

A Simple Momentum Strategy with R

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What is Momentum?

Momentum refers to the tendency of stock prices to continue to rise. Momentum strategy is concerned with buying (going long) stocks with recent price increase and selling (going short) those with price drop. Momentum is widely regarded an anomaly hard to explain by the Efficient Market Hypothesis that argues past prices can't predict future success.

Why R?

R has great tools for the study and analysis of Financial Time Series. in what follows, we use libraries "quantmod" for quantitative financial modelling (Dependencies: R >= 3.2.0, xts >= 0.9-0, zoo, TTR >= 0.2, methods), "PerformanceAnalytics" for Econometric and Risk Analysis (Dependencies: R >= 3.0.0, xts >= 0.10.0) and tidyverse.

```
library(tidyverse)
library(quantmod)
library(PerformanceAnalytics)
options(digits=4,scipen = 0)
```

We select (somewhat arbitrarily) 30 stocks from different industry sectors in SP500 and pull historical price data.

```
#30 stock from different sectors
symbols <- c("IBM","NFLX",
             "C","GS","JPM","MS","BAC","STT", #finance
             "AMZN","AAPL","MSFT","GOOGL",#tech
             "PFE","MRK","GSK","NVS",#drugs/bio
             "BP","CVX","XOM","TOT",#oil&gas
             "F","GM","TM","HMC","TSLA","TTM",#auto
             "KR","TGT","WMT","TJX","TRIP",
             "SBUX","TSCO")#consumer/retail

# historical stock prices from Yahoo finance
levels <- list()

getSymbols(symbols, src = 'yahoo', from = '2010-01-01')

for(i in 1:length(symbols)) {
  prices <- Ad(get(symbols[i])) #Adjusted prices are more reliable
  colnames(prices) <- symbols[i]
```

```

    levels[[i]] <- prices
  }

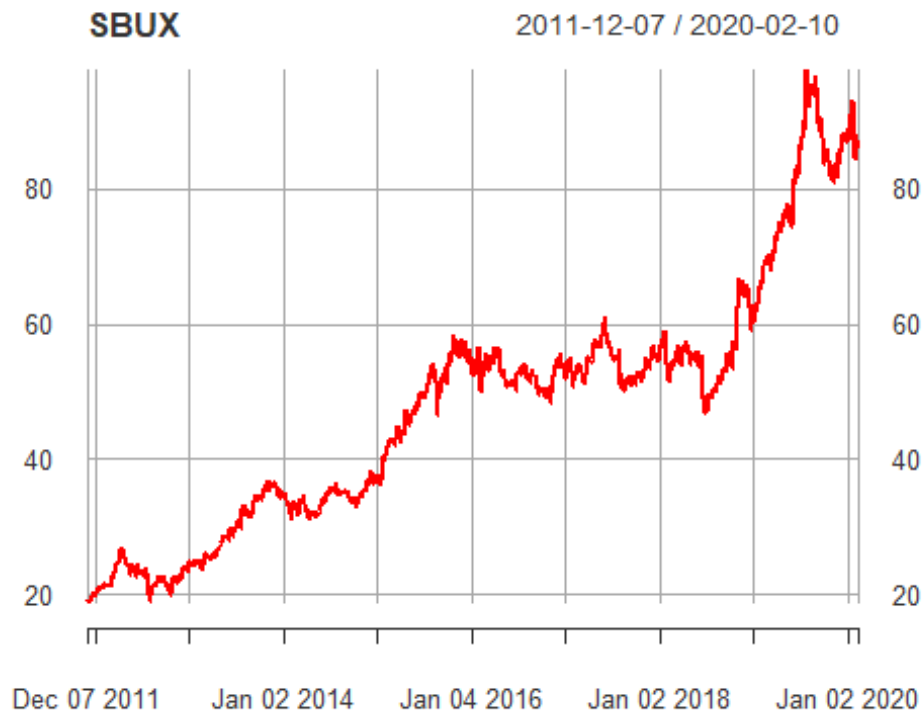
prices<-na.omit(do.call(cbind, levels))

rm(list=setdiff(ls(), "prices"))

```

Price Plots

It is usually good idea to plot our data.



Monthly returns

For this analysis we first convert daily prices to monthly by sampling at the end of each month and then convert prices to returns.

```

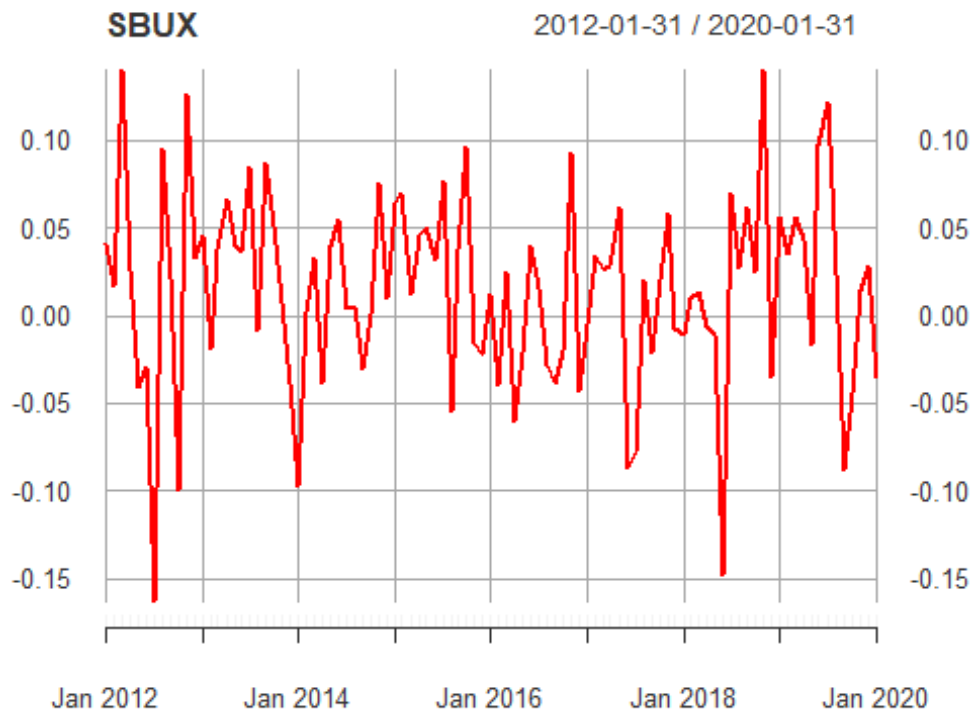
prices_monthly <- to.monthly(prices, indexAt = "last", OHLC = FALSE)

returns_monthly <- na.omit(Return.calculate(prices_monthly, method = "log"))

returns_monthly <- returns_monthly[-nrow(returns_monthly),] #removing NAs

plot(returns_monthly$SBUX,col=2,main="SBUX")

```



Momentum Score

We first convert net returns to gross returns by adding 1, then multiply gross returns and subtract 1 to find cumulative 12 month net returns.

```
#net to gross return by adding 1
ret_mon_p1 <- returns_monthly + 1

#12-1 momentum score:
momentum_score <- lag.xts(rollapply(ret_mon_p1, width = 12, FUN = prod) -1 )
```

Top decile momentum

We use cross sectional percent ranking of the momentum score, create a buy signal for the top decile (i.e. high quality momentum), and calculate period total returns from the strategy.

```
#percent rank cross-sectional momentum score
momentum_pct_rank <- data.frame(t(apply(-momentum_score, 1, percent_rank)))

#creating buy signal for the top decile
momentum_pct_rnk_signal <- ifelse(momentum_pct_rank < 0.10 , 1 , 0)

momentum_returns<-momentum_pct_rnk_signal*returns_monthly

period_total<-apply(momentum_returns,1,sum) %>% as.xts(order.by=index(moment
```

```
um_returns))
```

```
momentum_returns_xts<-cbind.xts(momentum_returns,period_total) %>% na.omit(.)
```

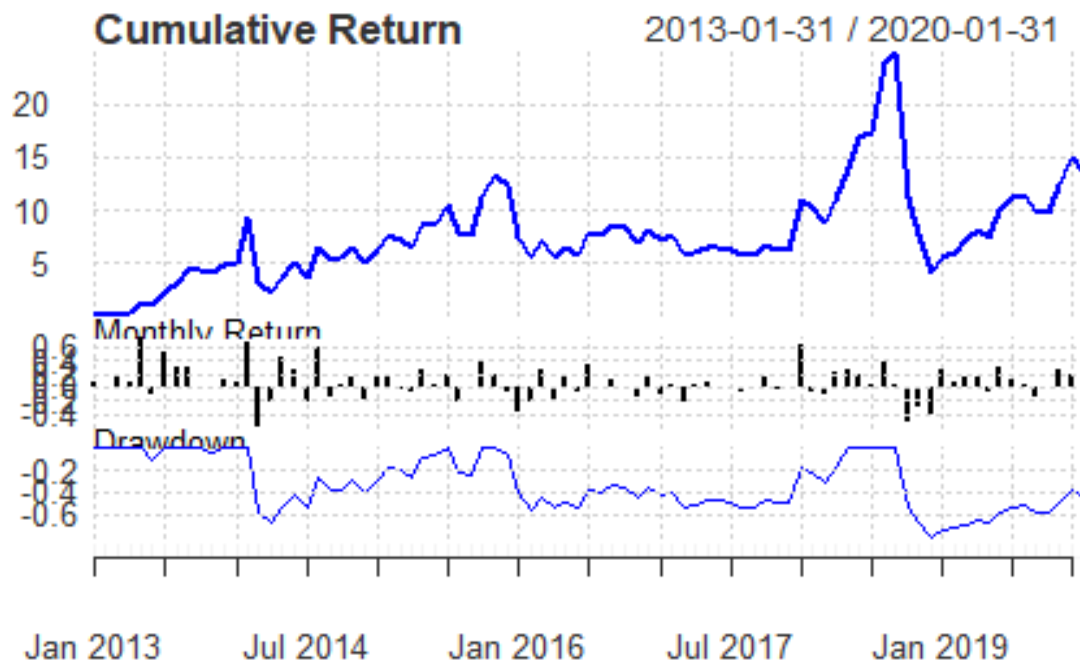
Performance metrics

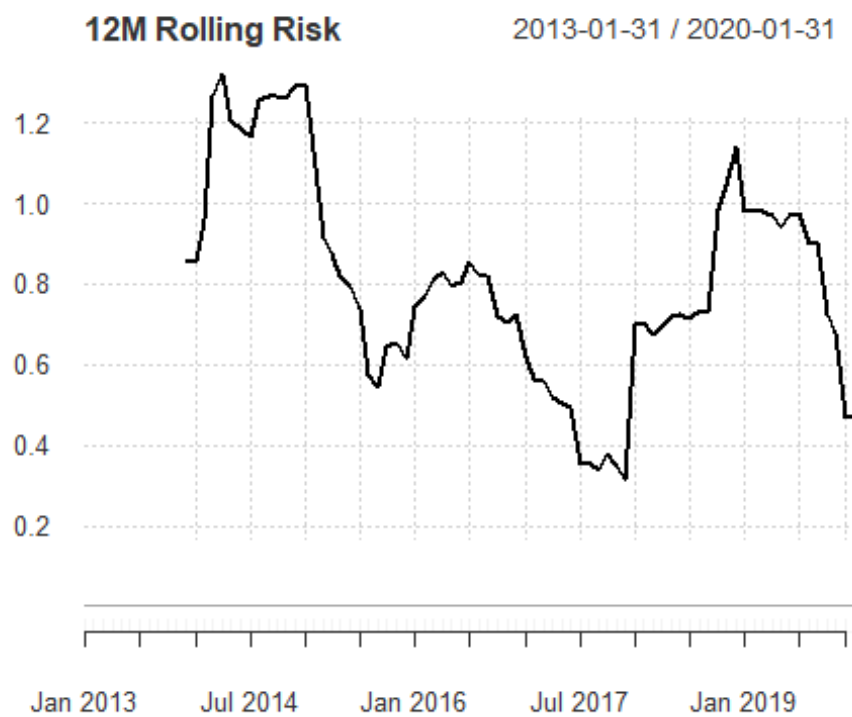
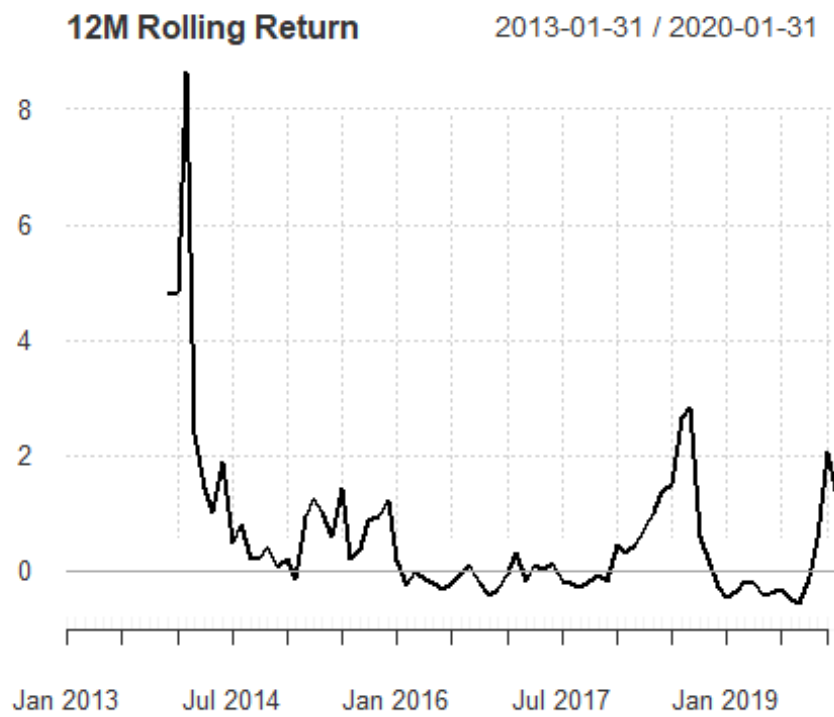
Finally, let's have a look at strategy risk and return performance:

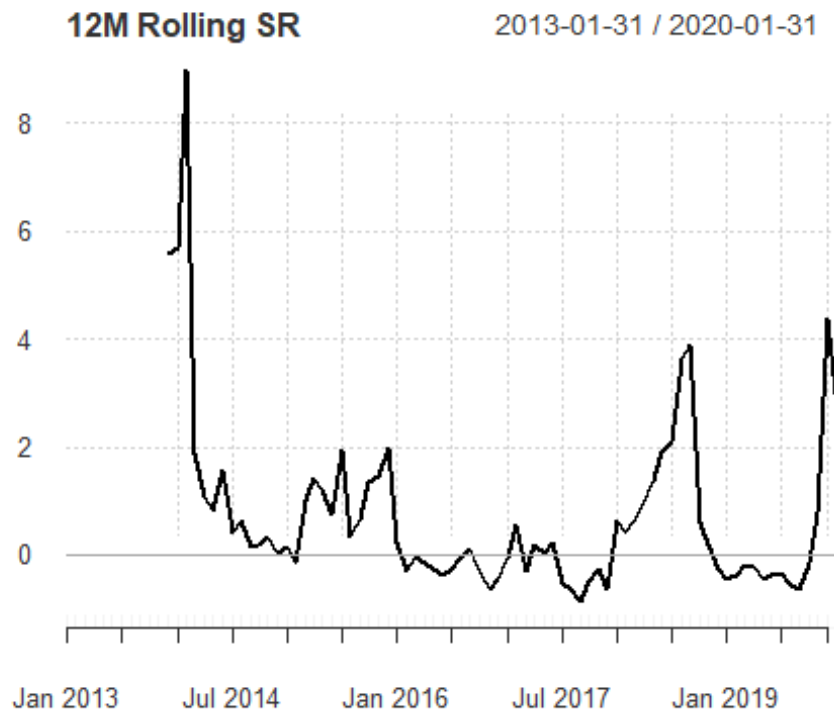
```
strategy_perf<-rbind.data.frame(  
  Return.annualized(momentum_returns_xts$period_total),  
  sd.annualized(momentum_returns_xts$period_total),  
  SharpeRatio.annualized(momentum_returns_xts$period_total),  
  AdjustedSharpeRatio(momentum_returns_xts$period_total),  
  SortinoRatio(momentum_returns_xts$period_total),  
  skewness(momentum_returns_xts$period_total),  
  kurtosis(momentum_returns_xts$period_total),  
  maxDrawdown(momentum_returns_xts$period_total),  
  VaR(momentum_returns_xts$period_total,p=0.95,method="historical"))  
  
rownames(strategy_perf)<-c("Return","Risk","Sharpe Ratio",  
  "Adjusted Sharpe","Sortino Ratio",  
  "Skewness","Kurtosis","MaxDD","VaR")
```

	period_total
<i>Return</i>	0.4613
<i>Risk</i>	0.8341
<i>Sharpe Ratio</i>	0.5531
<i>Adjusted Sharpe</i>	0.5602
<i>Sortino Ratio</i>	0.462
<i>Skewness</i>	0.2578
<i>Kurtosis</i>	0.8617
<i>MaxDD</i>	0.7979
<i>VaR</i>	-0.2745

Momentum Strategy Cumulative Return Index







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- This is not an investment advice.
- The contents of this presentation are mine and may not reflect my employer's views.