Arc Stone Capital Internship Exercise

Background

The VIX index is a measure of 30-day implied volatility on the S&P 500 index. The VIX itself is only a measure of the volatility and cannot be traded directly. Plays on volatility can be expressed through S&P 500 options, VIX futures, and VIX options. For simplicity sake, this exercise will only use VIX futures. The VIX futures contracts are cash-settled contracts, meaning the purchaser of the contract is entitled to the cash-value of the contract at its expiry. There are usually 8 open contracts at any one given time and their values fluctuate with Spot VIX, but do not necessarily move completely in sync.

Futures are specific contracts traded on an exchange with a specific maturity date. A "futures curve" is determined by plotting the time to maturity on the X-axis and value of the contract on the Y-axis.

This data and exercise will be similar to the types of analysis required in the internship.

Data

Along with this set of instructions you will have two files: "data.csv" and "expiry_dates.csv".

"data.csv" contains 30 minute bar data on the S&P 500 Index, VIX Index, and a series of VIX futures. Each futures contract has an expiration date, which can be found in the "expiry_dates.csv".

*NOTE: there may be gaps in the data, please ignore those gaps in your return calculations

Objective

The goal of the exercise is to determine how the VIX futures curve behaves in market selloffs (a market selloff is when the S&P 500 Index drops in value). You will need to load the data into a python editor (notebook is fine) and manipulate the data to analyze, fit, model, and plot the relative movement of the futures contracts in a market selloff.

Feel free to use any python libraries you may find necessary. (pandas, numpy, matplotlib, datetime are sufficient) and also use any methods you would like.

You will need to determine two models.

Model #1 - The behavior of the VIX Index vs. the behavior of the SPX index.

Model #2 - The behavior of the VIX futures price movements vs. VIX index levels and time to maturity.

Please include a brief explanation, stating your observations, assumptions, and conclusions of the exercise.

Result

Python File(s) or Python Notebook

Charts/Plots & Brief Conclusion Summary

Hints:

Convert Data to Daily

Be specific about what constitutes a market selloff (>2%?, >3%?) and over what time frame