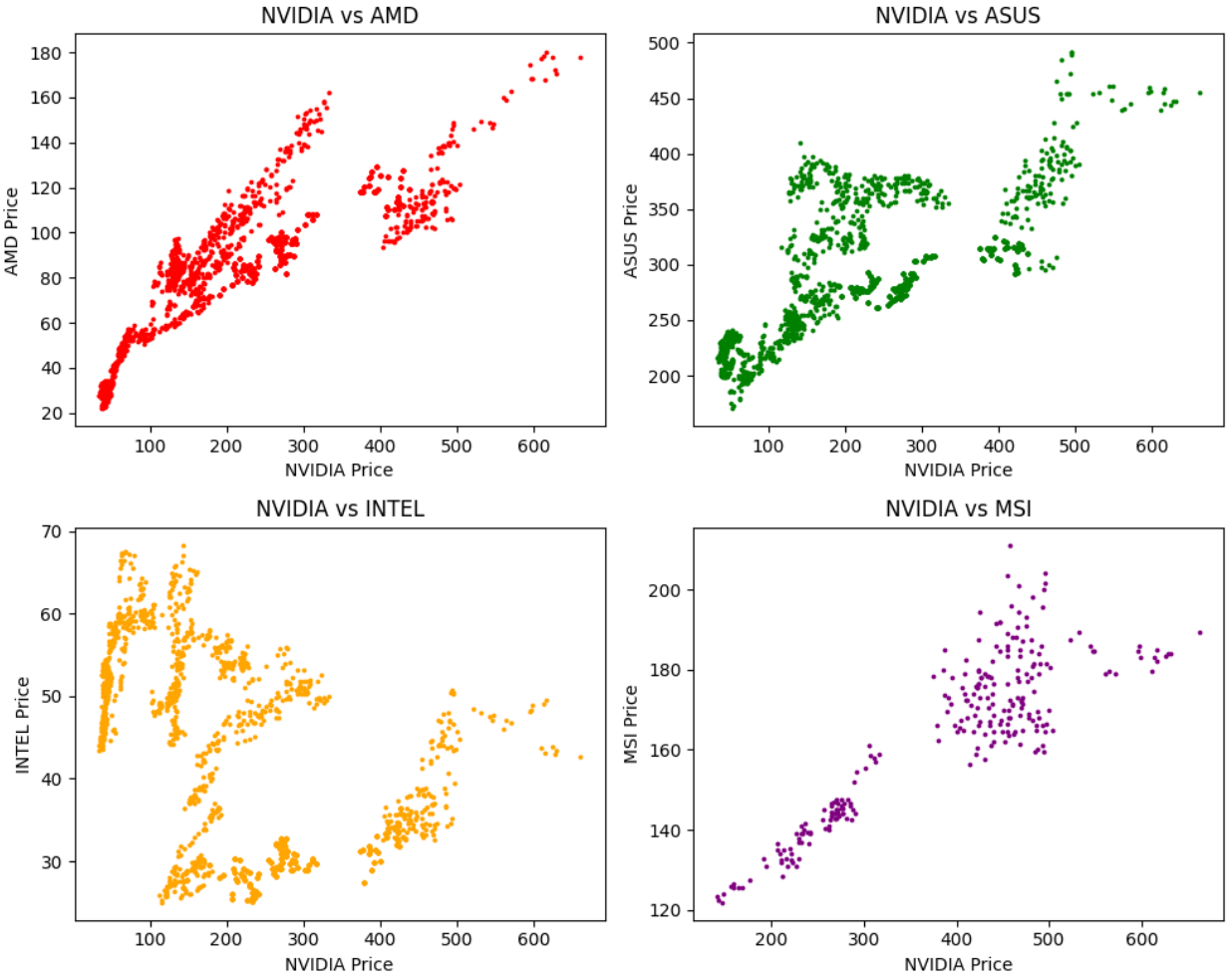

Figure 4: Scatter Plots of Price Correlations

Scatter plots provide a direct comparison of NVIDIA's stock prices with those of AMD, ASUS, INTEL, and MSI. These plots are crucial for examining the correlation between the stock prices of NVIDIA and each competitor. A positive correlation, as seen in most comparisons, might suggest that NVIDIA's stock price movements are in sync with market trends affecting these companies.

Through detailed analysis of these visualizations, we aim to understand not just the individual growth trajectories and market behaviors of these companies, but also how closely NVIDIA's performance is interlinked with these entities. This understanding could provide investors and company strategists with valuable insights into potential market movements and investment strategies.

2.Hypothesis Testing: Are Competitor Stock Prices Correlated with NVIDIA's Performance?

We normalized the datasets and synchronized their dates for comparison. Using the Pearson correlation coefficient, we calculated the correlations between NVIDIA's stock prices and those of its key competitors:

- NVIDIA vs. AMD: Pearson Correlation coefficient of 0.862, p-value of 0.0
- NVIDIA vs. ASUS: Pearson Correlation coefficient of 0.70, p-value of 6.26e-287
- NVIDIA vs. INTEL: Pearson Correlation coefficient of -0.47, p-value of 1.236e-107
- NVIDIA vs. MSI: Pearson Correlation coefficient of 0.88, p-value of 8.2e-82

The significant results, with very low p-values, indicate that the calculated Pearson correlation coefficients are statistically meaningful. A correlation coefficient close to 1 implies a strong positive correlation, while 0 implies no correlation.

Thus, we conclude that among the competitors, AMD shows the strongest correlation with NVIDIA's stock prices, suggesting that movements in NVIDIA's stock are closely mirrored by changes in AMD's prices due to similar market influences and technology sector dynamics. ASUS, INTEL, and MSI also show significant correlations, but to varying degrees, reflecting different levels of market and operational overlaps with NVIDIA.

This analysis helps in understanding how closely NVIDIA's financial performance is connected with these specific competitors, which could influence investment strategies and market positioning decisions.

3. Linear Regression Models

This part of report presents a series of linear regression models analyzing the relationship between NVIDIA's stock prices and those of several other technology companies: ASUS, Intel, MSI, and AMD. The aim is to determine how well the stock prices of these companies predict NVIDIA's stock prices, assessed by the coefficient of determination (R-squared value).

3.1 NVIDIA Prices Predicted by AMD Prices

Figure 5 presents the linear regression model for NVIDIA and AMD stock prices. The model achieves an R-squared value of 0.82, indicating a very strong predictive relationship. Similar to MSI, the high correlation suggests that movements in AMD stock prices are closely mirrored by movements in NVIDIA stock prices.

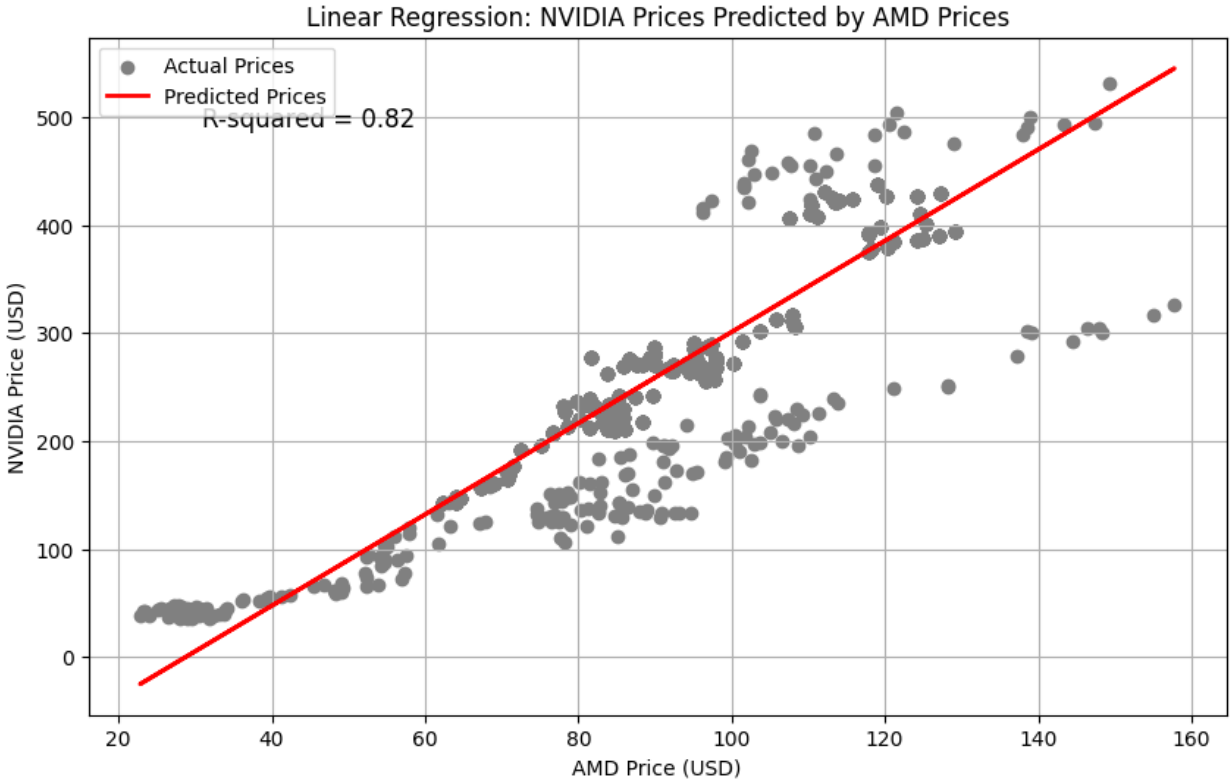

Figure 5: Linear Regression: NVIDIA Prices Predicted by AMD Prices

3.2 NVIDIA Prices Predicted by ASUS Prices

Figure 6 illustrates the linear regression model between NVIDIA and ASUS stock prices. With an R-squared value of 0.48, the model suggests that ASUS prices have a moderate predictive power on NVIDIA prices. The trend line indicates a positive correlation, meaning as ASUS stock prices increase, NVIDIA stock prices also tend to rise.

Figure 6: Linear Regression: NVIDIA Prices Predicted by ASUS Prices

3.3 NVIDIA Prices Predicted by Intel Prices

Figure 7 shows a linear regression model between NVIDIA and Intel stock prices. The low R-squared value of 0.07 indicates that Intel stock prices have little to no predictive power on NVIDIA stock prices. The data points are widely dispersed, demonstrating a weak correlation between the two stock prices.

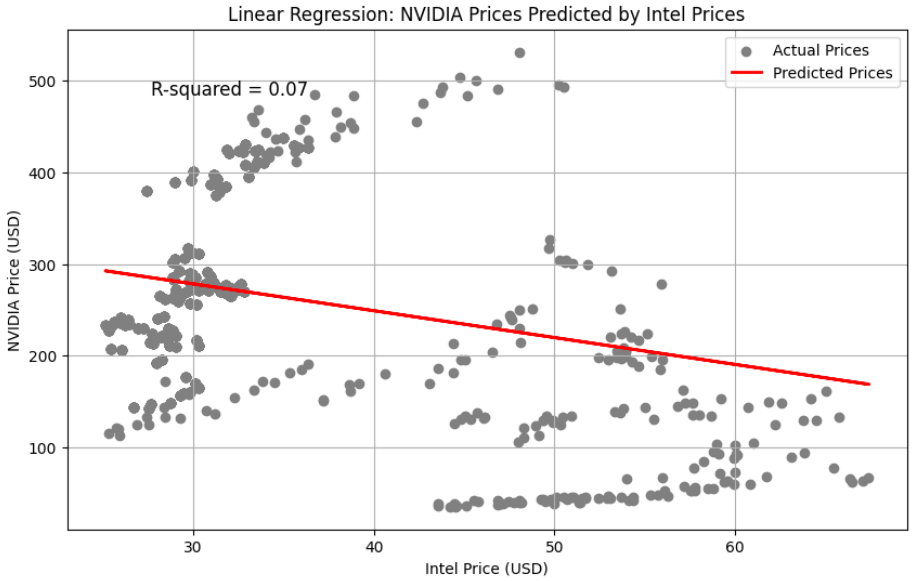

Figure 7: Linear Regression: NVIDIA Prices Predicted by INTEL Prices

3.4 NVIDIA Prices Predicted by MSI Prices

In Figure 8, the linear regression between NVIDIA and MSI stock prices indicates a strong relationship, with an R-squared value of 0.86. This suggests that MSI stock prices are a strong predictor of NVIDIA prices. The data points closely follow the regression line, indicating a strong positive correlation.

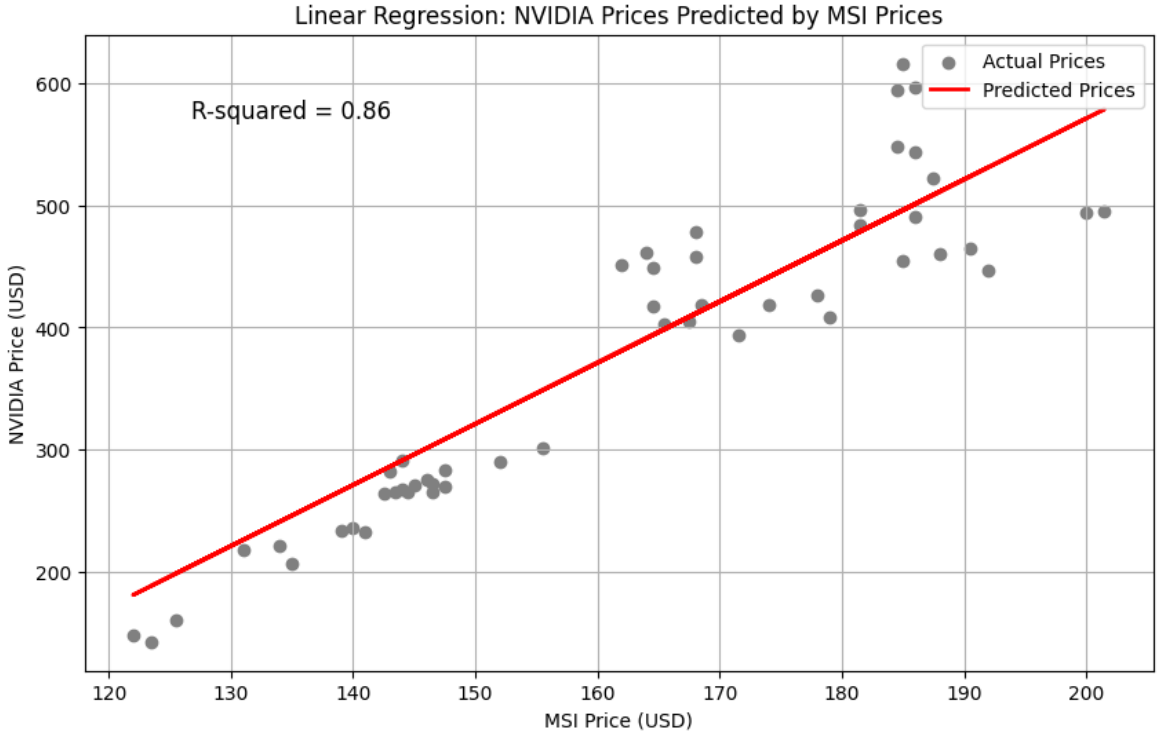

Figure 8: Linear Regression: NVIDIA Prices Predicted by MSI Prices

The regression analyzes reveal varied predictive strengths of ASUS, Intel, MSI, and AMD stock prices on NVIDIA's stock prices. MSI and AMD show strong predictive abilities with high R-squared values, suggesting a close relationship with NVIDIA's stock performance. Conversely, ASUS shows a moderate relationship, and Intel displays minimal predictive power. These insights could be crucial for investors interested in NVIDIA's stock movements based on the performance of these related technology stocks.

The Google Drive Links Project Documents:
https://drive.google.com/drive/folders/1ejesnTvnGR-o1S8qSOxzpQOCIOs8B7Jo?usp=sharing