

Assignment 1

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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 autocorrelation 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 immediately 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 reproducible setup. Moreover, the blotter library and the INF361Course library are loaded.

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

# Loading libraries
library(blotter)
library(INF361Course)
```

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 <- 6

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
addEMAStrng <- 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 Today's Close is below Yesterday's Low.
  if (CloseToday < LowYesterday) {
    # Smash Day (Buy)

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

      # BUY RULE: If today was a smash day place a STOP BUY order
      # at today's high price for the next day.
      # (Buy tomorrow for 'price >= today's 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 tomorrow's 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 chosen transactions are printed in the following. The plots for the first, third and the 5th last transaction 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)

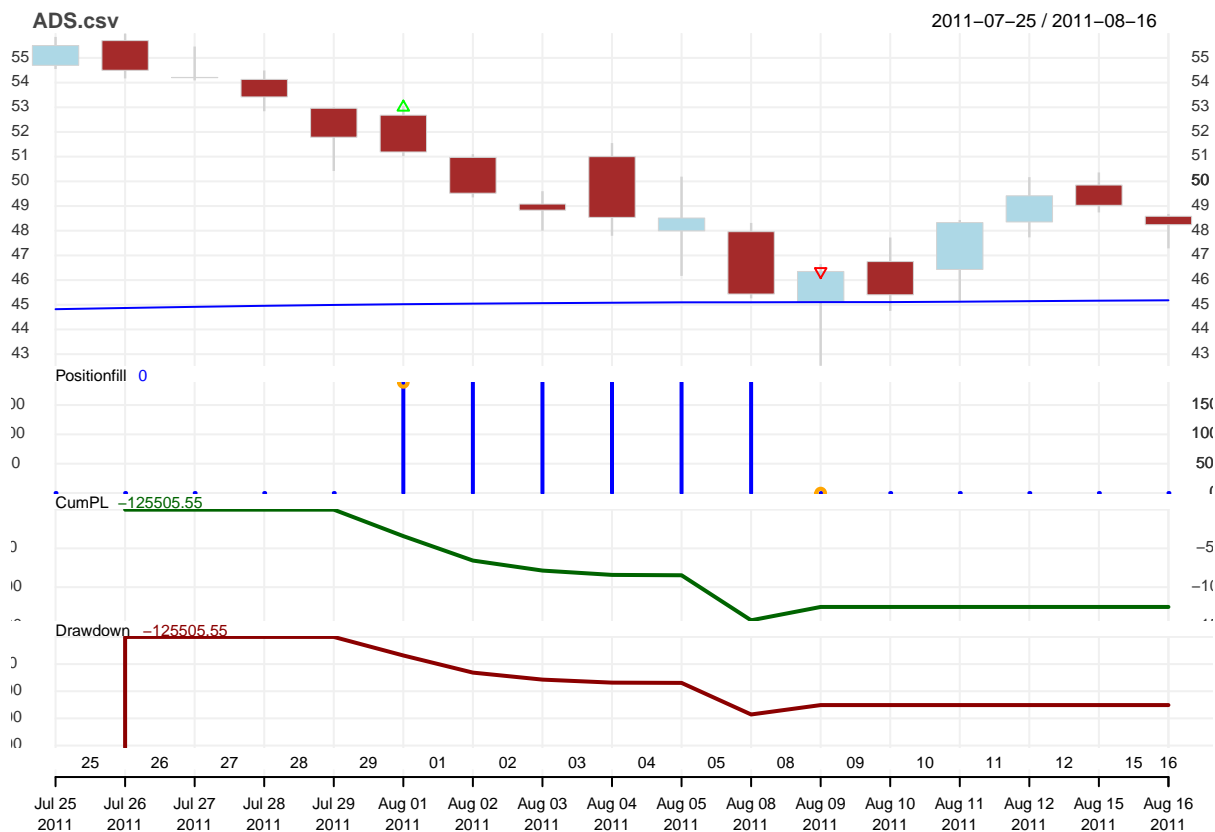
  # Create a list of transactions to check
  for (i in

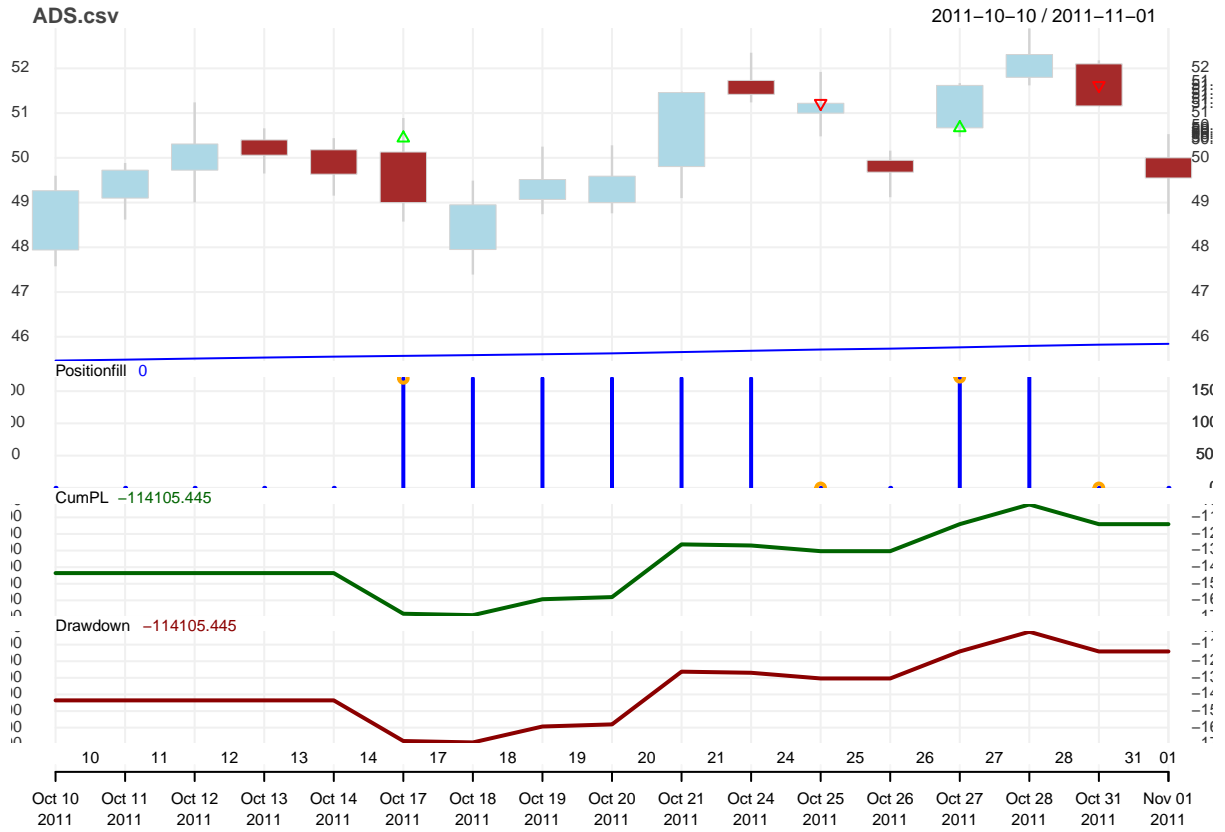
```

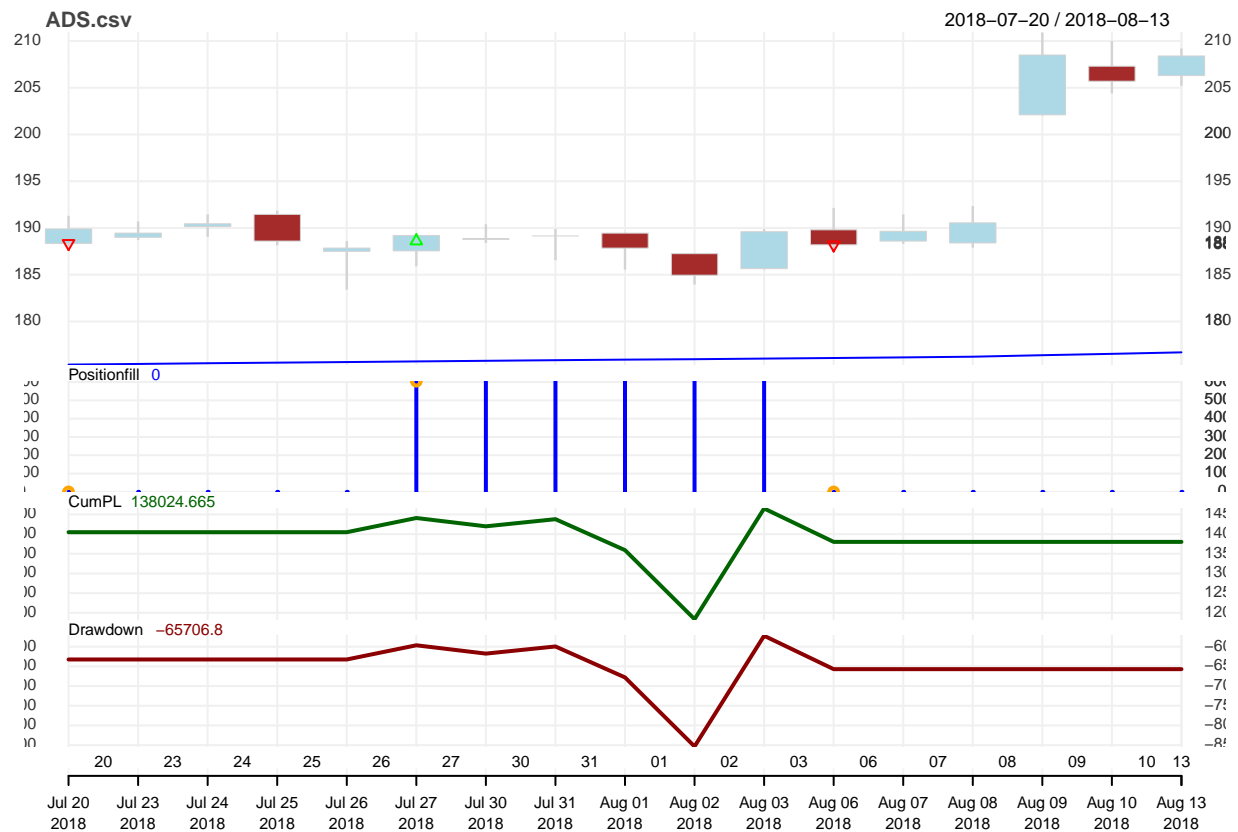
```

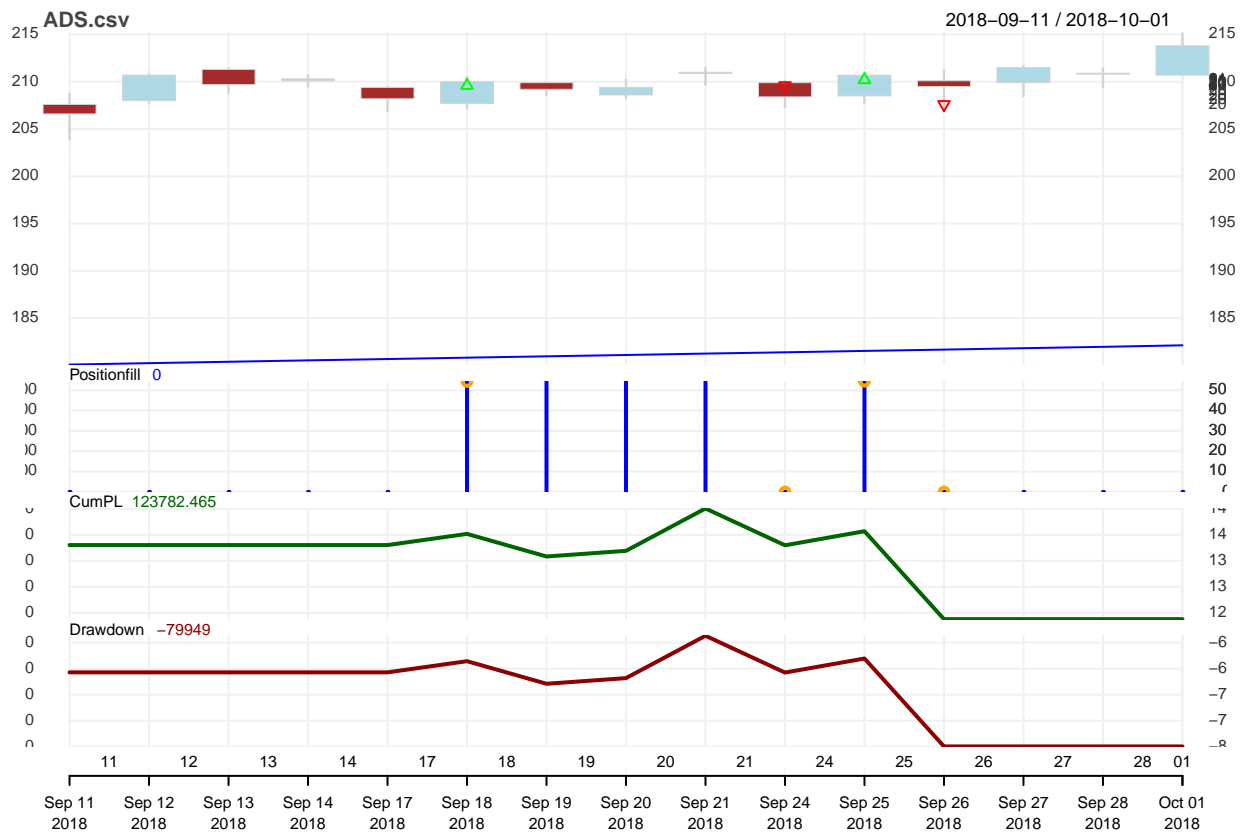
      c(2,6, (nrow(transactionsInstrument)-7),(nrow(transactionsInstrument)-5))) {
    from <- as.Date(index(transactionsInstrument[i,1]))-7
    to <- as.Date(index(transactionsInstrument[i+1,1]))+7
    daterange_check <- c(daterange_check, paste(from, ":", to, sep = ""))
  }
# Plot the transactions and check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

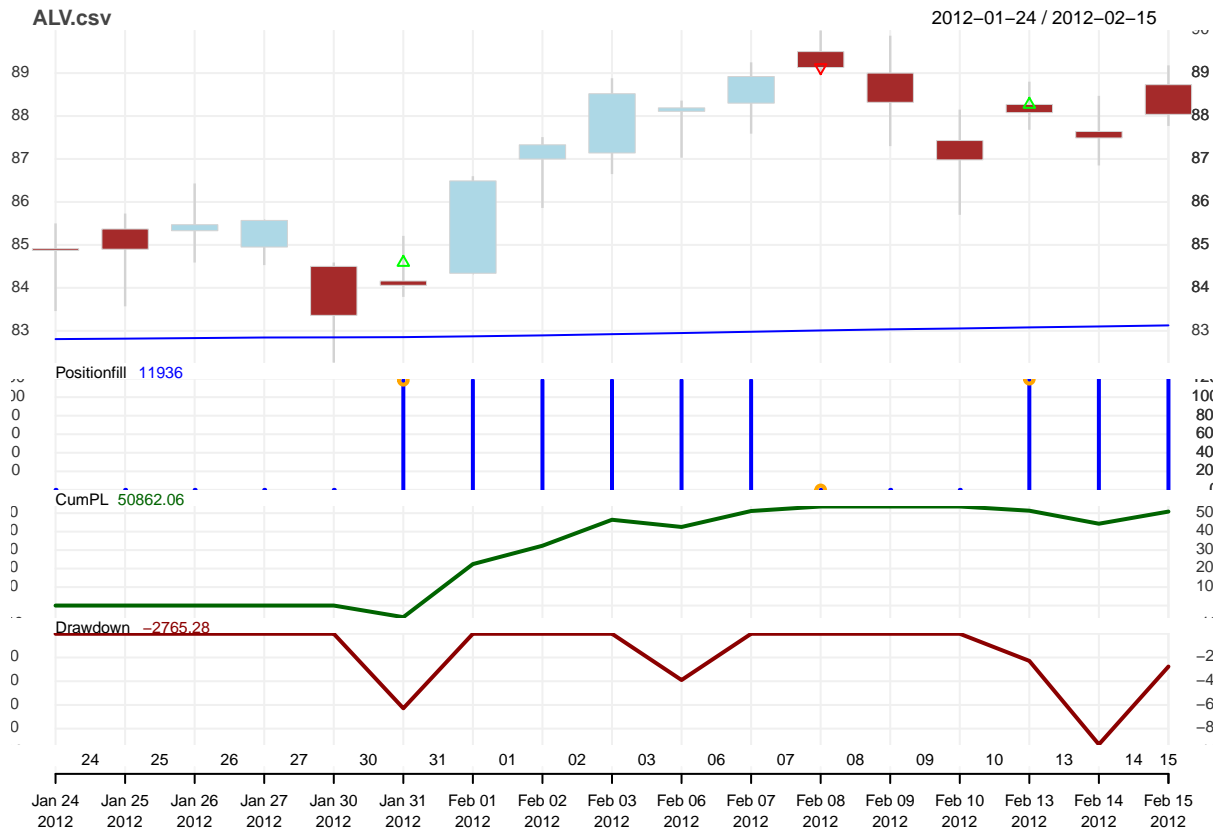
```

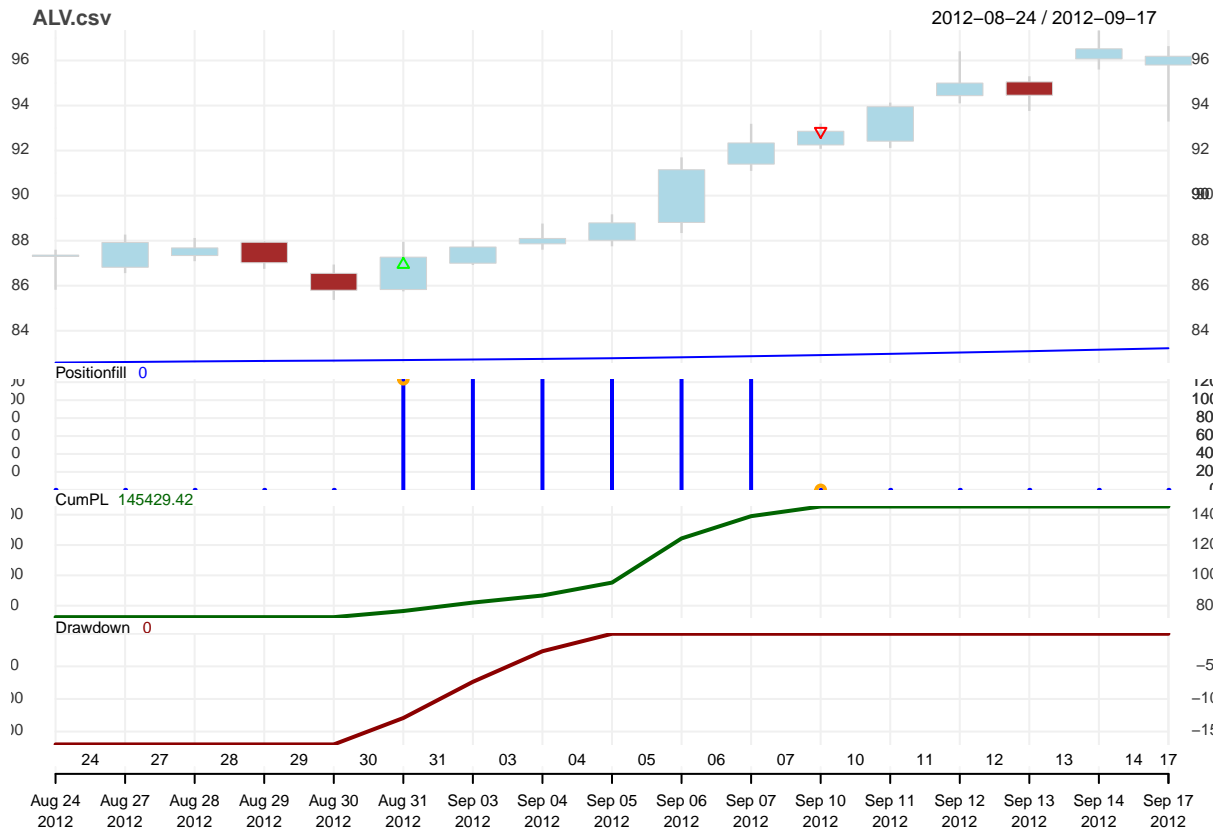




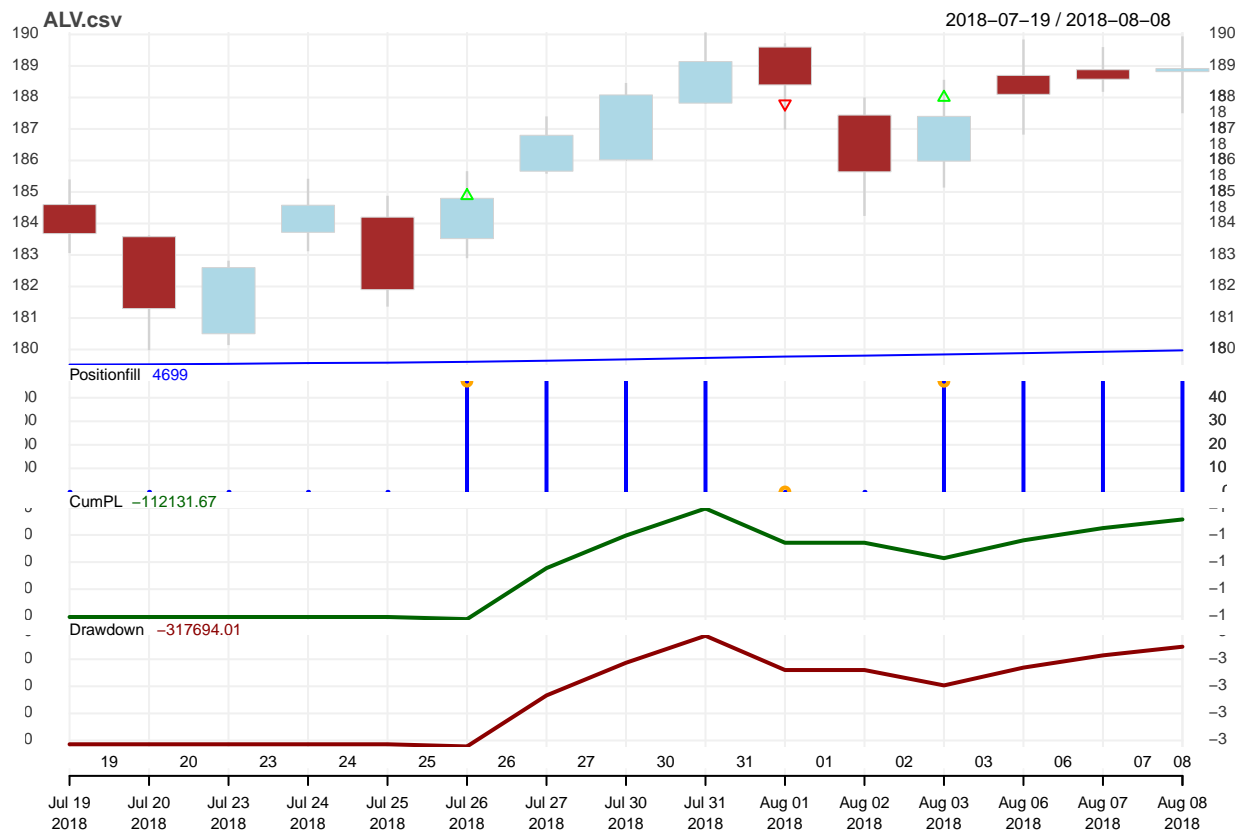


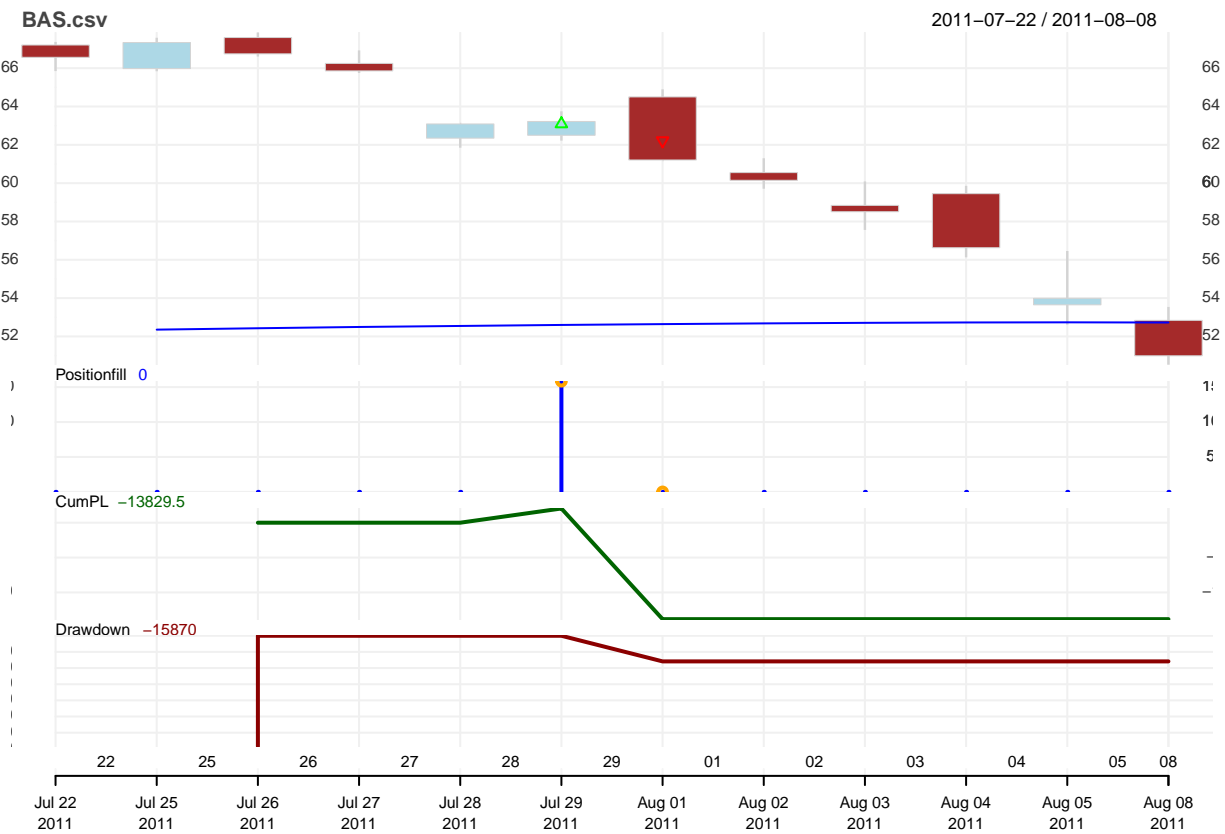


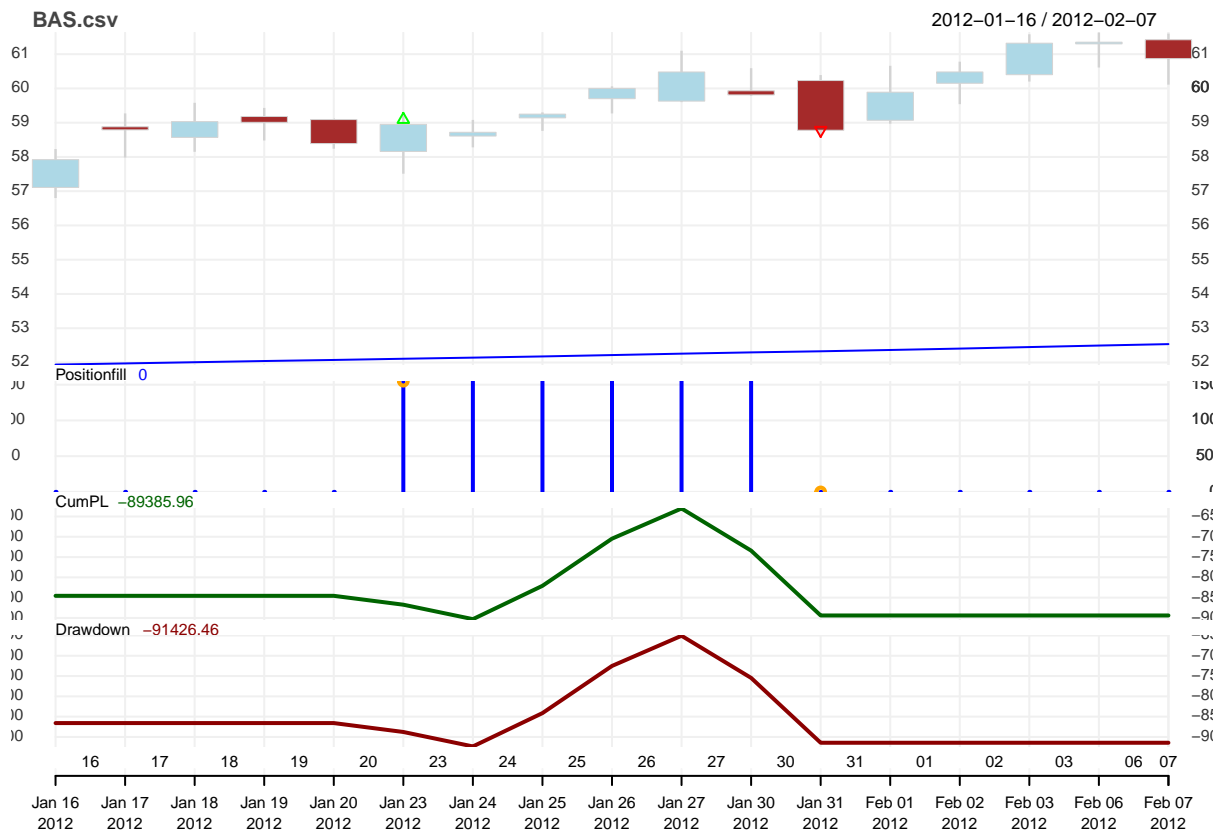


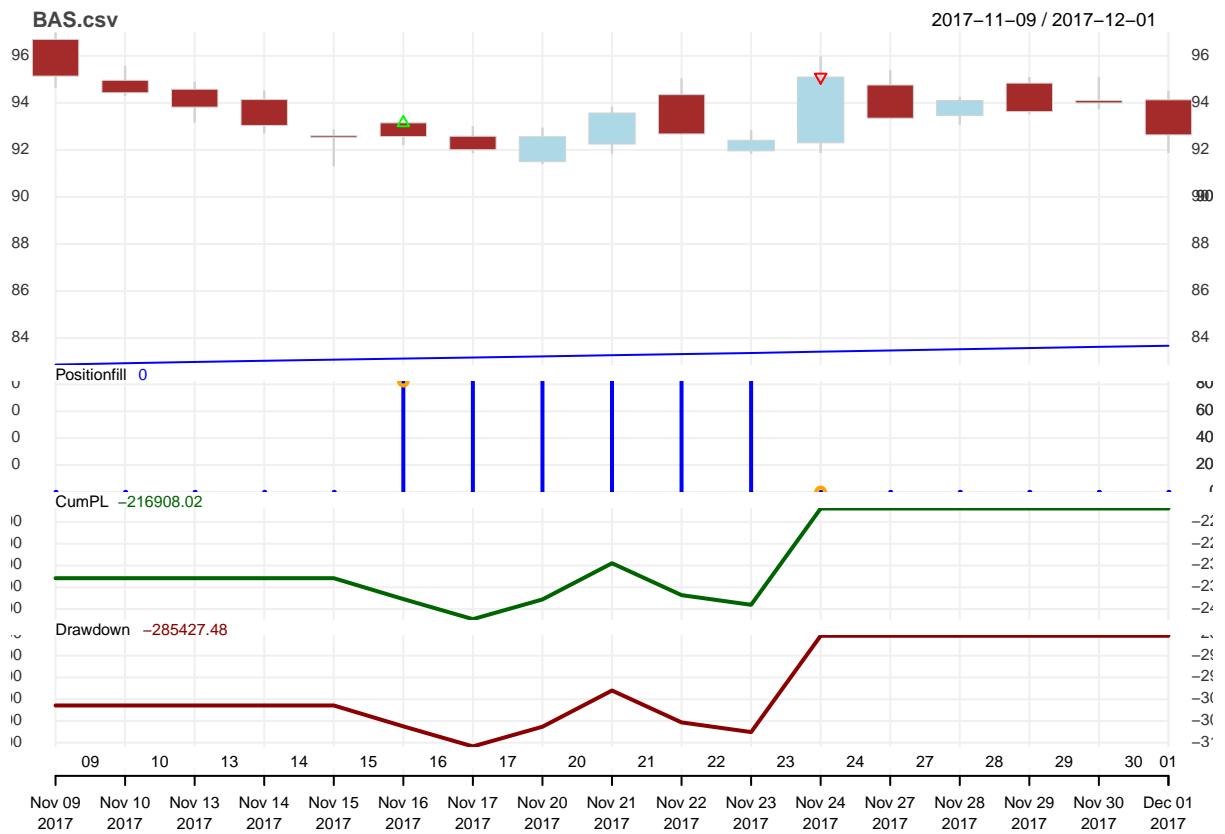


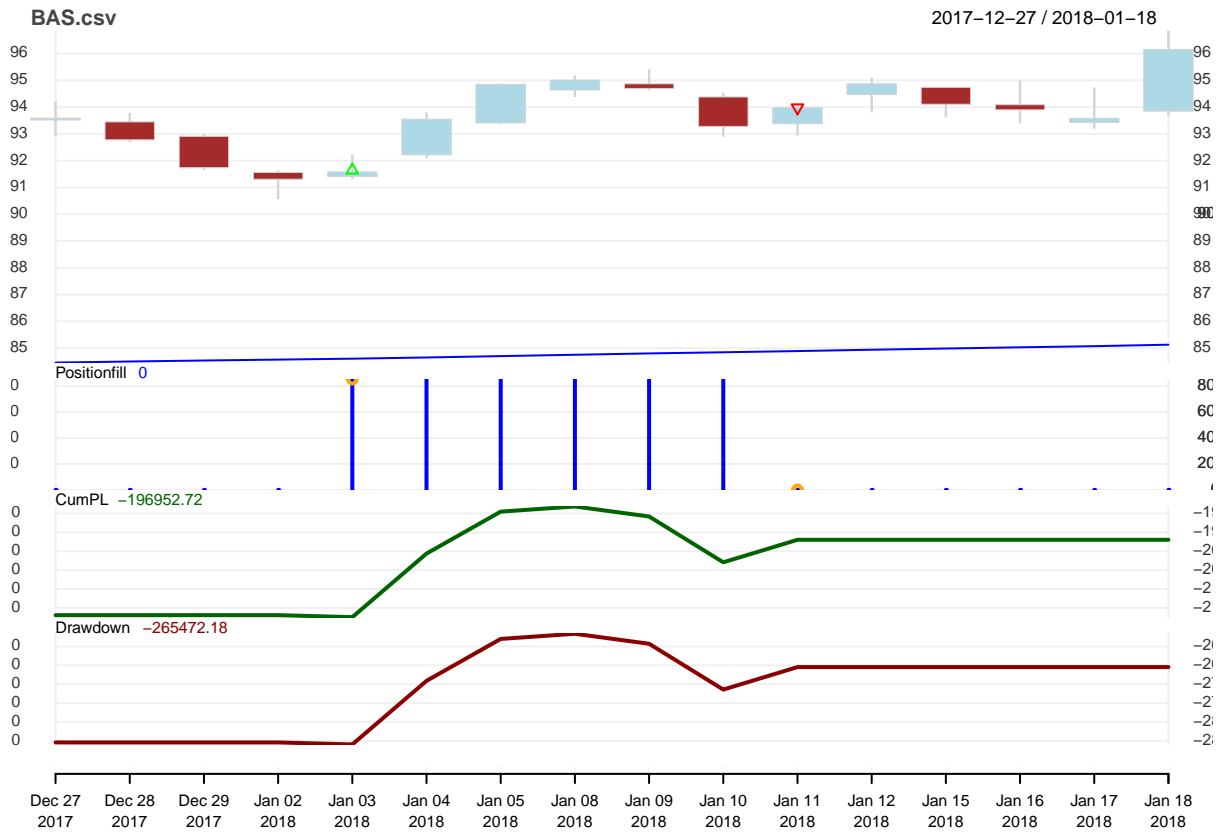


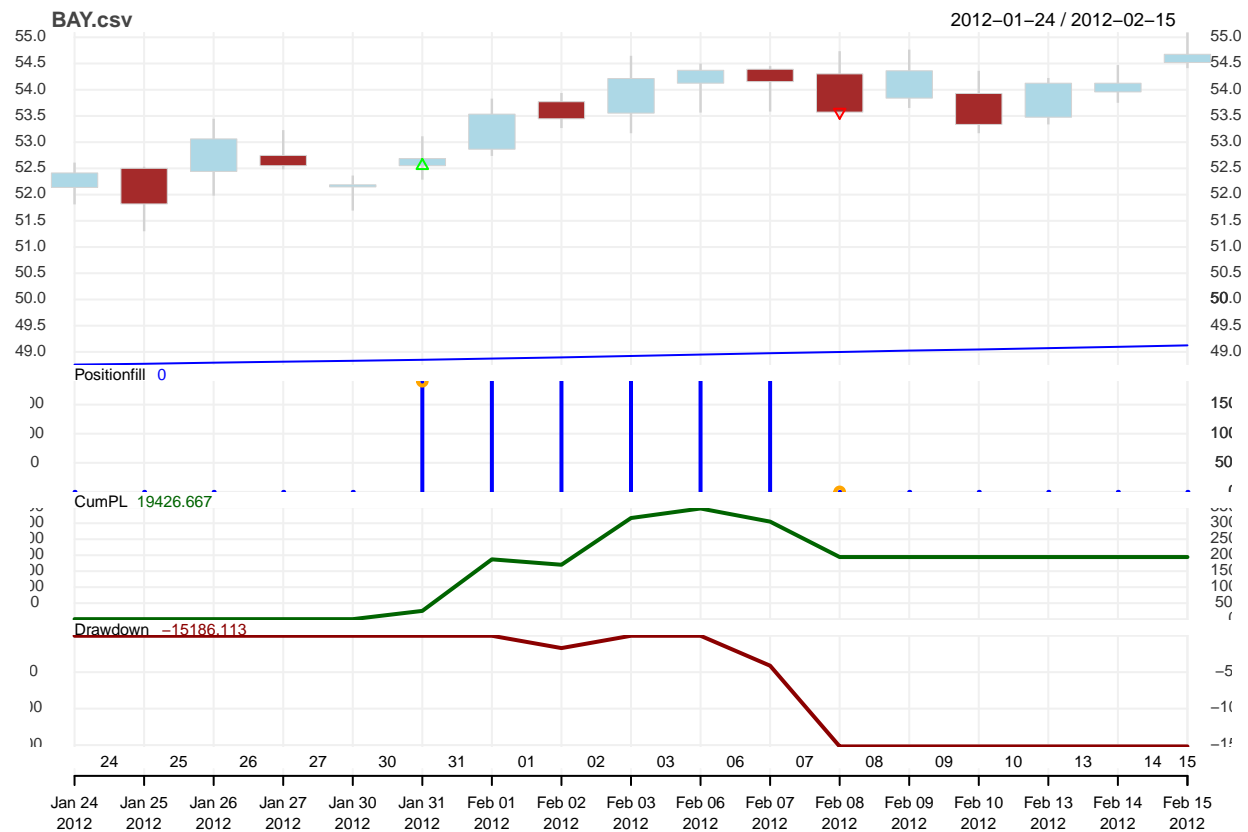


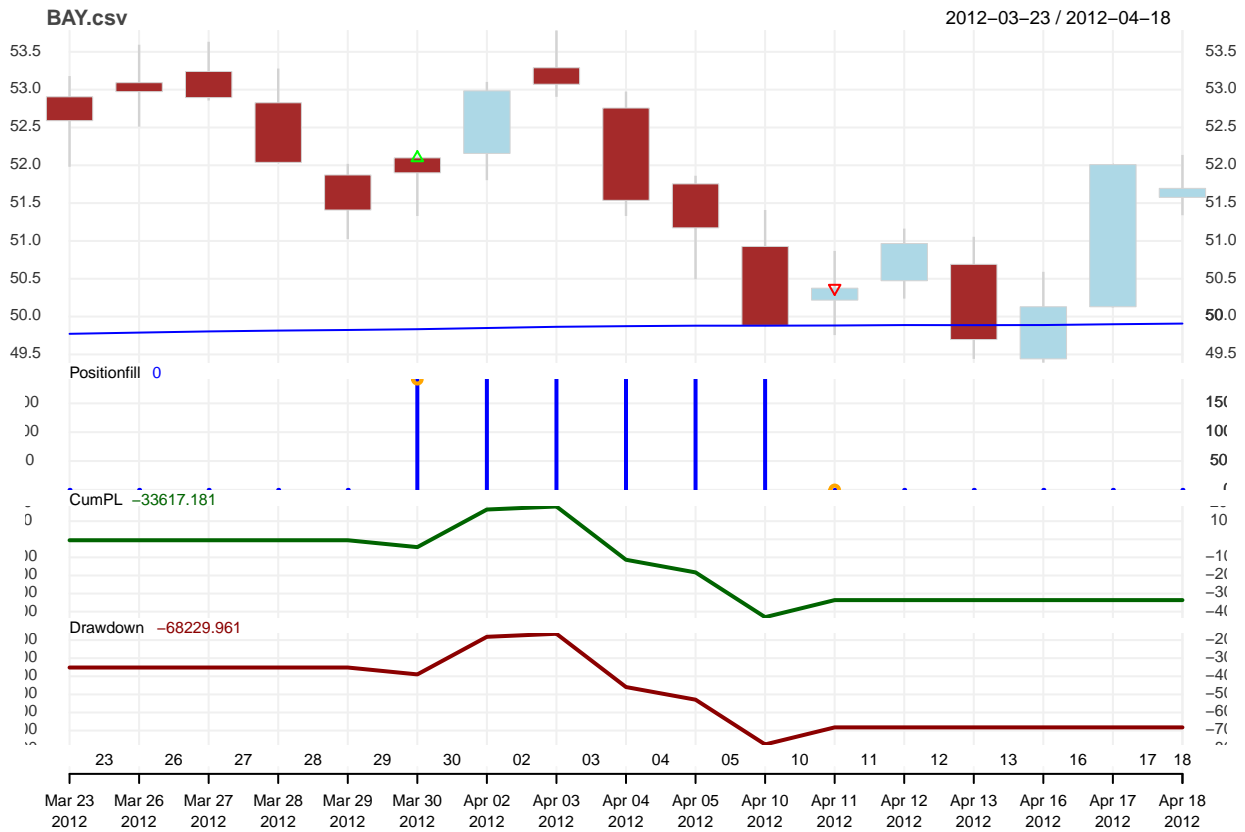


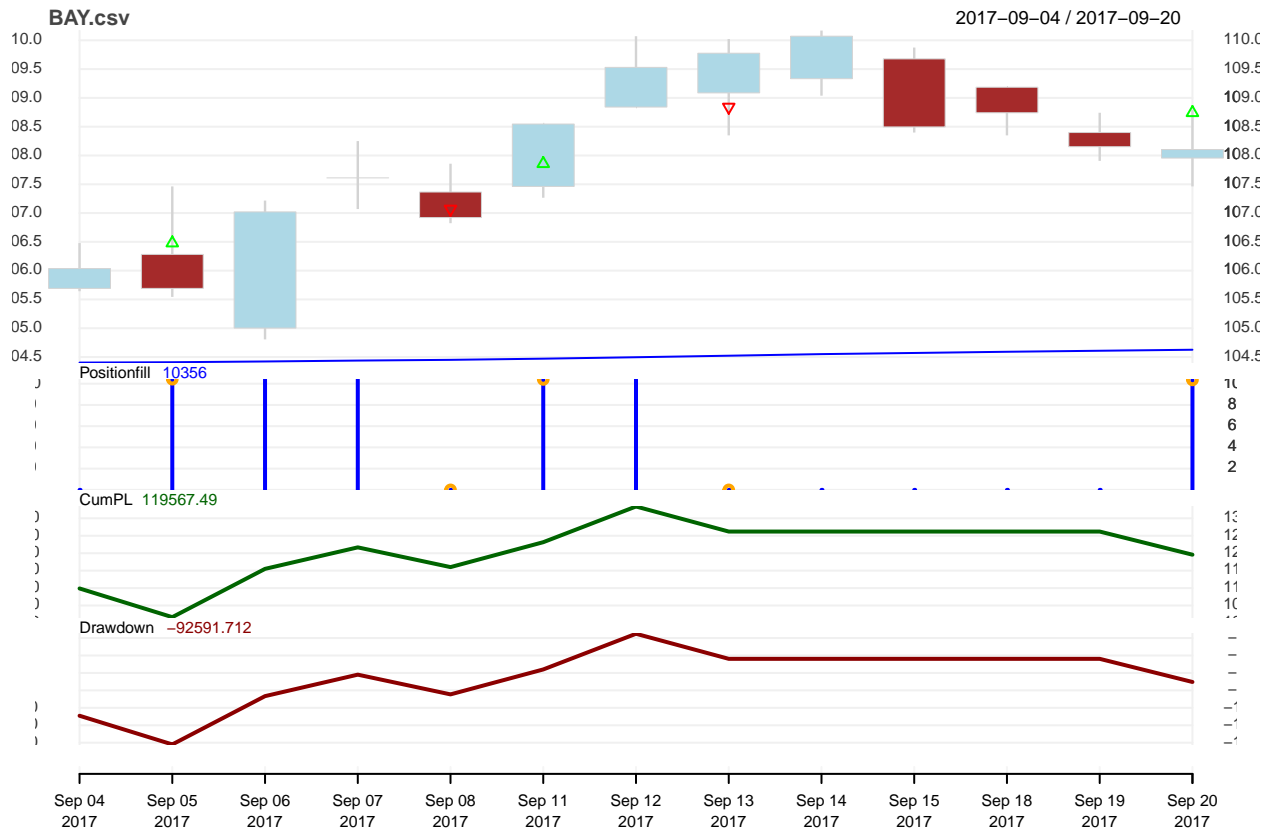


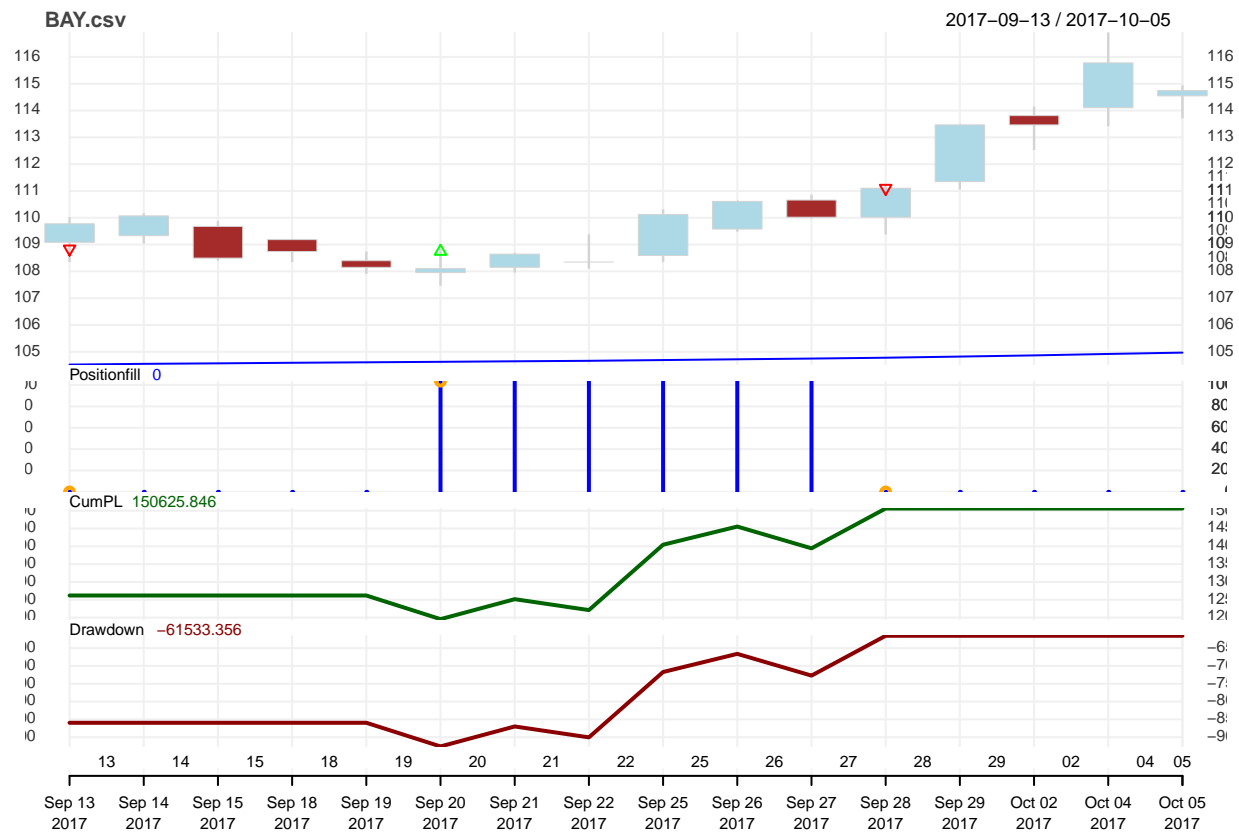


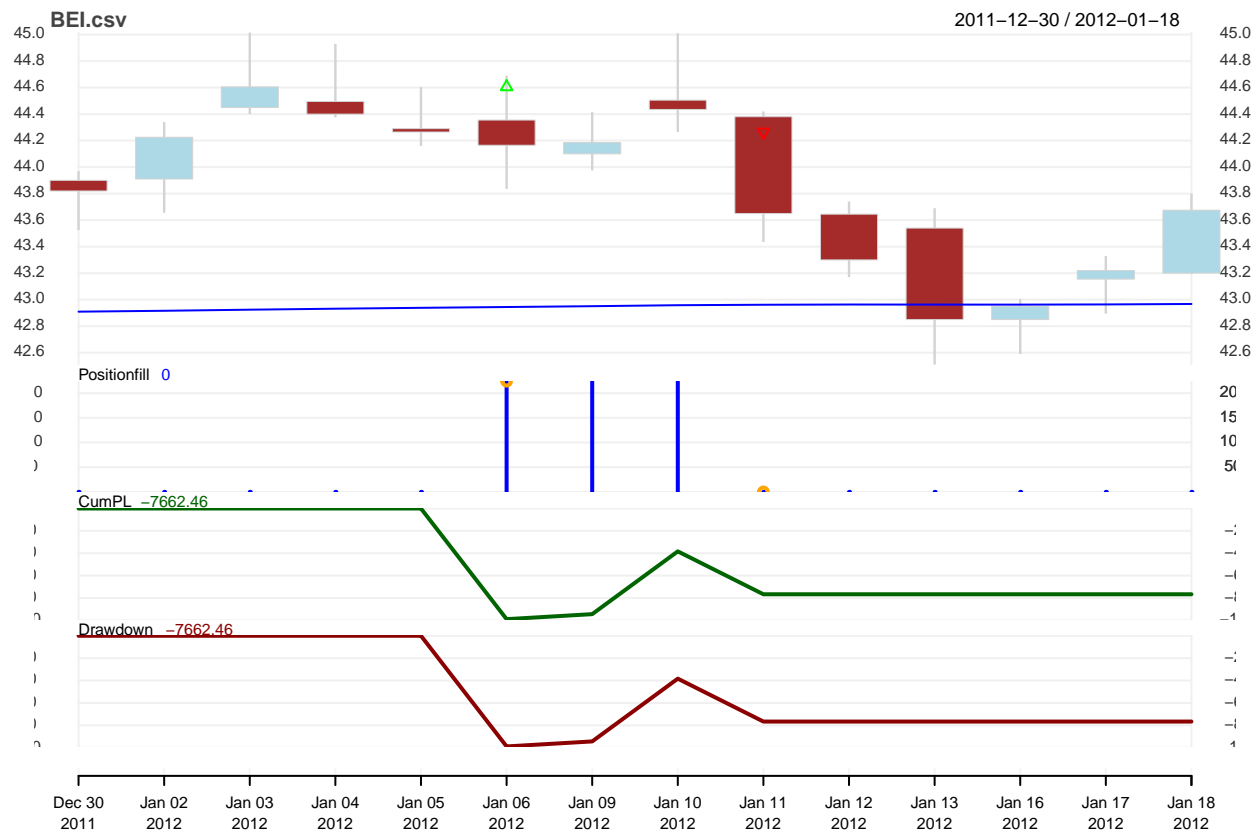


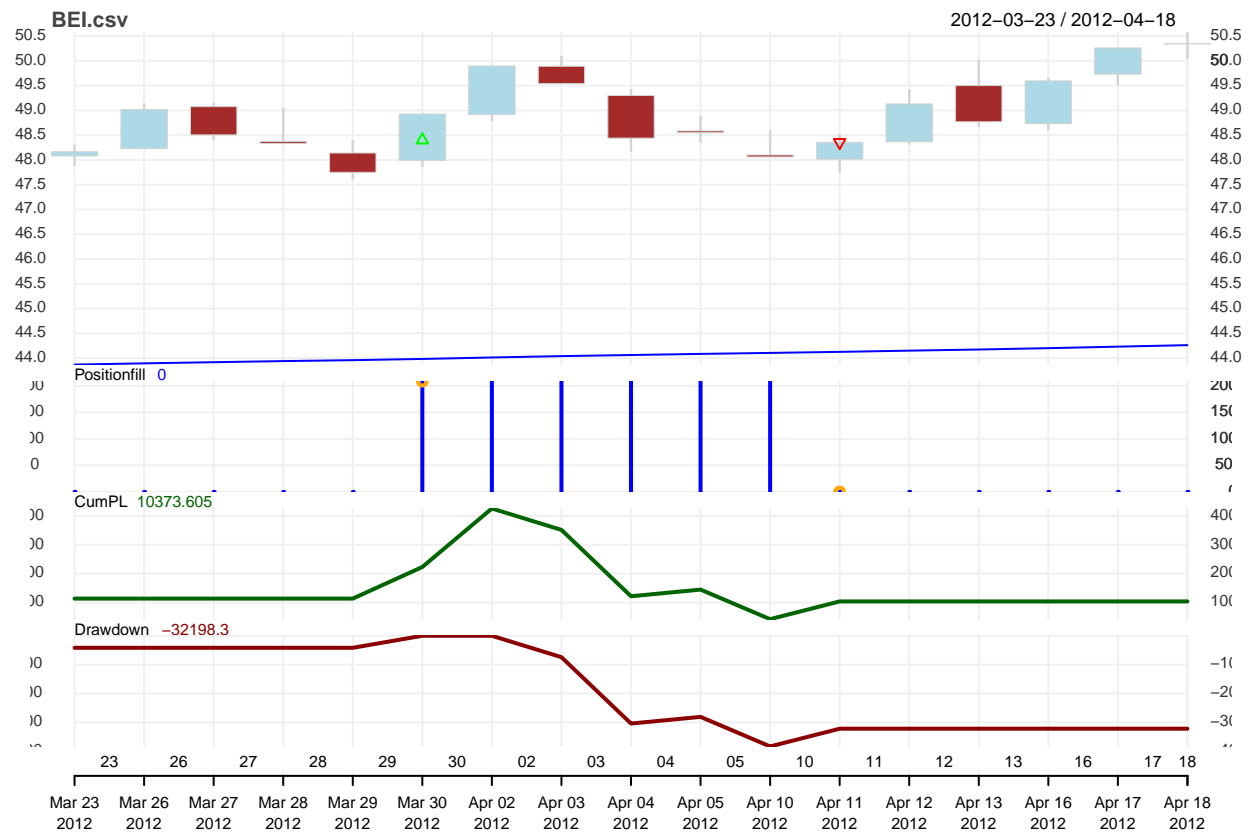


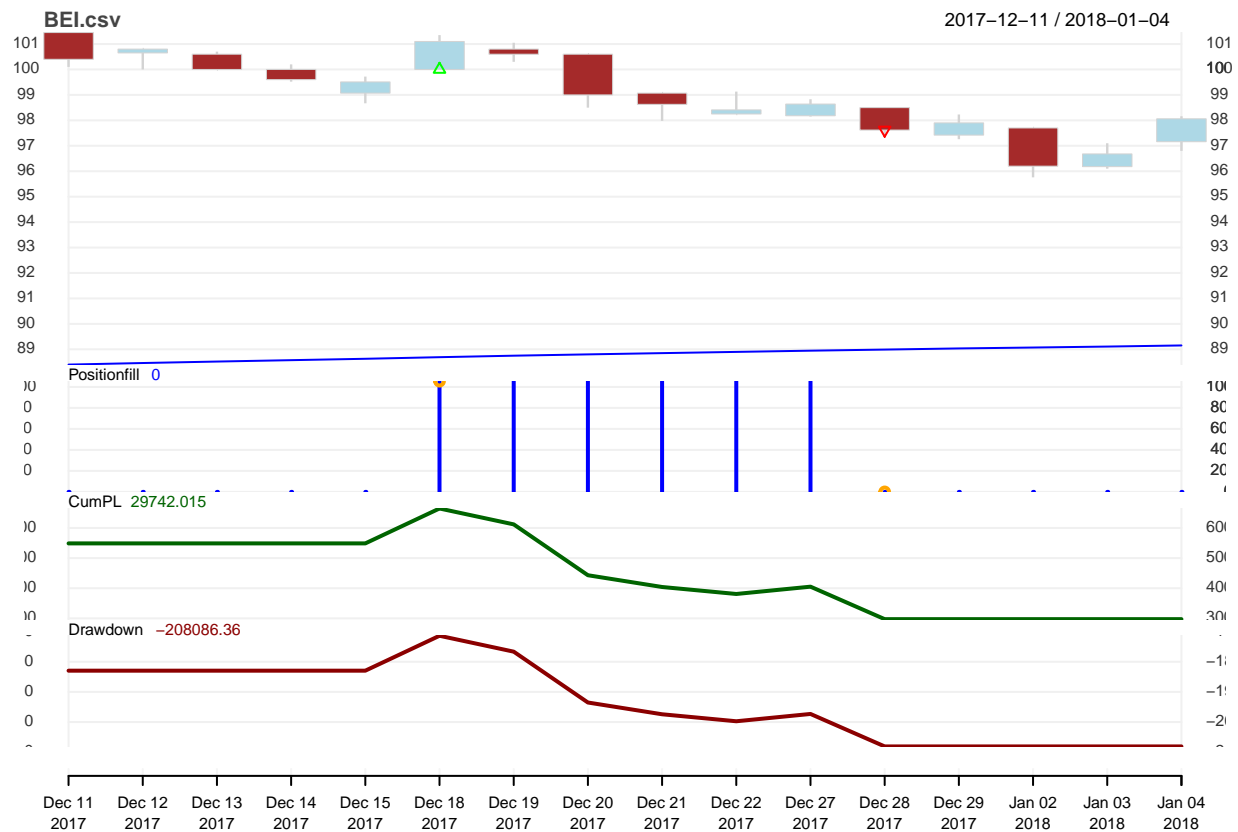


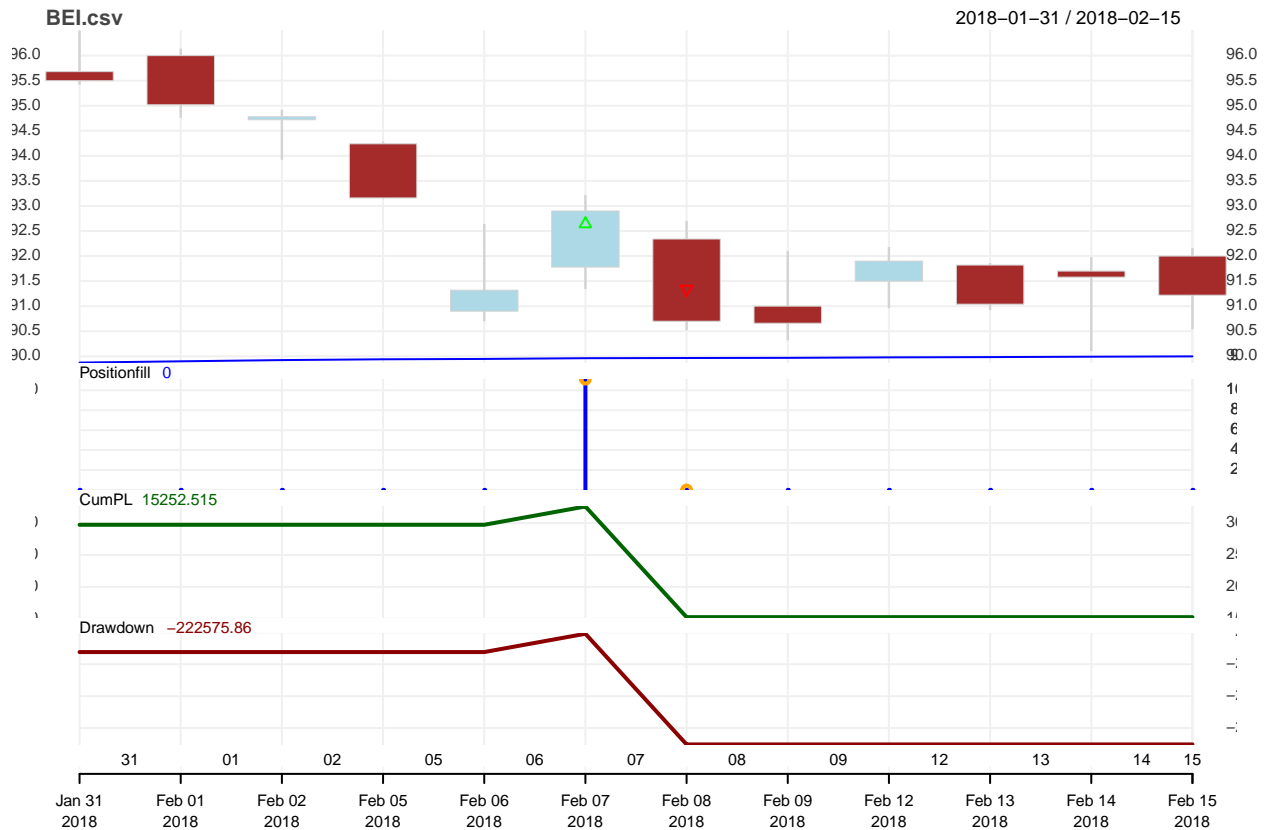












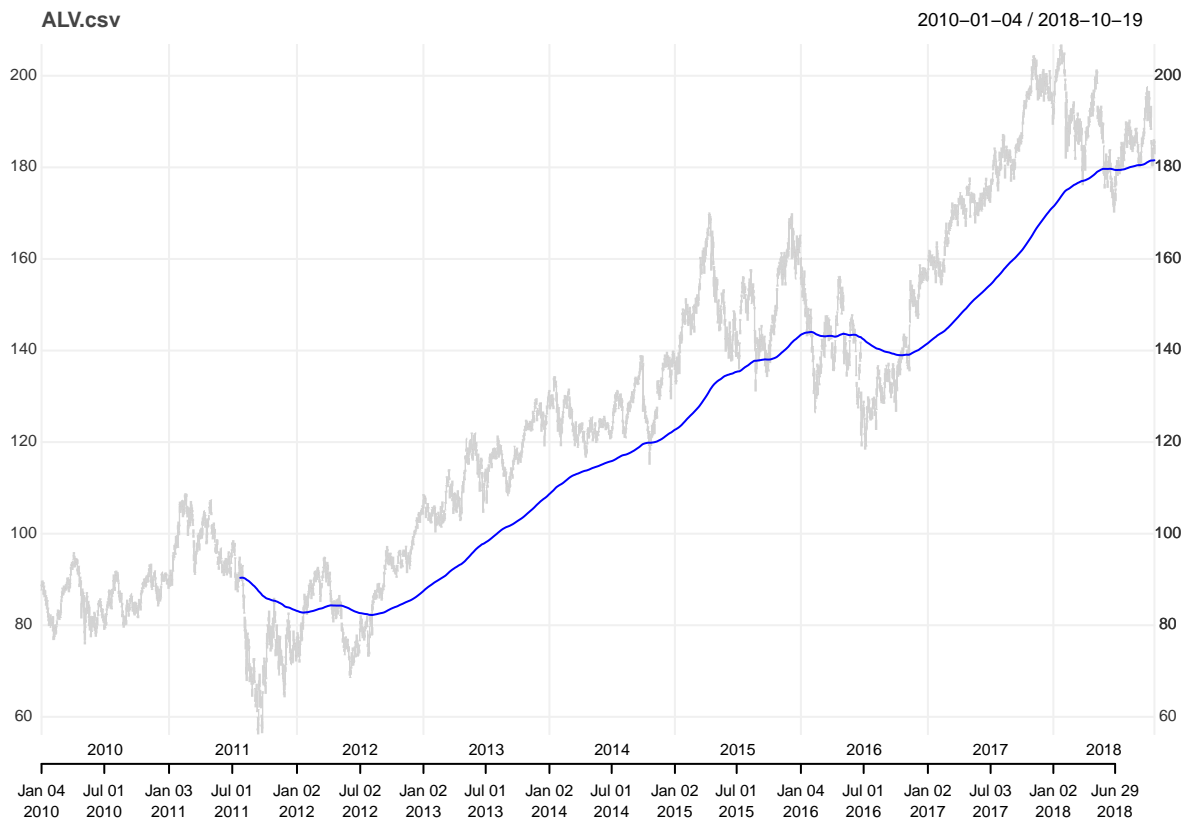
Part C: Analysis and Reporting

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

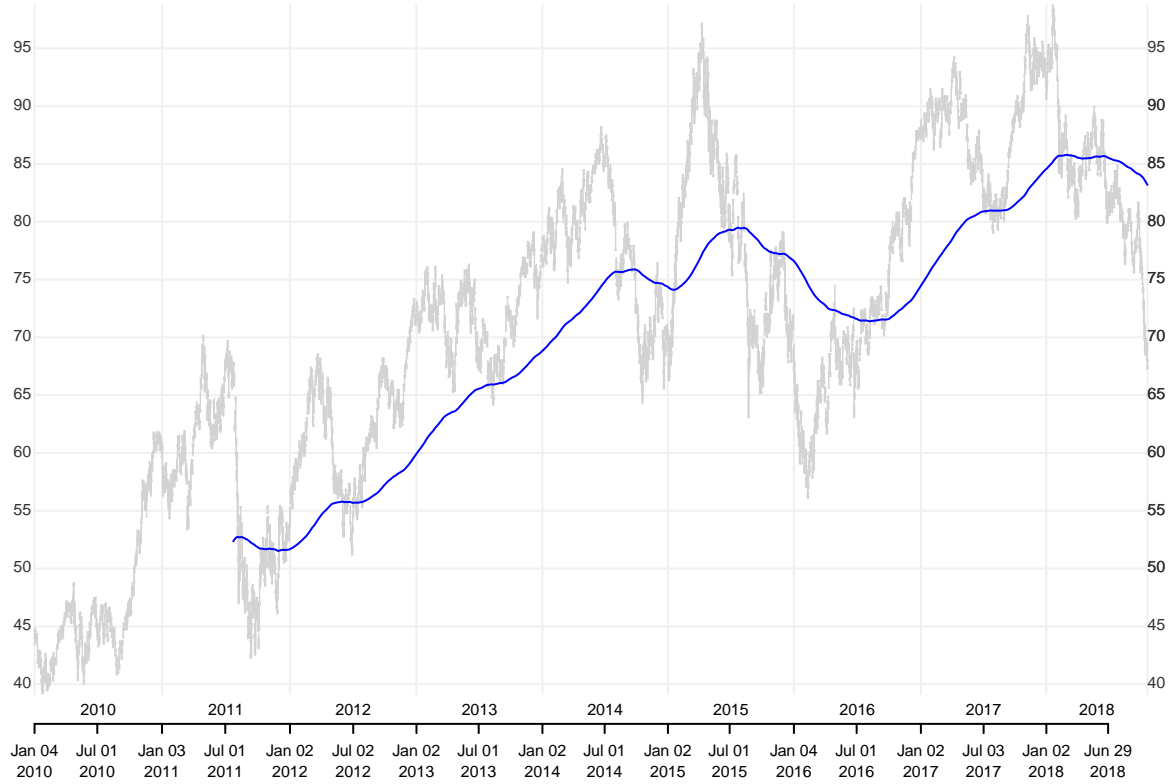
```
for (instrument in instrumentlist){
  chart <- get(instrument)
  print(chart_Series(x=chart,name=instrument,
    theme=myTheme,
    subset=daterange,
    TA="add_TA((chart$EMA), on=1,type='l',col='blue')"))
}
```



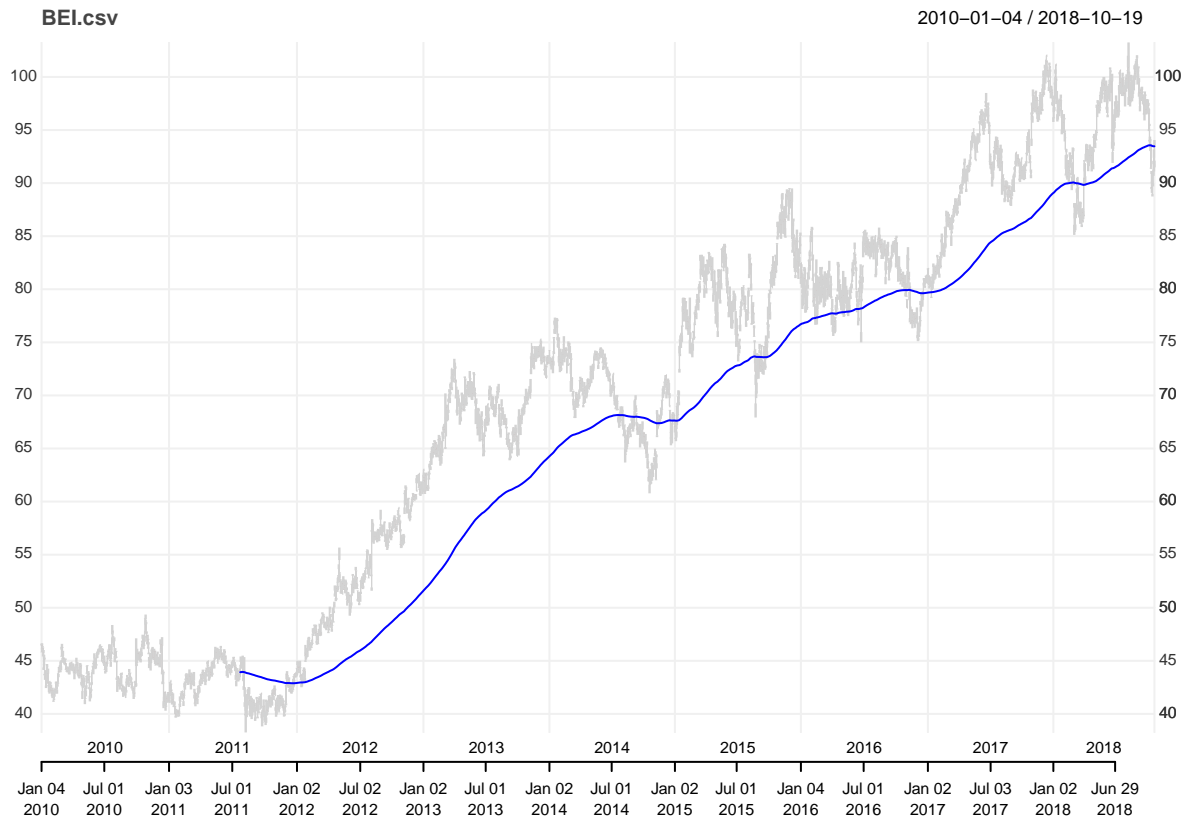


BAS.csv

2010-01-04 / 2018-10-19







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             0.00
## 2011-08-01  18867 53.000  999951.0            -20.00
## 2011-08-09 -18867 46.350 -874485.5        -125485.55
## 2011-09-20  17761 49.235  874462.8            -20.00
## 2011-09-28 -17761 48.220 -856435.4        -18047.42
## 2011-10-17  16979 50.440  856420.8            -20.00
## 2011-10-25 -16979 51.220 -869664.4         13223.62
## 2011-10-27  17162 50.670  869598.5            -20.00
## 2011-10-31 -17162 51.620 -885902.4         16283.90
## 2011-11-02  17532 50.530  885892.0            -20.00
## 2011-11-03 -17532 49.665 -870726.8        -15185.18
```


## 2011-11-08	17089	50.950	870684.6	-20.00
## 2011-11-09	-17089	50.300	-859576.7	-11127.85
## 2011-11-24	17450	49.255	859499.8	-20.00
## 2011-11-29	-17450	49.100	-856795.0	-2724.75
## 2012-01-31	15321	55.920	856750.3	-20.00
## 2012-02-07	-15321	57.710	-884174.9	27404.59
## 2012-02-28	15096	58.570	884172.7	-20.00
## 2012-03-07	-15096	56.000	-845376.0	-38816.72
## 2012-05-07	13399	63.090	845342.9	-20.00
## 2012-05-11	-13399	60.560	-811443.4	-33919.47
## 2012-05-21	13482	60.180	811346.8	-20.00
## 2012-05-23	-13482	60.410	-814447.6	3080.86
## 2012-06-13	14015	58.110	814411.7	-20.00
## 2012-06-21	-14015	57.930	-811888.9	-2542.70
## 2012-07-13	14243	57.000	811851.0	-20.00
## 2012-07-18	-14243	57.600	-820396.8	8525.80
## 2012-08-31	13179	62.250	820392.8	-20.00
## 2012-09-10	-13179	64.100	-844773.9	24361.15
## 2012-09-12	13242	63.790	844707.2	-20.00
## 2012-09-20	-13242	65.590	-868542.8	23815.60
## 2012-10-01	13432	64.660	868513.1	-20.00
## 2012-10-09	-13432	65.960	-885974.7	17441.60
## 2012-11-01	13284	66.690	885910.0	-20.00
## 2012-11-05	-13284	66.090	-877939.6	-7990.40
## 2012-11-19	13819	63.530	877921.1	-20.00
## 2012-11-27	-13819	66.480	-918687.1	40746.05
## 2012-12-21	13622	67.440	918667.7	-20.00
## 2013-01-07	-13622	66.280	-902866.2	-15821.52
## 2013-02-01	13041	69.230	902828.4	-20.00
## 2013-02-04	-13041	68.500	-893308.5	-9539.93
## 2013-02-25	12554	71.150	893217.1	-20.00
## 2013-03-05	-12554	71.640	-899368.6	6131.46
## 2013-03-22	11358	79.180	899326.4	-20.00
## 2013-03-27	-11358	81.500	-925677.0	26330.56
## 2013-04-02	11330	81.700	925661.0	-20.00
## 2013-04-10	-11330	77.940	-883060.2	-42620.80
## 2013-04-17	11365	77.700	883060.5	-20.00
## 2013-04-25	-11365	79.570	-904313.0	21232.55
## 2013-05-10	10767	83.980	904212.7	-20.00
## 2013-05-20	-10767	86.580	-932206.9	27974.20
## 2013-06-25	11822	78.850	932164.7	-20.00
## 2013-06-28	-11822	82.200	-971768.4	39583.70
## 2013-07-04	11756	82.660	971751.0	-20.00
## 2013-07-05	-11756	82.530	-970222.7	-1548.28
## 2013-08-01	11388	85.190	970143.7	-20.00
## 2013-08-09	-11388	83.970	-956250.4	-13913.36
## 2013-09-02	11772	81.230	956239.6	-20.00
## 2013-09-03	-11772	81.100	-954709.2	-1550.36
## 2013-09-16	11823	80.750	954707.2	-20.00
## 2013-09-20	-11823	78.000	-922194.0	-32533.25
## 2013-09-23	12102	80.670	976268.3	-20.00
## 2013-10-01	-12102	80.460	-973726.9	-2561.42
## 2013-10-10	11451	80.300	919515.3	-20.00
## 2013-10-16	-11451	81.500	-933256.5	13721.20

## 2013-11-27	10444	89.360	933275.8	-20.00
## 2013-12-05	-10444	87.770	-916669.9	-16625.96
## 2013-12-10	10386	88.250	916564.5	-20.00
## 2013-12-18	-10386	86.900	-902543.4	-14041.10
## 2014-01-14	9988	90.360	902515.7	-20.00
## 2014-01-16	-9988	90.350	-902415.8	-119.88
## 2014-01-17	9959	90.900	905273.1	-20.00
## 2014-01-23	-9959	91.900	-915232.1	9939.00
## 2014-02-21	10709	85.190	912299.7	-20.00
## 2014-03-03	-10709	81.070	-868178.6	-44141.08
## 2014-03-07	10729	80.920	868190.7	-20.00
## 2014-03-14	-10729	75.380	-808752.0	-59458.66
## 2015-03-16	11277	71.710	808673.7	-20.00
## 2015-03-24	-11277	71.160	-802471.3	-6222.35
## 2015-04-15	10461	76.710	802463.3	-20.00
## 2015-04-22	-10461	74.770	-782169.0	-20314.34
## 2015-04-24	10457	74.790	782079.0	-20.00
## 2015-05-05	-10457	73.880	-772563.2	-9535.87
## 2015-05-26	10192	75.800	772553.6	-20.00
## 2015-06-03	-10192	72.090	-734741.3	-37832.32
## 2015-07-28	10300	71.330	734699.0	-20.00
## 2015-08-05	-10300	74.480	-767144.0	32425.00
## 2015-09-30	10715	71.590	767086.9	-20.00
## 2015-10-08	-10715	75.230	-806089.5	38982.60
## 2015-10-14	10664	75.590	806091.8	-20.00
## 2015-10-22	-10664	80.150	-854719.6	48607.84
## 2015-11-10	9716	87.960	854619.4	-20.00
## 2015-11-12	-9716	88.390	-858797.2	4157.88
## 2015-11-25	9579	89.650	858757.4	-20.00
## 2015-11-27	-9579	89.460	-856937.3	-1840.01
## 2015-12-29	9503	90.170	856885.5	-20.00
## 2016-01-08	-9503	83.450	-793025.3	-63880.16
## 2016-01-15	9276	85.490	793005.2	-20.00
## 2016-01-25	-9276	92.210	-855340.0	62314.72
## 2016-02-04	9026	94.760	855303.8	-20.00
## 2016-02-12	-9026	87.060	-785803.6	-69520.20
## 2016-02-25	8018	98.000	785764.0	-20.00
## 2016-03-02	-8018	98.370	-788730.7	2946.66
## 2016-03-09	8167	96.570	788687.2	-20.00
## 2016-03-17	-8167	101.500	-828950.5	40243.31
## 2016-04-04	8056	102.900	828962.4	-20.00
## 2016-04-12	-8056	103.100	-830573.6	1591.20
## 2016-05-12	7228	114.900	830497.2	-20.00
## 2016-05-23	-7228	114.050	-824353.4	-6163.80
## 2016-06-01	7094	116.200	824322.8	-20.00
## 2016-06-09	-7094	119.400	-847023.6	22680.80
## 2016-06-27	7008	120.850	846916.8	-20.00
## 2016-07-05	-7008	125.550	-879854.4	32917.60
## 2016-08-26	5736	153.400	879902.4	-20.00
## 2016-08-29	-5736	152.150	-872732.4	-7190.00
## 2016-09-05	5961	146.400	872690.4	-20.00
## 2016-09-08	-5961	147.000	-876267.0	3556.60
## 2016-09-12	5995	146.150	876169.2	-20.00
## 2016-09-20	-5995	151.300	-907043.5	30854.25

## 2016-09-28	5872	154.450	906930.4	-20.00
## 2016-10-07	-5872	155.150	-911040.8	4090.40
## 2016-10-14	5874	155.100	911057.4	-20.00
## 2016-10-20	-5874	157.550	-925448.7	14371.30
## 2016-11-07	6800	136.100	925480.0	-20.00
## 2016-11-10	-6800	131.000	-890800.0	-34700.00
## 2017-02-27	5691	156.500	890641.5	-20.00
## 2017-03-07	-5691	159.800	-909421.8	18760.30
## 2017-03-23	5057	179.850	909501.4	-20.00
## 2017-03-31	-5057	178.300	-901663.1	-7858.35
## 2017-04-20	5051	178.500	901603.5	-20.00
## 2017-04-28	-5051	183.900	-928878.9	27255.40
## 2017-05-04	5012	185.300	928723.6	-20.00
## 2017-05-05	-5012	183.050	-917446.6	-11297.00
## 2017-06-07	5372	170.800	917537.6	-20.00
## 2017-06-15	-5372	174.950	-939831.4	22273.80
## 2017-06-26	5546	169.450	939769.7	-20.00
## 2017-07-04	-5546	168.350	-933669.1	-6120.60
## 2017-07-20	5158	181.000	933598.0	-20.00
## 2017-07-28	-5158	192.550	-993172.9	59554.90
## 2017-08-30	5374	184.800	993115.2	-20.00
## 2017-09-04	-5374	189.450	-1018104.3	24969.10
## 2017-10-09	5237	194.400	1018072.8	-20.00
## 2017-10-17	-5237	191.300	-1001838.1	-16254.70
## 2017-12-04	5652	177.250	1001817.0	-20.00
## 2017-12-12	-5652	174.100	-984013.2	-17823.80
## 2018-01-12	5833	168.700	984027.1	-20.00
## 2018-01-22	-5833	182.800	-1066272.4	82225.30
## 2018-02-07	5993	177.900	1066154.7	-20.00
## 2018-02-15	-5993	177.300	-1062558.9	-3615.80
## 2018-03-14	5809	182.900	1062466.1	-20.00
## 2018-03-19	-5809	192.800	-1119975.2	57489.10
## 2018-03-20	5794	194.600	1127512.4	-20.00
## 2018-03-28	-5794	192.950	-1117952.3	-9580.10
## 2018-04-10	5414	205.100	1110411.4	-20.00
## 2018-04-18	-5414	213.700	-1156971.8	46540.40
## 2018-05-30	5918	195.500	1156969.0	-20.00
## 2018-06-07	-5918	198.200	-1172947.6	15958.60
## 2018-06-14	5949	197.150	1172845.4	-20.00
## 2018-06-18	-5949	198.950	-1183553.6	10688.20
## 2018-06-21	6211	190.550	1183506.1	-20.00
## 2018-06-29	-6211	186.950	-1161146.4	-22379.60
## 2018-07-03	6244	185.950	1161071.8	-20.00
## 2018-07-11	-6244	182.450	-1139217.8	-21874.00
## 2018-07-18	6055	188.150	1139248.2	-20.00
## 2018-07-20	-6055	188.350	-1140459.2	1191.00
## 2018-07-27	6047	188.600	1140464.2	-20.00
## 2018-08-06	-6047	188.200	-1138045.4	-2438.80
## 2018-09-18	5429	209.600	1137918.4	-20.00
## 2018-09-24	-5429	209.600	-1137918.4	-20.00
## 2018-09-25	5447	210.200	1144959.4	-20.00
## 2018-09-26	-5447	207.600	-1130797.2	-14182.20
## 2018-10-12	5757	195.200	1123766.4	-20.00
## 2018-10-18	-5757	199.500	-1148521.5	24735.10

```

##
## [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
## 2012-02-08  -11821  89.13 -1053605.7    53647.34
## 2012-02-13   11936  88.27   1053590.7     -20.00
## 2012-02-21  -11936  89.85 -1072449.6    18838.88
## 2012-08-31   12335  86.94   1072404.9     -20.00
## 2012-09-10  -12335  92.86 -1145428.1    73003.20
## 2012-10-01   12189  93.97   1145400.3     -20.00
## 2012-10-09  -12189  91.50 -1115293.5   -30126.83
## 2012-10-25   11835  94.23   1115212.1     -20.00
## 2012-11-02  -11835  95.67 -1132254.4    17022.40
## 2012-11-12   12030  94.12   1132263.6     -20.00
## 2012-11-20  -12030  95.81 -1152594.3    20310.70
## 2013-01-02   10721 107.50   1152507.5     -20.00
## 2013-01-10  -10721 104.90 -1124632.9   -27894.60
## 2013-02-27   10840 103.75   1124650.0     -20.00
## 2013-03-01  -10840 103.55 -1122482.0    -2188.00
## 2013-03-19   10167 110.40   1122436.8     -20.00
## 2013-03-27  -10167 105.80 -1075668.6   -46788.20
## 2013-04-09   10128 106.20   1075593.6     -20.00
## 2013-04-17  -10128 104.30 -1056350.4   -19263.20
## 2013-05-09   8990 117.50   1056325.0     -20.00
## 2013-05-17  -8990 119.60 -1075204.0    18859.00
## 2013-05-30   8960 120.00   1075200.0     -20.00
## 2013-06-07  -8960 116.90 -1047424.0   -27796.00
## 2013-07-04   9470 110.60   1047382.0     -20.00
## 2013-07-05  -9470 110.25 -1044067.5   -3334.50
## 2013-09-02   9456 110.40   1043942.4     -20.00
## 2013-09-10  -9456 113.90 -1077038.4    33076.00
## 2013-10-01   9225 116.75   1077018.8     -20.00
## 2013-10-02  -9225 116.05 -1070561.2   -6477.50
## 2013-11-08   8595 124.55   1070507.2     -20.00
## 2013-11-18  -8595 127.55 -1096292.2    25765.00
## 2013-11-22   8612 127.30   1096307.6     -20.00
## 2013-12-02  -8612 127.80 -1100613.6    4286.00
## 2013-12-13   9021 122.00   1100562.0     -20.00
## 2013-12-23  -9021 129.65 -1169572.7    68990.65
## 2014-01-10   9003 129.90   1169489.7     -20.00
## 2014-01-20  -9003 132.75 -1195148.2    25638.55
## 2014-01-28   9550 125.15   1195182.5     -20.00
## 2014-01-29  -9550 124.50 -1188975.0   -6227.50
## 2014-02-19   9156 129.85   1188906.6     -20.00
## 2014-02-27  -9156 128.00 -1171968.0   -16958.60
## 2014-03-04   9217 127.15   1171941.6     -20.00
## 2014-03-12  -9217 121.90 -1123552.3   -48409.25
## 2014-03-25   9293 120.90   1123523.7     -20.00
## 2014-04-02  -9293 123.15 -1144432.9    20889.25
## 2014-04-04   9210 124.25   1144342.5     -20.00
## 2014-04-14  -9210 119.30 -1098753.0   -45609.50
## 2014-06-05   8825 124.50   1098712.5     -20.00
## 2014-06-11  -8825 124.85 -1101801.2    3068.75

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## 2014-07-29	8518	129.35	1101803.3	-20.00
## 2014-08-06	-8518	121.75	-1037066.5	-64756.80
## 2014-08-21	8117	127.75	1036946.8	-20.00
## 2014-08-29	-8117	129.80	-1053586.6	16619.85
## 2015-03-27	6528	161.40	1053619.2	-20.00
## 2015-04-08	-6528	165.35	-1079404.8	25765.60
## 2015-05-06	6986	154.50	1079337.0	-20.00
## 2015-05-14	-6986	148.35	-1036373.1	-42983.90
## 2015-06-10	7319	141.60	1036370.4	-20.00
## 2015-06-12	-7319	142.00	-1039298.0	2907.60
## 2015-08-10	6715	154.75	1039146.2	-20.00
## 2015-08-11	-6715	154.30	-1036124.5	-3041.75
## 2015-08-13	6750	153.50	1036125.0	-20.00
## 2015-08-21	-6750	139.90	-944325.0	-91820.00
## 2015-09-02	6704	140.85	944258.4	-20.00
## 2015-09-04	-6704	141.50	-948616.0	4337.60
## 2015-10-15	6511	145.70	948652.7	-20.00
## 2015-10-20	-6511	147.75	-962000.2	13327.55
## 2015-12-21	5856	164.25	961848.0	-20.00
## 2015-12-28	-5856	161.35	-944865.6	-17002.40
## 2016-01-08	6098	154.95	944885.1	-20.00
## 2016-01-18	-6098	148.10	-903113.8	-41791.30
## 2016-01-21	6169	146.40	903141.6	-20.00
## 2016-01-29	-6169	148.65	-917021.9	13860.25
## 2016-05-02	6072	151.00	916872.0	-20.00
## 2016-05-06	-6072	139.60	-847651.2	-69240.80
## 2016-11-29	5636	150.40	847654.4	-20.00
## 2016-12-07	-5636	156.05	-879497.8	31823.40
## 2017-02-24	5295	166.10	879499.5	-20.00
## 2017-03-06	-5295	167.30	-885853.5	6334.00
## 2017-03-21	5183	170.90	885774.7	-20.00
## 2017-03-24	-5183	169.00	-875927.0	-9867.70
## 2017-04-06	5050	173.45	875922.5	-20.00
## 2017-04-18	-5050	169.20	-854460.0	-21482.50
## 2017-05-05	4914	173.85	854298.9	-20.00
## 2017-05-15	-4914	173.60	-853070.4	-1248.50
## 2017-06-08	4953	172.25	853154.2	-20.00
## 2017-06-16	-4953	174.45	-864050.8	10876.60
## 2017-07-03	4950	174.55	864022.5	-20.00
## 2017-07-11	-4950	179.90	-890505.0	26462.50
## 2017-08-14	4904	181.55	890321.2	-20.00
## 2017-08-22	-4904	182.90	-896941.6	6600.40
## 2017-08-24	4891	183.40	897009.4	-20.00
## 2017-09-01	-4891	180.95	-885026.4	-12002.95
## 2017-09-21	4786	184.90	884931.4	-20.00
## 2017-09-29	-4786	189.95	-909100.7	24149.30
## 2017-10-18	4636	196.10	909119.6	-20.00
## 2017-10-26	-4636	200.35	-928822.6	19683.00
## 2017-11-07	4579	202.85	928850.2	-20.00
## 2017-11-15	-4579	197.20	-902978.8	-25891.35
## 2017-11-21	4575	197.35	902876.2	-20.00
## 2017-11-29	-4575	200.10	-915457.5	12561.25
## 2017-12-04	4596	199.15	915293.4	-20.00
## 2017-12-05	-4596	198.10	-910467.6	-4845.80

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## 2017-12-14      4606 197.70   910606.2        -20.00
## 2017-12-22     -4606 195.25  -899321.5       -11304.70
## 2018-02-07      4629 194.26   899229.5        -20.00
## 2018-02-08     -4629 190.78  -883120.6       -16128.92
## 2018-02-12      4662 189.40   882982.8        -20.00
## 2018-02-16     -4662 188.38  -878227.6       -4775.24
## 2018-03-05      4695 187.08   878340.6        -20.00
## 2018-03-13     -4695 185.80  -872331.0       -6029.60
## 2018-04-12      4621 188.74   872167.5        -20.00
## 2018-04-20     -4621 193.54  -894348.3        22160.80
## 2018-05-15      4646 192.48   894262.1        -20.00
## 2018-05-24     -4646 187.20  -869731.2       -24550.88
## 2018-07-26      4705 184.88   869860.4        -20.00
## 2018-08-01     -4705 187.80  -883599.0       13718.60
## 2018-08-03      4699 188.00   883412.0        -20.00
## 2018-08-13     -4699 186.66  -877115.3       -6316.66
## 2018-09-06      4812 182.30   877227.6        -20.00
## 2018-09-11     -4812 181.12  -871549.4       -5698.16
##
## [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
## 2012-01-31     -15492 58.78  -910619.8       -4822.52
## 2012-02-23      13987 65.10   910553.7        -20.00
## 2012-03-02     -13987 66.64  -932093.7       21519.98
## 2012-08-02      15540 59.98   932089.2        -20.00
## 2012-08-10     -15540 60.93  -946852.2       14743.00
## 2012-08-23      15081 62.78   946785.2        -20.00
## 2012-08-31     -15081 61.81  -932156.6       -14648.57
## 2012-09-14      14019 66.49   932123.3        -20.00
## 2012-09-24     -14019 67.48  -946002.1       13858.81
## 2012-09-27      14041 67.37   945942.2        -20.00
## 2012-10-05     -14041 66.74  -937096.3       -8865.83
## 2012-10-11      14544 64.43   937069.9        -20.00
## 2012-10-19     -14544 65.87  -958013.3       20923.36
## 2012-11-06      14841 64.55   957986.5        -20.00
## 2012-11-07     -14841 64.21  -952940.6       -5065.94
## 2012-11-19      15023 63.43   952908.9        -20.00
## 2012-11-27     -15023 67.90 -1020061.7       67132.81
## 2013-02-18      14264 71.51  1020018.6        -20.00
## 2013-02-21     -14264 73.41 -1047120.2       27081.60
## 2013-02-22      14380 73.52  1057217.6        -20.00
## 2013-02-26     -14380 72.25 -1038955.0       -18282.60
## 2013-05-24      13803 74.53  1028737.6        -20.00
## 2013-05-29     -13803 74.45 -1027633.4       -1124.24
## 2013-06-14      14077 73.00  1027621.0        -20.00
## 2013-06-24     -14077 68.42  -963148.3       -64492.66
## 2013-06-28      14060 68.50   963110.0        -20.00
## 2013-07-01     -14060 68.10  -957486.0       -5644.00

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## 2013-07-04	14018	68.30	957429.4	-20.00
## 2013-07-05	-14018	67.54	-946775.7	-10673.68
## 2013-07-17	13310	71.13	946740.3	-20.00
## 2013-07-25	-13310	66.74	-888309.4	-58450.90
## 2013-08-01	13162	67.49	888303.4	-20.00
## 2013-08-05	-13162	67.47	-888040.1	-283.24
## 2013-08-22	13117	67.70	888020.9	-20.00
## 2013-08-30	-13117	66.13	-867427.2	-20613.69
## 2013-11-22	11286	76.85	867329.1	-20.00
## 2013-12-02	-11286	78.97	-891255.4	23906.32
## 2014-03-04	10961	81.31	891238.9	-20.00
## 2014-03-12	-10961	78.20	-857150.2	-34108.71
## 2014-03-21	10930	78.42	857130.6	-20.00
## 2014-03-31	-10930	80.68	-881832.4	24681.80
## 2014-06-30	10336	85.31	881764.2	-20.00
## 2014-07-08	-10336	84.69	-875355.8	-6428.32
## 2014-07-14	10423	83.98	875323.5	-20.00
## 2014-07-17	-10423	83.66	-871988.2	-3355.36
## 2014-09-17	11395	76.52	871945.4	-20.00
## 2014-09-22	-11395	76.84	-875591.8	3626.40
## 2015-02-10	10876	80.50	875518.0	-20.00
## 2015-02-16	-10876	82.95	-902164.2	26626.20
## 2015-02-18	10893	82.82	902158.3	-20.00
## 2015-02-19	-10893	82.26	-896058.2	-6120.08
## 2015-03-11	10168	88.12	896004.2	-20.00
## 2015-03-19	-10168	89.93	-914408.2	18384.08
## 2015-04-20	9940	91.99	914380.6	-20.00
## 2015-04-22	-9940	92.25	-916965.0	2564.40
## 2015-04-24	9987	91.81	916906.5	-20.00
## 2015-05-05	-9987	85.93	-858182.9	-58743.56
## 2015-05-13	9903	86.66	858194.0	-20.00
## 2015-05-21	-9903	87.98	-871265.9	13051.96
## 2015-06-03	10288	84.68	871187.8	-20.00
## 2015-06-11	-10288	83.78	-861928.6	-9279.20
## 2015-11-30	10974	78.54	861898.0	-20.00
## 2015-12-02	-10974	76.64	-841047.4	-20870.60
## 2016-08-23	11583	72.61	841041.6	-20.00
## 2016-08-31	-11583	72.90	-844400.7	3339.07
## 2016-09-07	11444	73.78	844338.3	-20.00
## 2016-09-13	-11444	71.74	-820992.6	-23365.76
## 2016-10-14	10514	78.08	820933.1	-20.00
## 2016-10-24	-10514	80.00	-841120.0	20166.88
## 2016-10-27	10486	80.21	841082.1	-20.00
## 2016-11-04	-10486	77.05	-807946.3	-33155.76
## 2016-11-24	9977	80.98	807937.5	-20.00
## 2016-12-02	-9977	81.01	-808236.8	279.31
## 2017-02-01	8907	90.73	808132.1	-20.00
## 2017-02-09	-8907	88.23	-785864.6	-22287.50
## 2017-02-20	8781	89.49	785811.7	-20.00
## 2017-02-28	-8781	87.90	-771849.9	-13981.79
## 2017-03-21	8641	89.32	771814.1	-20.00
## 2017-03-27	-8641	89.45	-772937.5	1103.33
## 2017-04-21	8686	88.99	772967.1	-20.00
## 2017-05-02	-8686	89.54	-777744.4	4757.30

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## 2017-05-16      8790 88.47   777651.3      -20.00
## 2017-05-24     -8790 84.60  -743634.0     -34037.30
## 2017-06-26      8737 85.11   743606.1      -20.00
## 2017-07-04     -8737 82.36  -719579.3     -24046.75
## 2017-10-25      7907 91.00   719537.0      -20.00
## 2017-11-03     -7907 97.01  -767058.1     47501.07
## 2017-11-16      8234 93.15   766997.1      -20.00
## 2017-11-24     -8234 95.10  -783053.4     16036.30
## 2018-01-03      8545 91.64   783063.8      -20.00
## 2018-01-11     -8545 93.98  -803059.1     19975.30
## 2018-02-07      8962 89.60   802995.2      -20.00
## 2018-02-12     -8962 86.20  -772524.4     -30490.80
## 2018-06-14      8828 87.50   772450.0      -20.00
## 2018-06-20     -8828 85.53  -755058.8     -17411.16
##
## [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
## 2012-02-08     -19029 53.574  -1019459.6     19446.667
## 2012-02-23      18250 55.857   1019390.2        -20.000
## 2012-03-02     -18250 54.765  -999461.2    -19949.000
## 2012-03-30      19184 52.098   999448.0        -20.000
## 2012-04-11     -19184 50.376  -966413.2    -33054.848
## 2012-05-02      17972 53.771   966372.4        -20.000
## 2012-05-10     -17972 51.655  -928343.7    -38048.752
## 2012-07-13      16425 56.517   928291.7        -20.000
## 2012-07-20     -16425 58.377  -958842.2     30530.500
## 2012-09-11      14950 64.133   958788.3        -20.000
## 2012-09-13     -14950 64.104  -958354.8     -453.550
## 2012-09-27      14254 67.233   958339.2        -20.000
## 2012-09-28     -14254 66.741  -951326.2    -7032.968
## 2012-10-01      14152 67.794   959420.7        -20.000
## 2012-10-09     -14152 66.761  -944801.7   -14639.016
## 2012-11-16      14412 64.990   936635.9        -20.000
## 2012-11-26     -14412 68.198  -982869.6     46213.696
## 2012-12-03      14255 68.946   982825.2        -20.000
## 2012-12-11     -14255 71.258 -1015782.8     32937.560
## 2013-01-16      14228 71.386   1015680.0        -20.000
## 2013-01-24     -14228 71.268 -1014001.1    -1698.904
## 2013-02-06      14347 70.678   1014017.3        -20.000
## 2013-02-14     -14347 69.398  -995653.1   -18384.160
## 2013-02-22      13949 71.376   995623.8        -20.000
## 2013-02-26     -13949 70.491  -983279.0   -12364.865
## 2013-02-27      13986 72.380   1012306.7        -20.000
## 2013-03-07     -13986 76.671 -1072320.6     59993.926
## 2013-03-25      13410 77.793   1043204.1        -20.000
## 2013-04-04     -13410 80.302 -1076849.8     33625.690
## 2013-04-15      13370 80.538   1076793.1        -20.000
## 2013-04-23     -13370 78.236 -1046015.3   -30797.740
## 2013-04-30      13233 79.043   1045976.0        -20.000
## 2013-05-09     -13233 81.906 -1083862.1     37866.079
## 2013-05-24      12958 83.638   1083781.2        -20.000
## 2013-05-29     -12958 84.199 -1091050.6     7249.438

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## 2013-06-06	13519	80.706	1091064.4	-20.000
## 2013-06-11	-13519	81.414	-1100635.9	9551.452
## 2013-06-14	13549	81.227	1100544.6	-20.000
## 2013-06-20	-13549	80.991	-1097347.1	-3217.564
## 2013-07-04	13702	80.086	1097338.4	-20.000
## 2013-07-05	-13702	79.790	-1093282.6	-4075.792
## 2013-07-08	13669	81.454	1113394.7	-20.000
## 2013-07-16	-13669	82.369	-1125901.9	12487.135
## 2013-09-02	13157	84.042	1105740.6	-20.000
## 2013-09-03	-13157	83.441	-1097833.2	-7927.357
## 2013-09-10	13406	81.887	1097777.1	-20.000
## 2013-09-12	-13406	82.418	-1104895.7	7098.586
## 2013-10-08	13103	84.317	1104805.7	-20.000
## 2013-10-16	-13103	88.047	-1153679.8	48854.190
## 2013-10-22	13020	88.608	1153676.2	-20.000
## 2013-10-30	-13020	91.048	-1185445.0	31748.800
## 2013-11-27	12457	95.162	1185433.0	-20.000
## 2013-12-03	-12457	96.008	-1195971.7	10518.622
## 2014-01-02	11781	101.509	1195877.5	-20.000
## 2014-01-08	-11781	98.459	-1159945.5	-35952.050
## 2014-02-28	11612	99.886	1159876.2	-20.000
## 2014-03-03	-11612	96.786	-1123879.0	-36017.200
## 2014-03-04	11860	99.148	1175895.3	-20.000
## 2014-03-12	-11860	93.932	-1114033.5	-61881.760
## 2014-04-14	11522	92.170	1061982.7	-20.000
## 2014-04-24	-11522	95.467	-1099970.8	37968.034
## 2014-06-24	10747	102.346	1099912.5	-20.000
## 2014-07-02	-10747	102.838	-1105200.0	5267.524
## 2014-07-16	10951	100.919	1105164.0	-20.000
## 2014-07-24	-10951	99.344	-1087916.1	-17267.825
## 2014-08-05	11460	94.926	1087852.0	-20.000
## 2014-08-12	-11460	94.483	-1082775.2	-5096.780
## 2014-08-13	11468	95.369	1093691.7	-20.000
## 2014-08-15	-11468	95.192	-1091661.9	-2049.836
## 2014-08-21	11068	97.642	1080701.7	-20.000
## 2014-08-29	-11068	100.427	-1111526.0	30804.380
## 2014-09-30	10221	108.742	1111452.0	-20.000
## 2014-10-09	-10221	103.674	-1059652.0	-51820.028
## 2014-10-28	10068	105.249	1059646.9	-20.000
## 2014-11-03	-10068	110.219	-1109684.9	50017.960
## 2014-11-05	9935	111.695	1109689.8	-20.000
## 2014-11-06	-9935	110.760	-1100400.6	-9309.225
## 2014-12-05	9290	118.436	1100270.4	-20.000
## 2014-12-15	-9290	107.365	-997420.8	-102869.590
## 2015-01-02	8794	113.417	997389.1	-20.000
## 2015-01-12	-8794	113.466	-997820.0	410.906
## 2015-03-27	7247	137.675	997730.7	-20.000
## 2015-04-08	-7247	137.675	-997730.7	-20.000
## 2015-05-13	7725	129.162	997776.5	-20.000
## 2015-05-21	-7725	135.559	-1047193.3	49396.825
## 2015-06-16	8472	123.602	1047156.1	-20.000
## 2015-06-24	-8472	131.278	-1112187.2	65011.072
## 2015-07-01	8805	126.309	1112150.7	-20.000
## 2015-07-02	-8805	124.439	-1095685.4	-16485.350

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## 2015-07-08      8968 122.175 1095665.4      -20.000
## 2015-07-16     -8968 135.067 -1211280.9     115595.456
## 2015-08-13      9431 128.424 1211166.7      -20.000
## 2015-08-21     -9431 116.369 -1097476.0    -113710.705
## 2015-09-02      9395 116.812 1097448.7      -20.000
## 2015-09-04     -9395 117.649 -1105312.4      7843.615
## 2015-09-14      9356 118.141 1105327.2      -20.000
## 2015-09-21     -9356 114.204 -1068492.6    -36854.572
## 2015-11-16      8958 119.272 1068438.6      -20.000
## 2015-11-20     -8958 123.209 -1103706.2     35247.646
## 2015-11-25      9008 122.520 1103660.2      -20.000
## 2015-12-03     -9008 115.828 -1043378.6    -60301.536
## 2017-03-01      10136 102.936 1043359.3      -20.000
## 2017-03-09     -10136 104.166 -1055826.6     12447.280
## 2017-03-16      9934 106.282 1055805.4      -20.000
## 2017-03-24     -9934 105.298 -1046030.3    -9795.056
## 2017-03-28      9929 105.347 1045990.4      -20.000
## 2017-04-05     -9929 106.135 -1053814.4      7804.052
## 2017-04-27      9747 108.103 1053679.9      -20.000
## 2017-05-02     -9747 109.677 -1069021.7     15321.778
## 2017-05-03      9909 109.973 1089722.5      -20.000
## 2017-05-05     -9909 111.104 -1100929.5     11187.079
## 2017-06-08      9232 117.009 1080227.1      -20.000
## 2017-06-16     -9232 120.847 -1115659.5     35412.416
## 2017-08-22      10535 105.889 1115540.6      -20.000
## 2017-08-30     -10535 105.347 -1109830.6    -5729.970
## 2017-09-05      10423 106.479 1109830.6      -20.000
## 2017-09-08     -10423 107.070 -1115990.6     6139.993
## 2017-09-11      10399 107.857 1121604.9      -20.000
## 2017-09-13     -10399 108.841 -1131837.6     10212.616
## 2017-09-20      10356 108.742 1126132.2      -20.000
## 2017-09-28     -10356 111.104 -1150593.0     24440.872
## 2017-10-18      9800 117.403 1150549.4      -20.000
## 2017-10-26     -9800 110.661 -1084477.8    -66091.600
## 2017-11-16      10161 106.725 1084432.7      -20.000
## 2017-11-20     -10161 105.397 -1070938.9    -13513.808
##
## [1] "Transactions for the instrument: BEI.csv"
##      Quantity    Price    Value Net realized Profit
## 1999-12-31         0  0.000         0.0         0.000
## 2012-01-06      22419 44.605  999999.5      -20.000
## 2012-01-11     -22419 44.265 -992377.0     -7642.460
## 2012-02-08      21292 46.605  992313.7      -20.000
## 2012-02-16     -21292 47.500 -1011370.0     19036.340
## 2012-03-30      20895 48.400 1011318.0      -20.000
## 2012-04-11     -20895 48.355 -1010377.7     -960.275
## 2012-04-24      19611 51.520 1010358.7      -20.000
## 2012-04-26     -19611 51.590 -1011731.5     1352.770
## 2012-05-21      19396 52.160 1011695.4      -20.000
## 2012-05-23     -19396 51.970 -1008010.1    -3705.240
## 2012-06-29      19599 51.430 1007976.6      -20.000
## 2012-07-09     -19599 51.840 -1016012.2     8015.590
## 2012-07-26      18919 53.700 1015950.3      -20.000
## 2012-08-03     -18919 56.970 -1077815.4     61845.130

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## 2012-08-20	18905	57.010	1077774.1	-20.000
## 2012-08-28	-18905	57.860	-1093843.3	16049.250
## 2012-09-03	19059	57.390	1093796.0	-20.000
## 2012-09-07	-19059	57.320	-1092461.9	-1354.130
## 2012-09-27	19045	57.360	1092421.2	-20.000
## 2012-10-05	-19045	58.400	-1112228.0	19786.800
## 2012-10-25	19762	56.280	1112205.4	-20.000
## 2012-11-02	-19762	60.700	-1199553.4	87328.040
## 2012-11-16	20289	59.120	1199485.7	-20.000
## 2012-11-26	-20289	60.280	-1223020.9	23515.240
## 2013-01-08	19767	61.870	1222984.3	-20.000
## 2013-01-16	-19767	62.430	-1234053.8	11049.520
## 2013-01-29	18959	65.090	1234041.3	-20.000
## 2013-01-31	-18959	64.990	-1232145.4	-1915.900
## 2013-02-01	18953	65.310	1237820.4	-20.000
## 2013-02-04	-18953	64.670	-1225690.5	-12149.920
## 2013-02-08	18756	65.040	1219890.2	-20.000
## 2013-02-11	-18756	64.530	-1210324.7	-9585.560
## 2013-02-12	18776	64.950	1219501.2	-20.000
## 2013-02-20	-18776	64.400	-1209174.4	-10346.800
## 2013-04-18	17423	68.870	1199922.0	-20.000
## 2013-04-26	-17423	68.790	-1198528.2	-1413.840
## 2013-06-04	17315	69.220	1198544.3	-20.000
## 2013-06-11	-17315	67.910	-1175861.6	-22702.650
## 2013-06-14	17473	67.290	1175758.2	-20.000
## 2013-06-24	-17473	64.530	-1127532.7	-48245.480
## 2013-07-04	16591	67.960	1127524.4	-20.000
## 2013-07-05	-16591	67.530	-1120390.2	-7154.130
## 2013-08-16	16272	68.850	1120327.2	-20.000
## 2013-08-23	-16272	67.480	-1098034.6	-22312.640
## 2013-09-02	16669	65.870	1097987.0	-20.000
## 2013-09-10	-16669	65.410	-1090319.3	-7687.740
## 2013-09-19	16342	66.720	1090338.2	-20.000
## 2013-09-20	-16342	66.410	-1085272.2	-5086.020
## 2013-10-07	15985	67.890	1085221.6	-20.000
## 2013-10-15	-15985	69.000	-1102965.0	17723.350
## 2013-11-05	15212	72.500	1102870.0	-20.000
## 2013-11-13	-15212	72.840	-1108042.1	5152.080
## 2013-11-28	14927	74.230	1108031.2	-20.000
## 2013-12-03	-14927	74.460	-1111464.4	3413.210
## 2013-12-16	15322	72.540	1111457.9	-20.000
## 2013-12-17	-15322	71.880	-1101345.4	-10132.520
## 2013-12-18	15326	72.740	1114813.2	-20.000
## 2014-01-02	-15326	73.120	-1120637.1	5803.880
## 2014-02-14	14960	74.000	1107040.0	-20.000
## 2014-02-24	-14960	73.580	-1100756.8	-6303.200
## 2014-03-04	15064	73.070	1100726.5	-20.000
## 2014-03-12	-15064	69.020	-1039717.3	-61029.200
## 2014-03-21	14874	69.900	1039692.6	-20.000
## 2014-03-31	-14874	70.800	-1053079.2	13366.600
## 2014-04-09	14975	70.320	1053042.0	-20.000
## 2014-04-11	-14975	69.900	-1046752.5	-6309.500
## 2014-04-14	15075	70.010	1055400.8	-20.000
## 2014-04-24	-15075	71.150	-1072586.2	17165.500

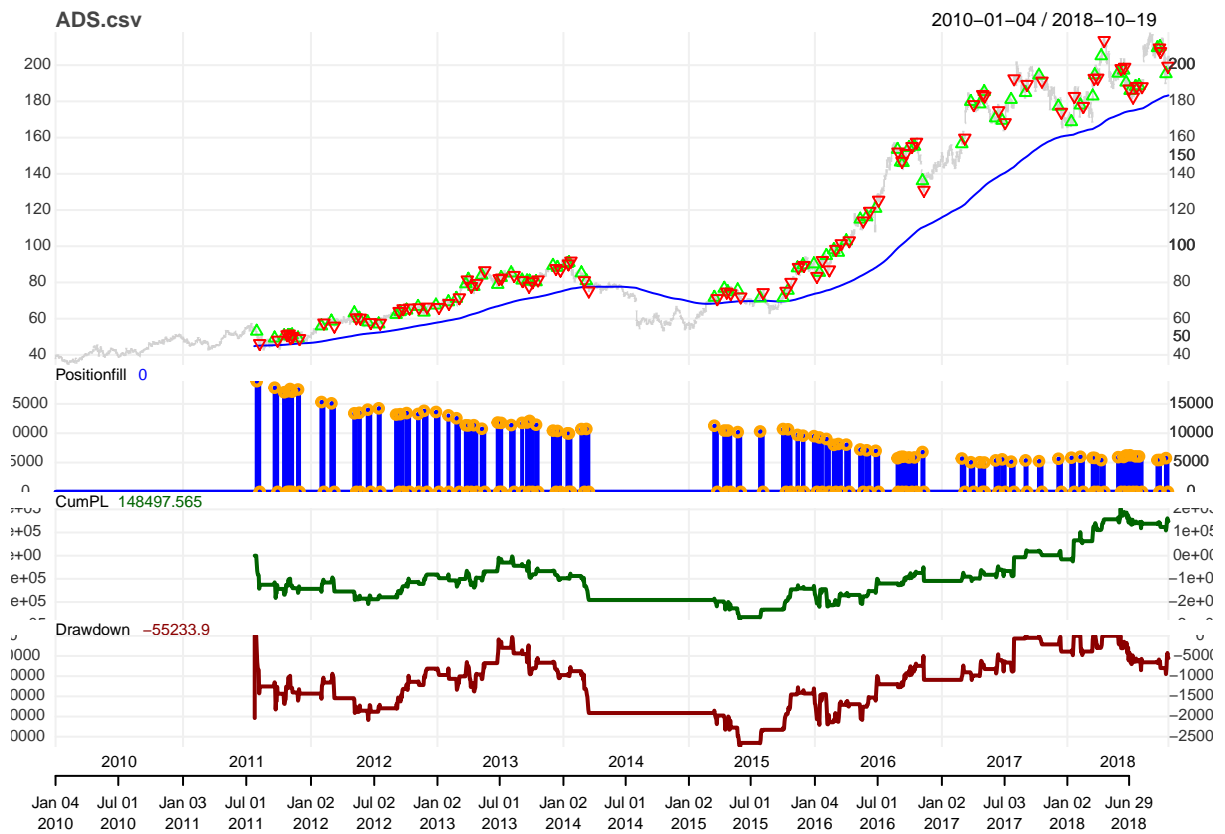
## 2014-05-26	14458	73.580	1063819.6	-20.000
## 2014-06-03	-14458	73.730	-1065988.3	2148.700
## 2014-07-14	15349	69.450	1065988.1	-20.000
## 2014-07-15	-15349	68.760	-1055397.2	-10610.810
## 2014-07-16	15318	69.830	1069655.9	-20.000
## 2014-07-21	-15318	67.850	-1039326.3	-30349.640
## 2014-12-29	15027	68.210	1024991.7	-20.000
## 2014-12-30	-15027	67.490	-1014172.2	-10839.440
## 2015-03-27	12520	81.000	1014120.0	-20.000
## 2015-03-31	-12520	81.360	-1018627.2	4487.200
## 2015-04-15	12250	83.150	1018587.5	-20.000
## 2015-04-22	-12250	81.480	-998130.0	-20477.500
## 2015-05-13	12416	80.390	998122.2	-20.000
## 2015-05-21	-12416	83.080	-1031521.3	33379.040
## 2015-05-27	12333	83.630	1031408.8	-20.000
## 2015-06-04	-12333	81.100	-1000206.3	-31222.490
## 2015-06-16	12843	77.880	1000212.8	-20.000
## 2015-06-24	-12843	78.980	-1014340.1	14107.300
## 2015-07-01	13323	76.130	1014280.0	-20.000
## 2015-07-09	-13323	75.080	-1000290.8	-14009.150
## 2015-07-23	12601	79.380	1000267.4	-20.000
## 2015-07-31	-12601	77.820	-980609.8	-19677.560
## 2015-10-28	11427	85.810	980550.9	-20.000
## 2015-11-05	-11427	88.450	-1010718.2	30147.280
## 2015-11-25	11391	88.730	1010723.4	-20.000
## 2015-12-03	-11391	88.050	-1002977.5	-7765.880
## 2015-12-07	11849	84.640	1002899.4	-20.000
## 2015-12-15	-11849	84.560	-1001951.4	-967.920
## 2016-01-08	12524	80.000	1001920.0	-20.000
## 2016-01-14	-12524	80.710	-1010812.0	8872.040
## 2016-01-21	12696	79.610	1010728.6	-20.000
## 2016-01-26	-12696	81.130	-1030026.5	19277.920
## 2016-03-01	12843	80.200	1030008.6	-20.000
## 2016-03-02	-12843	79.990	-1027311.6	-2717.030
## 2016-03-18	12739	80.640	1027273.0	-20.000
## 2016-03-24	-12739	80.380	-1023960.8	-3332.140
## 2016-04-04	13090	78.220	1023899.8	-20.000
## 2016-04-06	-13090	77.000	-1007930.0	-15989.800
## 2016-05-12	12572	80.170	1007897.2	-20.000
## 2016-05-23	-12572	78.480	-986650.6	-21266.680
## 2016-06-03	12025	82.050	986651.2	-20.000
## 2016-06-08	-12025	83.150	-999878.8	13207.500
## 2016-07-20	11897	84.040	999823.9	-20.000
## 2016-07-28	-11897	84.060	-1000061.8	217.940
## 2016-09-02	12104	82.620	1000032.5	-20.000
## 2016-09-08	-12104	83.440	-1009957.8	9905.280
## 2016-09-22	11996	84.190	1009943.2	-20.000
## 2016-09-30	-11996	83.950	-1007064.2	-2899.040
## 2016-10-14	12363	81.450	1006966.4	-20.000
## 2016-10-24	-12363	80.550	-995839.6	-11146.700
## 2017-01-02	12237	81.380	995847.1	-20.000
## 2017-01-10	-12237	80.990	-991074.6	-4792.430
## 2017-02-02	12040	82.310	991012.4	-20.000
## 2017-02-10	-12040	84.420	-1016416.8	25384.400

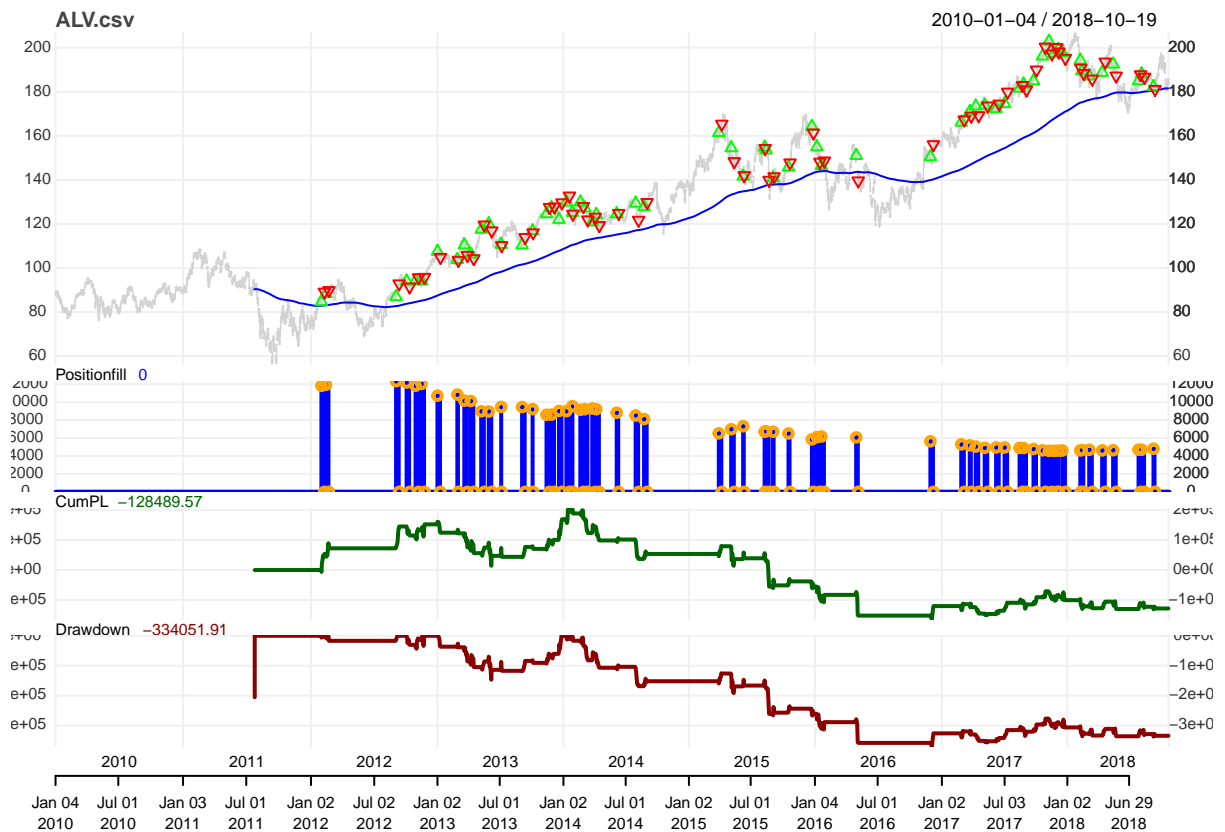
## 2017-03-01	11699	86.880	1016409.1	-20.000
## 2017-03-02	-11699	86.430	-1011144.6	-5284.550
## 2017-03-09	11806	85.640	1011065.8	-20.000
## 2017-03-17	-11806	87.190	-1029365.1	18279.300
## 2017-04-20	11324	90.900	1029351.6	-20.000
## 2017-04-28	-11324	91.340	-1034334.2	4962.560
## 2017-06-14	10812	95.660	1034275.9	-20.000
## 2017-06-22	-10812	96.270	-1040871.2	6575.320
## 2017-06-26	10778	96.570	1040831.5	-20.000
## 2017-06-27	-10778	96.280	-1037705.8	-3145.620
## 2017-07-07	11341	91.500	1037701.5	-20.000
## 2017-07-17	-11341	93.250	-1057548.2	19826.750
## 2017-07-31	11454	92.320	1057433.3	-20.000
## 2017-08-08	-11454	90.220	-1033379.9	-24073.400
## 2017-08-22	11612	88.990	1033351.9	-20.000
## 2017-08-30	-11612	88.680	-1029752.2	-3619.720
## 2017-10-26	10932	94.190	1029685.1	-20.000
## 2017-11-02	-10932	96.960	-1059966.7	30261.640
## 2017-11-08	10792	98.220	1059990.2	-20.000
## 2017-11-16	-10792	96.850	-1045205.2	-14805.040
## 2017-11-28	10719	97.500	1045102.5	-20.000
## 2017-12-01	-10719	98.890	-1060001.9	14879.410
## 2017-12-04	10681	100.350	1071838.3	-20.000
## 2017-12-06	-10681	99.870	-1066711.5	-5146.880
## 2017-12-18	10548	100.000	1054800.0	-20.000
## 2017-12-28	-10548	97.620	-1029695.8	-25124.240
## 2018-02-07	11115	92.640	1029693.6	-20.000
## 2018-02-08	-11115	91.340	-1015244.1	-14469.500
## 2018-02-23	11203	90.620	1015215.9	-20.000
## 2018-02-27	-11203	92.260	-1033588.8	18352.920
## 2018-04-24	11212	92.180	1033522.2	-20.000
## 2018-05-03	-11212	94.100	-1055049.2	21507.040

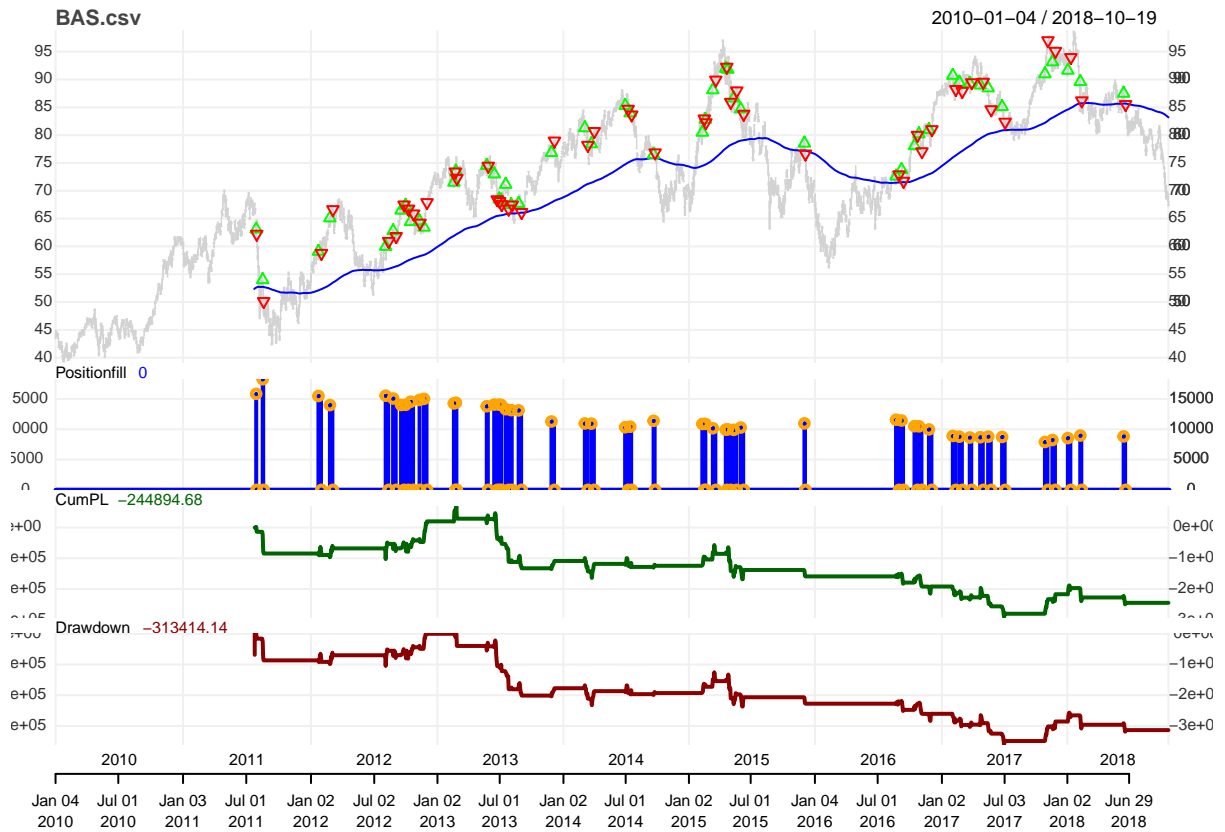
Step 3: Graph which visualize transactions

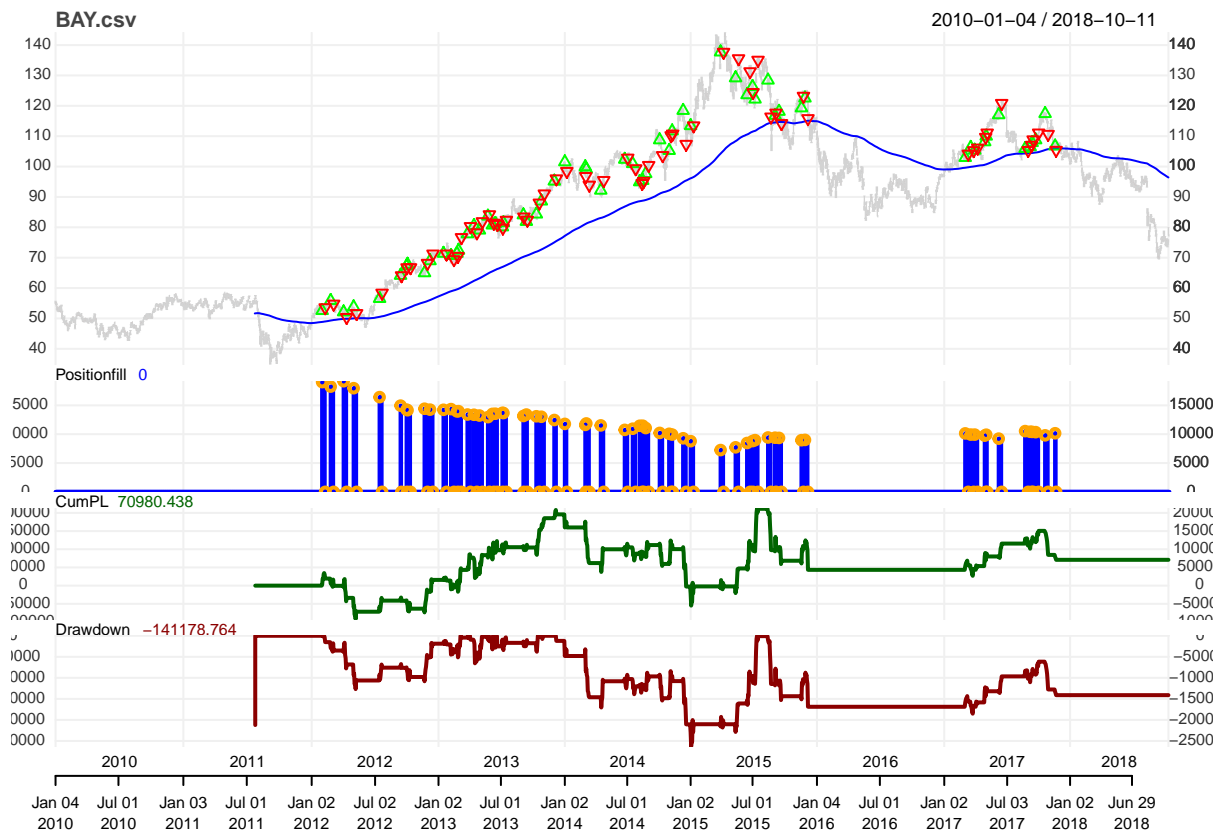
The following graphs show the combined view of the performance of the Smash Day trading system. It visualizes the trades (buy-transactions are visualized in green and sell-transactions are visualized in red). Moreover, the size of the blue squares indicates the size of the position (height) and the holding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

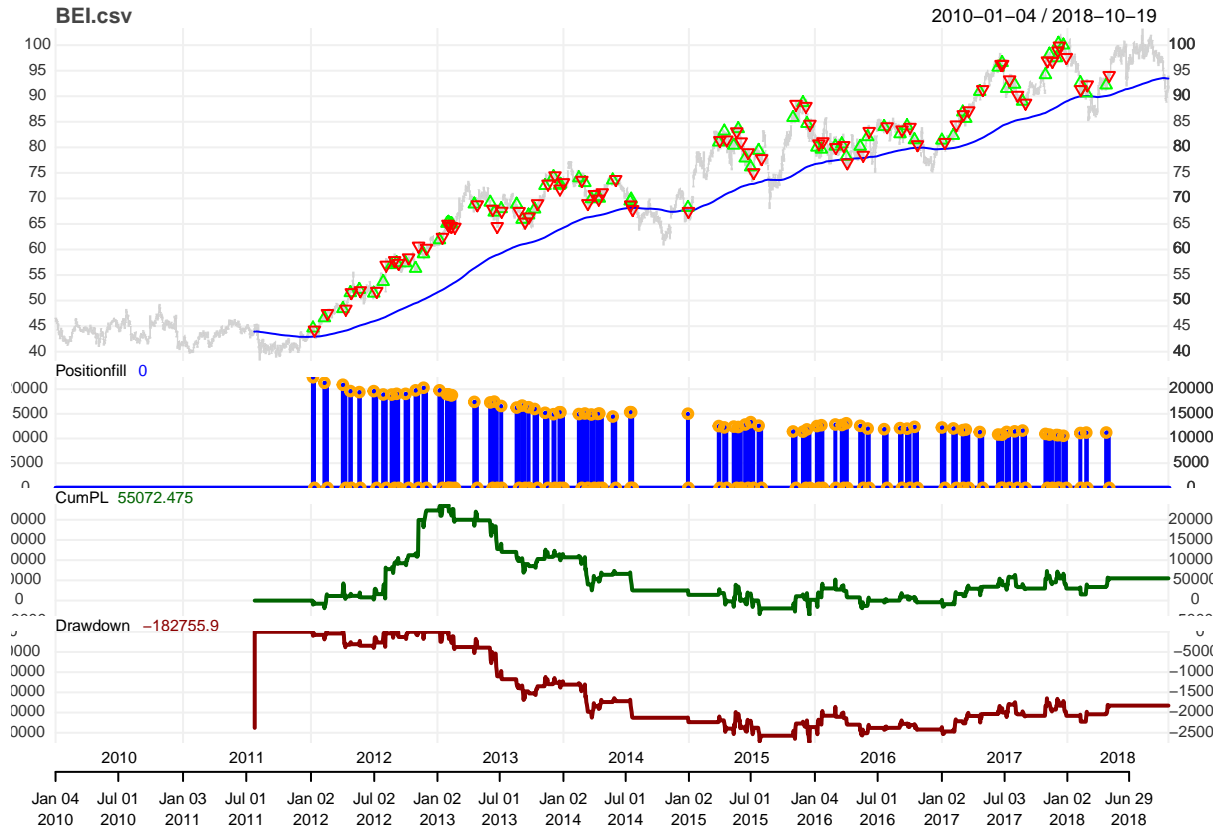
```
# Plot graph with indicators for transaction
for (instrument in instrumentlist){
  chart.Posn(portfolioname,
    Symbol=instrument,
    type='candlesticks',
    theme=myTheme,
    subset=daterange,
    TA=addEMAStrng)
}
```











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 investors 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
##      "86"    "48.84"    "50"        "0.98"
##
## [1] "ALV.csv"
##      Trades  Win Percent Loss Percent    W/L Ratio
##      "61"    "47.54"    "52.46"    "0.91"
##
## [1] "BAS.csv"
##      Trades  Win Percent Loss Percent    W/L Ratio
##      "50"    "42"        "58"        "0.72"
##
## [1] "BAY.csv"
##      Trades  Win Percent Loss Percent    W/L Ratio
##      "63"    "50.79"    "47.62"    "1.07"
##
## [1] "BEI.csv"
##      Trades  Win Percent Loss Percent    W/L Ratio
##      "77"    "44.16"    "55.84"    "0.79"
```

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

Performance Metrics

```
##
##           ADS           ALV           BAS           BAY
## Cumulative Return  0.10262881 -0.14279604 -0.23310755 0.029017913
## Annualized Return  0.01350713 -0.02093738 -0.03579225 0.003936023
## Annualized Sharp Ratio 0.11426114 -0.25022458 -0.47840160 0.036484869
## Calmar Ratio       0.05241041 -0.06607737 -0.11517074 0.016399253
##
##           BEI
## Cumulative Return  0.029185066
## Annualized Return  0.003958417
## Annualized Sharp Ratio 0.046280539
## Calmar Ratio       0.016020382
```

Risk Metrics

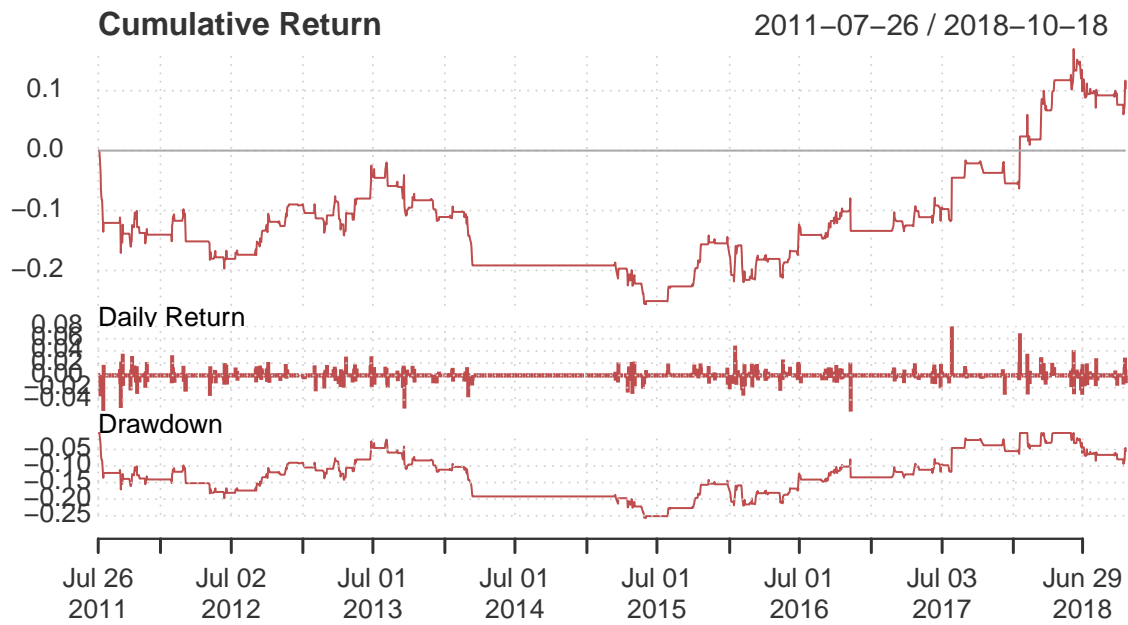
```
##
##           ADS           ALV           BAS           BAY
## Annualized StdDev  0.11821280 0.08367436 0.074816324 0.107880981
## Max Drawdown       0.25771843 0.31686163 0.310775539 0.240012364
## Value-at-Risk      -0.01002185 -0.00597567 -0.004610732 -0.007661363
## Conditional VaR    -0.01965260 -0.01456194 -0.013494822 -0.018047918
##
##           BEI
## Annualized StdDev  0.085530926
## Max Drawdown       0.247086332
## Value-at-Risk      -0.008057492
## Conditional VaR    -0.013080564
```

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

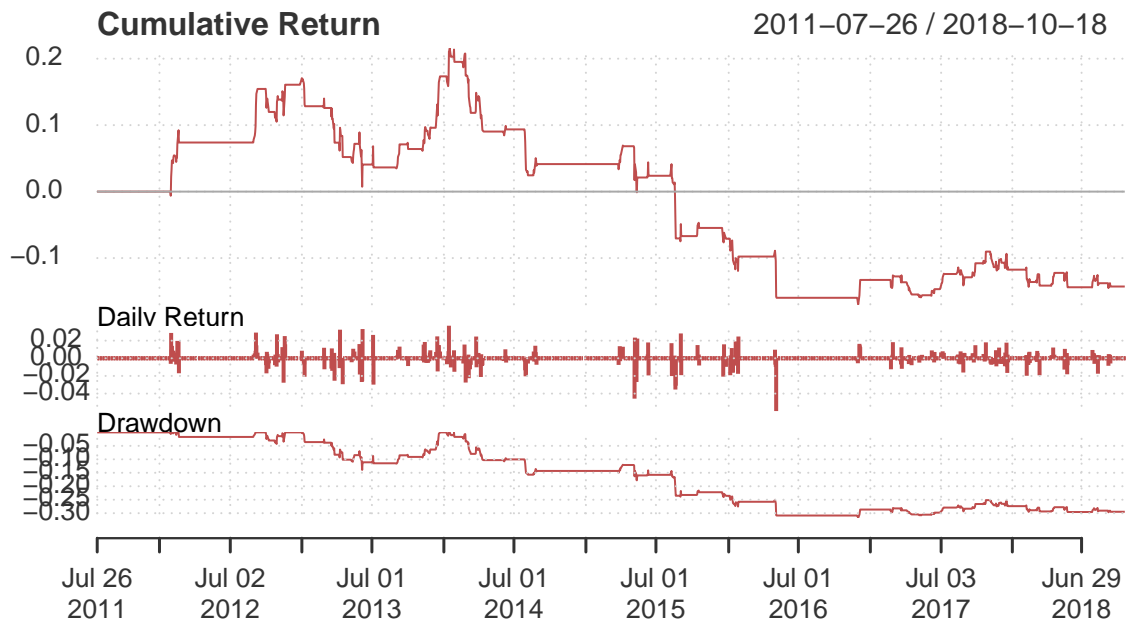
The following plots visualizes some important information about the returns of the strategy applied to the instruments on the instrumentlist. The cumulative return over the entire period, the daily returns and the drawdown for each instrument is illustrated.

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

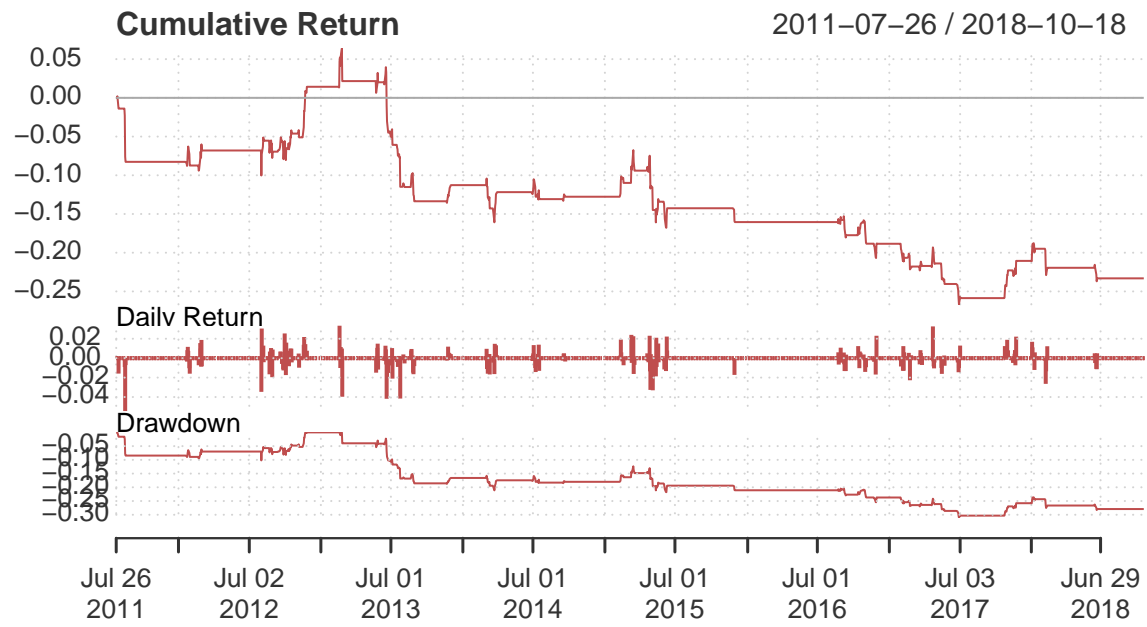
ADS



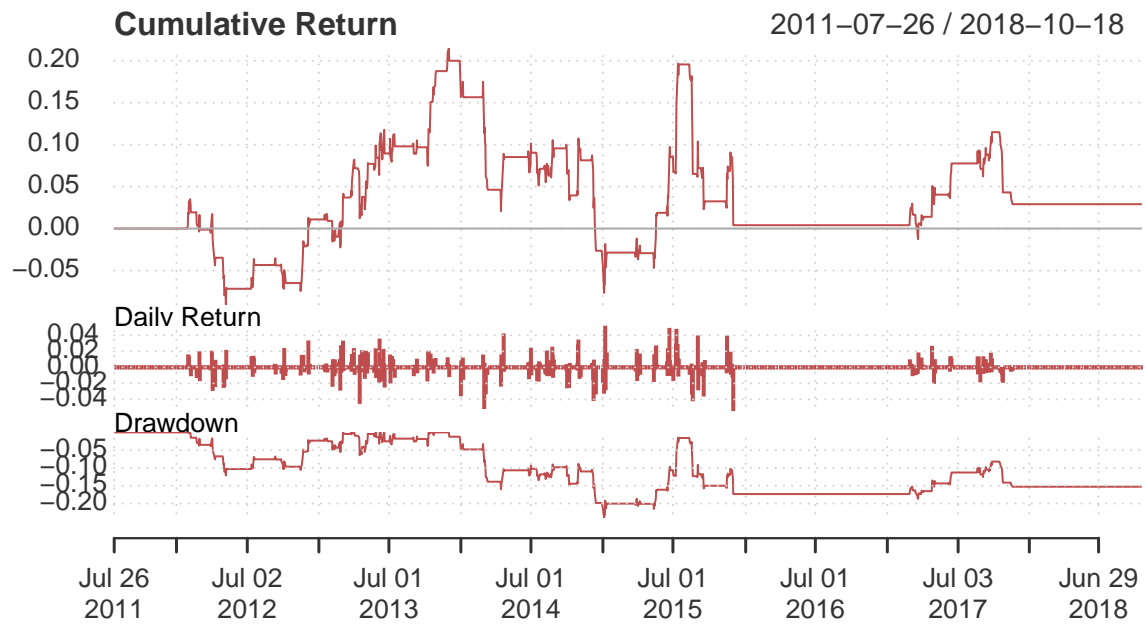
ALV



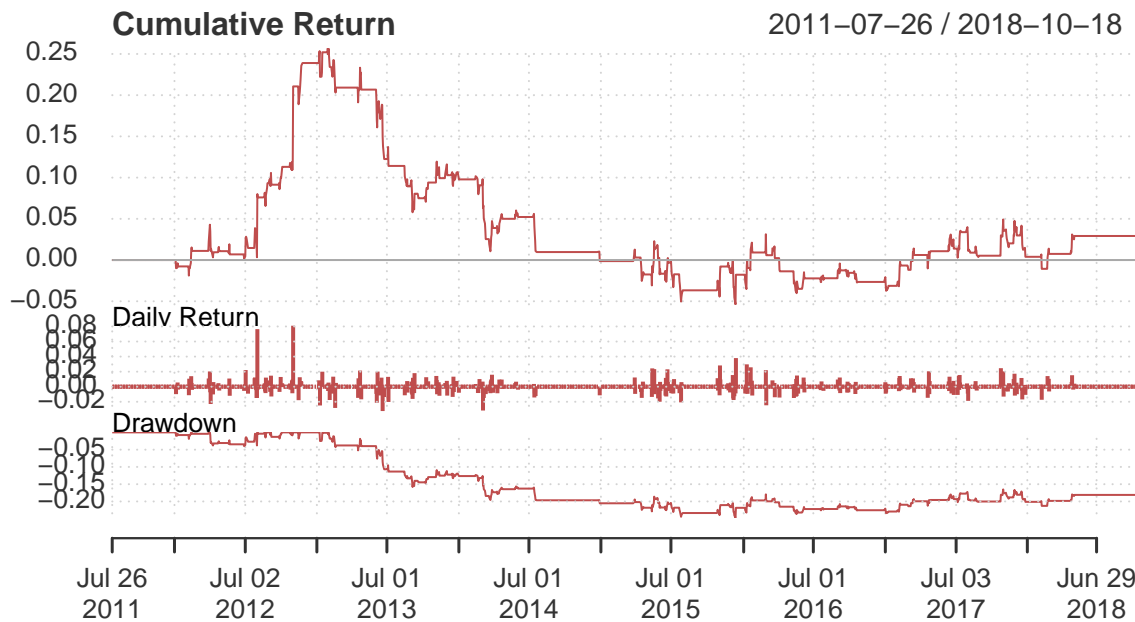
BAS



BAY



BEI



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 calculate 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)
```

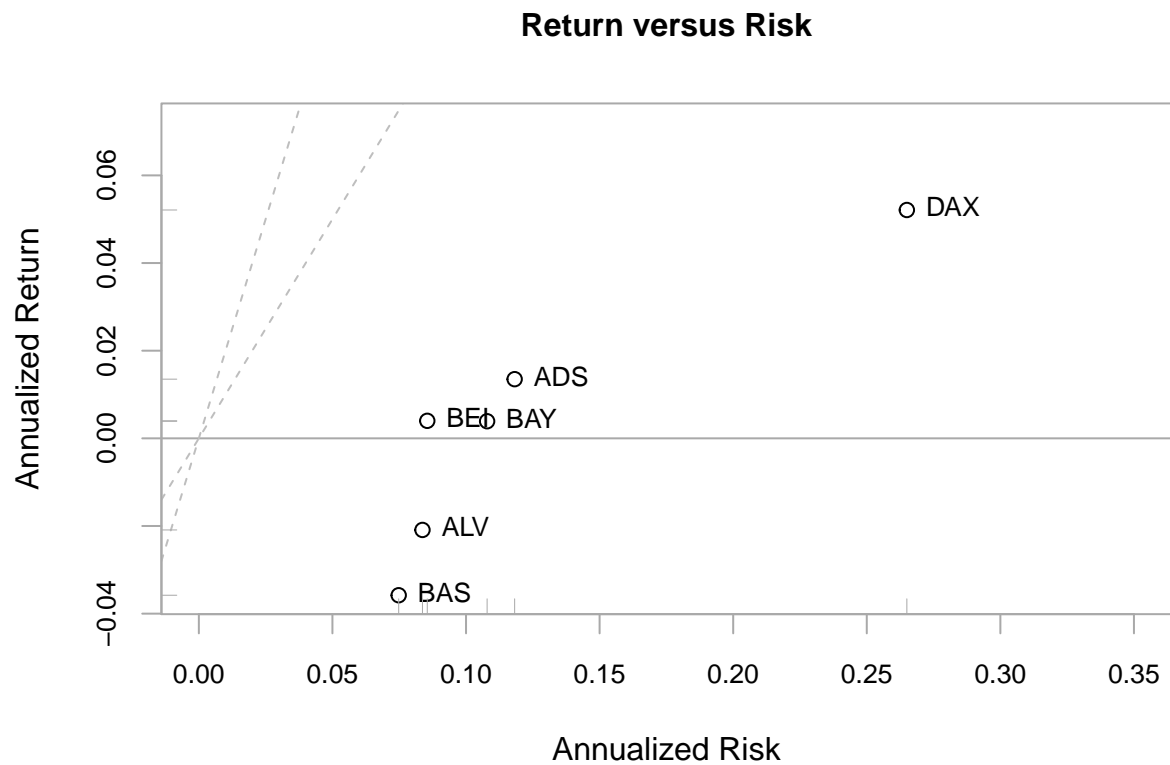
##	ADS	ALV	BAS	BAY	BEI
## Observations	1835.0000	1835.0000	1835.0000	1835.0000	1835.0000
## NAs	400.0000	400.0000	400.0000	400.0000	400.0000
## Minimum	-0.0592	-0.0598	-0.0544	-0.0545	-0.0323
## Quartile 1	0.0000	0.0000	0.0000	0.0000	0.0000
## Median	0.0000	0.0000	0.0000	0.0000	0.0000
## Arithmetic Mean	0.0001	-0.0001	-0.0001	0.0000	0.0000
## Geometric Mean	0.0001	-0.0001	-0.0001	0.0000	0.0000
## Quartile 3	0.0000	0.0000	0.0000	0.0000	0.0000
## Maximum	0.0802	0.0369	0.0334	0.0519	0.0810
## SE Mean	0.0002	0.0001	0.0001	0.0002	0.0001
## LCL Mean (0.95)	-0.0003	-0.0003	-0.0003	-0.0003	-0.0002
## UCL Mean (0.95)	0.0004	0.0002	0.0001	0.0003	0.0003

```
## Variance      0.0001    0.0000    0.0000    0.0000    0.0000
## Stdev         0.0074    0.0053    0.0047    0.0068    0.0054
## Skewness      0.3381   -1.0543   -1.8070   -0.0255    3.5187
## Kurtosis      23.7015   24.9045   31.4950   19.5413   56.5937
##              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    0.0135 -0.0209 -0.0358 0.0039 0.0040 0.0521
## Annualized Std Dev    0.1182 0.0837 0.0748 0.1079 0.0855 0.2650
## Annualized Sharpe (Rf=0%) 0.1143 -0.2502 -0.4784 0.0365 0.0463 0.1965
```

```
# charts.PerformanceSummary(returns,geometric=FALSE,wealth.index=TRUE)
chart.RiskReturnScatter(returns,Rf=0,
  add.sharpe=c(1,2),
  xlim=c(0,0.35),
  main="Return versus Risk"
)
```



```
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"))
}
```

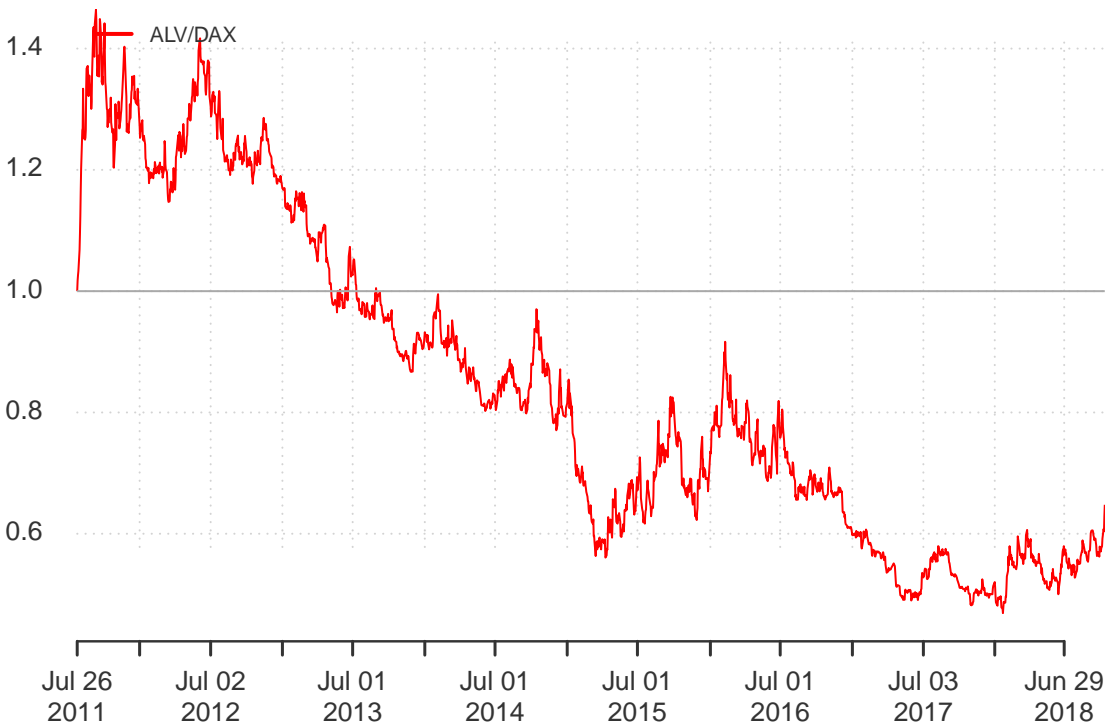
Relative Performance

2011-07-26 / 2018-10-11



Relative Performance

2011-07-26 / 2018-10-11



Relative Performance

2011-07-26 / 2018-10-11



Relative Performance

2011-07-26 / 2018-10-11



Relative Performance

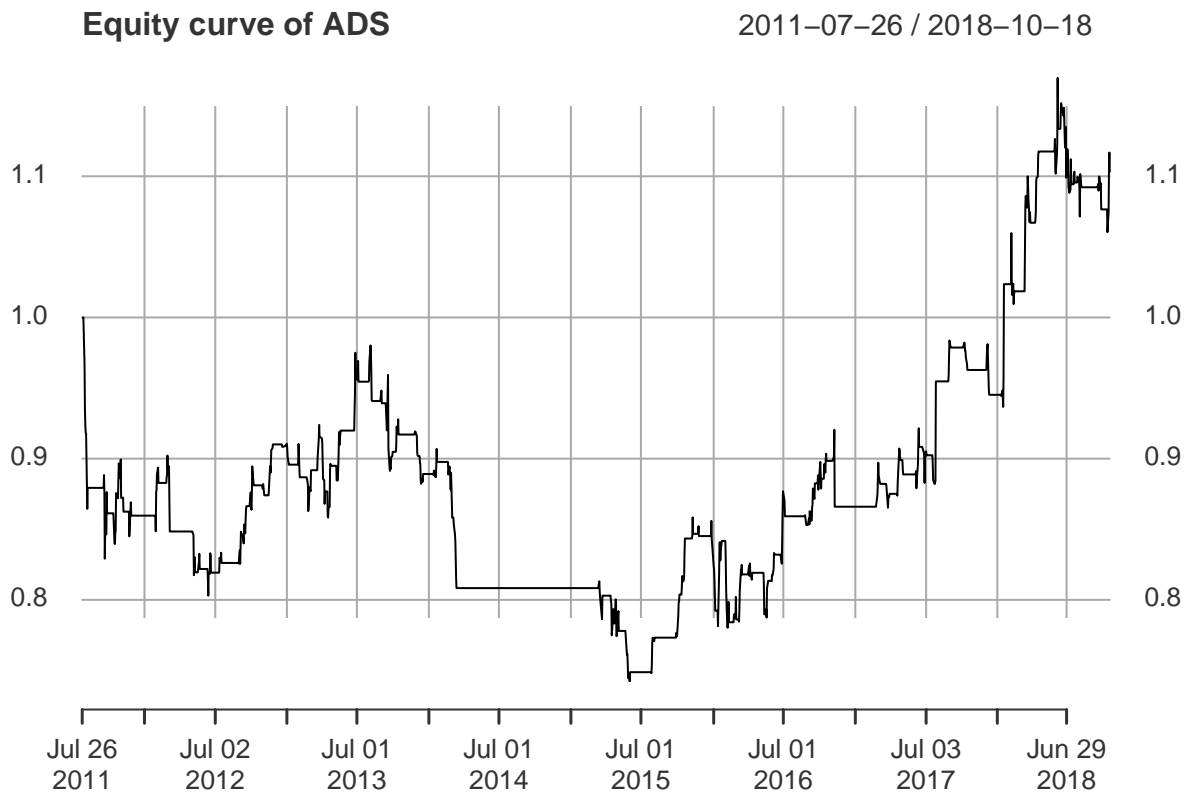
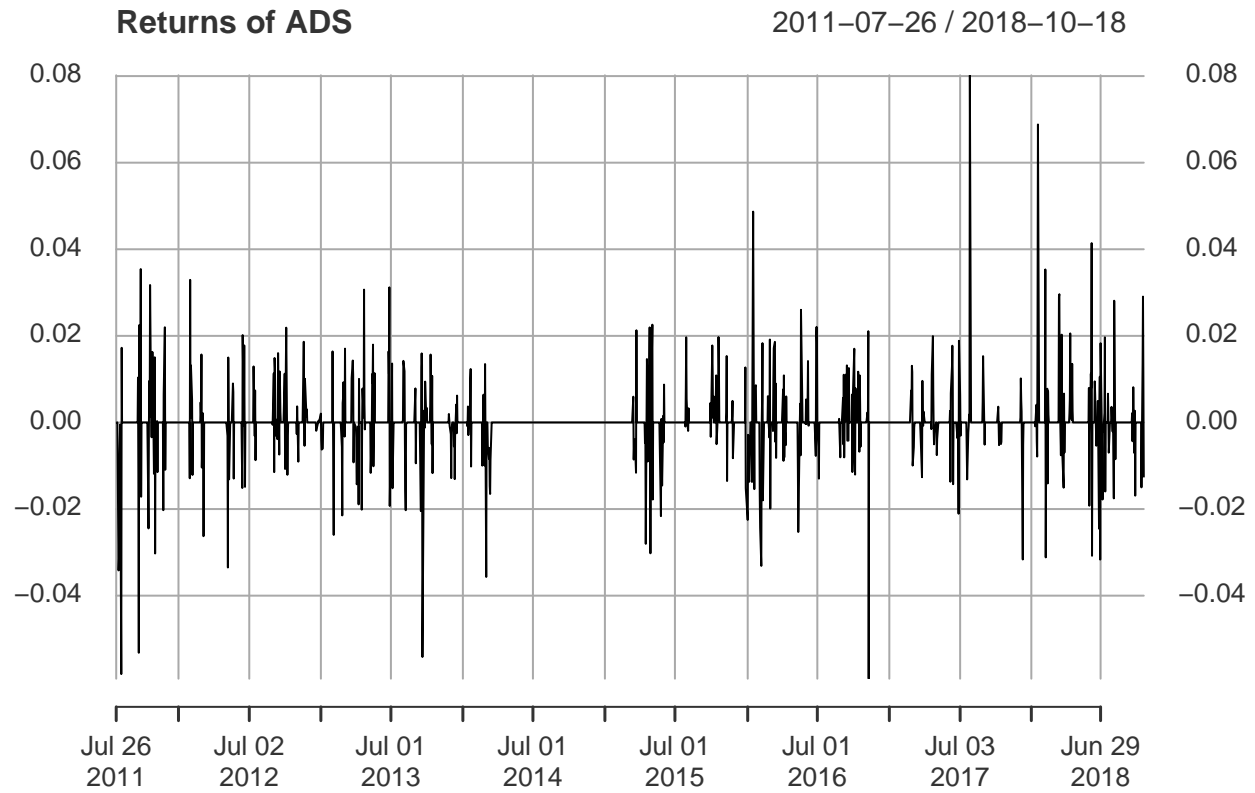
2011-07-26 / 2018-10-11



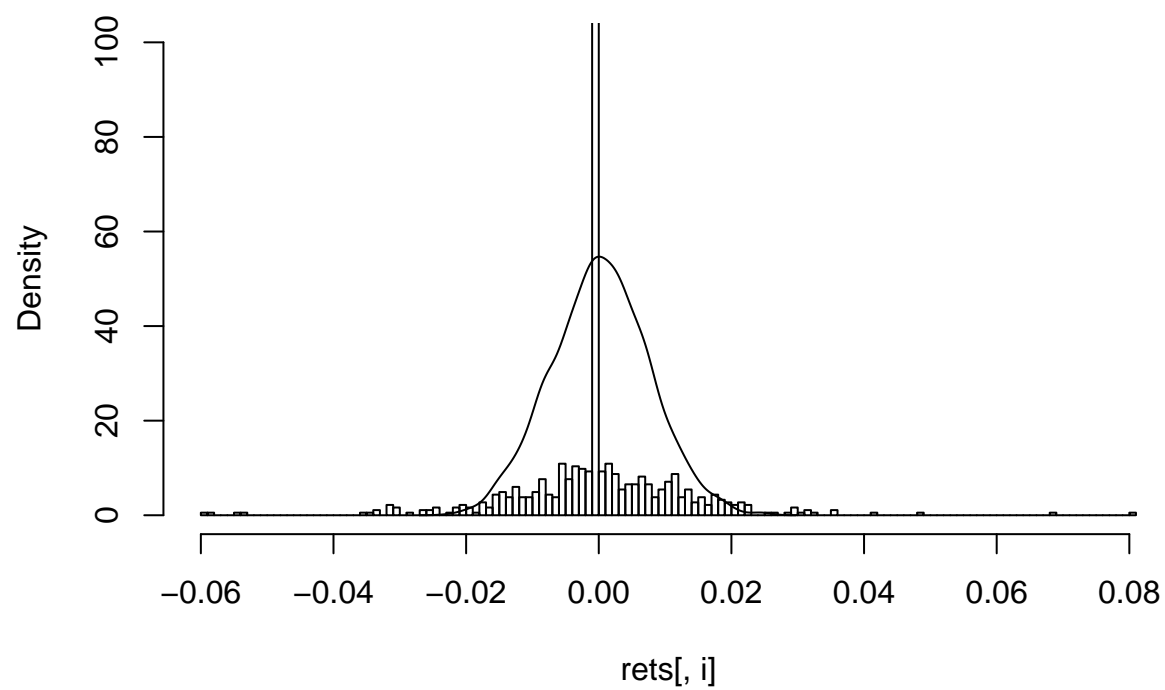
Calculations and visualizations based on returns

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

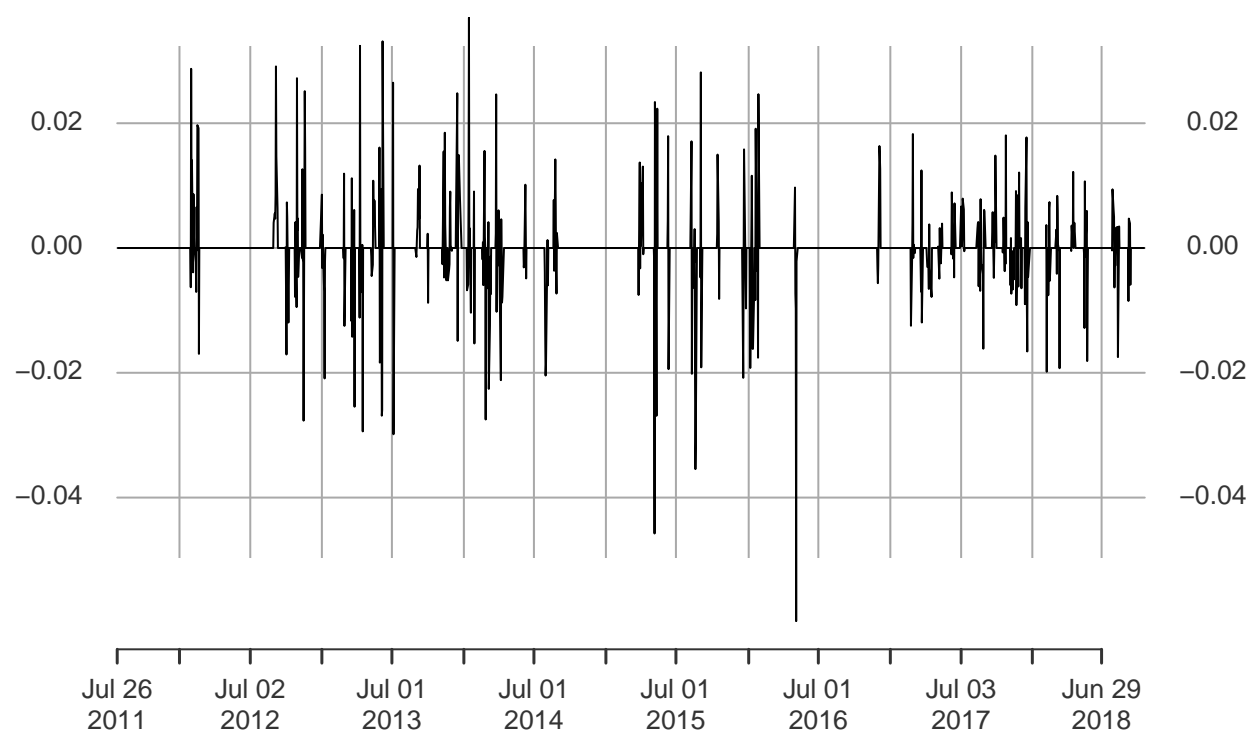


Histogram of Simple Returns of ADS



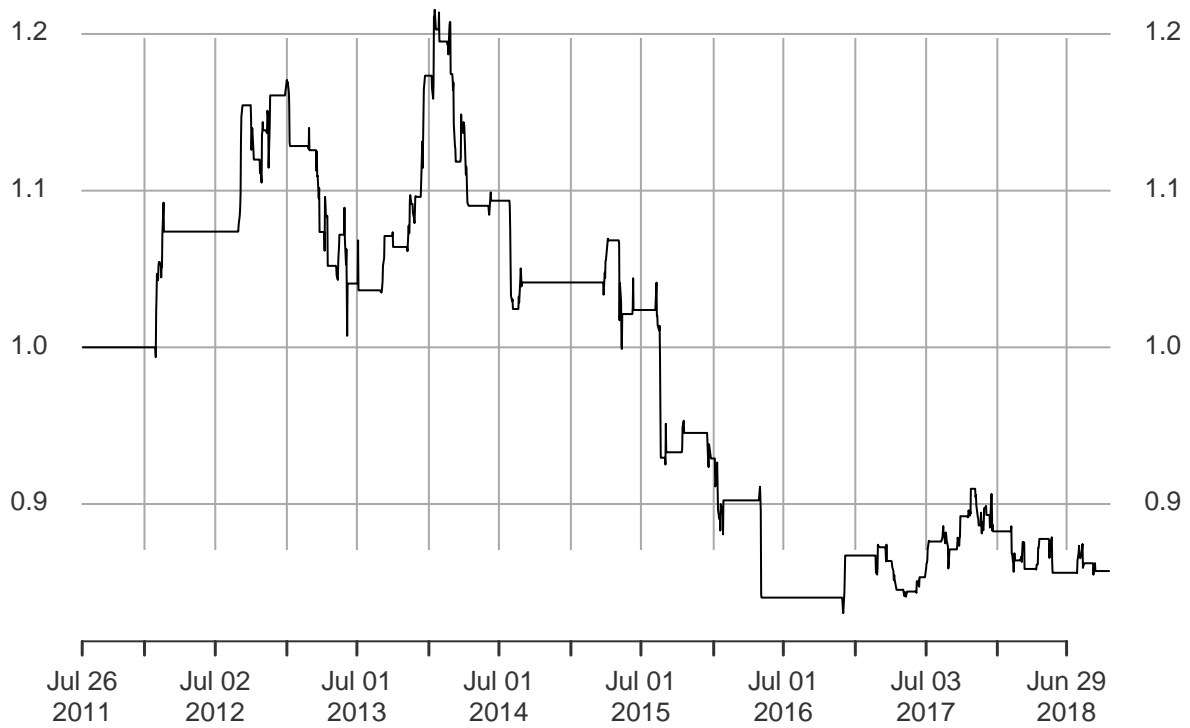
Returns of ALV

2011-07-26 / 2018-10-18

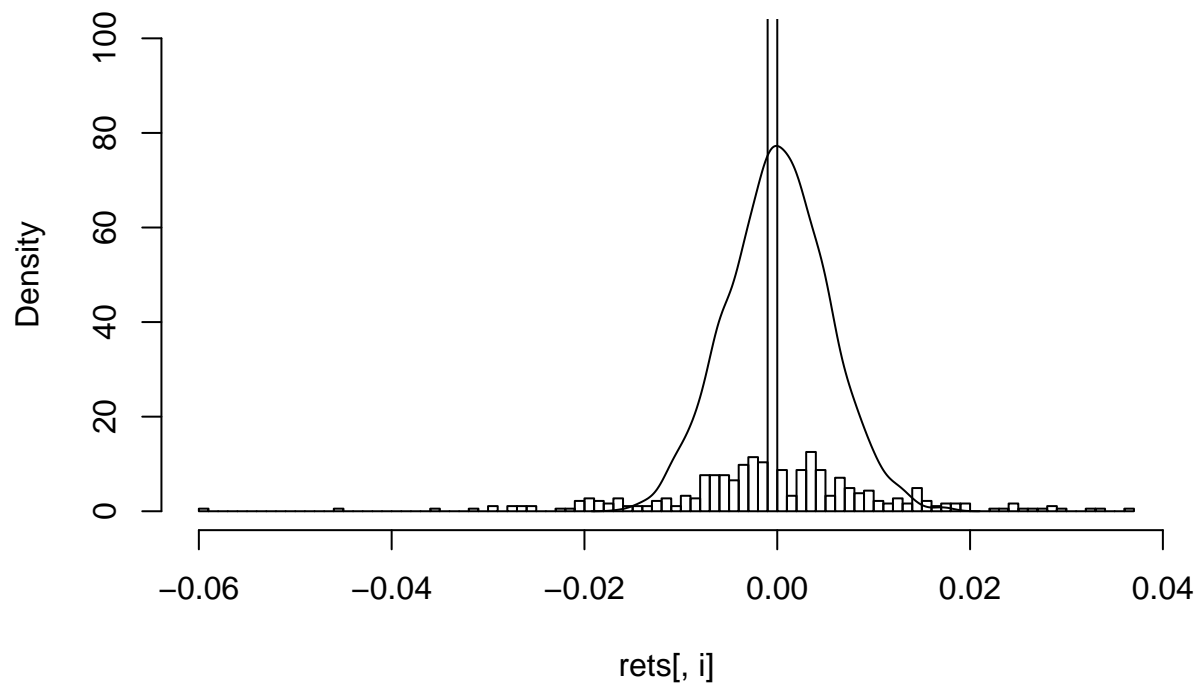


Equity curve of ALV

2011-07-26 / 2018-10-18

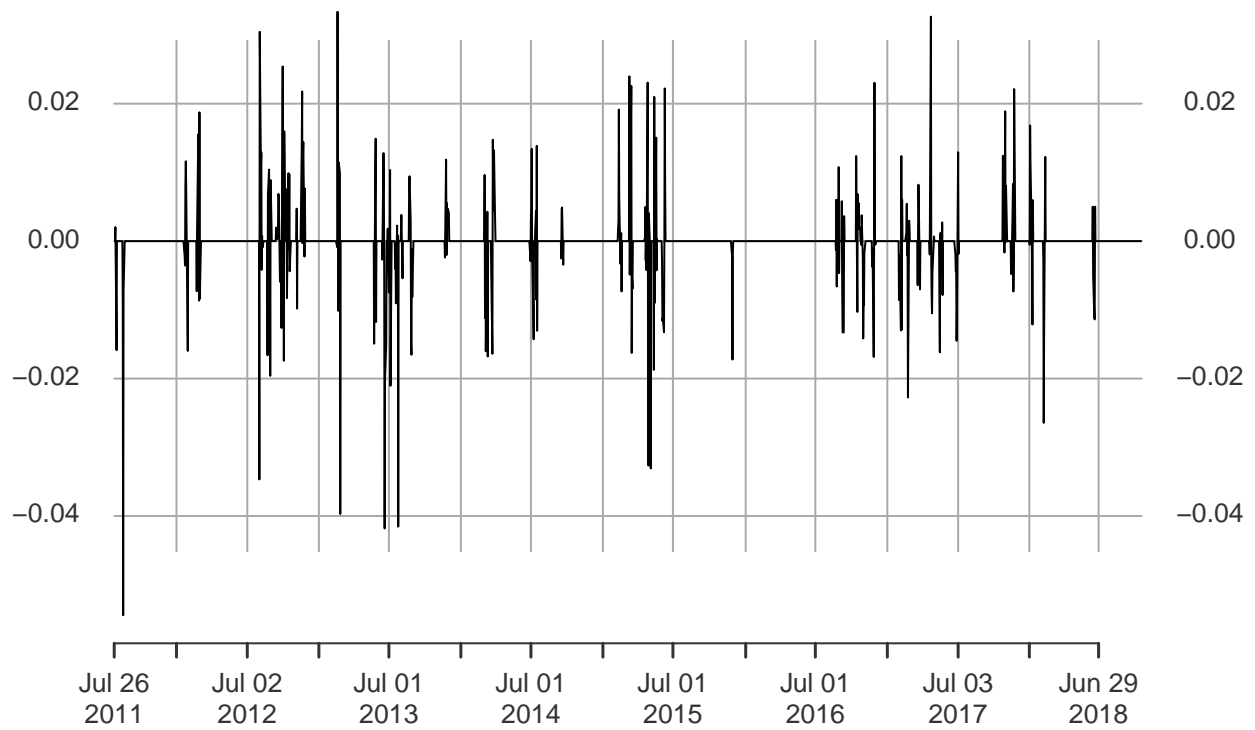


Histogram of Simple Returns of ALV



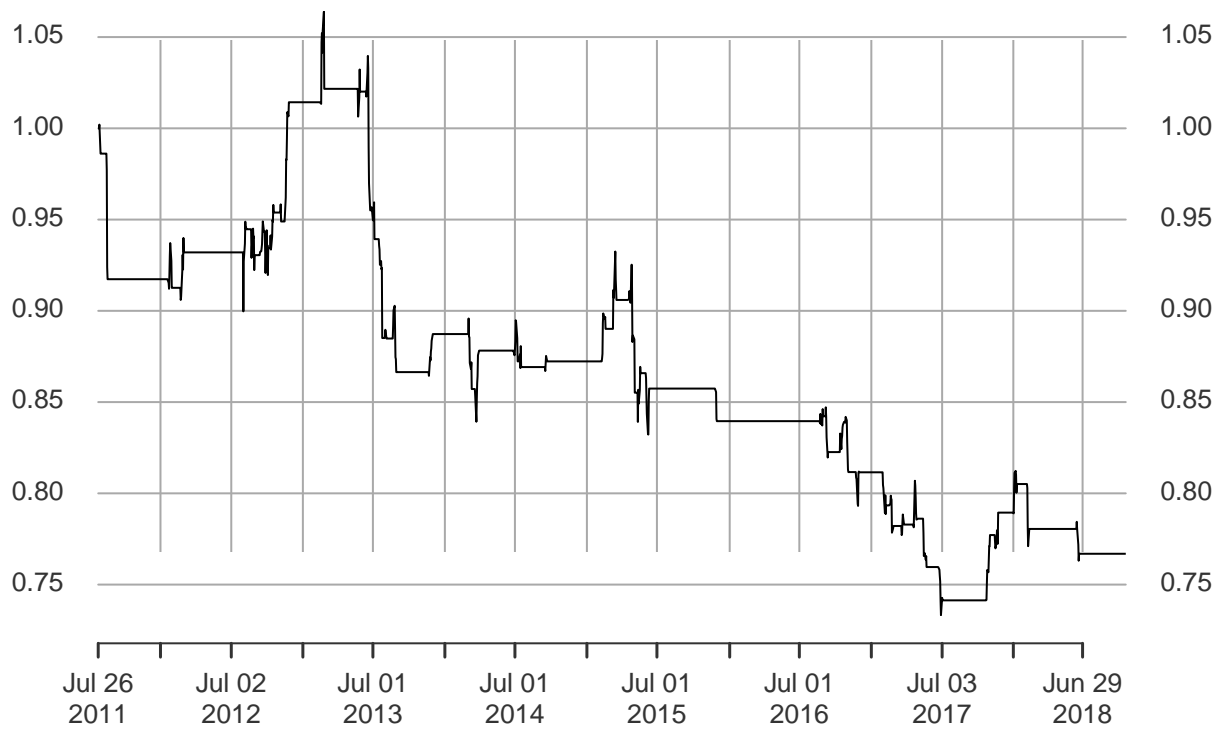
Returns of BAS

2011-07-26 / 2018-10-18

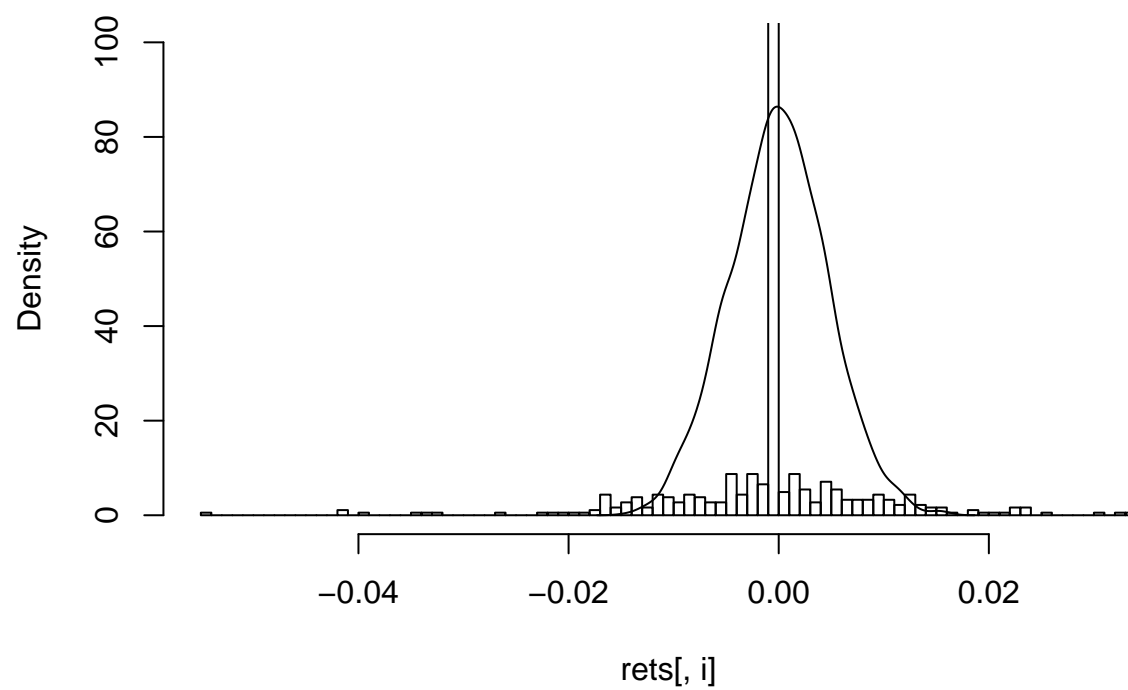


Equity curve of BAS

2011-07-26 / 2018-10-18

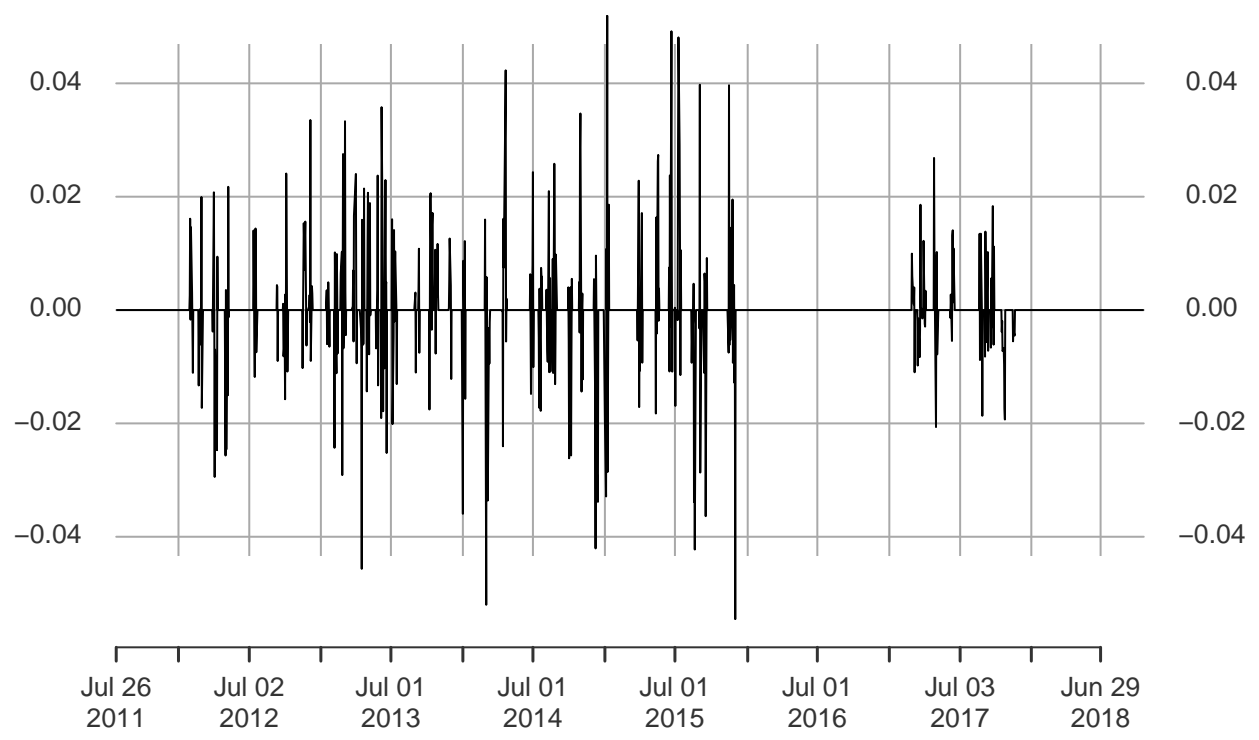


Histogram of Simple Returns of BAS



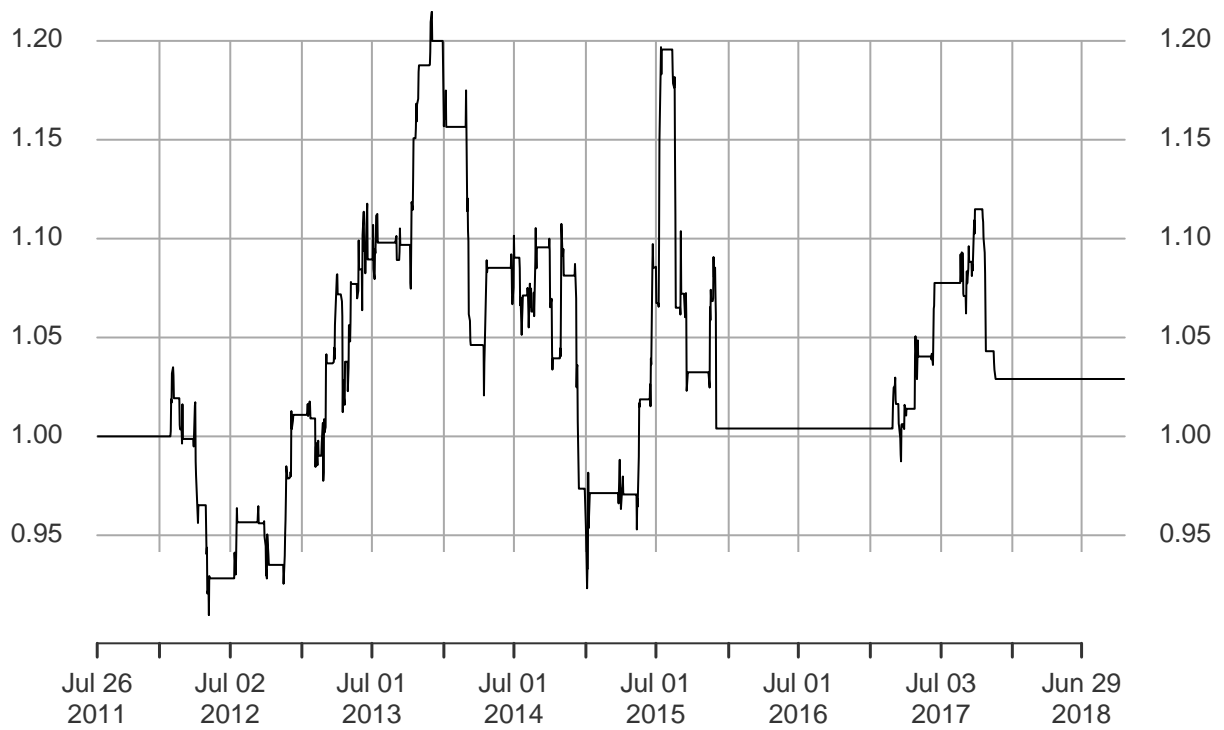
Returns of BAY

2011-07-26 / 2018-10-18

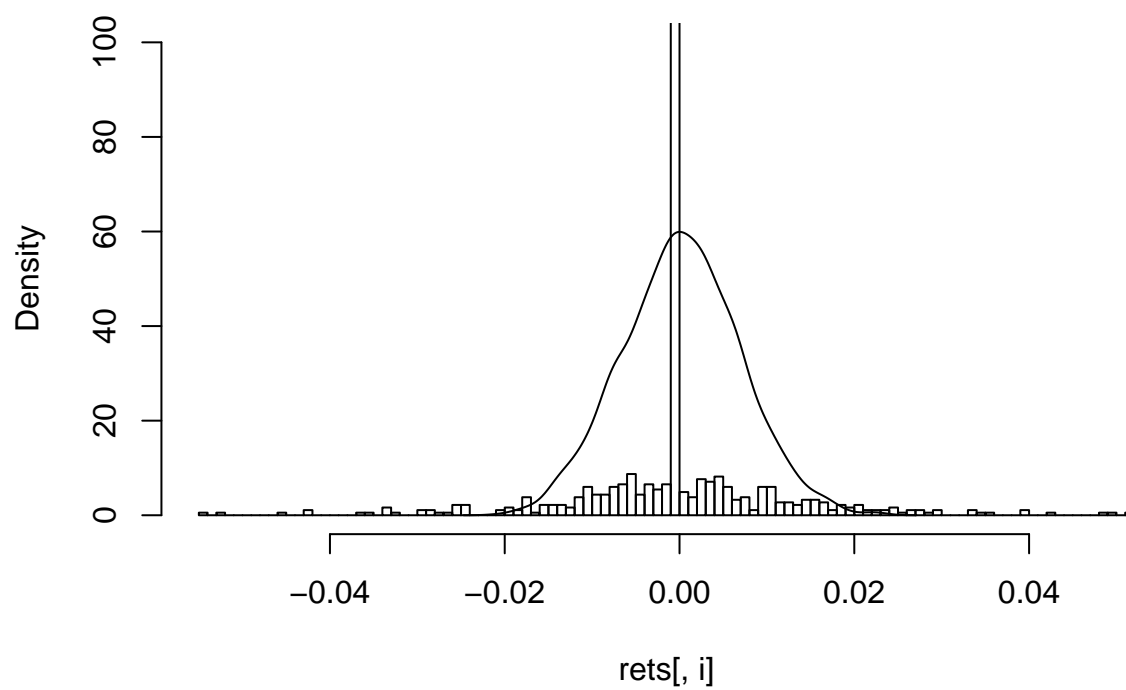


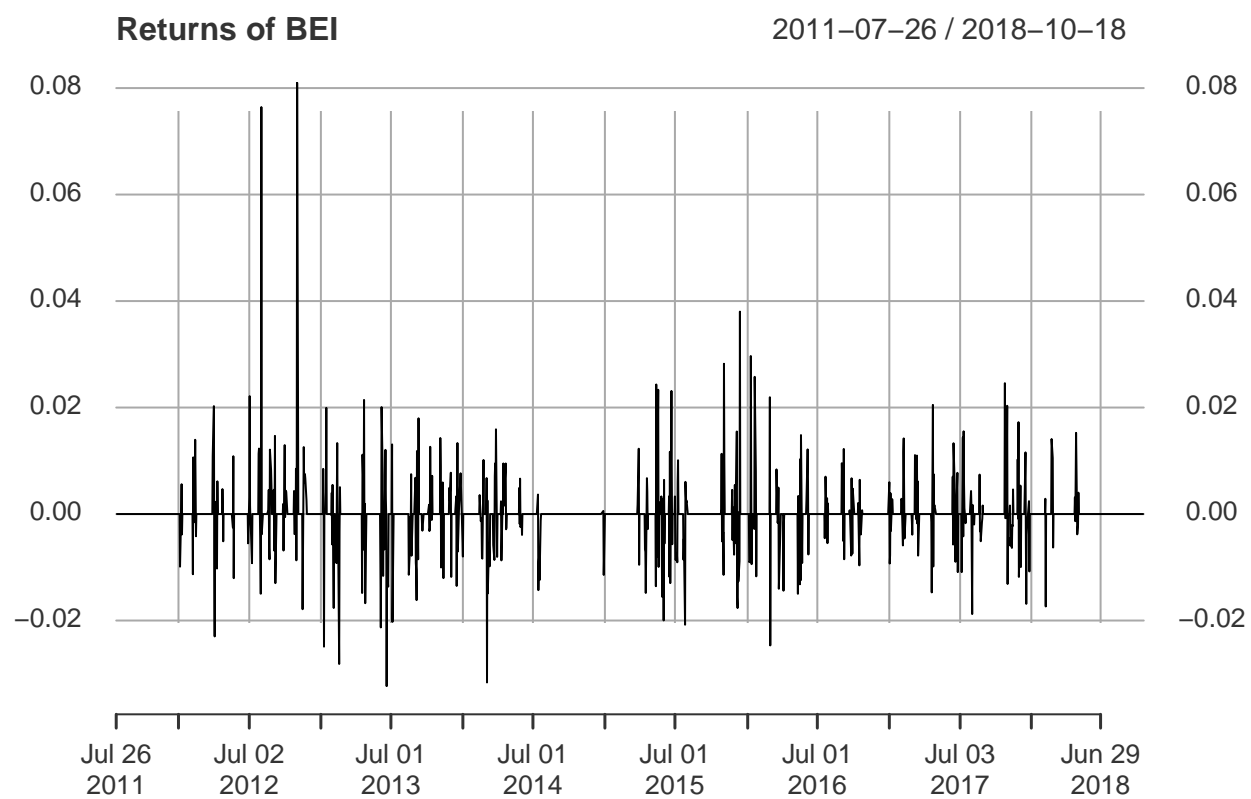
Equity curve of BAY

2011-07-26 / 2018-10-18



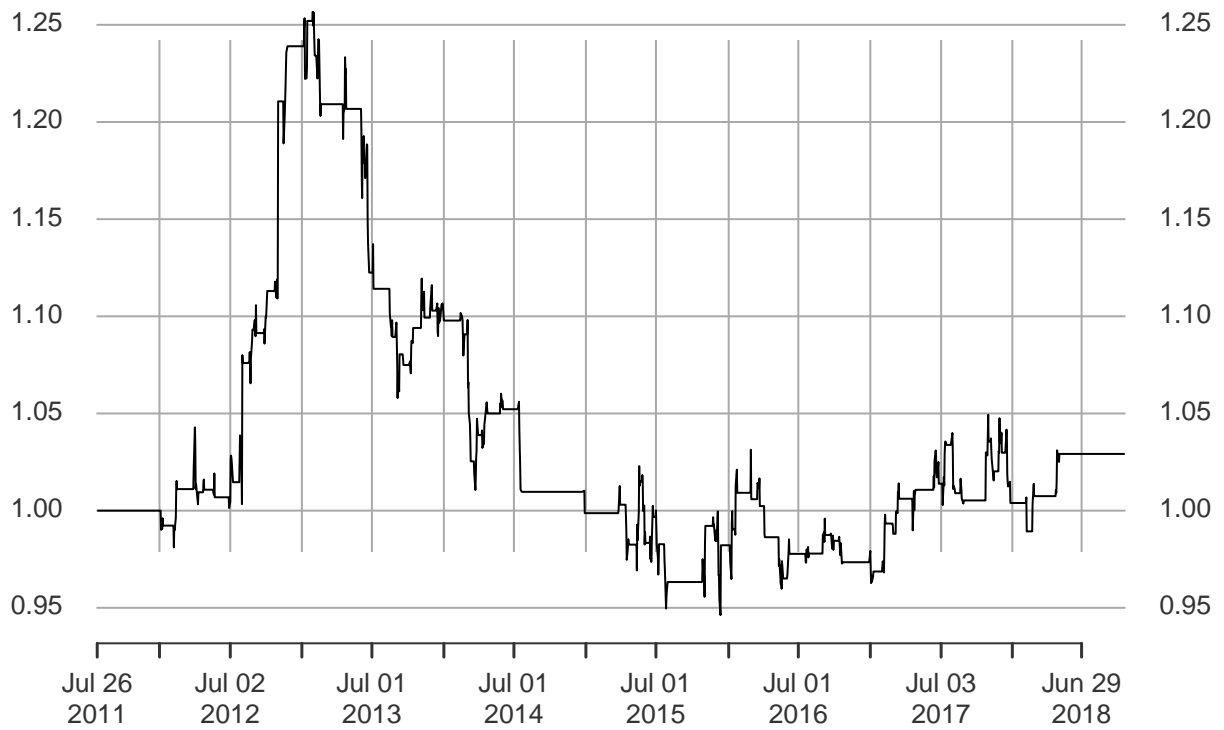
Histogram of Simple Returns of BAY



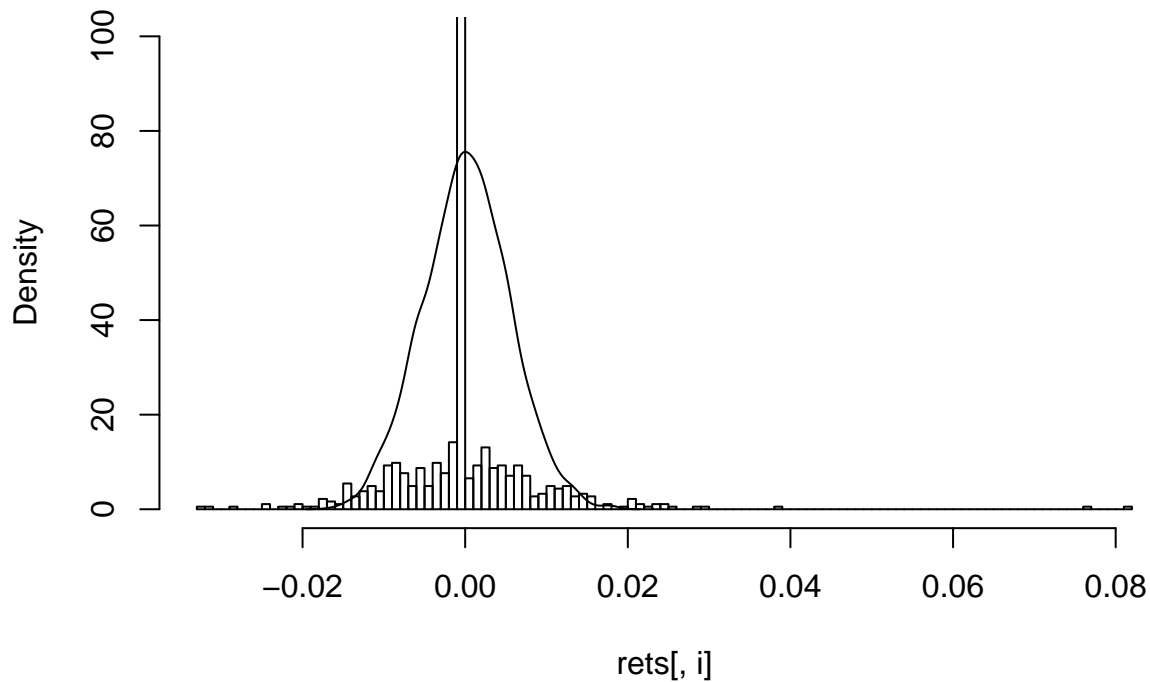


Equity curve of BEI

2011-07-26 / 2018-10-18



Histogram of Simple Returns of BEI



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 confidence level 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 257.43 per day."
```

```
## [1] "Given a 10000 investment in ALV we would expect a maximum loss of 196.9 per day."
```

```
## [1] "Given a 10000 investment in BAS we would expect a maximum loss of 164.82 per day."
```

```
## [1] "Given a 10000 investment in BAY we would expect a maximum loss of 256.62 per day."
```

```
## [1] "Given a 10000 investment in BEI we would expect a maximum loss of 156.06 per day."
```

Conclusion and Suggestions