Assignment 1

Philipp Epstein

10/14/2018

Introduction

This report is written for the 1st assignment of the Financial Trading Systems course 2018 at the Bond University. During the first weeks we learned how to use the Blotter Framework in R to implement a trading strategy, backtest the strategy on a set of instruments (stock, futures, etc.) and visualize meaningful results which give insights about the strategy. Moreover, we learned how to compare the strategy to another alternative (e.g. a buy and hold strategy). The trading idea, implementation and analysis and results are summarized in the following report.

Trading Idea

Smash Day by Larry Williams

The trading idea which is used for this report is based on the Smash Day strategy introduced by Larry Williams in his book "Long Term Secrets to short term trading" 2012. The basic theoretical foundation is set by the concept of autocorrelation. There are two autocorrelation principles which can be empirically observed. The positive autocorrelation which describes the fact that if we observe an upward movement it is more likely to observe an upward movement in the future. The same is valid for a negative trend. However, the negative autocorreleation can be observed on short term time periods. We can expect a price to bounce up again after a sharp down movement and vice versa. Larry William's Smash Day pattern is based on the observation of this autocorrelation behaviour. A Smash Day pattern is initialized when we observe a close which is lower than the previous day's low. This looks like a breakout to the downside. If the very next day the price moves opposite the Smash Day and trades above the high of the Smash Day this is according to Williams a buy signal. Williams explains this buy signal with a feeling of hurt felt by the public as a result of an unfulfilled breakout. The public would want to get back on track and the price responds with a reversal. The exact opposite is true for a Sell setup. The Smash Day is set up when we observe a close above the previous day's high. The sell signal is initiated when the price reverses immidiately the next day and falls below the smash day's low.

Own variation of the Smash Day trading strategy

In addition to the Smash Day pattern, I have incorporated another rule for the buy signal and 2 additional components for the sell signal. I want to make sure that I only enter long when we are observing a longlasting upward trend. In order to do this buy orders are only performed when the current price is above the exponential moving average of the last 200 days. After that the Smash Day pattern is checked. For the sell I incorporated two "harder" conditions before checking whether we observe a Smash Day (sell). The first is that a maximum holding period can be set in order to make sure that a position is not open for too long. The second sell case is when the price falls below the 200 day exponential moving average the position is liquidated. If both is not the case a check for the smash day pattern is performed. If we observe it, we sell the current position.

These variations are incorporated to reduce the risk of falling prices.

Implementation of the trading idea

Part A: Initialization

Step 1: General Setup

The environment has to be cleared in order to ensure a reproducable setup. Moreover, the blotter library and the INF361Course library are loaded.

```
# Clear Environment
rm(list=ls())

# Loading libraries
library(blotter)
library(INFT361Course)
```

Step 2: Setting the Variables

The variables set in the next section can be adjusted to test the strategy with different parameters. The critical variables which should be adjusted to test the strategy are: * daterange * emaPeriod * maxHoldingPeriod * instrumentlist * BuyHoldInstrument

```
# Set values:
startCapital <- 1e+6
transactionCost <- -20
daterange <- '2010::2018'
emaPeriod <- 400
maxHoldingPeriod <- 4

InstrumentDirectory <- "~/Desktop/R/DownloadedData/"
instrumentlist <- c("ADS.csv","ALV.csv", "BAS.csv", "BAY.csv", "BEI.csv")
BuyHoldDirectory <- "~/Desktop/R/DownloadedData/"
BuyHoldInstrument <- "DAXEX.csv"

currency("EUR")
Sys.setenv(TZ="UTC")
initdate <- '1999-12-31'
startdate <- '2000-01-01'
enddate <- '2018-12-31'
portfolioname <- "Smash Day"
accountname <- portfolioname
```

Step 3: Presetup for plotting graphs

Some setup for plotting the graphs in the visualization is performed here to ensure that the Theme is available later, when it is needed and used.

```
# Settings for graph
myTheme <- chart_theme()
myTheme$col$up.col <- 'lightblue'
myTheme$col$dn.col <- 'brown'
myTheme$col$dn.border <- 'lightgray'
myTheme$col$up.border <- 'lightgray'

# Concatenate string for EMA with input parameter
addEMAString <- paste("add_EMA(n=",emaPeriod,")",sep = "")
```

Step 4: Initializing the portfolio

The portfolio takes the instrumentlist which includes all the stocks we defined in Step 2.

```
# Clear portfolio and Account
suppressWarnings(rm("account.Smash Day","portfolio.Smash Day",
                    "account.buyhold","portfolio.buyhold",
                    pos=.blotter))

# Initialize Portfolio and Account
initPortf(portfolioname,
          instrumentlist,
          initDate=initdate,
          currency="EUR")

initAcct(accountname,
         portfolios=portfolioname,
         initDate=initdate,
         initEq=startCapital,
         currency="EUR")
```

Part B: Bar by bar processing

Step 1: Go through the data bar by bar

In this step the bar by bar processing is implemented. Thus, a for loop is implemented to loop through the instrumentlist. For each instrument in the list the data is loaded and the exponential moving average is added to the data. Furthermore, another for loop is used to loop through the dates bar by bar. In this step the defined strategy is applied.

```
for (instrument in instrumentlist) {
    LoadCourseFile(InstrumentDirectory, instrument, debugme = TRUE, dates = daterange)

    # Initialize the instrument
    stock(instrument, currency = "EUR")

    # Load the XTS file
    symbol <- get(instrument)

    # Calculate the Exponential Moving Average
    ema <- EMA(symbol$Close, n=emaPeriod)

    # Merge the xts file with the Exponential Moving Average
    symbol <- merge(symbol,ema)
    assign(instrument,symbol)
  # Starting to go bar by bar through using a "for loop"
  for (i in (emaPeriod + 1):(nrow(symbol) - 1)) {
    # Dates
    CurrentDate <- time(symbol[i])
    TomorrowDate <- time(symbol[i + 1])

    # Today's variables
    CloseToday <- as.numeric(symbol[i, "Close"])
    EMA_today <- as.numeric(symbol[i, "EMA"])
    LowToday <- as.numeric(symbol[i, "Low"])
    HighToday <- as.numeric(symbol[i, "High"])
```

```
# Yesterday's variables
LowYesterday <- as.numeric(symbol[i - 1, "Low"])
HighYesterday <- as.numeric(symbol[i - 1, "High"])

# Tomorrow's variables
OpenTomorrow <- as.numeric(symbol[i + 1, "Open"])
LowTomorrow <- as.numeric(symbol[i + 1, "Low"])
HighTomorrow <- as.numeric(symbol[i + 1, "High"])

# Config
Equity <- getEndEq(accountname, CurrentDate)
Position <-
  getPosQty(portfolioname, Symbol = instrument, Date = CurrentDate)

# Check whether we have a position
if (Position == 0) {
  # Start checking BUY rules

  # Check whether we have a Smash Day (Buy).
  # Smash Day (Buy) is when Todays Close is below Yesterdays Low.
  if (CloseToday < LowYesterday) {
    # Smash Day (Buy)

    #Check whether todays close is above today's EMA
    if (CloseToday > EMA_today) {

      # BUY RULE: If today was a smash day place a STOP BUY order
      # at todays high price for the next day.
      # (Buy tomorrow for 'price >= todays high')

      ######
      # Simulate STOP BUY order:
      ######

      # Option 1 to check: Check whether the open price tomorrow
      # is above today's high and add the transaction tomorrow at
      # tomorrow's open price.

      # Option 2 to check: Check whether today's high was lower
      # than tomorrows high and add the transaction tomorrow
      # at today's high price

      # Check Option 1
      if (OpenTomorrow > HighToday) {
        # Don't trade at the day before the last day
        if (CurrentDate != time(symbol[nrow(symbol) - 1])) {
          # Calculate the buy quantity
          BuyQuantity <- as.numeric(trunc(Equity / OpenTomorrow))
          # Add transaction
          addTxn(
            portfolioname,
            Symbol = instrument,
            TxnDate = TomorrowDate ,
```

```
            TxnPrice = OpenTomorrow,
            TxnQty = BuyQuantity,
            TxnFees = transactionCost
          )
          # Store the bar at which we placed the transaction
          BuyBar <- i
        }

      } else {
        # Check Option 2
        if (HighToday < HighTomorrow) {
          # Don't trade at the day before the last day
          if (CurrentDate != time(symbol[nrow(symbol) - 1])) {
            # Calculate the buy quantity
            BuyQuantity <- as.numeric(trunc(Equity / HighToday))
            # Add transaction
            addTxn(
              portfolioname,
              Symbol = instrument,
              TxnDate = TomorrowDate ,
              TxnPrice = HighToday,
              TxnQty = BuyQuantity,
              TxnFees = transactionCost
            )
            # Store the bar at which we placed the transaction
            BuyBar <- i
          }
        }
      }
    }
  }
} else {
  # We already have a position

  # Check the sell rules in the following order and sell at the
  # first condition which is satisfied.

  #####
  # SELL rules:
  #####

  # Rule 1: Sell if we hold the position longer than the specified
  # maximum holding period

  # Rule 2: Sell at tomorrow's opening price if the close price
  # today falls below the EMA

  # Rule 3: Sell if we meet the Smash Day (Sell) requirements.
  # Today's close must be higher than yesterday's high

  # Rule 4: If no sell rule can be applied and we reach the
  # second last day. Sell at the last day.
```

```
    # Check Rule 1:
    if ((i - BuyBar) > maxHoldingPeriod) {
      # Place the sell transaction at todays close price
      addTxn(
        portfolioname,
        Symbol = instrument,
        TxnDate = CurrentDate,
        TxnPrice = as.numeric(symbol[i, "Close"]),
        TxnQty = -Position,
        TxnFees = transactionCost
      )

    } else {
      # Check Rule 2:
      if (as.numeric(symbol[i, "Close"]) < EMA_today) {
        # Place the sell transaction at tomorrow's open price
        addTxn(
          portfolioname,
          Symbol = instrument,
          TxnDate = time(symbol[i + 1]),
          TxnPrice = OpenTomorrow,
          TxnQty = -Position,
          TxnFees = transactionCost
        )

      } else {
        # Check Rule 3:

        # Sell Rule 3: If today is a Smash Day (Sell) place an order tomorrow at todays
        # low price.

        # Simulate this behaviour:

        # Option 1 to check: Check whether the open price tomorrow is below today's
        # low and add the transaction tomorrow at tomorrow's open price.

        # Option 2 to check: Check whether today's low was larger than tomorrow's
        # low and add the transaction tomorrow at today's low price.

        # Check for Smash Day (Sell)
        if (CloseToday > HighYesterday) {
          # Check for Option 1
          if (OpenTomorrow < LowToday) {
            # Add Sell transaction tomorrow at tomorrow's open price
            addTxn(
              portfolioname,
              Symbol = instrument,
              TxnDate = time(symbol[i + 1]),
              TxnPrice = OpenTomorrow,
              TxnQty = -Position,
              TxnFees = transactionCost
            )
```

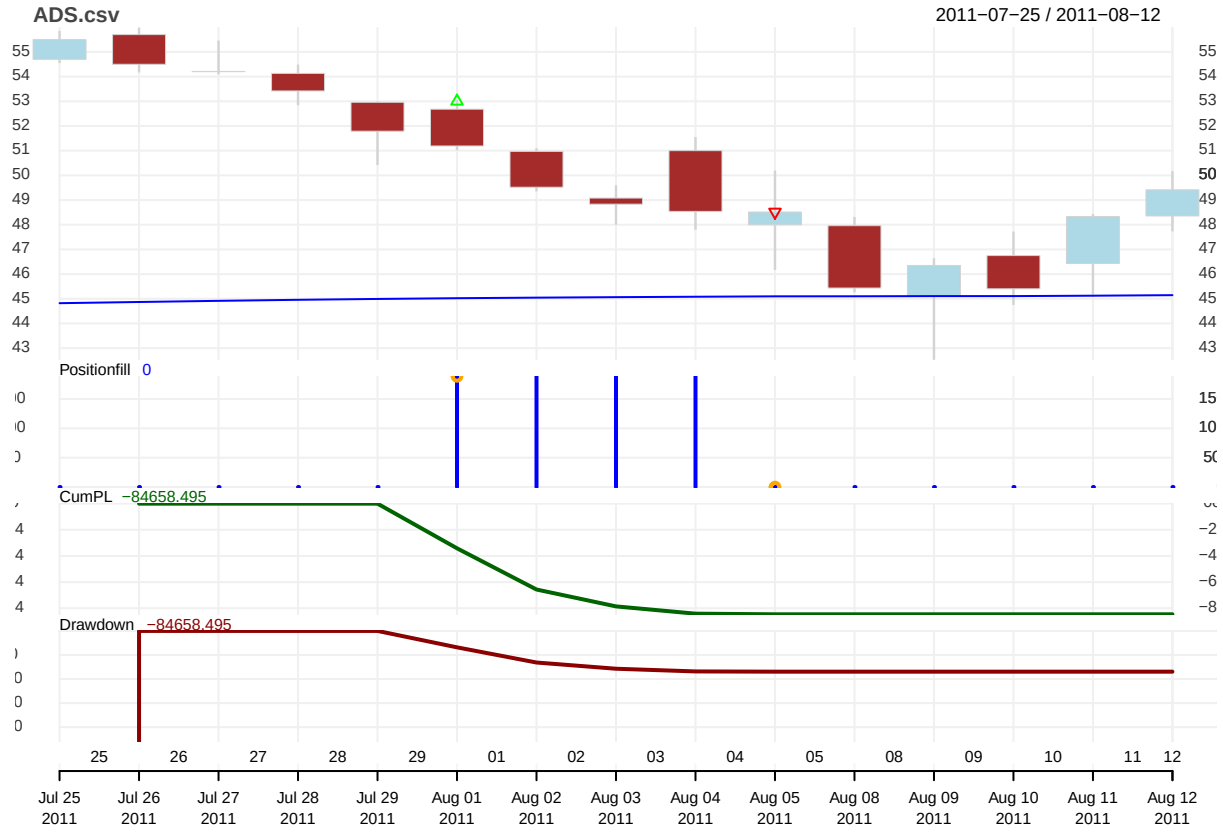
```
            } else {
              # Check for Option 2
              if (LowToday > LowTomorrow) {
                # Add Sell transaction tomorrow at today's low price
                addTxn(
                  portfolioname,
                  Symbol = instrument,
                  TxnDate = time(symbol[i + 1]),
                  TxnPrice = LowToday,
                  TxnQty = -Position,
                  TxnFees = transactionCost
                )
              }
            }
          } else {
            # Check Rule 4
            if (i == nrow(symbol) - 1) {
              # Add Sell transaction for the last day at the close price
              addTxn(
                portfolioname,
                Symbol = instrument,
                TxnDate = time(symbol[i + 1]),
                TxnPrice = as.numeric(symbol[i, "Close"]),
                TxnQty = -Position,
                TxnFees = transactionCost
              )
            }
          }
        }
      }
    }

    updatePortf(portfolioname, Symbols = instrument, Dates = CurrentDate)
    updateAcct(accountname, Dates = CurrentDate)
    updateEndEq(accountname, CurrentDate)

  } # End Bar-by-bar processing
} # End for loop for multiple instruments
```

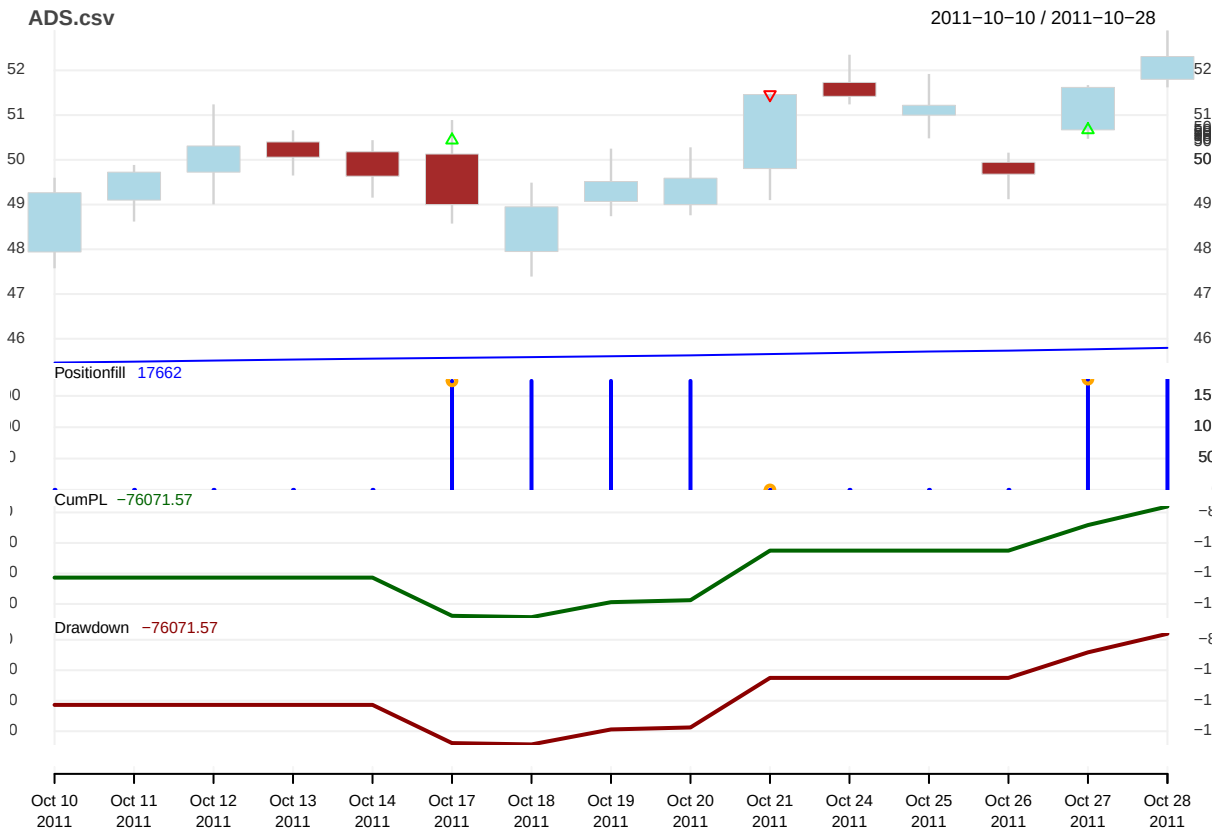
Step 2: System Check

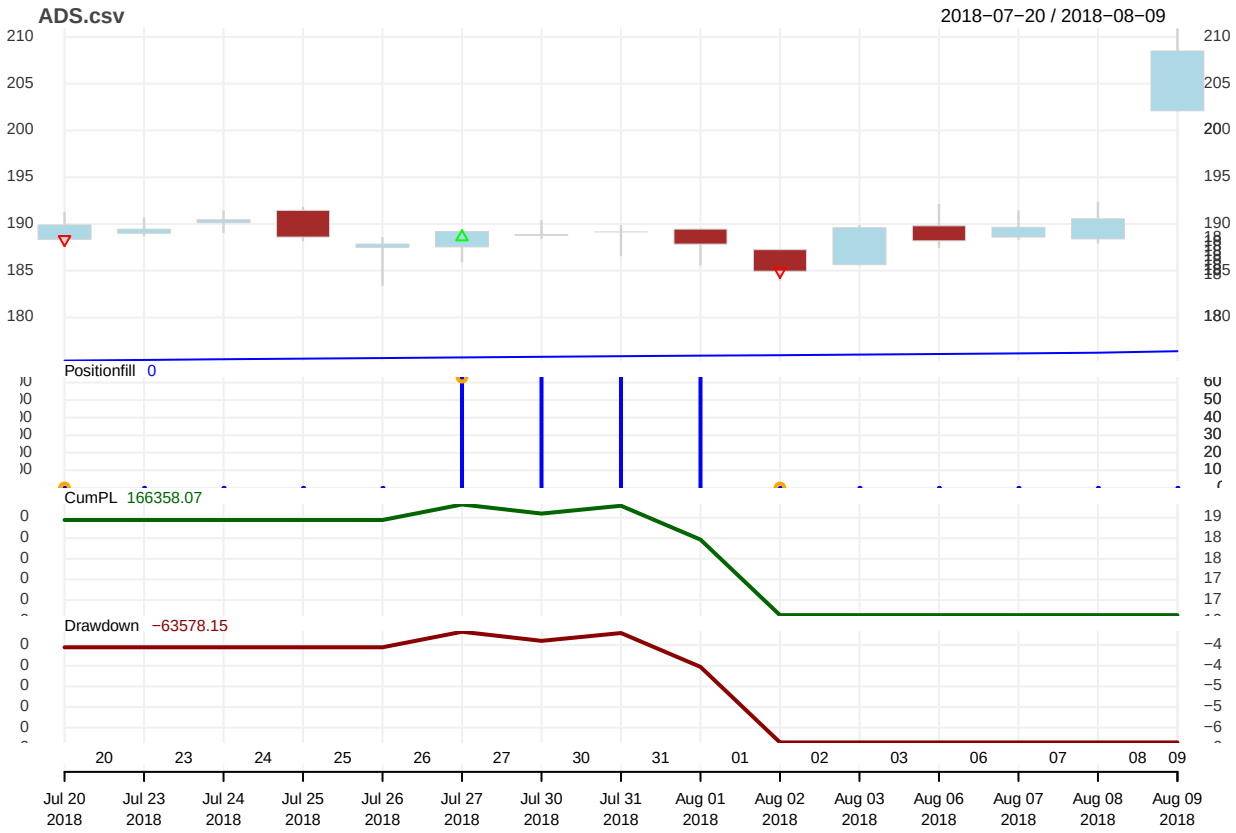
In order to make sure that the system works as designed the plots of some choosen transactions are printed in the following. The plots for the first, third and the 5th last trasnaction are plotted for every instrument in the instrumentlist. The plots can be checked manually and by this it can be ensured that the transactions were performed as expected.

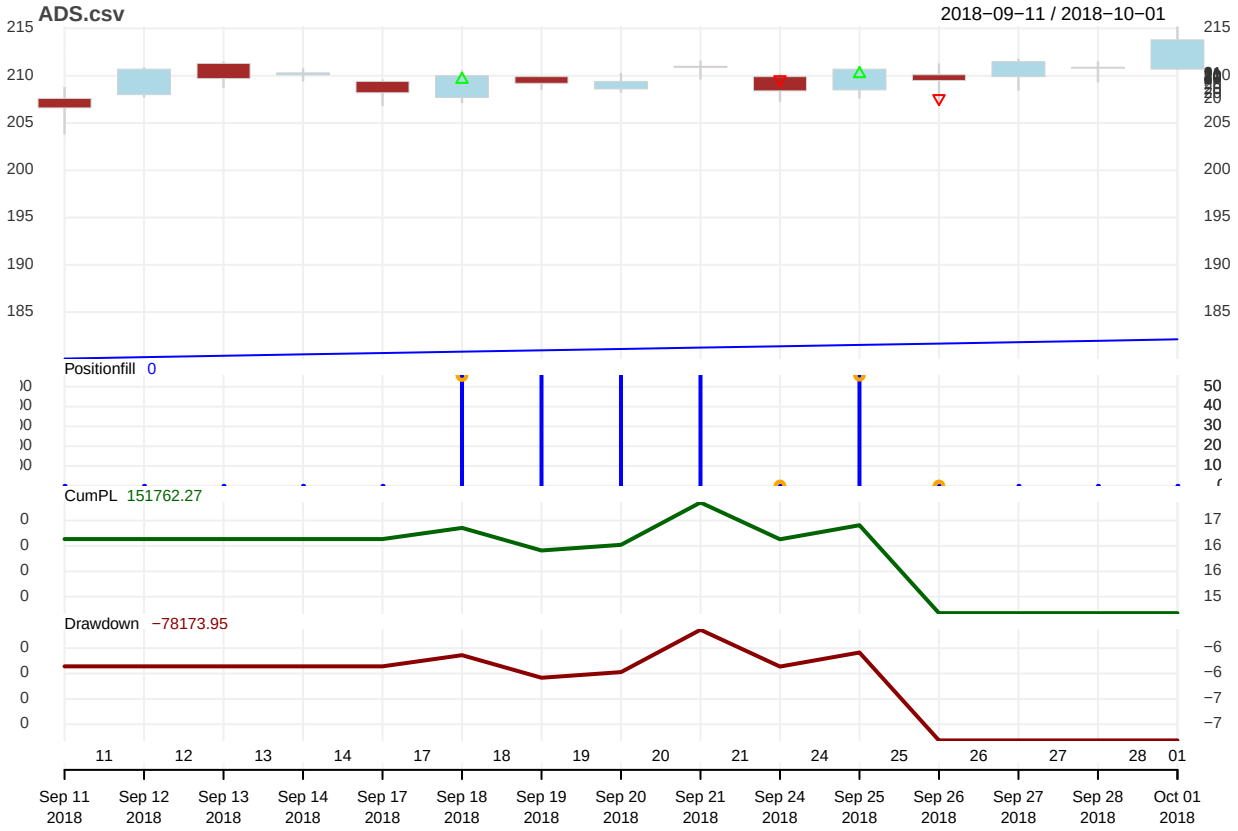
```
# Loop through all instruments in the instrumentlist
for (instrument in instrumentlist){
  rm(daterange_check)
  daterange_check <- c()
  transactionsInstrument <- getTxns(Portfolio=portfolioname,Symbol=instrument)

  # Create a list of transactions to check
  for (i in
```

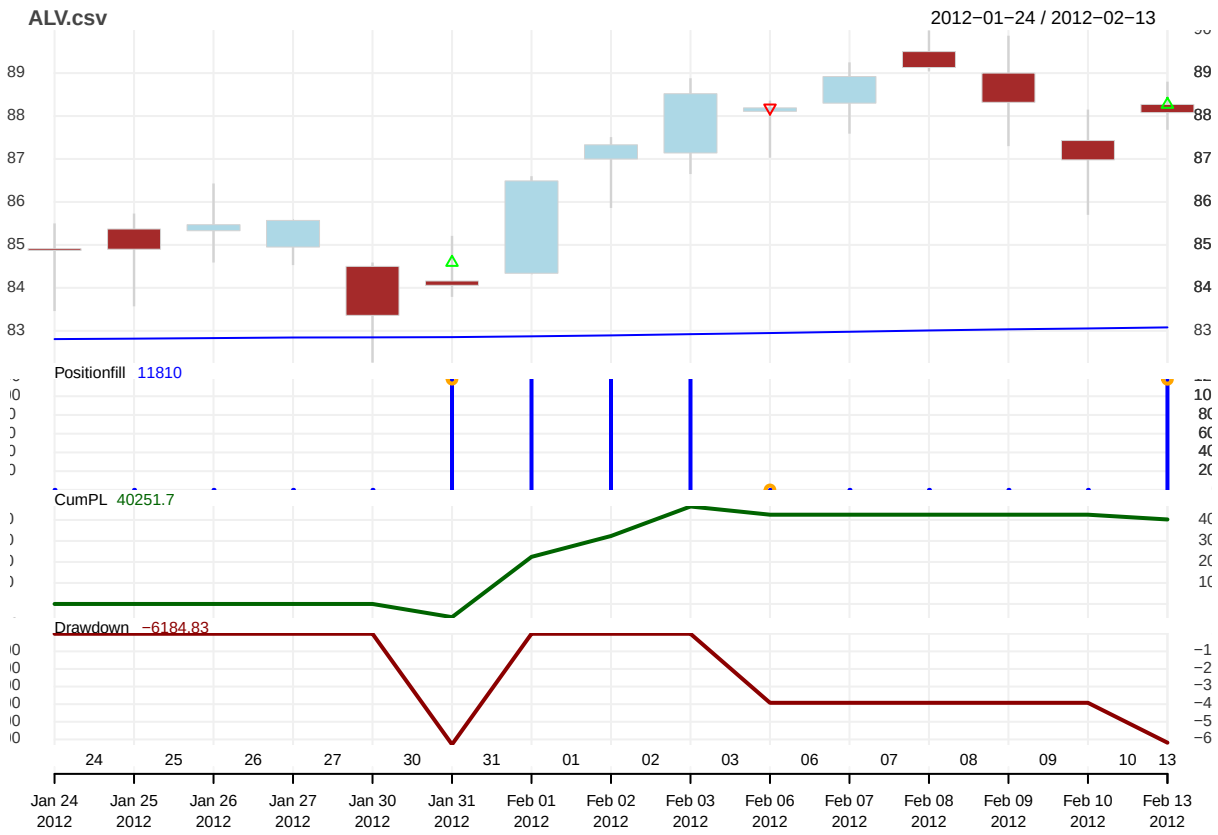
```
      c(2,6, (nrow(transactionsInstrument)-7),(nrow(transactionsInstrument)-5))) {
    from <- as.Date(index(transactionsInstrument[i,1]))-7
    to <- as.Date(index(transactionsInstrument[i+1,1]))+7
    daterange_check <- c(daterange_check, paste(from, "::", to, sep = ""))
  }
  # Plot the transactions and check them manually
  for (daterange_check_i in daterange_check){
    print(chart.Posn(portfolioname,
                     Symbol=instrument,
                     type='candlesticks',
                     theme=myTheme,
                     subset=daterange_check_i,
                     TA=addEMAString))
  }
}
```

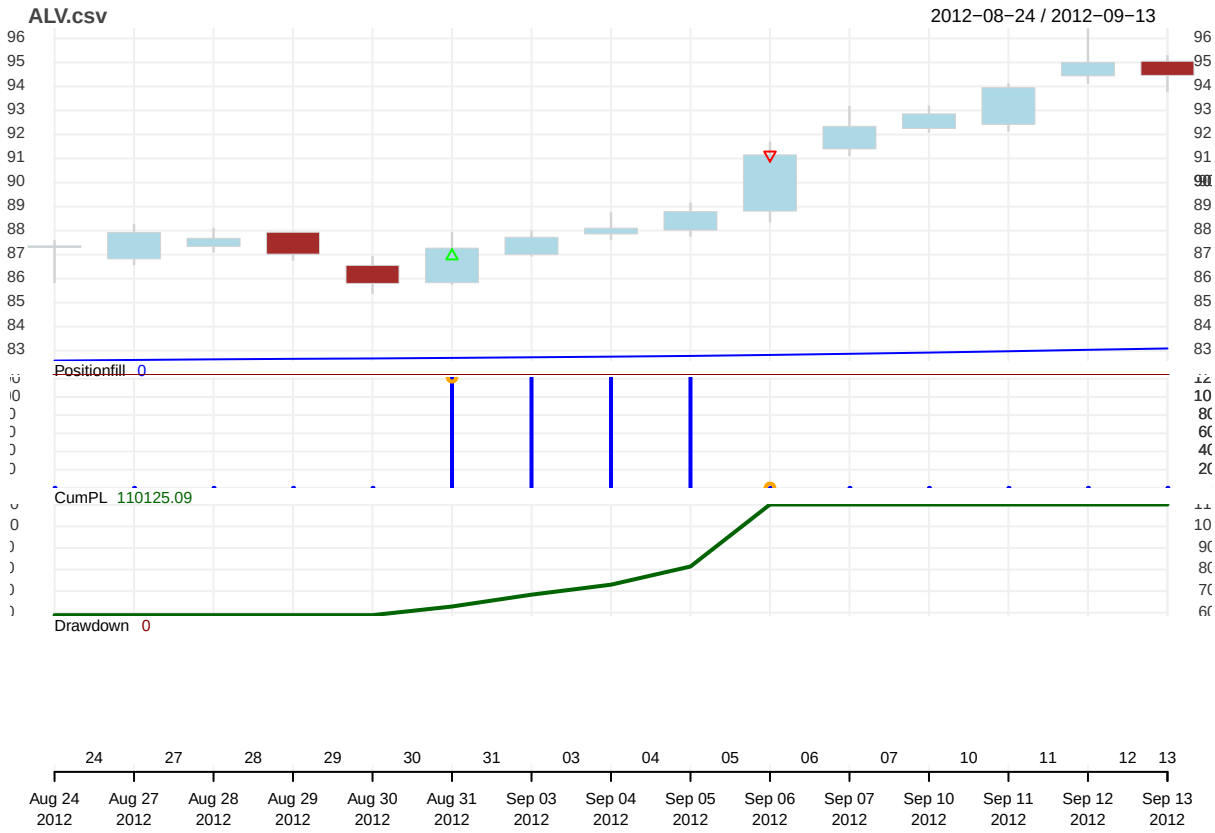


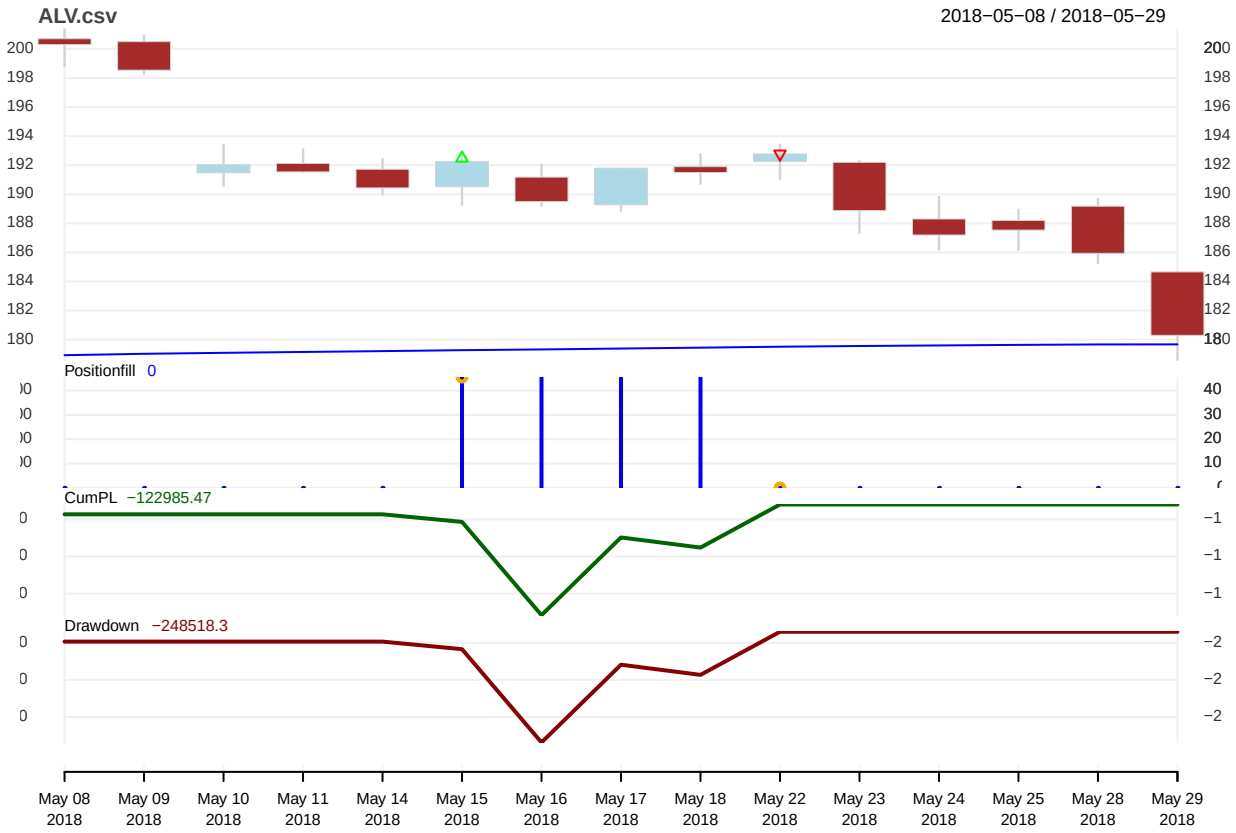

ADS.csv
2011−10−10 / 2011−10−28
52
51
50
49
48
47
46
Positionfill 17662
15
10
CumPL −76071.57
Drawdown −76071.57
Oct 10 2011
Oct 11 2011
Oct 12 2011
Oct 13 2011
Oct 14 2011
Oct 17 2011
Oct 18 2011
Oct 19 2011
Oct 20 2011
Oct 21 2011
Oct 24 2011
Oct 25 2011
Oct 26 2011
Oct 27 2011
Oct 28 2011

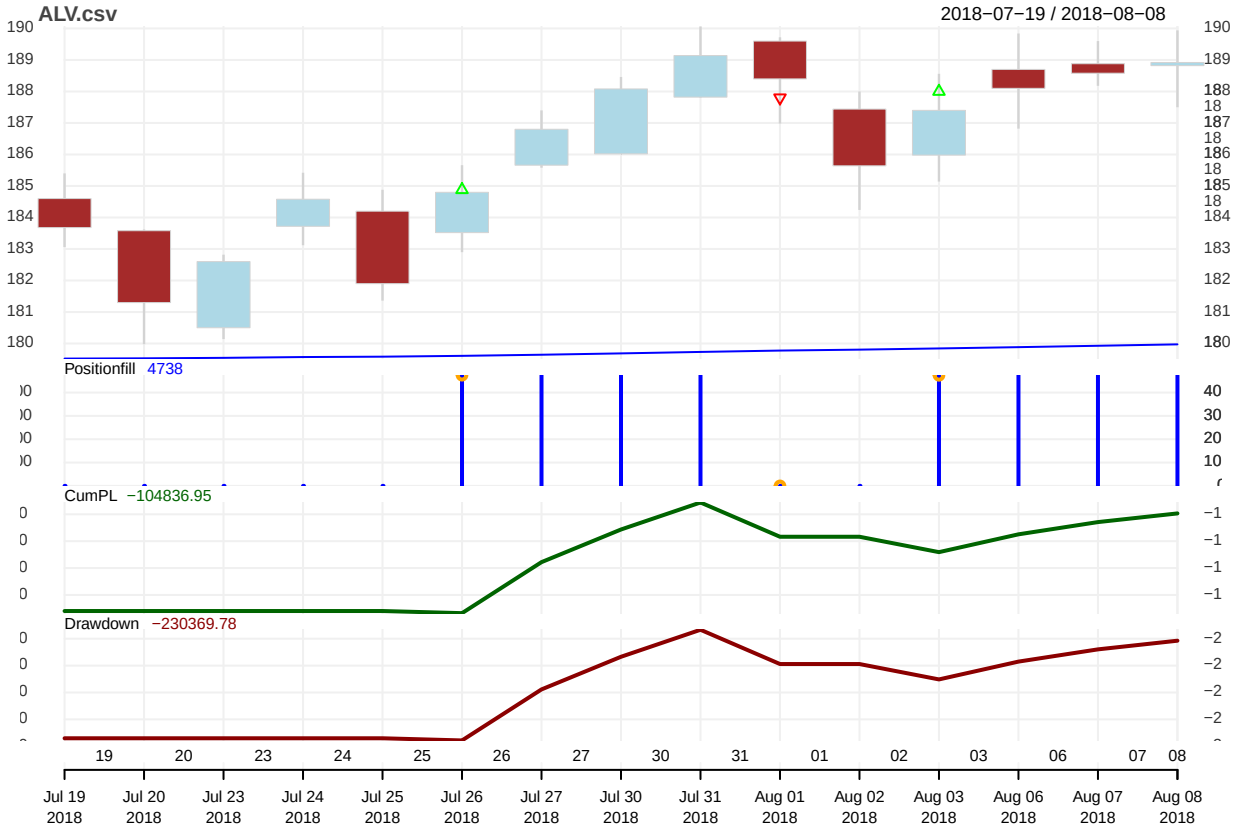

ADS.csv
2018−07−20 / 2018−08−09
Positionfill 0
CumPL 166358.07
Drawdown −63578.15
Jul 20 2018
Jul 23 2018
Jul 24 2018
Jul 25 2018
Jul 26 2018
Jul 27 2018
Jul 30 2018
Jul 31 2018
Aug 01 2018
Aug 02 2018
Aug 03 2018
Aug 06 2018
Aug 07 2018
Aug 08 2018
Aug 09 2018

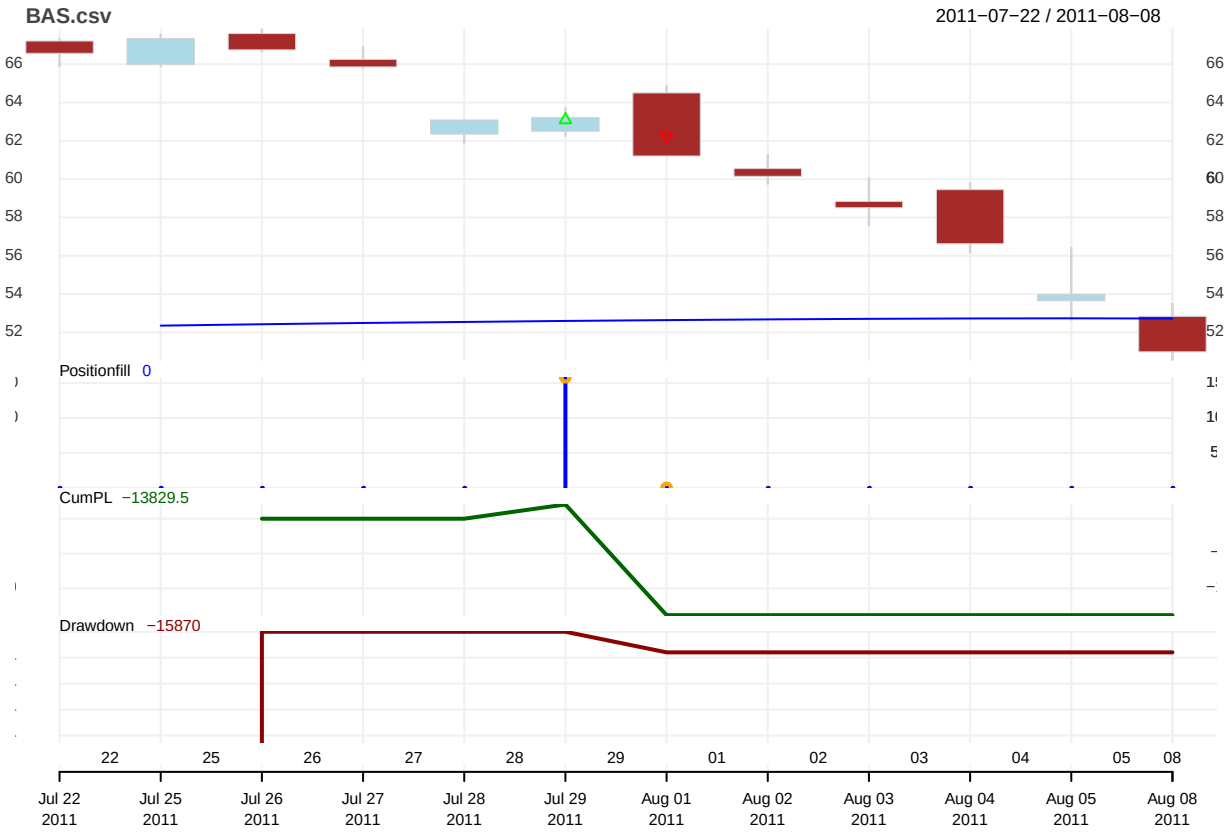

ADS.csv
2018−09−11 / 2018−10−01
Positionfill 0
CumPL 151762.27
Drawdown −78173.95
Sep 11 2018
Sep 12 2018
Sep 13 2018
Sep 14 2018
Sep 17 2018
Sep 18 2018
Sep 19 2018
Sep 20 2018
Sep 21 2018
Sep 24 2018
Sep 25 2018
Sep 26 2018
Sep 27 2018
Sep 28 2018
Oct 01 2018

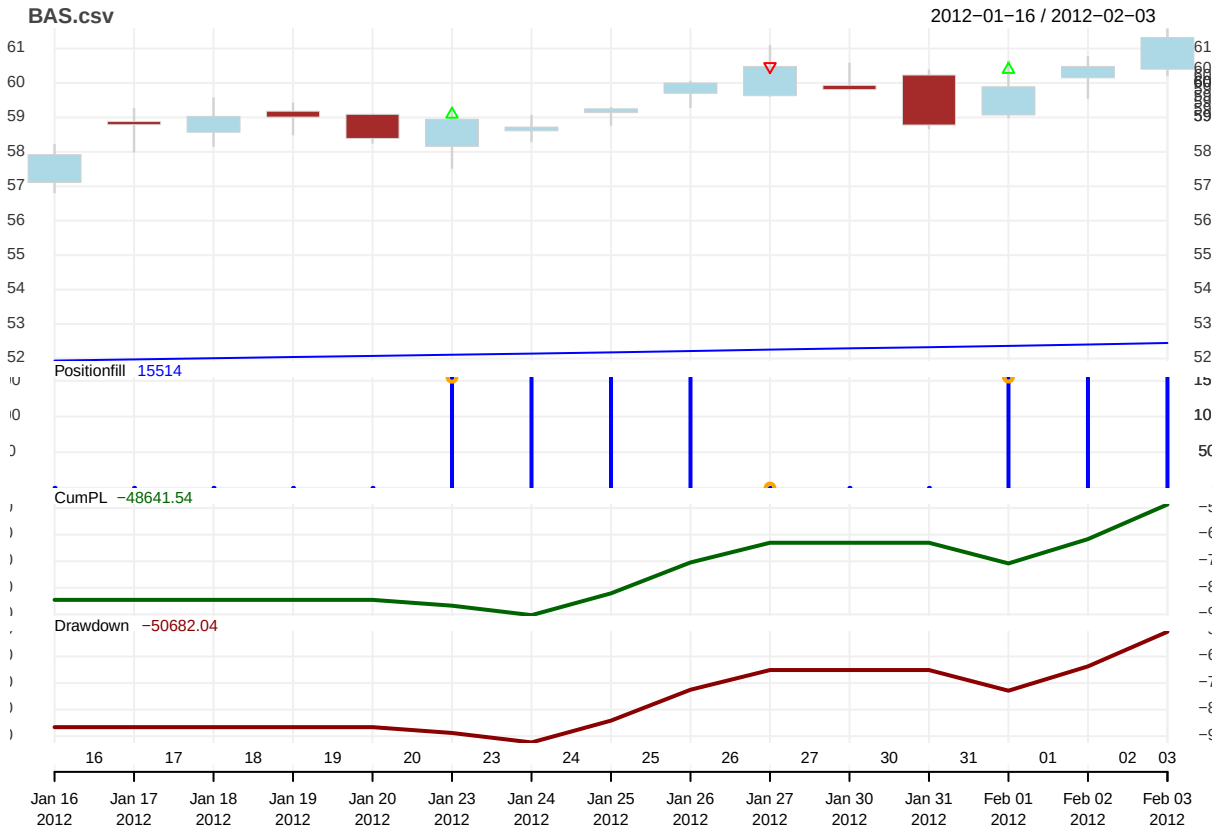

ALV.csv
2012−01−24 / 2012−02−13
Positionfill 11810
CumPL 40251.7
Drawdown −6184.83
24 25 26 27 30 31 01 02 03 06 07 08 09 10 13
Jan 24 2012
Jan 25 2012
Jan 26 2012
Jan 27 2012
Jan 30 2012
Jan 31 2012
Feb 01 2012
Feb 02 2012
Feb 03 2012
Feb 06 2012
Feb 07 2012
Feb 08 2012
Feb 09 2012
Feb 10 2012
Feb 13 2012

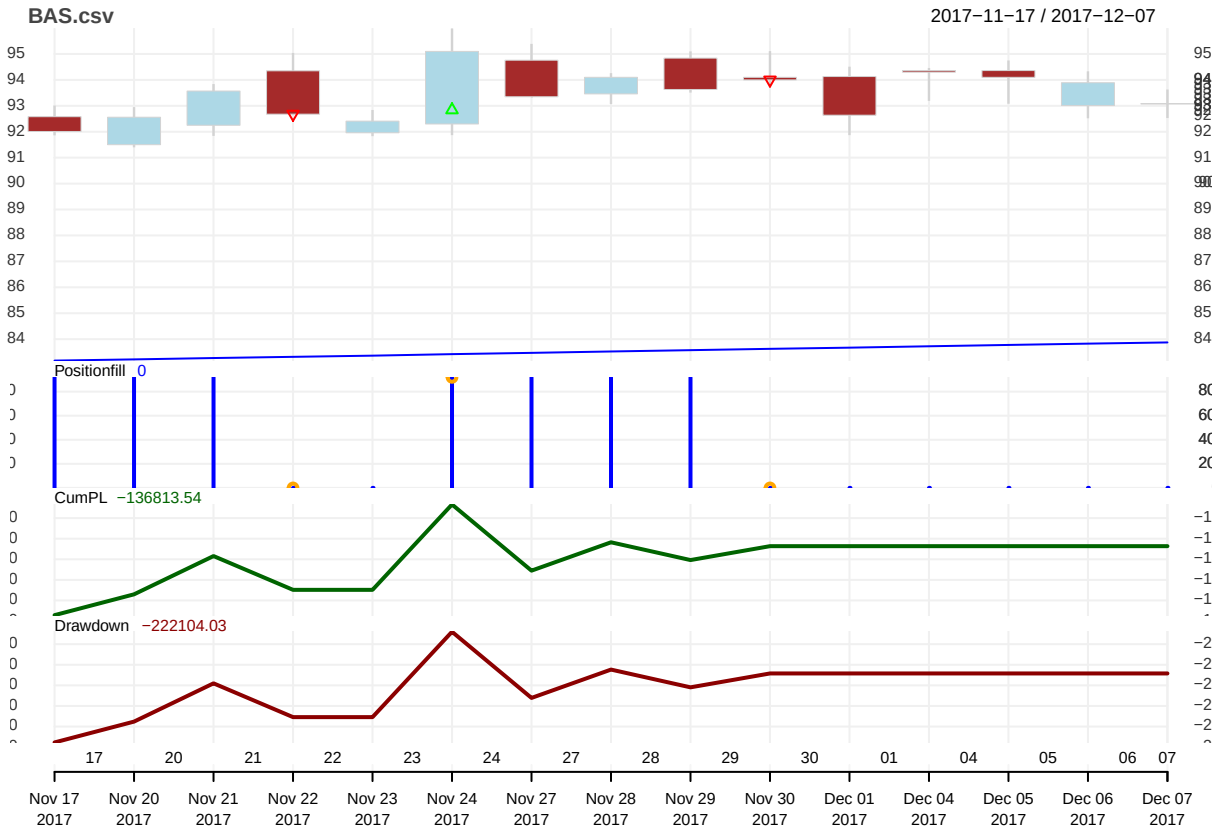

ALV.csv
2012−08−24 / 2012−09−13
Positionfill 0
CumPL 110125.09
Drawdown 0
24 27 28 29 30 31 03 04 05 06 07 10 11 12 13
Aug 24 2012
Aug 27 2012
Aug 28 2012
Aug 29 2012
Aug 30 2012
Aug 31 2012
Sep 03 2012
Sep 04 2012
Sep 05 2012
Sep 06 2012
Sep 07 2012
Sep 10 2012
Sep 11 2012
Sep 12 2012
Sep 13 2012

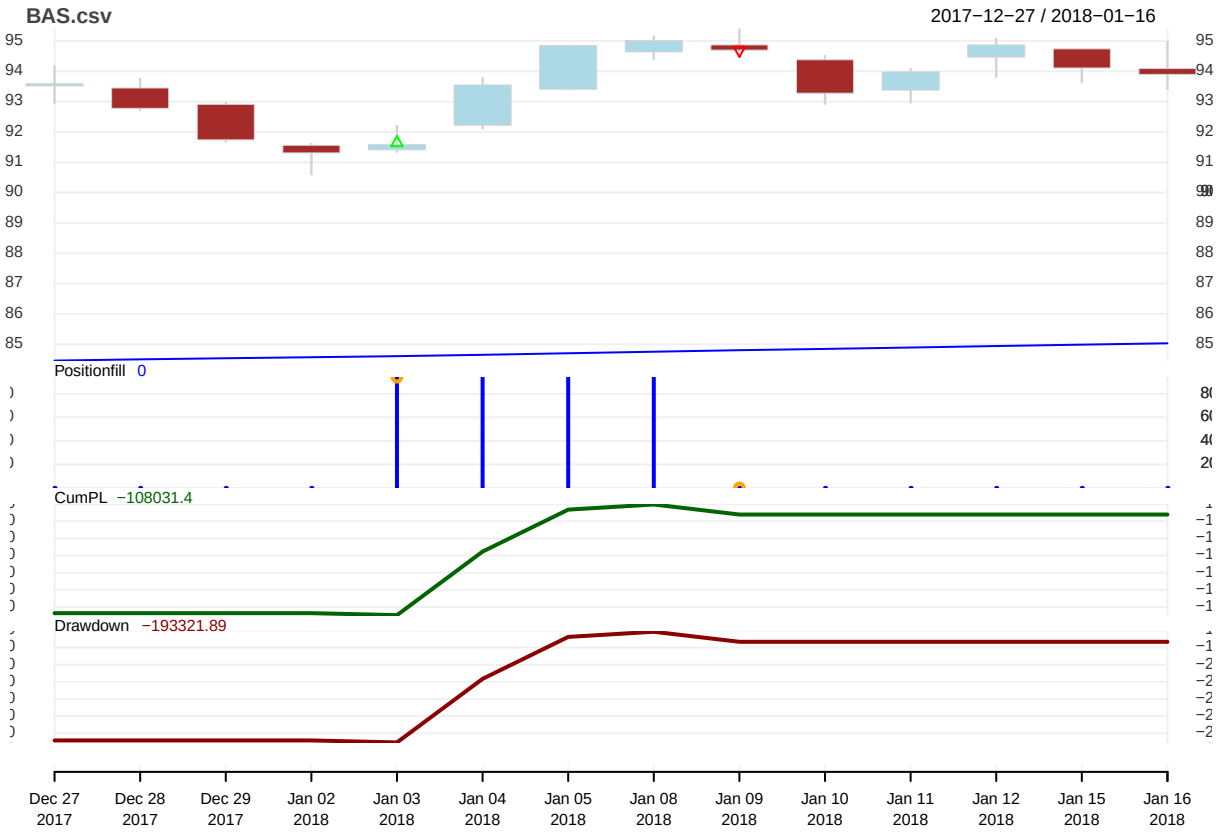

ALV.csv
2018−05−08 / 2018−05−29
200
198
196
194
192
190
188
186
184
182
180
Positionfill 0
40
30
20
10
CumPL −122985.47
−1
−1
−1
Drawdown −248518.3
−2
−2
−2
May 08 2018
May 09 2018
May 10 2018
May 11 2018
May 14 2018
May 15 2018
May 16 2018
May 17 2018
May 18 2018
May 22 2018
May 23 2018
May 24 2018
May 25 2018
May 28 2018
May 29 2018

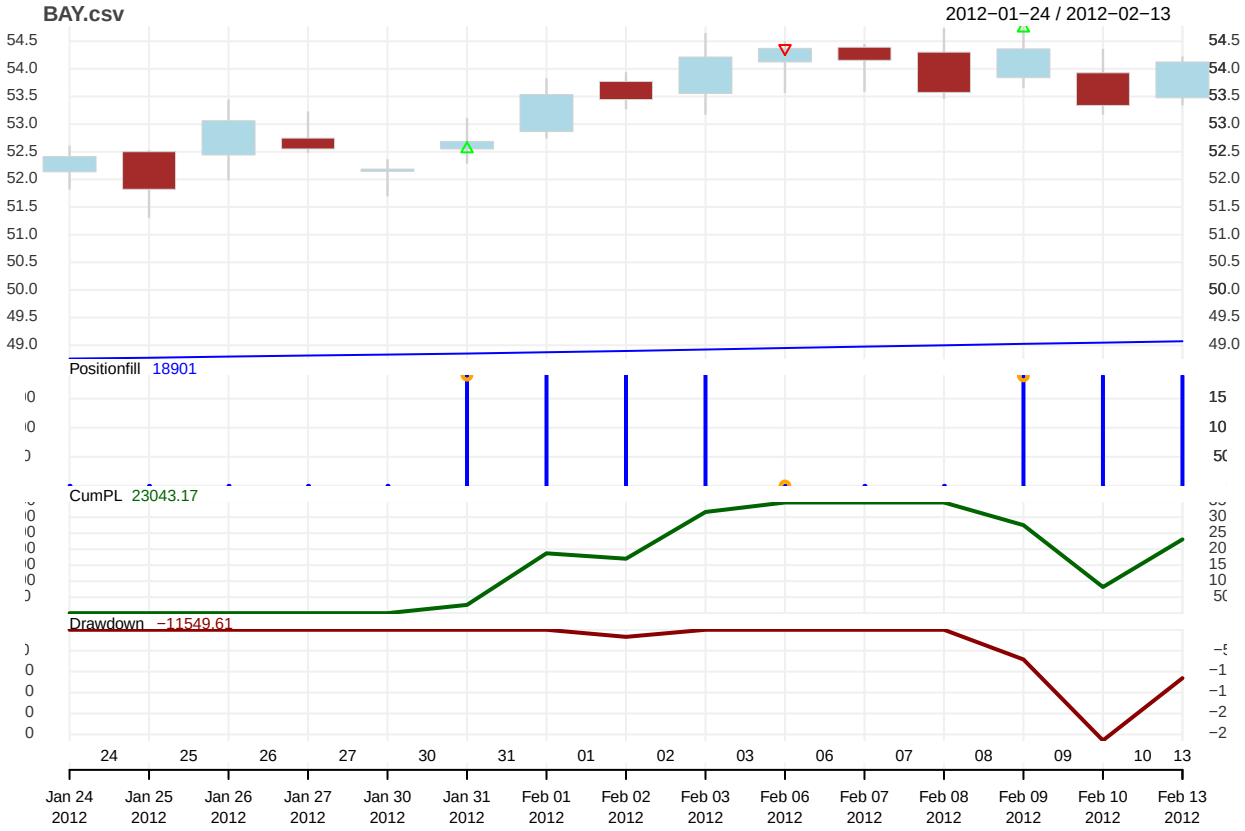

ALV.csv
2018−07−19 / 2018−08−08
Positionfill 4738
CumPL −104836.95
Drawdown −230369.78
Jul 19 2018
Jul 20 2018
Jul 23 2018
Jul 24 2018
Jul 25 2018
Jul 26 2018
Jul 27 2018
Jul 30 2018
Jul 31 2018
Aug 01 2018
Aug 02 2018
Aug 03 2018
Aug 06 2018
Aug 07 2018
Aug 08 2018

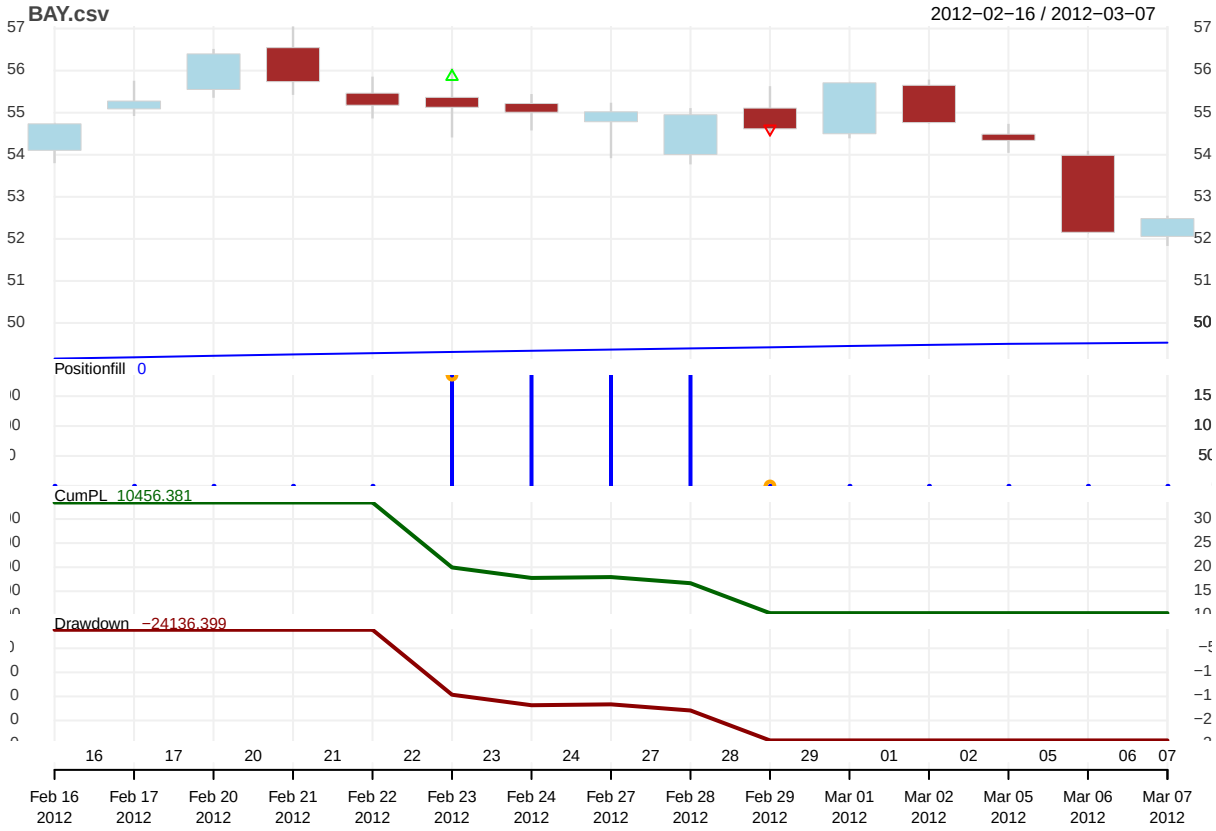

BAS.csv
2011−07−22 / 2011−08−08
66
64
62
60
58
56
54
52
Positionfill 0
CumPL −13829.5
Drawdown −15870
22
25
26
27
28
29
01
02
03
04
05
08
Jul 22 2011
Jul 25 2011
Jul 26 2011
Jul 27 2011
Jul 28 2011
Jul 29 2011
Aug 01 2011
Aug 02 2011
Aug 03 2011
Aug 04 2011
Aug 05 2011
Aug 08 2011

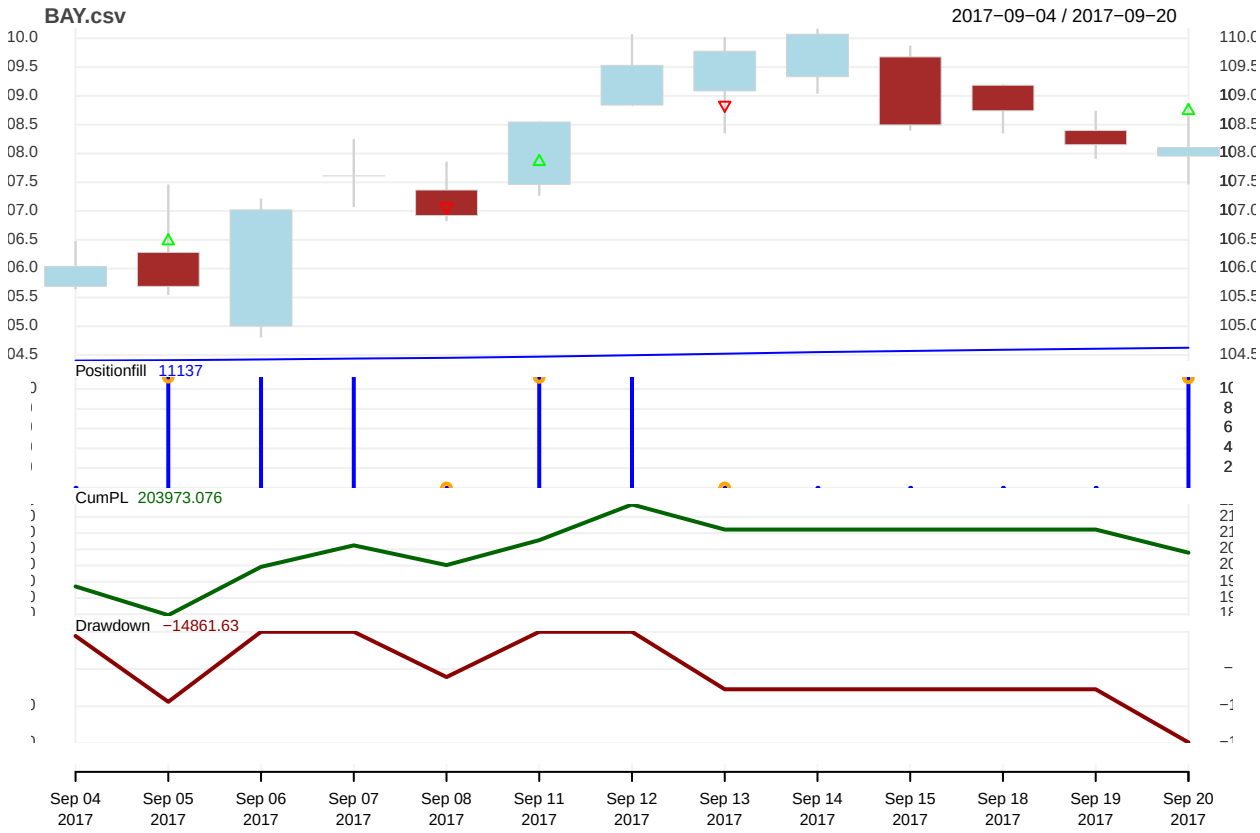

BAS.csv
2012−01−16 / 2012−02−03
Positionfill 15514
CumPL −48641.54
Drawdown −50682.04
16 17 18 19 20 23 24 25 26 27 30 31 01 02 03
Jan 16 2012
Jan 17 2012
Jan 18 2012
Jan 19 2012
Jan 20 2012
Jan 23 2012
Jan 24 2012
Jan 25 2012
Jan 26 2012
Jan 27 2012
Jan 30 2012
Jan 31 2012
Feb 01 2012
Feb 02 2012
Feb 03 2012

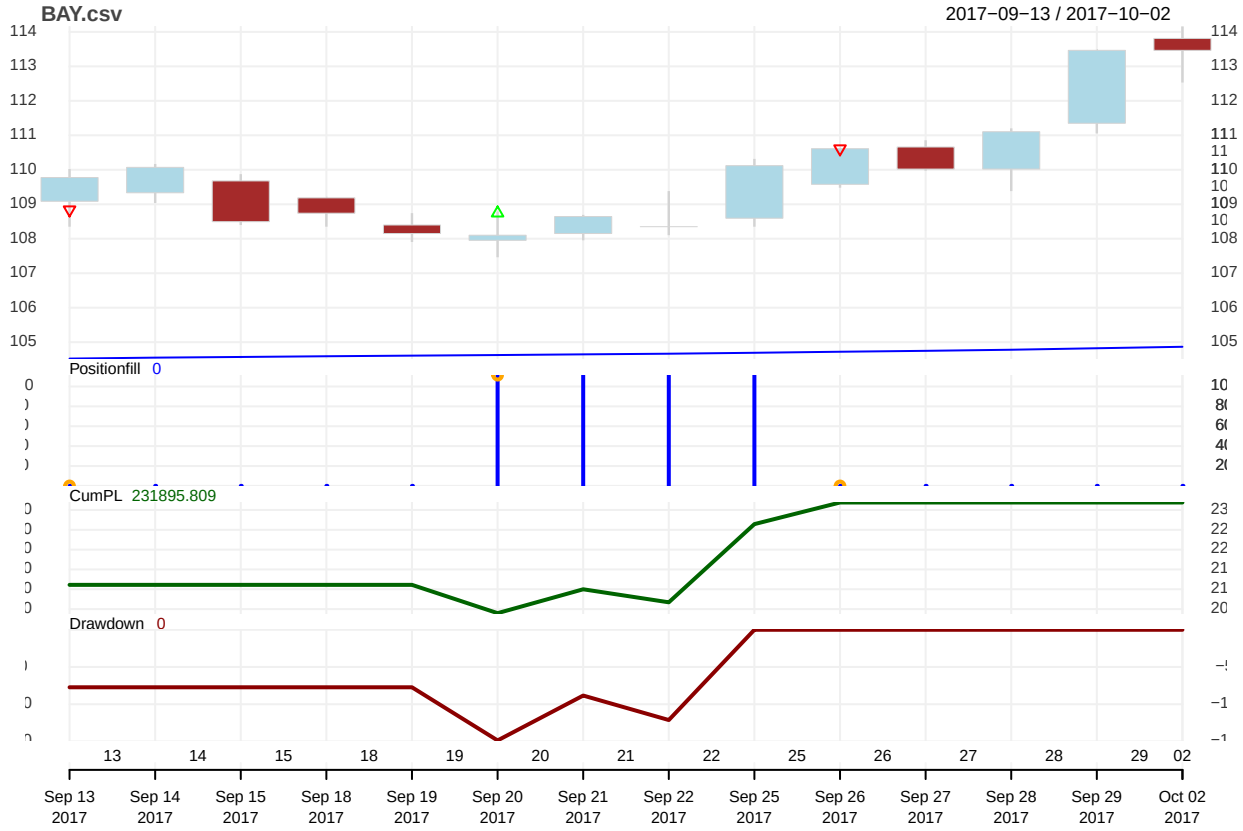

BAS.csv
2017−11−17 / 2017−12−07
Positionfill 0
CumPL −136813.54
Drawdown −222104.03
Nov 17 2017
Nov 20 2017
Nov 21 2017
Nov 22 2017
Nov 23 2017
Nov 24 2017
Nov 27 2017
Nov 28 2017
Nov 29 2017
Nov 30 2017
Dec 01 2017
Dec 04 2017
Dec 05 2017
Dec 06 2017
Dec 07 2017

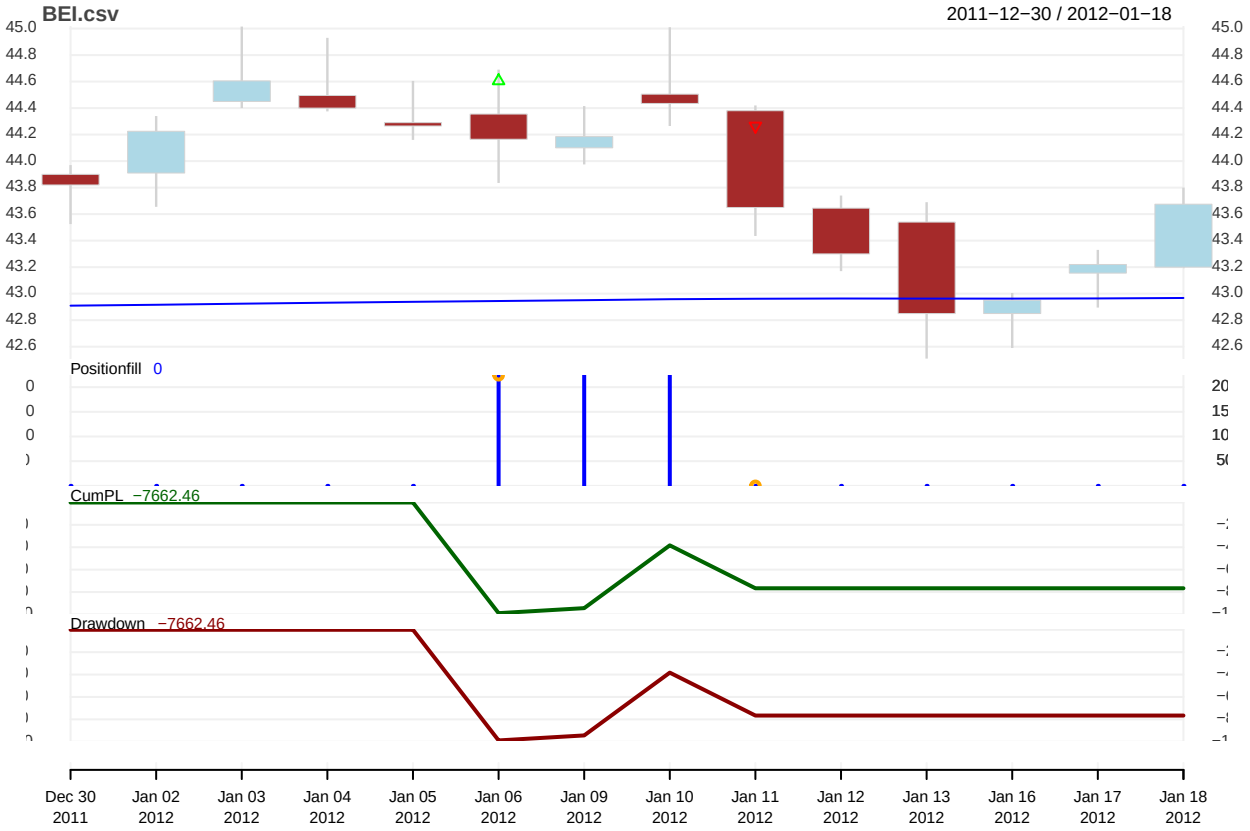

BAS.csv
2017−12−27 / 2018−01−16
95
94
93
92
91
90
89
88
87
86
85
Positionfill 0
CumPL −108031.4
Drawdown −193321.89
Dec 27 2017
Dec 28 2017
Dec 29 2017
Jan 02 2018
Jan 03 2018
Jan 04 2018
Jan 05 2018
Jan 08 2018
Jan 09 2018
Jan 10 2018
Jan 11 2018
Jan 12 2018
Jan 15 2018
Jan 16 2018

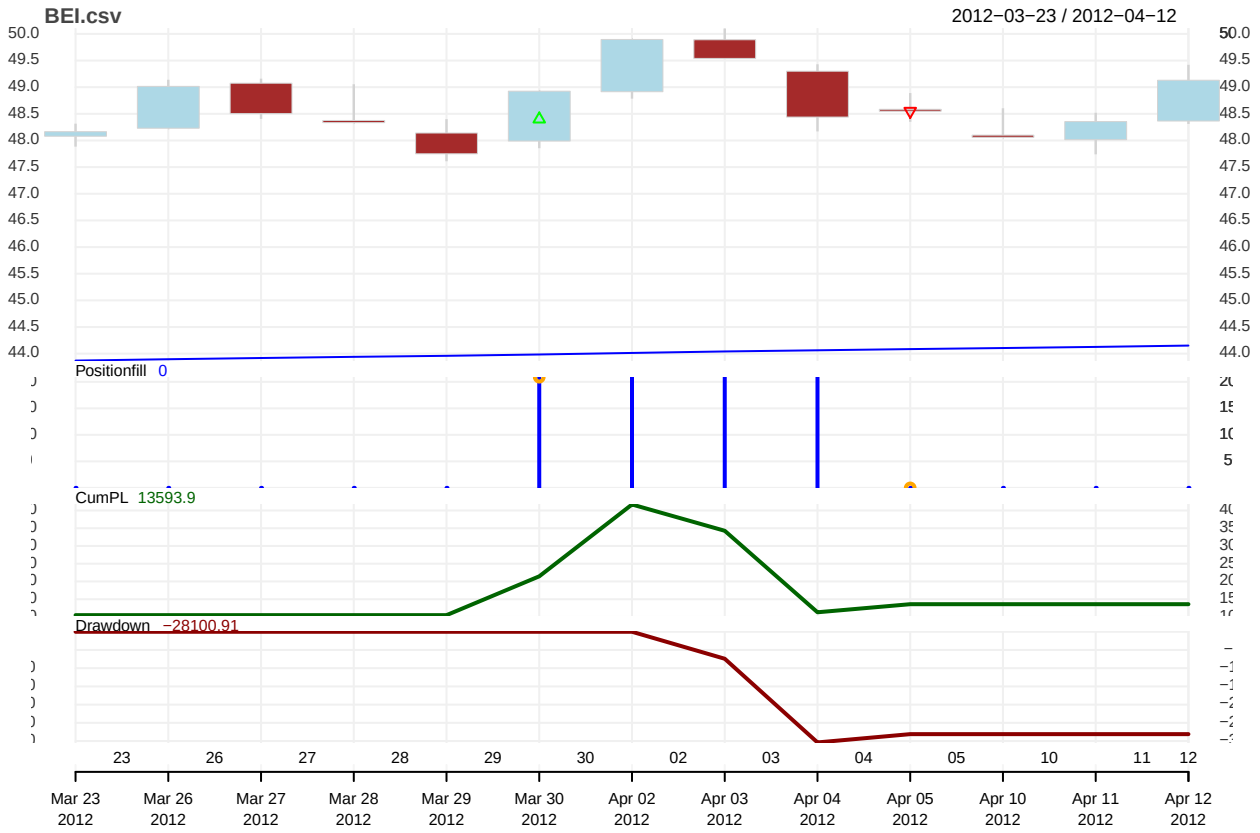

BAY.csv
2012−01−24 / 2012−02−13
Positionfill 18901
CumPL 23043.17
Drawdown −11549.61
Jan 24 2012
Jan 25 2012
Jan 26 2012
Jan 27 2012
Jan 30 2012
Jan 31 2012
Feb 01 2012
Feb 02 2012
Feb 03 2012
Feb 06 2012
Feb 07 2012
Feb 08 2012
Feb 09 2012
Feb 10 2012
Feb 13 2012

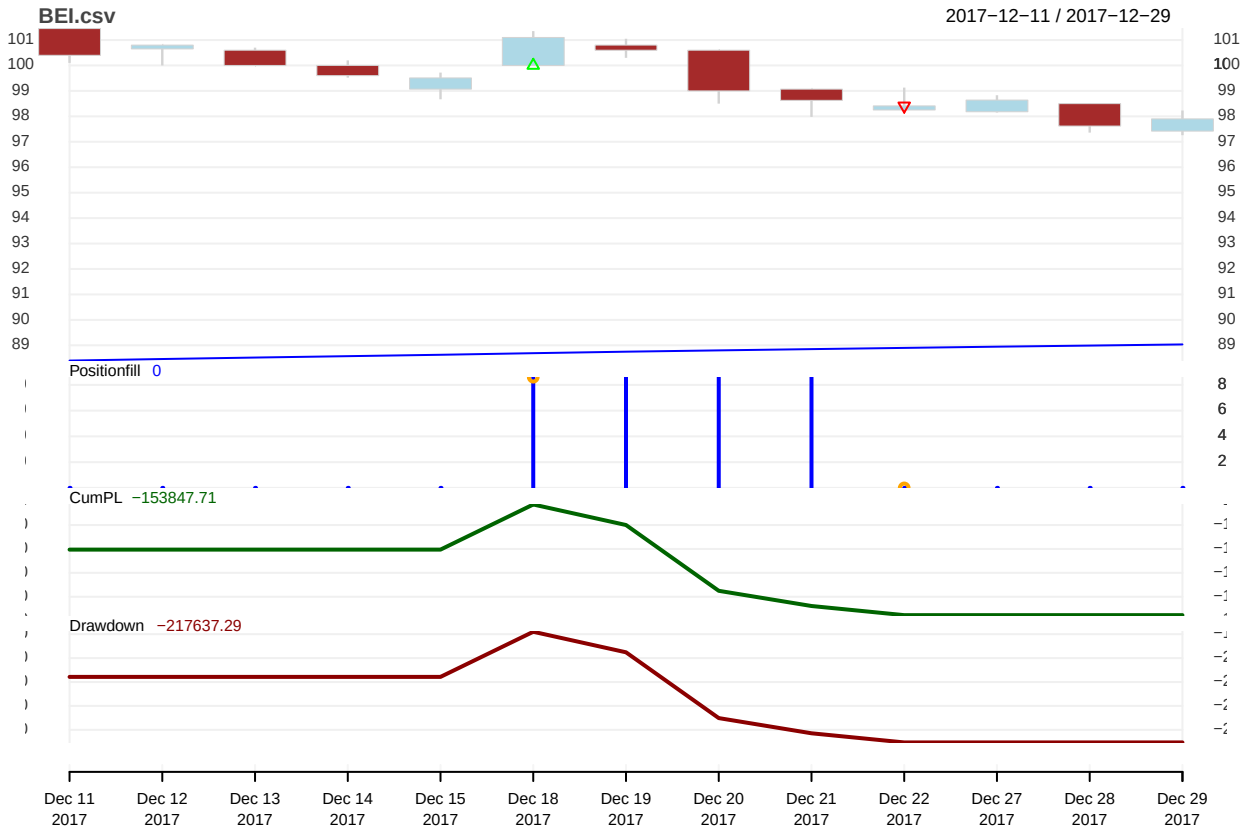

BAY.csv
2012−02−16 / 2012−03−07
Positionfill 0
CumPL 10456.381
Drawdown −24136.399
16 17 20 21 22 23 24 27 28 29 01 02 05 06 07
Feb 16 2012
Feb 17 2012
Feb 20 2012
Feb 21 2012
Feb 22 2012
Feb 23 2012
Feb 24 2012
Feb 27 2012
Feb 28 2012
Feb 29 2012
Mar 01 2012
Mar 02 2012
Mar 05 2012
Mar 06 2012
Mar 07 2012

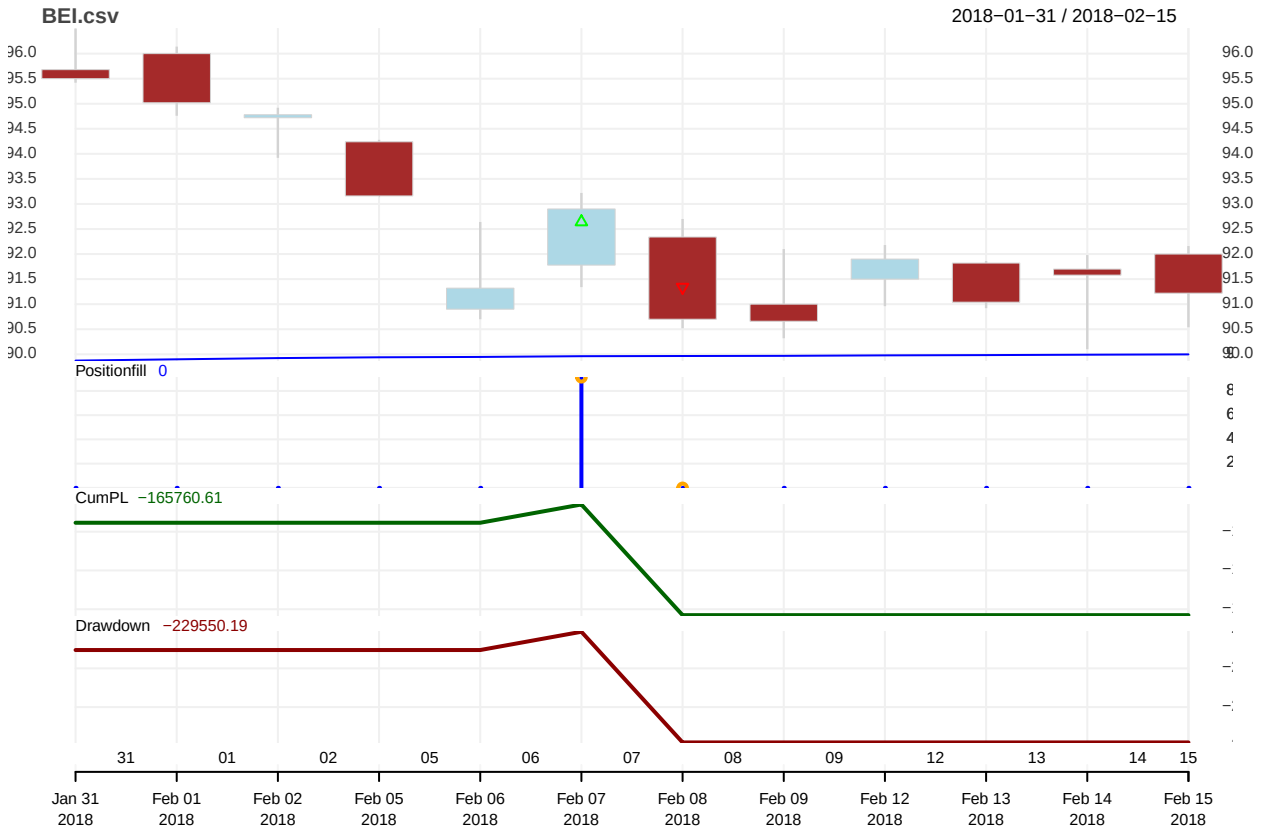

BAY.csv
2017−09−04 / 2017−09−20
Positionfill 11137
CumPL 203973.076
Drawdown −14861.63
Sep 04 2017
Sep 05 2017
Sep 06 2017
Sep 07 2017
Sep 08 2017
Sep 11 2017
Sep 12 2017
Sep 13 2017
Sep 14 2017
Sep 15 2017
Sep 18 2017
Sep 19 2017
Sep 20 2017


BAY.csv
2017−09−13 / 2017−10−02
Positionfill 0
CumPL 231895.809
Drawdown 0
Sep 13 2017
Sep 14 2017
Sep 15 2017
Sep 18 2017
Sep 19 2017
Sep 20 2017
Sep 21 2017
Sep 22 2017
Sep 25 2017
Sep 26 2017
Sep 27 2017
Sep 28 2017
Sep 29 2017
Oct 02 2017


BEI.csv
2011−12−30 / 2012−01−18
45.0
44.8
44.6
44.4
44.2
44.0
43.8
43.6
43.4
43.2
43.0
42.8
42.6
Positionfill 0
CumPL −7662.46
Drawdown −7662.46
Dec 30 2011
Jan 02 2012
Jan 03 2012
Jan 04 2012
Jan 05 2012
Jan 06 2012
Jan 09 2012
Jan 10 2012
Jan 11 2012
Jan 12 2012
Jan 13 2012
Jan 16 2012
Jan 17 2012
Jan 18 2012


BEI.csv
2012−03−23 / 2012−04−12
Positionfill 0
CumPL 13593.9
Drawdown −28100.91
Mar 23 2012
Mar 26 2012
Mar 27 2012
Mar 28 2012
Mar 29 2012
Mar 30 2012
Apr 02 2012
Apr 03 2012
Apr 04 2012
Apr 05 2012
Apr 10 2012
Apr 11 2012
Apr 12 2012


BEI.csv
2017−12−11 / 2017−12−29
Positionfill 0
CumPL −153847.71
Drawdown −217637.29
Dec 11 2017
Dec 12 2017
Dec 13 2017
Dec 14 2017
Dec 15 2017
Dec 18 2017
Dec 19 2017
Dec 20 2017
Dec 21 2017
Dec 22 2017
Dec 27 2017
Dec 28 2017
Dec 29 2017



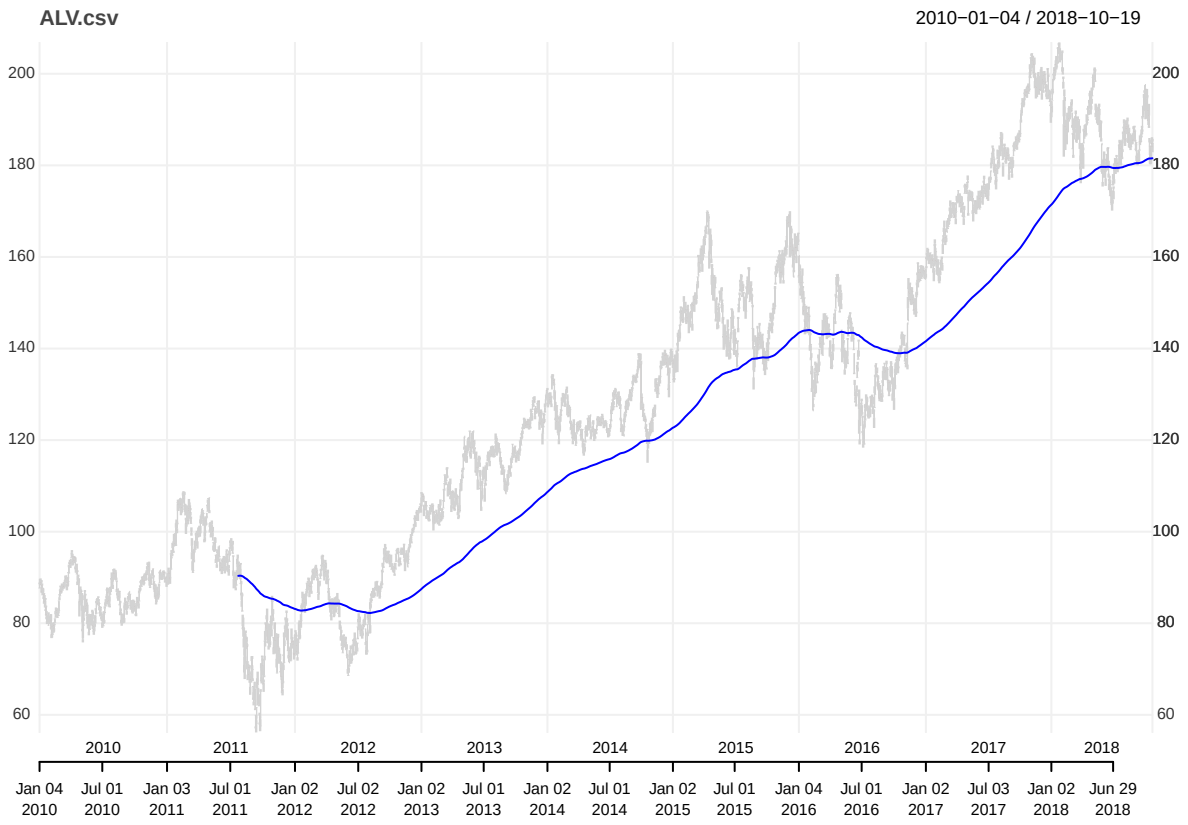
Part C: Analysis and Reporting

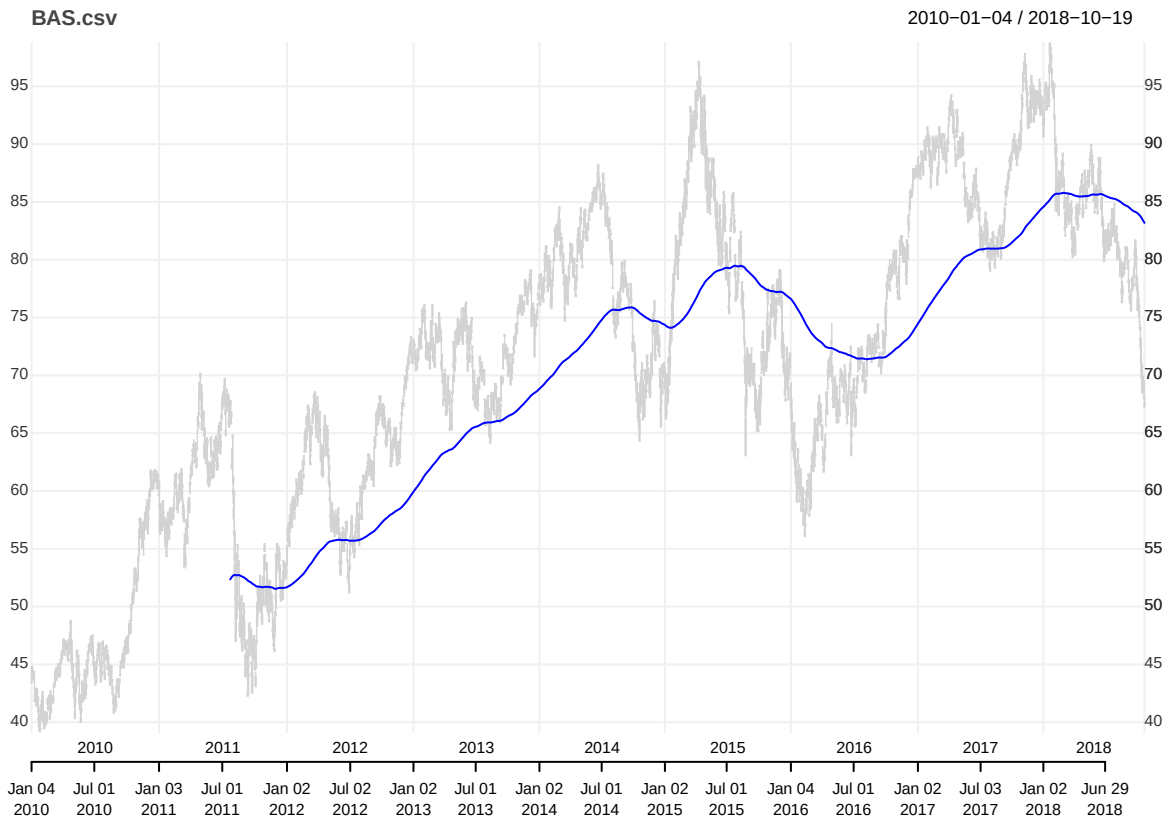
Step 1: Visualize original data

Plot of the instrument with the EMA line which indicates the general trend of the stock exponentially smoothed for the last 200 days. Moreover, the tradevolume is added below the graph. This plots can be used to get a first impression of the long term trend of the instrument and to see which general behaviour of the price can be observed

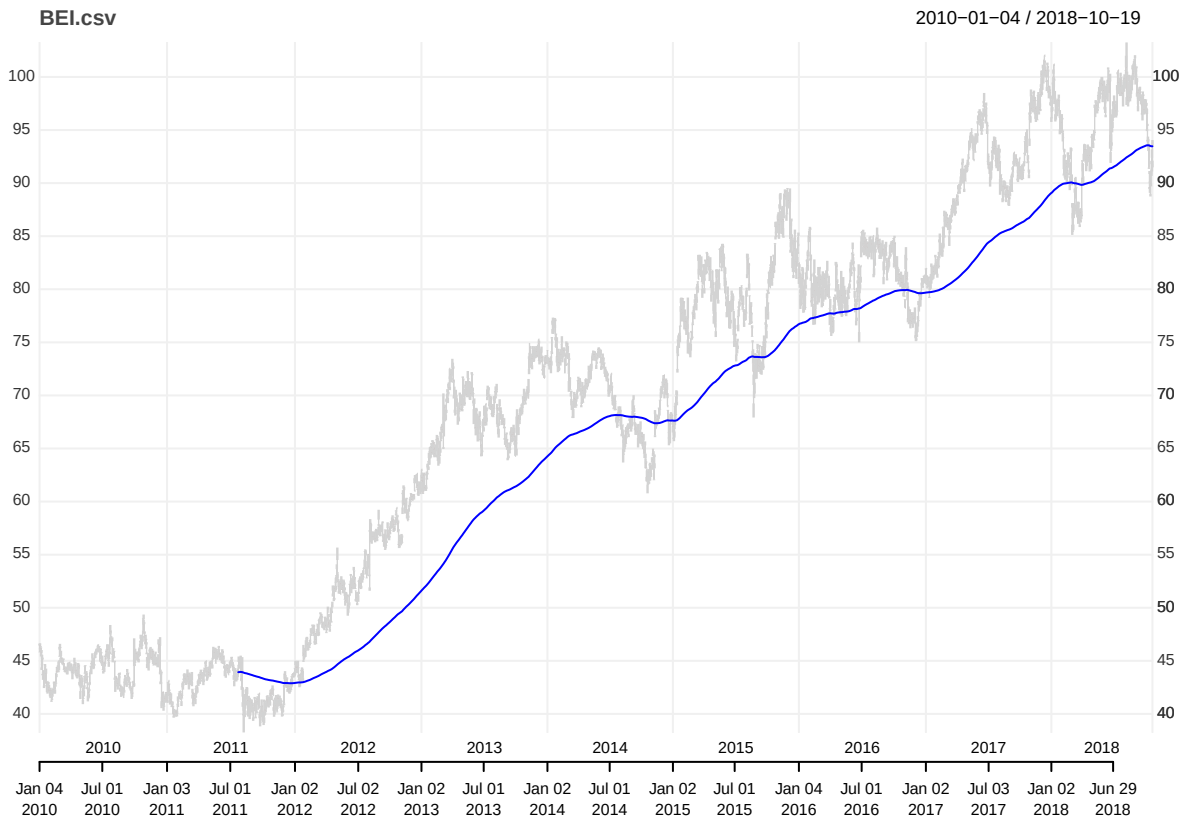
```
for (instrument in instrumentlist){
  chart <- get(instrument)
  print(chart_Series(x=chart,name=instrument,
                     theme=myTheme,
                     subset=daterange,
                     TA="add_TA((chart$EMA), on=1,type='l',col='blue')"))
}
```

ADS.csv
2010−01−04 / 2018−10−19
200
180
160
140
120
100
80
60
40
2010
2011
2012
2013
2014
2015
2016
2017
2018
Jan 04 2010
Jul 01 2010
Jan 03 2011
Jul 01 2011
Jan 02 2012
Jul 02 2012
Jan 02 2013
Jul 01 2013
Jan 02 2014
Jul 01 2014
Jan 02 2015
Jul 01 2015
Jan 04 2016
Jul 01 2016
Jan 02 2017
Jul 03 2017
Jan 02 2018
Jun 29 2018


ALV.csv
2010−01−04 / 2018−10−19
200
180
160
140
120
100
80
60
2010
2011
2012
2013
2014
2015
2016
2017
2018
Jan 04 2010
Jul 01 2010
Jan 03 2011
Jul 01 2011
Jan 02 2012
Jul 02 2012
Jan 02 2013
Jul 01 2013
Jan 02 2014
Jul 01 2014
Jan 02 2015
Jul 01 2015
Jan 04 2016
Jul 01 2016
Jan 02 2017
Jul 03 2017
Jan 02 2018
Jun 29 2018


BAS.csv
2010−01−04 / 2018−10−19
95
90
85
80
75
70
65
60
55
50
45
40
2010
2011
2012
2013
2014
2015
2016
2017
2018
Jan 04 2010
Jul 01 2010
Jan 03 2011
Jul 01 2011
Jan 02 2012
Jul 02 2012
Jan 02 2013
Jul 01 2013
Jan 02 2014
Jul 01 2014
Jan 02 2015
Jul 01 2015
Jan 04 2016
Jul 01 2016
Jan 02 2017
Jul 03 2017
Jan 02 2018
Jun 29 2018

BAY.csv
2010−01−04 / 2018−10−11
140
130
120
110
100
90
80
70
60
50
40
2010
2011
2012
2013
2014
2015
2016
2017
2018
Jan 04 2010
Jul 01 2010
Jan 03 2011
Jul 01 2011
Jan 02 2012
Jul 02 2012
Jan 02 2013
Jul 01 2013
Jan 02 2014
Jul 01 2014
Jan 02 2015
Jul 01 2015
Jan 04 2016
Jul 01 2016
Jan 02 2017
Jul 03 2017
Jan 02 2018
Jun 29 2018



Step 2: All transactions performed by the trading system

The following table can be used to get a better overview of the transactions performed and the exact details like the quantity, price and value per transaction.

```
for (instrument in instrumentlist){
  print(sprintf("Transactions for the instrument: %s", instrument))
  txns <- getTxns(Portfolio = portfolioname, Symbol = instrument)
  txns.pr <- txns[,c(1,2,4,6)]
  colnames(txns.pr) <- c("Quantity","Price","Value","Net realized Profit")
  print(txns.pr)
  writeLines("")
}
```

```
## [1] "Transactions for the instrument: ADS.csv"
##            Quantity   Price      Value Net realized Profit
## 1999-12-31        0   0.000        0.0               0.000
## 2011-08-01    18867  53.000   999951.0             -20.000
## 2011-08-05   -18867  48.515  -915332.5          -84638.495
## 2011-09-20    18591  49.235   915327.9             -20.000
## 2011-09-26   -18591  47.190  -877309.3          -38038.595
## 2011-10-17    17392  50.440   877252.5             -20.000
## 2011-10-21   -17392  51.460  -894992.3           17719.840
## 2011-10-27    17662  50.670   894933.5             -20.000
## 2011-10-31   -17662  51.620  -911712.4           16758.900
## 2011-11-02    18043  50.530   911712.8             -20.000
## 2011-11-03   -18043  49.665  -896105.6          -15627.195
```

```
## 2011-11-08    17587  50.950   896057.7           -20.000
## 2011-11-09   -17587  50.300  -884626.1         -11451.550
## 2011-11-24    17959  49.255   884570.5           -20.000
## 2011-11-29   -17959  49.100  -881786.9          -2803.645
## 2012-01-31    15768  55.920   881746.6           -20.000
## 2012-02-06   -15768  58.500  -922428.0          40661.440
## 2012-02-28    15749  58.570   922418.9           -20.000
## 2012-03-05   -15749  59.470  -936593.0          14154.100
## 2012-03-08    16393  57.130   936532.1           -20.000
## 2012-03-14   -16393  59.800  -980301.4          43749.310
## 2012-05-07    15537  63.090   980229.3           -20.000
## 2012-05-11   -15537  60.560  -940920.7         -39328.610
## 2012-05-21    15635  60.180   940914.3           -20.000
## 2012-05-23   -15635  60.410  -944510.3           3576.050
## 2012-06-13    16253  58.110   944461.8           -20.000
## 2012-06-19   -16253  59.110  -960714.8          16233.000
## 2012-07-13    16854  57.000   960678.0           -20.000
## 2012-07-18   -16854  57.600  -970790.4          10092.400
## 2012-08-31    15594  62.250   970726.5           -20.000
## 2012-09-06   -15594  64.280 -1002382.3          31635.820
## 2012-09-12    15713  63.790  1002332.3           -20.000
## 2012-09-18   -15713  64.770 -1017731.0          15378.740
## 2012-10-01    15740  64.660  1017748.4           -20.000
## 2012-10-05   -15740  67.080 -1055839.2          38070.800
## 2012-11-01    15831  66.690  1055769.4           -20.000
## 2012-11-05   -15831  66.090 -1046270.8          -9518.600
## 2012-11-19    16468  63.530  1046212.0           -20.000
## 2012-11-23   -16468  66.160 -1089522.9          43290.840
## 2012-12-21    16155  67.440  1089493.2           -20.000
## 2013-01-03   -16155  67.180 -1085292.9          -4220.300
## 2013-02-01    15676  69.230  1085249.5           -20.000
## 2013-02-04   -15676  68.500 -1073806.0         -11463.480
## 2013-02-25    15092  71.150  1073795.8           -20.000
## 2013-03-01   -15092  70.540 -1064589.7          -9226.120
## 2013-03-22    13444  79.180  1064495.9           -20.000
## 2013-03-27   -13444  81.500 -1095686.0          31170.080
## 2013-04-02    13411  81.700  1095678.7           -20.000
## 2013-04-08   -13411  78.720 -1055713.9         -39984.780
## 2013-04-17    13587  77.700  1055709.9           -20.000
## 2013-04-23   -13587  79.330 -1077856.7          22126.810
## 2013-05-10    12834  83.980  1077799.3           -20.000
## 2013-05-16   -12834  86.460 -1109627.6          31808.320
## 2013-06-25    14072  78.850  1109577.2           -20.000
## 2013-06-28   -14072  82.200 -1156718.4          47121.200
## 2013-07-04    13993  82.660  1156661.4           -20.000
## 2013-07-05   -13993  82.530 -1154842.3          -1839.090
## 2013-08-01    13556  85.190  1154835.6           -20.000
## 2013-08-07   -13556  85.780 -1162833.7           7978.040
## 2013-09-02    14314  81.230  1162726.2           -20.000
## 2013-09-03   -14314  81.100 -1160865.4          -1880.820
## 2013-09-16    14376  80.750  1160862.0           -20.000
## 2013-09-20   -14376  78.000 -1121328.0         -39554.000
## 2013-09-23    14716  80.670  1187139.7           -20.000
## 2013-09-27   -14716  80.120 -1179045.9          -8113.800
```

```
## 2013-10-10    13862  80.300  1113118.6            -20.000
## 2013-10-16   -13862  81.500 -1129753.0          16614.400
## 2013-11-27    12643  89.360  1129778.5            -20.000
## 2013-12-03   -12643  88.030 -1112963.3         -16835.190
## 2013-12-10    12611  88.250  1112920.8            -20.000
## 2013-12-16   -12611  86.540 -1091355.9         -21584.810
## 2014-01-14    12077  90.360  1091277.7            -20.000
## 2014-01-16   -12077  90.350 -1091156.9           -140.770
## 2014-01-17    12042  90.900  1094617.8            -20.000
## 2014-01-23   -12042  91.900 -1106659.8          12022.000
## 2014-02-21    12949  85.190  1103125.3            -20.000
## 2014-02-27   -12949  83.140 -1076579.9         -26565.450
## 2014-03-04    13057  82.450  1076549.7            -20.000
## 2014-03-05   -13057  80.500 -1051088.5         -25481.150
## 2014-03-07    12989  80.920  1051069.9            -20.000
## 2014-03-13   -12989  76.180  -989502.0         -61587.860
## 2015-03-16    13798  71.710   989454.6            -20.000
## 2015-03-20   -13798  70.300  -969999.4         -19475.180
## 2015-03-24    13872  69.920   969930.2            -20.000
## 2015-03-30   -13872  73.800 -1023753.6          53803.360
## 2015-04-15    13345  76.710  1023694.9            -20.000
## 2015-04-21   -13345  75.630 -1009282.3         -14432.600
## 2015-04-24    13495  74.790  1009291.1            -20.000
## 2015-04-30   -13495  73.420  -990802.9         -18508.150
## 2015-05-26    13071  75.800   990781.8            -20.000
## 2015-06-01   -13071  71.680  -936929.3         -53872.520
## 2015-07-28    13134  71.330   936848.2            -20.000
## 2015-08-03   -13134  74.350  -976512.9          39644.680
## 2015-09-30    13640  71.590   976487.6            -20.000
## 2015-10-06   -13640  74.560 -1016998.4          40490.800
## 2015-10-14    13454  75.590  1016987.9            -20.000
## 2015-10-20   -13454  77.060 -1036765.2          19757.380
## 2015-11-10    11786  87.960  1036696.6            -20.000
## 2015-11-12   -11786  88.390 -1041764.5           5047.980
## 2015-11-25    11620  89.650  1041733.0            -20.000
## 2015-11-27   -11620  89.460 -1039525.2          -2227.800
## 2015-12-29    11528  90.170  1039479.8            -20.000
## 2016-01-06   -11528  86.230  -994059.4         -45440.320
## 2016-01-08    11649  85.330   994009.2            -20.000
## 2016-01-14   -11649  84.710  -986786.8          -7242.380
## 2016-02-04    10413  94.760   986735.9            -20.000
## 2016-02-10   -10413  87.020  -906139.3         -80616.620
## 2016-02-25     9246  98.000   906108.0            -20.000
## 2016-03-02    -9246  98.370  -909529.0           3401.020
## 2016-03-09     9418  96.570   909496.3            -20.000
## 2016-03-15    -9418 101.400  -954985.2          45468.940
## 2016-04-04     9280 102.900   954912.0            -20.000
## 2016-04-08    -9280 103.000  -955840.0            908.000
## 2016-05-12     8319 114.900   955853.1            -20.000
## 2016-05-19    -8319 109.500  -910930.5         -44942.600
## 2016-06-01     7839 116.200   910891.8            -20.000
## 2016-06-07    -7839 119.600  -937544.4          26632.600
## 2016-06-27     7757 120.850   937433.4            -20.000
## 2016-07-01    -7757 128.200  -994447.4          56993.950
```

```
## 2016-07-06     7799 127.500   994372.5            -20.000
## 2016-07-12    -7799 130.950 -1021279.0          26886.550
## 2016-08-26     6658 153.400  1021337.2            -20.000
## 2016-08-29    -6658 152.150 -1013014.7          -8342.500
## 2016-09-05     6919 146.400  1012941.6            -20.000
## 2016-09-08    -6919 147.000 -1017093.0           4131.400
## 2016-09-12     6959 146.150  1017057.9            -20.000
## 2016-09-16    -6959 149.900 -1043154.1          26076.250
## 2016-09-28     6754 154.450  1043155.3            -20.000
## 2016-10-05    -6754 155.850 -1052610.9           9435.600
## 2016-10-07     6747 156.000  1052532.0            -20.000
## 2016-10-13    -6747 153.200 -1033640.4         -18911.600
## 2016-11-07     7594 136.100  1033543.4            -20.000
## 2016-11-10    -7594 131.000  -994814.0         -38749.400
## 2017-02-27     6357 156.500   994870.5            -20.000
## 2017-03-03    -6357 161.000 -1023477.0          28586.500
## 2017-03-23     5690 179.850  1023346.5            -20.000
## 2017-03-29    -5690 177.950 -1012535.5         -10831.000
## 2017-04-20     5672 178.500  1012452.0            -20.000
## 2017-04-26    -5672 185.350 -1051305.2          38833.200
## 2017-05-04     5674 185.300  1051392.2            -20.000
## 2017-05-05    -5674 183.050 -1038625.7         -12786.500
## 2017-06-07     6080 170.800  1038464.0            -20.000
## 2017-06-13    -6080 175.700 -1068256.0          29772.000
## 2017-06-26     6304 169.450  1068212.8            -20.000
## 2017-06-30    -6304 167.750 -1057496.0         -10736.800
## 2017-07-20     5843 181.000  1057583.0            -20.000
## 2017-07-26    -5843 176.950 -1033918.8         -23684.150
## 2017-08-30     5594 184.800  1033771.2            -20.000
## 2017-09-04    -5594 189.450 -1059783.3          25992.100
## 2017-10-09     5451 194.400  1059674.4            -20.000
## 2017-10-13    -5451 193.100 -1052588.1          -7106.300
## 2017-12-04     5939 177.250  1052687.8            -20.000
## 2017-12-08    -5939 180.600 -1072583.4          19875.650
## 2018-01-12     6357 168.700  1072425.9            -20.000
## 2018-01-18    -6357 171.000 -1087047.0          14601.100
## 2018-02-07     6111 177.900  1087146.9            -20.000
## 2018-02-13    -6111 175.800 -1074313.8         -12853.100
## 2018-03-14     5873 182.900  1074171.7            -20.000
## 2018-03-19    -5873 192.800 -1132314.4          58122.700
## 2018-03-20     5858 194.600  1139966.8            -20.000
## 2018-03-26    -5858 193.000 -1130594.0          -9392.800
## 2018-03-29     5772 194.550  1122942.6            -20.000
## 2018-04-06    -5772 203.700 -1175756.4          52793.800
## 2018-04-10     5732 205.100  1175633.2            -20.000
## 2018-04-16    -5732 210.700 -1207732.4          32079.200
## 2018-05-30     6178 195.500  1207799.0            -20.000
## 2018-06-05    -6178 196.400 -1213359.2           5540.200
## 2018-06-14     6154 197.150  1213261.1            -20.000
## 2018-06-18    -6154 198.950 -1224338.3          11057.200
## 2018-06-21     6425 190.550  1224283.8            -20.000
## 2018-06-27    -6425 189.100 -1214967.5          -9336.250
## 2018-07-03     6534 185.950  1214997.3            -20.000
## 2018-07-09    -6534 181.850 -1188207.9         -26809.400
```

```
## 2018-07-18     6315 188.150  1188167.2             -20.000
## 2018-07-20    -6315 188.350 -1189430.2            1243.000
## 2018-07-27     6306 188.600  1189311.6             -20.000
## 2018-08-02    -6306 184.950 -1166294.7          -23036.900
## 2018-09-18     5564 209.600  1166214.4             -20.000
## 2018-09-24    -5564 209.600 -1166214.4             -20.000
## 2018-09-25     5583 210.200  1173546.6             -20.000
## 2018-09-26    -5583 207.600 -1159030.8          -14535.800
## 2018-10-12     5900 195.200  1151680.0             -20.000
## 2018-10-18    -5900 199.500 -1177050.0           25350.000
##
## [1] "Transactions for the instrument: ALV.csv"
##             Quantity  Price      Value Net realized Profit
## 1999-12-31        0   0.00        0.0                0.00
## 2012-01-31    11821  84.59   999938.4              -20.00
## 2012-02-06   -11821  88.19 -1042494.0            42535.60
## 2012-02-13    11810  88.27  1042468.7              -20.00
## 2012-02-17   -11810  89.66 -1058884.6            16395.90
## 2012-08-31    12179  86.94  1058842.3              -20.00
## 2012-09-06   -12179  91.15 -1110115.9            51253.59
## 2012-10-01    11813  93.97  1110067.6              -20.00
## 2012-10-05   -11813  92.95 -1098018.4           -12069.26
## 2012-10-25    11652  94.23  1097968.0              -20.00
## 2012-10-31   -11652  95.66 -1114630.3            16642.36
## 2012-11-12    11842  94.12  1114569.0              -20.00
## 2012-11-16   -11842  92.40 -1094200.8           -20388.24
## 2013-01-02    10179 107.50  1094242.5              -20.00
## 2013-01-08   -10179 107.05 -1089661.9            -4600.55
## 2013-01-10    10298 105.80  1089528.4              -20.00
## 2013-01-16   -10298 103.55 -1066357.9           -23190.50
## 2013-02-27    10278 103.75  1066342.5              -20.00
## 2013-03-01   -10278 103.55 -1064286.9            -2075.60
## 2013-03-19     9640 110.40  1064256.0              -20.00
## 2013-03-25    -9640 107.70 -1038228.0           -26048.00
## 2013-04-09     9776 106.20  1038211.2              -20.00
## 2013-04-15    -9776 107.15 -1047498.4             9267.20
## 2013-05-09     8914 117.50  1047395.0              -20.00
## 2013-05-15    -8914 118.35 -1054971.9             7556.90
## 2013-05-30     8791 120.00  1054920.0              -20.00
## 2013-06-05    -8791 116.10 -1020635.1           -34304.90
## 2013-06-07     8795 116.05  1020659.8              -20.00
## 2013-06-13    -8795 113.05  -994274.8           -26405.00
## 2013-07-04     8989 110.60   994183.4              -20.00
## 2013-07-05    -8989 110.25  -991037.2            -3166.15
## 2013-09-02     8977 110.40   991060.8              -20.00
## 2013-09-06    -8977 112.00 -1005424.0            14343.20
## 2013-10-01     8611 116.75  1005334.2              -20.00
## 2013-10-02    -8611 116.05  -999306.5            -6047.70
## 2013-11-08     8023 124.55   999264.7              -20.00
## 2013-11-14    -8023 127.70 -1024537.1            25252.45
## 2013-11-22     8048 127.30  1024510.4              -20.00
## 2013-11-28    -8048 127.80 -1028534.4             4004.00
## 2013-12-13     8430 122.00  1028460.0              -20.00
## 2013-12-19    -8430 127.15 -1071874.5            43394.50
```

```
## 2014-01-10     8252 129.90  1071934.8            -20.00
## 2014-01-16    -8252 133.55 -1102054.6           30099.80
## 2014-01-28     8805 125.15  1101945.8            -20.00
## 2014-01-29    -8805 124.50 -1096222.5           -5743.25
## 2014-02-19     8442 129.85  1096193.7            -20.00
## 2014-02-25    -8442 131.00 -1105902.0            9688.30
## 2014-03-04     8697 127.15  1105823.6            -20.00
## 2014-03-10    -8697 122.85 -1068426.4          -37417.10
## 2014-03-25     8837 120.90  1068393.3            -20.00
## 2014-03-31    -8837 122.70 -1084299.9           15886.60
## 2014-04-04     8727 124.25  1084329.8            -20.00
## 2014-04-10    -8727 120.35 -1050294.4          -34055.30
## 2014-06-05     8436 124.50  1050282.0            -20.00
## 2014-06-11    -8436 124.85 -1053234.6            2932.60
## 2014-07-29     8142 129.35  1053167.7            -20.00
## 2014-08-04    -8142 122.30  -995766.6          -57421.10
## 2014-08-07     8138 122.35   995684.3            -20.00
## 2014-08-13    -8138 125.80 -1023760.4           28056.10
## 2014-08-21     8014 127.75  1023788.5            -20.00
## 2014-08-27    -8014 130.40 -1045025.6           21217.10
## 2014-08-29     8022 130.25  1044865.5            -20.00
## 2014-09-04    -8022 133.65 -1072140.3           27254.80
## 2015-03-27     6643 161.40  1072180.2            -20.00
## 2015-04-02    -6643 163.50 -1086130.5           13930.30
## 2015-05-06     7030 154.50  1086135.0            -20.00
## 2015-05-12    -7030 145.50 -1022865.0          -63290.00
## 2015-06-10     7223 141.60  1022776.8            -20.00
## 2015-06-12    -7223 142.00 -1025666.0            2869.20
## 2015-08-10     6627 154.75  1025528.2            -20.00
## 2015-08-11    -6627 154.30 -1022546.1           -3002.15
## 2015-08-13     6662 153.50  1022617.0            -20.00
## 2015-08-19    -6662 149.75  -997634.5          -25002.50
## 2015-09-02     7082 140.85   997499.7            -20.00
## 2015-09-04    -7082 141.50 -1002103.0            4583.30
## 2015-10-15     6878 145.70  1002124.6            -20.00
## 2015-10-20    -6878 147.75 -1016224.5           14079.90
## 2015-12-21     6187 164.25  1016214.8            -20.00
## 2015-12-28    -6187 161.35  -998272.4          -17962.30
## 2016-01-08     6442 154.95   998187.9            -20.00
## 2016-01-14    -6442 151.90  -978539.8          -19668.10
## 2016-01-21     6684 146.40   978537.6            -20.00
## 2016-01-27    -6684 147.50  -985890.0            7332.40
## 2016-01-29     6663 147.95   985790.8            -20.00
## 2016-02-03    -6663 143.80  -958139.4          -27671.45
## 2016-05-02     6345 151.00   958095.0            -20.00
## 2016-05-06    -6345 139.60  -885762.0          -72353.00
## 2016-11-29     5889 150.40   885705.6            -20.00
## 2016-12-05    -5889 151.20  -890416.8            4691.20
## 2017-02-24     5361 166.10   890462.1            -20.00
## 2017-03-02    -5361 167.35  -897163.3            6681.25
## 2017-03-21     5249 170.90   897054.1            -20.00
## 2017-03-24    -5249 169.00  -887081.0           -9993.10
## 2017-04-06     5114 173.45   887023.3            -20.00
## 2017-04-12    -5114 171.40  -876539.6          -10503.70
```

```
## 2017-05-05     5042 173.85   876551.7             -20.00
## 2017-05-11    -5042 173.30  -873778.6            -2793.10
## 2017-06-08     5072 172.25   873652.0             -20.00
## 2017-06-14    -5072 173.95  -882274.4             8602.40
## 2017-07-03     5055 174.55   882350.2             -20.00
## 2017-07-07    -5055 178.75  -903581.2            21211.00
## 2017-08-14     4977 181.55   903574.4             -20.00
## 2017-08-18    -4977 182.70  -909297.9             5703.55
## 2017-08-24     4957 183.40   909113.8             -20.00
## 2017-08-30    -4957 178.50  -884824.5           -24309.30
## 2017-09-21     4786 184.90   884931.4             -20.00
## 2017-09-27    -4786 186.65  -893306.9             8355.50
## 2017-10-18     4555 196.10   893235.5             -20.00
## 2017-10-24    -4555 197.00  -897335.0             4079.50
## 2017-11-07     4423 202.85   897205.5             -20.00
## 2017-11-13    -4423 198.40  -877523.2           -19702.35
## 2017-11-16     4433 197.95   877512.3             -20.00
## 2017-11-22    -4433 197.35  -874852.5            -2679.80
## 2017-11-24     4436 197.20   874779.2             -20.00
## 2017-11-30    -4436 198.90  -882320.4             7521.20
## 2017-12-04     4430 199.15   882234.5             -20.00
## 2017-12-05    -4430 198.10  -877583.0            -4671.50
## 2017-12-14     4439 197.70   877590.3             -20.00
## 2017-12-20    -4439 195.35  -867158.7           -10451.65
## 2018-02-07     4464 194.26   867176.6             -20.00
## 2018-02-08    -4464 190.78  -851641.9           -15554.72
## 2018-02-12     4496 189.40   851542.4             -20.00
## 2018-02-16    -4496 188.38  -846956.5            -4605.92
## 2018-03-05     4527 187.08   846911.2             -20.00
## 2018-03-09    -4527 190.02  -860220.5            13289.38
## 2018-04-12     4558 188.74   860276.9             -20.00
## 2018-04-18    -4558 192.12  -875683.0            15386.04
## 2018-05-15     4549 192.48   875591.5             -20.00
## 2018-05-22    -4549 192.78  -876956.2             1344.70
## 2018-07-26     4743 184.88   876885.8             -20.00
## 2018-08-01    -4743 187.80  -890735.4            13829.56
## 2018-08-03     4738 188.00   890744.0             -20.00
## 2018-08-09    -4738 189.64  -898514.3             7750.32
## 2018-09-06     4928 182.30   898374.4             -20.00
## 2018-09-11    -4928 181.12  -892559.4            -5835.04
##
## [1] "Transactions for the instrument: BAS.csv"
##            Quantity Price      Value Net realized Profit
## 1999-12-31        0  0.00        0.0                0.00
## 2011-07-29    15850 63.09   999976.5              -20.00
## 2011-08-01   -15850 62.22  -986187.0           -13809.50
## 2011-08-17    18262 54.00   986148.0              -20.00
## 2011-08-19   -18262 50.13  -915474.1           -70693.94
## 2012-01-23    15492 59.09   915422.3              -20.00
## 2012-01-27   -15492 60.48  -936956.2            21513.88
## 2012-02-01    15514 60.39   936890.5              -20.00
## 2012-02-07   -15514 60.87  -944337.2             7426.72
## 2012-02-23    14506 65.10   944340.6              -20.00
## 2012-02-29   -14506 65.90  -955945.4            11584.80
```

```
## 2012-08-02    15937 59.98   955901.3            -20.00
## 2012-08-08   -15937 60.94  -971200.8           15279.52
## 2012-08-23    15469 62.78   971143.8            -20.00
## 2012-08-29   -15469 62.52  -967121.9           -4041.94
## 2012-08-31    15548 62.20   967085.6            -20.00
## 2012-09-04   -15548 61.51  -956357.5          -10748.12
## 2012-09-14    14383 66.49   956325.7            -20.00
## 2012-09-20   -14383 67.44  -969989.5           13643.85
## 2012-09-27    14397 67.37   969925.9            -20.00
## 2012-10-03   -14397 66.84  -962295.5           -7650.41
## 2012-10-11    14935 64.43   962262.1            -20.00
## 2012-10-17   -14935 65.50  -978242.5           15960.45
## 2012-11-06    15154 64.55   978190.7            -20.00
## 2012-11-07   -15154 64.21  -973038.3           -5172.36
## 2012-11-19    15340 63.43   973016.2            -20.00
## 2012-11-23   -15340 67.54 -1036063.6           63027.40
## 2013-02-18    14488 71.51  1036036.9            -20.00
## 2013-02-21   -14488 73.41 -1063564.1           27507.20
## 2013-02-22    14606 73.52  1073833.1            -20.00
## 2013-02-26   -14606 72.25 -1055283.5          -18569.62
## 2013-05-24    14020 74.53  1044910.6            -20.00
## 2013-05-29   -14020 74.45 -1043789.0           -1141.60
## 2013-06-14    14298 73.00  1043754.0            -20.00
## 2013-06-20   -14298 70.93 -1014157.1          -29616.86
## 2013-06-28    14805 68.50  1014142.5            -20.00
## 2013-07-01   -14805 68.10 -1008220.5           -5942.00
## 2013-07-04    14761 68.30  1008176.3            -20.00
## 2013-07-05   -14761 67.54  -996957.9          -11238.36
## 2013-07-17    14015 71.13   996886.9            -20.00
## 2013-07-23   -14015 69.80  -978247.0          -18659.95
## 2013-08-01    14494 67.49   978200.1            -20.00
## 2013-08-05   -14494 67.47  -977910.2            -309.88
## 2013-08-22    14445 67.70   977926.5            -20.00
## 2013-08-28   -14445 66.84  -965503.8          -12442.70
## 2013-11-22    12563 76.85   965466.5            -20.00
## 2013-11-28   -12563 78.18  -982175.3           16688.79
## 2014-03-04    12078 81.31   982062.2            -20.00
## 2014-03-10   -12078 79.34  -958268.5          -23813.66
## 2014-03-21    12220 78.42   958292.4            -20.00
## 2014-03-27   -12220 79.20  -967824.0            9511.60
## 2014-06-30    11344 85.31   967756.6            -20.00
## 2014-07-04   -11344 87.05  -987495.2           19718.56
## 2014-07-14    11758 83.98   987436.8            -20.00
## 2014-07-17   -11758 83.66  -983674.3           -3782.56
## 2014-09-17    12855 76.52   983664.6            -20.00
## 2014-09-22   -12855 76.84  -987778.2            4093.60
## 2015-02-10    12270 80.50   987735.0            -20.00
## 2015-02-16   -12270 82.95 -1017796.5           30041.50
## 2015-02-18    12289 82.82  1017775.0            -20.00
## 2015-02-19   -12289 82.26 -1010893.1           -6901.84
## 2015-03-11    11471 88.12  1010824.5            -20.00
## 2015-03-17   -11471 91.15 -1045581.7           34737.13
## 2015-03-19    11429 91.48  1045524.9            -20.00
## 2015-03-25   -11429 90.92 -1039124.7           -6420.24
```

```
## 2015-04-20    11296 91.99  1039119.0             -20.00
## 2015-04-22   -11296 92.25 -1042056.0            2916.96
## 2015-04-24    11349 91.81  1041951.7             -20.00
## 2015-04-30   -11349 89.48 -1015508.5          -26463.17
## 2015-05-13    11718 86.66  1015481.9             -20.00
## 2015-05-19   -11718 88.38 -1035636.8           20134.96
## 2015-06-03    12230 84.68  1035636.4             -20.00
## 2015-06-09   -12230 80.85  -988795.5          -46860.90
## 2015-11-30    12589 78.54   988740.1             -20.00
## 2015-12-02   -12589 76.64  -964821.0          -23939.10
## 2016-08-23    13287 72.61   964769.1             -20.00
## 2016-08-29   -13287 72.37  -961580.2           -3208.88
## 2016-09-07    13033 73.78   961574.7             -20.00
## 2016-09-13   -13033 71.74  -934987.4          -26607.32
## 2016-10-14    11974 78.08   934929.9             -20.00
## 2016-10-20   -11974 79.64  -953609.4           18659.44
## 2016-10-27    11888 80.21   953536.5             -20.00
## 2016-11-02   -11888 78.10  -928452.8          -25103.68
## 2016-11-07    11886 78.11   928415.5             -20.00
## 2016-11-09   -11886 76.84  -913320.2          -15115.22
## 2016-11-24    11278 80.98   913292.4             -20.00
## 2016-11-30   -11278 80.99  -913405.2              92.78
## 2017-02-01    10067 90.73   913378.9             -20.00
## 2017-02-07   -10067 89.00  -895963.0          -17435.91
## 2017-02-20    10011 89.49   895884.4             -20.00
## 2017-02-24   -10011 87.36  -874561.0          -21343.43
## 2017-03-21     9791 89.32   874532.1             -20.00
## 2017-03-27    -9791 89.45  -875805.0            1252.83
## 2017-04-21     9841 88.99   875750.6             -20.00
## 2017-04-27    -9841 89.98  -885493.2            9722.59
## 2017-05-16    10009 88.47   885496.2             -20.00
## 2017-05-22   -10009 85.18  -852566.6          -32949.61
## 2017-06-26    10017 85.11   852546.9             -20.00
## 2017-06-30   -10017 81.09  -812278.5          -40288.34
## 2017-10-25     8925 91.00   812175.0             -20.00
## 2017-11-01    -8925 96.01  -856889.2           44694.25
## 2017-11-16     9199 93.15   856886.9             -20.00
## 2017-11-22    -9199 92.68  -852563.3           -4343.53
## 2017-11-24     9183 92.84   852549.7             -20.00
## 2017-11-30    -9183 94.00  -863202.0           10632.28
## 2018-01-03     9419 91.64   863157.2             -20.00
## 2018-01-09    -9419 94.70  -891979.3           28802.14
## 2018-02-07     9955 89.60   891968.0             -20.00
## 2018-02-12    -9955 86.20  -858121.0          -33867.00
## 2018-06-14     9806 87.50   858025.0             -20.00
## 2018-06-20    -9806 85.53  -838707.2          -19337.82
##
## [1] "Transactions for the instrument: BAY.csv"
##            Quantity   Price      Value Net realized Profit
## 1999-12-31        0   0.000        0.0               0.000
## 2012-01-31    19029  52.551   999993.0            -20.000
## 2012-02-06   -19029  54.371 -1034625.8          34612.780
## 2012-02-09    18901  54.735  1034546.2            -20.000
## 2012-02-15   -18901  54.676 -1033431.1          -1135.159
```

```
## 2012-02-23    18501  55.857  1033410.4           -20.000
## 2012-02-29   -18501  54.617 -1010469.1         -22961.240
## 2012-03-30    19395  52.098  1010440.7           -20.000
## 2012-04-05   -19395  51.173  -992500.3         -17960.375
## 2012-05-02    18457  53.771   992451.3           -20.000
## 2012-05-08   -18457  50.514  -932336.9         -60134.449
## 2012-07-13    16496  56.517   932304.4           -20.000
## 2012-07-19   -16496  58.829  -970443.2          38118.752
## 2012-09-11    15131  64.133   970396.4           -20.000
## 2012-09-13   -15131  64.104  -969957.6           -458.799
## 2012-09-27    14426  67.233   969903.3           -20.000
## 2012-09-28   -14426  66.741  -962805.7          -7117.592
## 2012-10-01    14323  67.794   971013.5           -20.000
## 2012-10-05   -14323  67.912  -972703.6           1670.114
## 2012-11-16    14840  64.990   964451.6           -20.000
## 2012-11-22   -14840  67.548 -1002412.3          37940.720
## 2012-12-03    14538  68.946  1002336.9           -20.000
## 2012-12-07   -14538  70.756 -1028650.7          26293.780
## 2013-01-16    14409  71.386  1028600.9           -20.000
## 2013-01-22   -14409  71.859 -1035416.3           6795.457
## 2013-01-25    14403  71.888  1035402.9           -20.000
## 2013-01-31   -14403  71.524 -1030160.2          -5262.692
## 2013-02-06    14575  70.678  1030131.8           -20.000
## 2013-02-12   -14575  69.743 -1016504.2         -13647.625
## 2013-02-22    14241  71.376  1016465.6           -20.000
## 2013-02-26   -14241  70.491 -1003862.3         -12623.285
## 2013-02-27    14279  72.380  1033514.0           -20.000
## 2013-03-05   -14279  76.750 -1095913.2          62379.230
## 2013-03-25    13705  77.793  1066153.1           -20.000
## 2013-04-02   -13705  80.981 -1109844.6          43671.540
## 2013-04-15    13780  80.538  1109813.6           -20.000
## 2013-04-19   -13780  77.074 -1062079.7         -47753.920
## 2013-04-23    13664  77.724  1062020.7           -20.000
## 2013-04-29   -13664  78.836 -1077215.1          15174.368
## 2013-04-30    13807  79.043  1091346.7           -20.000
## 2013-05-07   -13807  80.548 -1112126.2          20759.535
## 2013-05-24    13127  83.638  1097916.0           -20.000
## 2013-05-29   -13127  84.199 -1105280.3           7344.247
## 2013-06-06    13695  80.706  1105268.7           -20.000
## 2013-06-11   -13695  81.414 -1114964.7           9676.060
## 2013-06-14    13726  81.227  1114921.8           -20.000
## 2013-06-20   -13726  80.991 -1111682.5          -3259.336
## 2013-07-04    13880  80.086  1111593.7           -20.000
## 2013-07-05   -13880  79.790 -1107485.2          -4128.480
## 2013-07-08    13847  81.454  1127893.5           -20.000
## 2013-07-12   -13847  83.264 -1152956.6          25043.070
## 2013-09-02    13475  84.042  1132465.9           -20.000
## 2013-09-03   -13475  83.441 -1124367.5          -8118.475
## 2013-09-10    13731  81.887  1124390.4           -20.000
## 2013-09-12   -13731  82.418 -1131681.6           7271.161
## 2013-10-08    13421  84.317  1131618.5           -20.000
## 2013-10-14   -13421  85.587 -1148663.1          17024.670
## 2013-10-22    12963  88.608  1148625.5           -20.000
## 2013-10-28   -12963  89.936 -1165840.4          17194.864
```

```
## 2013-11-27    12250  95.162  1165734.5           -20.000
## 2013-12-03   -12250  96.008 -1176098.0          10343.500
## 2014-01-02    11586 101.509  1176083.3           -20.000
## 2014-01-08   -11586  98.459 -1140746.0         -35357.300
## 2014-02-28    11420  99.886  1140698.1           -20.000
## 2014-03-03   -11420  96.786 -1105296.1         -35422.000
## 2014-03-04    11664  99.148  1156462.3           -20.000
## 2014-03-10   -11664  94.906 -1106983.6         -49498.688
## 2014-04-14    11455  92.170  1055807.4           -20.000
## 2014-04-22   -11455  95.772 -1097068.3          41240.910
## 2014-06-24    10718 102.346  1096944.4           -20.000
## 2014-06-30   -10718 101.509 -1087973.5          -8990.966
## 2014-07-16    10781 100.919  1088007.7           -20.000
## 2014-07-22   -10781  98.301 -1059783.1         -28244.658
## 2014-08-05    11164  94.926  1059753.9           -20.000
## 2014-08-11   -11164  95.438 -1065469.8           5695.968
## 2014-08-13    11171  95.369  1065367.1           -20.000
## 2014-08-15   -11171  95.192 -1063389.8          -1997.267
## 2014-08-21    10890  97.642  1063321.4           -20.000
## 2014-08-27   -10890 100.033 -1089359.4          26017.990
## 2014-08-29    10895  99.984  1089325.7           -20.000
## 2014-09-04   -10895 101.509 -1105940.6          16594.875
## 2014-09-30    10170 108.742  1105906.1           -20.000
## 2014-10-07   -10170 103.920 -1056866.4         -49059.740
## 2014-10-09    10056 105.101  1056895.7           -20.000
## 2014-10-15   -10056  97.307  -978519.2         -78396.464
## 2014-10-28     9296 105.249   978394.7           -20.000
## 2014-11-03    -9296 110.219 -1024595.8          46181.120
## 2014-11-05     9173 111.695  1024578.2           -20.000
## 2014-11-06    -9173 110.760 -1016001.5          -8596.755
## 2014-12-05     8578 118.436  1015944.0           -20.000
## 2014-12-11    -8578 113.958  -977531.7         -38432.284
## 2015-01-02     8619 113.417   977541.1           -20.000
## 2015-01-08    -8619 114.598  -987720.2          10159.039
## 2015-03-27     7174 137.675   987680.5           -20.000
## 2015-04-02    -7174 136.592  -979911.0          -7789.442
## 2015-05-13     7586 129.162   979822.9           -20.000
## 2015-05-19    -7586 135.313 -1026484.4          46641.486
## 2015-06-16     8305 123.602  1026514.6           -20.000
## 2015-06-22    -8305 131.475 -1091899.9          65365.265
## 2015-07-01     8644 126.309  1091815.0           -20.000
## 2015-07-02    -8644 124.439 -1075650.7         -16184.280
## 2015-07-08     8804 122.175  1075628.7           -20.000
## 2015-07-14    -8804 135.165 -1189992.7         114343.960
## 2015-08-13     9266 128.424  1189976.8           -20.000
## 2015-08-19    -9266 123.602 -1145296.1         -44700.652
## 2015-09-02     9804 116.812  1145224.8           -20.000
## 2015-09-04    -9804 117.649 -1153430.8           8185.948
## 2015-09-14     9763 118.141  1153410.6           -20.000
## 2015-09-18    -9763 113.220 -1105366.9         -48063.723
## 2015-11-16     9267 119.272  1105293.6           -20.000
## 2015-11-20    -9267 123.209 -1141777.8          36464.179
## 2015-11-25     9319 122.520  1141763.9           -20.000
## 2015-12-01    -9319 122.864 -1144969.6           3185.736
```

```
## 2017-03-01    11123 102.936  1144957.1            -20.000
## 2017-03-07   -11123 105.446 -1172875.9          27898.730
## 2017-03-10    11195 104.757  1172754.6            -20.000
## 2017-03-14   -11195 104.905 -1174411.5           1636.860
## 2017-03-16    11050 106.282  1174416.1            -20.000
## 2017-03-22   -11050 103.379 -1142337.9         -32098.150
## 2017-03-28    10843 105.347  1142277.5            -20.000
## 2017-04-03   -10843 106.085 -1150279.7           7982.134
## 2017-04-05    10803 106.479  1150292.6            -20.000
## 2017-04-11   -10803 104.216 -1125845.4         -24467.189
## 2017-04-27    10414 108.103  1125784.6            -20.000
## 2017-05-02   -10414 109.677 -1142176.3          16371.636
## 2017-05-03    10586 109.973  1164174.2            -20.000
## 2017-05-05   -10586 111.104 -1176146.9          11952.766
## 2017-06-08     9863 117.009  1154059.8            -20.000
## 2017-06-14    -9863 119.518 -1178806.0          24726.267
## 2017-08-22    11132 105.889  1178756.3            -20.000
## 2017-08-28   -11132 107.217 -1193539.6          14763.296
## 2017-09-05    11209 106.479  1193523.1            -20.000
## 2017-09-08   -11209 107.070 -1200147.6           6604.519
## 2017-09-11    11183 107.857  1206164.8            -20.000
## 2017-09-13   -11183 108.841 -1217168.9          10984.072
## 2017-09-20    11137 108.742  1211059.7            -20.000
## 2017-09-26   -11137 110.612 -1231885.8          20806.190
## 2017-10-18    10492 117.403  1231792.3            -20.000
## 2017-10-24   -10492 114.401 -1200295.3         -31516.984
## 2017-11-16    11247 106.725  1200336.1            -20.000
## 2017-11-20   -11247 105.397 -1185400.1         -14956.016
##
## [1] "Transactions for the instrument: BEI.csv"
##            Quantity   Price      Value Net realized Profit
## 1999-12-31        0   0.000        0.0                0.00
## 2012-01-06    22419  44.605   999999.5              -20.00
## 2012-01-11   -22419  44.265  -992377.0            -7642.46
## 2012-02-08    21292  46.605   992313.7              -20.00
## 2012-02-14   -21292  47.460 -1010518.3            18184.66
## 2012-03-30    20878  48.400  1010495.2              -20.00
## 2012-04-05   -20878  48.550 -1013626.9             3111.70
## 2012-04-24    19673  51.520  1013553.0              -20.00
## 2012-04-26   -19673  51.590 -1014930.1             1357.11
## 2012-05-21    19458  52.160  1014929.3              -20.00
## 2012-05-23   -19458  51.970 -1011232.3            -3717.02
## 2012-06-29    19661  51.430  1011165.2              -20.00
## 2012-07-05   -19661  52.450 -1031219.5            20034.22
## 2012-07-10    19634  52.520  1031177.7              -20.00
## 2012-07-16   -19634  52.950 -1039620.3             8422.62
## 2012-07-26    19359  53.700  1039578.3              -20.00
## 2012-08-01   -19359  53.130 -1028543.7           -11054.63
## 2012-08-20    18041  57.010  1028517.4              -20.00
## 2012-08-24   -18041  57.140 -1030862.7             2325.33
## 2012-09-03    17962  57.390  1030839.2              -20.00
## 2012-09-07   -17962  57.320 -1029581.8            -1277.34
## 2012-09-27    17948  57.360  1029497.3              -20.00
## 2012-10-03   -17948  57.950 -1040086.6            10569.32
```

```
## 2012-10-25    18480  56.280  1040054.4            -20.00
## 2012-10-31   -18480  56.110 -1036912.8           -3161.60
## 2012-11-16    17539  59.120  1036905.7            -20.00
## 2012-11-22   -17539  59.820 -1049183.0           12257.30
## 2013-01-08    16957  61.870  1049129.6            -20.00
## 2013-01-14   -16957  61.210 -1037938.0          -11211.62
## 2013-01-29    15945  65.090  1037860.1            -20.00
## 2013-01-31   -15945  64.990 -1036265.5           -1614.50
## 2013-02-01    15940  65.310  1041041.4            -20.00
## 2013-02-04   -15940  64.670 -1030839.8          -10221.60
## 2013-02-08    15775  65.040  1026006.0            -20.00
## 2013-02-11   -15775  64.530 -1017960.8           -8065.25
## 2013-02-12    15792  64.950  1025690.4            -20.00
## 2013-02-18   -15792  64.300 -1015425.6          -10284.80
## 2013-04-18    14631  68.870  1007637.0            -20.00
## 2013-04-24   -14631  69.640 -1018902.8           11245.87
## 2013-06-04    14719  69.220  1018849.2            -20.00
## 2013-06-10   -14719  68.580 -1009429.0           -9440.16
## 2013-06-14    15000  67.290  1009350.0            -20.00
## 2013-06-20   -15000  65.890  -988350.0          -21020.00
## 2013-07-04    14543  67.960   988342.3            -20.00
## 2013-07-05   -14543  67.530  -982088.8           -6273.49
## 2013-08-16    14264  68.850   982076.4            -20.00
## 2013-08-22   -14264  67.960  -969381.4          -12714.96
## 2013-09-02    14716  65.870   969342.9            -20.00
## 2013-09-06   -14716  64.840  -954185.4          -15177.48
## 2013-09-19    14300  66.720   954096.0            -20.00
## 2013-09-20   -14300  66.410  -949663.0           -4453.00
## 2013-10-07    13988  67.890   949645.3            -20.00
## 2013-10-11   -13988  68.620  -959856.6           10191.24
## 2013-11-05    13239  72.500   959827.5            -20.00
## 2013-11-11   -13239  73.450  -972404.6           12557.05
## 2013-11-14    13074  74.370   972313.4            -20.00
## 2013-11-15   -13074  73.600  -962246.4          -10086.98
## 2013-11-28    12963  74.230   962243.5            -20.00
## 2013-12-03   -12963  74.460  -965225.0            2961.49
## 2013-12-16    13306  72.540   965217.2            -20.00
## 2013-12-17   -13306  71.880  -956435.3           -8801.96
## 2013-12-18    13309  72.740   968096.7            -20.00
## 2013-12-27   -13309  73.610  -979675.5           11558.83
## 2014-02-14    13080  74.000   967920.0            -20.00
## 2014-02-20   -13080  73.460  -960856.8           -7083.20
## 2014-03-04    13149  73.070   960797.4            -20.00
## 2014-03-10   -13149  70.230  -923454.3          -37363.16
## 2014-03-21    13211  69.900   923448.9            -20.00
## 2014-03-27   -13211  70.270  -928337.0            4868.07
## 2014-04-09    13201  70.320   928294.3            -20.00
## 2014-04-11   -13201  69.900  -922749.9           -5564.42
## 2014-04-14    13289  70.010   930362.9            -20.00
## 2014-04-22   -13289  71.510  -950296.4           19913.50
## 2014-05-26    12810  73.580   942559.8            -20.00
## 2014-05-30   -12810  74.080  -948964.8            6385.00
## 2014-07-14    13664  69.450   948964.8            -20.00
## 2014-07-15   -13664  68.760  -939536.6           -9448.16
```

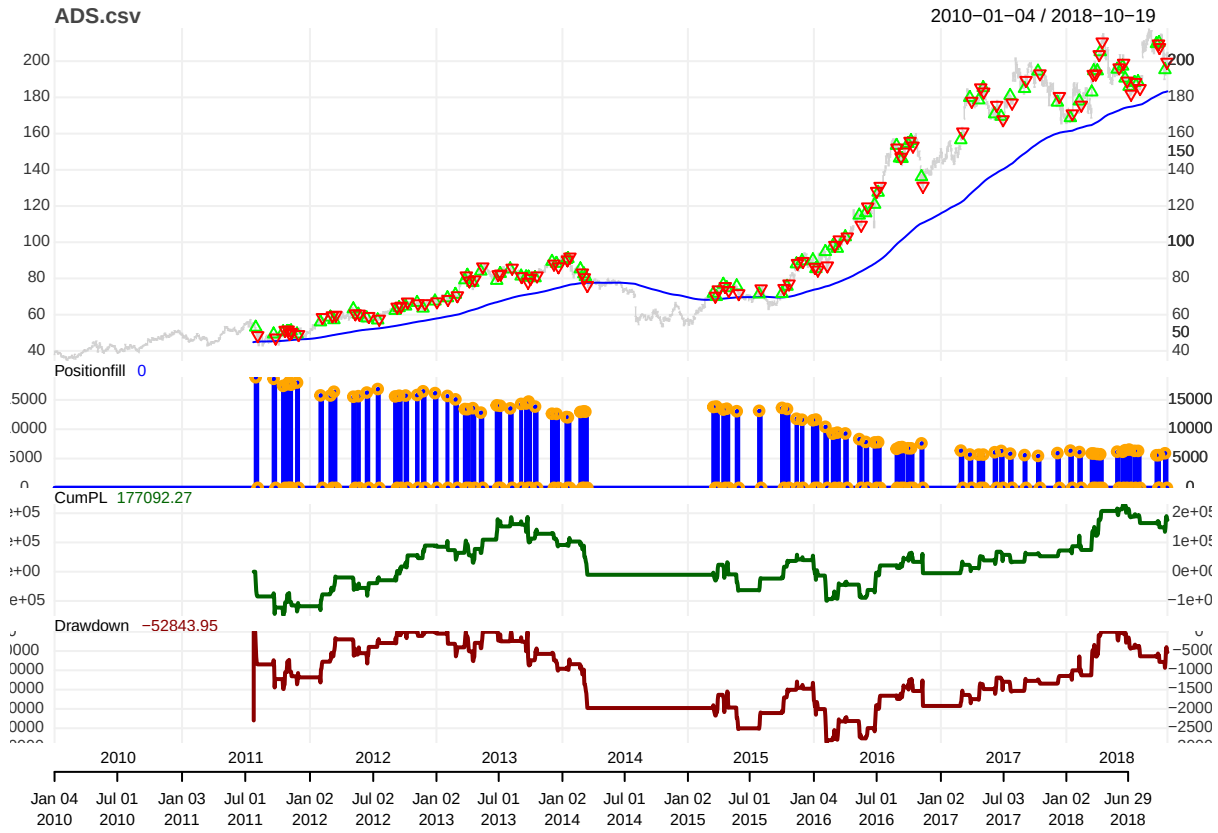
```
## 2014-07-16    13636  69.830   952201.9            -20.00
## 2014-07-21   -13636  67.850  -925202.6          -27019.28
## 2014-12-29    13377  68.210   912445.2            -20.00
## 2014-12-30   -13377  67.490  -902813.7           -9651.44
## 2015-03-27    11145  81.000   902745.0            -20.00
## 2015-03-31   -11145  81.360  -906757.2            3992.20
## 2015-04-15    10905  83.150   906750.8            -20.00
## 2015-04-21   -10905  81.710  -891047.5          -15723.20
## 2015-05-13    11083  80.390   890962.4            -20.00
## 2015-05-19   -11083  83.700  -927647.1           36664.73
## 2015-05-27    11092  83.630   927624.0            -20.00
## 2015-06-02   -11092  81.030  -898784.8          -28859.20
## 2015-06-16    11540  77.880   898735.2            -20.00
## 2015-06-22   -11540  78.920  -910736.8           11981.60
## 2015-07-01    11963  76.130   910743.2            -20.00
## 2015-07-07   -11963  73.870  -883706.8          -27056.38
## 2015-07-23    11132  79.380   883658.2            -20.00
## 2015-07-29   -11132  77.450  -862173.4          -21504.76
## 2015-10-28    10047  85.810   862133.1            -20.00
## 2015-11-03   -10047  85.130  -855301.1           -6851.96
## 2015-11-25     9639  88.730   855268.5            -20.00
## 2015-12-01    -9639  88.050  -848713.9           -6574.52
## 2015-12-07    10026  84.640   848600.6            -20.00
## 2015-12-11   -10026  82.100  -823134.6          -25486.04
## 2015-12-15     9939  82.820   823148.0            -20.00
## 2015-12-21    -9939  81.560  -810624.8          -12543.14
## 2016-01-08    10132  80.000   810560.0            -20.00
## 2016-01-14   -10132  80.710  -817753.7            7173.72
## 2016-01-21    10272  79.610   817753.9            -20.00
## 2016-01-26   -10272  81.130  -833367.4           15593.44
## 2016-03-01    10390  80.200   833278.0            -20.00
## 2016-03-02   -10390  79.990  -831096.1           -2201.90
## 2016-03-18    10306  80.640   831075.8            -20.00
## 2016-03-24   -10306  80.380  -828396.3           -2699.56
## 2016-04-04    10590  78.220   828349.8            -20.00
## 2016-04-06   -10590  77.000  -815430.0          -12939.80
## 2016-05-12    10171  80.170   815409.1            -20.00
## 2016-05-19   -10171  78.030  -793643.1          -21785.94
## 2016-06-03     9672  82.050   793587.6            -20.00
## 2016-06-08    -9672  83.150  -804226.8           10619.20
## 2016-07-20     9569  84.040   804178.8            -20.00
## 2016-07-26    -9569  84.350  -807145.1            2946.39
## 2016-09-02     9769  82.620   807114.8            -20.00
## 2016-09-08    -9769  83.440  -815125.4            7990.58
## 2016-09-22     9682  84.190   815127.6            -20.00
## 2016-09-28    -9682  84.170  -814933.9            -213.64
## 2016-10-14    10004  81.450   814825.8            -20.00
## 2016-10-20   -10004  80.800  -808323.2           -6522.60
## 2017-01-02     9933  81.380   808347.5            -20.00
## 2017-01-06    -9933  80.540  -800003.8           -8363.72
## 2017-02-02     9718  82.310   799888.6            -20.00
## 2017-02-08    -9718  84.420  -820393.6           20484.98
## 2017-03-01     9443  86.880   820407.8            -20.00
## 2017-03-02    -9443  86.430  -816158.5           -4269.35
```

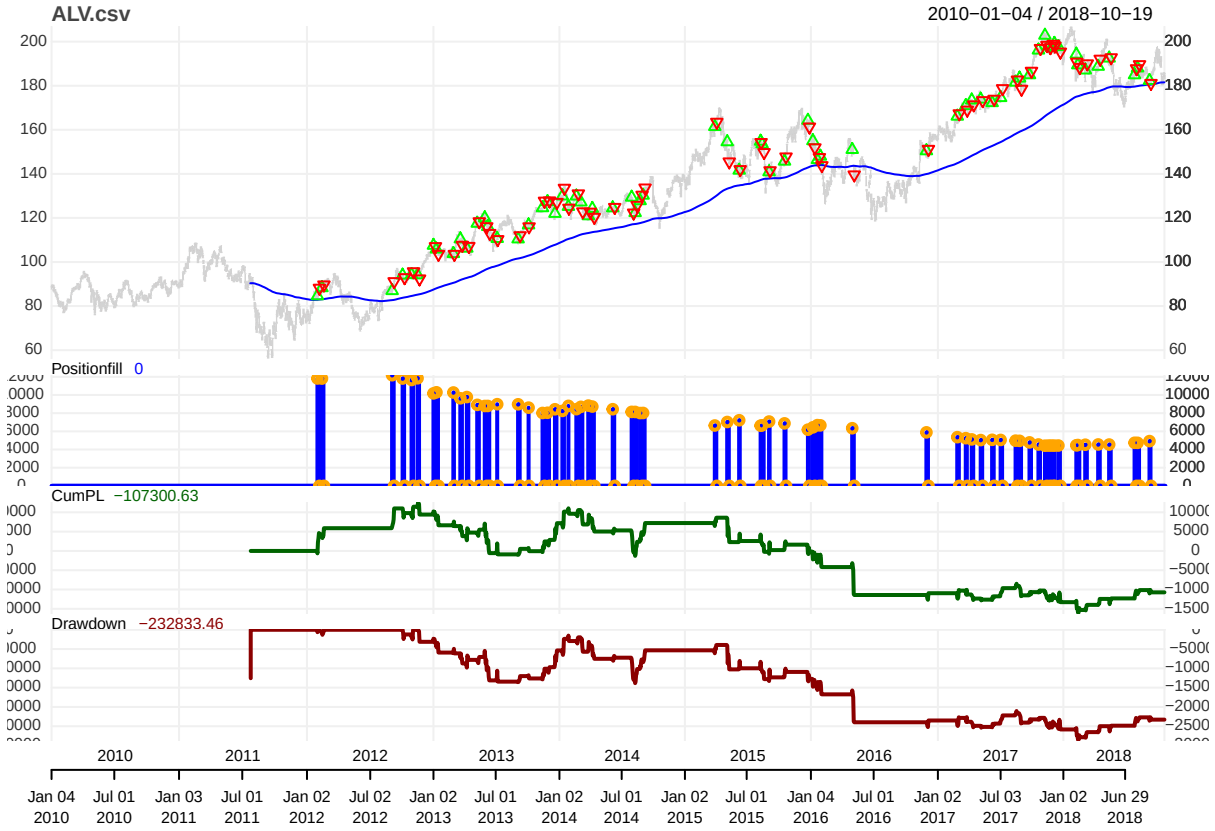
```
## 2017-03-09     9529  85.640   816063.6             -20.00
## 2017-03-15    -9529  87.330  -832167.6           16084.01
## 2017-04-20     9155  90.900   832189.5             -20.00
## 2017-04-26    -9155  91.070  -833745.8            1536.35
## 2017-06-14     8715  95.660   833676.9             -20.00
## 2017-06-20    -8715  97.250  -847533.8           13836.85
## 2017-06-26     8776  96.570   847498.3             -20.00
## 2017-06-27    -8776  96.280  -844953.3           -2565.04
## 2017-07-07     9234  91.500   844911.0             -20.00
## 2017-07-13    -9234  93.300  -861532.2           16601.20
## 2017-07-31     9332  92.320   861530.2             -20.00
## 2017-08-04    -9332  90.550  -845012.6          -16537.64
## 2017-08-22     9495  88.990   844960.0             -20.00
## 2017-08-28    -9495  88.610  -841351.9           -3628.10
## 2017-10-26     8932  94.190   841305.1             -20.00
## 2017-11-02    -8932  96.960  -866046.7           24721.64
## 2017-11-08     8817  98.220   866005.7             -20.00
## 2017-11-14    -8817  96.630  -851986.7          -14039.03
## 2017-11-28     8738  97.500   851955.0             -20.00
## 2017-12-01    -8738  98.890  -864100.8           12125.82
## 2017-12-04     8706 100.350   873647.1             -20.00
## 2017-12-06    -8706  99.870  -869468.2           -4198.88
## 2017-12-18     8598 100.000   859800.0             -20.00
## 2017-12-22    -8598  98.410  -846129.2          -13690.82
## 2018-02-07     9133  92.640   846081.1             -20.00
## 2018-02-08    -9133  91.340  -834208.2          -11892.90
## 2018-02-23     9205  90.620   834157.1             -20.00
## 2018-02-27    -9205  92.260  -849253.3           15076.20
## 2018-04-24     9213  92.180   849254.3             -20.00
## 2018-04-30    -9213  93.920  -865285.0           16010.62
```

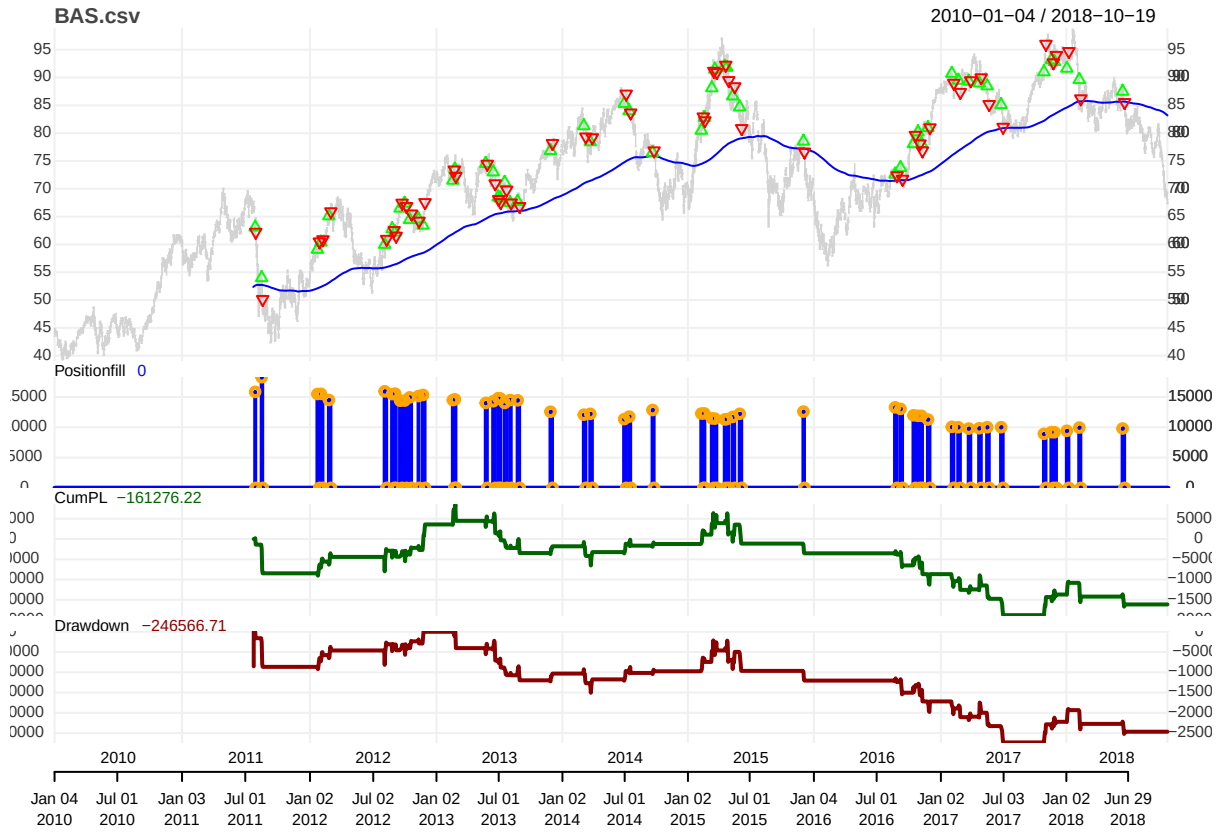
Step 3: Graph which visualize transactions

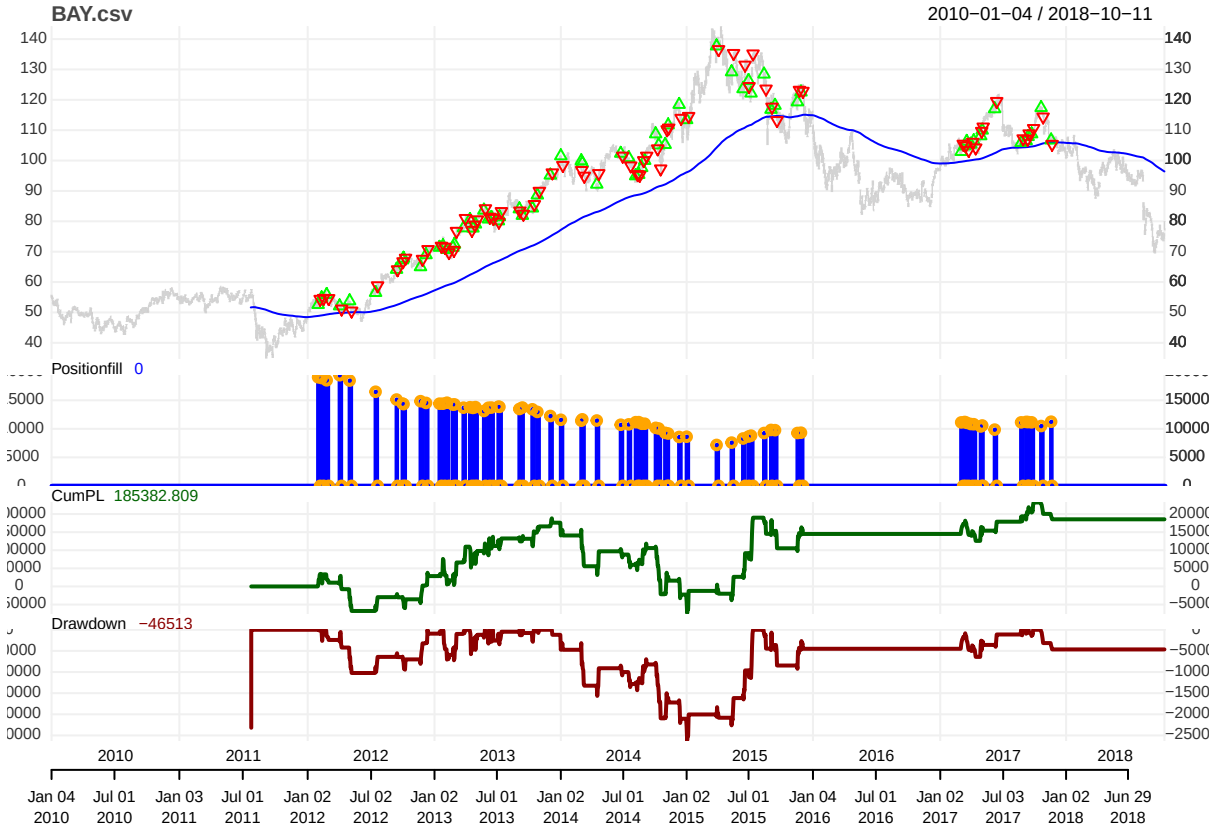
The following graphs show the combined view of the performance of the Smash Day trading system. It visualizes the trades (buy-transactions are visualized in green and sell-transactions are visualized in red). Moreover, the size of the blue squares indicates the size of the position (height) and the holding duration of the position (width). The green line shows the cummulative net profit curve, while the red line indicates the drawdown on each day compared to the last reached high.

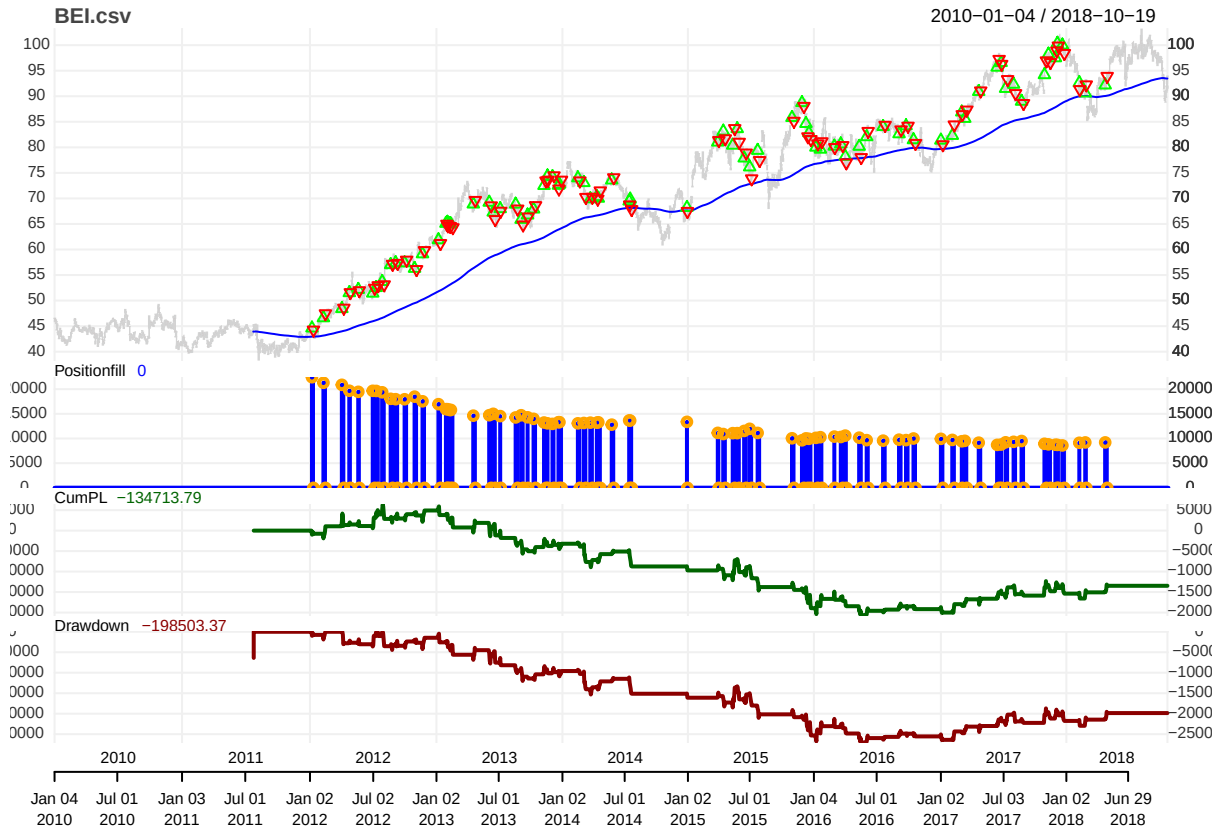
```
# Plot graph with indicators for transaction
for (instrument in instrumentlist){
  chart.Posn(portfolioname,
             Symbol=instrument,
             type='candlesticks',
             theme=myTheme,
             subset=daterange,
             TA=addEMAString)
}
```


ADS.csv
2010−01−04 / 2018−10−19
Positionfill 0
CumPL 177092.27
Drawdown −52843.95
2010
2011
2012
2013
2014
2015
2016
2017
2018
Jan 04 2010
Jul 01 2010
Jan 03 2011
Jul 01 2011
Jan 02 2012
Jul 02 2012
Jan 02 2013
Jul 01 2013
Jan 02 2014
Jul 01 2014
Jan 02 2015
Jul 01 2015
Jan 04 2016
Jul 01 2016
Jan 02 2017
Jul 03 2017
Jan 02 2018
Jun 29 2018


ALV.csv
2010−01−04 / 2018−10−19
Positionfill 0
CumPL −107300.63
Drawdown −232833.46
2010
2011
2012
2013
2014
2015
2016
2017
2018
Jan 04 2010
Jul 01 2010
Jan 03 2011
Jul 01 2011
Jan 02 2012
Jul 02 2012
Jan 02 2013
Jul 01 2013
Jan 02 2014
Jul 01 2014
Jan 02 2015
Jul 01 2015
Jan 04 2016
Jul 01 2016
Jan 02 2017
Jul 03 2017
Jan 02 2018
Jun 29 2018


BAS.csv
2010−01−04 / 2018−10−19
Positionfill 0
CumPL −161276.22
Drawdown −246566.71
2010
2011
2012
2013
2014
2015
2016
2017
2018
Jan 04 2010
Jul 01 2010
Jan 03 2011
Jul 01 2011
Jan 02 2012
Jul 02 2012
Jan 02 2013
Jul 01 2013
Jan 02 2014
Jul 01 2014
Jan 02 2015
Jul 01 2015
Jan 04 2016
Jul 01 2016
Jan 02 2017
Jul 03 2017
Jan 02 2018
Jun 29 2018


BAY.csv
2010−01−04 / 2018−10−11
Positionfill 0
CumPL 185382.809
Drawdown −46513
2010
2011
2012
2013
2014
2015
2016
2017
2018
Jan 04 2010
Jul 01 2010
Jan 03 2011
Jul 01 2011
Jan 02 2012
Jul 02 2012
Jan 02 2013
Jul 01 2013
Jan 02 2014
Jul 01 2014
Jan 02 2015
Jul 01 2015
Jan 04 2016
Jul 01 2016
Jan 02 2017
Jul 03 2017
Jan 02 2018
Jun 29 2018



Step 4: Performance Statistics

The following table summarizes some important trading statistics for all instruments. This statistic is just an excerpt of the overall statistics which can be calculated. It is printed here as it can be assumed that they are interesting for investers to rate the trading strategy.

```
library(PerformanceAnalytics)
# Get returns for the account
rets <- PortfReturns(Account=accountname)
rownames(rets) <- NULL
tstats <- tradeStats(Portfolio=portfolioname, Symbols=instrumentlist)
for (i in 1:nrow(tstats)) {
  trades.tab <- cbind(
    c("Trades", "Win Percent", "Loss Percent","W/L Ratio"),
    c(tstats[i,"Num.Trades"],
      round(tstats[i,"Percent.Positive"],2),
      round(tstats[i,"Percent.Negative"],2),
      round((tstats[i,"Percent.Positive"]/tstats[i,"Percent.Negative"]),2)))
  trades1 <- trades.tab
  rownames(trades1) <- c("Trades",
                         "Win Percent",
                         "Loss Percent",
                         "W/L Ratio")
  trades1 <- trades1[,2]
  print(row.names(tstats[i,]))
  print(trades1)
```

```
  writeLines("")
  }
```

```
## [1] "ADS.csv"
##       Trades  Win Percent Loss Percent    W/L Ratio
##         "91"      "50.55"      "48.35"       "1.05"
##
## [1] "ALV.csv"
##       Trades  Win Percent Loss Percent    W/L Ratio
##         "67"      "52.24"      "47.76"       "1.09"
##
## [1] "BAS.csv"
##       Trades  Win Percent Loss Percent    W/L Ratio
##         "55"      "41.82"      "58.18"       "0.72"
##
## [1] "BAY.csv"
##       Trades  Win Percent Loss Percent    W/L Ratio
##         "70"      "55.71"      "44.29"       "1.26"
##
## [1] "BEI.csv"
##       Trades  Win Percent Loss Percent    W/L Ratio
##         "80"      "41.25"      "58.75"        "0.7"
```

Step 5: Calculate statistics of the Portfolio and all instruments in the portfolio

```
## Performance Metrics
```

```
##                              ADS         ALV         BAS        BAY
## Cumulative Return      0.14081628 -0.11915594 -0.16653052 0.15930136
## Annualized Return      0.01825703 -0.01727275 -0.02470543 0.02050718
## Annualized Sharp Ratio 0.16402822 -0.23614458 -0.32694903 0.20167443
## Calmar Ratio           0.07045755 -0.06593662 -0.09937036 0.08593266
##                              BEI
## Cumulative Return      -0.13784232
## Annualized Return      -0.02016231
## Annualized Sharp Ratio -0.32998724
## Calmar Ratio           -0.08267532
```

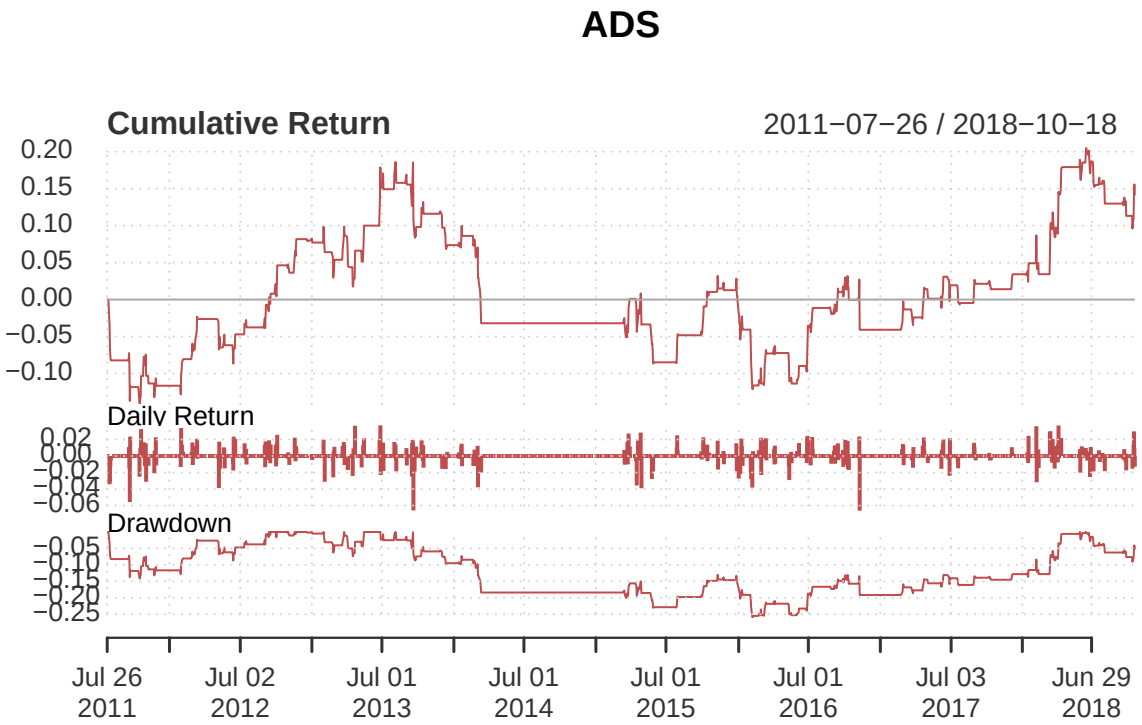
```
## Risk Metrics
```

```
##                             ADS          ALV         BAS          BAY
## Annualized StdDev  0.111304192  0.073144791  0.07556355  0.101684585
## Max Drawdown       0.259120958  0.261959838  0.24861969  0.238642442
## Value-at-Risk     -0.008943496 -0.004425955 -0.00369260 -0.006439263
## Conditional VaR   -0.019440405 -0.012328857 -0.01315486 -0.016355603
##                           BEI
## Annualized StdDev  0.06110027
## Max Drawdown       0.24387340
## Value-at-Risk     -0.00612568
## Conditional VaR   -0.01120670
```

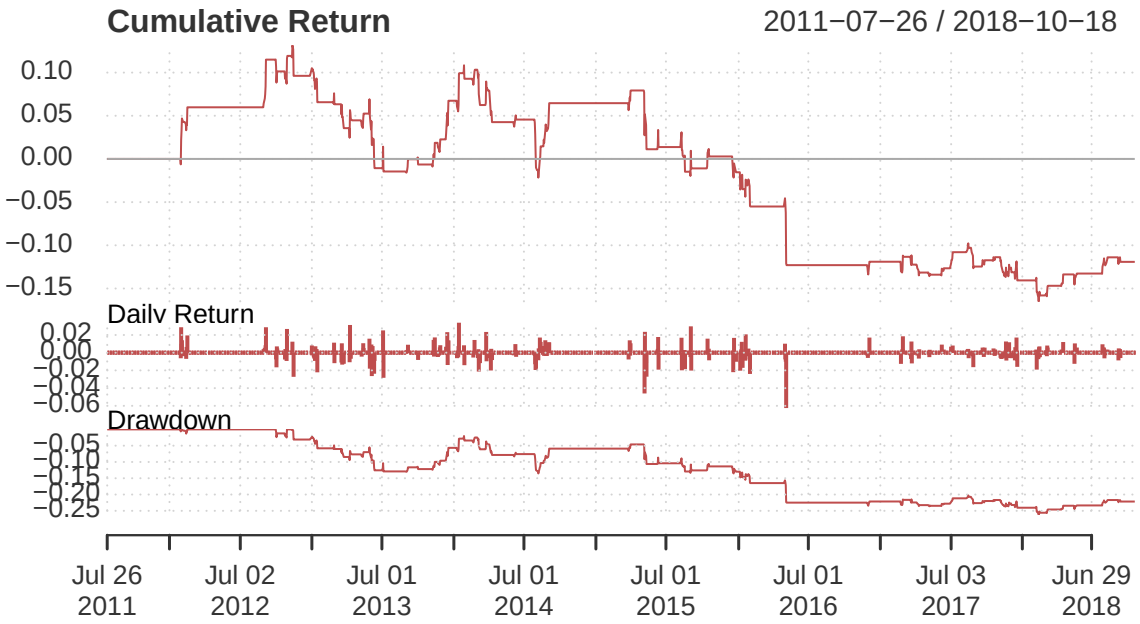
Step 6: Visualize returns of the trading strategy for every instrument

The following plots visualizes some important information about the returns of the strategy applied to the instruments on the instrumentlist. The cummulative return over the entire period, the daily returns and the drawdown for each instrument is illustrated.

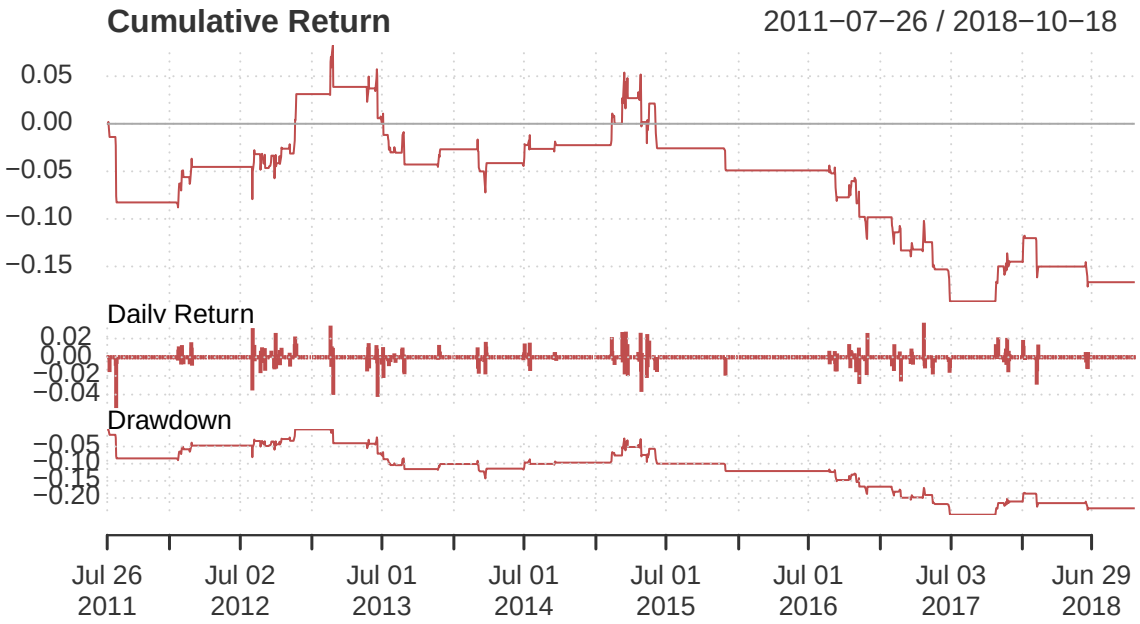
```
for (i in 1:ncol(rets)){
  charts.PerformanceSummary(rets[,i],colorset=rainbow12equal,lwd=1,main=substr(colnames(rets[,i]),1,3))
}
```



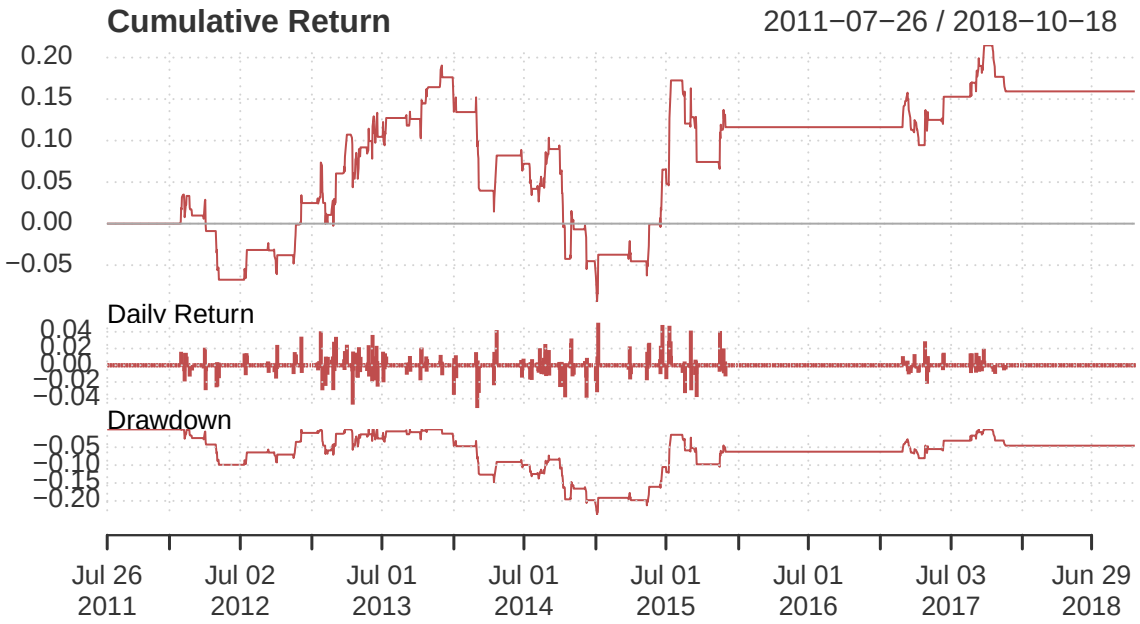
ALV

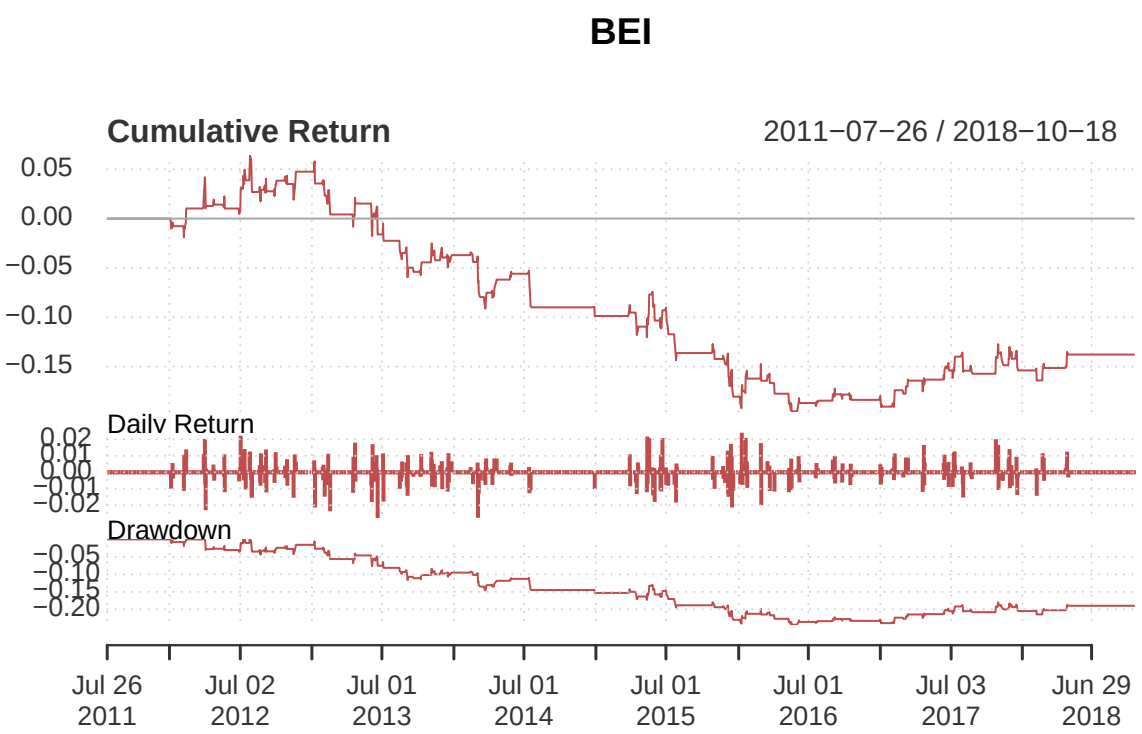

Cumulative Return
2011−07−26 / 2018−10−18
0.10
0.05
0.00
−0.05
−0.10
−0.15
Dailv Return
0.02
0.00
−0.02
−0.04
−0.06
Drawdown
−0.05
−0.10
−0.15
−0.20
−0.25
Jul 26 2011
Jul 02 2012
Jul 01 2013
Jul 01 2014
Jul 01 2015
Jul 01 2016
Jul 03 2017
Jun 29 2018

BAS


Cumulative Return
2011−07−26 / 2018−10−18
0.05
0.00
−0.05
−0.10
−0.15
Dailv Return
0.02
0.00
−0.02
−0.04
Drawdown
−0.05
−0.10
−0.15
−0.20
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018

BAY


Cumulative Return
2011−07−26 / 2018−10−18
0.20
0.15
0.10
0.05
0.00
−0.05
Dailv Return
0.04
0.02
0.00
−0.02
−0.04
Drawdown
−0.05
−0.10
−0.15
−0.20
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018



Compare with Buy and Hold Strategy

In order to compare the trading strategy properly we need to define a benchmark against which we can measure the results. In this case a simple buy and hold strategy is used. At the first date of the trading period we place a buy order and sell our position at the last day of the selected period. In order to do this we create a new Portfolio and a new Account. As stocks from the DAX (German Stocks Market Index) are used in the strategy, the buy and hold strategy is performed on an DAX ETF.

Step 1: Perform the Buy and Hold Strategy

```
# Any objects, in case there was a buyhold
# portfolio initialized before are removed
suppressWarnings(try(rm(list=c("account.buyhold",
                               "portfolio.buyhold"),
                        pos=.blotter)))

# The Buy and hold instrument is loaded
LoadCourseFile(BuyHoldDirectory,BuyHoldInstrument,debugme=TRUE,dates=daterange)
# The Buy and hold instrument is initialized
stock(BuyHoldInstrument,currency="EUR")

BuyHoldSymbol<-get(BuyHoldInstrument)

# The portfolio and account "buyhold" is initialized
initPortf("buyhold",
          BuyHoldInstrument,
```

```
           initDate=initdate,
           currency="EUR")
initAcct("buyhold",
         portfolios="buyhold",
         initDate=initdate,
         initEq=startCapital,
         currency="EUR")

# The first date of the defined daterange is selected
currentdate <- first(time(BuyHoldSymbol))

# The close price at this date is selected
closeprice <- as.numeric(Cl(BuyHoldSymbol[currentdate,]))

# Calculate the unitsize we can buy with our startingcapital
unitsize <- as.numeric(trunc(startCapital/closeprice))

# Place the transaction for the instrument at the first date
addTxn("buyhold",
       Symbol=BuyHoldInstrument,
       TxnDate=currentdate,
       TxnPrice=closeprice,
       TxnQty=unitsize,
       TxnFees=transactionCost)

# Select the last date of the daterange period
lastdate <-last(time(BuyHoldSymbol))

# Select the price at the last date
lastprice <- as.numeric(Cl(BuyHoldSymbol[lastdate,]))

# Sell the position at the last date of the daterange
addTxn("buyhold",
       Symbol=BuyHoldInstrument,
       TxnDate=lastdate,
       TxnPrice=lastprice,
       TxnQty=-unitsize,
       TxnFees=transactionCost)

# update portfolio and account
updatePortf(Portfolio="buyhold")
updateAcct(name="buyhold")
updateEndEq(Account="buyhold")
```

Step 2: Visualize the Buy and Hold strategy

We can see that we hold the position from the first until the last date. The cumulative profits are visualized by the green line.

```
chart.Posn("buyhold",Symbol=BuyHoldInstrument, theme=myTheme)
```

Step 3: Compare the returns of the trading strategy with the buy and hold strategy

In order to compare the results of both strategies, we calculat the returns for the buy and hold strategy and combine them with the returns of the trading strategy which were calculated before.

```
rets.bh <- PortfReturns(Account='buyhold')
returns <- cbind(rets,rets.bh)
colnames(returns) <- substr(colnames(returns),1,3)
```

In order to compare the performance between the strategy investment in one of the stocks and the alternative buy and hold strategy of the DAX ETF, the following graphs visualize the relative performance between each of the stocks used and the DAX ETF.

```
table.Stats(returns)
```

```
##                       ADS       ALV       BAS       BAY       BEI
## Observations    1835.0000 1835.0000 1835.0000 1835.0000 1835.0000
## NAs              400.0000  400.0000  400.0000  400.0000  400.0000
## Minimum           -0.0661   -0.0625   -0.0544   -0.0511   -0.0278
## Quartile 1         0.0000    0.0000    0.0000    0.0000    0.0000
## Median             0.0000    0.0000    0.0000    0.0000    0.0000
## Arithmetic Mean    0.0001   -0.0001   -0.0001    0.0001   -0.0001
## Geometric Mean     0.0001   -0.0001   -0.0001    0.0001   -0.0001
## Quartile 3         0.0000    0.0000    0.0000    0.0000    0.0000
## Maximum            0.0372    0.0338    0.0370    0.0509    0.0240
## SE Mean            0.0002    0.0001    0.0001    0.0001    0.0001
## LCL Mean (0.95)   -0.0002   -0.0003   -0.0003   -0.0002   -0.0002
## UCL Mean (0.95)    0.0004    0.0002    0.0001    0.0004    0.0001
```

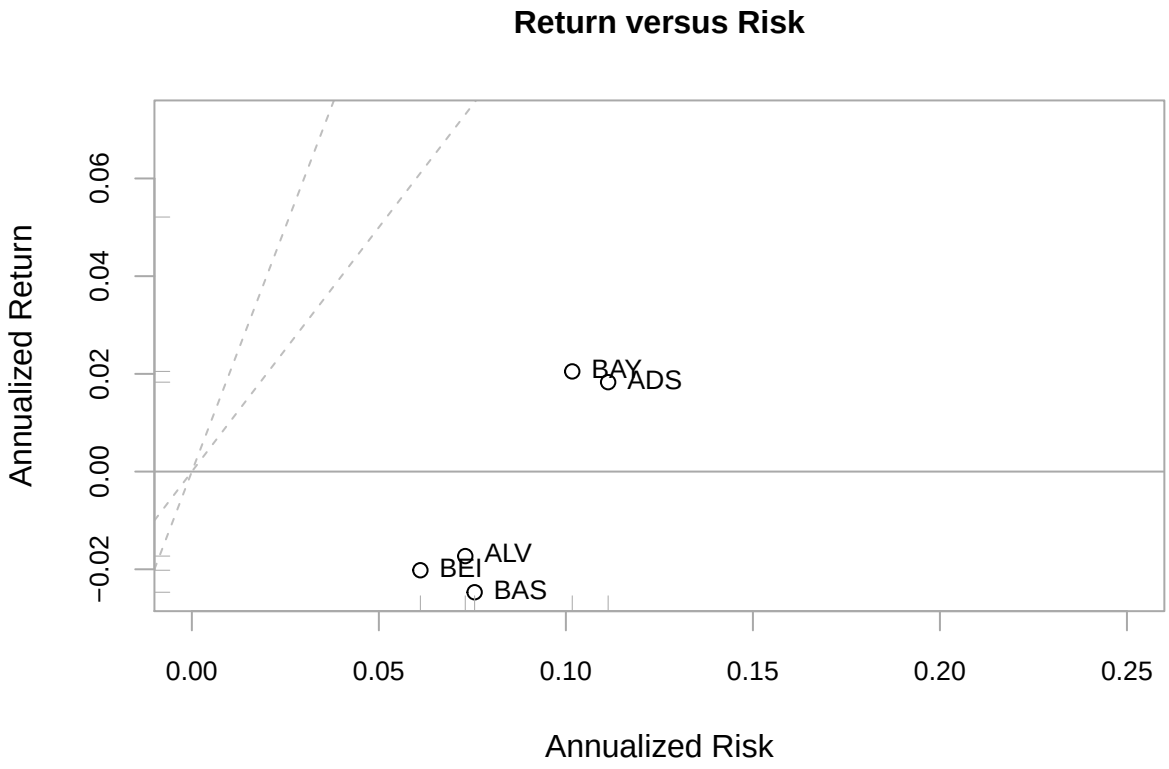
```
## Variance           0.0000    0.0000    0.0000    0.0000    0.0000
## Stdev              0.0070    0.0046    0.0048    0.0064    0.0038
## Skewness          -1.1535   -1.5280   -1.2962    0.5019   -0.2806
## Kurtosis          18.6240   37.5933   31.4776   21.5728   14.2159
##                       DAX
## Observations    2230.0000
## NAs                5.0000
## Minimum           -0.1069
## Quartile 1        -0.0080
## Median             0.0012
## Arithmetic Mean    0.0003
## Geometric Mean     0.0002
## Quartile 3         0.0092
## Maximum            0.0757
## SE Mean            0.0004
## LCL Mean (0.95)   -0.0004
## UCL Mean (0.95)    0.0010
## Variance           0.0003
## Stdev              0.0167
## Skewness          -0.3004
## Kurtosis           2.1434
```

```
table.AnnualizedReturns(returns)
```

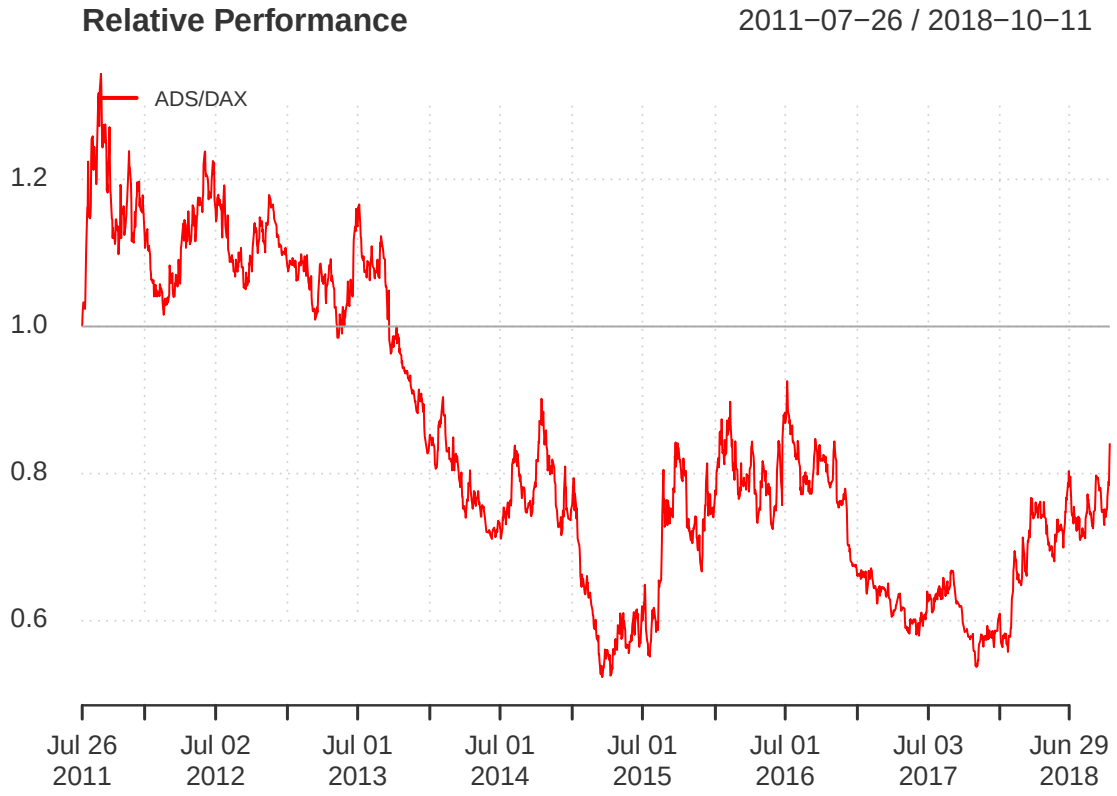
```
##                               ADS     ALV     BAS    BAY     BEI    DAX
## Annualized Return          0.0183 -0.0173 -0.0247 0.0205 -0.0202 0.0521
## Annualized Std Dev         0.1113  0.0731  0.0756 0.1017  0.0611 0.2650
## Annualized Sharpe (Rf=0%) 0.1640 -0.2361 -0.3269 0.2017 -0.3300 0.1965
```

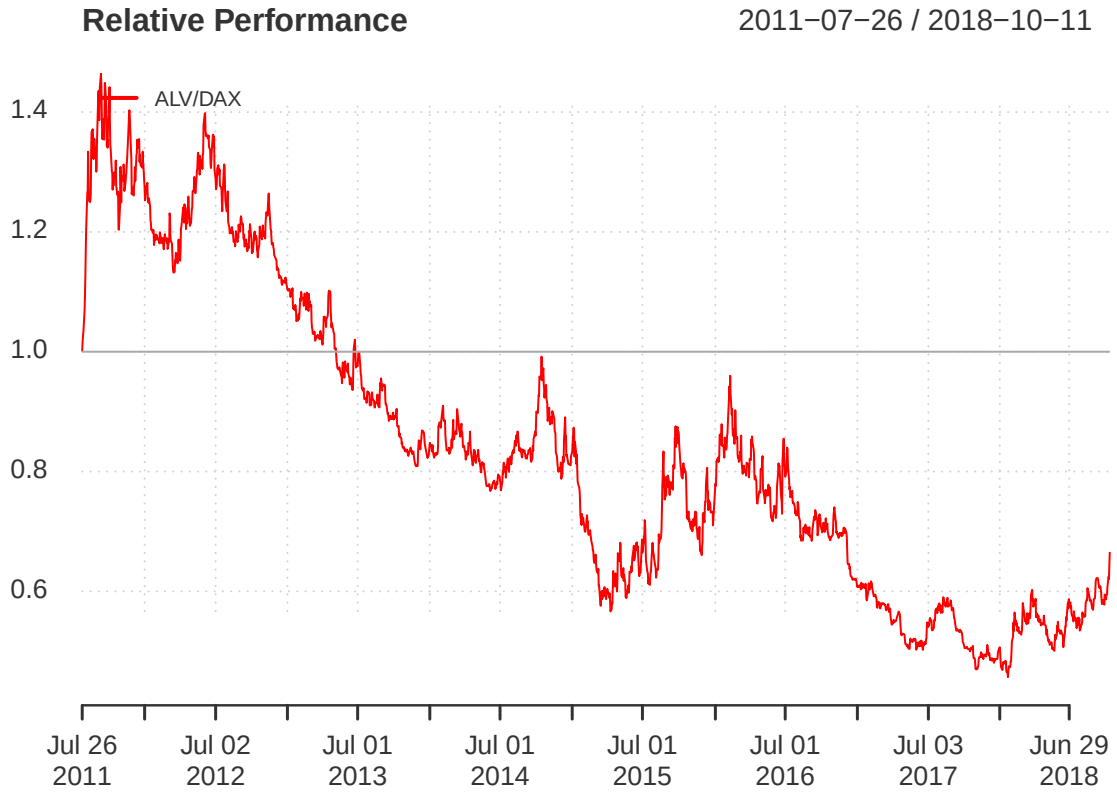
```
# charts.PerformanceSummary(returns,geometric=FALSE,wealth.index=TRUE)
chart.RiskReturnScatter(returns,Rf=0,
                        add.sharpe=c(1,2),
                        xlim=c(0,0.25),
                        main="Return versus Risk"
                        )
```

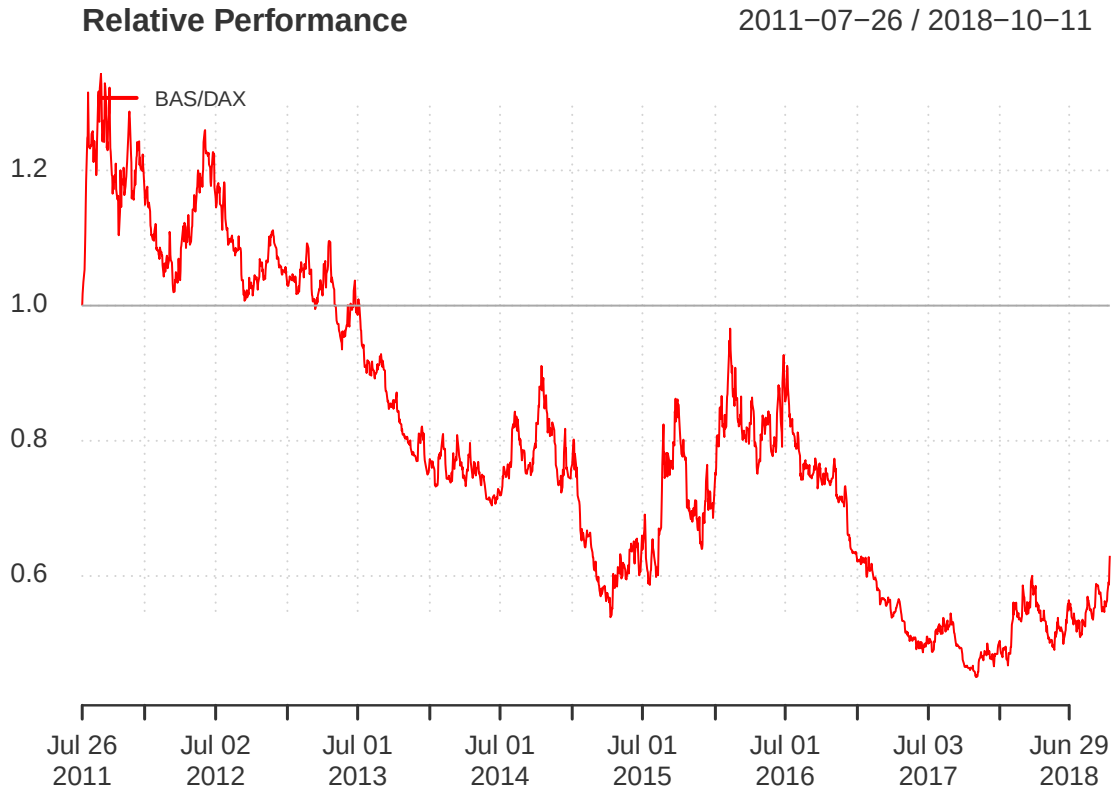
```
## Warning in rug(side = 1, risk, col = element.color): some values will be
## clipped
```

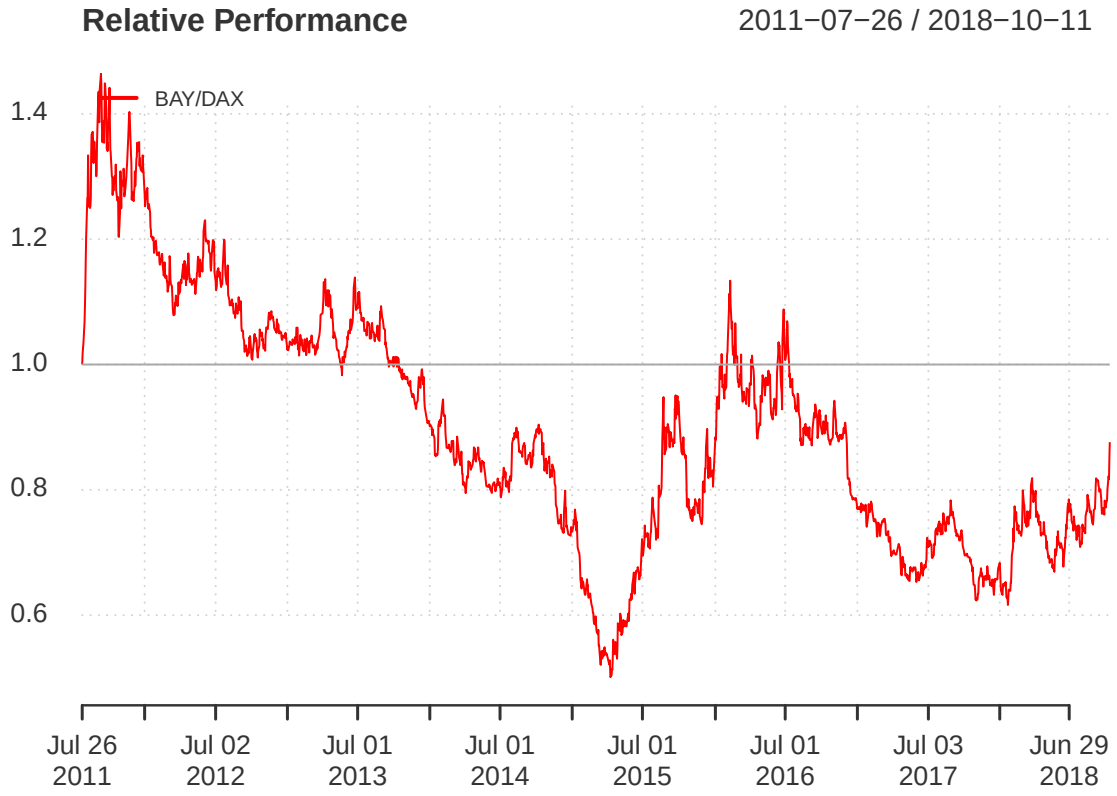


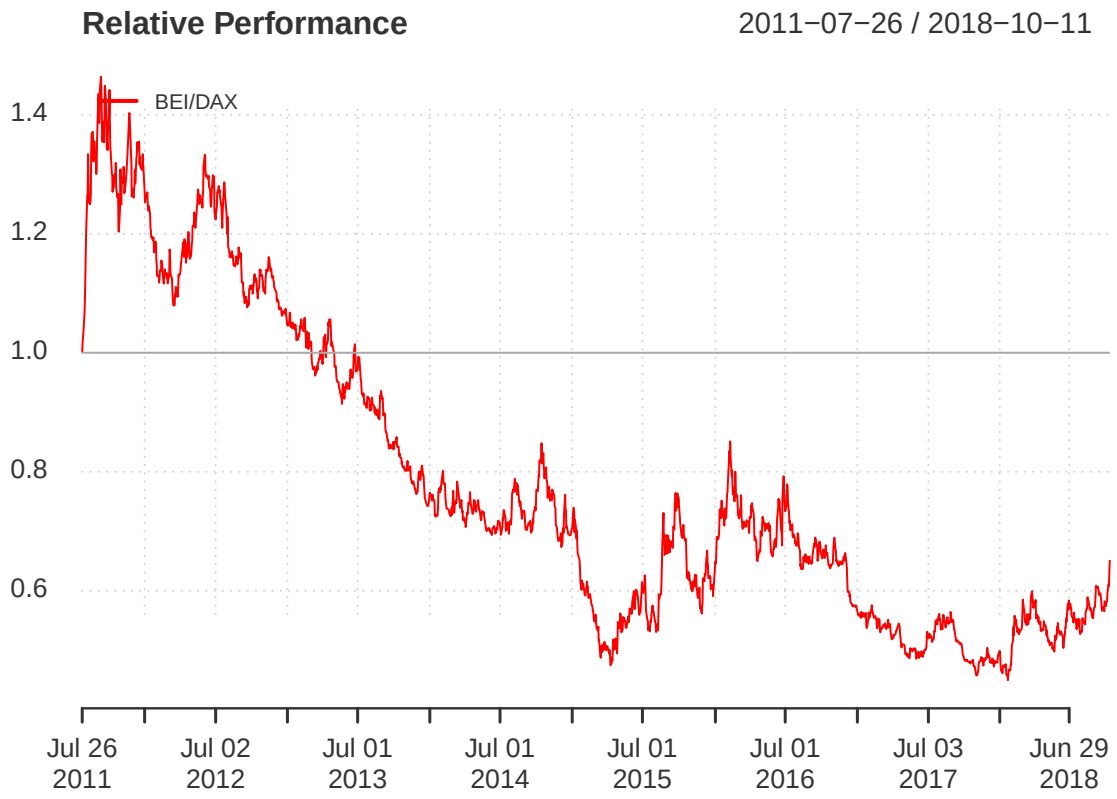

```
for (i in colnames(returns[,-which(names(returns) == "DAX")])){

  print(chart.RelativePerformance(returns[,i],returns[,"DAX"],
                            colorset=c("red","blue"),
                            lwd=1,
                            legend.loc="topleft"))
}
```


Relative Performance
2011−07−26 / 2018−10−11
ADS/DAX
1.2
1.0
0.8
0.6
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018


Relative Performance
2011−07−26 / 2018−10−11
ALV/DAX
1.4
1.2
1.0
0.8
0.6
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018


Relative Performance
2011−07−26 / 2018−10−11
BAS/DAX
1.2
1.0
0.8
0.6
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018

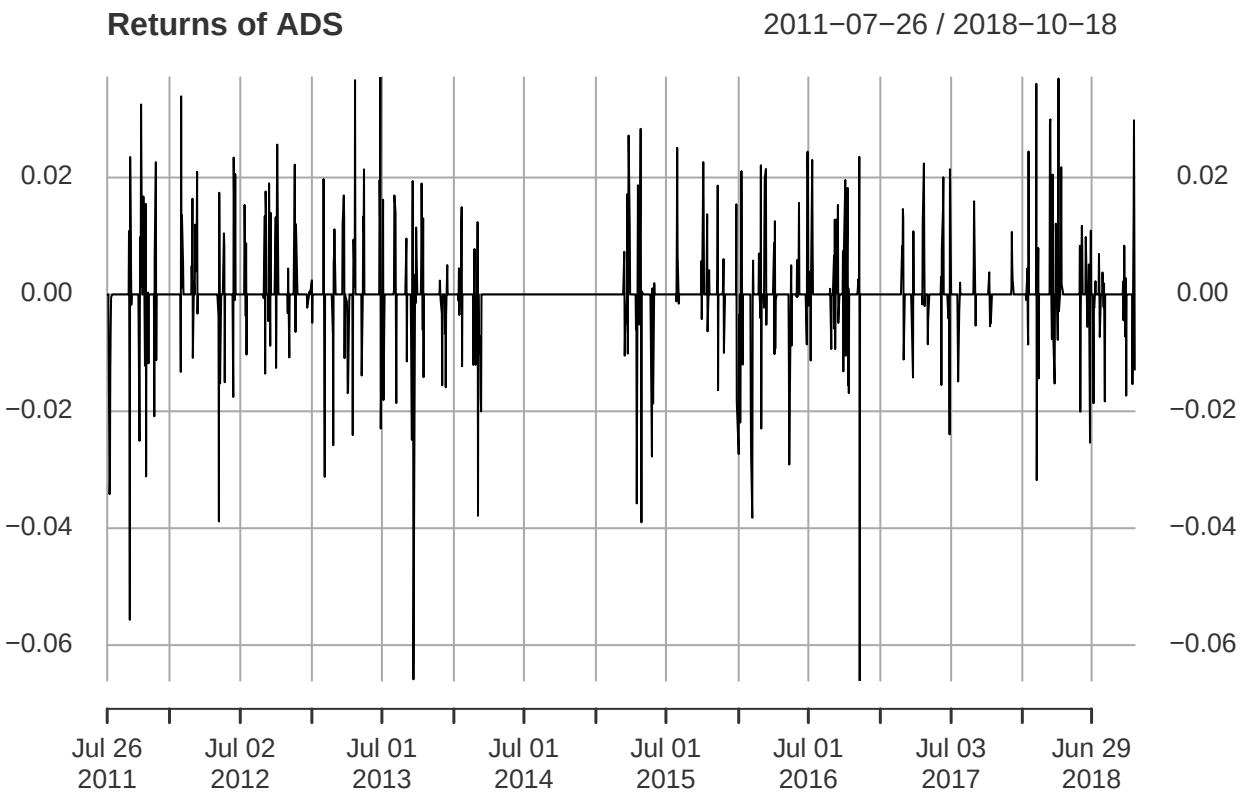

Relative Performance
2011−07−26 / 2018−10−11
BAY/DAX
1.4
1.2
1.0
0.8
0.6
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018

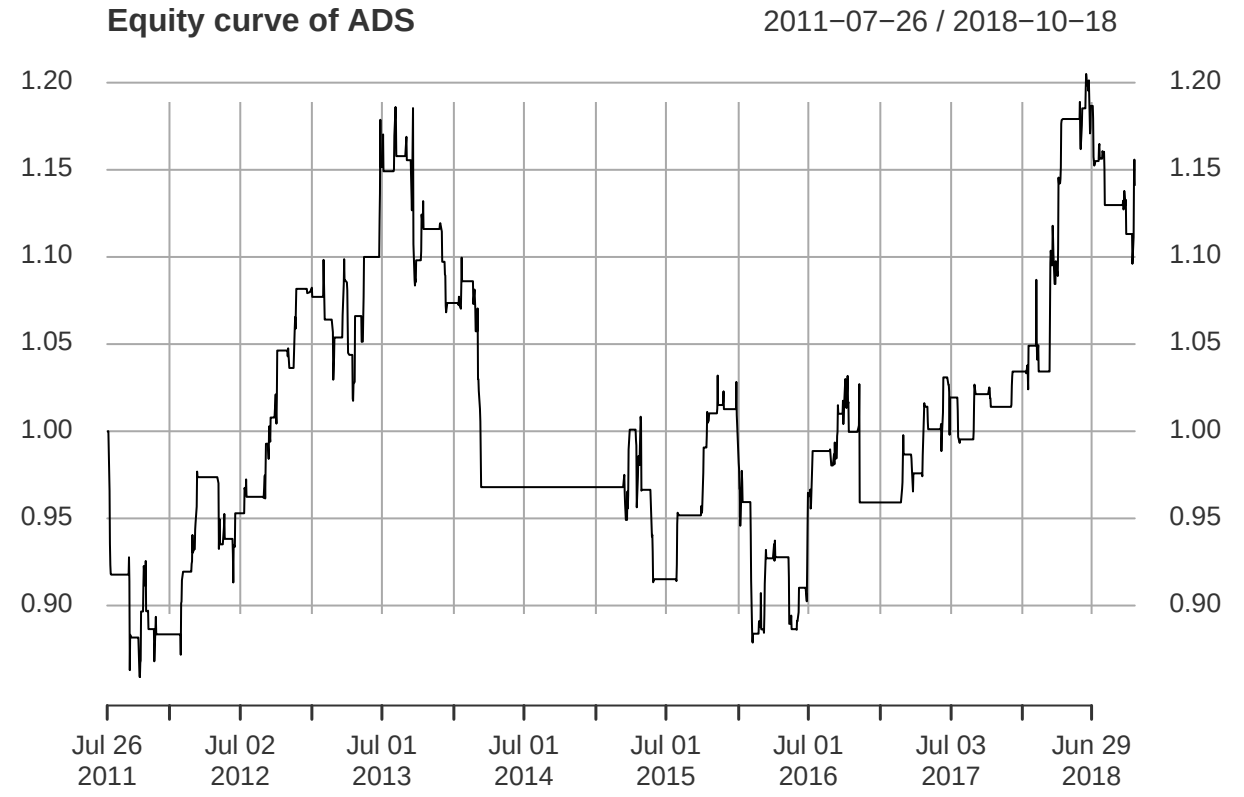


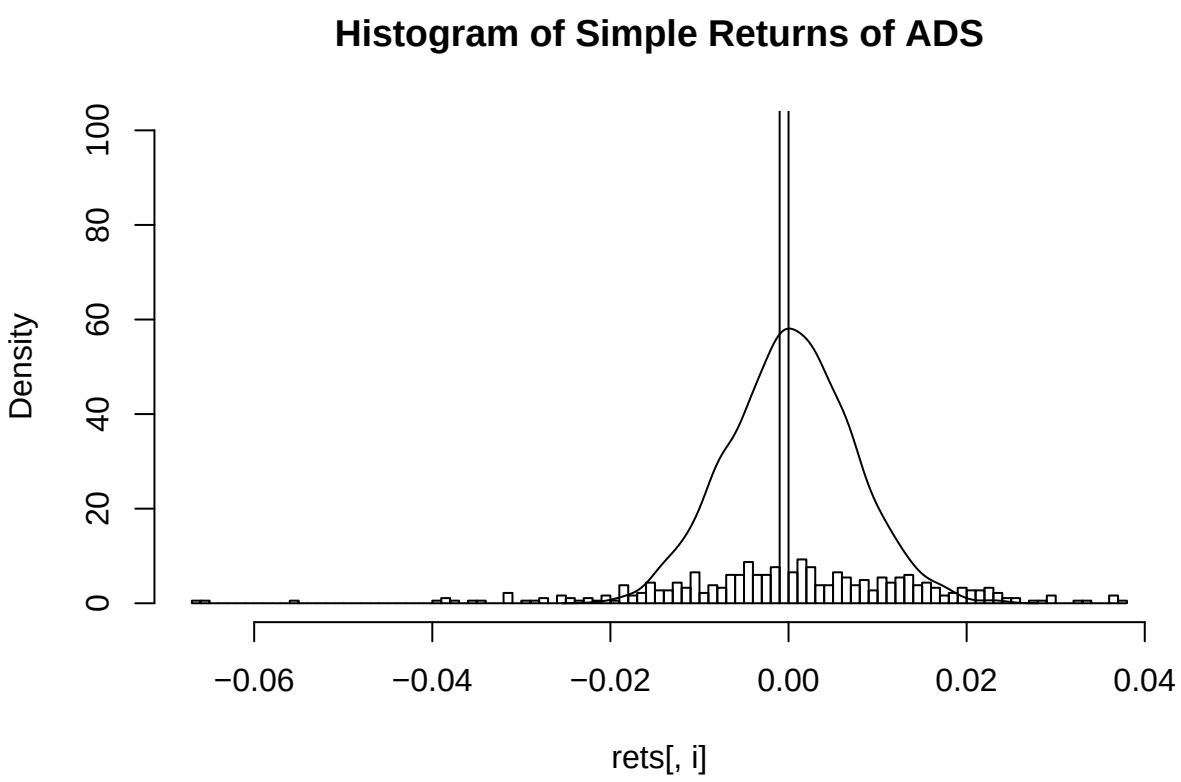
Calculations and visualizations based on returns

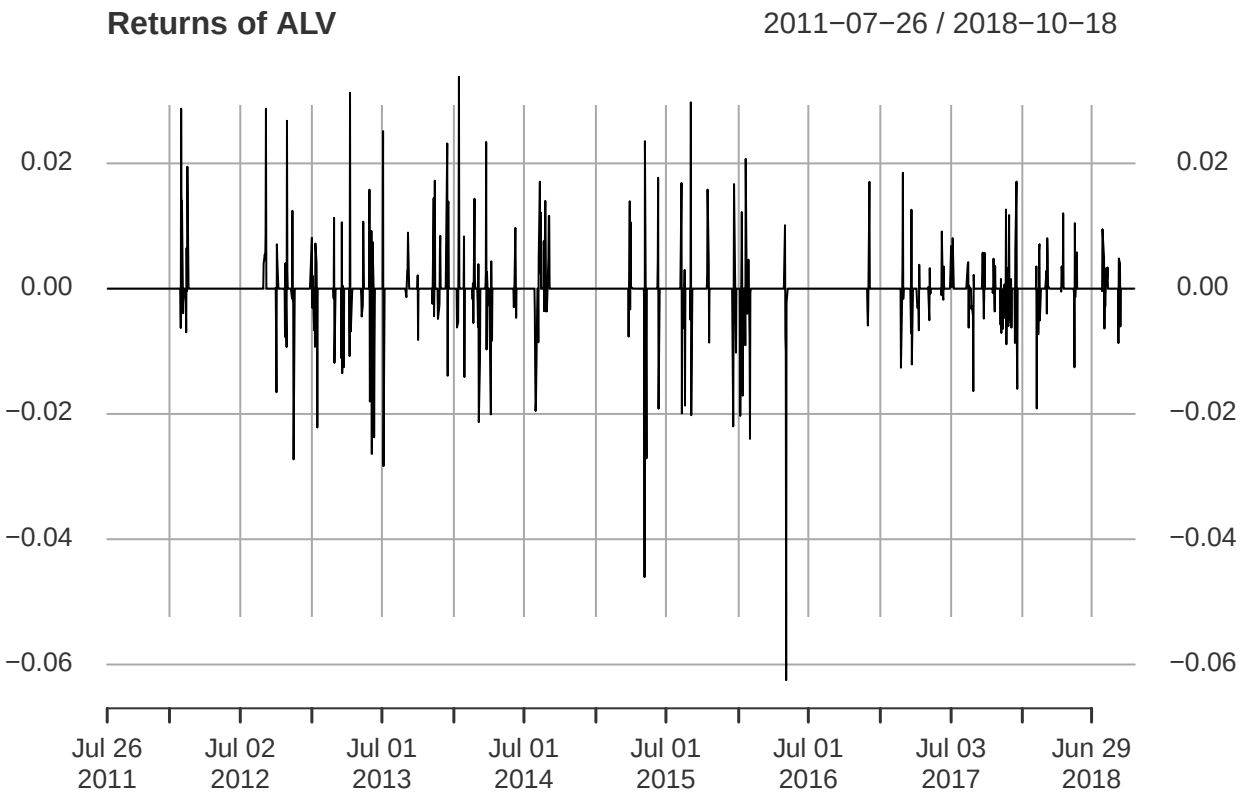
The visualization of returns, equity curve, value at risk and some other measure which can be calculated based on the returns of the trading strategy, can be observed in the following graphs.

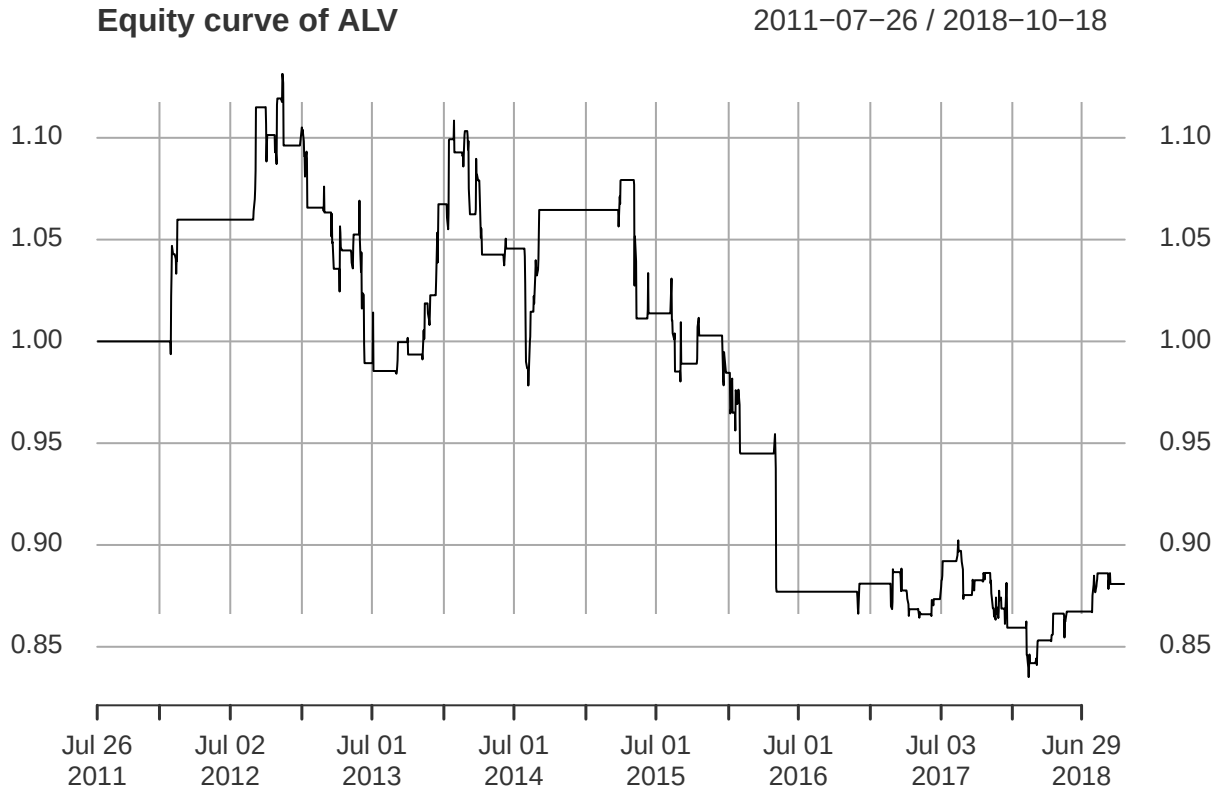
Returns and Equity Curve

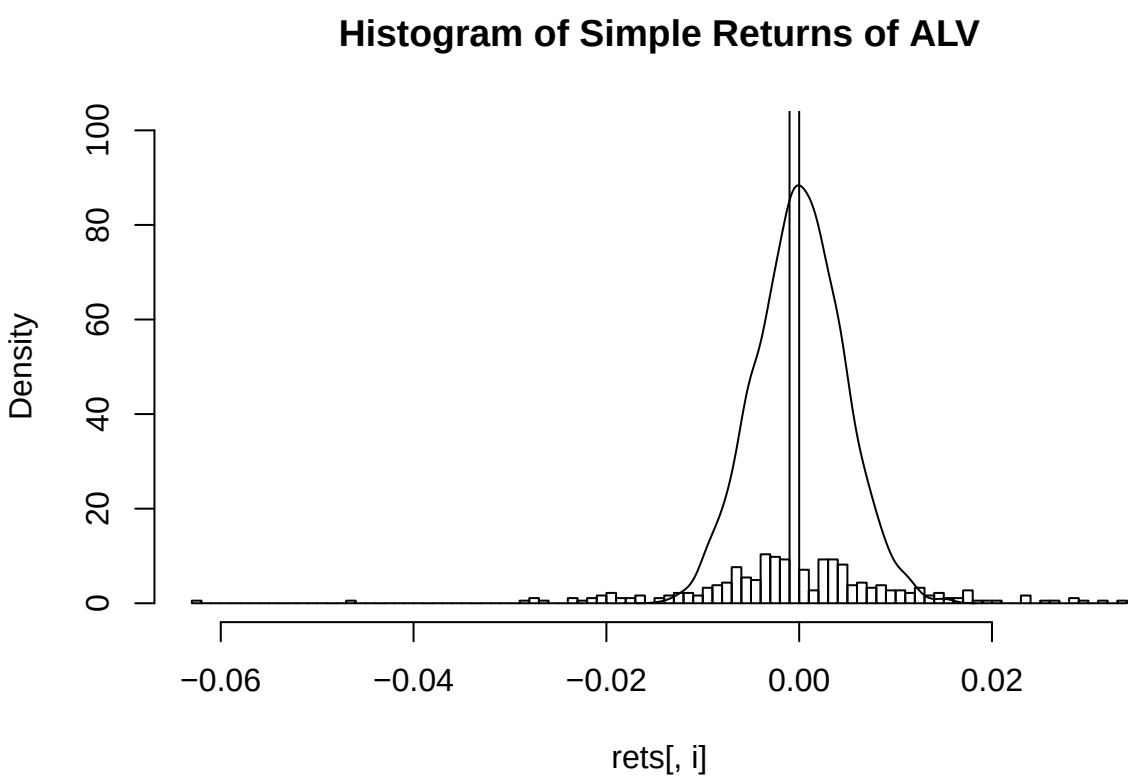


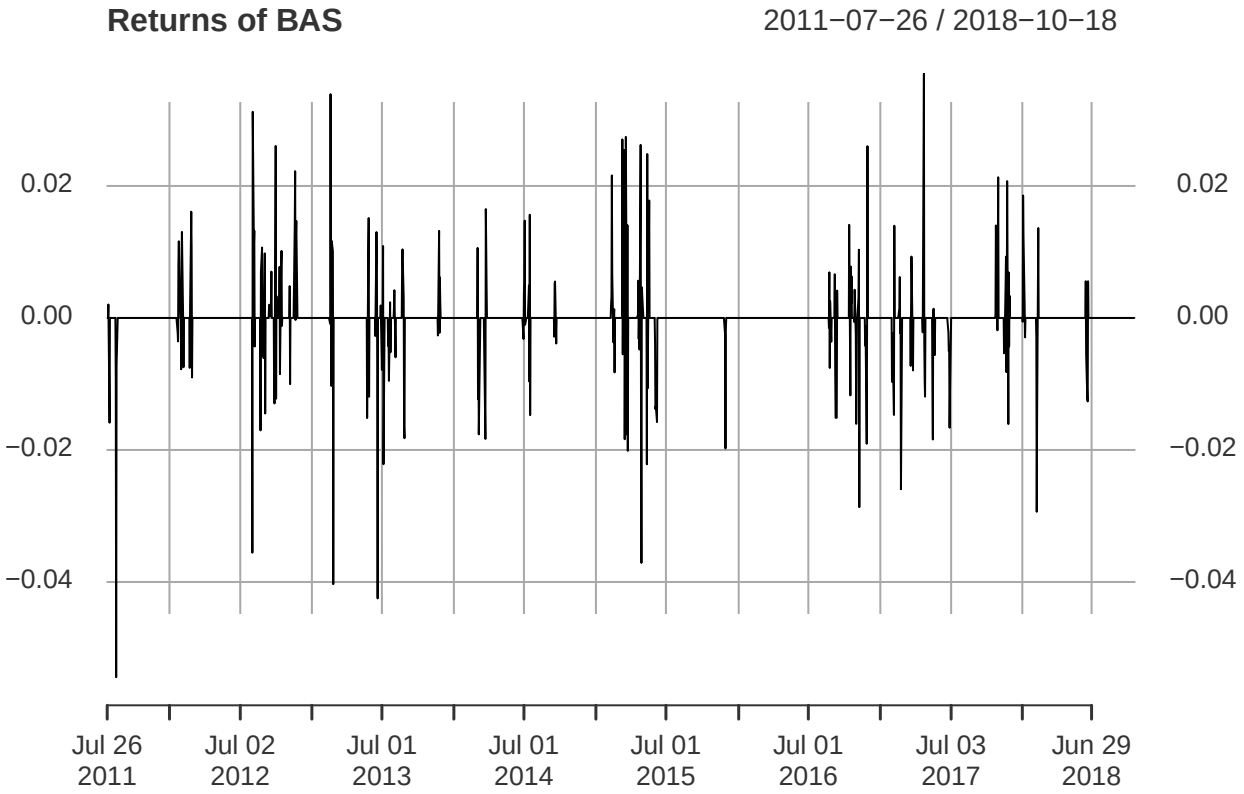


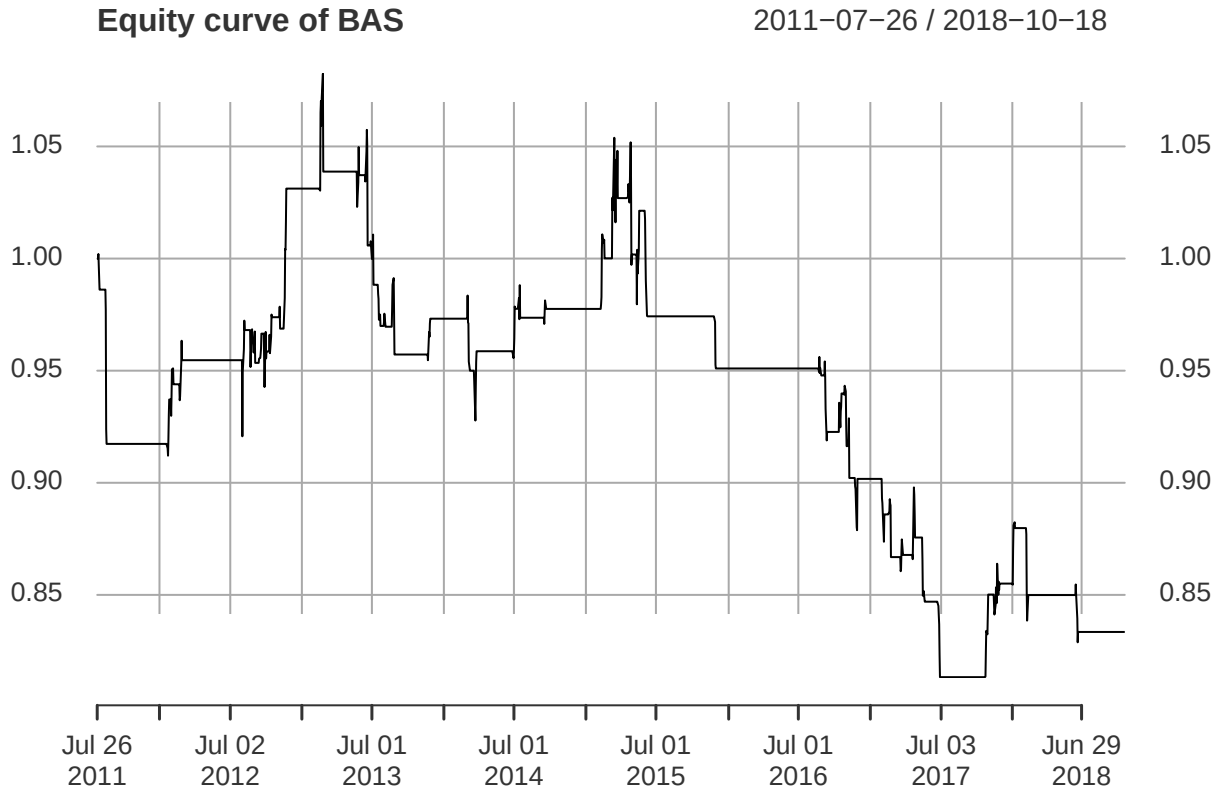

Histogram of Simple Returns of ADS
Density
0
20
40
60
80
100
−0.06
−0.04
−0.02
0.00
0.02
0.04
rets[, i]

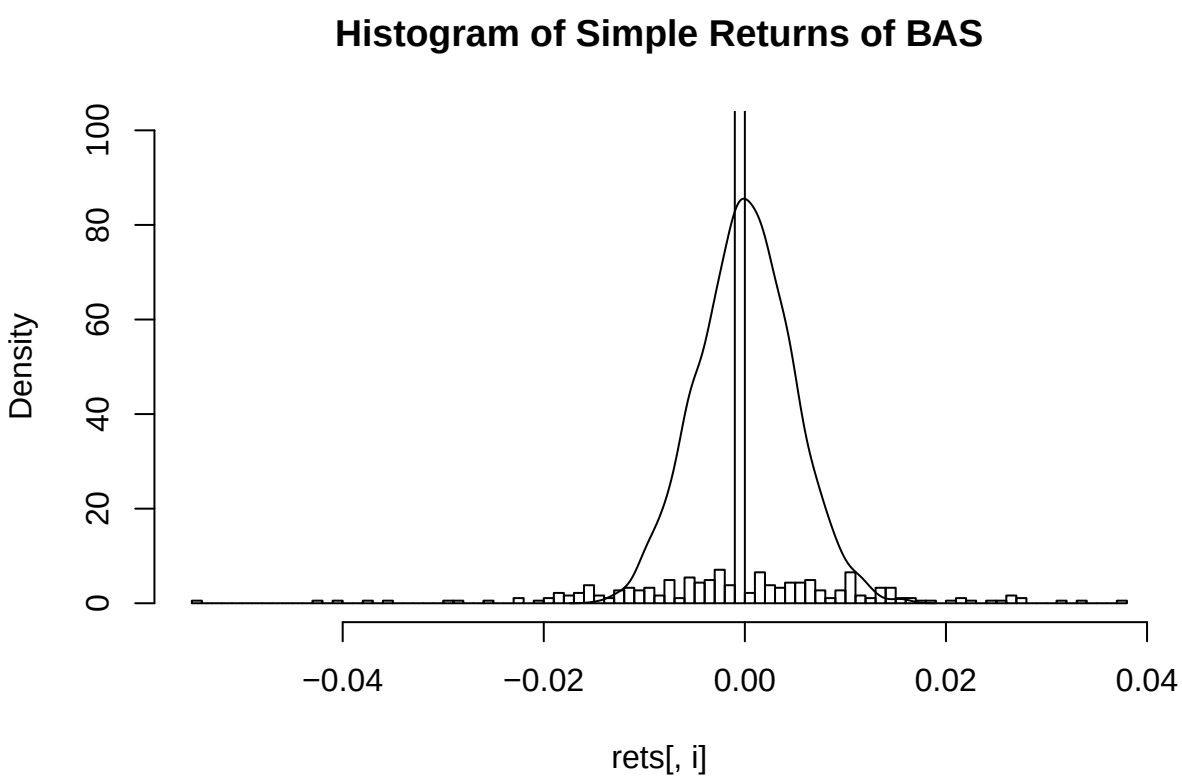

Returns of ALV
2011−07−26 / 2018−10−18
0.02
0.00
−0.02
−0.04
−0.06
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018

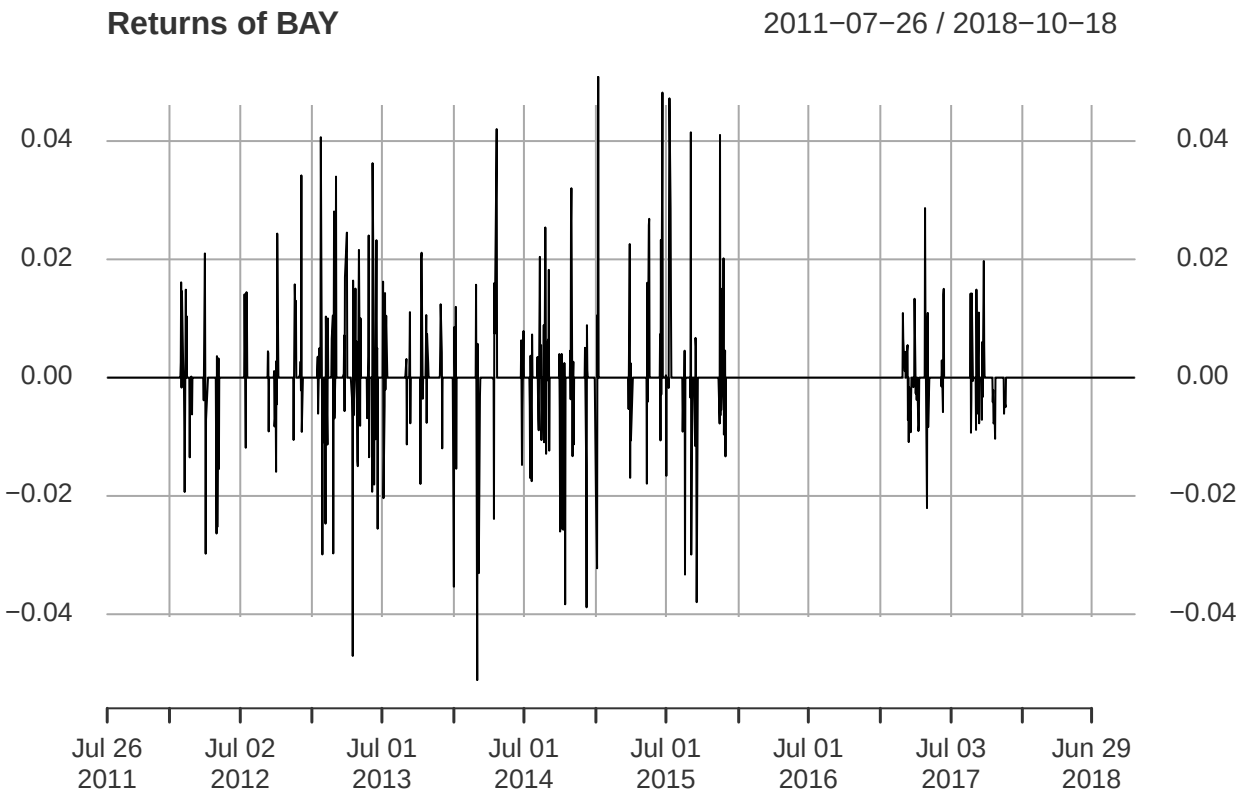

Equity curve of ALV
2011−07−26 / 2018−10−18
1.10
1.05
1.00
0.95
0.90
0.85
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018

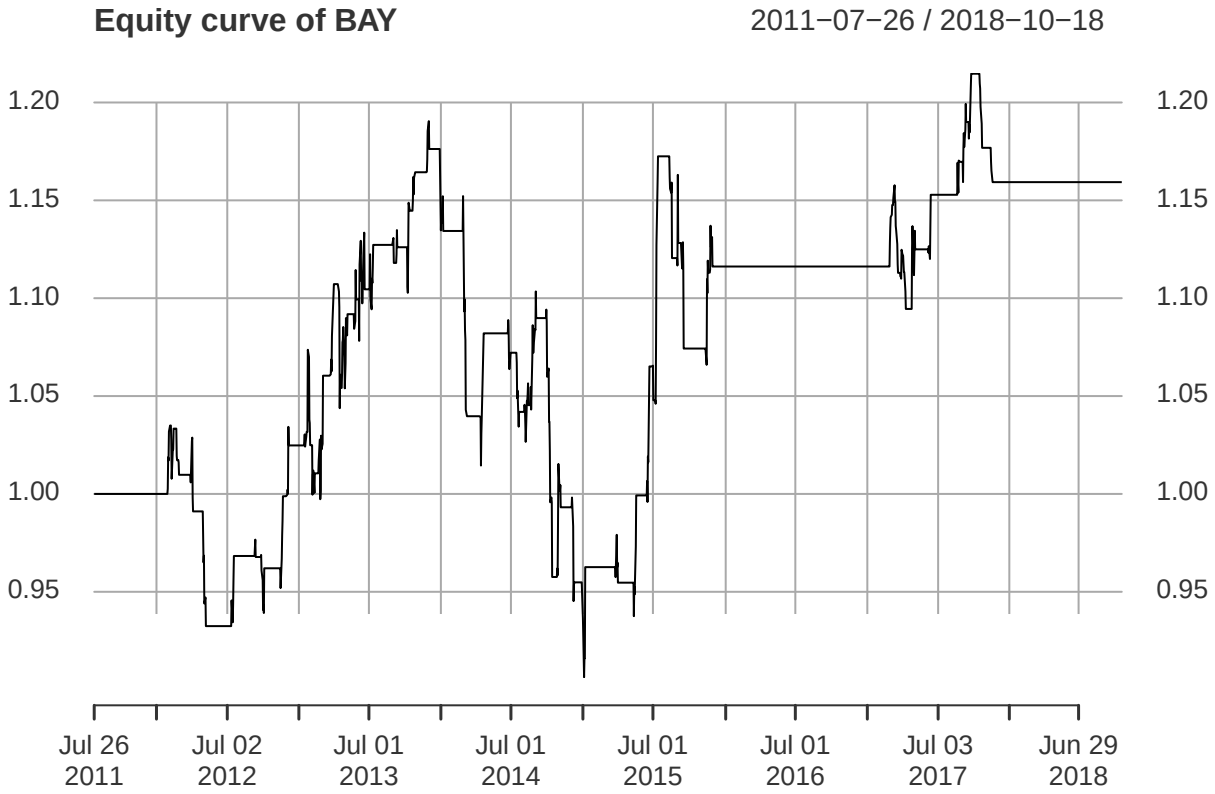

Histogram of Simple Returns of ALV
Density
0
20
40
60
80
100
−0.06
−0.04
−0.02
0.00
0.02
rets[, i]

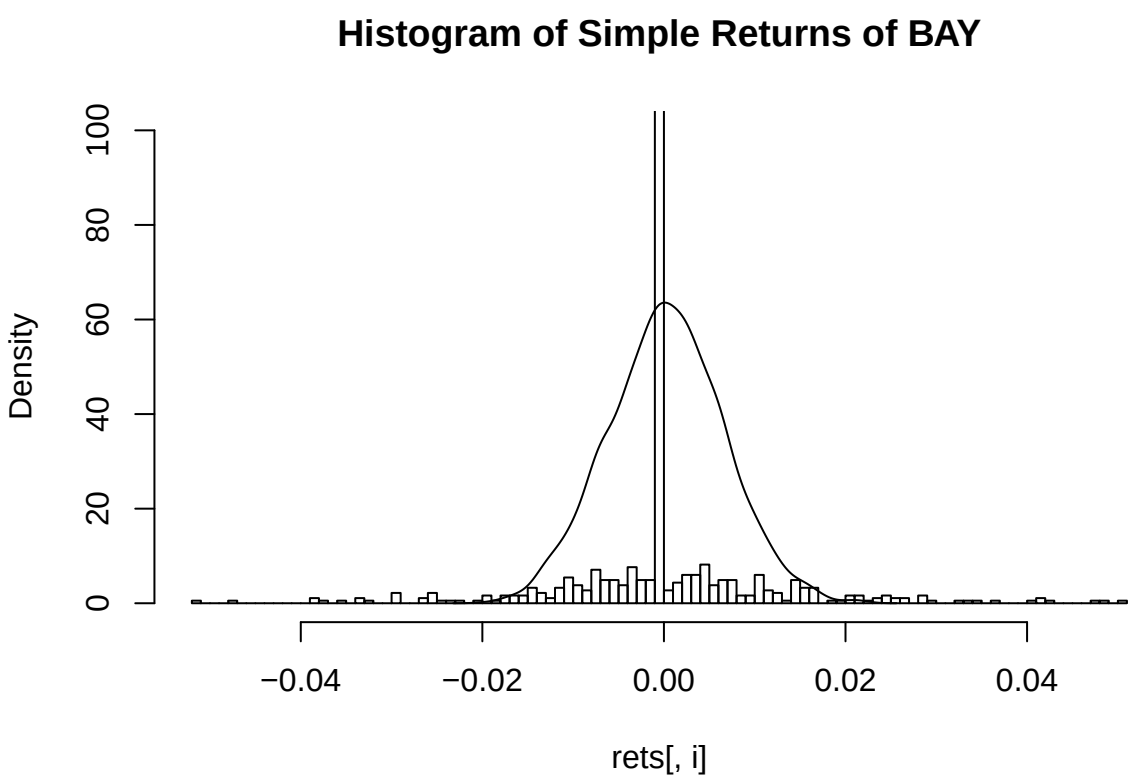

Returns of BAS
2011−07−26 / 2018−10−18
0.02
0.00
−0.02
−0.04
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018

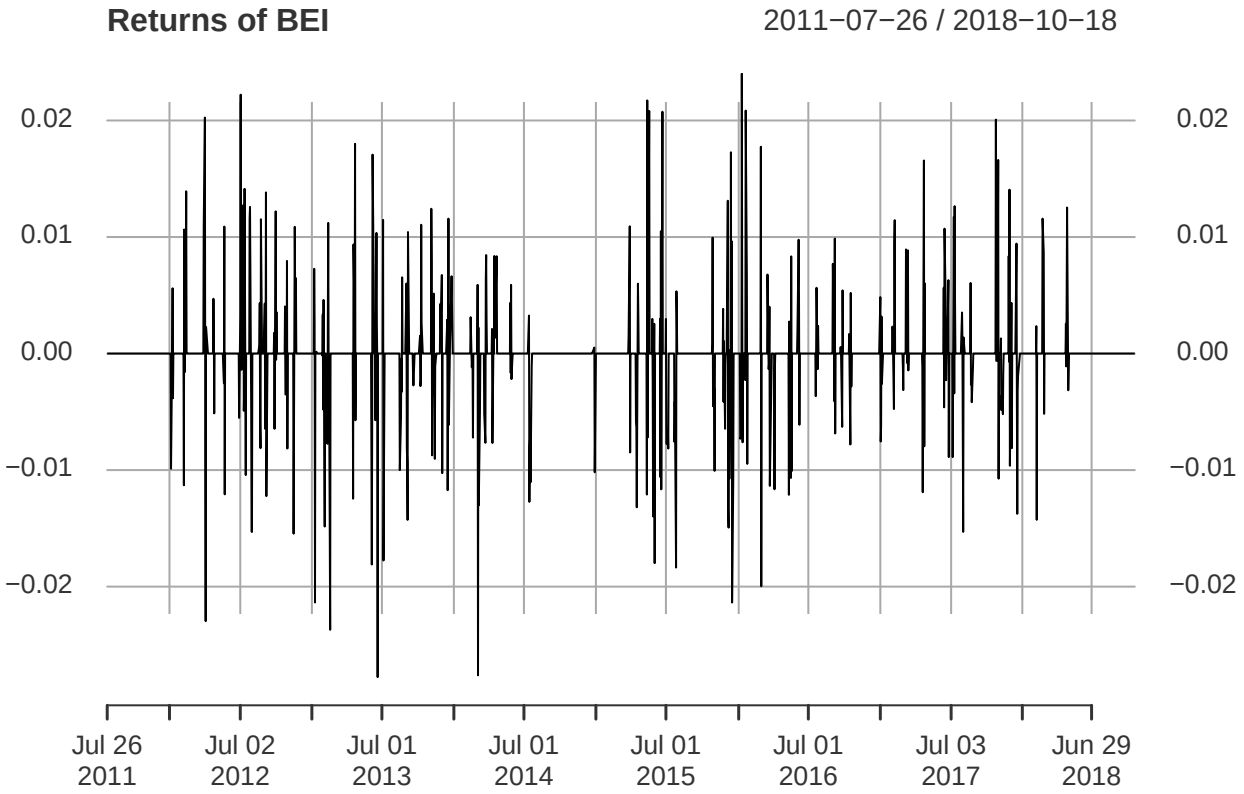

Equity curve of BAS
2011−07−26 / 2018−10−18
1.05
1.00
0.95
0.90
0.85
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018

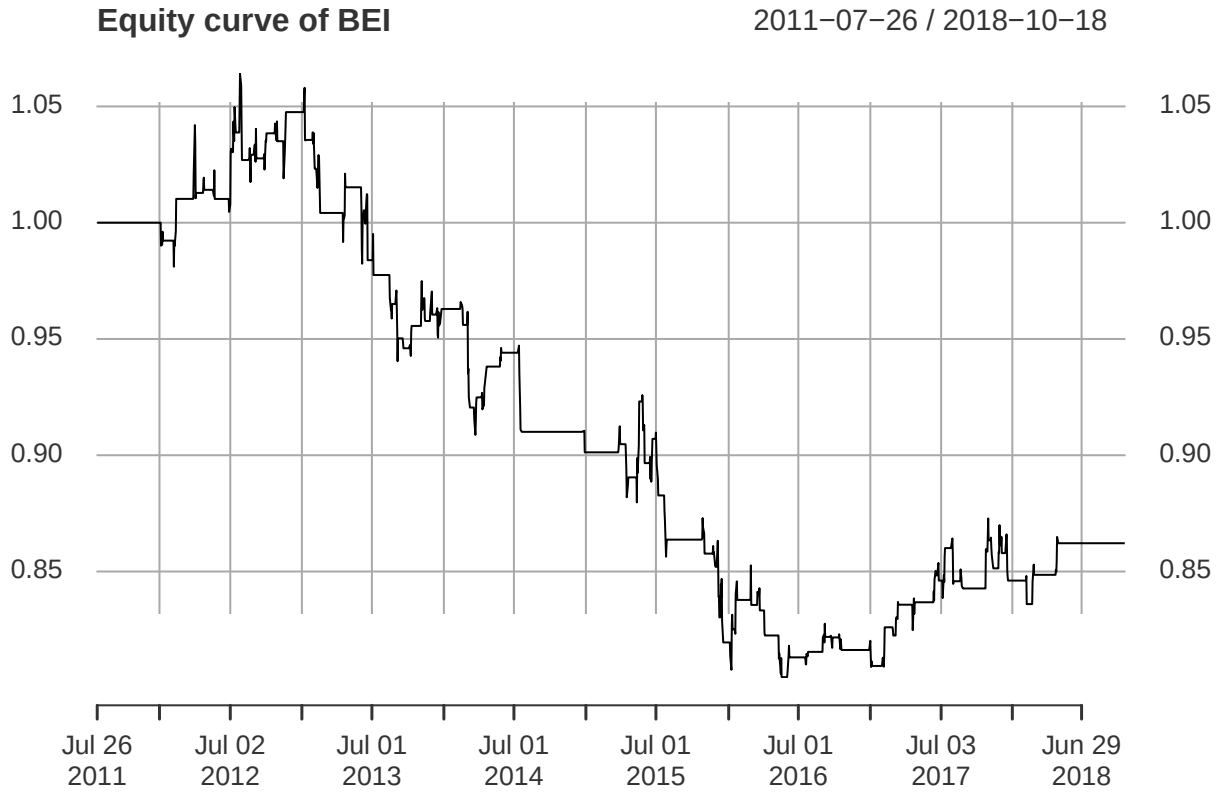

Histogram of Simple Returns of BAS
Density
0
20
40
60
80
100
−0.04
−0.02
0.00
0.02
0.04
rets[, i]

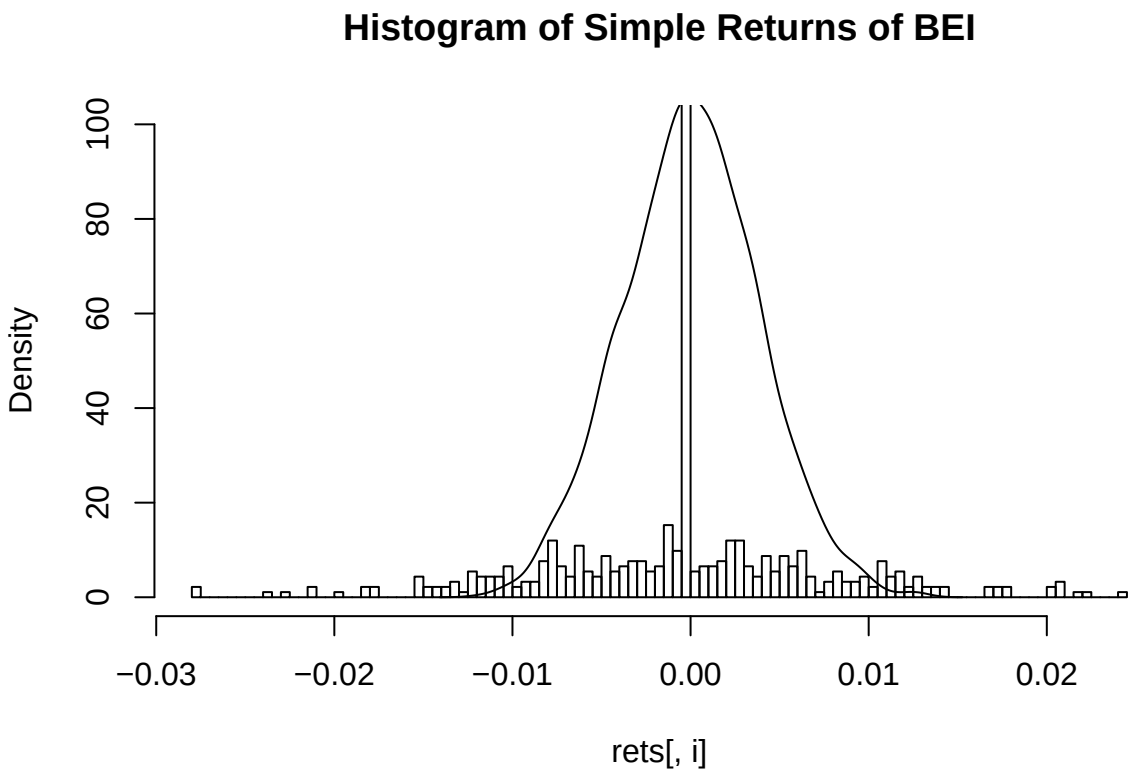

Returns of BAY
2011−07−26 / 2018−10−18
0.04
0.02
0.00
−0.02
−0.04
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018


Equity curve of BAY
2011−07−26 / 2018−10−18
1.20
1.15
1.10
1.05
1.00
0.95
Jul 26 2011
Jul 02 2012
Jul 01 2013
Jul 01 2014
Jul 01 2015
Jul 01 2016
Jul 03 2017
Jun 29 2018


Histogram of Simple Returns of BAY
Density
0
20
40
60
80
100
−0.04
−0.02
0.00
0.02
0.04
rets[, i]


Returns of BEI
2011−07−26 / 2018−10−18
0.02
0.01
0.00
−0.01
−0.02
Jul 26
2011
Jul 02
2012
Jul 01
2013
Jul 01
2014
Jul 01
2015
Jul 01
2016
Jul 03
2017
Jun 29
2018


Equity curve of BEI
2011−07−26 / 2018−10−18
1.05
1.00
0.95
0.90
0.85
Jul 26 2011
Jul 02 2012
Jul 01 2013
Jul 01 2014
Jul 01 2015
Jul 01 2016
Jul 03 2017
Jun 29 2018



Value at Risk

The historical "Value at Risk" measures the risk of loss for investments. More specifically, it describes the maximum amount we would expect to lose per day with a confidencelevel of 99%, given an investment of 10000.

```
## [1] "Investment: 10000"
```

```
## [1] "Confidence Level: 0.99"
```

```
## [1] "Given a 10000 investment in ADS we would expect a maximum loss of 252.72 per day."
## [1] "Given a 10000 investment in ALV we would expect a maximum loss of 184.52 per day."
## [1] "Given a 10000 investment in BAS we would expect a maximum loss of 174.31 per day."
## [1] "Given a 10000 investment in BAY we would expect a maximum loss of 250.61 per day."
## [1] "Given a 10000 investment in BEI we would expect a maximum loss of 141.68 per day."
```

Conclusion and Suggestions