Project 2 - Analyze SP500 over 10 years

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Contents

1 Objectives

1. Write a Python program to download the historical data of S&P500 over that period.

2. Show in a chart how the price of S&P 500 varied over that period. Plot Daily returns of the Index and identify periods of 5 worst historical monthly draw-downs.

3. The Calmar Ratio is a drawdown related measure which equal to the compounded annual growth rate divided by the maximum drawdown.

4. Consider a simple trading strategy where you invest 10,00 USD in the S&P500 every time the price closes above the 30 day moving average of daily close prices.

5. Graphically represent the return profile of this strategy.

6. Calculate and graphically represent Lake Ratio & Gain to Pain ratio of such a strategy.

2 Implementation

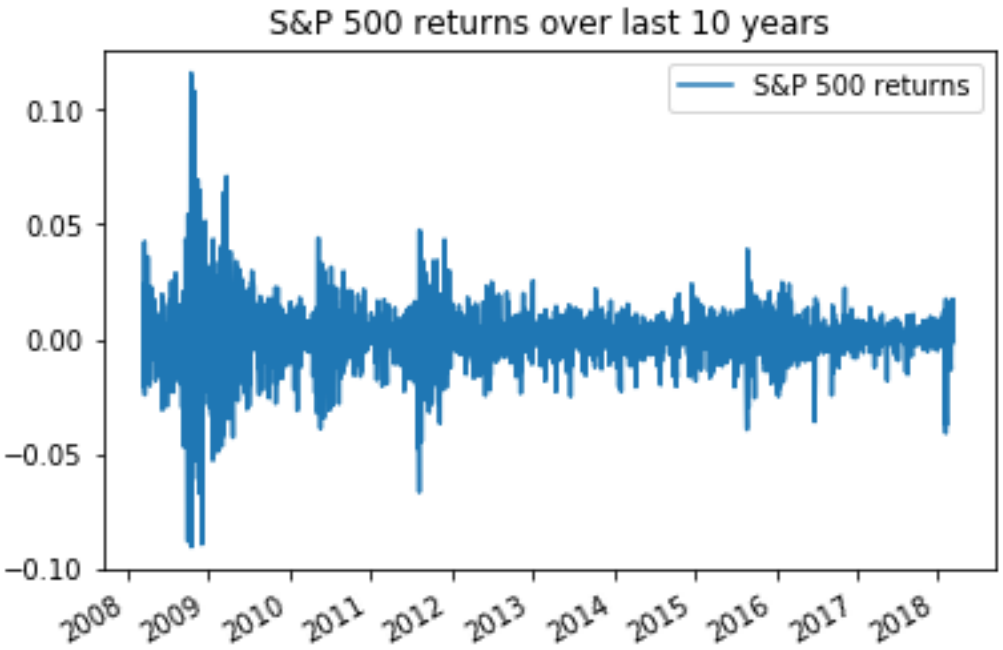
2.1 Data Download

Required data has been downloaded from Yahoo Finance using next python function:

```
from pandas_datareader import data as pdr
pdr.get_data_yahoo()
```

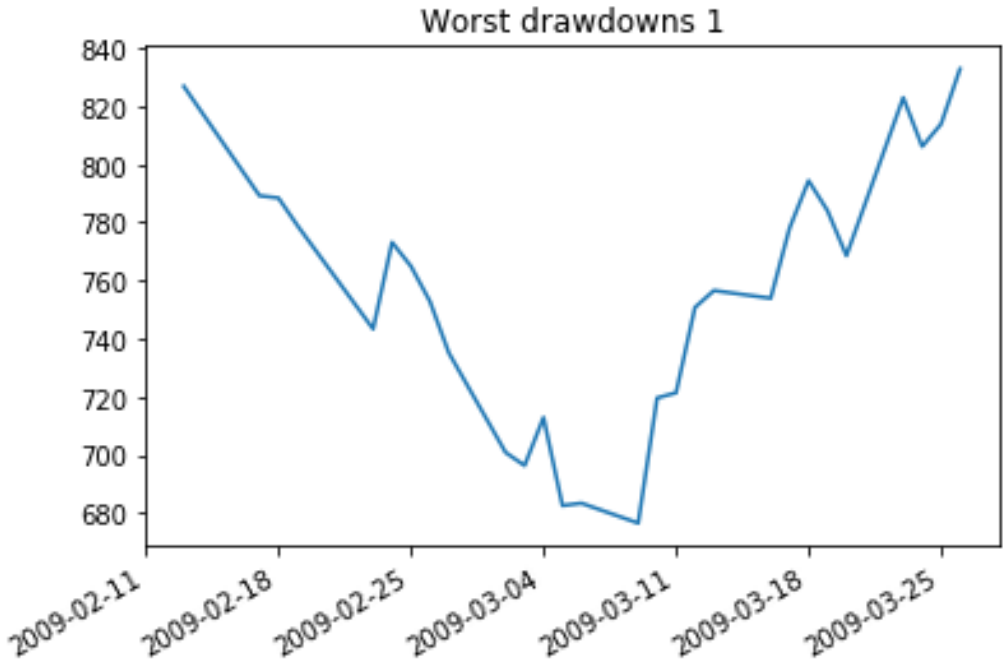
3 Returns

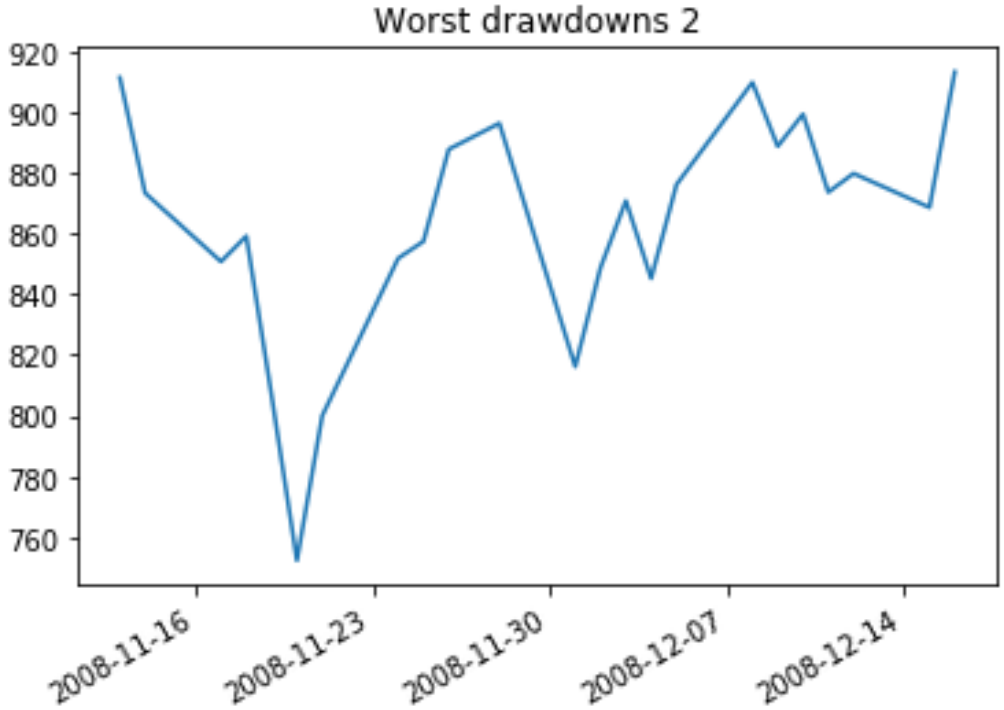
Next step was to calculate returns, it was done as usual and gave next result:

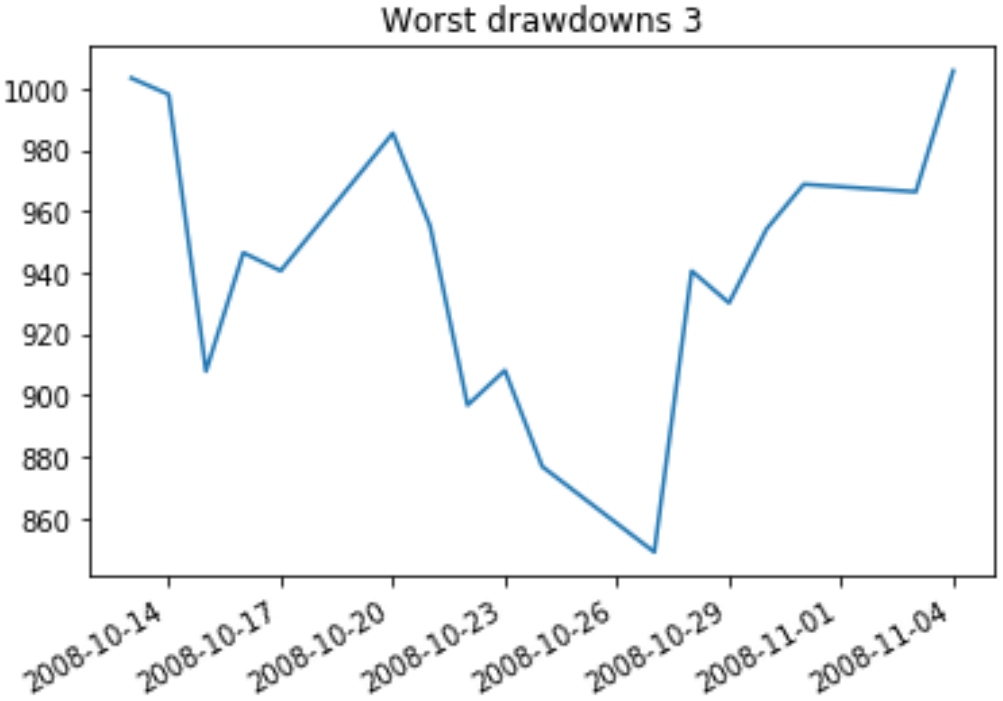


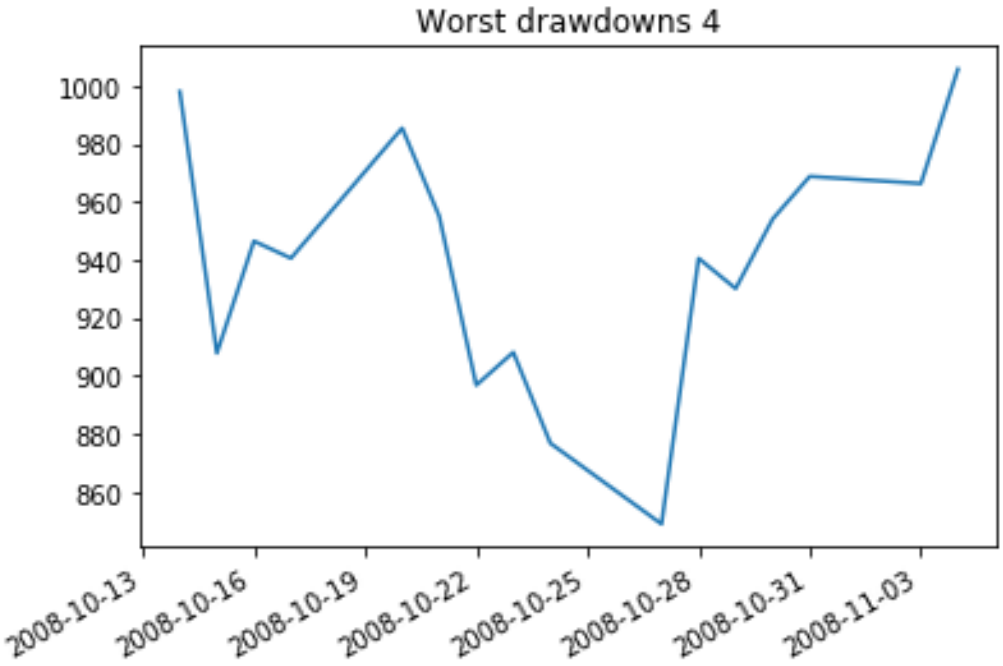
4 5 worst historical monthly draw-downs

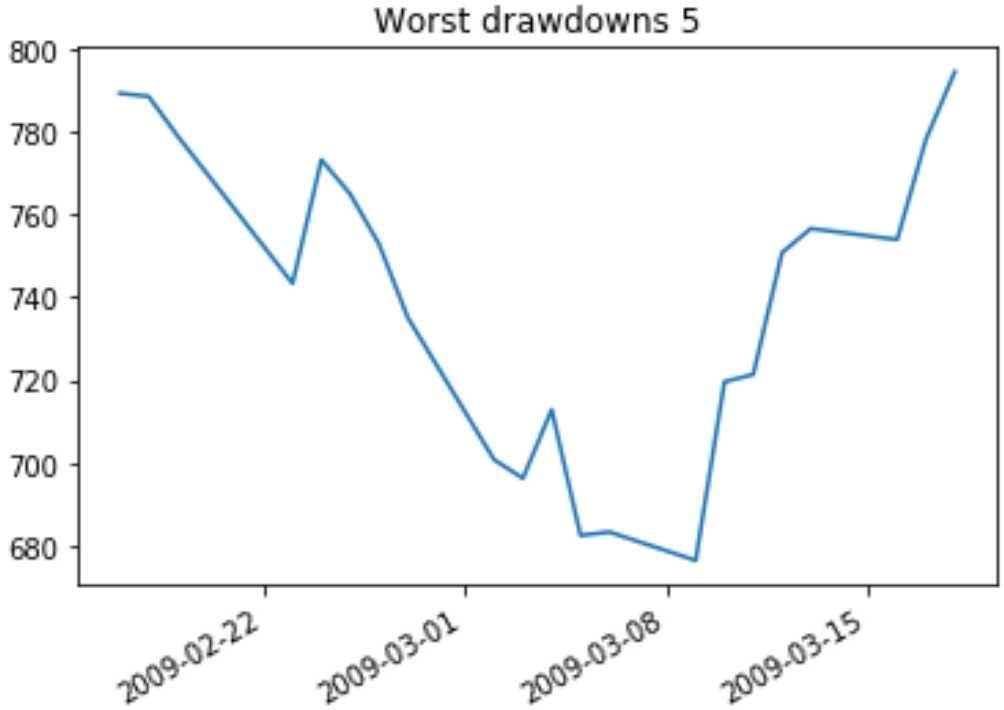
To find the draw-downs I used a moving 30-days window. During this period I found peak, min, and recovery dates and corresponding values. After that I stored the data in a data frame which later was sorted to determine the worst draw-downs.


Worst drawdowns 1
840
820
800
780
760
740
720
700
680
2009-02-11
2009-02-18
2009-02-25
2009-03-04
2009-03-11
2009-03-18
2009-03-25


Worst drawdowns 2
920
900
880
860
840
820
800
780
760
2008-11-16
2008-11-23
2008-11-30
2008-12-07
2008-12-14


Worst drawdowns 3
1000
980
960
940
920
900
880
860
2008-10-14
2008-10-17
2008-10-20
2008-10-23
2008-10-26
2008-10-29
2008-11-01
2008-11-04


Worst drawdowns 4
1000
980
960
940
920
900
880
860
2008-10-13
2008-10-16
2008-10-19
2008-10-22
2008-10-25
2008-10-28
2008-10-31
2008-11-03



5 Calmar Ratio

Calmar ratio is calculated based on the formula below:

$$calmar\_ratio = \frac{compounded\_annual\_growth\_rate}{maximum\_drawdown}$$

So, first I needed to calculate compounded annual growth rate:

$$calmar\_ratio = (1 + r_1) \times \cdots \times (1 + r_n)^{\frac{252}{n}} - 1$$

As a result I have **43.1604726332**

6 Investment Strategy

The suggested stratedy was implemented straight forward without any special tricks. However, the results were rather interesting: only 35 out of 127 returns were positive and at the same time they sum up in **1.4276913216651255** comparing with negative ones (**-1.1387902785388777**). So as a result we can conclude that overall the strategy is profitable.

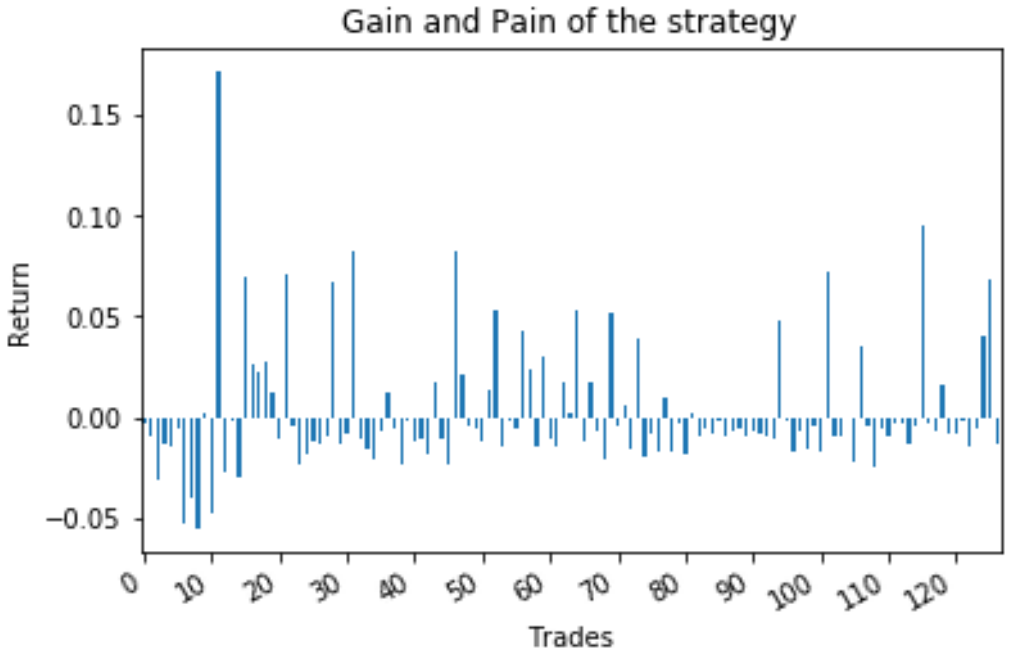
This can be proved by cumulative return chart:

7 Gain-to-Pain ratio

To calculate Gain-to-Pain ratio I used the next formula:

$$gain\_to\_pain = \frac{net\_gain}{total\_loss}$$

The result is **0.253691174372** The picture below illustrates gain and losses of the strategy:



8 Lake Ratio

Finally , lake ratio was calculated. My result is **0.079**