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Using Monthly Electric Vehicle Sales to Predict Lithium Future Sales

Core hypothesis

Main Hypothesis:

- I believe rises in global electric vehicle sales lead to positive returns in lithium prices and any lithium-related stocks.

Null Hypothesis(H0):

- Changes in electric vehicle sales do not predict changes in future lithium pricing.

Alternative Hypothesis(H1):

- Positive changes in electric sales are positively associated with lithium stock returns.

Testable version:

- I believe that if more electric cars are sold during the month, lithium prices might go up in the following month. I plan to test if this pattern is real or just a coincidence, while taking into account things like oil prices and overall economic activity.

Asset Class:

In this project, the main asset is hard commodities, especially lithium. Commodities are raw materials or natural resources that are traded in markets. Similarly, oil, gold, and other metals. Lithium is a key commodity because it is a critical material used in batteries for electric vehicles, phones, and renewable energy sources.

Because lithium is directly tied to EV production, changes in EV sales can affect the lithium market demand and therefore directly affect lithium pricing. However, the thing about lithium is that it doesn't trade directly like gold or oil since there are limited open markets for it. This leads researchers and investors to often use related equities, such as stocks, as proxies for lithium prices.

For example:

- **The Global X Lithium & Battery Tech ETF(ticker: LIT)** invests in major lithium producers and battery companies.
- Individual lithium mining stocks like **Albemarle(ALB)** and **Livent(LTHM)** can also represent lithium exposure

Alpha Signal: "Change in EV sales"

If global EV sales suddenly increase, it suggests stronger future demand for lithium. I can use the percentage change from the previous month to the current month to find the formula for the growth rate:

$$\text{signal_t} = (\text{EV_t} - \text{EV_}\{t-1\}) / \text{EV_}\{t-1\}$$

Some alternative forms I can use to possibly smooth noise:

1. Log difference:

$$\text{Signal_t} = \log(\text{EV_t}) - \log(\text{EV_}\{t-1\})$$

2. Smoothed verison(3 month average):

$$\text{Signal_t} = (\text{EV_t} + \text{EV_t2} + \text{EV_t3}) / 3$$

3. Standardized Z-Score:

$$\text{Signal_t} = \text{EV_growth} - \text{EV_mean} / \text{standard deviation}$$

My prediction target:

- Once I have this signal, I can test if I can predict next month's lithium returns:
$$\text{Lithium Return_t+1} = a + b * \text{EV sales growth_t} + \text{controls} + e$$
- A = average baseline return of lithium
- B = how much lithium return changes when EV sales grow by 1%
 - If $B > 0$ and statistically significant, my hypothesis holds.
- Controls = additional factors or variables that I need to take into account. Things that might affect EV sales are oil prices, industrial production, previous lithium pricing, and inflation.
- E = Error term. Any random noise that I might observe, or any possible regulations that are placed on the EV.

Timeline

- Period: I will be looking at data from 2016 to 2024 to use to backtest
- Frequency: I believe that month to month will be the best possible timeframe. Anything shorter, I think I will have too much variable noise, and anything farther apart I will miss out on possible gains
- Reasons: This covers some of the most important years of EV innovation and provides enough observations for testing.

Key Datasets:

Data Type	Purpose	Source
EV Sales	Main predictor	IEA, EV-Volumes

Lithium Prices, ETF	Measure target returns	Yahoo Finance, Quandl
Oil Pricing	Control for market trends	EIA, FRED
Industrial Production Index	Control for economic growth	FRED, OECD
Past lithium Returns	Control for momentum	Calculated from price data

Possible Weaknesses:

Small sample size, less than 10 years of data.

Lithium batteries can also be used for things other than EV sales.

There can be a lot of noise in the lithium ETF since it holds a basket of stocks.