

James Grandin

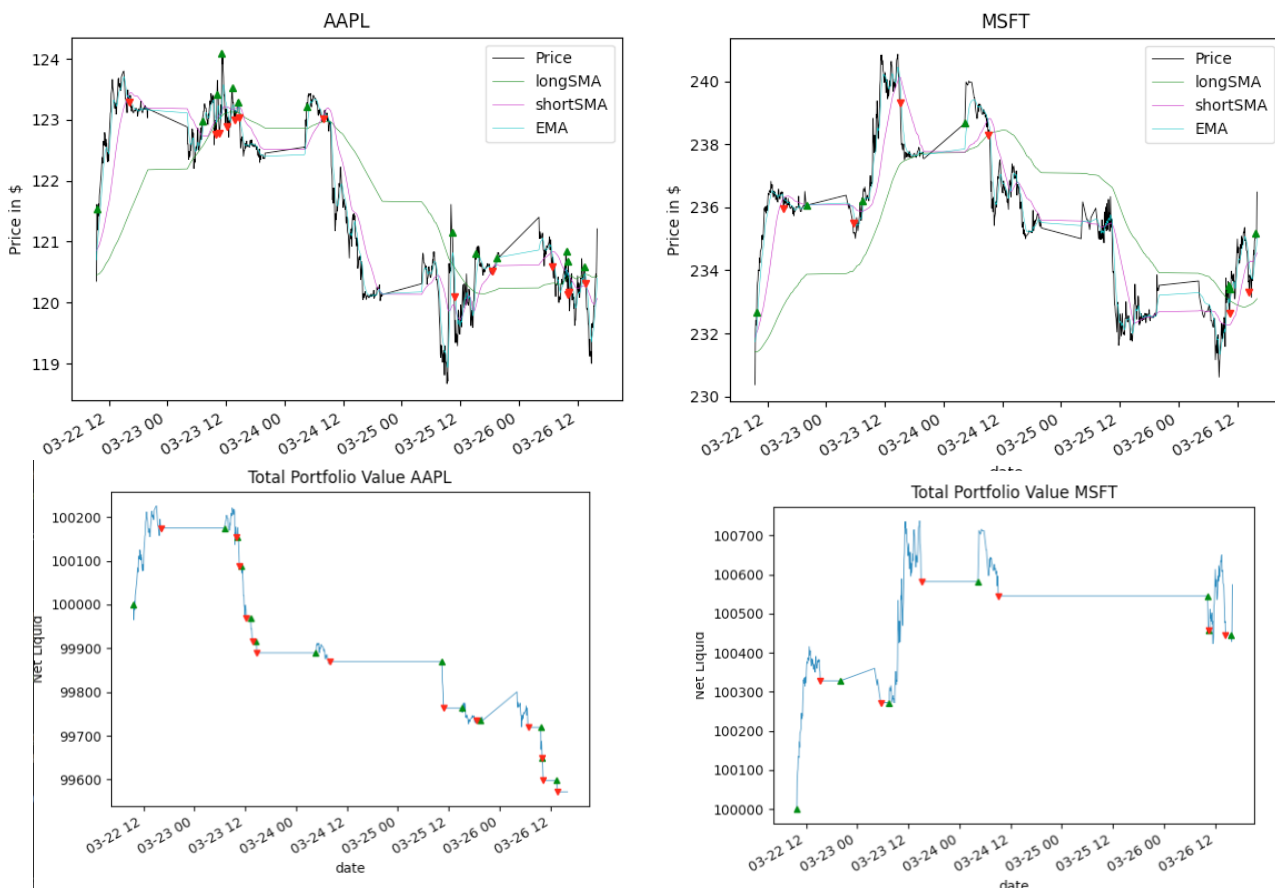
April 11, 2021

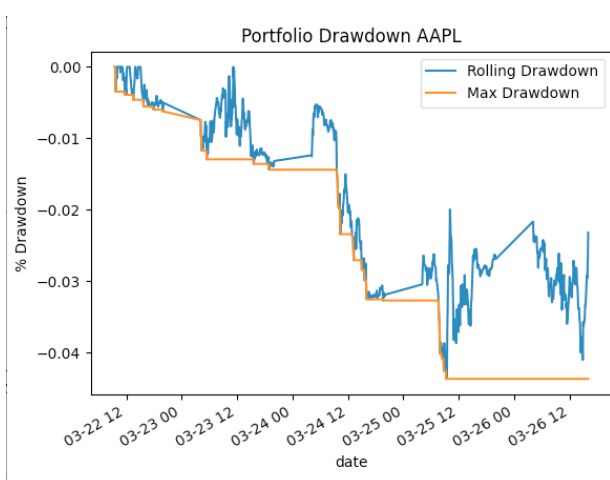
## Moving Average Cross Backtest Short Report

I felt that it was more important to build the starting infrastructure for a back-testing system rather than try to generate signals for a complicated algorithm that would likely be unprofitable anyway, so I chose to test a simple, long only moving average cross over strategy. This algorithm is applied to the 5-minute time frame and signals a BUY condition when the 10 EMA crosses over the 50 SMA and a SELL condition when it crosses back below. This only occurs if the 10 EMA is currently trading above to 200 SMA, to try to filter out trade signals when the market is showing signs of weakness. The system also triggers a BUY when the 10 EMA crosses above the 200 SMA, signifying a change in momentum to the upside, and generates a SELL signal when the 10EMA crosses back below either the 50 SMA or the 200 SMA, whichever comes first.

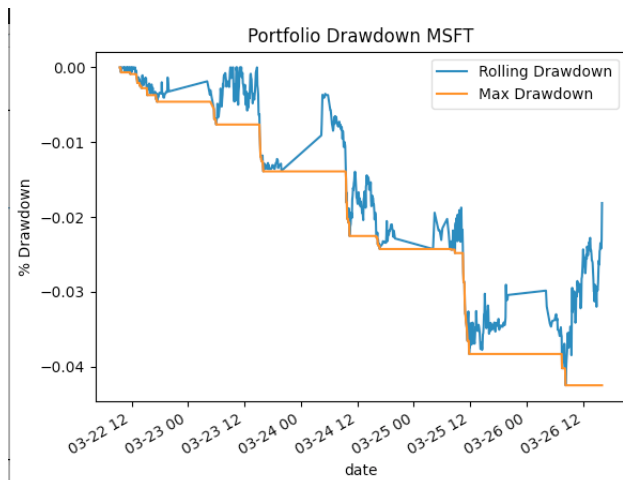
### Basic Analysis on Returns

Because this was more of a proof of concept for me, I ran tests on 2 equities over a week long period to gather some initial data for some basic portfolio analysis. Below are the results of the testing: (The red and green arrows overlaid on the graphs signify the buy and sell signals)





sharpe ratio for AAPL is -1.033332856690279



sharpe ratio for MSFT is 0.7696218924355421

As you can see, the results are lack luster. Though the signals generated by MSFT ended up making the week profitable, the sharpe ratio was about 0.77. At minimum, a sharpe of 1.0 is desired for confidence in a trading system. The results for AAPL during this period were undesirable to say the least. With a sharpe of -1, no one would let this model loose in a live market environment. Many of the losses took place during periods of choppy price action. If I can figure out a way to stop producing trading signals during periods of sideways action (perhaps when the 200SMA has a slope = 0) this system might have a better chance at being profitable, but even then I have my doubts. Though the early signs from this testing are negative, much more rigorous analysis is needed to determine the validity or invalidity of this strategy.

### Future Plans

This was a great learning experience, but there is significant room for improvement of this system.

First: this system does not account for slippage during order execution. Trading only very liquid securities could mitigate this problem, but simulating slippage would add more accuracy to any future models.

Second: this system only tests for one position at a time. I would like to integrate a portfolio weight functionality so that I can test a portfolio the has multiple holdings concurrently. This would more effectively simulate a real-world portfolio.

Third: I knew from the start that this system had a low chance for success. It is a low hanging fruit strategy in the world of algo trading, so any alpha using this strategy is likely competed

away if it was even profitable in the first place. With this in mind, I would like to test more complex algorithms involving volume indicators (volume is one of the most important things to take note of in my opinion). I also want to test more advanced statistical analysis techniques and machine learning models when I get a little further in my education.

### **Things to Fix**

The most significant bug arises when a sell order is generated before a buy order at the beginning of a testing period. This causes the portfolio's net liquid column to not initialize correctly. I need a way to filter out sell signals in the dataframe until the first buy order is generated. I'm sure that this can be done relatively simply, I just need to sit down and figure it out and things have been a little busy this past week.

A second thing I noticed is that many of the massive losing positions were due to overnight gap downs and a delayed response of the moving averages to these moves. If I can filter periods of time that aren't during live market hours, I think that I can significantly limit potential losses.

Then, there is the issue of data. The current method used to request data from the API I have access to only returns 1-2 months of data. Much more data is needed to produce enough independent random samples to properly assess a model's accuracy and potential for return. This just requires some research into available alternatives, but many databases with quality intraday data are behind a paywall, and for this test I didn't feel it was necessary to drop the cash.

### **Conclusion**

Overall, this was a great learning experience. Though the performance of the strategy lack luster based on my very limited analysis and the system needs a lot of work, I am excited to make future improvements and explore the world of automatic trading systems more deeply.