wids report

Dheer

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1.Week1

Here I learnt the basic principles of pairs trading and some basic mathematical terms reagarding the same like Stationarity, how to test for it using ADF test,what is cointegeration and the difference between cointegeration and correlation, also explored the Engle-Granger test for cointegeration.
Also learnt about feature engineering and how we use various features to create trading signals.
Also learnt what exactly is a regression model and how overfitting can affect the performance of a regression model.

2.Week2

We learnt about the mathematics behind Hurst's test and how it can be used to find whether a time series is time reverting or not and how to calculate the half-life for mean reversion for a time series.

We also learnt the mathematics behind the Kalman filter an how it estimtates the state of a dynamic system from previous noisy observations.Also learnt what is hedge ratio and used it to calculate the spread between two stocks
Implemented the Kalman filter using the Pykalman library and created a backtest function which calculated the cumulative return's and the Sharpe ratio for a pair of stocks.

3.Week 3

Here we learnt the ways in which we can mmanage the risk of our portfolio, such as stop-loss orders, position sizing and portfolio diversification
Also learnt about Risk-adjusted return measures like sharpe ratio and sortino ratio, which help calculate the performance of a strategy while taking into account the risk.
Learnt about volatility and it's different types and how it is used to apply a variance threshold strategy wherein a predefined threshold of variance of the spread is used to determine whether to initiate or close a trade.

Project

Here we applied the various concepts we learnt upto now, 1.First we imported the data of the top30 stocks on the NASDAQ stock exchange.
2.We found out the cointegerated pairs of stocks and then sorted them to create 3 kinds of portfolios:
i) Portfolio1 contains only the most cointegerated pairs of stocks.
ii) Portfolio2 contains the top5 most cointegerated pairs
iii) Portfolio3 contains the top5 least cointegerated pairs
3.Created function to backtest the pairs and allocated capital to the stocks in a portfolio and compared profits of all 3 portfolios.
4.Also tested the portfolio 1 and 2 both with risk management and without risk management techniques.

Here is the final PNL value and graph of the cumulative PNL of some of the portfolio's I have traded on:-
All the portfolio's here are traded in the time period 2010 to 2019.
1.Portfolio 1(Consists of only the most cointegerated pairs of stocks from NASDAQ.

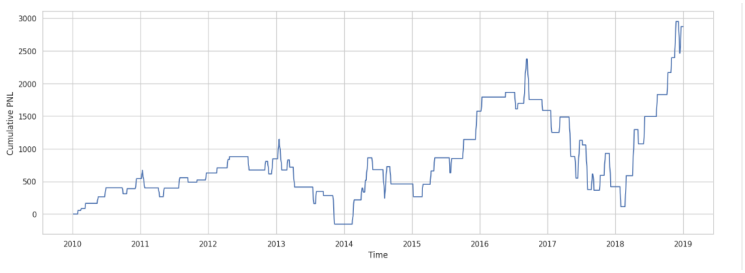

Figure 1: Cumulative pnl graph of the most cointegerated pair

The total profit of this stock was : 2871.936497018185
2.Portfolio 2(Consists of the top 5 most cointegerated pairs of stocks from NASDAQ.

Figure 2: Cumulative pnl graph of the portfolio containing the top5 most cointegerated pairs

The total profit for this portfolio was: 4483.410691

Comparision between the single pair of stock and portfolio containg top5 most cointegerated pairs of stock's and portfolio containing top 5 least cointegerated pairs

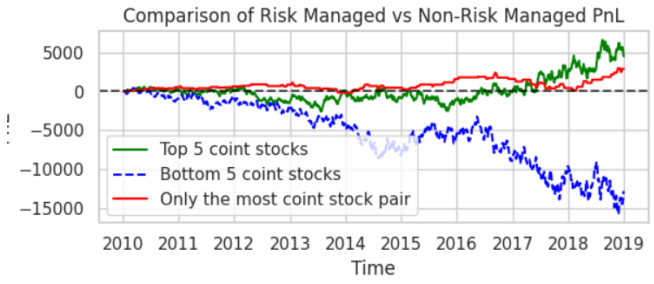

Figure 3: Compraision between single pair and portfolio

Traded the most coint pairs both using risk management and without risk management techniques:-

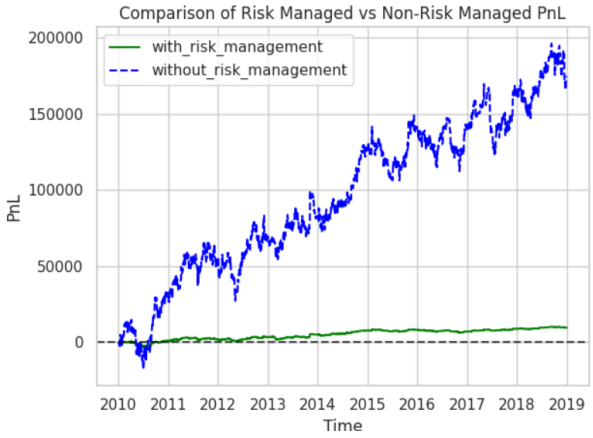

Figure 4: Risk management vs without risk management (portfolio1)

Trading the portfolio containing the top5 most coint pairs using risk management techniques and without risk management.

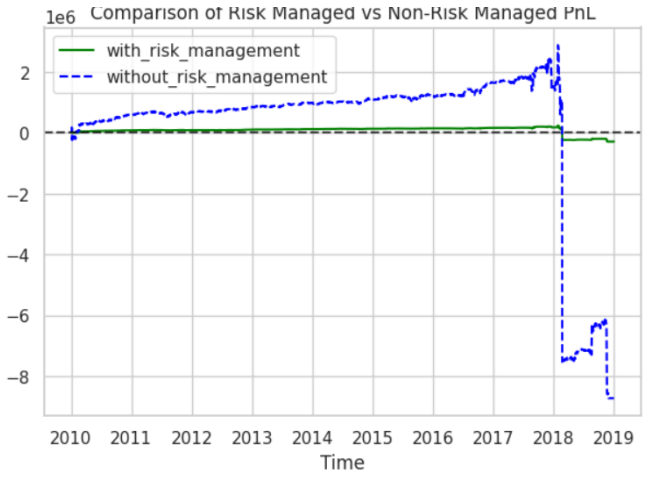

Figure 5: Risk management vs without risk management (portfolio2)

Such a huge loss in this portfolio in 2018 was due to a single pair of stock, which lost it's cointegeration in 2018.
Without that pair this was the cumulative pnl of the stock.

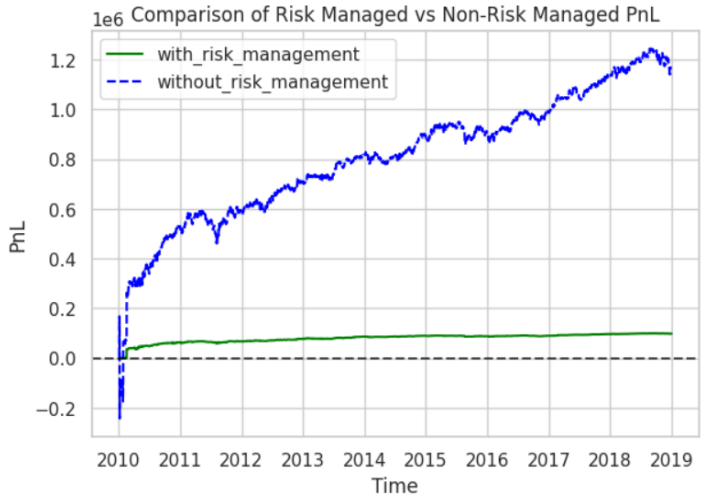

Figure 6: Portfolio 2 without the pair of stock's causing losses