Foxconn Technology Group Financial Research Project

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1 Introduction

Foxconn Technology Group, also known as Hon Hai Precision Industry Co. Ltd., is a Taiwanese multinational electronics contract manufacturing company. It was founded on February 20, 1974, by Terry Gou in Tucheng, New Taipei City, Taiwan. Foxconn has been a long time manufacturer of Apple iPhones and other apple products. Over the past several years the Tiawanese corporation has quietly expanded it automotive electronics business due to geo-political tensions in the South China Sea. Recently, the company's chairman, Young Lui, announced that Foxconn will start exclusively manufacturing electric vehicles (BBC News)

Foxconn Facilities

The EV market is a fastly growing industry that has influenced growth in non-traditional automotive sectors, such as semiconductor manufacturing and the mining industry. The United States and China's disagreement on issues like Taiwanese statehood and the treatment of the Uighur muslim population have complicated trade relations between the two countries and has made it more difficult for American companies to source needed Chinese manufactured parts for the electronics powering the American information economy. Foxxconn is in the process of shifting it's business model due to this uncertainty, and has already moved some of it's Chinese operations to countries like Vietnam and Mexico.

The Foxconn and Apple partnership has been a lucrative enterprise for both companies, but will Foxconn be able to replicate that success as a car company? Surprisingly, there won't be a car that says "Foxconn" on it anytime soon, because Foxconn is primarily focused on making it's automotive electronics manufacturing base it's core business. In fact, most major car manufacturers already use Foxconn electronic components in their cars, and the Chinese market presents an enormous business opportunity for the EV revolution.

It's difficult to determine what kind of company Foxconn actually is and what kind of market forces impact it's stock price. Has their stock price moved with it's clients over the years? Is the company fundamentally an electronic components company or a car company? The purpose of this project is to compare Foxconn historical financial data to its clients, electronic component manufacturers, car companies, and then predict the stock price using linear regression.

1.1 Background

Initially, Foxconn started as a manufacturer of plastic products and electrical components. However, it gradually expanded its operations and diversified into various electronic products, becoming one of the world's largest contract electronics manufacturers. The company's success can be attributed to its focus on high-quality manufacturing, advanced technology, and cost-effective production.

In the early years, Foxconn primarily operated as an original equipment manufacturer (OEM), producing electronic components and assembling products for major international brands. It established strong partnerships with companies like IBM, Apple, and Compaq, gaining a reputation for its reliability and efficiency.

Foxconn Workers

One of the significant turning points for Foxconn occurred in the late 1990s when Terry Gou recognized the potential of outsourcing electronic manufacturing to China due to its vast labor force and low production costs. This decision led to the establishment of Foxconn's first manufacturing facility in Shenzhen,

China, in 1988. The move to China proved to be immensely successful, as it allowed Foxconn to further expand its manufacturing capabilities and cater to the growing demand from global electronics brands.

Over the years, Foxconn continued to grow rapidly and diversified its operations into different sectors of the electronics industry. It expanded its production lines to include a wide range of products such as smartphones, tablets, laptops, televisions, gaming consoles, and many other consumer electronics devices.

Foxconn's manufacturing facilities are known for their massive scale and high level of automation. The company implemented advanced manufacturing techniques and invested heavily in robotics and artificial intelligence to enhance production efficiency and reduce costs. This emphasis on automation has made Foxconn one of the largest employers of industrial robots globally.

While Foxconn's success brought it significant profits and recognition, it also faced criticisms and controversies. Reports of poor working conditions and labor rights violations at some of its Chinese factories drew international attention and scrutiny. The company has since made efforts to improve labor conditions and has partnered with labor rights organizations to address these concerns.

In recent years, Foxconn has been actively diversifying its business interests beyond contract manufacturing. It has invested in various industries, including robotics, artificial intelligence, cloud computing, and electric vehicles. The company aims to become a leading player in emerging technologies and leverage its manufacturing expertise to develop innovative products and solutions.

2 Import the Data

I will use historical data provided by the yfinance API. The API returns a pandas dataframe of each company's Open, High, Low, Close, and Adj Close prices, as well as the Volume of trades for that day.

Date	Open	High	Low	Close	Adj Close	Volume
2008-03-03	109.445877	111.138336	108.317566	108.317566	72.990013	5268065
2008-03-04	103.804337	111.138336	103.240181	109.163795	73.560257	19835009
2008-03-05	109.445877	111.702492	109.445877	110.010033	74.130486	7251566
2008-03-06	111.984566	117.626106	111.984566	117.626106	79.262589	15788242
2008-03-07	116.497803	118.472336	114.523262	114.805336	77.361809	13329693
2008-03-10	115.651566	116.215721	111.138336	111.702492	75.270950	8157347
2008-03-11	110.010033	112.830795	109.163795	111.702492	75.270950	8393098
2008-03-12	115.933647	117.344032	110.574181	110.574181	74.510635	12149165
2008-03-13	111.138336	111.702492	102.958107	102.958107	69.378525	19530128
2008-03-14	104.368492	105.778877	98.726952	102.111870	68.808289	19106485

Data Import

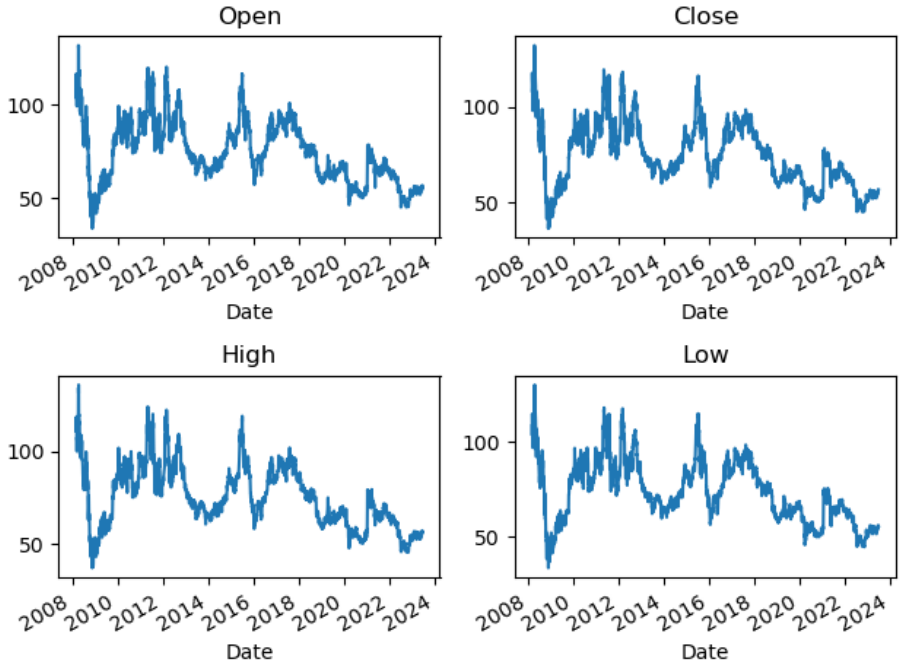
3 Exploratory Data Analysis

In this section we are going to explore and examine the data to uncover patterns, relationships, and insights. This is a critical initial step in the data analysis process. The main goal is to gain a better understanding of the data and its characteristics before applying any formal statistical techniques or building models. Exploratory Data Analysis (EDA) is a critical first step in any data-driven study. The goal of EDA is to understand the structure, distribution, and underlying patterns of the data before applying formal statistical techniques or machine learning models. In this section, we examine historical stock price data to identify trends, volatility, and relationships relevant to Foxconn's market behavior.

The dataset consists of historical daily stock prices, including Open, High, Low, and Close (OHLC) values. These metrics provide insight into intraday price movements, volatility, and overall market sentiment.

3.1 Open, High, Low, Close

This figure visualizes the Open, High, Low, and Close prices of Foxconn stock over time.



Open, High, Low, Close

3.2 Correlation Methodology

To quantify relationships between Foxconn and its clients, we compute the Pearson correlation coefficient, defined as:

$$\rho_{X,Y} = \frac{Cov(X,Y)}{\sigma_X \sigma_Y}$$

where:

- $Cov(X,Y)$ is the covariance between variables X and Y,
- σ_X and σ_Y are the standard deviations of X and Y.

The Pearson coefficient measures linear association and ranges from -1 (perfect negative correlation) to 1 (perfect positive correlation).

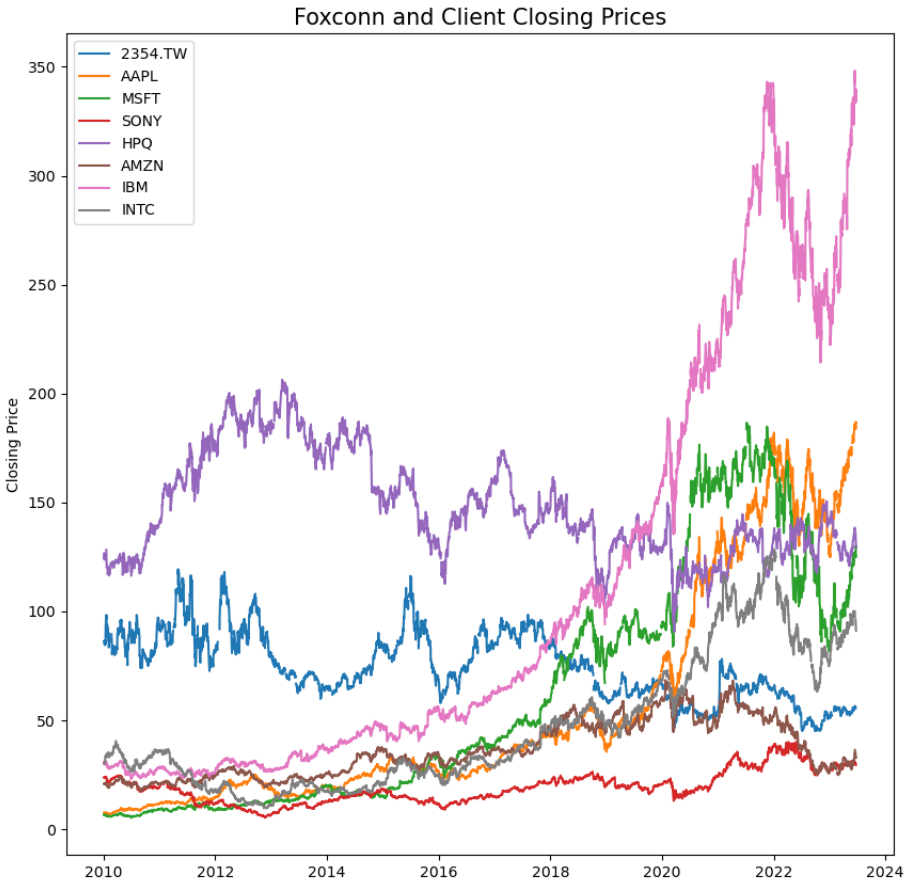
4 Customer Correlation Analysis

At one point, over 50% of Foxconn's revenue was derived from manufacturing electronics for Apple, coinciding with Apple's rise as the most profitable company in history. However, Foxconn serves a diverse client base that includes Microsoft, Amazon, IBM, and other major technology firms. This section investigates whether Foxconn's stock performance is correlated with the performance of its major clients.

The following client companies were selected for analysis:

- Apple (AAPL)
- Microsoft (MSFT)
- Sony (SONY)
- HP (HPQ)
- Amazon (AMZN)
- IBM (IBM)
- Intel (INTC)

Initially, Foxconn was only outperformed by HP. However, during the COVID-19 pandemic, many technology firms experienced substantial growth, leading to higher closing prices across the sector.



Client Closing Prices

Foxconn exhibits a weak positive correlation with IBM but negative correlations with all other clients. In contrast, the technology companies show strong positive correlations with one another, reflecting shared exposure to innovation-driven growth and macroeconomic trends.

Client Correlation Heatmap

These results suggest that Foxconn's stock behavior is driven less by technology-sector growth and more by manufacturing-specific factors such as supply chains, labor constraints, and capital intensity.

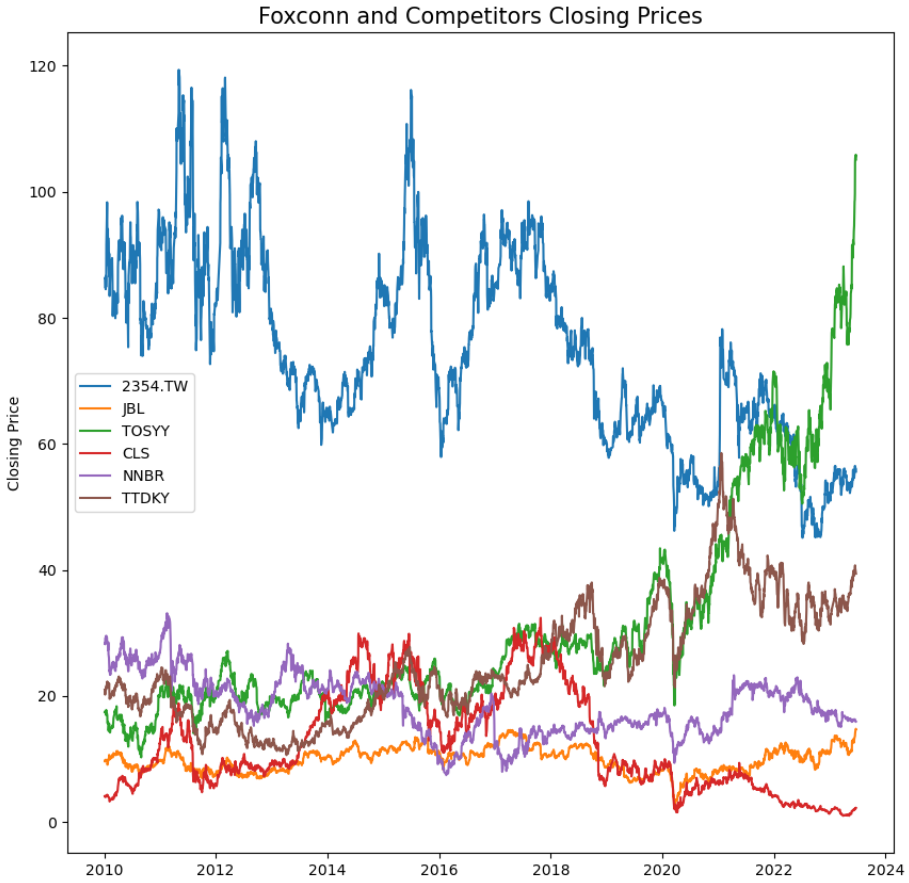
5 Competitor Analysis

Foxconn is widely known as a consumer electronics manufacturer, yet recent strategic statements suggest an ambition to reposition as an automotive manufacturing firm. To assess whether Foxconn behaves more like a manufacturing company than a technology firm, we compare its stock performance with that of direct competitors.

The competitor firms analyzed are:

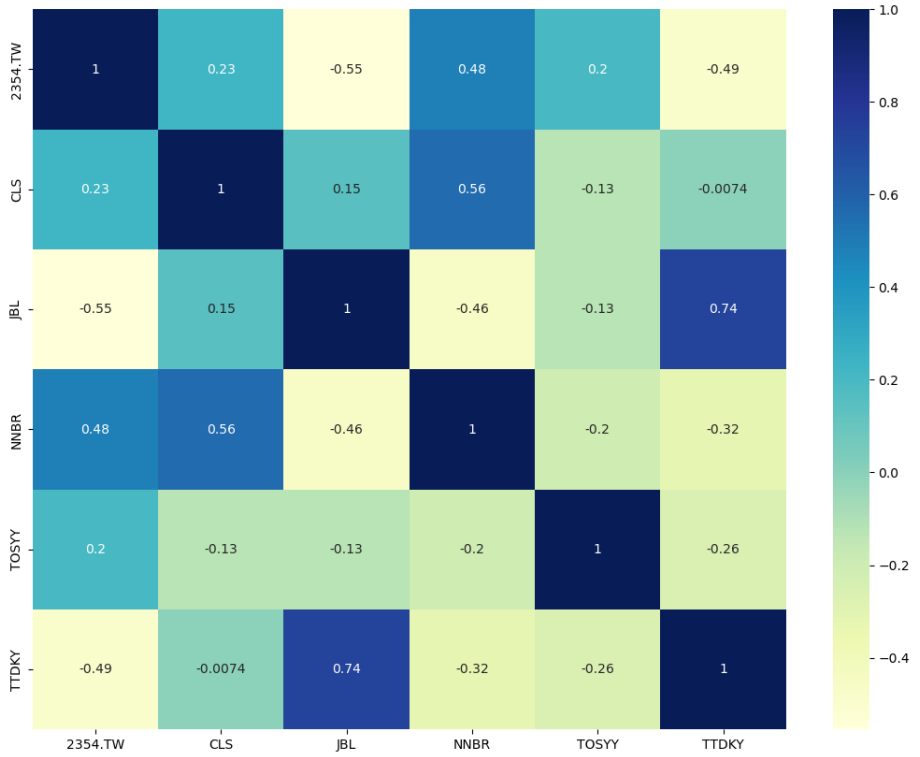
- Jabil Inc. (JBL)
- Toshiba (TOSYY)
- Celestica (CLS)
- NN Inc. (NNBR)

- TDK Corporation (TTDKY)



Competitor Closing Prices

Foxconn's closing price declined steadily during the COVID-19 pandemic, likely due to factory shutdowns, global supply chain disruptions, and China's zero-COVID policy. In contrast, Toshiba experienced a surge similar to technology firms, reflecting its diversified business model across electronics, infrastructure, and semiconductors.



Competitor Correlation Heatmap

The heatmap reveals moderate positive correlations between Foxconn and several competitors, indicating shared exposure to manufacturing-sector risks. Negative correlations with JBL and TDK suggest differences in specialization and geographic exposure.

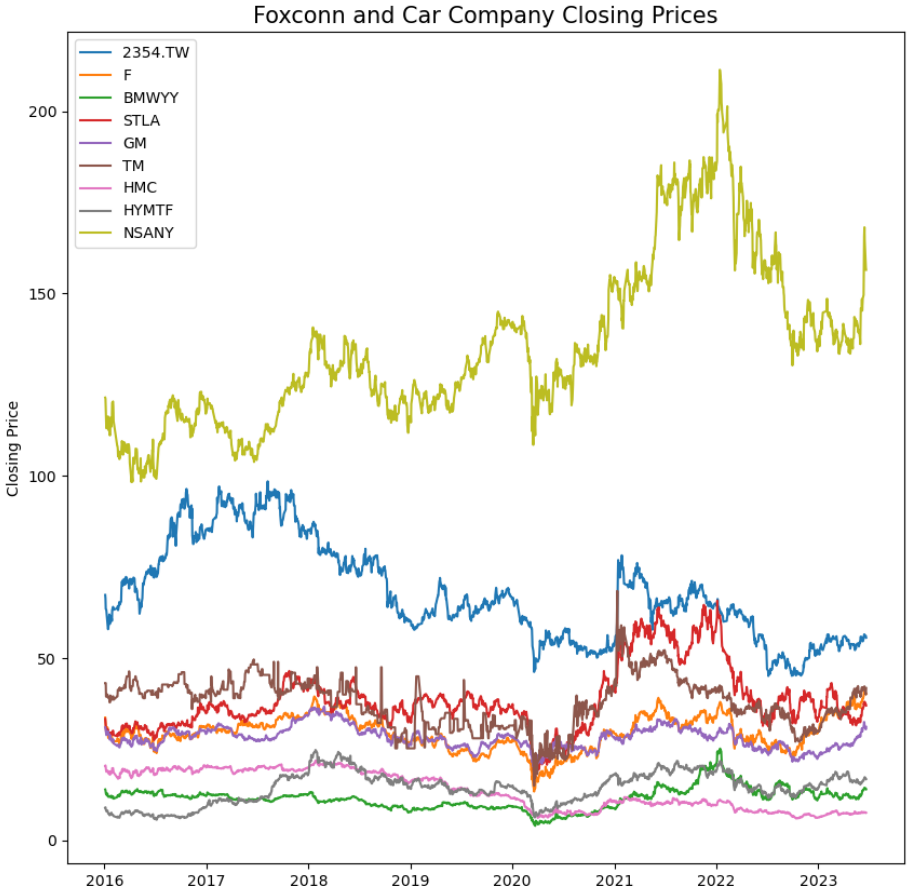
6 Car Company Analysis

Foxconn has increasingly positioned itself as a contract manufacturer for electric vehicles (EVs), aiming to replicate its electronics manufacturing model within the automotive industry. In this section, we examine whether Foxconn's stock behavior aligns with major automobile manufacturers.

The following companies were analyzed:

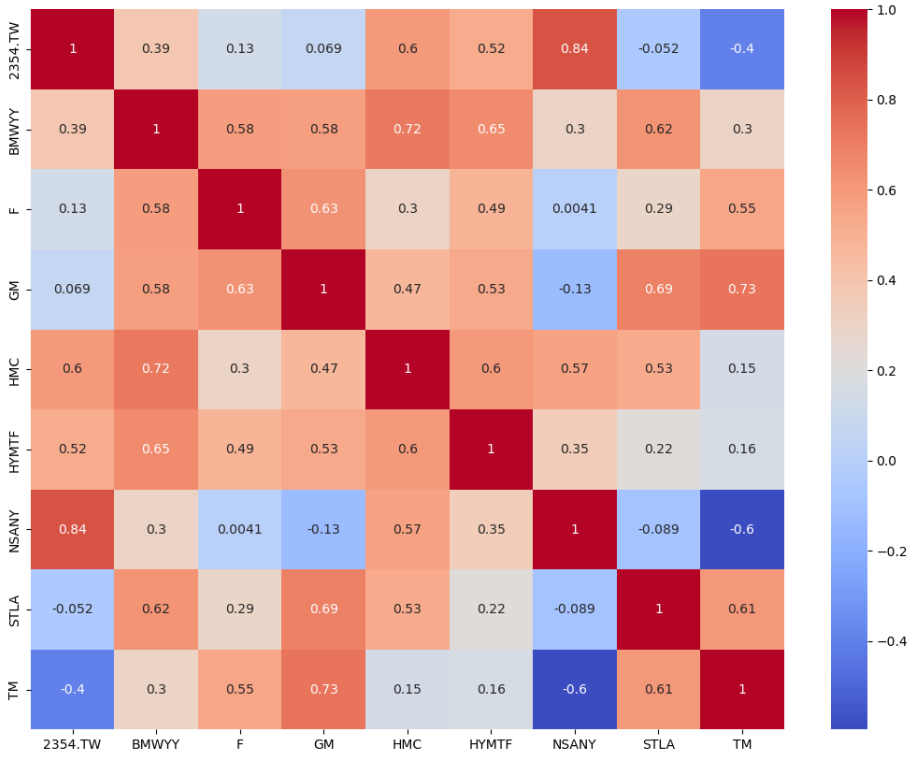
- Ford (F)
- BMW (BMWYY)
- Stellantis (STLA)
- General Motors (GM)

- Toyota Motor Corp. (TM)
- Honda Motor Co. (HMC)
- Hyundai Motor Co. (HYMTF)
- Nissan Motor Co. (NSANY)



Automotive Closing Prices

Although automotive stock prices are generally lower due to capital-intensive operations and large share counts, relative price movements remain informative. Notably, Nissan consistently maintained a higher closing price than Foxconn over the past seven years.



Automotive Correlation Heatmap

Foxconn shows strong positive correlations with Asian automakers, particularly Nissan. These relationships likely reflect existing supplier arrangements and geographic proximity. The strength of these correlations suggests that investors may already be pricing in Foxconn's role in the automotive supply chain.

7 Feature Engineering

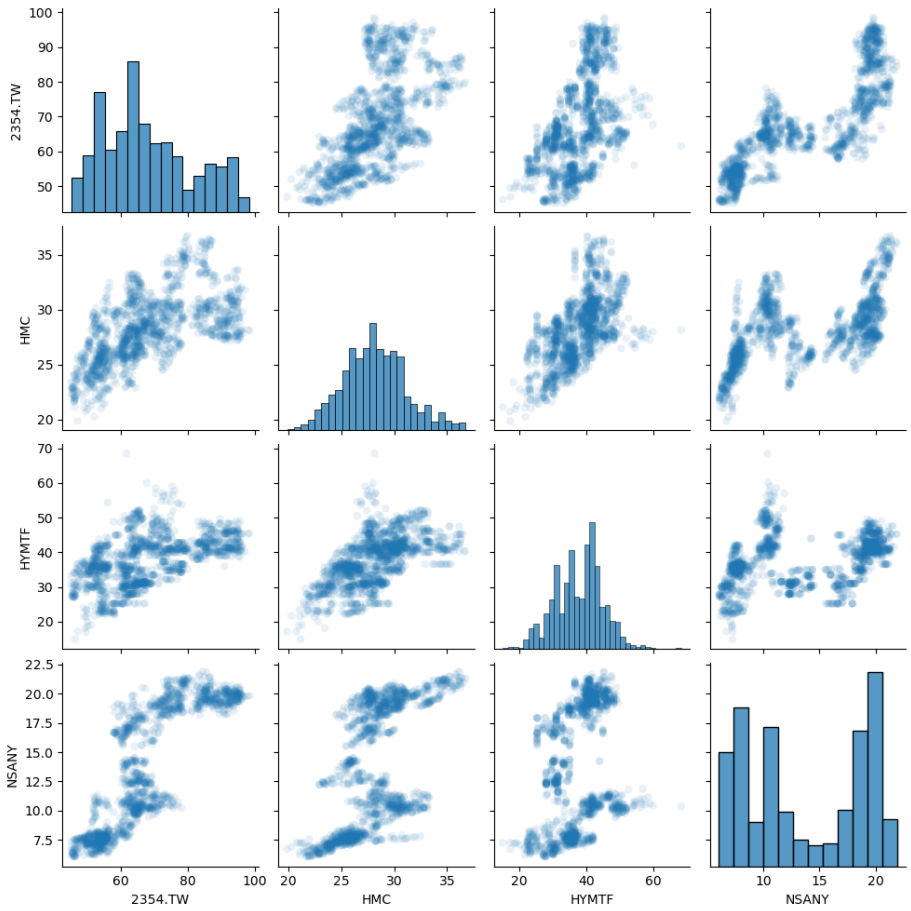
Feature engineering is the process of transforming raw data into informative inputs suitable for machine learning models. Based on the exploratory analysis, Foxconn exhibited strong correlations with several Asian automobile manufacturers. Consequently, a new dataset was constructed containing Foxconn and its most strongly correlated automotive partners.

Restricting the feature space to these firms reduces noise, improves interpretability, and increases the likelihood of meaningful predictive relationships.

7.1 Distribution Analysis

Before applying regression-based models, it is essential to examine the distribution of the features. Many machine learning algorithms implicitly assume

comparable feature scales and benefit from approximately symmetric distributions.



Pairplot of Automotive Closing Prices

The pairplot reveals that the closing prices are not normally distributed and exhibit skewness. As a result, normalization is required prior to model training.

7.2 Normalization

Normalization rescales features to a common range, ensuring that no single feature dominates the learning process due to scale differences. Min–Max normalization was applied using the following transformation:

$$x' = \frac{x - x_{\min}}{x_{\max} - x_{\min}}$$

where:

- x is the original feature value,
- $x_{\min}$ and $x_{\max}$ are the minimum and maximum values of the feature.

This transformation maps all features to the interval $[0, 1]$ while preserving relative differences.

Date	2354.TW	HMC	HYMTF	NSANY
2016-01-04	0.416231	0.659751	0.526759	0.908748
2016-01-05	0.397690	0.645525	0.526759	0.915670
2016-01-06	0.343920	0.615293	0.526759	0.873505
2016-01-07	0.342066	0.571429	0.457335	0.836375
2016-01-08	0.338358	0.535270	0.457335	0.807426
2016-01-11	0.286443	0.563130	0.468750	0.822530
2016-01-12	0.262339	0.594546	0.467814	0.827565
2016-01-13	0.256777	0.583284	0.463136	0.820642
2016-01-14	0.240090	0.598696	0.452844	0.809943
2016-01-15	0.243798	0.543569	0.452844	0.780365

Normalized Dataset

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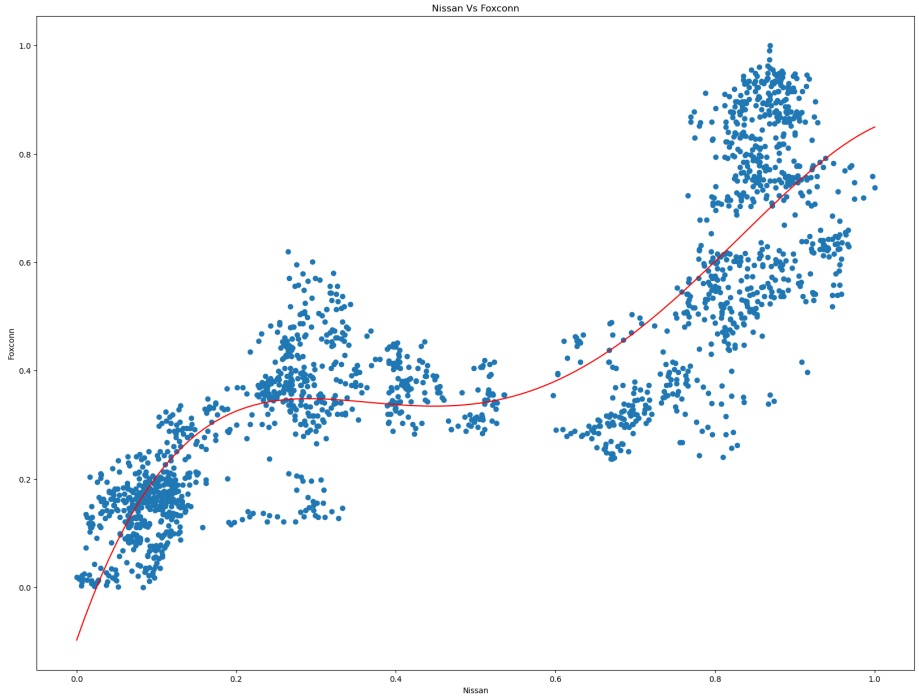
7.3 Bivariate Relationships

After normalization, scatterplots were examined to confirm the relationships between Foxconn and selected automotive manufacturers.

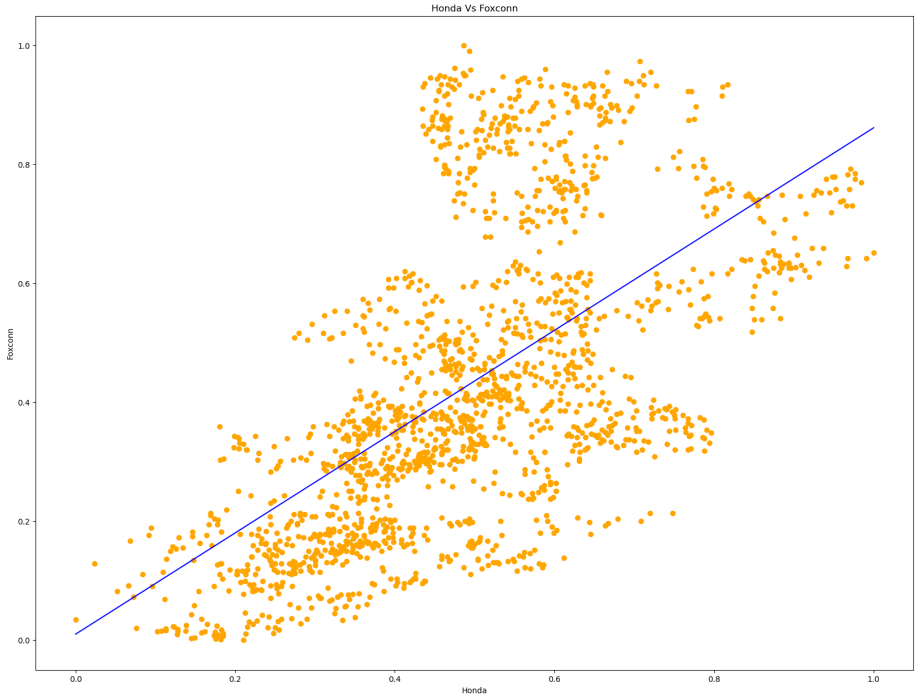
7.3.1 Nissan



Foxconn vs. Nissan

Although slight curvature is visible, the relationship between Foxconn and Nissan is predominantly positive and linear, supporting the use of linear regression models.

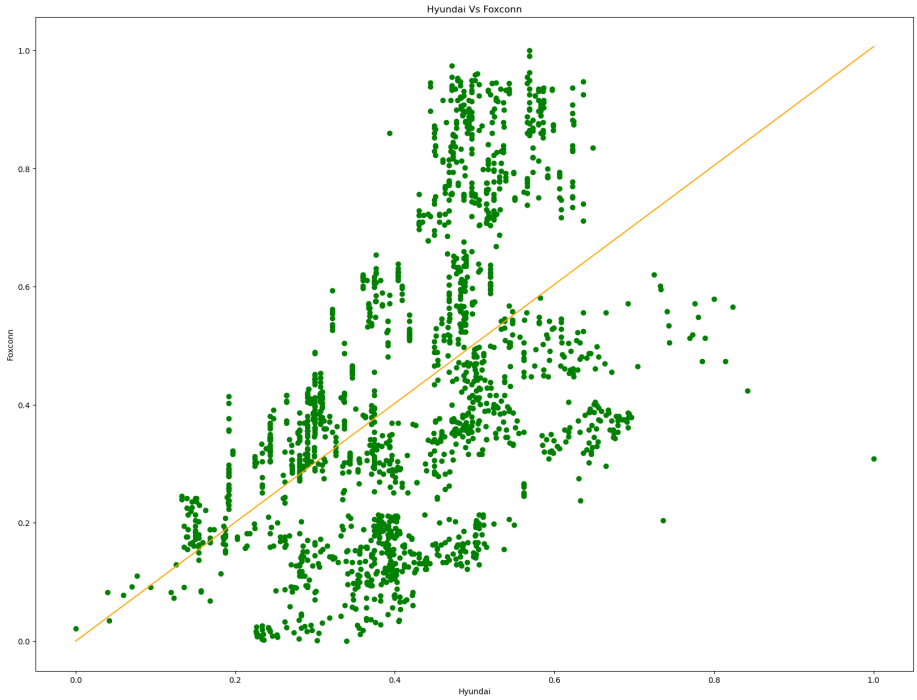
7.3.2 Honda



Foxconn vs. Honda

Honda and Foxconn also exhibit a positive linear relationship, further reinforcing the hypothesis that Foxconn behaves similarly to Asian automotive manufacturers.

7.3.3 Hyundai



Foxconn vs. Hyundai

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8 Machine Learning

With normalized features and confirmed correlations, the data is now suitable for supervised machine learning. The objective is to predict Foxconn's closing price using the normalized closing prices of its automotive partners.

Let:

$$Y = FoxconnClosingPrice$$

$$X = \{Nissan, Hyundai, Honda\}$$

The general linear regression model is defined as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

where ε is the error term.

The dataset was split into training and testing sets to evaluate generalization performance.

```
Number of training samples: 1404
Number of test samples: 352
```

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8.1 Linear Regression Results

Predicted vs. Actual Closing Prices

The predicted values begin to closely track actual Foxconn prices after approximately 2018. This timing suggests a structural shift in Foxconn's business model, potentially aligning more closely with the automotive sector during or shortly before the COVID-19 pandemic.

8.2 Coefficient of Determination (R^2)

The coefficient of determination, R^2, is defined as:

$$R^2 = 1 - \frac{\sum(y_i - \hat{y}_i)^2}{\sum(y_i - \bar{y})^2}$$

An R2 score between 0 and 1 represents the proportion of the variance in the dependent variable that is explained by the model. In our case, an R2 score of 0.77 means that the model explains 77% of the variation in the dependent variable, while the remaining 23% is due to other factors or random variation.

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R^2 Score (Training): 0.76
R^2 Score (Testing): 0.77
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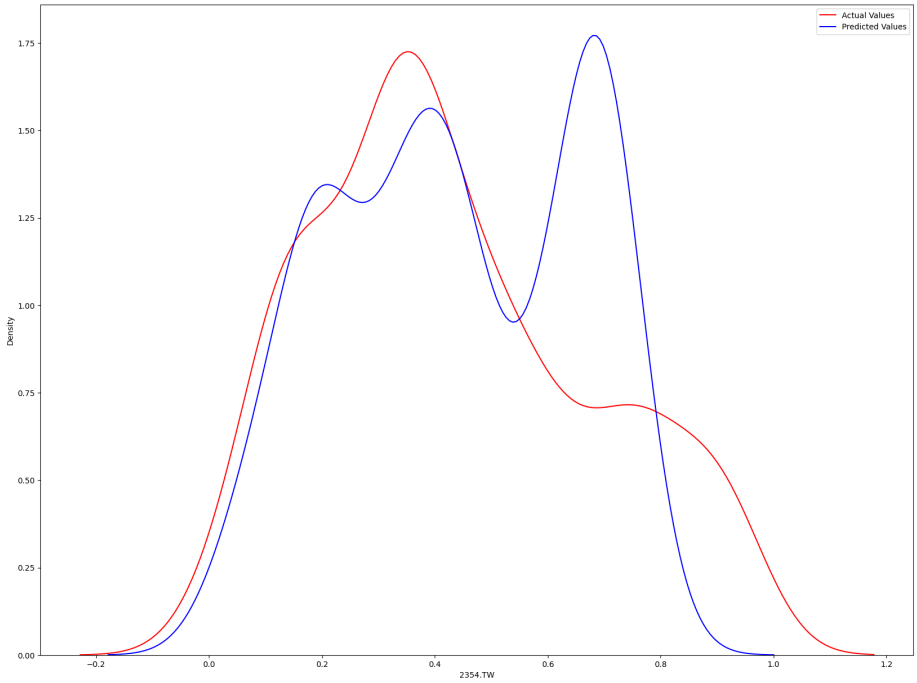


Distribution of Predicted and Actual Values

9 Financial Risk Management

Financial risk analysis evaluates the likelihood and magnitude of potential losses. This section examines Foxconn's volatility, returns, and Value at Risk (VaR).

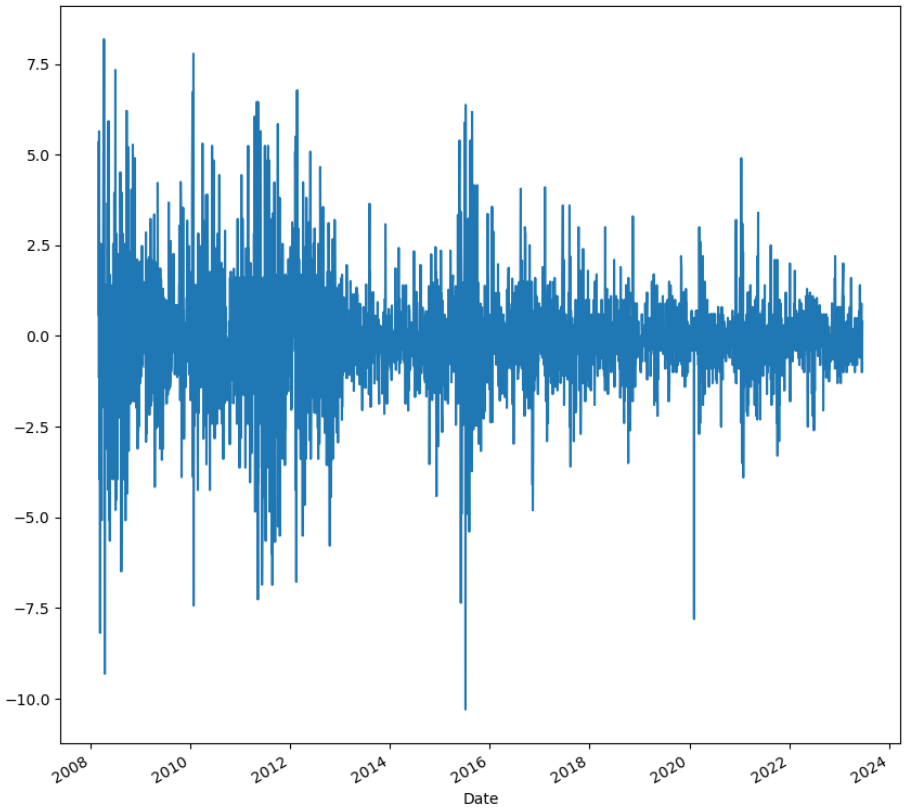
9.1 Daily Change

The daily price change is defined as:

$$\Delta P_t = Close_t - Open_t$$

Date	Open	High	Low	Close	Adj Close	Volume	Daily Change
2008-03-03	109.445877	111.138336	108.317566	108.317566	72.990013	5268065	-1.128311
2008-03-04	103.804337	111.138336	103.240181	109.163795	73.560257	19835009	5.359459
2008-03-05	109.445877	111.702492	109.445877	110.010033	74.130486	7251566	0.564156
2008-03-06	111.984566	117.626106	111.984566	117.626106	79.262589	15788242	5.641541
2008-03-07	116.497803	118.472336	114.523262	114.805336	77.361809	13329693	-1.692467

Daily Change Dataset

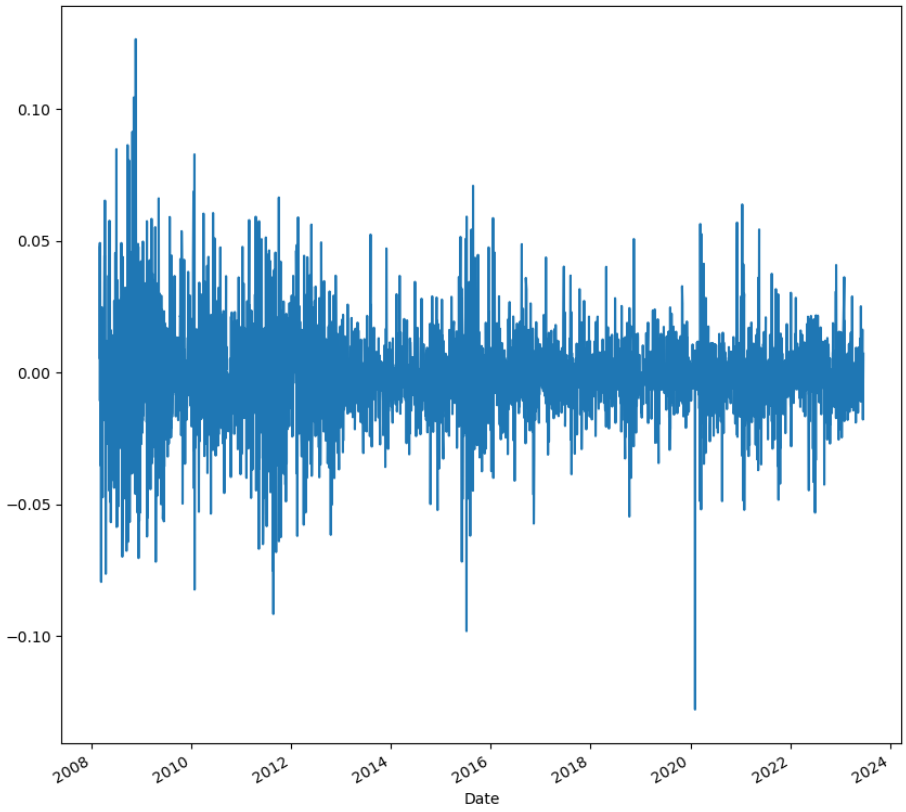


Daily Change Plot

9.2 Daily Return

Daily return measures relative price change:

$$R_t = \frac{\Delta P_t}{Close_t}$$



Daily Return Plot

Foxconn's volatility appears to decline over time, particularly during the pandemic, suggesting increased operational stability.

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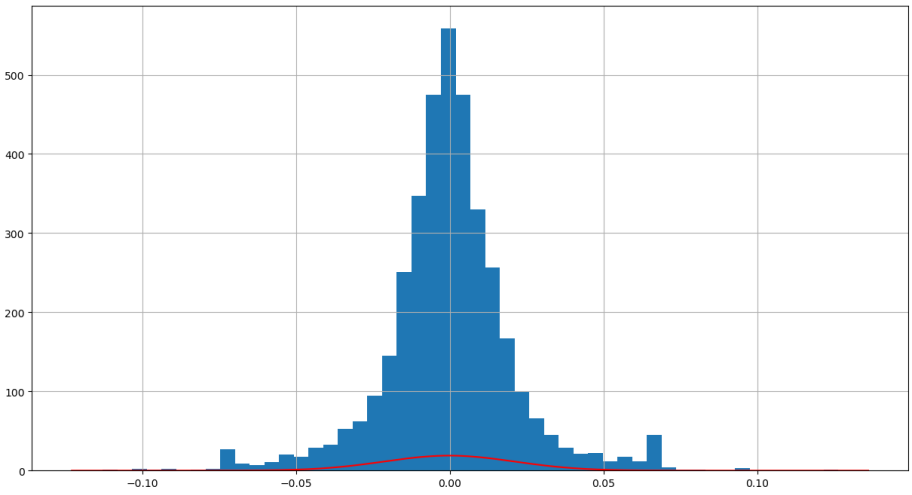
9.3 Log Return

Logarithmic returns are defined as:

$$r_t = \ln\left(\frac{P_{t+1}}{P_t}\right)$$

Log returns are additive over time and often approximately normally distributed.



Log Return Distribution

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9.4 Value at Risk (VaR)

Value at Risk estimates the maximum expected loss at a given confidence level α:

$$VaR_\alpha = \mu + \sigma\Phi^{-1}(\alpha)$$

For Foxconn, the one-day VaR at the 5% level is:

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Single day VaR = -0.03
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This implies a potential loss of approximately 3 cents per dollar invested in a single trading day.

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10 Moving Average Trading Strategy

10.1 Direction Feature

A direction indicator was engineered as:

$$D_t = \{\, 1 \; if R_t > 0 - 1 otherwise$$

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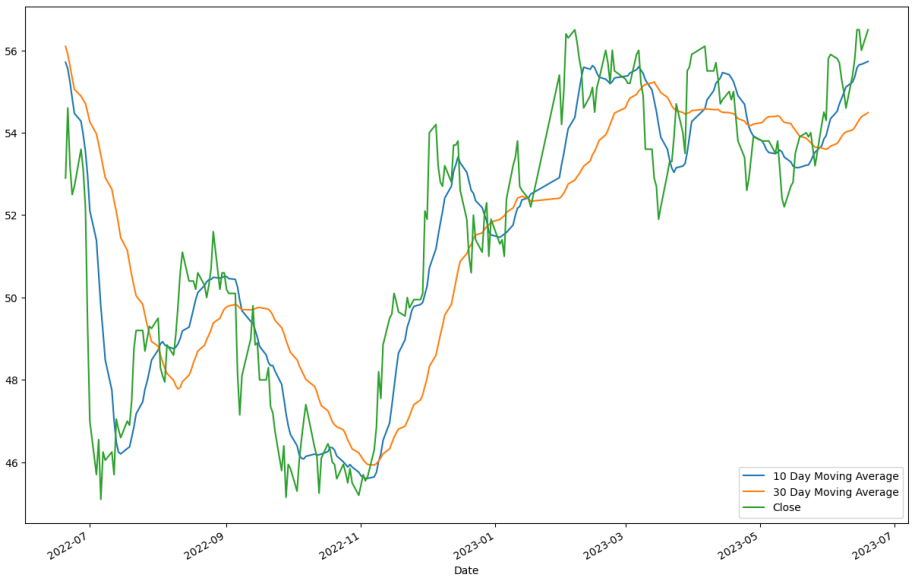
10.2 Dual Moving Average Strategy

Two moving averages were computed:

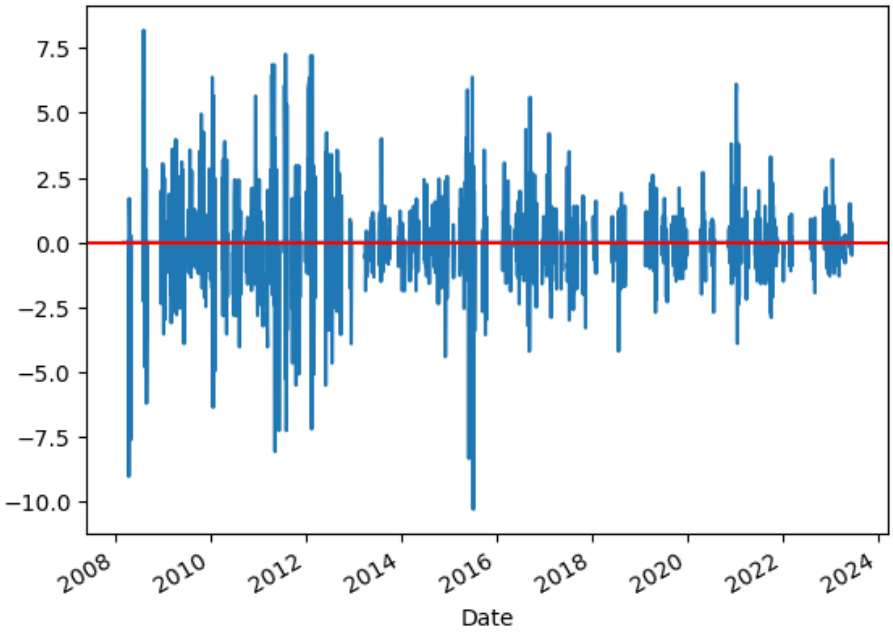
$$MA_{10}(t), \quad MA_{30}(t)$$



10-Day and 30-Day Moving Averages

The trading signal is determined by the relative positions of a short-term and a long-term moving average. When the 10-day moving average exceeds the 30-day moving average ($MA_{10} > MA_{30}$), it signals positive momentum, indicating that recent price changes are outpacing longer-term trends. This condition triggers a long position, as it suggests the emergence of an upward trend. When the inequality no longer holds, the position is exited, reflecting a potential weakening of momentum or trend reversal.

10.3 Backtesting



Trading Signals

Strategy Profit and Loss

The strategy results in a net loss of $44, indicating limited effectiveness for Foxconn during the observed period.

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11 Summary

Foxconn operates as an automotive manufacturer, though not in the traditional sense. Rather than designing vehicles, it specializes in large-scale contract manufacturing. This structural similarity explains why Foxconn's stock exhibits stronger correlations with Asian automotive firms than with major technology companies.

The transition toward automotive manufacturing has reduced volatility and stabilized daily returns. However, financial risk analysis indicates that Foxconn remains a high-risk investment due to the low-margin and highly cyclical nature of the automotive industry.

Using the normalized closing prices of automotive partners, Foxconn's stock price was predicted with moderate accuracy. Future research should investigate whether this structural shift was an intentional strategic decision or an emergent consequence of pandemic-era disruptions, as well as the roles of supply chain constraints and Apple's transition to in-house silicon.