PROJECT REPORT

FINANCIAL TRADING STRATEGY

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Contents

1 INTRODUCTION

This project aims at building a model that will ideally always output successful bids in the stock market. For that, it builds a model which gives better results when constantly trained in a sliding-time window. The goal is to design a simple financial trading strategy that will be profitable and that will provide a good risk-adjusted measure of return.

2 DATA SETS

Two datasets will be used here to test the strategy:

- The American Electric Company (AEP) dataset from Quandl

Open	High	Low	Close	Volume	Ex-Dividend
32.00	32.00	31.12	31.44	396900	0
31.38	31.94	31.38	31.81	325500	0
31.81	33.12	31.81	33.00	392200	0
32.75	33.69	32.75	33.19	433000	0
33.38	33.75	33.06	33.62	250500	0
33.62	33.81	33.44	33.50	307700	0

- The Chesapeake Energy Corporation (CHK) from Quandl.

Open	High	Low	Close	Volume	Ex-Dividend
2.31	2.38	2.25	2.25	369700	0
2.19	2.25	2.06	2.06	719400	0
2.12	2.19	1.94	2.06	807100	0
1.94	2.12	1.94	2.12	444900	0
2.06	2.12	2.06	2.06	207400	0
2.06	2.12	2.06	2.12	166700	0

An initial exploration of the AEP dataset reveals 5 important fields:

- The date
- The Open price
- The High price
- The Low price
- The Close price.

Some of the issues encountered with the data:

- The presence of the adjusted closing price was confusing for some methods in the packages Quandstrat and xts, as those methods kept throwing errors. I had to remove

the adjusted closing price from my data sets and just keep the closing price
- Some functions and arguments were not found because the Quandstrat package is not yet stable.

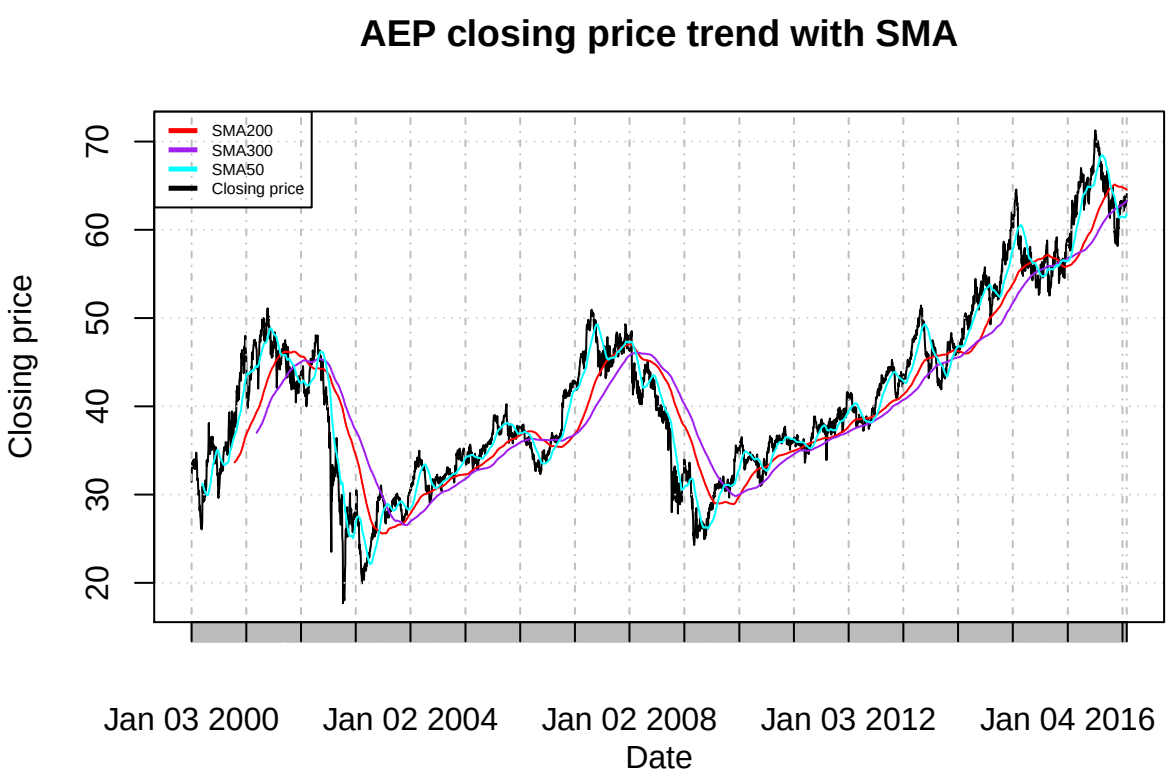
3 PRELIMINARY EXPLORATION

Indicators are transformations of market data that give an insight into the overall market behavior by measuring current conditions and/or forecasting trends. Among others, there are trend-following indicators which depict the general price direction, and oscillators used to discover on a scale of 0 to 100 short-term overbought (above 70 to 80) or oversold (below 30 to 20) conditions . Combining trend-following indicators and oscillator/reversion indicators gives more insight into the data for this project. The preliminary oscillator used is an RSI (Relative Strength Index) with a 3-days lookback period. The preliminary trend indicators are 3 SMA (Simple Moving Average). After applying those indicators to the stocks, there are some periods of time during which none of the indicators seem to be right.

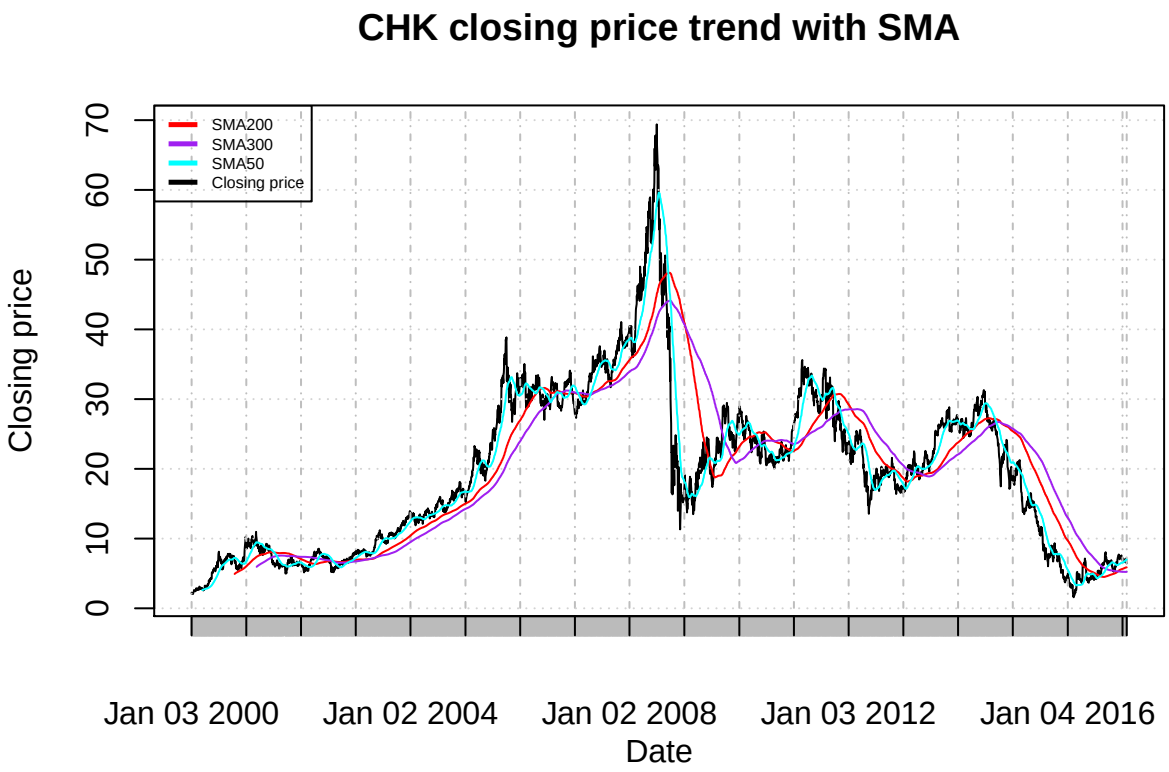
3.1 TREND-FOLLOWING INDICATORS: SIMPLE MOVING AVERAGES

The SMA50 (Simple Moving Average) seems to better mimic the trend of the closing prices for both data sets

- SMA AEP


AEP closing price trend with SMA
SMA200
SMA300
SMA50
Closing price
Closing price
20
30
40
50
60
70
Jan 03 2000
Jan 02 2004
Jan 02 2008
Jan 03 2012
Jan 04 2016
Date

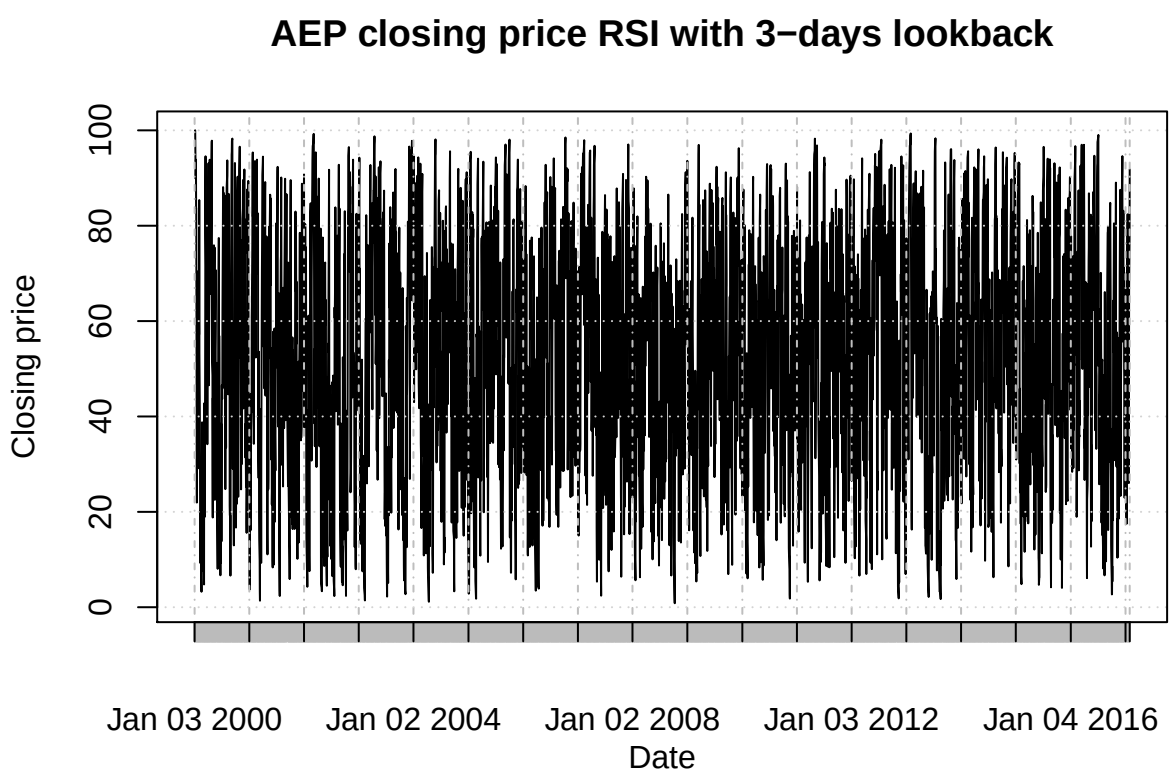
- SMA CHK



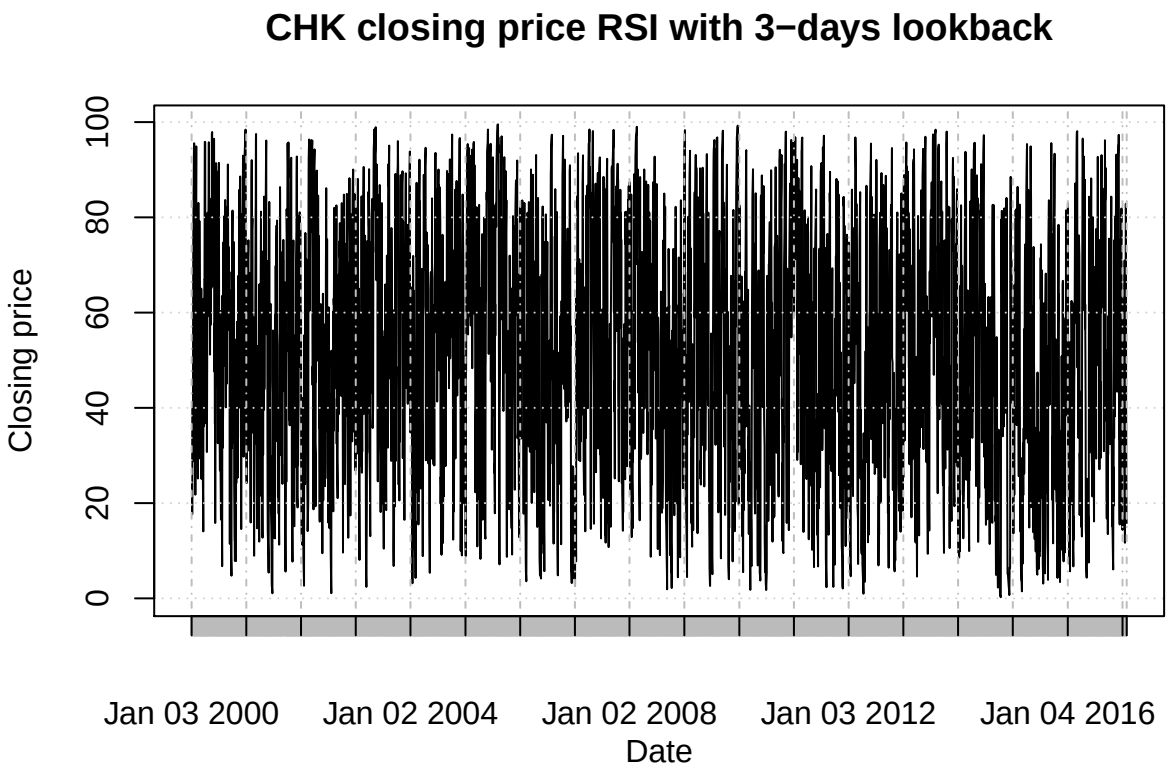
3.2 OSCILLATOR/REVERSION INDICATOR: RSI

An observation of the graphs of the stocks' RSI reveals that there are effectively periods of reversion (2013-09-03 to 2013-9-05 for example) that won't be captured by a trend-following indicator:

- RSI AEP


AEP closing price RSI with 3−days lookback
Closing price
0
20
40
60
80
100
Jan 03 2000
Jan 02 2004
Jan 02 2008
Jan 03 2012
Jan 04 2016
Date

- RSI CHK



4 APPROACH

The main objective is to obtain a profit factor above 1 after running the strategy on each of the data sets. The approach here would be to combine both SMA50 and SMA200 with an oscillator to avoid false signals. The trend-following indicators would help catch up trends. The analysis is done on 13 years, from January 01s, 2013 to December 31st, 2016 . The time is Eastern time and the currency is US dollar.

4.1 STRATEGY 1: RSI

"RSI Strategy", the initial strategy for this project, uses simple averages (over 50 days and over 200 days) with a custom RSI_3_4 indicator acting as an average between RSI3 and RSI4 . Signals help interpret how indicators interact with the market and with each other. Those signals are:

- a comparison and a crossover , which show a buy signal when the 50-day simple moving average is above the 200-day simple moving average and show a sell signal when the 50-day simple moving average crosses below the 200-day simple moving average

- a threshold, which an oversold condition, thus a buy opportunity, for RSI_3_4 below 20, and an overbought condition, thus a sell opportunity, for RSI_3_4 above 80
- a combined comparison and threshold to buy when the 50-day simple moving average is above the 200-day simple moving average and RSI_3_4 is less then 20.

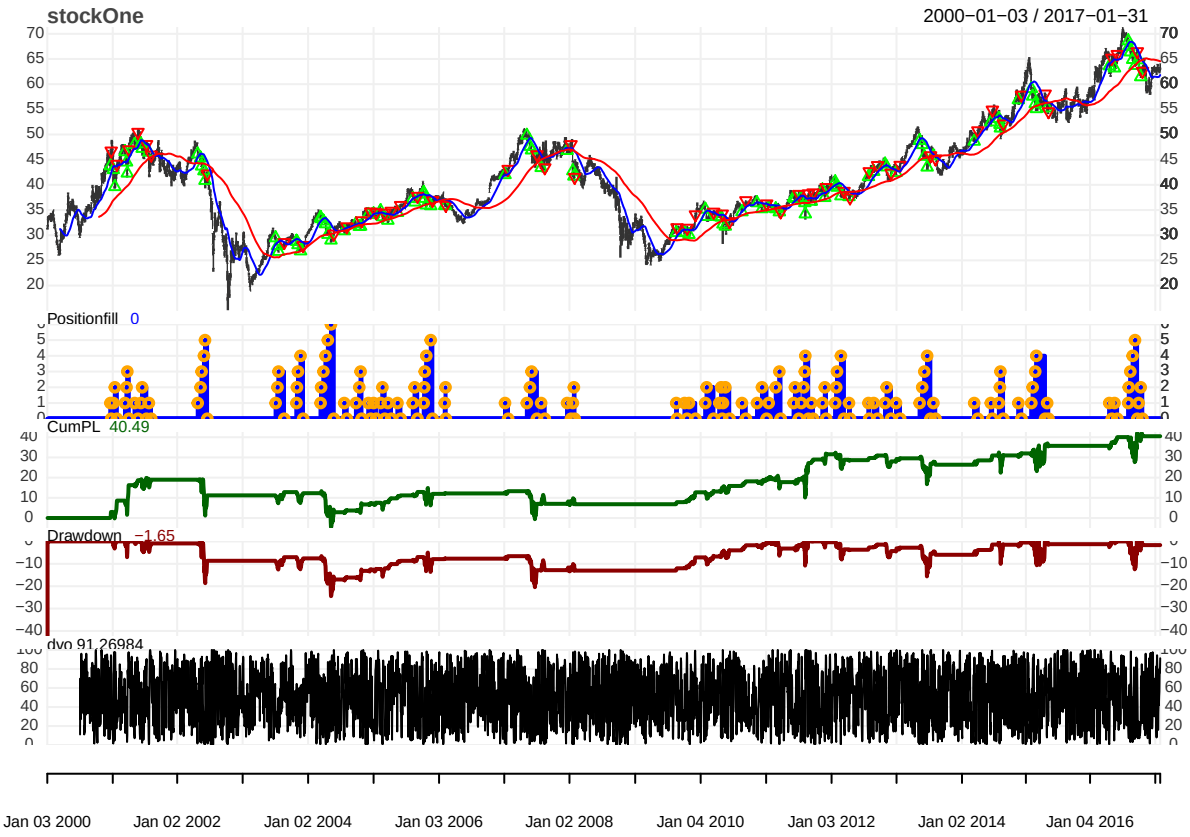
Rules help shape trading transactions at signal execution. They generate orders using market data, indicators and signals. This strategy has 2 rules:

- an entry rule of 1 share for the combined comparison and threshold entry signals
- an exit rule for a treshold above 80.

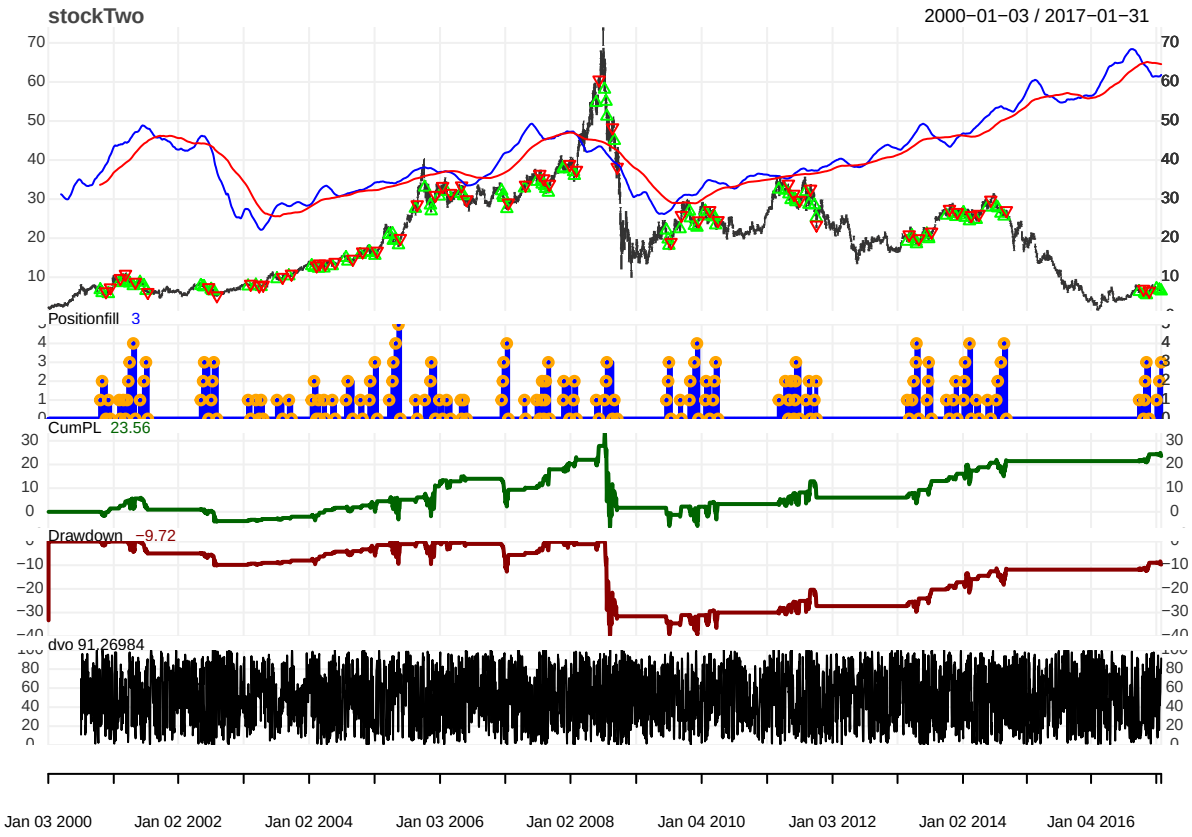
Running this RSI_3_4 strategy on the AES and the CHK over those 13 years, yields profit factors above 1, meaning that the strategy is profitable:

Let's take a look at the system performance for the 2 stocks:

- Stock 1: AES



- stock 2: CHK



We can further analyze this RSI-3_4 strategy by getting the order book and retrieving the trade statistics:

	stockOne	stockTwo
Portfolio	RSI strategy	RSI strategy
Symbol	stockOne	stockTwo
Num.Txns	170	177
Num.Trades	56	58
Net.Trading.PL	40.49	23.56
Avg.Trade.PL	0.7230357	0.4194828
Med.Trade.PL	1.04	1.13
Largest.Winner	7.92	5.86
Largest.Loser	-9.42	-19.36
Gross.Profits	79.26	76.87
Gross.Losses	-38.77	-52.54
Std.Dev.Trade.PL	2.919450	3.585156
Percent.Positive	73.21429	75.86207
Percent.Negative	26.78571	24.13793
Profit.Factor	2.044364	1.463076
Avg.Win.Trade	1.933171	1.747045
Med.Win.Trade	1.480	1.485

	stockOne	stockTwo
Avg.Losing.Trade	-2.584667	-3.752857
Med.Losing.Trade	-1.25	-1.97
Avg.Daily.PL	0.7230357	0.4194828
Med.Daily.PL	1.04	1.13
Std.Dev.Daily.PL	2.919450	3.585156
Ann.Sharpe	3.931506	1.857404
Max.Drawdown	-24.44	-39.85
Profit.To.Max.Draw	1.6567103	0.5912171
Avg.WinLoss.Ratio	0.7479381	0.4655241
Med.WinLoss.Ratio	1.1840000	0.7538071
Max.Equity	42.14	33.28
Min.Equity	-4.57	-6.57
End.Equity	40.49	23.56

	stockOne.DailyEndEq	stockTwo.DailyEndEq
Annualized Sharpe Ratio (Rf=0%)	0.2269338	0.1298233

For both instruments, the profit factor (absolute value ratio of gross profits over gross losses) is above 1 . Therefore, this strategy is profitable.

Profit factor = Abs(gross profits / gross losses)

The sharpe ratio is a risk-adjusted measure of return.

Sharpe ratio = (Mean portfolio return - Risk-free rate) / Standard deviation of portfolio return

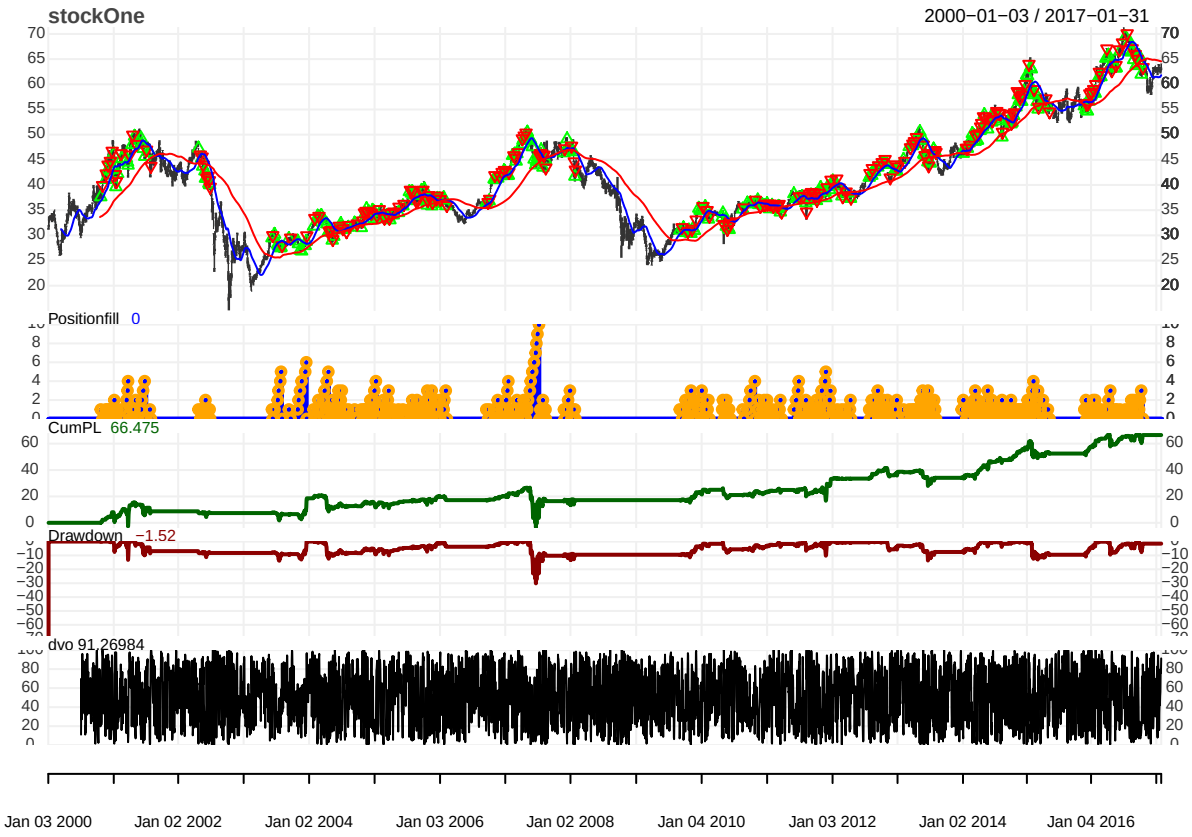
The annualized sharpe ratios are low, the highest being ~ 0.23 on stock AEP. Let's try to increase the annualized sharpe ratio by changing the oscillator of this strategy.

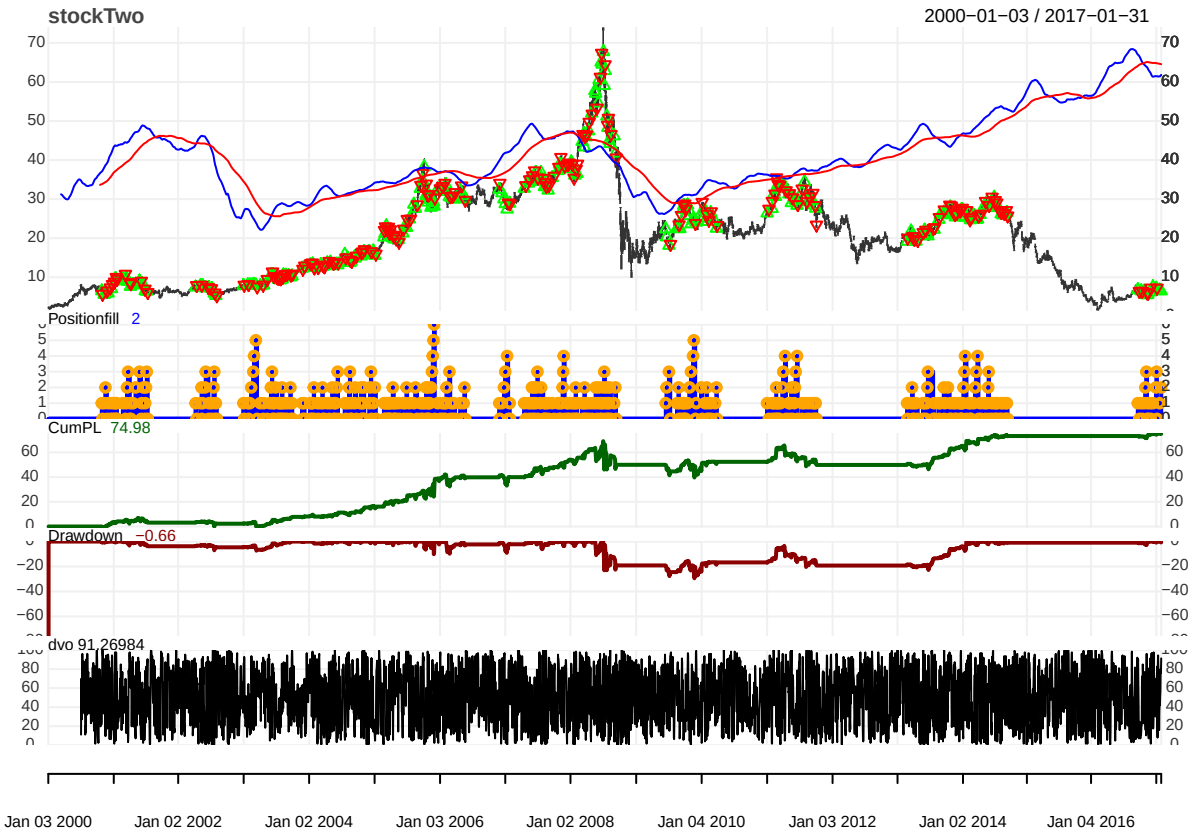
4.2 STRATEGY 2: DVO

Instead of using the RSI_3_4 as the oscillator, let's use a custom DVO with navg = 2 and a percentlookback period of 126 that we call DVO_2_126 . The trend following indicators SMA50 and SMA200 stay the same , as well as the signals, rules and settings of the strategy.

Let's run the DVO strategy.

Performance of the systems:


stockOne
2000−01−03 / 2017−01−31
Positionfill 0
CumPL 66.475
Drawdown −1.52
dvo 91.26984
Jan 03 2000
Jan 02 2002
Jan 02 2004
Jan 03 2006
Jan 02 2008
Jan 04 2010
Jan 03 2012
Jan 02 2014
Jan 04 2016



Analyzing this DVO strategy, we get the following trade metrics:

	stockOne	stockTwo
Portfolio	DVO strategy	DVO strategy
Symbol	stockOne	stockTwo
Num.Txns	505	473
Num.Trades	187	184
Net.Trading.PL	66.475	74.980
Avg.Trade.PL	0.3554813	0.4085326
Med.Trade.PL	0.47	0.47
Largest.Winner	11.99	9.33
Largest.Loser	-10.54	-16.16
Gross.Profits	172.555	176.690
Gross.Losses	-106.08	-101.52
Std.Dev.Trade.PL	2.264186	2.522341
Percent.Positive	69.51872	72.28261
Percent.Negative	30.48128	26.63043
Profit.Factor	1.626650	1.740445
Avg.Win.Trade	1.327346	1.328496
Med.Win.Trade	0.91	0.91
Avg.Losing.Trade	-1.861053	-2.071837

	stockOne	stockTwo
Med.Losing.Trade	-1.05	-0.92
Avg.Daily.PL	0.3554813	0.4085326
Med.Daily.PL	0.47	0.47
Std.Dev.Daily.PL	2.264186	2.522341
Ann.Sharpe	2.492326	2.571125
Max.Drawdown	-30.13	-29.43
Profit.To.Max.Draw	2.206273	2.547740
Avg.WinLoss.Ratio	0.7132233	0.6412167
Med.WinLoss.Ratio	0.8666667	0.9891304
Max.Equity	67.995	75.640
Min.Equity	-3.49	-0.75
End.Equity	66.475	74.980

	stockOne.DailyEndEq	stockTwo.DailyEndEq
Annualized Sharpe Ratio (Rf=0%)	0.3580253	0.4288117

5 CONCLUSION

On the same period of time, the same instruments/stocks and the strategy settings, the RSI strategy has a higher profit factor compared to the DVO strategy for each of the stocks respectively. However, there are more transactions in the DVO strategy and its annualized sharpe ratios are much better than the ones of the RSI strategy. Therefore, the absolute value of the gross profits over gross losses is higher in the RSI strategy for each respective stok, while the return per unit of risk is better in the DVO strategy.

Nonetheless, is that enough to select one strategy over the other? Would an entry rule with an order sizing functon instead of a single share considerably improve one strategy over the other in terms of profit and risk-adjusted return?