CRYPTO CONNECTION

FAC- Technical Finance task
Strategy used- Moving average convergence divergence

The second cryptocurrency I chose to perform lead-lag analysis with bitcoin is ethereum. To start with the python code, I first imported the necessary libraries I later used in my code, which were numpy, pandas, matplotlib and yahoo finance. I first downloaded the historical price data of both the cryptocurrencies from yfinance for the timeframe provided (2021-01-01 to 2023-06-15).

Then, to begin with the lead-lag analysis, I calculated the correlation value of the two closing price series of bitcoin and ethereum using the '.corr' function.

Then, to analyze whether bitcoin leads or lags ethereum, I calculated the correlation coefficient of bitcoin and ethereum on assuming

1. Bitcoin lags behind ethereum.
2. Bitcoin leads ethereum.

Upon analyzing the results in both the cases, I found that the correlation increases in the case where I assume bitcoin leads ethereum, and decreases in the case where I assume bitcoin lags behind ethereum. So the first inference is that bitcoin leads ethereum. Now, to calculate the price lag between ethereum and bitcoin, I analyzed the correlation value while assuming different lags. I found that the correlation value increased until assuming a lag of 24, and started decreasing thereafter. Hence the second inference is that bitcoin leads ethereum by 24 days.

Now, in strategy generation part, I generated buy sell signals twice as follows:

1. Using only MACD on ethereum.
2. Using MACD on bitcoin, and using these signals on ethereum with a price lag of 24 days.

To start with strategy building, I first defined a MACD function, which gives the data frame consisting of macd line, and signal line of stock. To generate macd line, I took the difference between 12 day and 26 day moving average of the stock, and to generate signal line, I took a 9 day moving average of the macd line values.

Next, I generated buy/sell signals for both the cases, and calculated all the required parameters, which were total return, annualized return, max drawdown and sharpe ratio.

RESULTS FROM BACKTESTING:

METRIC	DIRECT TRADING	LEAD-LAG TRADING
Total Return	223.44%	602.22%
Annualized Return	62.91%	169.56%
Max Drawdown	-55.12%	-48.57%
Sharpe Ratio	5.08	3.27

NOTE:

- The data extraction and strategy generation part of the code was the same as dealing with stocks, but the key difference was in the backtesting. While dealing with stocks, we need to ensure that the number of stocks one can buy is an integer, but this is not the case in dealing with cryptocurrency.
- One thing worth mentioning is that while generating signals, I ensured the fact that once a 'BUY' or 'SELL' signal is generated, the loop would ignore all the signals of the same type until a signal of the opposite type is generated. This thing reduces the number of signals drastically. To solve this problem, one alternate method that can be used is the 70% method. In this method, we would use only 70% of the total money present with us at each action. In this way, after one BUY signal, we can still buy the crypto with 70% of the remaining amount, and hence maybe increase our returns.