Random Portfolio vs Equity Volatility Analysis

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Conclusions for part 1 and goal for part 2

In the previous part of this project, we looked into comparing a single equity's performance and risk measures to the S&P 500 index. We then repeated this on other equities from the S&P 500 index to remark that without any prior information, it can be a lot riskier to invest in a single equity as opposed to the index, and that even in the case where an equity's risk measures were smaller than the index, it did not guarantee a better return (in fact riskier stocks did not present that either). We know from mathematics and the law of large numbers that by taking a larger sample, you can reduce variability. Then, for this part, we will look into the performance of randomly built portfolios using equities from the index.

Methodology

Using R to create randomly sampled portfolios from the index equities, we will then use the same previous metrics as in part 1: this will allow to compare the random portfolio performance and risk to both the simple random equity method and to the index. The metrics used were Cumulative Returns, Return Variation, Semi-Variation, Down Deviation, Beta, Alpha, and the Sharpe, Sortino and Treynor Ratios.

Portfolio Analysis

First Analysis (one random portfolio, size = 25)

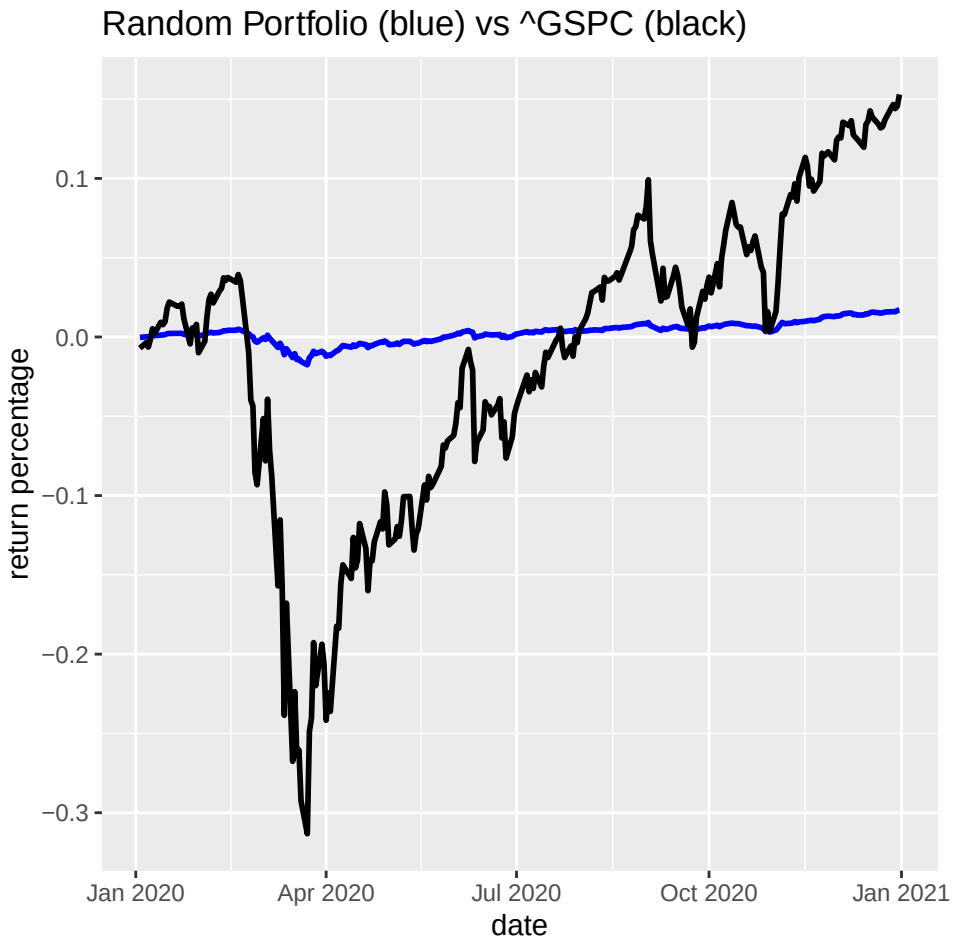
First, we start by selecting 25 random stocks from the S&P 500 index, then we balance our portfolio data by weighting the equity data in terms of stock prices on the first trading day of 2020 (we are assuming in this scenario that the only time we invest is on the first trading day of the year).

```
set.seed(1)
random.sampling.index <- sample(valid.index, 25, replace = FALSE)
random.sample.stocks <- stocks$df.control$ticker[random.sampling.index]
random.sample.stocks
```

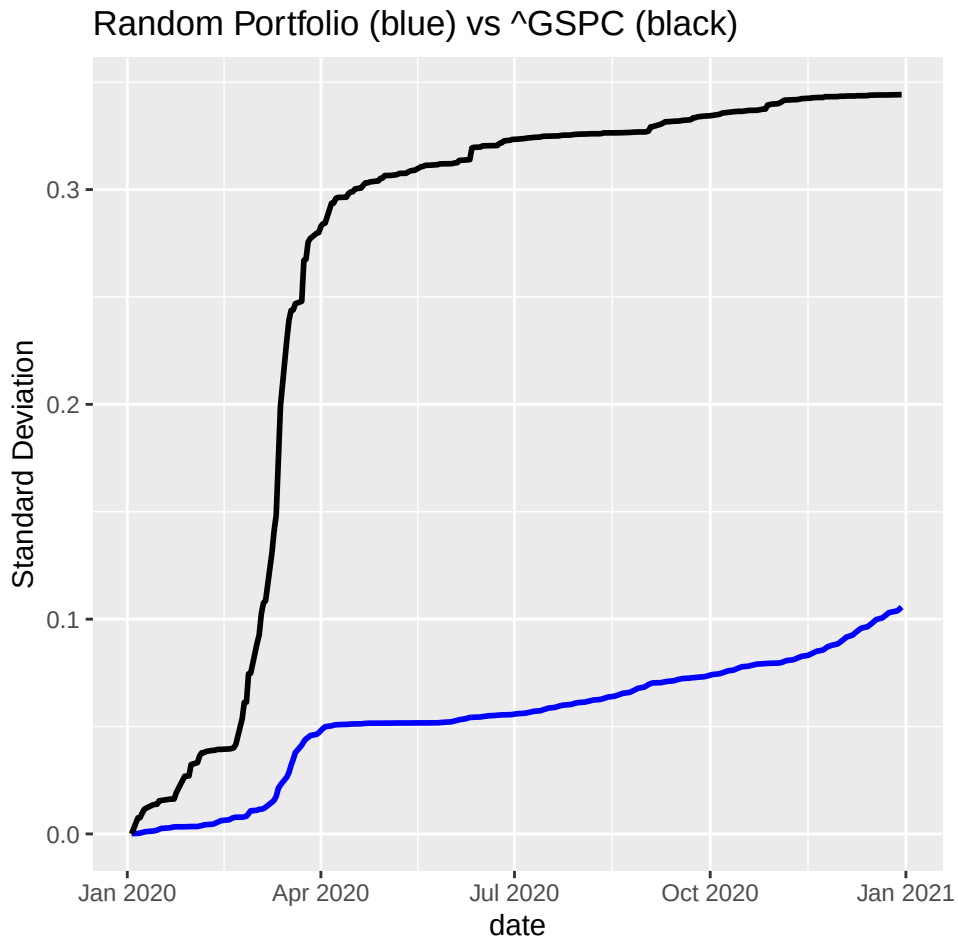
```
##  [1] "MCO"  "ENPH" "CCI"  "SO"   "VFC"  "MPC"  "KEY"  "VTR"  "FRT"  "MXIM"
## [11] "WM"   "CAH"  "KR"   "PYPL" "TSLA" "NTAP" "SJM"  "NDAQ" "BF-B" "GPC"
## [21] "AME"  "CI"   "GS"   "PKI"  "EA"
```

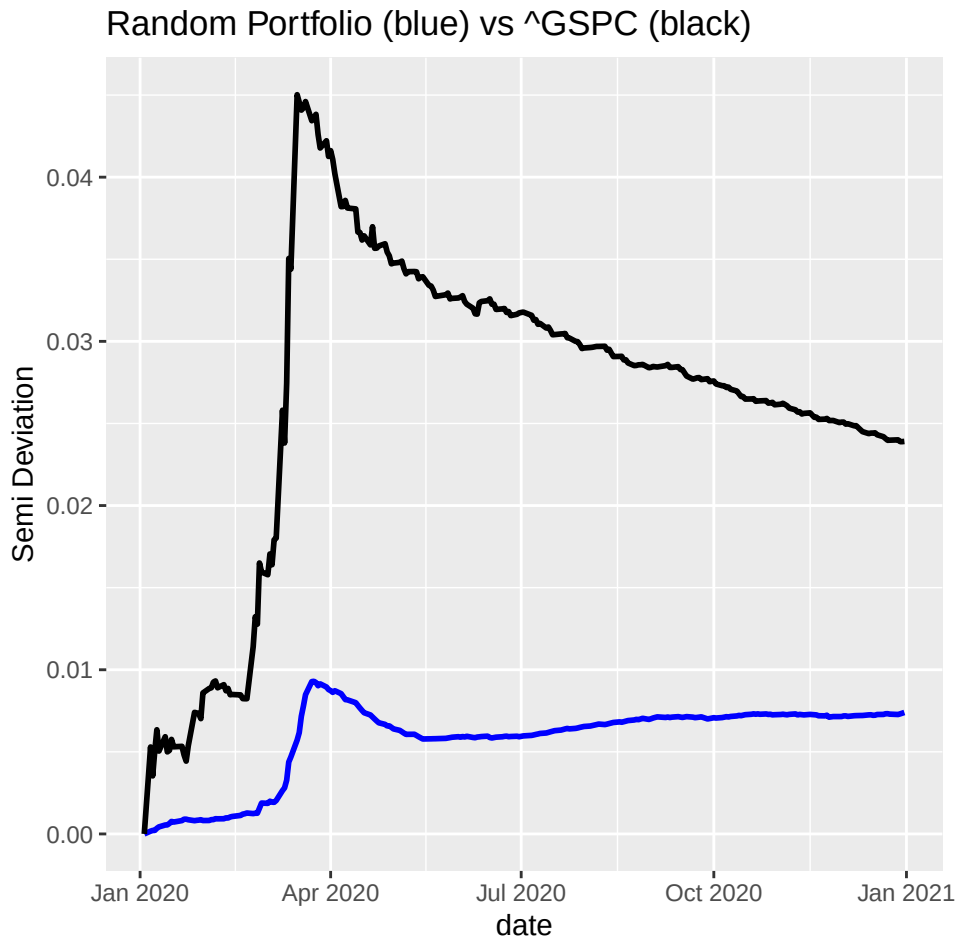
```
equities <- vector(mode = 'list', length = 25)
share.values <- c(rep(0, 25))
for (i in 1:25) {
  share.data <- filter(stocks$df.tickers, ticker == random.sample.stocks[i])
  share.values[i] <- share.data[1,6]
  equity.return <- share.values[i] * (cumprod(1+(share.data$ret.adjusted.prices[-1]))-1)
  equities[[i]] <- equity.return
}
share.weights <- share.values/sum(share.values)
inv.capital <- sum(share.values)
```

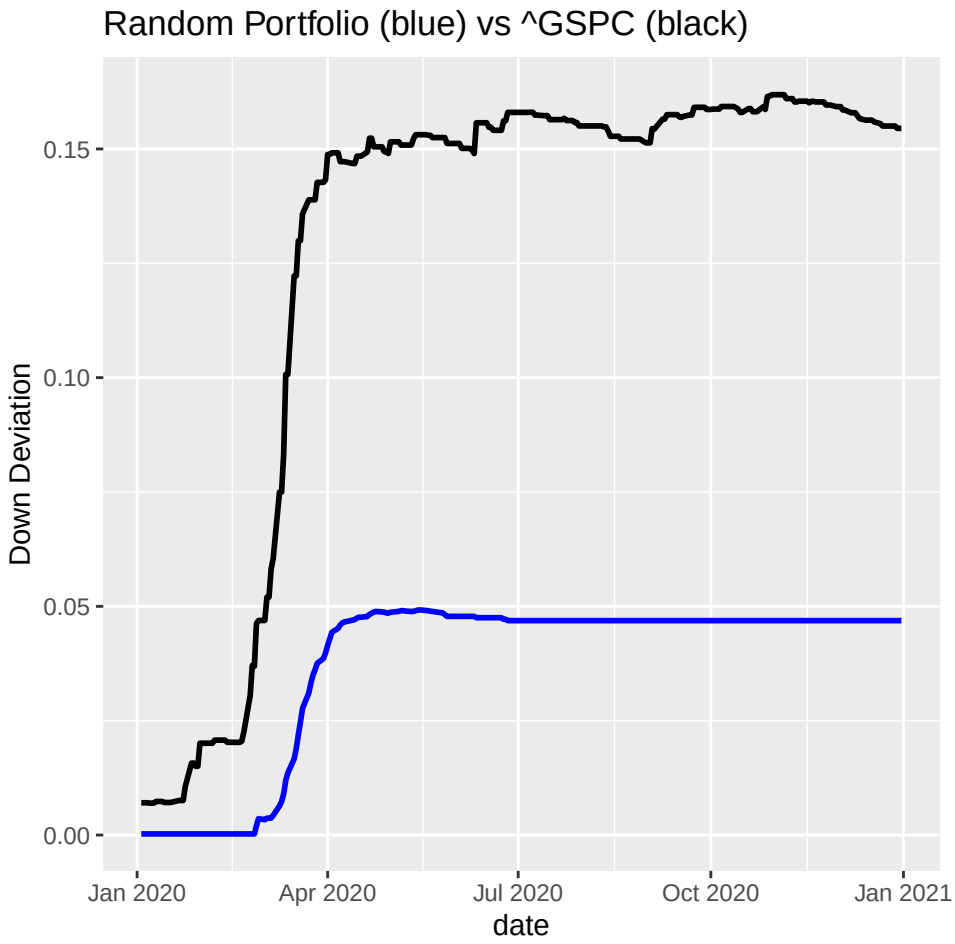
Then, modifying our previous code, which is hidden from the report for tidyness purposes, we can get our metrics:

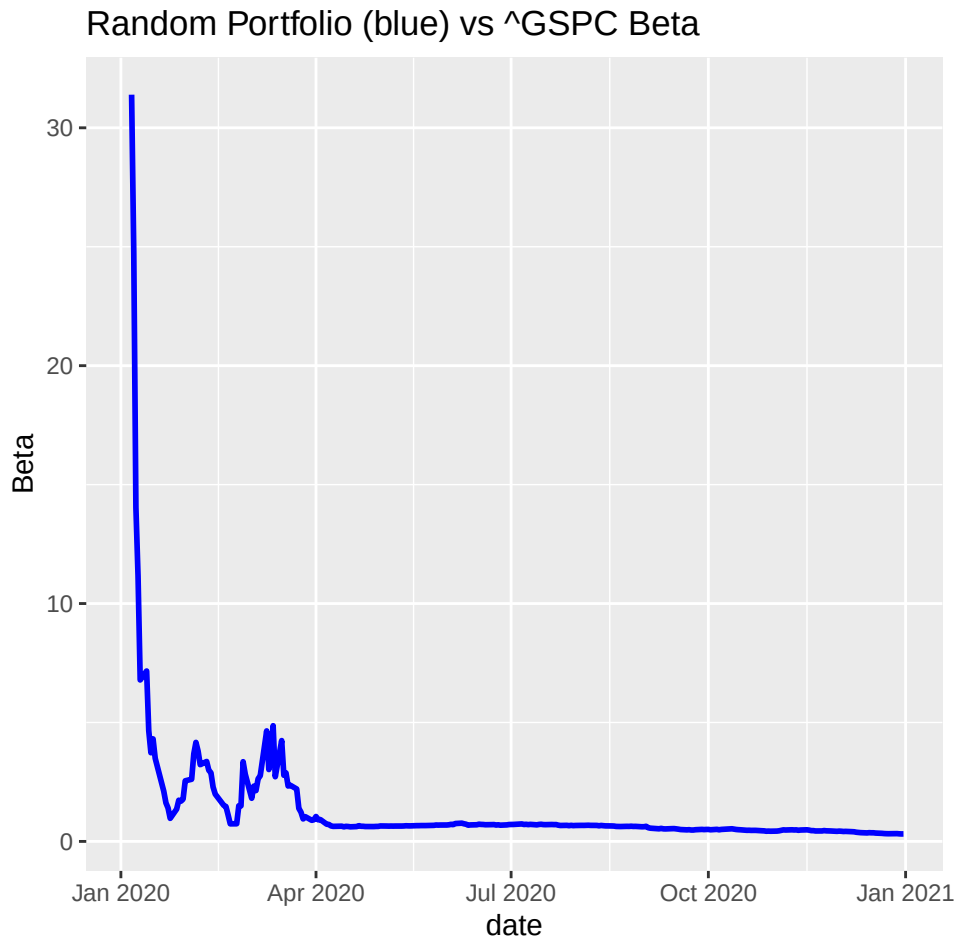


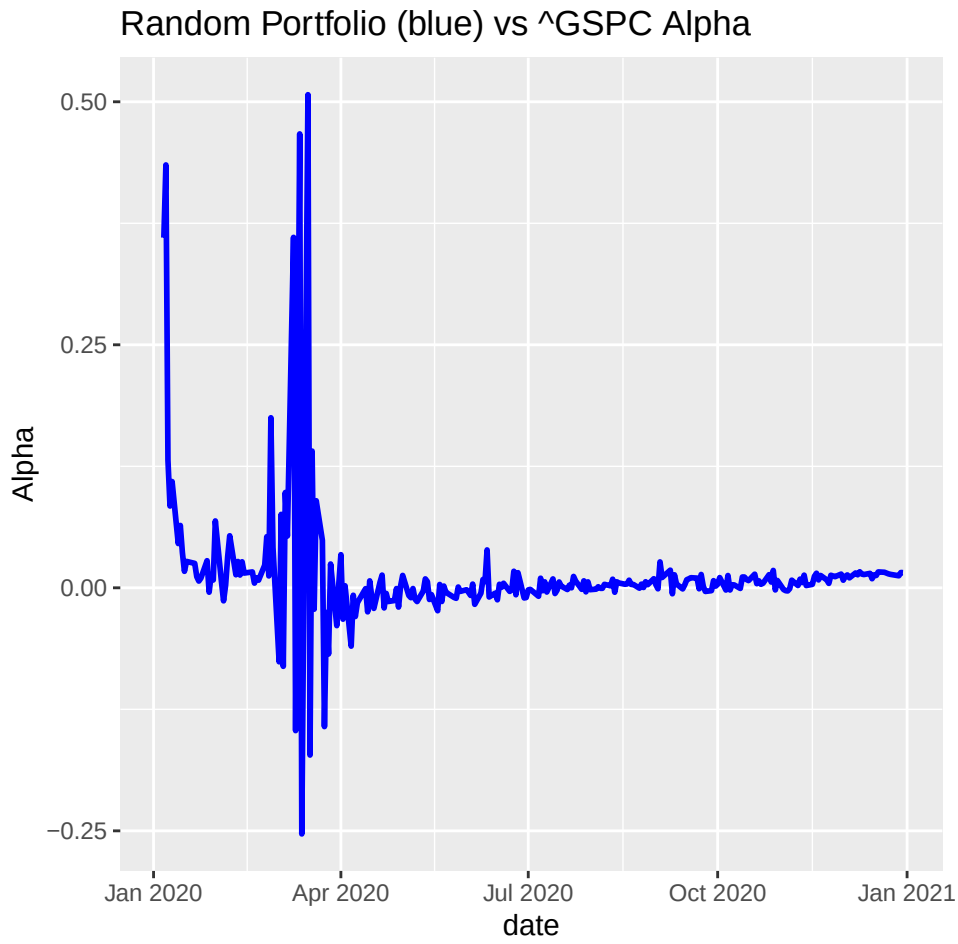
Thus, we see in this case that our random portfolio underperformed overall compared to the index over the year, but that it had a lot less variation.

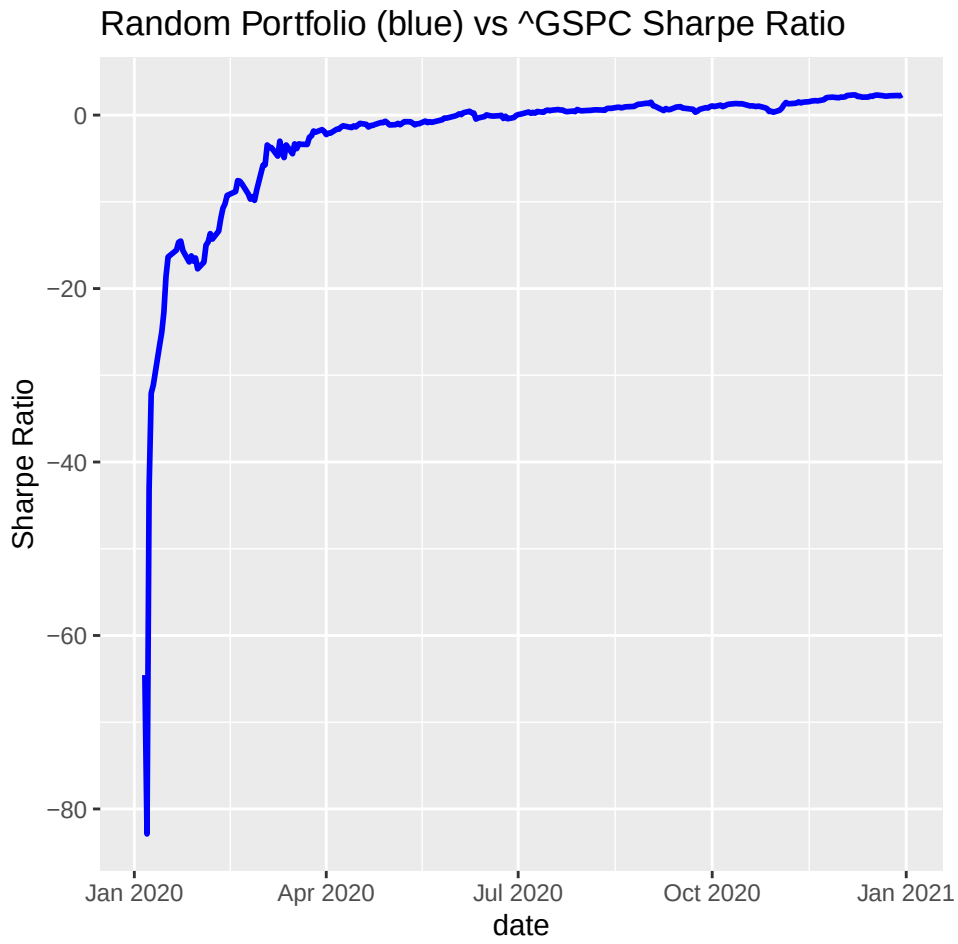

Random Portfolio (blue) vs ^GSPC (black)
Standard Deviation
0.3
0.2
0.1
0.0
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
date

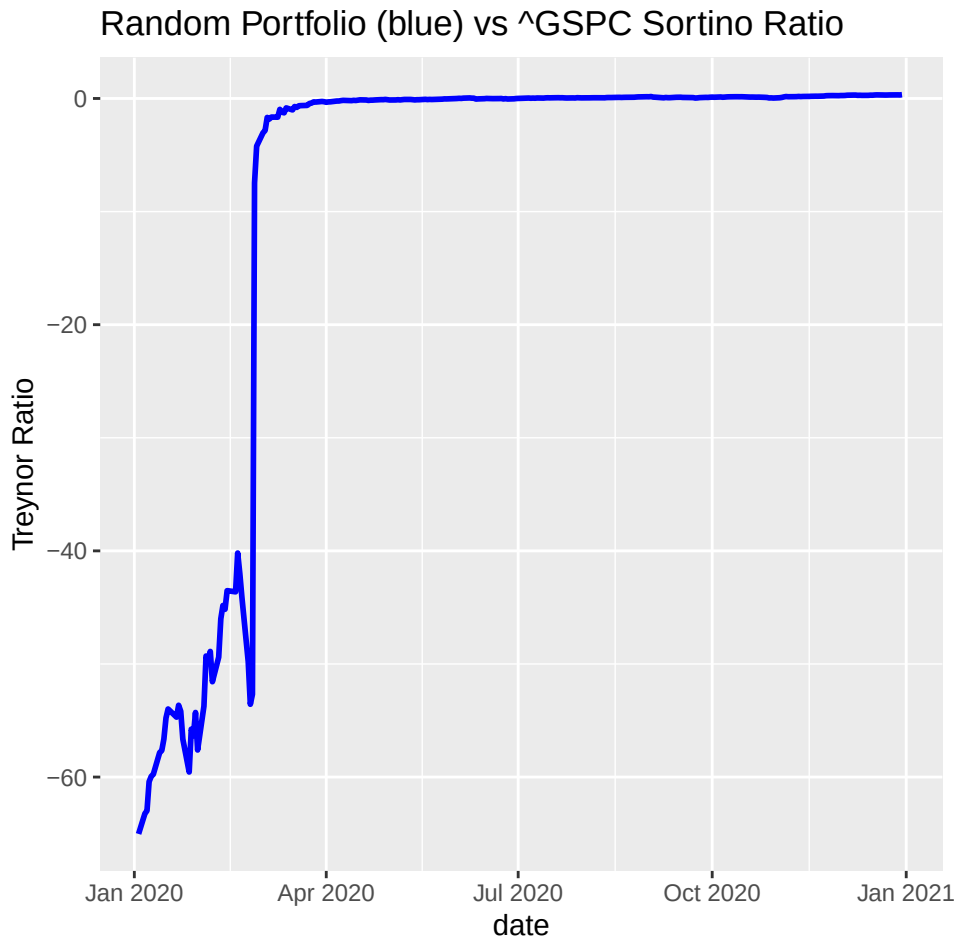

Random Portfolio (blue) vs ^GSPC (black)
Semi Deviation
0.04
0.03
0.02
0.01
0.00
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
date

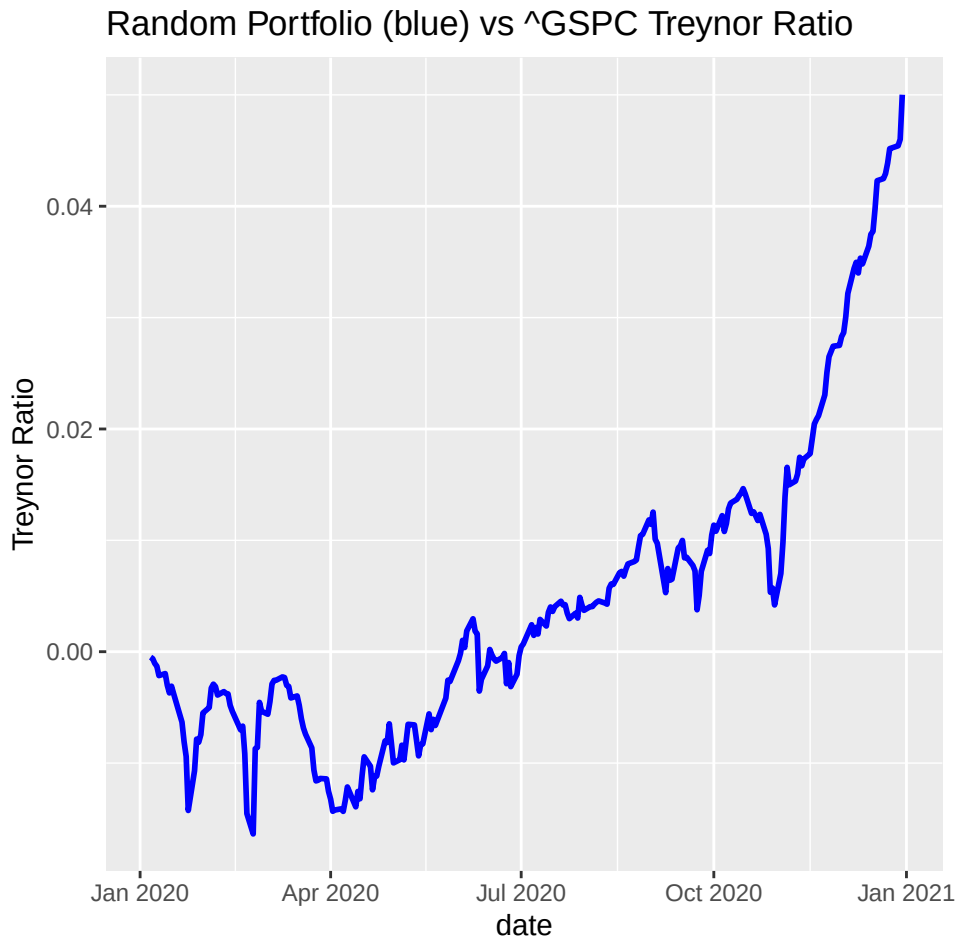

Random Portfolio (blue) vs ^GSPC (black)
Down Deviation
0.15
0.10
0.05
0.00
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
date


Random Portfolio (blue) vs ^GSPC Beta
30
20
10
0
Beta
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
date


Random Portfolio (blue) vs ^GSPC Alpha
0.50
0.25
0.00
−0.25
Alpha
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
date


Random Portfolio (blue) vs ^GSPC Sharpe Ratio
Sharpe Ratio
0
−20
−40
−60
−80
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
date


Random Portfolio (blue) vs ^GSPC Sortino Ratio
Treynor Ratio
0
−20
−40
−60
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
date


Random Portfolio (blue) vs ^GSPC Treynor Ratio
Treynor Ratio
0.04
0.02
0.00
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
date