

# EV Stock Price Analysis from Constituent Data

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## Problem / Hypothesis

The relationship between the market for precious metals and the valuation of electric vehicle technologies is valuable in its potential to assist in the advancement of preferred transport solutions. With this in mind, we hypothesize:

- The volatility of the closing stock price of companies directly involved with electric vehicle manufacturing are generally equivalent to that of traditional technology companies.**
- It is possible to predict the average price of electric vehicle manufacturing stocks on a given day based on the same day value of lithium, gold, and oil.**
- Changes in electric vehicle manufacturing stock prices over time are most affected by changes in the price of lithium, rather than the price of oil.**

## Dataset

- Price data for four asset categories collected: **Oil, Gold, Lithium**, and 19 EV-related stocks
- Price data for analysis isolated between post-crash **March 2020** through **February 2022**; **~500 data points**
- EV-related stock prices combined to form the "**aggregate EV stock price**" from a market-cap-weighted average of security prices for a given day

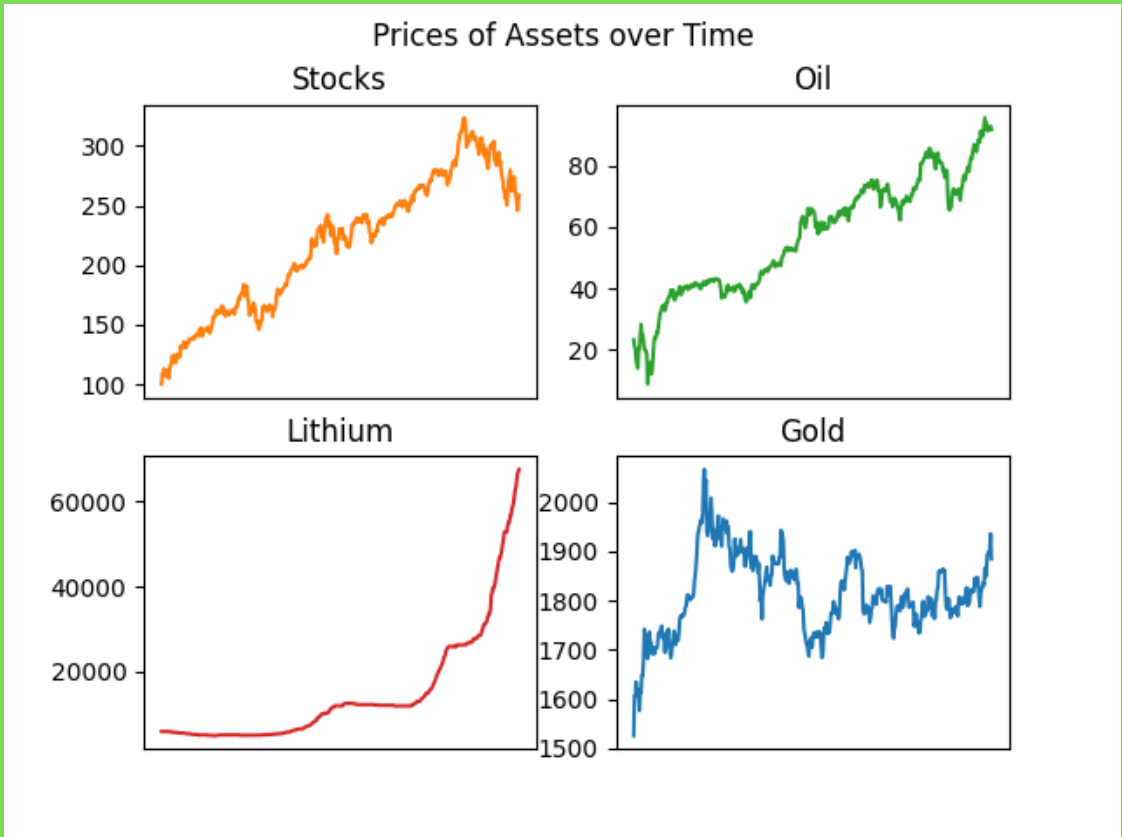


Figure 1: Price of each asset class over time (March 2020 through February 2022)

## Methodology

To analyze the volatility between traditional technology companies and focused EV companies, a Bartlett's test was performed.

To determine whether or not aggregate EV stock prices could be predicted using historical oil and precious metal data, multi-linear regression was performed and validated using K-fold cross validation along an 80/20 split. In evaluating accuracy, mean square error was quantified, as well as a more general analysis of movement direction . Multi-linear regression was also used to resolve our third hypothesis. Evaluation of this model was accomplished by analyzing the resulting mean squared error and the root mean squared errors.

## Results

**Outcome 1: linear regression trained with oil, gold, and lithium historical price data is unable to accurately predict aggregate EV stock prices**

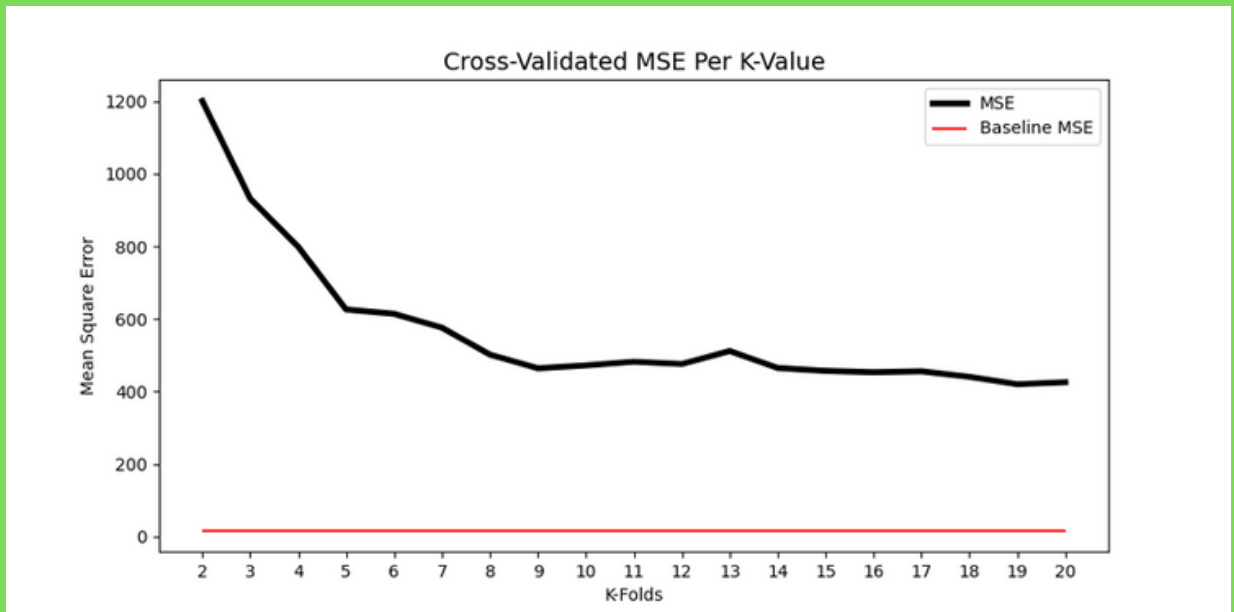


Fig. 2 Mean Square Errors: The regression trained with Oil, Gold, and Lithium historical price data is unable to accurately predict aggregate EV stock prices, as illustrated by the MSE values calculated.

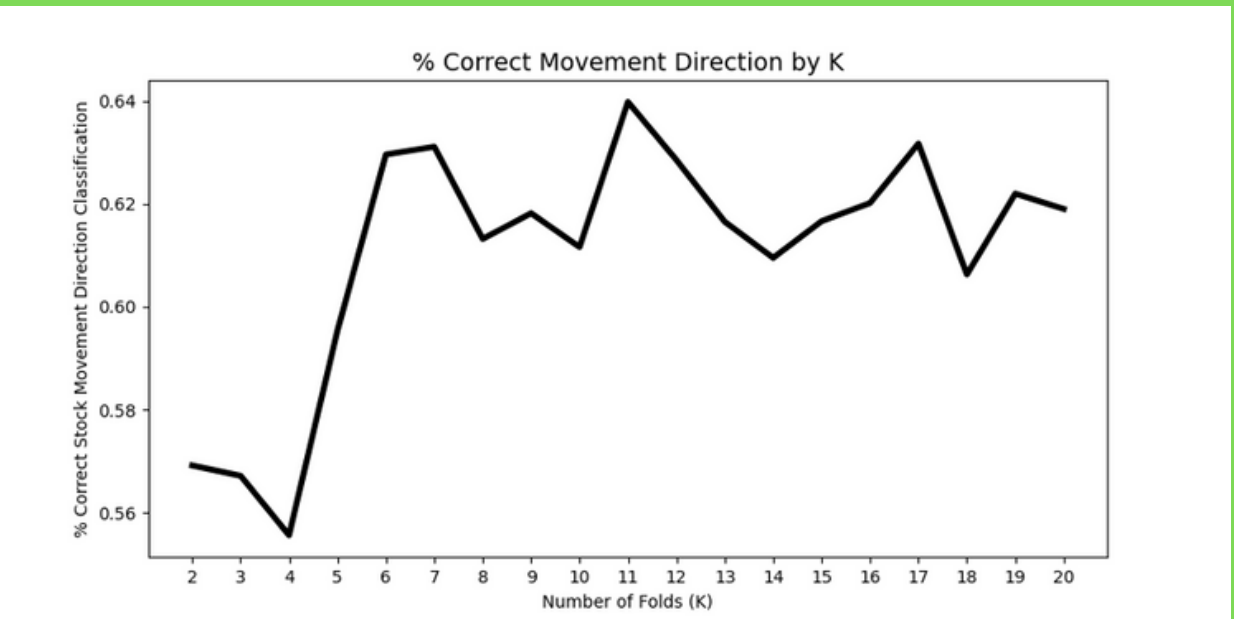


Fig. 3: Movement Direction: When looking at just the direction of predictions generated by the model, we can see that multi-linear regression was at most 65% accurate.

**Outcome 2: the variances of closing stock prices between general technology companies and electric vehicle manufacturing companies are statistically different, implying that their volatilities are also different.**

Bartlett's results ( $p = 0.11$  and test statistics of 2.52) indicate that there is a significant difference between the variances of these two populations.

Variables	MSE
Oil AND Lithium to EV Stocks	381.2
Lithium to EV Stocks	397.8
Oil to EV Stocks	1933.6

**Outcome 3: Multi-linear regression modeling of closing stock price was stronger with lithium than oil**

MSE values attained of the multilinear regression indicate that lithium prices may have a greater impact than oil prices upon the valuation of these industry members. Error was seen to be far greater between just oil and EV stock.

## Significance / Limitations

Our analysis seems to indicate that in a limited timeframe, the price of gold and lithium are positively associated with the performance of public companies involved in the production of vehicles that rely on gold and lithium as capital goods. This is a reasonable outcome when understood in the context of the massive increase in demand for EVs across the United States. However, our study of EV stock prices and the variables that affect them rely on a few key underlying assumptions.

The first, which is common in any analysis of stock prices in that subset of the market is indicative of broader trends. The DRIV ETF consists of 19 key EV-related stocks, however, the electrical vehicle market is composed of hundreds of other public or unlisted private companies that contribute to the total value of the industry.

Similarly, our analysis of precious metals was limited to gold and lithium. Our intention was to analyze a broader range of metals involved in EV production, however, such datasets are difficult to acquire because of financial barriers.