

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 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 <- '2000::2018'
emaPeriod <- 400
maxHoldingPeriod <- 20

InstrumentDirectory <- "~/Desktop/R/DownloadedData/"
instrumentlist <- c("BAY.csv", "DBK.csv", "HEI.csv", "TKA.csv", "VOW.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)

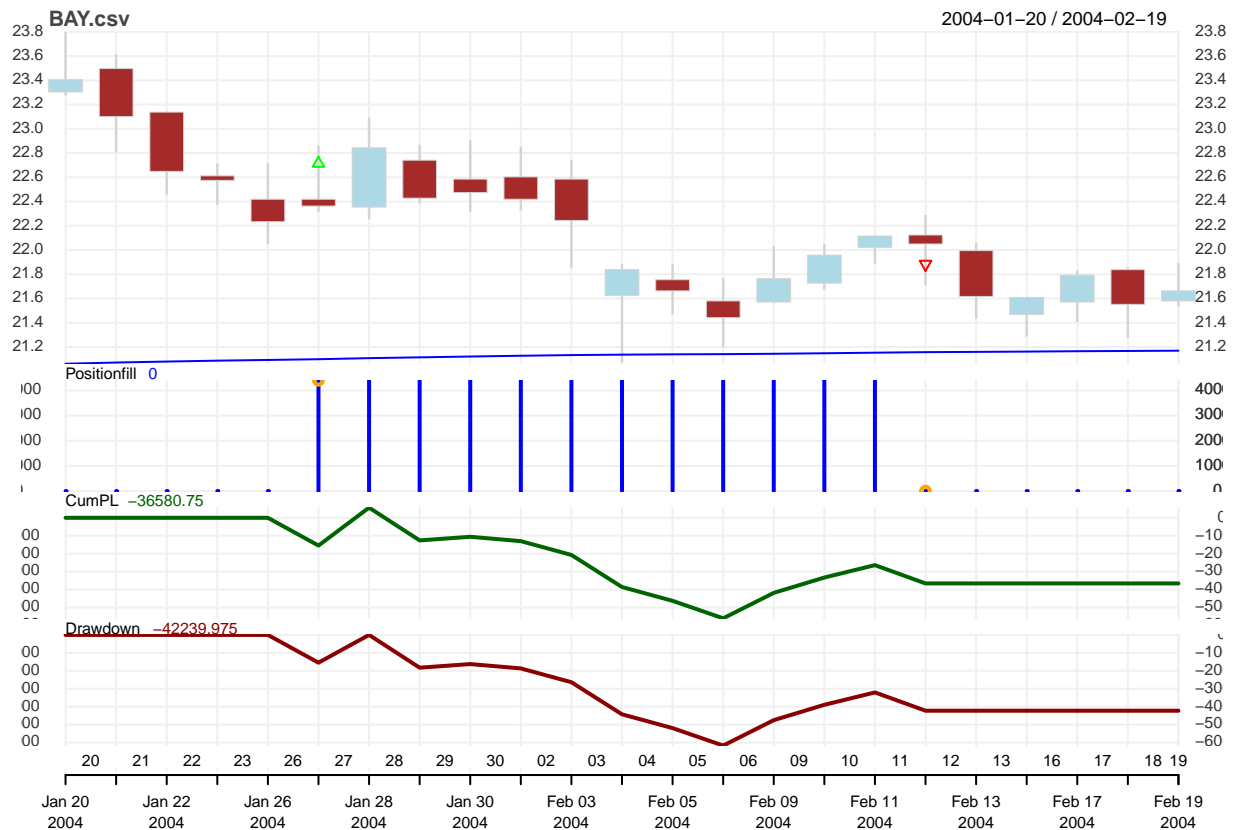
  # Create a list of transactions to check
  for (i in

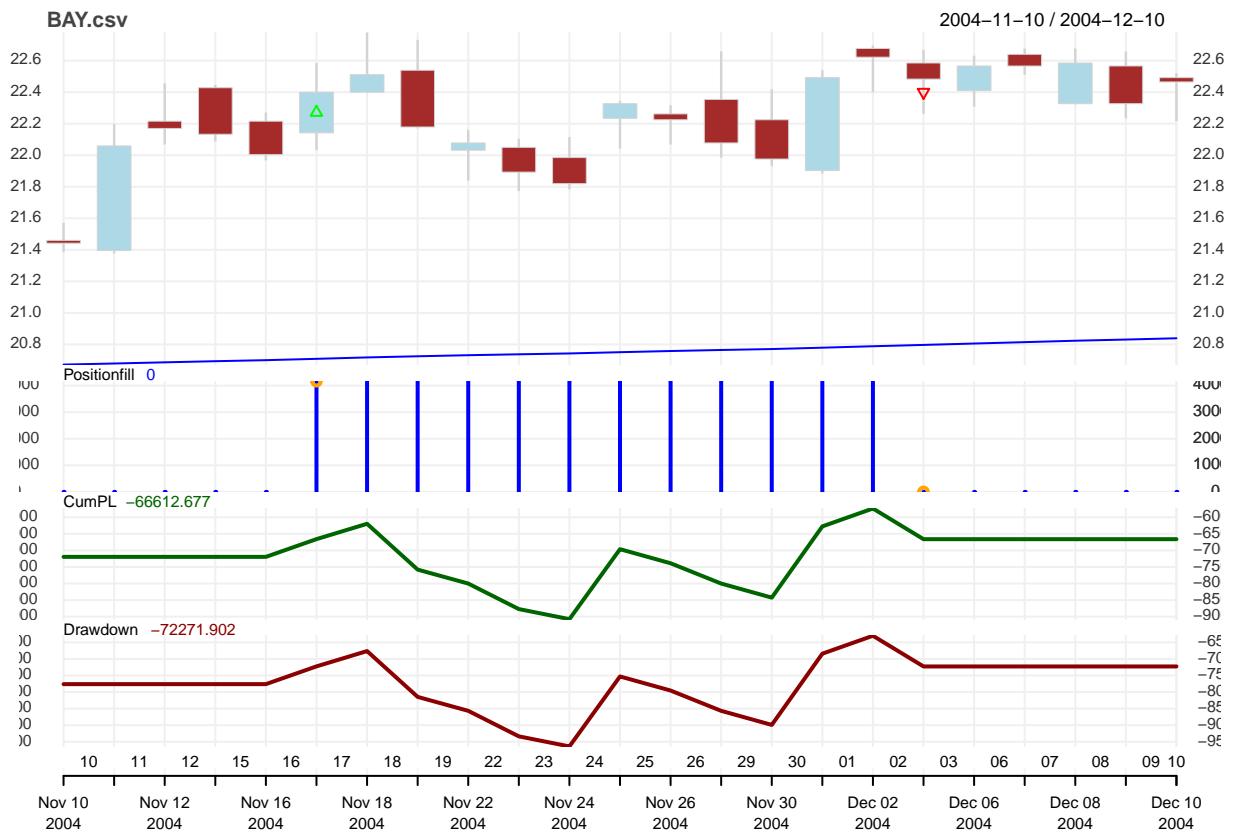
```

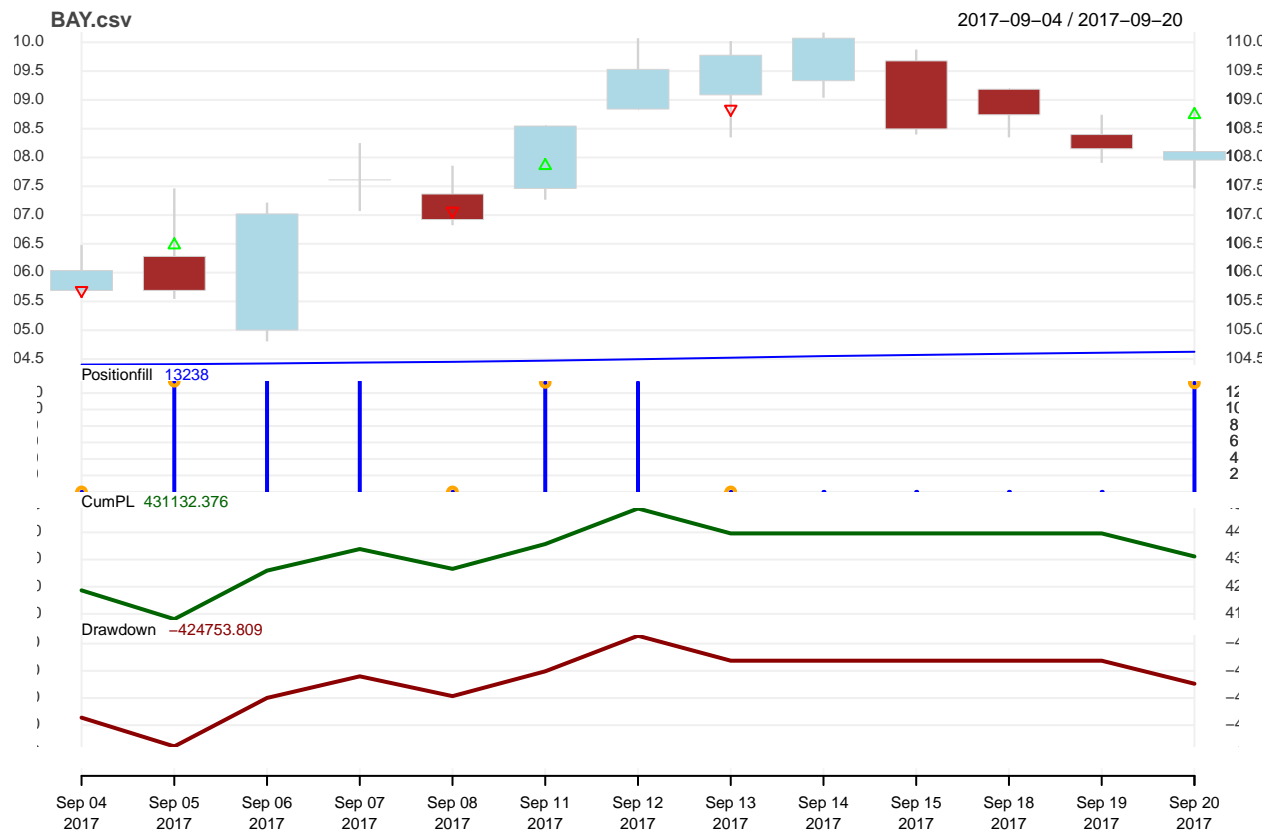
```

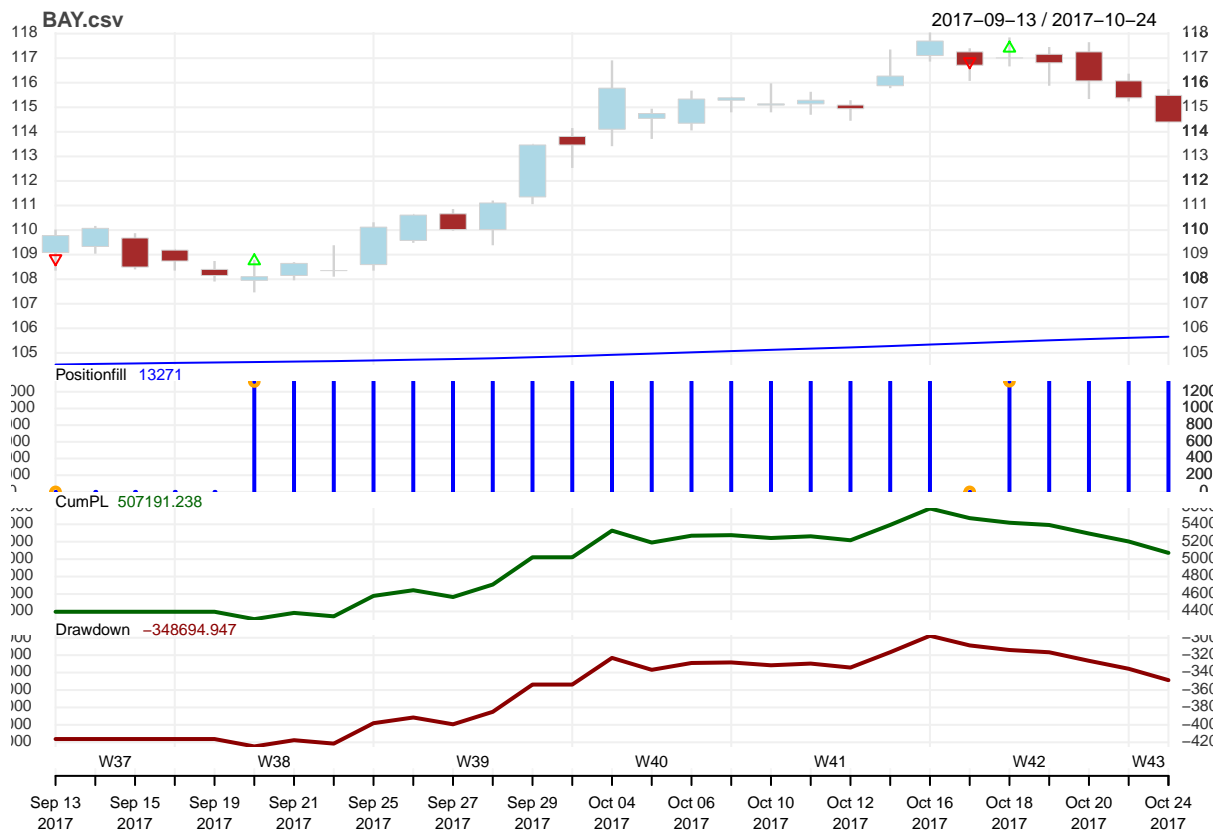
    c(2,6, (nrow(transactionsInstrument)-7),(nrow(transactionsInstrument)-5))) {
  from <- as.Date(index(transactionsInstrument[i,1]))-7
  to <- as.Date(index(transactionsInstrument[i+1,1]))+7
  daterange_check <- c(daterange_check, paste(from, ":", to, sep = ""))
}
# Plot the transactions and check them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

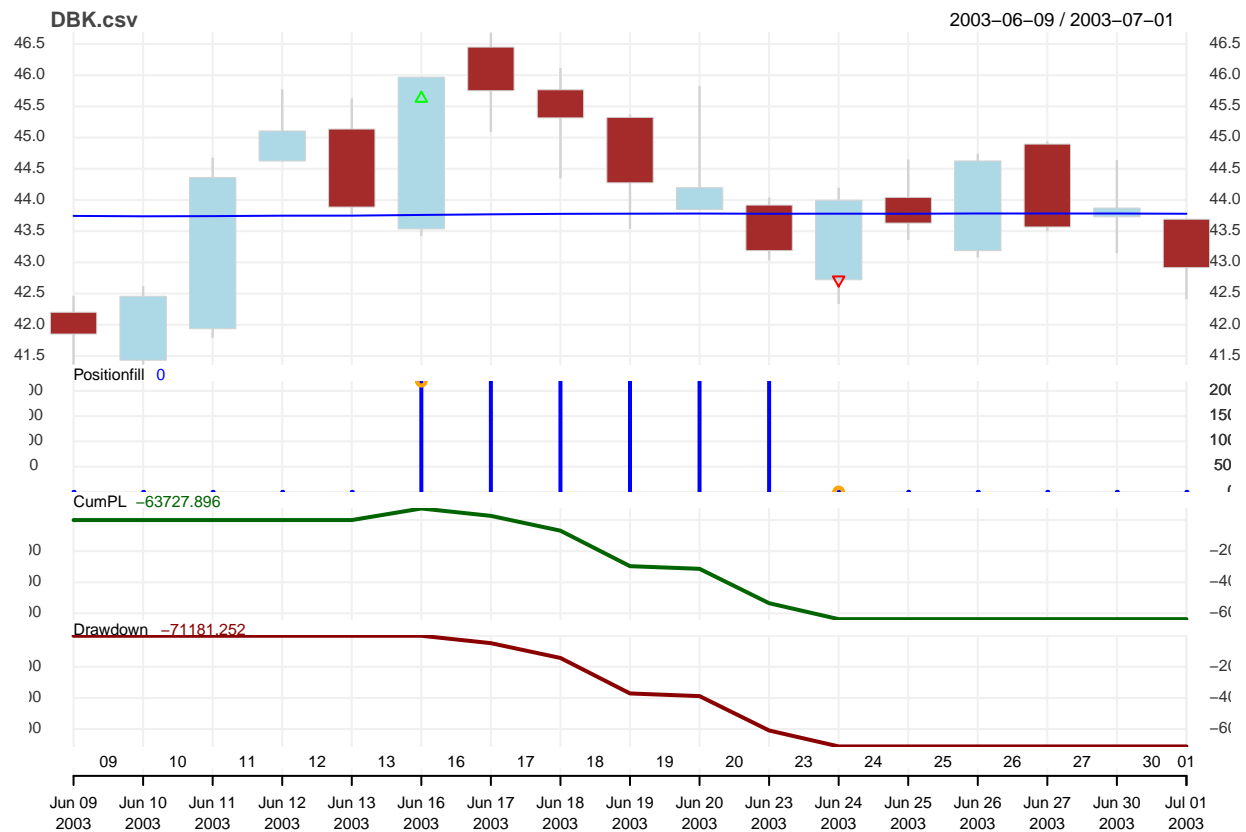
```



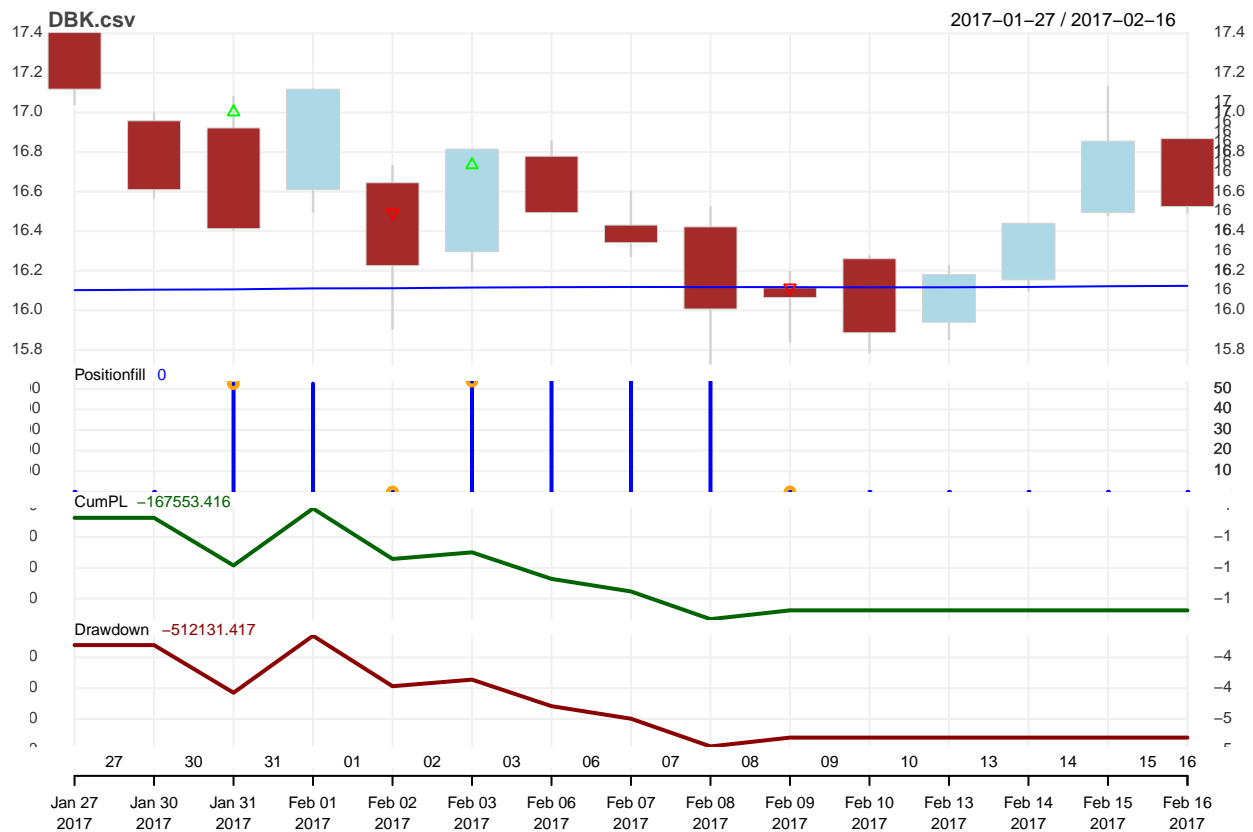


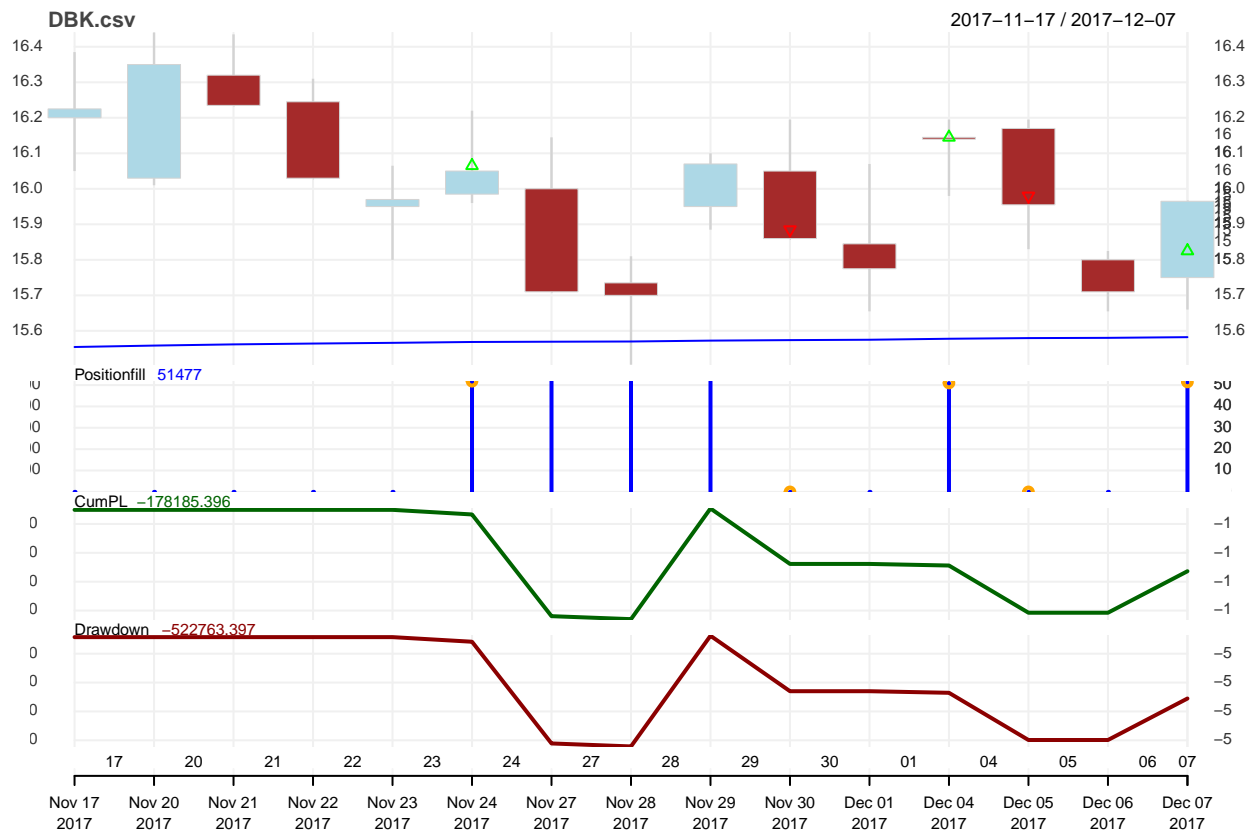


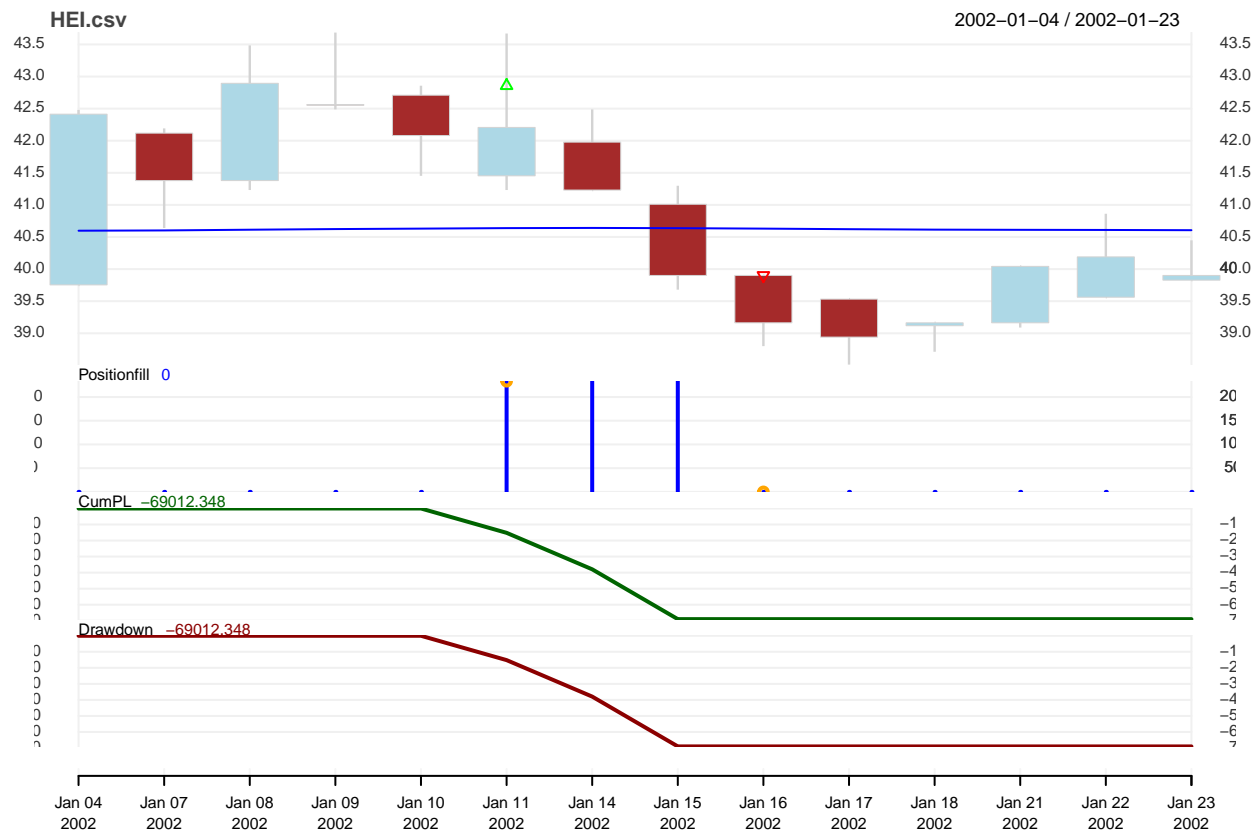




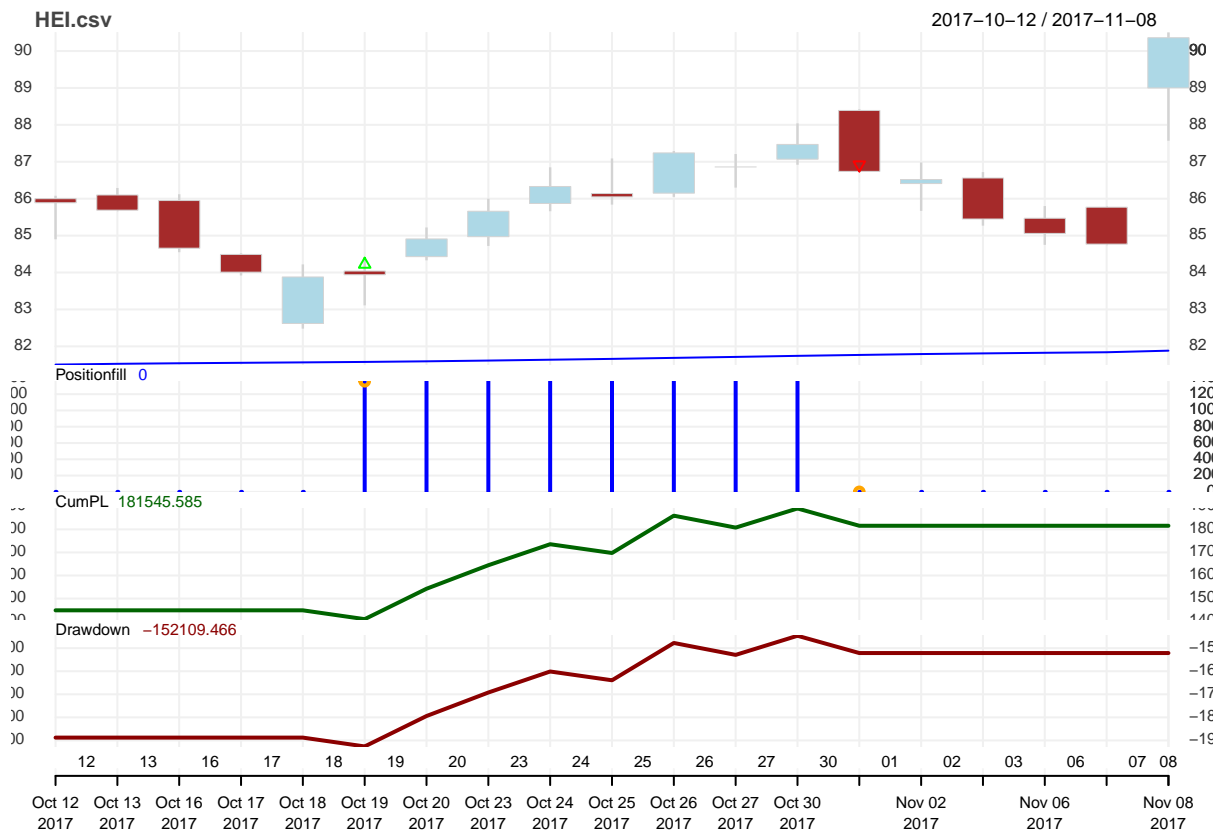




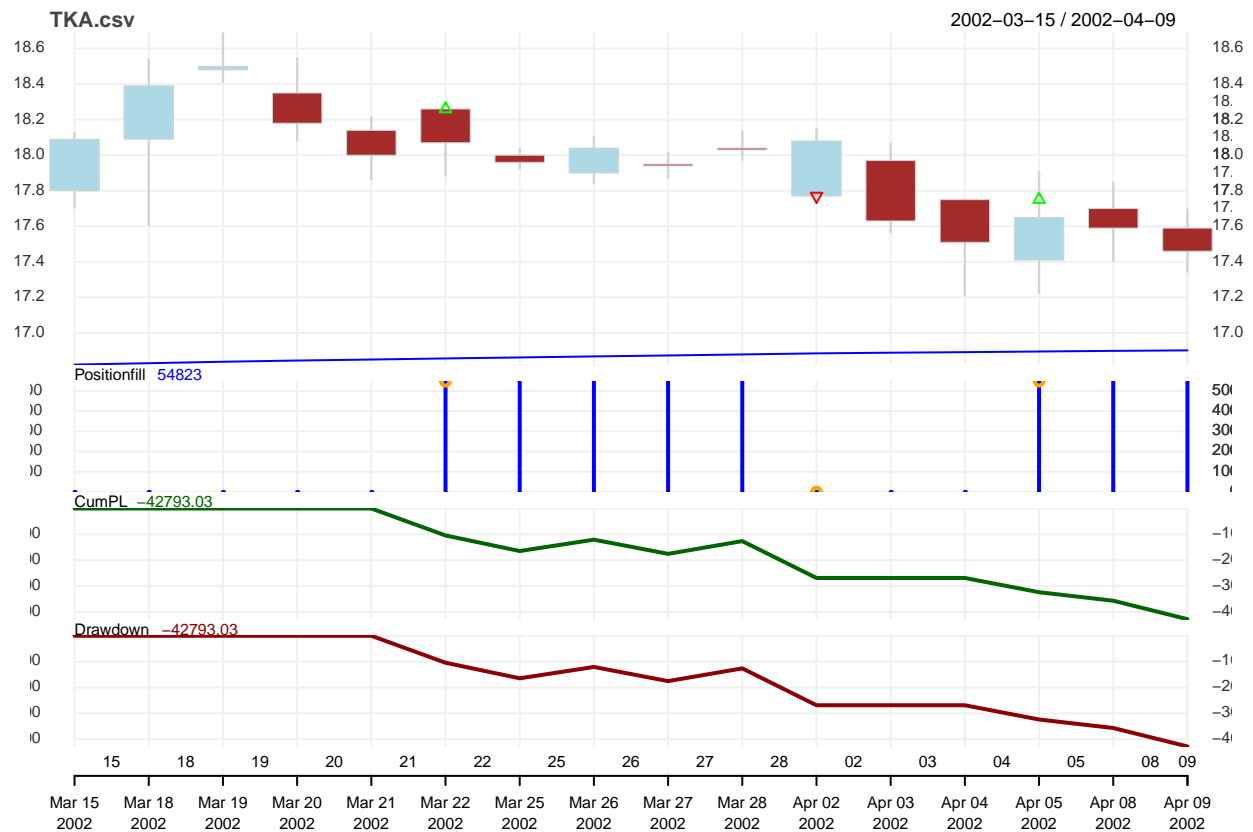


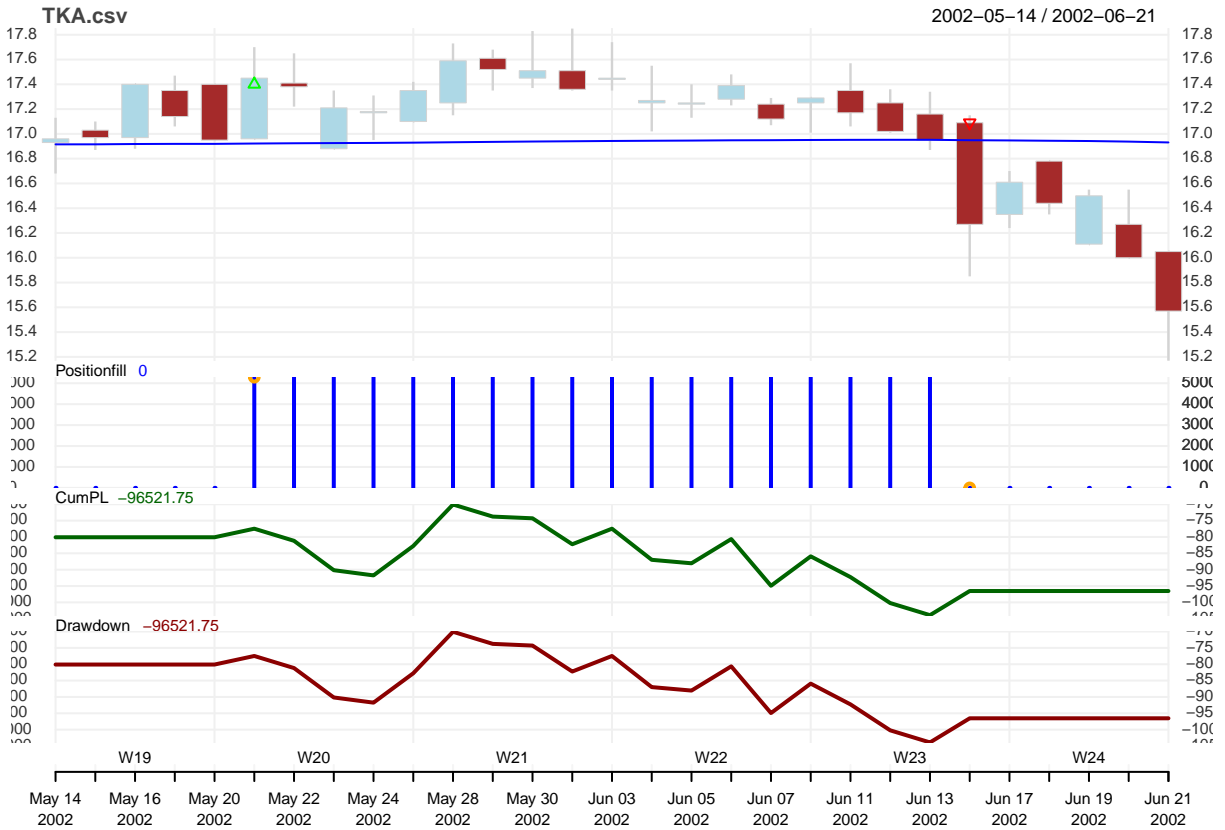


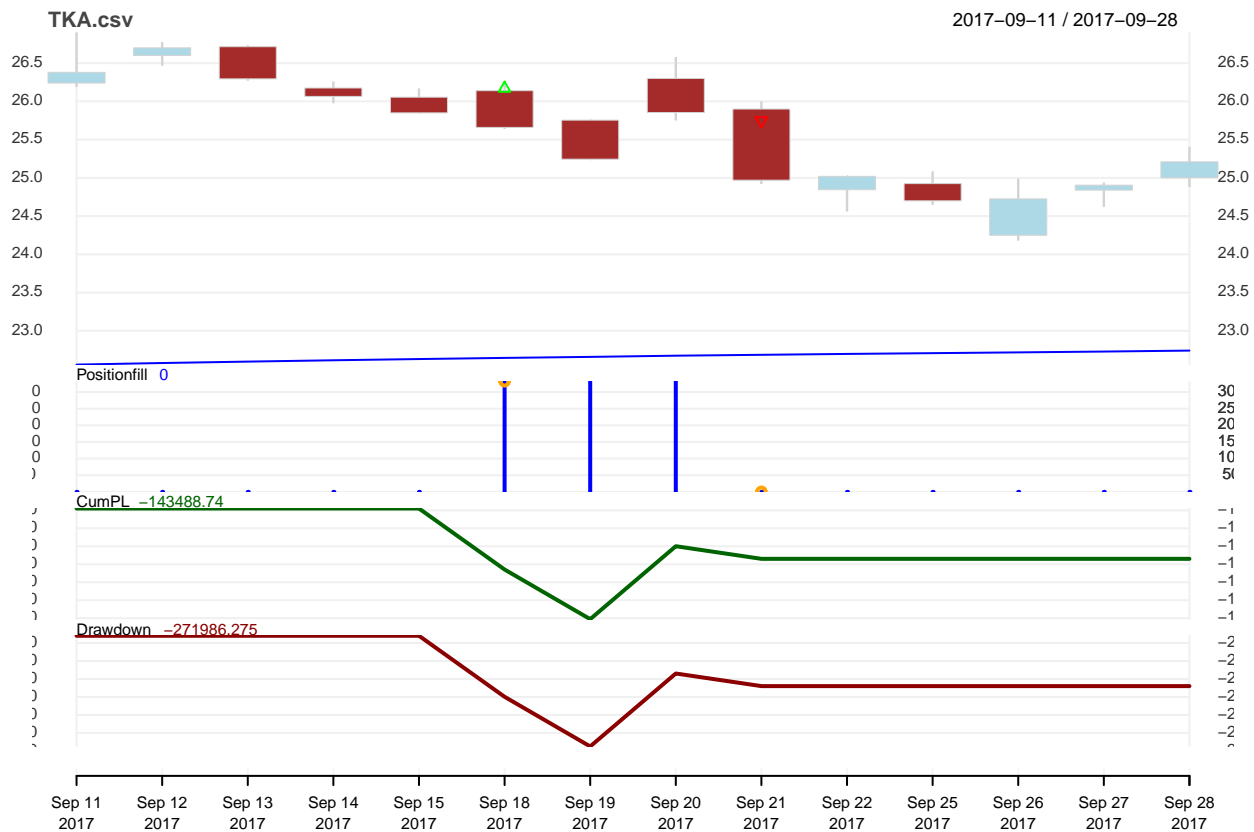


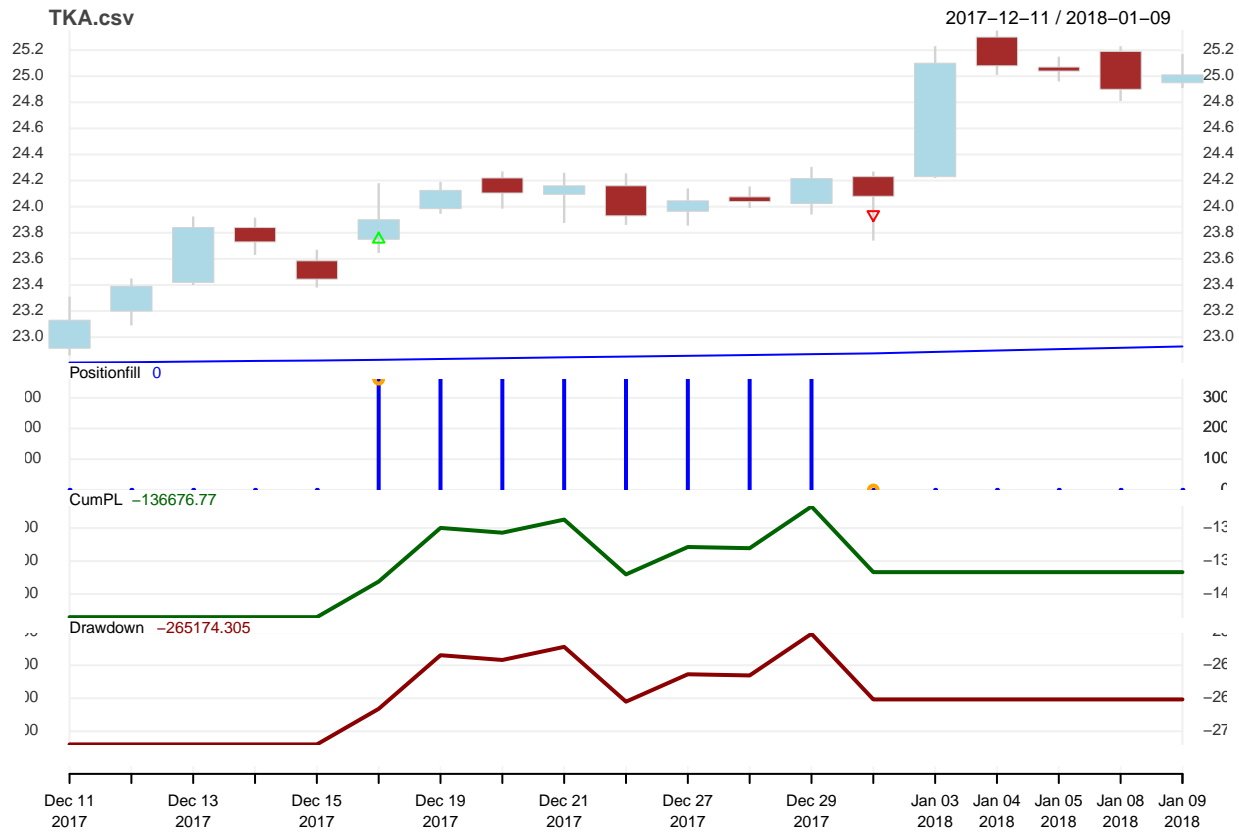


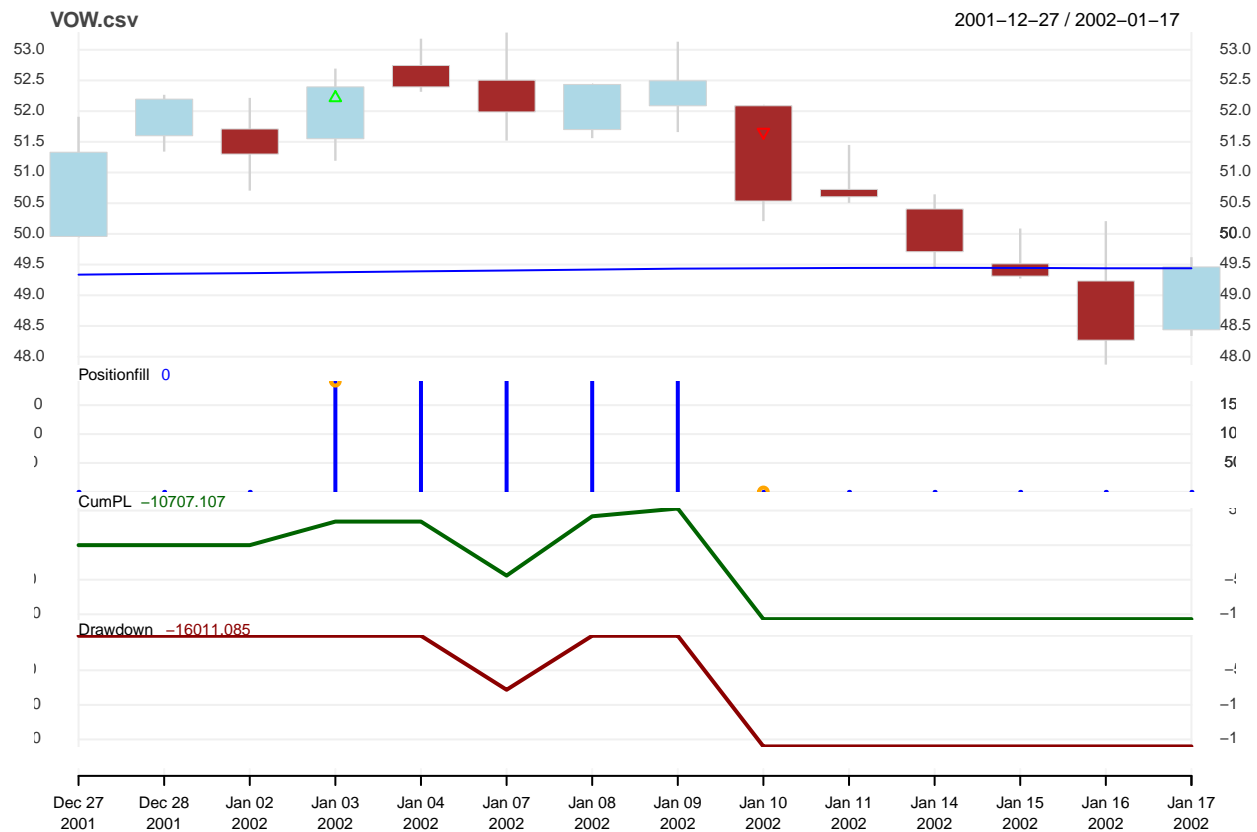


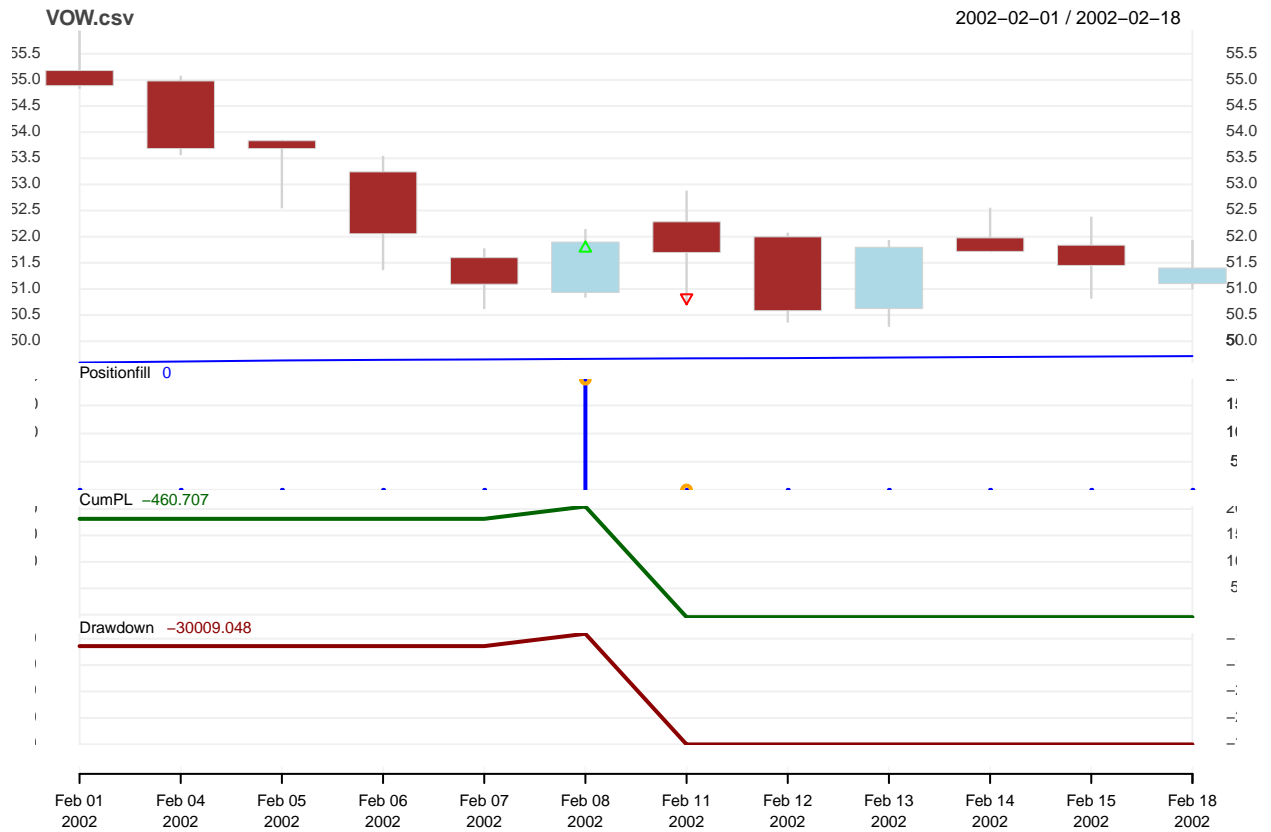


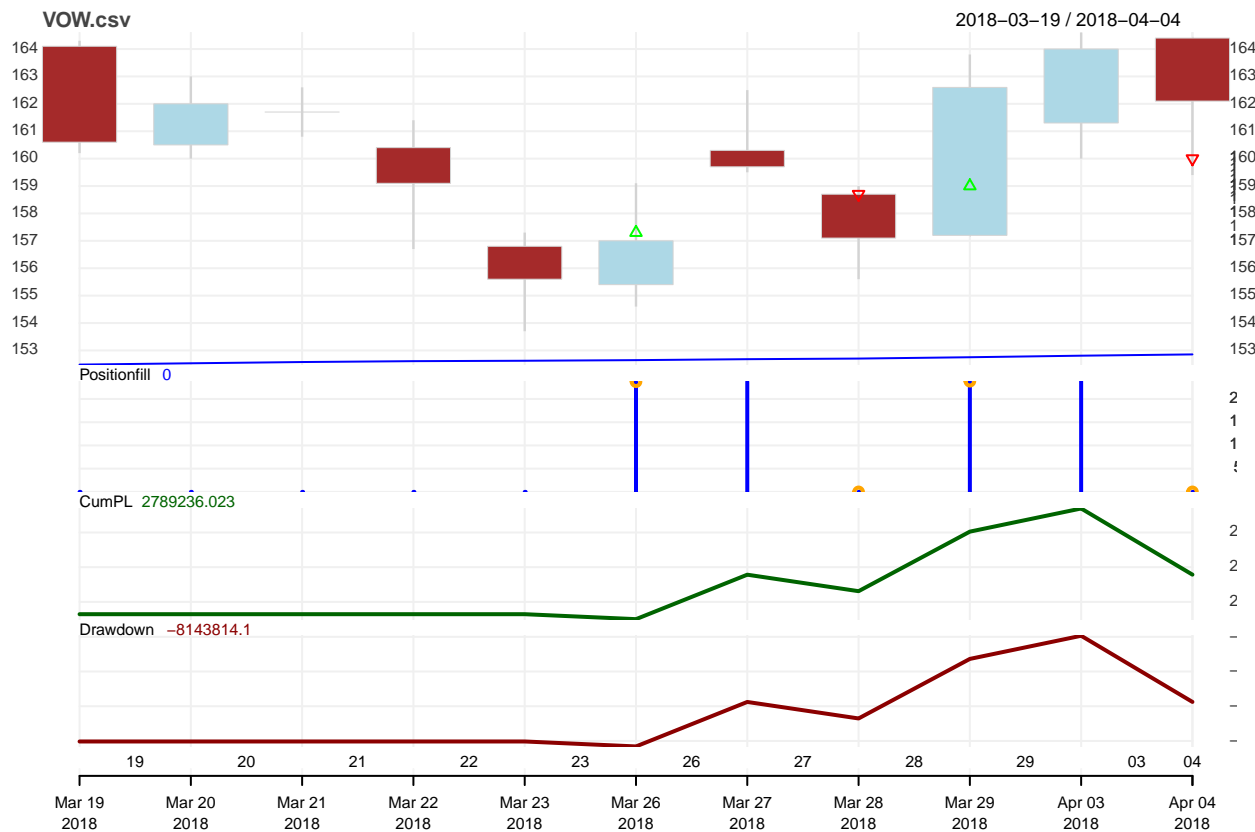


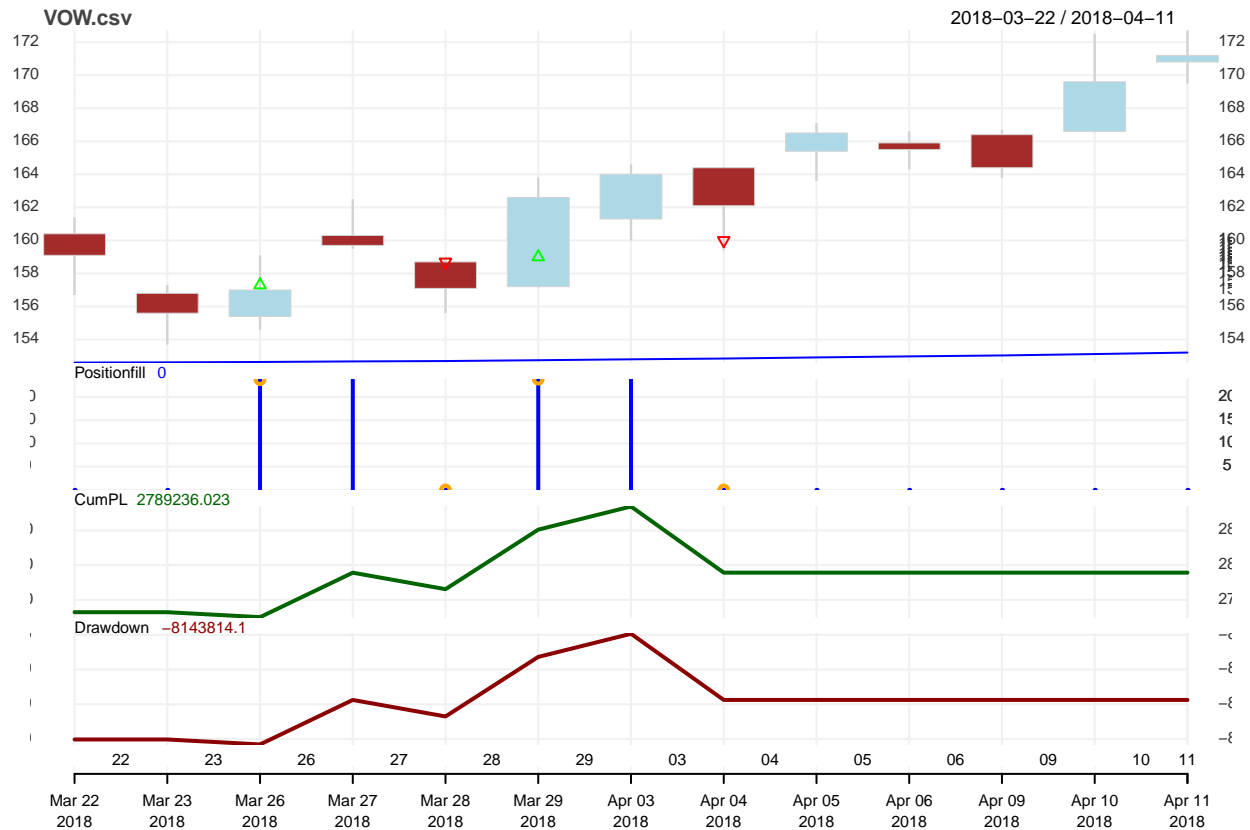












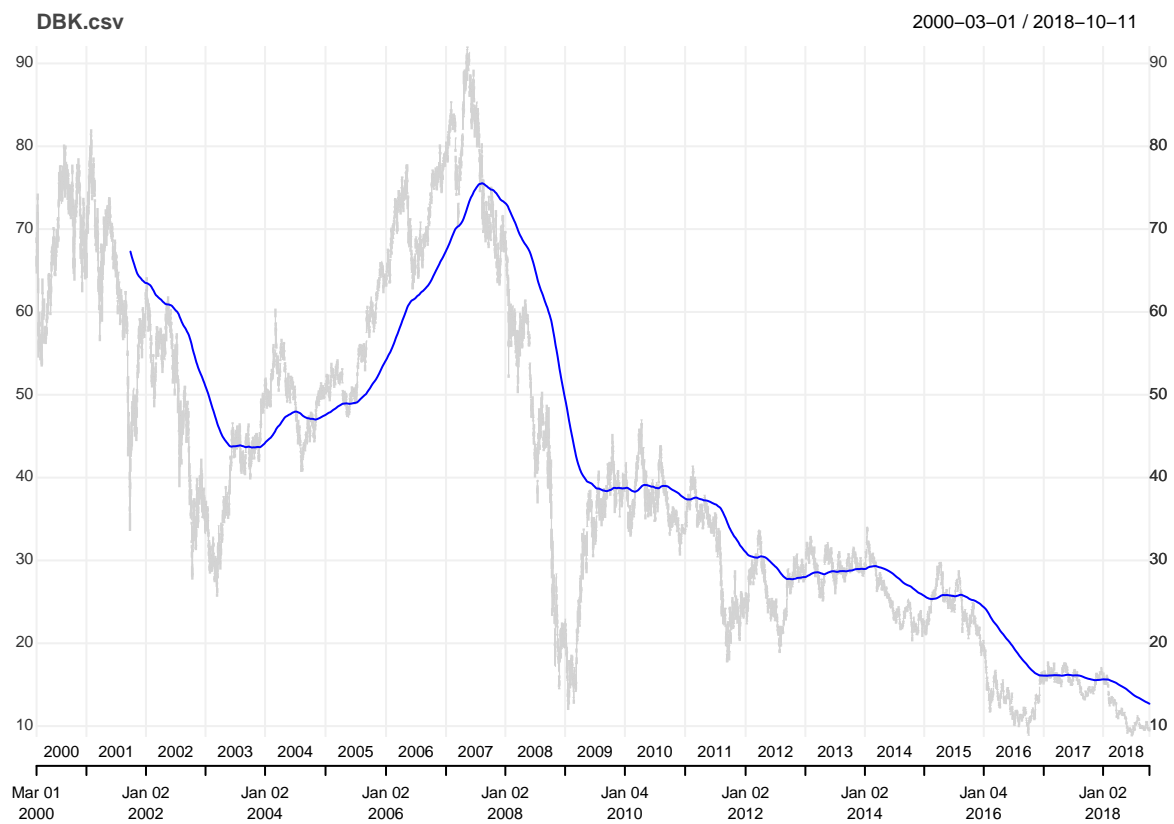
Part C: Analysis and Reporting

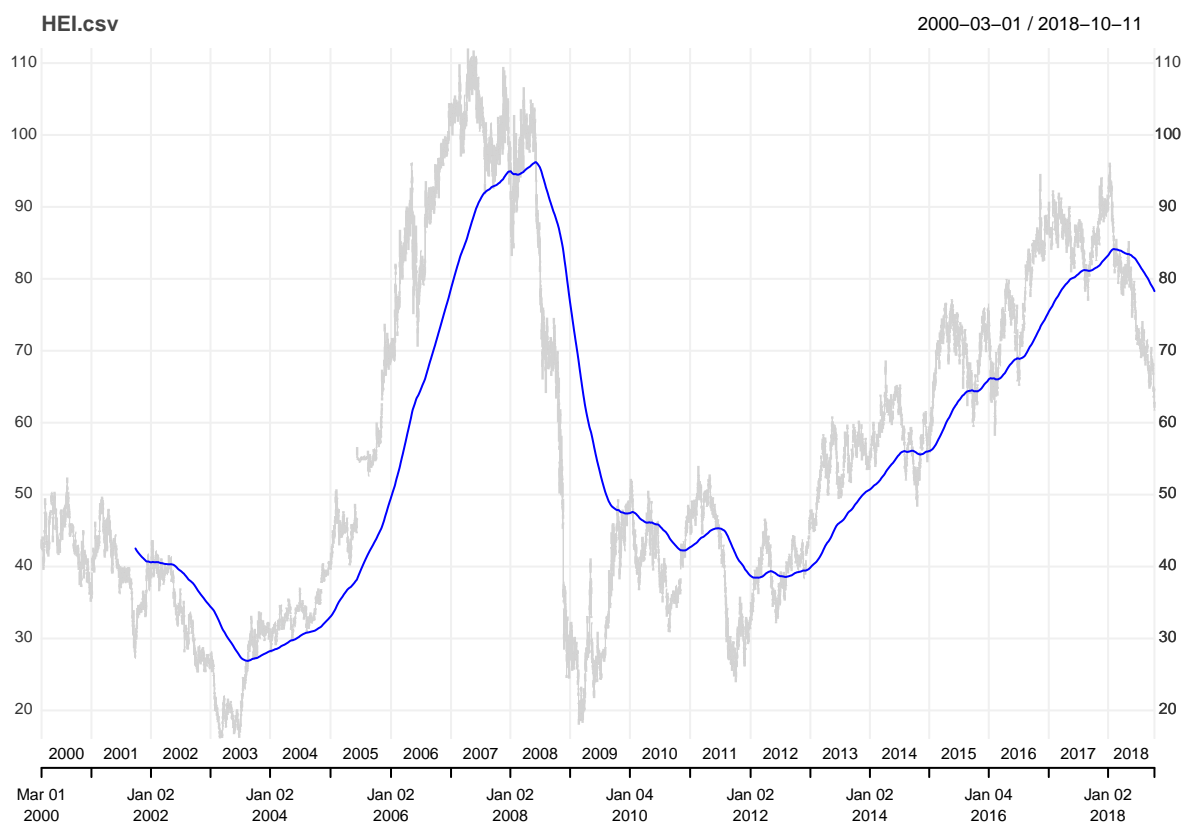
Step 1: Visualize original data

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')"))
}
```

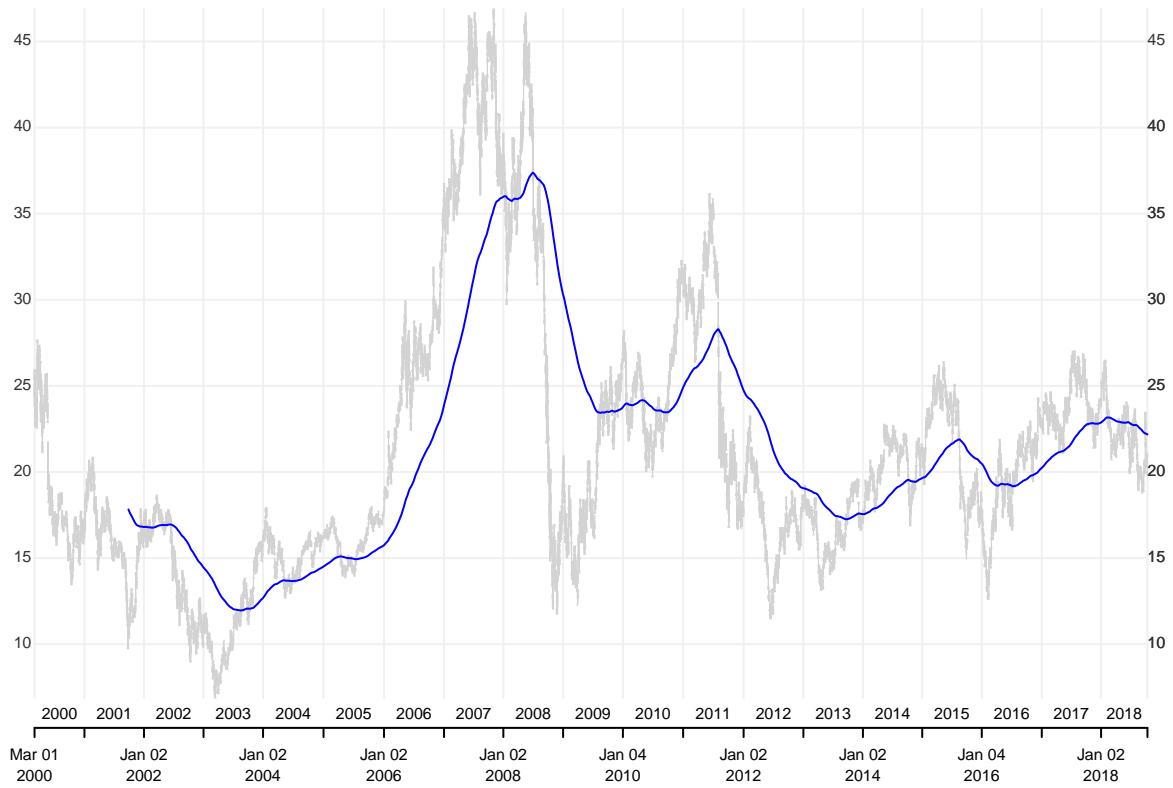


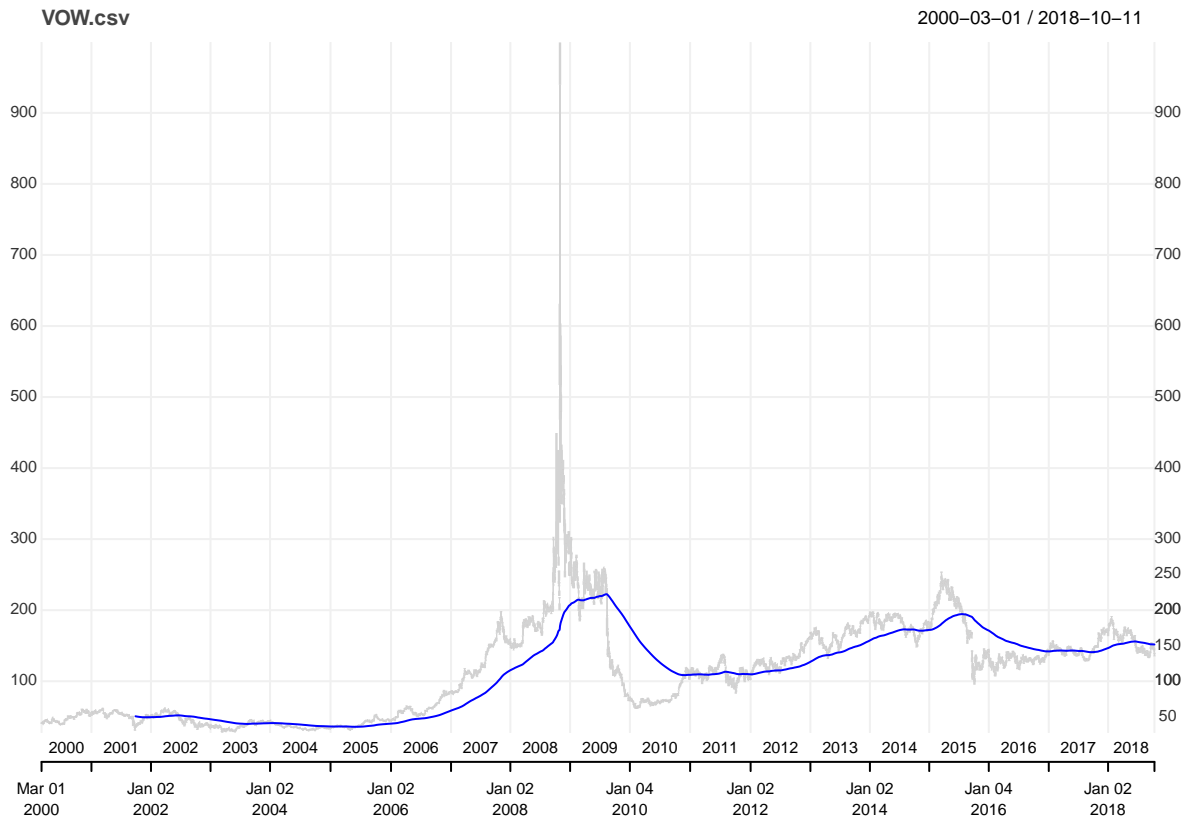




TKA.csv

2000-03-01 / 2018-10-11





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: BAY.csv"
##           Quantity    Price      Value Net realized Profit
## 1999-12-31         0    0.000        0.0          0.000
## 2004-01-27      44025  22.714   999983.8         -20.000
## 2004-02-12     -44025  21.884  -963443.1        -36560.750
## 2004-06-02      44549  21.626   963416.7         -20.000
## 2004-06-15     -44549  20.833  -928089.3        -35347.357
## 2004-11-17      41670  22.271   928032.6         -20.000
## 2004-12-03     -41670  22.400  -933408.0          5355.430
## 2005-02-17      36091  25.862   933385.4         -20.000
## 2005-02-28     -36091  25.990  -938005.1          4599.648
## 2005-04-19      37628  24.927   937953.2         -20.000
## 2005-04-27     -37628  24.356  -916467.6        -21505.588
```


## 2005-06-28	33667	27.220	916415.7	-20.000
## 2005-06-29	-33667	26.787	-901837.9	-14597.811
## 2005-09-26	30741	29.336	901818.0	-20.000
## 2005-10-05	-30741	29.946	-920570.0	18732.010
## 2005-10-07	30953	29.739	920511.3	-20.000
## 2005-11-04	-30953	28.824	-892189.3	-28341.995
## 2006-01-09	24961	35.742	892156.1	-20.000
## 2006-02-02	-24961	33.636	-839588.2	-52587.866
## 2006-02-06	25018	33.558	839554.0	-20.000
## 2006-02-28	-25018	33.863	-847184.5	7610.490
## 2006-03-22	25906	32.701	847152.1	-20.000
## 2006-03-27	-25906	34.197	-885907.5	38735.376
## 2006-04-13	26863	32.977	885861.2	-20.000
## 2006-04-18	-26863	32.633	-876620.3	-9260.872
## 2006-05-03	24640	35.575	876568.0	-20.000
## 2006-05-31	-24640	34.483	-849661.1	-26926.880
## 2006-06-14	27322	31.097	849632.2	-20.000
## 2006-06-23	-27322	32.682	-892937.6	43285.370
## 2006-06-28	27117	32.928	892908.6	-20.000
## 2006-07-26	-27117	38.203	-1035950.8	143022.175
## 2006-09-04	27172	38.124	1035905.3	-20.000
## 2006-09-18	-27172	38.134	-1036177.0	251.720
## 2006-09-25	26928	38.478	1036135.6	-20.000
## 2006-09-27	-26928	38.478	-1036135.6	-20.000
## 2006-09-28	26723	38.970	1041395.3	-20.000
## 2006-10-26	-26723	39.767	-1062693.5	21278.231
## 2006-10-31	27298	38.734	1057360.7	-20.000
## 2006-11-24	-27298	39.118	-1067843.2	10462.432
## 2006-11-27	27358	39.364	1076920.3	-20.000
## 2006-12-19	-27358	39.777	-1088219.2	11278.854
## 2006-12-20	27130	40.151	1089296.6	-20.000
## 2007-01-04	-27130	40.525	-1099443.2	10126.620
## 2007-01-17	25390	42.897	1089154.8	-20.000
## 2007-01-25	-25390	42.513	-1079405.1	-9769.760
## 2007-03-15	25104	42.995	1079346.5	-20.000
## 2007-04-11	-25104	48.053	-1206322.5	126956.032
## 2007-04-13	25073	48.112	1206312.2	-20.000
## 2007-04-17	-25073	48.368	-1212730.9	6398.688
## 2007-05-18	24680	49.136	1212676.5	-20.000
## 2007-06-18	-24680	55.159	-1361324.1	148627.640
## 2007-06-22	24422	55.739	1361257.9	-20.000
## 2007-06-29	-24422	54.794	-1338179.1	-23098.790
## 2007-07-19	24170	55.365	1338172.1	-20.000
## 2007-08-01	-24170	50.287	-1215436.8	-122755.260
## 2007-08-02	24109	51.567	1243228.8	-20.000
## 2007-08-03	-24109	51.114	-1232307.4	-10941.377
## 2007-08-08	22919	52.551	1204416.4	-20.000
## 2007-08-14	-22919	51.468	-1179595.1	-24841.277
## 2007-08-15	22945	52.216	1198096.1	-20.000
## 2007-09-05	-22945	56.202	-1289554.9	91438.770
## 2007-09-11	23229	54.716	1270998.0	-20.000
## 2007-09-20	-23229	56.959	-1323100.6	52082.647
## 2007-10-01	23871	55.424	1323026.3	-20.000
## 2007-10-02	-23871	54.775	-1307534.0	-15512.279

## 2007-11-20	24419	53.545	1307515.4	-20.000
## 2007-12-07	-24419	57.117	-1394740.0	87204.668
## 2007-12-18	23919	58.308	1394669.1	-20.000
## 2008-01-22	-23919	54.096	-1293922.2	-100766.828
## 2008-02-21	24125	53.633	1293896.1	-20.000
## 2008-02-27	-24125	52.206	-1259469.8	-34446.375
## 2008-05-16	22977	54.814	1259461.3	-20.000
## 2008-06-13	-22977	52.974	-1217183.6	-42297.680
## 2008-07-16	22639	53.761	1217095.3	-20.000
## 2008-08-13	-22639	52.551	-1189702.1	-27413.190
## 2009-09-22	25144	47.315	1189688.4	-20.000
## 2009-09-30	-25144	46.872	-1178549.6	-11158.792
## 2009-10-05	26000	45.327	1178502.0	-20.000
## 2009-10-13	-26000	46.498	-1208948.0	30426.000
## 2009-11-20	23602	51.222	1208941.6	-20.000
## 2009-12-18	-23602	53.348	-1259119.5	50157.852
## 2010-01-04	22676	55.523	1259039.5	-20.000
## 2010-01-15	-22676	53.535	-1213959.7	-45099.888
## 2010-01-26	24149	50.268	1213921.9	-20.000
## 2010-02-18	-24149	49.362	-1192042.9	-21898.994
## 2010-03-01	24821	48.024	1192003.7	-20.000
## 2010-03-11	-24821	51.399	-1275774.6	83750.875
## 2010-03-16	24925	51.183	1275736.3	-20.000
## 2010-04-06	-24925	49.254	-1227655.9	-48100.325
## 2010-04-13	24702	49.697	1227615.3	-20.000
## 2010-04-27	-24702	50.947	-1258492.8	30857.500
## 2010-08-12	26389	47.689	1258465.0	-20.000
## 2010-08-19	-26389	47.064	-1241971.9	-16513.125
## 2010-09-20	24125	51.478	1241906.8	-20.000
## 2010-10-07	-24125	51.813	-1249988.6	8061.875
## 2010-10-13	23631	52.895	1249961.7	-20.000
## 2010-10-15	-23631	54.086	-1278106.3	28124.521
## 2010-10-21	23962	53.338	1278085.2	-20.000
## 2010-11-08	-23962	54.548	-1307079.2	28974.020
## 2010-11-15	24109	54.214	1307045.3	-20.000
## 2010-11-22	-24109	56.192	-1354732.9	47667.602
## 2010-11-24	24020	56.398	1354680.0	-20.000
## 2010-11-26	-24020	56.398	-1354680.0	-20.000
## 2010-12-01	24364	55.601	1354662.8	-20.000
## 2010-12-08	-24364	57.078	-1390648.4	35965.628
## 2011-01-06	25928	53.633	1390596.4	-20.000
## 2011-01-19	-25928	54.578	-1415098.4	24481.960
## 2011-03-14	26092	54.233	1415047.4	-20.000
## 2011-03-31	-26092	53.643	-1399653.2	-15414.280
## 2011-04-20	26010	53.810	1399598.1	-20.000
## 2011-04-26	-26010	55.493	-1443372.9	43754.830
## 2011-05-13	25153	57.383	1443354.6	-20.000
## 2011-06-01	-25153	55.572	-1397802.5	-45572.083
## 2011-06-09	25441	54.942	1397779.4	-20.000
## 2011-06-15	-25441	55.247	-1405538.9	7739.505
## 2011-07-13	25604	54.893	1405480.4	-20.000
## 2011-07-20	-25604	54.962	-1407247.0	1746.676
## 2012-01-31	26778	52.551	1407210.7	-20.000
## 2012-02-16	-26778	54.106	-1448850.5	41619.790

## 2012-02-23	25938	55.857	1448818.9	-20.000
## 2012-03-14	-25938	54.027	-1401352.3	-47486.540
## 2012-03-30	26897	52.098	1401279.9	-20.000
## 2012-04-11	-26897	50.218	-1350713.5	-50586.360
## 2012-05-02	25119	53.771	1350673.7	-20.000
## 2012-05-18	-25119	49.697	-1248338.9	-102354.806
## 2012-07-13	22087	56.517	1248291.0	-20.000
## 2012-07-20	-22087	58.377	-1289372.8	41061.820
## 2012-09-11	20104	64.133	1289329.8	-20.000
## 2012-09-13	-20104	64.104	-1288746.8	-603.016
## 2012-09-27	19168	67.233	1288722.1	-20.000
## 2012-09-28	-19168	66.741	-1279291.5	-9450.656
## 2012-10-01	19031	67.794	1290187.6	-20.000
## 2012-10-29	-19031	65.442	-1245426.7	-44780.912
## 2012-11-16	18995	64.990	1234485.0	-20.000
## 2012-12-14	-18995	71.298	-1354305.5	119800.460
## 2013-01-16	18971	71.386	1354263.8	-20.000
## 2013-02-13	-18971	69.930	-1326642.0	-27641.776
## 2013-02-22	18586	71.376	1326594.3	-20.000
## 2013-02-26	-18586	70.491	-1310145.7	-16468.610
## 2013-02-27	18636	72.380	1348873.7	-20.000
## 2013-03-07	-18636	76.671	-1428840.8	79947.076
## 2013-03-25	17868	77.793	1390005.3	-20.000
## 2013-04-12	-17868	79.289	-1416735.9	26710.528
## 2013-04-15	17907	80.538	1442194.0	-20.000
## 2013-04-29	-17907	78.836	-1411716.3	-30497.714
## 2013-04-30	17771	79.043	1404673.2	-20.000
## 2013-05-23	-17771	82.841	-1472167.4	67474.258
## 2013-05-24	17656	83.638	1476712.5	-20.000
## 2013-05-29	-17656	84.199	-1486617.5	9885.016
## 2013-06-06	18134	80.706	1463522.6	-20.000
## 2013-06-11	-18134	81.414	-1476361.5	12818.872
## 2013-06-14	18175	81.227	1476300.7	-20.000
## 2013-06-20	-18175	80.991	-1472011.4	-4309.300
## 2013-07-04	18380	80.086	1471980.7	-20.000
## 2013-07-05	-18380	79.790	-1466540.2	-5460.480
## 2013-07-08	18335	81.454	1493459.1	-20.000
## 2013-08-05	-18335	88.175	-1616688.6	123209.535
## 2013-09-02	18915	84.042	1589654.4	-20.000
## 2013-09-03	-18915	83.441	-1578286.5	-11387.915
## 2013-09-10	19274	81.887	1578290.0	-20.000
## 2013-09-12	-19274	82.418	-1588524.5	10214.494
## 2013-10-08	18839	84.317	1588448.0	-20.000
## 2013-10-21	-18839	88.254	-1662617.1	74149.143
## 2013-10-22	18933	88.608	1677615.3	-20.000
## 2013-10-31	-18933	90.438	-1712262.7	34627.390
## 2013-11-27	17835	95.162	1697214.3	-20.000
## 2013-12-03	-17835	96.008	-1712302.7	15068.410
## 2014-01-02	16868	101.509	1712253.8	-20.000
## 2014-01-08	-16868	98.459	-1660806.4	-51467.400
## 2014-02-28	16626	99.886	1660704.6	-20.000
## 2014-03-03	-16626	96.786	-1609164.0	-51560.600
## 2014-03-04	16981	99.148	1683632.2	-20.000
## 2014-03-24	-16981	94.099	-1597895.1	-85757.069

## 2014-04-14	16528	92.170	1523385.8	-20.000
## 2014-05-15	-16528	101.706	-1680996.8	157591.008
## 2014-06-24	16424	102.346	1680930.7	-20.000
## 2014-07-15	-16424	99.492	-1634056.6	-46894.096
## 2014-07-16	16328	100.919	1647805.4	-20.000
## 2014-07-31	-16328	98.124	-1602168.7	-45656.760
## 2014-08-05	16733	94.926	1588396.8	-20.000
## 2014-08-12	-16733	94.483	-1580984.0	-7432.719
## 2014-08-13	16745	95.369	1596953.9	-20.000
## 2014-08-15	-16745	95.192	-1593990.0	-2983.865
## 2014-08-21	16160	97.642	1577894.7	-20.000
## 2014-09-04	-16160	101.509	-1640385.4	62470.720
## 2014-09-30	15085	108.742	1640373.1	-20.000
## 2014-10-29	-15085	105.347	-1589159.5	-51233.575
## 2014-11-05	14227	111.695	1589084.8	-20.000
## 2014-11-06	-14227	110.760	-1575782.5	-13322.245
## 2014-12-05	13305	118.436	1575791.0	-20.000
## 2014-12-19	-13305	112.039	-1490678.9	-85132.085
## 2015-01-02	13143	113.417	1490639.6	-20.000
## 2015-01-30	-13143	126.013	-1656188.9	165529.228
## 2015-03-27	12029	137.675	1656092.6	-20.000
## 2015-04-22	-12029	134.772	-1621172.4	-34940.187
## 2015-05-13	12551	129.162	1621112.3	-20.000
## 2015-06-11	-12551	127.736	-1603214.5	-17917.726
## 2015-06-16	12971	123.602	1603241.5	-20.000
## 2015-06-24	-12971	131.278	-1702806.9	99545.396
## 2015-07-01	13481	126.309	1702771.6	-20.000
## 2015-07-02	-13481	124.439	-1677562.2	-25229.470
## 2015-07-08	13730	122.175	1677462.8	-20.000
## 2015-07-30	-13730	130.393	-1790295.9	112813.140
## 2015-08-13	13940	128.424	1790230.6	-20.000
## 2015-08-25	-13940	112.482	-1567999.1	-222251.480
## 2015-09-02	13423	116.812	1567967.5	-20.000
## 2015-09-04	-13423	117.649	-1579202.5	11215.051
## 2015-09-14	13367	118.141	1579190.7	-20.000
## 2015-09-21	-13367	114.204	-1526564.9	-52645.879
## 2015-11-16	12799	119.272	1526562.3	-20.000
## 2015-11-20	-12799	123.209	-1576952.0	50369.663
## 2015-11-25	12870	122.520	1576832.4	-20.000
## 2015-12-07	-12870	115.139	-1481838.9	-95013.470
## 2017-03-01	14396	102.936	1481866.7	-20.000
## 2017-03-14	-14396	104.905	-1510212.4	28325.724
## 2017-03-16	14209	106.282	1510160.9	-20.000
## 2017-04-13	-14209	104.855	-1489884.7	-20296.243
## 2017-04-27	13782	108.103	1489875.5	-20.000
## 2017-05-02	-13782	109.677	-1511568.4	21672.868
## 2017-05-03	14010	109.973	1540721.7	-20.000
## 2017-05-05	-14010	111.104	-1556567.0	15825.310
## 2017-06-08	13053	117.009	1527318.5	-20.000
## 2017-07-06	-13053	108.890	-1421341.2	-105997.307
## 2017-08-22	13423	105.889	1421348.0	-20.000
## 2017-09-04	-13423	105.692	-1418703.7	-2664.331
## 2017-09-05	13441	106.479	1431184.2	-20.000
## 2017-09-08	-13441	107.070	-1439127.9	7923.631

```

## 2017-09-11      13294 107.857 1433851.0      -20.000
## 2017-09-13     -13294 108.841 -1446932.3      13061.296
## 2017-09-20      13238 108.742 1439526.6      -20.000
## 2017-10-17     -13238 116.861 -1547005.9     107459.322
## 2017-10-18      13271 117.403 1558055.2      -20.000
## 2017-11-07     -13271 114.106 -1514300.7    -43774.487
## 2017-11-16      14085 106.725 1503221.6      -20.000
## 2017-11-20     -14085 105.397 -1484516.7    -18724.880
##
## [1] "Transactions for the instrument: DBK.csv"
##      Quantity  Price      Value Net realized Profit
## 1999-12-31         0  0.000         0.0         0.000
## 2003-06-16      21916 45.627   999961.3        -20.000
## 2003-06-24     -21916 42.721  -936273.4     -63707.896
## 2003-07-11      21128 44.314   936266.2        -20.000
## 2003-08-04     -21128 43.063  -909835.1    -26451.128
## 2003-09-08      20370 44.663   909785.3        -20.000
## 2003-09-23     -20370 43.654  -889232.0    -20573.330
## 2003-11-12      20066 44.314   889204.7        -20.000
## 2003-11-18     -20066 43.537  -873613.4    -15611.282
## 2003-12-11      17951 48.664   873567.5        -20.000
## 2003-12-15     -17951 48.936  -878450.1      4862.672
## 2004-01-13      17828 49.270   878385.6        -20.000
## 2004-02-10     -17828 51.973  -926574.6     48169.084
## 2004-03-23      17772 52.136   926561.0        -20.000
## 2004-04-22     -17772 55.033  -978046.5     51465.484
## 2004-05-03      18213 53.697   977983.5        -20.000
## 2004-05-12     -18213 50.147  -913327.3    -64676.150
## 2004-05-26      17510 52.159   913304.1        -20.000
## 2004-06-08     -17510 51.576  -903095.8    -10228.330
## 2004-11-05      18761 48.135   903060.7        -20.000
## 2004-12-03     -18761 51.072  -958161.8     55081.057
## 2004-12-07      18720 51.180   958089.6        -20.000
## 2005-01-06     -18720 51.794  -969583.7     11474.080
## 2005-02-23      18748 51.716   969571.6        -20.000
## 2005-02-28     -18748 51.654  -968409.2    -1182.376
## 2005-03-24      18727 51.709   968354.4        -20.000
## 2005-03-29     -18727 51.274  -960208.2    -8166.245
## 2005-04-13      18259 52.586   960167.8        -20.000
## 2005-04-15     -18259 52.377  -956351.6    -3836.131
## 2005-04-28      19114 50.031   956292.5        -20.000
## 2005-04-29     -19114 49.635  -948723.4    -7589.144
## 2005-05-04      19265 49.246   948724.2        -20.000
## 2005-05-11     -19265 47.887  -922543.1    -26201.135
## 2005-06-07      18557 49.712   922505.6        -20.000
## 2005-06-13     -18557 50.349  -934326.4     11800.809
## 2005-08-19      16996 54.971   934287.1        -20.000
## 2005-08-23     -16996 55.608  -945113.6     10806.452
## 2005-08-26      17199 54.948   945050.7        -20.000
## 2005-09-08     -17199 58.886 -1012780.3     67709.662
## 2005-09-16      17271 58.637  1012719.6        -20.000
## 2005-09-19     -17271 57.954 -1000923.5    -11816.093
## 2005-09-23      17273 57.946  1000901.3        -20.000
## 2005-09-27     -17273 58.824 -1016067.0     15145.694

```

## 2005-10-07	16889	60.160	1016042.2	-20.000
## 2005-10-18	-16889	59.422	-1003578.2	-12484.082
## 2005-10-20	17069	58.793	1003537.7	-20.000
## 2005-10-21	-17069	58.101	-991726.0	-11831.748
## 2005-10-24	17014	58.606	997122.5	-20.000
## 2005-10-26	-17014	59.305	-1009015.3	11872.786
## 2005-12-06	15232	65.884	1003545.1	-20.000
## 2005-12-22	-15232	63.593	-968648.6	-34916.512
## 2006-01-02	15129	64.020	968558.6	-20.000
## 2006-01-10	-15129	65.465	-990420.0	21841.405
## 2006-01-19	15204	65.139	990373.4	-20.000
## 2006-01-20	-15204	64.805	-985295.2	-5098.136
## 2006-01-24	15292	64.432	985294.1	-20.000
## 2006-02-02	-15292	68.370	-1045514.0	60199.896
## 2006-02-06	15295	68.354	1045474.4	-20.000
## 2006-02-08	-15295	68.409	-1046315.7	821.225
## 2006-03-09	14846	70.475	1046271.8	-20.000
## 2006-04-06	-14846	76.215	-1131487.9	85196.040
## 2006-04-25	15251	74.188	1131441.2	-20.000
## 2006-04-26	-15251	74.040	-1129184.0	-2277.148
## 2006-05-19	15922	70.918	1129156.4	-20.000
## 2006-06-02	-15922	68.789	-1095258.5	-33917.938
## 2006-06-09	16627	65.869	1095203.9	-20.000
## 2006-06-12	-16627	65.177	-1083698.0	-11525.884
## 2006-07-24	16027	67.616	1083681.6	-20.000
## 2006-07-28	-16027	68.976	-1105478.4	21776.720
## 2006-08-02	16090	68.704	1105447.4	-20.000
## 2006-08-23	-16090	68.013	-1094329.2	-11138.190
## 2006-09-08	15838	69.092	1094279.1	-20.000
## 2006-09-22	-15838	71.834	-1137706.9	43407.796
## 2006-09-25	15912	72.588	1155020.3	-20.000
## 2006-10-11	-15912	76.137	-1211491.9	56451.688
## 2006-10-18	15704	76.036	1194069.3	-20.000
## 2006-10-25	-15704	75.967	-1192985.8	-1103.576
## 2006-11-29	15605	76.448	1192971.0	-20.000
## 2006-11-30	-15605	76.161	-1188492.4	-4498.635
## 2006-12-20	15093	78.740	1188422.8	-20.000
## 2006-12-21	-15093	78.312	-1181963.0	-6479.804
## 2006-12-27	14956	79.027	1181927.8	-20.000
## 2007-01-04	-14956	79.796	-1193429.0	11481.164
## 2007-01-09	15038	79.361	1193430.7	-20.000
## 2007-01-16	-15038	80.868	-1216093.0	22642.266
## 2007-02-06	14570	83.462	1216041.3	-20.000
## 2007-03-06	-14570	75.671	-1102526.5	-113534.870
## 2007-03-29	14322	76.976	1102450.3	-20.000
## 2007-04-02	-14322	77.800	-1114251.6	11781.328
## 2007-04-03	14335	78.258	1121828.4	-20.000
## 2007-05-04	-14335	88.946	-1275040.9	153192.480
## 2007-05-29	14515	87.315	1267377.2	-20.000
## 2007-05-30	-14515	86.771	-1259481.1	-7916.160
## 2007-06-11	15104	83.385	1259447.0	-20.000
## 2007-06-12	-15104	83.012	-1253813.2	-5653.792
## 2007-06-28	15090	83.089	1253813.0	-20.000
## 2007-07-10	-15090	83.952	-1266835.7	13002.670

## 2007-07-12	15454	81.971	1266779.8	-20.000
## 2007-07-17	-15454	83.245	-1286468.2	19668.396
## 2007-07-19	15540	82.779	1286385.7	-20.000
## 2007-07-31	-15540	76.899	-1195010.5	-91395.200
## 2007-08-02	15157	78.841	1194993.0	-20.000
## 2007-08-09	-15157	78.685	-1192628.5	-2384.492
## 2009-09-22	29416	40.543	1192612.9	-20.000
## 2009-09-24	-29416	40.554	-1192936.5	303.576
## 2009-10-05	30486	39.129	1192886.7	-20.000
## 2009-10-16	-30486	42.904	-1307971.3	115064.650
## 2009-11-25	33337	39.234	1307943.9	-20.000
## 2009-11-26	-33337	38.232	-1274540.2	-33423.674
## 2010-01-14	32173	39.614	1274501.2	-20.000
## 2010-01-18	-32173	37.983	-1222027.1	-52494.163
## 2010-03-19	28750	42.504	1221990.0	-20.000
## 2010-04-07	-28750	44.477	-1278713.8	56703.750
## 2010-04-09	28865	44.298	1278661.8	-20.000
## 2010-04-13	-28865	44.927	-1296817.9	18136.085
## 2010-04-14	28895	45.246	1307383.2	-20.000
## 2010-04-16	-28895	45.945	-1327580.8	20177.605
## 2010-04-20	30412	43.304	1316961.2	-20.000
## 2010-04-27	-30412	41.991	-1277030.3	-39950.956
## 2010-04-29	30832	41.417	1276968.9	-20.000
## 2010-04-30	-30832	40.523	-1249405.1	-27583.808
## 2010-08-13	29980	41.673	1249356.5	-20.000
## 2010-08-26	-29980	39.071	-1171348.6	-78027.960
## 2011-02-25	29793	39.315	1171311.8	-20.000
## 2011-02-28	-29793	38.907	-1159156.3	-12175.544
## 2012-11-06	38486	30.118	1159121.3	-20.000
## 2012-11-07	-38486	29.841	-1148460.7	-10680.622
## 2012-11-29	40086	28.649	1148423.8	-20.000
## 2012-12-06	-40086	29.539	-1184100.4	35656.540
## 2012-12-11	40582	29.177	1184061.0	-20.000
## 2012-12-17	-40582	27.713	-1124649.0	-59432.048
## 2012-12-27	39644	28.368	1124621.0	-20.000
## 2013-01-08	-39644	30.169	-1196019.8	71378.844
## 2013-03-14	41009	29.164	1195986.5	-20.000
## 2013-03-19	-41009	28.492	-1168428.4	-27578.048
## 2013-05-22	36966	31.607	1168384.4	-20.000
## 2013-05-23	-36966	30.518	-1128128.4	-40275.974
## 2013-05-30	36607	30.816	1128081.3	-20.000
## 2013-06-05	-36607	30.867	-1129948.3	1846.957
## 2013-06-07	36657	30.824	1129915.4	-20.000
## 2013-06-21	-36657	28.202	-1033800.7	-96134.654
## 2013-08-01	35456	29.156	1033755.1	-20.000
## 2013-08-07	-35456	28.304	-1003546.6	-30228.512
## 2013-10-01	34667	28.947	1003505.6	-20.000
## 2013-10-21	-34667	31.297	-1084973.1	81447.450
## 2013-10-22	34783	31.467	1094516.7	-20.000
## 2013-11-15	-34783	29.011	-1009089.6	-85447.048
## 2014-02-05	33364	29.956	999452.0	-20.000
## 2014-02-13	-33364	30.249	-1009227.6	9755.652
## 2014-02-21	33457	30.164	1009196.9	-20.000
## 2014-03-03	-33457	29.368	-982565.2	-26651.772

##	2015-03-27	34455	28.516	982518.8	-20.000
##	2015-04-28	-34455	25.905	-892556.8	-89982.005
##	2017-01-31	52496	17.002	892537.0	-20.000
##	2017-02-02	-52496	16.494	-865869.0	-26687.968
##	2017-02-03	53696	16.735	898602.6	-20.000
##	2017-02-09	-53696	16.114	-865257.3	-33365.216
##	2017-11-24	51817	16.065	832440.1	-20.000
##	2017-11-30	-51817	15.885	-823113.0	-9347.060
##	2017-12-04	50980	16.145	823072.1	-20.000
##	2017-12-05	-50980	15.980	-814660.4	-8431.700
##	2017-12-07	51477	15.825	814623.5	-20.000
##	2018-01-05	-51477	15.884	-817660.7	3017.143
##	[1] "Transactions for the instrument: HEI.csv"				
##		Quantity	Price	Value	Net realized Profit
##	1999-12-31	0	0.000	0.0	0.000
##	2002-01-11	23333	42.857	999982.4	-20.000
##	2002-01-16	-23333	39.901	-931010.0	-68992.348
##	2003-08-21	32240	28.876	930962.2	-20.000
##	2003-08-25	-32240	28.930	-932703.2	1720.960
##	2003-08-28	32048	29.102	932660.9	-20.000
##	2003-09-25	-32048	30.196	-967721.4	35040.512
##	2003-11-12	30811	31.407	967681.1	-20.000
##	2003-11-13	-30811	30.919	-952645.3	-15055.768
##	2003-11-14	30811	31.552	972148.7	-20.000
##	2003-11-21	-30811	31.073	-957390.2	-14778.469
##	2003-12-18	29221	32.094	937818.8	-20.000
##	2004-01-05	-29221	30.603	-894250.3	-43588.511
##	2004-03-23	27886	32.067	894220.4	-20.000
##	2004-04-14	-27886	33.451	-932814.6	38574.224
##	2004-06-02	28659	32.547	932764.5	-20.000
##	2004-06-30	-28659	37.022	-1061013.5	128229.025
##	2004-07-09	30641	34.626	1060975.3	-20.000
##	2004-07-19	-30641	34.535	-1058186.9	-2808.331
##	2004-08-04	31455	33.640	1058146.2	-20.000
##	2004-08-06	-31455	33.369	-1049621.9	-8544.305
##	2004-09-02	31903	32.899	1049576.8	-20.000
##	2004-09-13	-31903	32.465	-1035730.9	-13865.902
##	2004-10-07	29054	35.647	1035687.9	-20.000
##	2004-10-14	-29054	35.711	-1037547.4	1839.456
##	2004-10-19	28612	36.262	1037528.3	-20.000
##	2004-10-28	-28612	34.843	-996927.9	-40620.428
##	2004-11-29	25383	39.273	996866.6	-20.000
##	2004-12-28	-25383	40.231	-1021183.5	24296.914
##	2005-01-04	25382	40.231	1021143.2	-20.000
##	2005-01-11	-25382	41.768	-1060155.4	38992.134
##	2005-02-10	21390	49.561	1060109.8	-20.000
##	2005-02-21	-21390	47.464	-1015255.0	-44874.830
##	2005-05-04	24399	41.609	1015218.0	-20.000
##	2005-06-01	-24399	47.224	-1152218.4	136980.385
##	2005-06-06	24850	46.365	1152170.2	-20.000
##	2005-06-07	-24850	46.181	-1147597.8	-4592.400
##	2005-06-27	20952	54.770	1147541.0	-20.000
##	2005-07-25	-20952	55.066	-1153742.8	6181.792

##	2005-08-03	20924	55.140	1153749.4	-20.000
##	2005-08-04	-20924	55.001	-1150840.9	-2928.436
##	2005-08-26	21072	54.613	1150805.1	-20.000
##	2005-09-07	-21072	53.985	-1137571.9	-13253.216
##	2005-11-30	16536	68.791	1137528.0	-20.000
##	2005-12-29	-16536	69.160	-1143629.8	6081.784
##	2006-01-19	16399	69.733	1143551.5	-20.000
##	2006-02-16	-16399	77.574	-1272136.0	128564.559
##	2006-03-02	15135	84.049	1272081.6	-20.000
##	2006-03-27	-15135	85.203	-1289547.4	17445.790
##	2006-05-18	15107	85.360	1289533.5	-20.000
##	2006-05-24	-15107	78.729	-1189359.0	-100194.517
##	2006-06-14	16038	74.157	1189330.0	-20.000
##	2006-06-16	-16038	74.674	-1197621.6	8271.646
##	2006-08-08	13353	89.683	1197537.1	-20.000
##	2006-08-09	-13353	89.027	-1188777.5	-8779.568
##	2006-09-08	12916	92.038	1188762.8	-20.000
##	2006-09-22	-12916	91.604	-1183157.3	-5625.544
##	2006-09-25	12929	92.269	1192945.9	-20.000
##	2006-09-26	-12929	91.280	-1180159.1	-12806.781
##	2006-10-04	12422	94.208	1170251.8	-20.000
##	2006-10-09	-12422	92.961	-1154761.5	-15510.234
##	2006-10-31	11979	96.397	1154739.7	-20.000
##	2006-11-28	-11979	97.727	-1170671.7	15912.070
##	2007-01-11	11428	102.438	1170661.5	-20.000
##	2007-01-26	-11428	103.537	-1183220.8	12539.372
##	2007-02-02	11353	104.220	1183209.7	-20.000
##	2007-03-02	-11353	100.304	-1138751.3	-44478.348
##	2007-03-15	11368	100.166	1138687.1	-20.000
##	2007-03-20	-11368	99.390	-1129865.5	-8841.568
##	2007-03-29	10981	102.890	1129835.1	-20.000
##	2007-04-04	-10981	102.521	-1125783.1	-4071.989
##	2007-06-22	10691	105.292	1125676.8	-20.000
##	2007-07-20	-10691	100.129	-1070479.1	-55217.633
##	2007-08-17	11123	96.240	1070477.5	-20.000
##	2007-09-14	-11123	93.811	-1043459.8	-27037.767
##	2007-09-26	10893	95.788	1043418.7	-20.000
##	2007-10-03	-10893	96.600	-1052263.8	8825.116
##	2007-10-09	10829	97.164	1052189.0	-20.000
##	2007-10-16	-10829	98.115	-1062487.3	10278.379
##	2007-10-23	10856	97.866	1062433.3	-20.000
##	2007-11-01	-10856	100.507	-1091104.0	28650.696
##	2007-11-23	10418	104.737	1091150.1	-20.000
##	2007-12-11	-10418	101.412	-1056510.2	-34659.850
##	2008-01-29	11051	95.594	1056409.3	-20.000
##	2008-01-30	-11051	94.855	-1048242.6	-8186.689
##	2008-03-04	10824	96.841	1048207.0	-20.000
##	2008-03-13	-10824	98.429	-1065395.5	17168.512
##	2008-04-23	10613	100.387	1065407.2	-20.000
##	2008-05-08	-10613	101.616	-1078450.6	13023.377
##	2008-05-23	10796	99.889	1078401.6	-20.000
##	2008-06-09	-10796	93.608	-1010592.0	-67829.676
##	2009-12-29	20827	48.520	1010526.0	-20.000
##	2009-12-30	-20827	47.820	-995947.1	-14598.900

## 2010-12-13	21260	46.845	995924.7	-20.000
## 2010-12-20	-21260	47.515	-1010168.9	14224.200
## 2011-01-03	21237	47.565	1010137.9	-20.000
## 2011-01-04	-21237	47.180	-1001961.7	-8196.245
## 2011-04-13	20196	49.610	1001923.6	-20.000
## 2011-05-03	-20196	51.820	-1046556.7	44613.160
## 2011-05-13	21622	48.400	1046504.8	-20.000
## 2011-05-16	-21622	48.295	-1044234.5	-2290.310
## 2011-05-19	21577	48.395	1044218.9	-20.000
## 2011-06-10	-21577	45.590	-983695.4	-60543.485
## 2012-03-21	22010	44.690	983626.9	-20.000
## 2012-04-02	-22010	44.480	-979004.8	-4642.100
## 2012-04-11	22799	42.940	978989.1	-20.000
## 2012-04-13	-22799	42.880	-977621.1	-1387.940
## 2012-09-03	24004	40.725	977562.9	-20.000
## 2012-09-11	-24004	42.900	-1029771.6	52188.700
## 2012-09-14	23366	44.070	1029739.6	-20.000
## 2012-09-17	-23366	43.660	-1020159.6	-9600.060
## 2012-09-19	23403	43.590	1020136.8	-20.000
## 2012-09-20	-23403	43.035	-1007148.1	-13008.665
## 2012-10-01	23973	42.010	1007105.7	-20.000
## 2012-10-19	-23973	41.055	-984211.5	-22914.215
## 2012-11-08	22505	43.730	984143.6	-20.000
## 2012-11-09	-22505	42.390	-953987.0	-30176.700
## 2013-01-09	20194	47.240	953964.6	-20.000
## 2013-02-04	-20194	46.670	-942454.0	-11530.580
## 2013-03-11	17413	54.120	942391.6	-20.000
## 2013-03-21	-17413	56.970	-992018.6	49607.050
## 2013-03-25	17321	57.270	991973.7	-20.000
## 2013-03-28	-17321	56.580	-980022.2	-11971.490
## 2013-04-02	17185	57.200	982982.0	-20.000
## 2013-04-04	-17185	56.660	-973702.1	-9299.900
## 2013-04-19	19112	50.790	970698.5	-20.000
## 2013-05-13	-19112	56.700	-1083650.4	112931.920
## 2013-05-24	18435	58.780	1083609.3	-20.000
## 2013-05-29	-18435	58.610	-1080475.4	-3153.950
## 2013-06-25	21394	50.500	1080397.0	-20.000
## 2013-07-05	-21394	50.350	-1077187.9	-3229.100
## 2013-07-31	19443	55.400	1077142.2	-20.000
## 2013-08-06	-19443	57.200	-1112139.6	34977.400
## 2013-08-08	19321	57.560	1112116.8	-20.000
## 2013-08-12	-19321	56.880	-1098978.5	-13158.280
## 2013-09-02	20649	53.220	1098939.8	-20.000
## 2013-09-03	-20649	52.920	-1092745.1	-6214.700
## 2013-09-23	18580	58.810	1092689.8	-20.000
## 2013-09-27	-18580	58.050	-1078569.0	-14140.800
## 2013-10-01	18702	57.670	1078544.3	-20.000
## 2013-10-16	-18702	58.130	-1087147.3	8582.920
## 2013-11-19	19299	56.330	1087112.7	-20.000
## 2013-12-02	-19299	57.180	-1103516.8	16384.150
## 2014-02-19	19042	57.950	1103483.9	-20.000
## 2014-03-19	-19042	59.900	-1140615.8	37111.900
## 2014-04-14	18076	63.100	1140595.6	-20.000
## 2014-05-15	-18076	60.950	-1101732.2	-38883.400

## 2014-05-19	18039	61.070	1101641.7	-20.000
## 2014-06-04	-18039	63.140	-1138982.5	37320.730
## 2014-06-16	17626	64.620	1138992.1	-20.000
## 2014-06-20	-17626	64.500	-1136877.0	-2135.120
## 2014-07-21	19533	58.200	1136820.6	-20.000
## 2014-07-30	-19533	57.540	-1123928.8	-12911.780
## 2014-11-21	19404	57.920	1123879.7	-20.000
## 2014-12-08	-19404	60.100	-1166180.4	42280.720
## 2015-03-11	16485	70.740	1166148.9	-20.000
## 2015-03-17	-16485	71.510	-1178842.4	12673.450
## 2015-03-27	16288	72.370	1178762.6	-20.000
## 2015-04-28	-16288	71.650	-1167035.2	-11747.360
## 2015-05-07	16153	72.250	1167054.2	-20.000
## 2015-05-12	-16153	74.080	-1196614.2	29539.990
## 2015-05-13	16198	74.750	1210800.5	-20.000
## 2015-05-22	-16198	75.810	-1227970.4	17149.880
## 2015-06-03	16379	74.100	1213683.9	-20.000
## 2015-06-04	-16379	73.260	-1199925.5	-13778.360
## 2015-06-10	16878	71.090	1199857.0	-20.000
## 2015-06-24	-16878	74.390	-1255554.4	55677.400
## 2015-07-01	17349	72.370	1255547.1	-20.000
## 2015-07-14	-17349	73.130	-1268732.4	13165.240
## 2015-07-16	17379	73.000	1268667.0	-20.000
## 2015-07-22	-17379	73.100	-1270404.9	1717.900
## 2015-07-23	17445	73.230	1277497.4	-20.000
## 2015-08-10	-17445	71.620	-1249410.9	-28106.450
## 2015-08-13	17536	70.840	1242250.2	-20.000
## 2015-08-28	-17536	67.300	-1180172.8	-62097.440
## 2015-09-11	17827	66.200	1180147.4	-20.000
## 2015-09-23	-17827	62.500	-1114187.5	-65979.900
## 2015-11-25	14977	74.390	1114139.0	-20.000
## 2015-12-08	-14977	72.100	-1079841.7	-34317.330
## 2015-12-15	15151	71.270	1079811.8	-20.000
## 2016-01-18	-15151	65.050	-985572.5	-94259.220
## 2016-03-22	13248	74.390	985518.7	-20.000
## 2016-03-24	-13248	73.800	-977702.4	-7836.320
## 2016-03-29	13328	74.580	994002.2	-20.000
## 2016-04-05	-13328	73.800	-983606.4	-10415.840
## 2016-04-07	13277	72.850	967229.4	-20.000
## 2016-04-21	-13277	78.830	-1046625.9	79376.460
## 2016-06-03	13740	76.170	1046575.8	-20.000
## 2016-06-24	-13740	68.010	-934457.4	-112138.400
## 2016-07-18	13000	71.880	934440.0	-20.000
## 2016-08-15	-13000	81.500	-1059500.0	125040.000
## 2016-09-05	12800	82.770	1059456.0	-20.000
## 2016-09-06	-12800	82.380	-1054464.0	-5012.000
## 2016-09-07	12758	83.080	1059934.6	-20.000
## 2016-09-08	-12758	82.020	-1046411.2	-13543.480
## 2016-09-13	13152	79.140	1040849.3	-20.000
## 2016-09-20	-13152	80.340	-1056631.7	15762.400
## 2016-10-14	12562	84.110	1056589.8	-20.000
## 2016-10-20	-12562	85.230	-1070659.3	14049.440
## 2016-10-27	12526	85.470	1070597.2	-20.000
## 2016-11-09	-12526	84.370	-1056818.6	-13798.600

```

## 2016-11-18      12468  84.760  1056787.7      -20.000
## 2016-11-23     -12468  84.620 -1055042.2     -1765.520
## 2017-02-01      11704  90.140  1054998.6      -20.000
## 2017-02-23     -11704  87.730 -1026791.9    -28226.640
## 2017-02-27      11877  86.450  1026766.7      -20.000
## 2017-03-16     -11877  89.740 -1065842.0    39055.330
## 2017-03-23      12246  87.030  1065769.4      -20.000
## 2017-03-31     -12246  87.720 -1074219.1    8429.740
## 2017-05-19      12917  83.160  1074177.7      -20.000
## 2017-06-06     -12917  83.350 -1076631.9    2434.230
## 2017-06-08      13078  82.320  1076581.0      -20.000
## 2017-07-06     -13078  87.540 -1144848.1    68247.160
## 2017-10-19      13593  84.220  1144802.5      -20.000
## 2017-11-01     -13593  86.920 -1181503.6    36681.100
## 2017-12-04      13153  89.830  1181534.0      -20.000
## 2018-01-04     -13153  92.500 -1216652.5    35098.510
## 2018-01-23      13124  92.700  1216594.8      -20.000
## 2018-01-24     -13124  92.160 -1209507.8   -7106.960
## 2018-01-26      13373  90.440  1209454.1      -20.000
## 2018-02-07     -13373  83.520 -1116913.0   -92561.160
##
## [1] "Transactions for the instrument: TKA.csv"
##           Quantity  Price      Value Net realized Profit
## 1999-12-31         0  0.000         0.0         0.000
## 2002-03-22      54764 18.260    999990.6        -20.000
## 2002-04-02     -54764 17.770   -973156.3     -26854.360
## 2002-04-05      54823 17.750    973108.2        -20.000
## 2002-04-29     -54823 16.780   -919929.9    -53198.310
## 2002-05-21      52868 17.400    919903.2        -20.000
## 2002-06-14     -52868 17.090   -903514.1   -16409.080
## 2004-04-19      59556 15.170    903464.5        -20.000
## 2004-05-11     -59556 13.580   -808770.5   -94714.040
## 2004-07-21      58016 13.940    808743.0        -20.000
## 2004-08-02     -58016 14.680   -851674.9    42911.840
## 2004-08-05      57659 14.770    851623.4        -20.000
## 2004-08-13     -57659 14.490   -835478.9   -16164.520
## 2004-08-16      57619 14.630    842966.0        -20.000
## 2004-08-30     -57619 15.340   -883875.5    40889.490
## 2004-10-26      58499 14.980    876315.0        -20.000
## 2004-11-23     -58499 15.770   -922529.2    46194.210
## 2005-01-25      55942 16.490    922483.6        -20.000
## 2005-02-01     -55942 16.180   -905141.6   -17362.020
## 2005-03-31      57285 15.800    905103.0        -20.000
## 2005-04-01     -57285 15.770   -903384.4   -1738.550
## 2005-08-19      57501 15.710    903340.7        -20.000
## 2005-09-16     -57501 16.440   -945316.4   41955.730
## 2005-10-07      54327 17.400    945289.8        -20.000
## 2005-10-11     -54327 17.580   -955068.7    9758.860
## 2005-10-14      54886 17.400    955016.4        -20.000
## 2005-10-27     -54886 16.910   -928122.3   -26914.140
## 2005-10-31      55112 16.840    928086.1        -20.000
## 2005-11-09     -55112 17.100   -942415.2   14309.120
## 2005-12-15      55110 17.100    942381.0        -20.000
## 2006-01-13     -55110 18.970  -1045436.7   103035.700

```

##	2006-02-09	51472	20.310	1045396.3	-20.000
##	2006-02-28	-51472	21.350	-1098927.2	53510.880
##	2006-05-17	40669	27.020	1098876.4	-20.000
##	2006-06-14	-40669	22.900	-931320.1	-167576.280
##	2006-07-12	32907	28.300	931268.1	-20.000
##	2006-07-21	-32907	26.490	-871706.4	-59581.670
##	2006-08-22	32465	26.850	871685.2	-20.000
##	2006-09-05	-32465	27.040	-877853.6	6148.350
##	2006-09-13	33568	26.150	877803.2	-20.000
##	2006-09-19	-33568	26.210	-879817.3	1994.080
##	2006-11-01	29803	29.520	879784.6	-20.000
##	2006-11-29	-29803	28.840	-859518.5	-20286.040
##	2006-12-27	24762	34.710	859489.0	-20.000
##	2007-01-17	-24762	35.610	-881774.8	22265.800
##	2007-01-24	25049	35.200	881724.8	-20.000
##	2007-02-16	-25049	39.010	-977161.5	95416.690
##	2007-03-06	26910	36.310	977102.1	-20.000
##	2007-03-09	-26910	37.280	-1003204.8	26082.700
##	2007-03-29	27387	36.630	1003185.8	-20.000
##	2007-03-30	-27387	36.340	-995243.6	-7962.230
##	2007-05-29	23422	42.490	995200.8	-20.000
##	2007-06-12	-23422	42.760	-1001524.7	6303.940
##	2007-06-28	23241	43.090	1001454.7	-20.000
##	2007-07-10	-23241	45.810	-1064670.2	63195.520
##	2007-07-19	24033	44.300	1064661.9	-20.000
##	2007-07-20	-24033	43.500	-1045435.5	-19246.400
##	2007-07-30	25448	41.080	1045403.8	-20.000
##	2007-08-27	-25448	42.400	-1078995.2	33571.360
##	2007-09-07	25604	42.140	1078952.6	-20.000
##	2007-09-20	-25604	42.200	-1080488.8	1516.240
##	2007-10-11	24090	44.850	1080436.5	-20.000
##	2007-11-07	-24090	43.080	-1037797.2	-42659.300
##	2007-12-12	27245	38.090	1037762.1	-20.000
##	2007-12-13	-27245	37.050	-1009427.2	-28354.800
##	2008-01-08	27134	37.200	1009384.8	-20.000
##	2008-01-11	-27134	35.250	-956473.5	-52931.300
##	2008-04-09	25621	37.330	956431.9	-20.000
##	2008-04-22	-25621	39.890	-1022021.7	65569.760
##	2009-11-23	41226	24.790	1021992.5	-20.000
##	2009-11-24	-41226	24.550	-1012098.3	-9914.240
##	2010-03-16	39876	25.380	1012052.9	-20.000
##	2010-03-30	-39876	25.810	-1029199.6	17126.680
##	2010-04-09	38778	26.540	1029168.1	-20.000
##	2010-04-12	-38778	26.495	-1027423.1	-1765.010
##	2010-04-14	38871	26.430	1027360.5	-20.000
##	2010-04-15	-38871	26.365	-1024833.9	-2546.615
##	2010-04-20	39295	26.080	1024813.6	-20.000
##	2010-05-05	-39295	23.610	-927754.9	-97078.650
##	2010-10-13	36253	25.590	927714.3	-20.000
##	2010-10-26	-36253	26.500	-960704.5	32970.230
##	2010-11-24	33578	28.610	960666.6	-20.000
##	2010-11-29	-33578	29.795	-1000456.5	39769.930
##	2010-12-01	33430	29.925	1000392.8	-20.000
##	2010-12-08	-33430	31.000	-1036330.0	35917.250

## 2010-12-13	34072	30.415	1036299.9	-20.000
## 2011-01-05	-34072	31.245	-1064579.6	28259.760
## 2011-01-31	35609	29.895	1064531.1	-20.000
## 2011-02-22	-35609	30.000	-1068270.0	3718.945
## 2011-03-03	35679	29.940	1068229.3	-20.000
## 2011-03-23	-35679	27.665	-987059.5	-81189.725
## 2011-04-13	32803	30.090	987042.3	-20.000
## 2011-05-03	-32803	31.200	-1023453.6	36391.330
## 2011-05-06	31882	32.100	1023412.2	-20.000
## 2011-05-16	-31882	32.800	-1045729.6	22297.400
## 2011-05-19	31978	32.700	1045680.6	-20.000
## 2011-06-16	-31978	33.930	-1085013.5	39312.940
## 2011-07-13	34065	31.850	1084970.2	-20.000
## 2011-08-04	-34065	27.550	-938490.8	-146499.500
## 2013-11-14	48650	19.290	938458.5	-20.000
## 2013-12-04	-48650	17.295	-841401.8	-97076.750
## 2014-01-22	44212	19.030	841354.4	-20.000
## 2014-01-29	-44212	18.765	-829638.2	-11736.180
## 2014-02-12	42653	19.450	829600.8	-20.000
## 2014-02-17	-42653	20.020	-853913.1	24292.210
## 2014-03-04	44323	19.265	853882.6	-20.000
## 2014-03-07	-44323	19.665	-871611.8	17709.200
## 2014-03-26	46533	18.730	871563.1	-20.000
## 2014-04-02	-46533	19.545	-909487.5	37904.395
## 2014-06-02	40792	22.295	909457.6	-20.000
## 2014-06-06	-40792	21.695	-884982.4	-24495.200
## 2014-06-23	40941	21.615	884939.7	-20.000
## 2014-07-21	-40941	21.440	-877775.0	-7184.675
## 2014-07-24	40402	21.725	877733.5	-20.000
## 2014-07-31	-40402	21.335	-861976.7	-15776.780
## 2014-08-25	40667	21.195	861937.1	-20.000
## 2014-08-28	-40667	21.195	-861937.1	-20.000
## 2014-12-01	40125	21.480	861885.0	-20.000
## 2014-12-30	-40125	21.325	-855665.6	-6239.375
## 2015-02-10	37234	22.980	855637.3	-20.000
## 2015-02-13	-37234	22.870	-851541.6	-4115.740
## 2015-03-05	36280	23.470	851491.6	-20.000
## 2015-03-17	-36280	24.930	-904460.4	52948.800
## 2015-03-27	37021	24.430	904423.0	-20.000
## 2015-04-16	-37021	25.590	-947367.4	42924.360
## 2015-05-27	37818	25.050	947340.9	-20.000
## 2015-06-04	-37818	24.045	-909333.8	-38027.090
## 2015-06-10	38709	23.490	909274.4	-20.000
## 2015-07-08	-38709	22.230	-860501.1	-48793.340
## 2015-08-13	36624	23.495	860480.9	-20.000
## 2015-08-19	-36624	21.360	-782288.6	-78212.240
## 2016-08-18	36165	21.630	782248.9	-20.000
## 2016-08-29	-36165	20.975	-758560.9	-23708.075
## 2016-09-01	35787	21.195	758505.5	-20.000
## 2016-09-29	-35787	21.265	-761010.6	2485.090
## 2016-10-14	34606	21.990	760985.9	-20.000
## 2016-10-25	-34606	22.415	-775693.5	14687.550
## 2016-11-14	35843	21.640	775642.5	-20.000
## 2016-11-24	-35843	21.400	-767040.2	-8622.320

```

## 2016-11-29      36086 21.255   767007.9          -20.000
## 2016-12-09     -36086 23.495  -847840.6      80812.640
## 2016-12-20      36725 23.085   847796.6          -20.000
## 2016-12-21     -36725 22.855  -839349.9     -8466.750
## 2017-01-20      35169 23.865   839308.2          -20.000
## 2017-01-23     -35169 23.510  -826823.2    -12504.995
## 2017-02-01      34804 23.755   826769.0          -20.000
## 2017-02-23     -34804 24.100  -838776.4     11987.380
## 2017-03-10      36909 22.725   838757.0          -20.000
## 2017-03-17     -36909 23.305  -860164.2     21387.220
## 2017-03-23      37932 22.675   860108.1          -20.000
## 2017-04-04     -37932 22.995  -872246.3     12118.240
## 2017-04-10      38508 22.650   872206.2          -20.000
## 2017-05-11     -38508 22.265  -857380.6    -14845.580
## 2017-06-08      36923 23.220   857352.1          -20.000
## 2017-06-12     -36923 23.810  -879136.6     21764.570
## 2017-06-21      36259 24.245   879099.5          -20.000
## 2017-06-27     -36259 25.400  -920978.6     41859.145
## 2017-07-10      35090 26.245   920937.1          -20.000
## 2017-08-07     -35090 25.725  -902690.2    -18266.800
## 2017-08-10      34697 26.015   902642.5          -20.000
## 2017-08-28     -34697 25.090  -870547.7    -32114.725
## 2017-09-18      33264 26.170   870518.9          -20.000
## 2017-09-21     -33264 25.750  -856548.0    -13990.880
## 2017-12-18      36063 23.750   856496.2          -20.000
## 2018-01-02     -36063 23.940  -863348.2      6831.970
## 2018-01-26      33001 26.160   863306.2          -20.000
## 2018-02-12     -33001 23.330  -769913.3    -93412.830
## 2018-06-11      32539 23.660   769872.7          -20.000
## 2018-06-14     -32539 23.300  -758158.7    -11734.040
##
## [1] "Transactions for the instrument: VOW.csv"
##           Quantity    Price      Value Net realized Profit
## 1999-12-31         0  0.000         0.0         0.000
## 2002-01-03      19151 52.216   999988.6        -20.000
## 2002-01-10     -19151 51.659  -989321.5     -10687.107
## 2002-01-28      19106 51.778   989270.5        -20.000
## 2002-01-30     -19106 53.290 -1018158.7     28868.272
## 2002-02-08      19663 51.778   1018110.8        -20.000
## 2002-02-11     -19663 50.834  -999548.9    -18581.872
## 2002-02-25      19767 50.565   999518.4        -20.000
## 2002-03-25     -19767 60.826 -1202347.5    202809.187
## 2002-04-05      20707 58.062   1202289.8        -20.000
## 2002-04-17     -20707 59.205 -1225957.9     23648.101
## 2002-05-13      21980 55.775   1225934.5        -20.000
## 2002-05-15     -21980 55.308 -1215669.8    -10284.660
## 2002-05-31      21088 57.644   1215596.7        -20.000
## 2002-06-07     -21088 54.681 -1153112.9    -62503.744
## 2003-09-11      26577 43.387   1153096.3        -20.000
## 2003-09-18     -26577 43.646 -1159979.7      6863.443
## 2003-10-27      27452 42.254   1159956.8        -20.000
## 2003-10-29     -27452 42.781 -1174424.0     14447.204
## 2003-11-20      27625 42.512   1174394.0        -20.000
## 2003-11-26     -27625 42.005 -1160388.1    -14025.875

```

## 2003-12-11	27269	42.552	1160350.5	-20.000
## 2003-12-15	-27269	43.248	-1179329.7	18959.224
## 2003-12-23	27069	43.566	1179288.1	-20.000
## 2004-01-13	-27069	40.812	-1104740.0	-74568.026
## 2005-07-08	28793	38.367	1104701.0	-20.000
## 2005-07-13	-28793	39.917	-1149330.2	44609.150
## 2005-08-19	26446	43.457	1149263.8	-20.000
## 2005-09-16	-26446	45.584	-1205514.5	56230.642
## 2005-10-20	25825	46.678	1205459.3	-20.000
## 2005-10-27	-25825	45.614	-1177981.5	-27497.800
## 2005-10-31	26336	44.729	1177982.9	-20.000
## 2005-11-09	-26336	46.330	-1220146.9	42143.936
## 2006-01-02	27186	44.879	1220080.5	-20.000
## 2006-01-20	-27186	45.744	-1243596.4	23495.890
## 2006-01-24	27162	45.783	1243557.8	-20.000
## 2006-02-21	-27162	57.913	-1573032.9	329455.060
## 2006-04-19	25314	62.138	1572961.3	-20.000
## 2006-05-18	-25314	53.667	-1358526.4	-214454.894
## 2006-06-15	26222	51.808	1358509.4	-20.000
## 2006-07-04	-26222	54.413	-1426817.7	68288.310
## 2006-07-14	26809	53.220	1426775.0	-20.000
## 2006-07-26	-26809	53.488	-1433959.8	7164.812
## 2006-08-08	24549	58.410	1433907.1	-20.000
## 2006-09-05	-24549	63.301	-1553976.2	120049.159
## 2006-09-12	25304	61.412	1553969.2	-20.000
## 2006-09-22	-25304	65.091	-1647062.7	93073.416
## 2006-09-25	25495	65.767	1676729.7	-20.000
## 2006-10-23	-25495	73.820	-1882040.9	205291.235
## 2006-11-28	22930	80.779	1852262.5	-20.000
## 2006-11-30	-22930	82.072	-1881911.0	29628.490
## 2006-12-18	22308	84.359	1881880.6	-20.000
## 2007-01-18	-22308	84.200	-1878333.6	-3566.972
## 2007-01-26	22164	84.746	1878310.3	-20.000
## 2007-02-23	-22164	94.390	-2092060.0	213729.616
## 2007-02-28	22089	94.708	2092005.0	-20.000
## 2007-03-28	-22089	109.860	-2426697.5	334672.528
## 2007-04-11	21991	110.347	2426640.9	-20.000
## 2007-05-10	-21991	104.491	-2297861.6	-128799.296
## 2007-05-29	20421	112.525	2297873.0	-20.000
## 2007-05-30	-20421	110.884	-2264362.2	-33530.861
## 2007-07-12	18797	120.458	2264249.0	-20.000
## 2007-08-01	-18797	129.744	-2438798.0	174528.942
## 2007-08-09	17483	139.497	2438826.1	-20.000
## 2007-08-14	-17483	142.192	-2485942.7	47096.685
## 2007-08-27	16731	148.575	2485808.3	-20.000
## 2007-08-28	-16731	148.068	-2477325.7	-8502.617
## 2007-09-10	16480	150.324	2477339.5	-20.000
## 2007-09-20	-16480	152.213	-2508470.2	31110.720
## 2007-11-06	13349	187.906	2508357.2	-20.000
## 2007-12-04	-13349	157.324	-2100118.1	-408259.118
## 2007-12-11	13472	155.892	2100177.0	-20.000
## 2007-12-12	-13472	155.405	-2093616.2	-6580.864
## 2008-01-22	13823	151.448	2093465.7	-20.000
## 2008-01-28	-13823	153.546	-2122466.4	28980.654

## 2008-02-01	13903	152.661	2122445.9	-20.000
## 2008-02-29	-13903	149.121	-2073229.3	-49236.620
## 2008-05-08	11147	185.987	2073197.1	-20.000
## 2008-06-05	-11147	171.561	-1912390.5	-160826.622
## 2008-06-25	10607	180.300	1912442.1	-20.000
## 2008-07-15	-10607	166.878	-1770074.9	-142387.154
## 2008-08-05	9078	194.964	1769883.2	-20.000
## 2008-09-02	-9078	206.805	-1877375.8	107472.598
## 2008-09-08	9306	201.735	1877345.9	-20.000
## 2008-09-15	-9306	207.124	-1927495.9	50130.034
## 2008-09-16	9358	210.454	1969428.5	-20.000
## 2008-10-14	-9358	350.061	-3275870.8	1306422.306
## 2008-10-22	12701	254.617	3233890.5	-20.000
## 2008-11-19	-12701	370.094	-4700563.9	1466653.377
## 2008-11-26	15009	313.176	4700458.6	-20.000
## 2008-12-19	-15009	306.216	-4595995.9	-104482.640
## 2008-12-23	17183	267.472	4595971.4	-20.000
## 2009-01-27	-17183	260.890	-4482872.9	-113118.506
## 2009-05-07	18942	236.662	4482851.6	-20.000
## 2009-05-28	-18942	210.027	-3978331.4	-504540.170
## 2010-12-20	34595	115.000	3978425.0	-20.000
## 2010-12-28	-34595	106.450	-3682637.8	-295807.250
## 2011-01-06	32289	114.050	3682560.4	-20.000
## 2011-01-26	-32289	109.800	-3545332.2	-137248.250
## 2011-02-01	31556	112.350	3545316.6	-20.000
## 2011-02-04	-31556	107.600	-3395425.6	-149911.000
## 2011-05-13	28568	118.850	3395306.8	-20.000
## 2011-06-02	-28568	115.950	-3312459.6	-82867.200
## 2011-06-24	26953	122.900	3312523.7	-20.000
## 2011-06-30	-26953	126.050	-3397425.6	84881.950
## 2011-12-07	29749	114.200	3397335.8	-20.000
## 2011-12-09	-29749	109.500	-3257515.5	-139840.300
## 2012-02-13	24981	130.400	3257522.4	-20.000
## 2012-03-05	-24981	129.400	-3232541.4	-25001.000
## 2012-03-08	25685	125.850	3232457.2	-20.000
## 2012-04-05	-25685	117.700	-3023124.5	-209352.750
## 2012-04-11	25717	117.550	3023033.4	-20.000
## 2012-04-13	-25717	117.450	-3020461.6	-2591.700
## 2012-04-16	25631	119.250	3056496.8	-20.000
## 2012-04-23	-25631	112.500	-2883487.5	-173029.250
## 2012-05-17	23150	123.000	2847450.0	-20.000
## 2012-05-23	-23150	120.850	-2797677.5	-49792.500
## 2012-07-25	21729	128.750	2797608.8	-20.000
## 2012-07-26	-21729	126.550	-2749804.9	-47823.800
## 2012-08-03	20975	131.100	2749822.5	-20.000
## 2012-08-15	-20975	133.550	-2801211.3	51368.750
## 2012-10-16	20927	133.850	2801078.9	-20.000
## 2012-11-05	-20927	152.350	-3188228.4	387129.500
## 2012-11-07	21419	148.850	3188218.1	-20.000
## 2012-12-05	-21419	152.850	-3273894.1	85656.000
## 2013-02-01	18951	172.750	3273785.2	-20.000
## 2013-02-04	-18951	170.100	-3223565.1	-50240.150
## 2013-02-27	20811	154.900	3223623.9	-20.000
## 2013-03-01	-20811	156.650	-3260043.1	36399.250

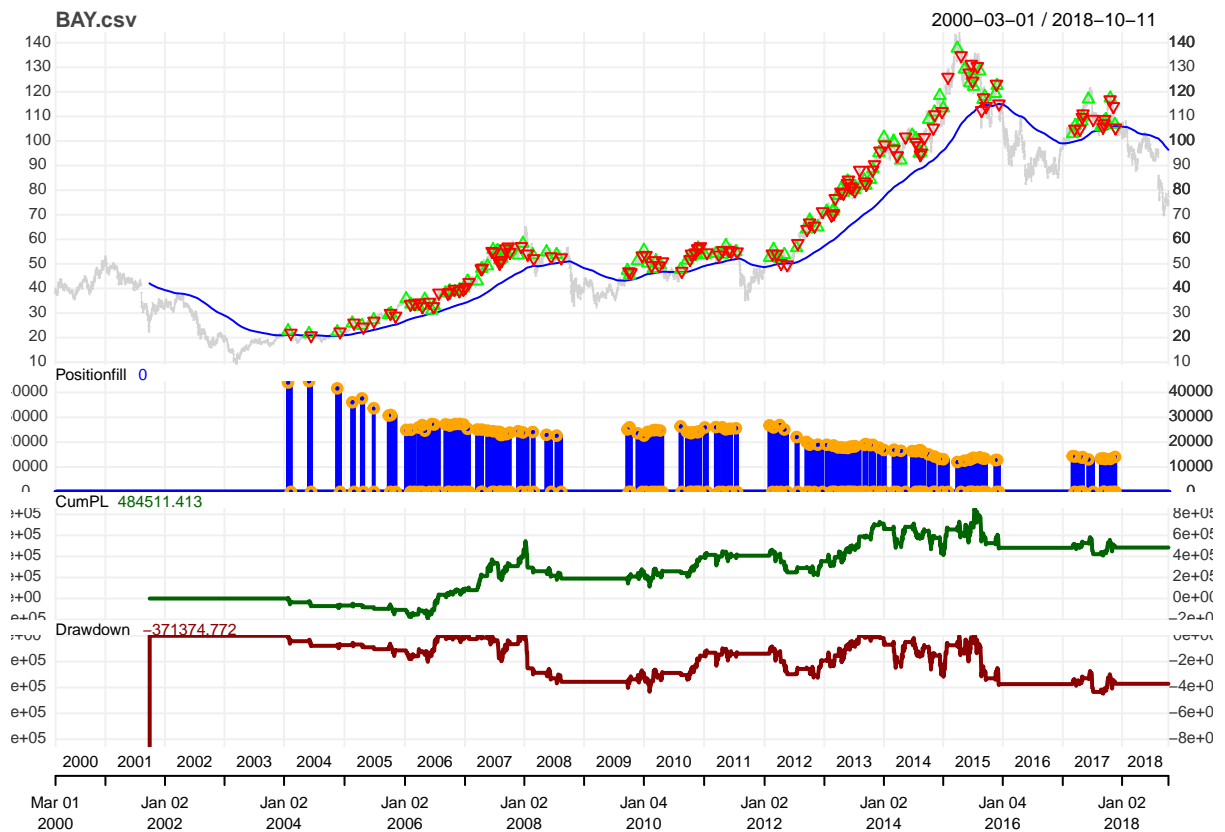
## 2013-03-22	21953	148.500	3260020.5	-20.000
## 2013-04-18	-21953	135.100	-2965850.3	-294190.200
## 2013-04-29	20446	145.050	2965692.3	-20.000
## 2013-05-02	-20446	146.750	-3000450.5	34738.200
## 2013-05-03	20268	148.900	3017905.2	-20.000
## 2013-05-23	-20268	161.200	-3267201.6	249276.400
## 2013-05-24	20692	164.200	3397626.4	-20.000
## 2013-06-03	-20692	163.300	-3379003.6	-18642.800
## 2013-06-07	19969	161.800	3230984.2	-20.000
## 2013-06-11	-19969	162.350	-3241967.1	10962.950
## 2013-06-14	20896	155.150	3242014.4	-20.000
## 2013-06-18	-20896	155.400	-3247238.4	5204.000
## 2013-06-25	22264	145.850	3247204.4	-20.000
## 2013-06-28	-22264	149.000	-3317336.0	70111.600
## 2013-07-04	22189	149.500	3317255.5	-20.000
## 2013-07-16	-22189	160.850	-3569100.6	251825.150
## 2013-07-17	22148	161.650	3580224.2	-20.000
## 2013-08-06	-22148	174.350	-3861503.8	281259.600
## 2013-08-08	22014	174.900	3850248.6	-20.000
## 2013-09-03	-22014	170.900	-3762192.6	-88076.000
## 2013-09-05	22481	167.350	3762195.4	-20.000
## 2013-09-26	-22481	169.950	-3820645.9	58430.600
## 2013-10-01	22574	169.250	3820649.5	-20.000
## 2013-10-02	-22574	167.800	-3787917.2	-32752.300
## 2013-10-28	22010	172.100	3787921.0	-20.000
## 2013-11-08	-22010	182.150	-4009121.5	221180.500
## 2013-12-06	21364	187.650	4008954.6	-20.000
## 2014-01-02	-21364	195.400	-4174525.6	165551.000
## 2014-01-07	21540	193.800	4174452.0	-20.000
## 2014-01-20	-21540	196.100	-4223994.0	49522.000
## 2014-01-28	22619	186.750	4224098.2	-20.000
## 2014-01-29	-22619	184.850	-4181122.1	-42996.100
## 2014-02-05	23568	177.400	4180963.2	-20.000
## 2014-02-24	-23568	183.200	-4317657.6	136674.400
## 2014-02-25	24516	186.500	4572234.0	-20.000
## 2014-03-25	-24516	176.150	-4318493.4	-253760.600
## 2014-04-04	21715	187.150	4063962.2	-20.000
## 2014-04-07	-21715	184.950	-4016189.2	-47793.000
## 2014-04-16	21238	189.100	4016105.8	-20.000
## 2014-04-23	-21238	191.900	-4075572.2	59446.400
## 2014-05-08	21794	187.000	4075478.0	-20.000
## 2014-06-03	-21794	193.700	-4221497.8	145999.800
## 2014-06-05	22010	191.800	4221518.0	-20.000
## 2014-06-13	-22010	193.500	-4258935.0	37397.000
## 2014-06-17	22055	193.100	4258820.5	-20.000
## 2014-06-20	-22055	194.000	-4278670.0	19829.500
## 2014-07-31	24044	177.950	4278629.8	-20.000
## 2014-08-04	-24044	171.800	-4130759.2	-147890.600
## 2014-12-05	22419	184.250	4130700.8	-20.000
## 2014-12-16	-22419	171.400	-3842616.6	-288104.150
## 2015-05-04	16729	229.700	3842651.3	-20.000
## 2015-06-02	-16729	215.350	-3602590.1	-240081.150
## 2015-06-10	17106	210.600	3602523.6	-20.000
## 2015-06-24	-17106	215.950	-3694040.7	91497.100

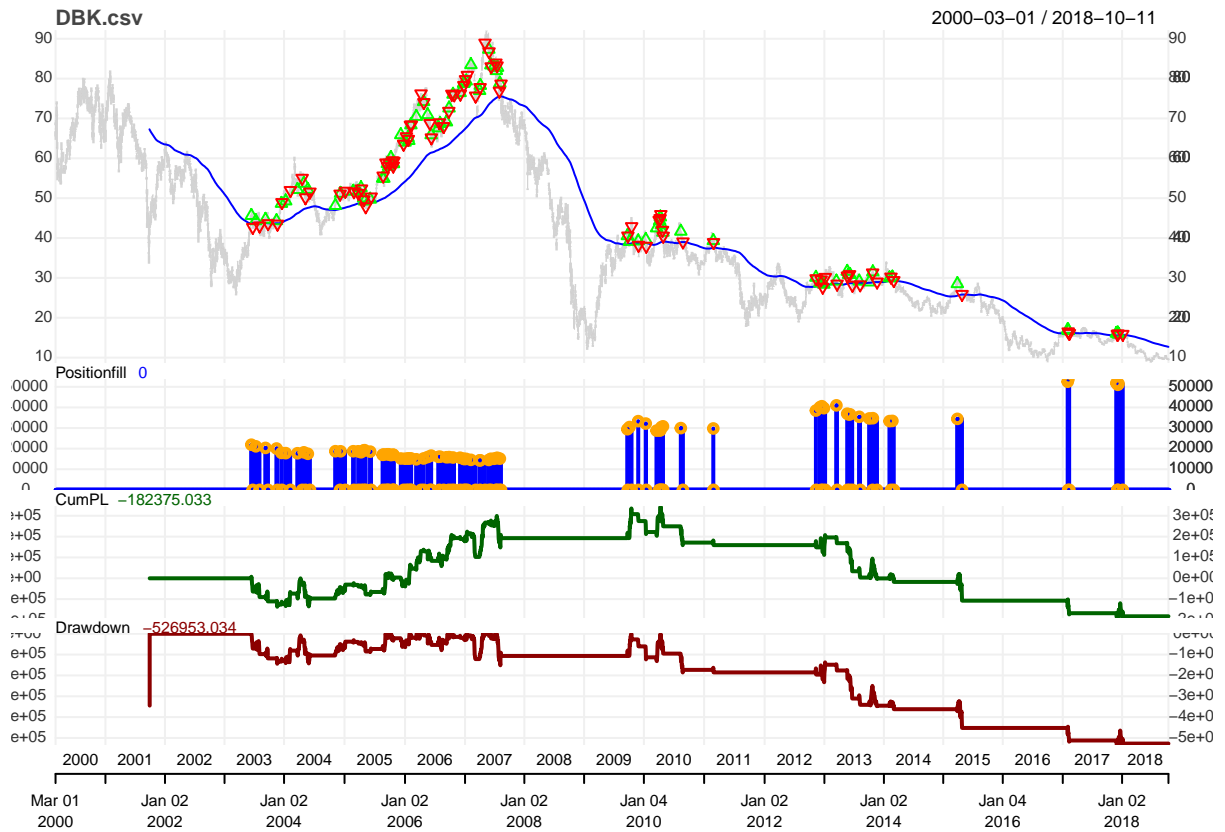
## 2015-07-09	18202	202.950	3694095.9	-20.000
## 2015-07-24	-18202	196.400	-3574872.8	-119243.100
## 2017-03-10	24645	145.050	3574757.3	-20.000
## 2017-03-20	-24645	140.650	-3466319.2	-108458.000
## 2017-04-28	23374	148.300	3466364.2	-20.000
## 2017-05-19	-23374	143.050	-3343650.7	-122733.500
## 2017-10-11	22622	147.800	3343531.6	-20.000
## 2017-10-13	-22622	148.600	-3361629.2	18077.600
## 2017-10-18	22433	149.850	3361585.0	-20.000
## 2017-10-19	-22433	148.550	-3332422.2	-29182.900
## 2017-11-16	21091	158.000	3332378.0	-20.000
## 2017-12-01	-21091	171.950	-3626597.4	294199.450
## 2017-12-07	21690	167.200	3626568.0	-20.000
## 2018-01-09	-21690	180.800	-3921552.0	294964.000
## 2018-01-12	21798	179.900	3921460.2	-20.000
## 2018-01-17	-21798	181.700	-3960696.6	39216.400
## 2018-02-07	23257	170.300	3960667.1	-20.000
## 2018-02-08	-23257	168.200	-3911827.4	-48859.700
## 2018-02-22	23326	167.700	3911770.2	-20.000
## 2018-03-07	-23326	160.000	-3732160.0	-179630.200
## 2018-03-26	23727	157.300	3732257.1	-20.000
## 2018-03-28	-23727	158.700	-3765474.9	33197.800
## 2018-03-29	23831	159.000	3789129.0	-20.000
## 2018-04-04	-23831	160.000	-3812960.0	23811.000
## 2018-04-26	22434	168.900	3789102.6	-20.000
## 2018-05-14	-22434	167.800	-3764425.2	-24697.400
## 2018-06-01	23237	162.000	3764394.0	-20.000
## 2018-06-15	-23237	158.200	-3676093.4	-88320.600

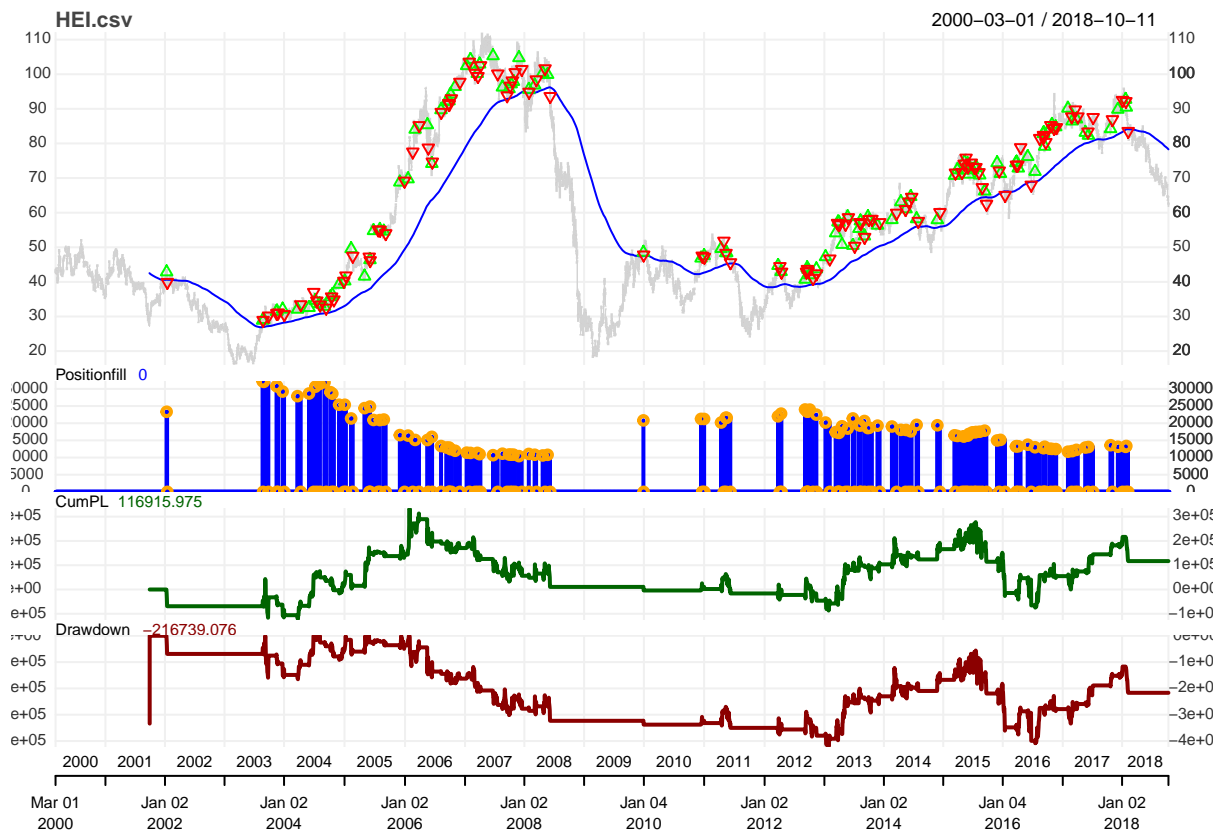
Step 3: Graph which visualize transactions

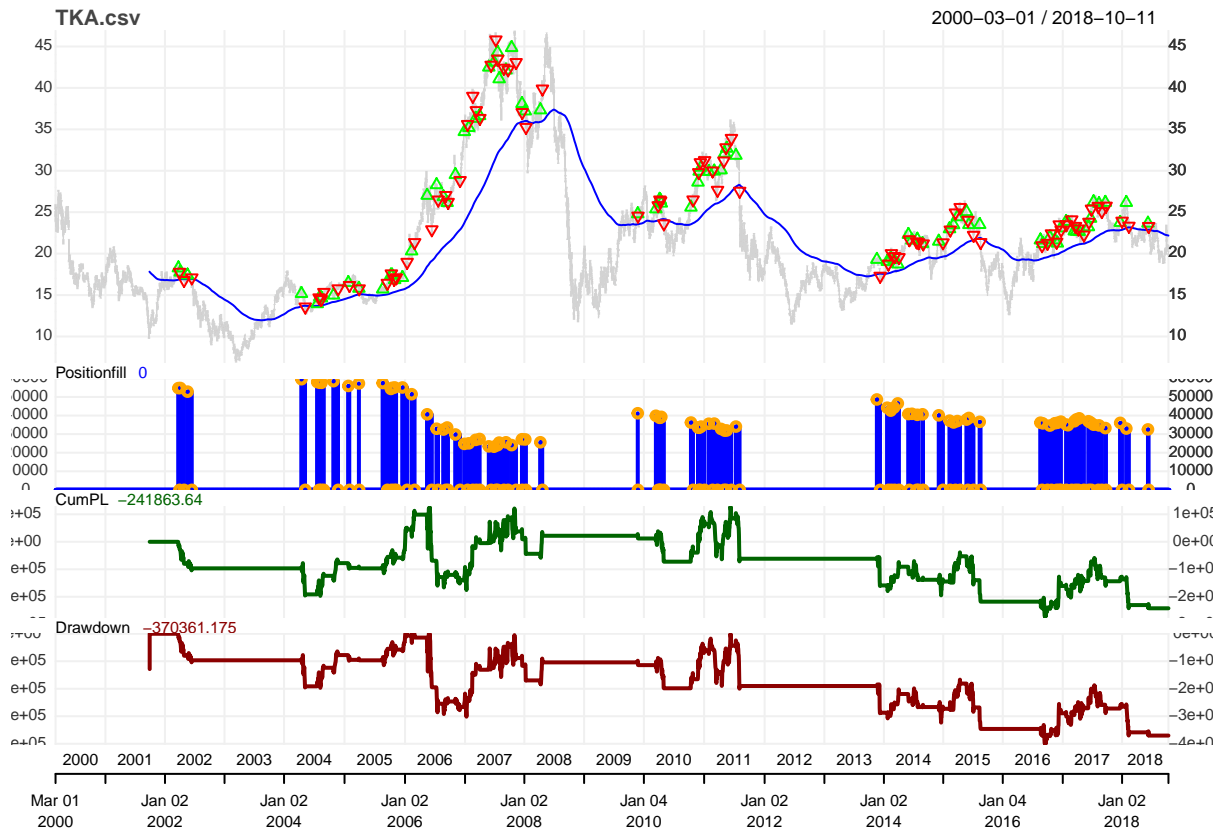
The following graphs show the combined view of the performance of the Smash Day trading system. It visualizes the trades (buy-transactions are visualized in green and sell-transactions are visualized in red). Moreover, the size of the blue squares indicates the size of the position (height) and the holding 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.

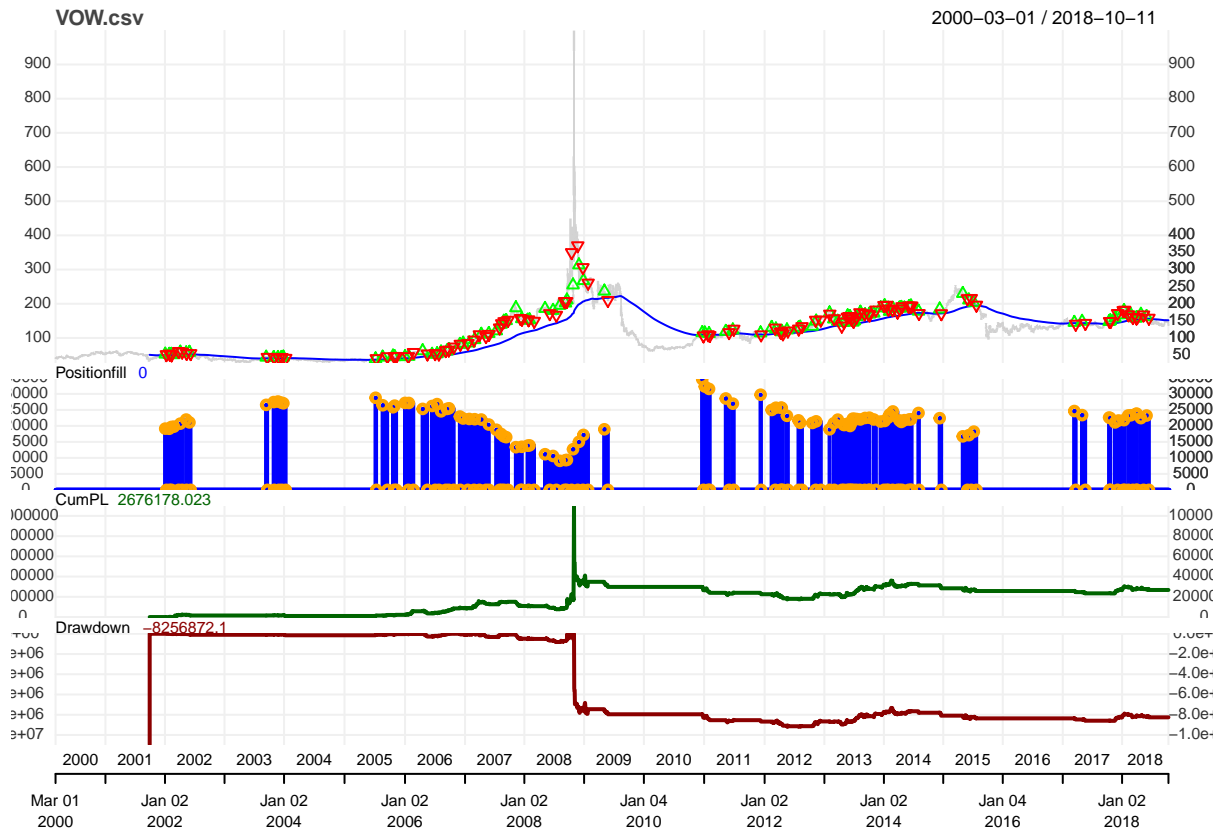
```
# Plot graph with indicators for transaction
for (instrument in instrumentlist){
  chart.Posn(portfolioname,
    Symbol=instrument,
    type='candlesticks',
    theme=myTheme,
    subset=daterange,
    TA=addEMAStrng)
}
```











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] "BAY.csv"
##      Trades  Win Percent Loss Percent      W/L Ratio
##      "117"    "48.72"    "49.57"    "0.98"
##
## [1] "DBK.csv"
##      Trades  Win Percent Loss Percent      W/L Ratio
##      "81"    "41.98"    "58.02"    "0.72"
##
## [1] "HEI.csv"
##      Trades  Win Percent Loss Percent      W/L Ratio
##      "110"    "42.73"    "57.27"    "0.75"
##
## [1] "TKA.csv"
##      Trades  Win Percent Loss Percent      W/L Ratio
##      "84"    "48.81"    "50"      "0.98"
##
## [1] "VOW.csv"
##      Trades  Win Percent Loss Percent      W/L Ratio
##      "105"    "52.38"    "47.62"    "1.1"
```

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

Performance Metrics

```
##
##              BAY      DBK      HEI      TKA
## Cumulative Return  0.27320987 -0.22107545 -0.034726133 -0.29745707
## Annualized Return  0.01415992 -0.01443851 -0.002055298 -0.02034195
## Annualized Sharp Ratio 0.08424849 -0.16290062 -0.015463526 -0.17909139
## Calmar Ratio      0.03712353 -0.03403789 -0.005054363 -0.05399060
##
##              VOW
## Cumulative Return  4.89527843
## Annualized Return  0.10879853
## Annualized Sharp Ratio 0.05057473
## Calmar Ratio      0.02013090
```

Risk Metrics

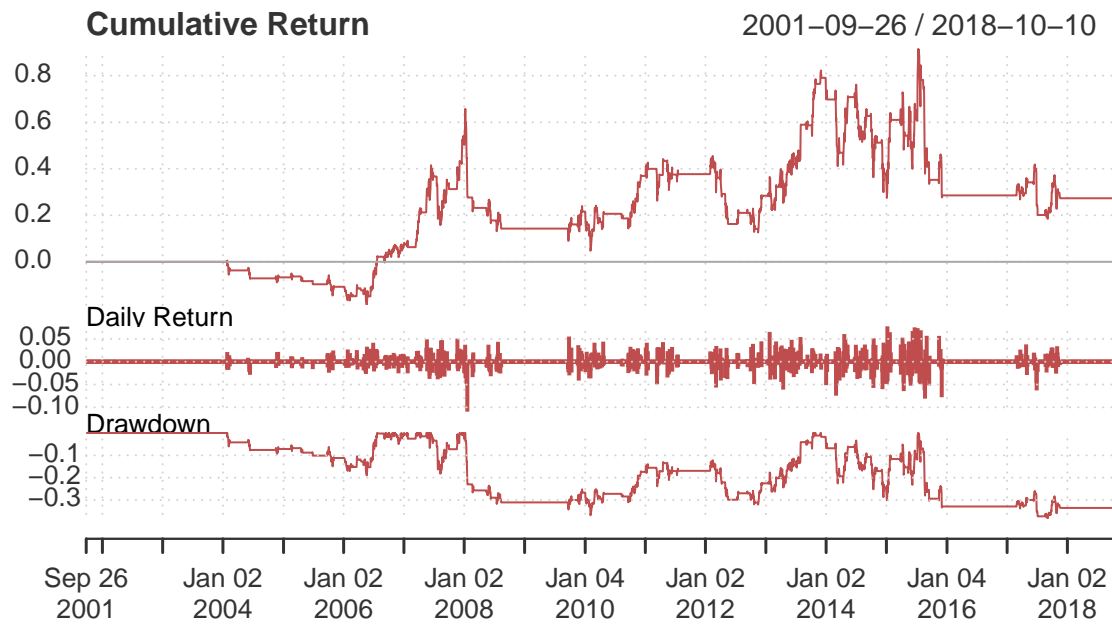
```
##
##              BAY      DBK      HEI      TKA
## Annualized StdDev  0.16807332 0.088633883 0.13291264 0.113584183
## Max Drawdown      0.38142720 0.424189462 0.40663837 0.376768363
## Value-at-Risk     -0.01432553 -0.005483433 -0.01045136 -0.009027765
## Conditional VaR    -0.02784233 -0.015273275 -0.02171036 -0.019339697
##
##              VOW
## Annualized StdDev  2.15124298
## Max Drawdown      5.40455492
## Value-at-Risk     -0.03161161
## Conditional VaR    -0.10506099
```

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

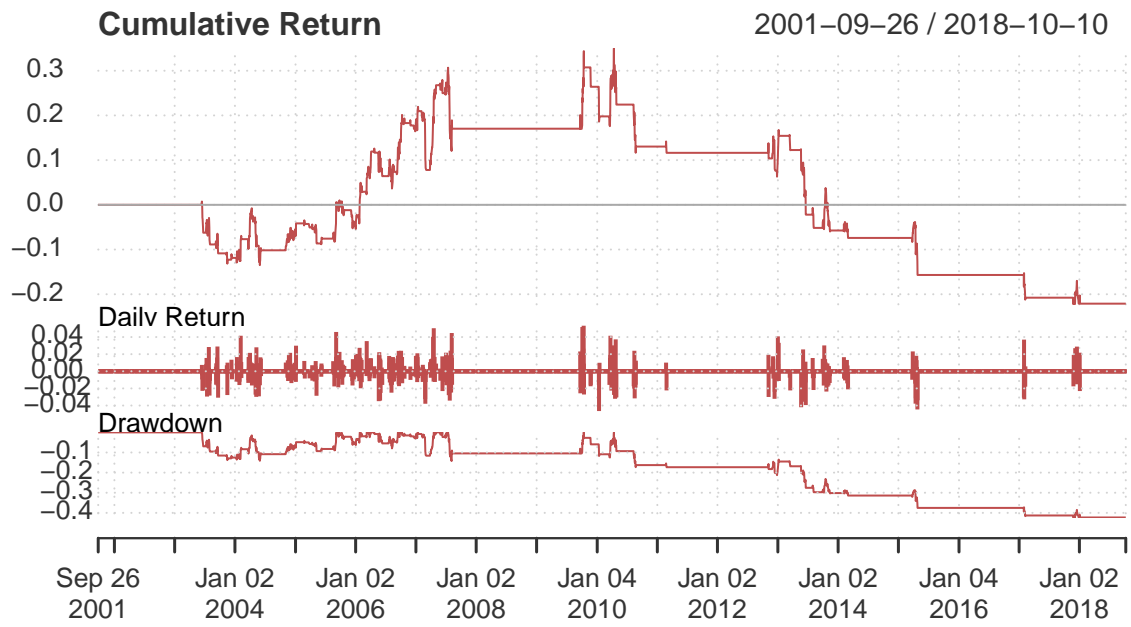
The following plots visualizes some important information about the returns of the strategy applied to the instruments on the instrumentlist. The cumulative return over the entire period, the daily returns and the drawdown for each instrument is illustrated.

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

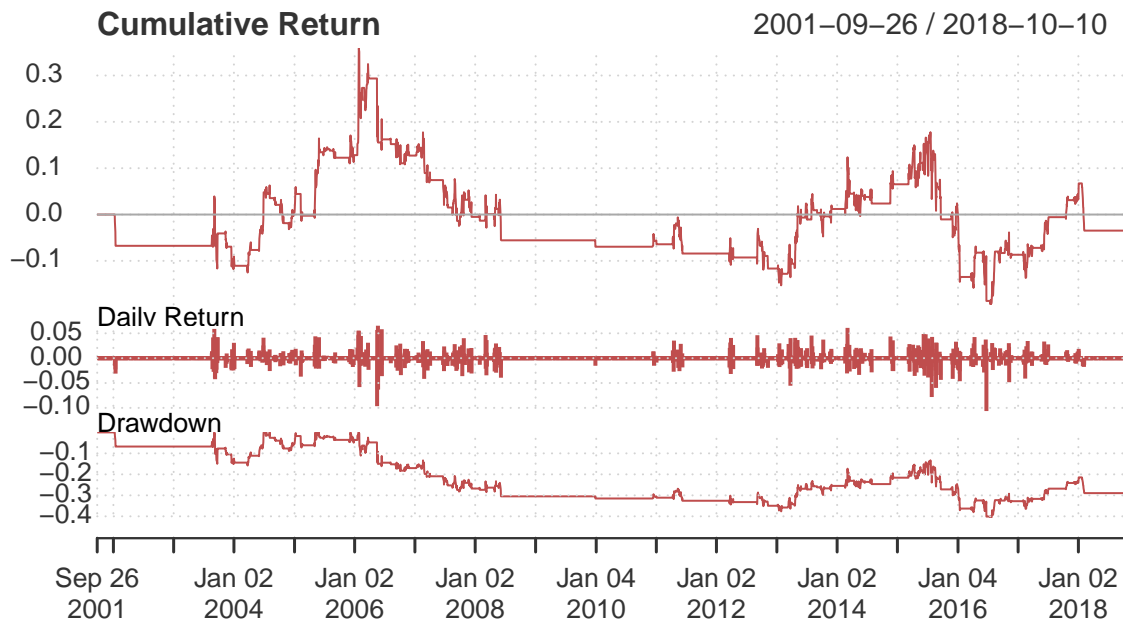
BAY



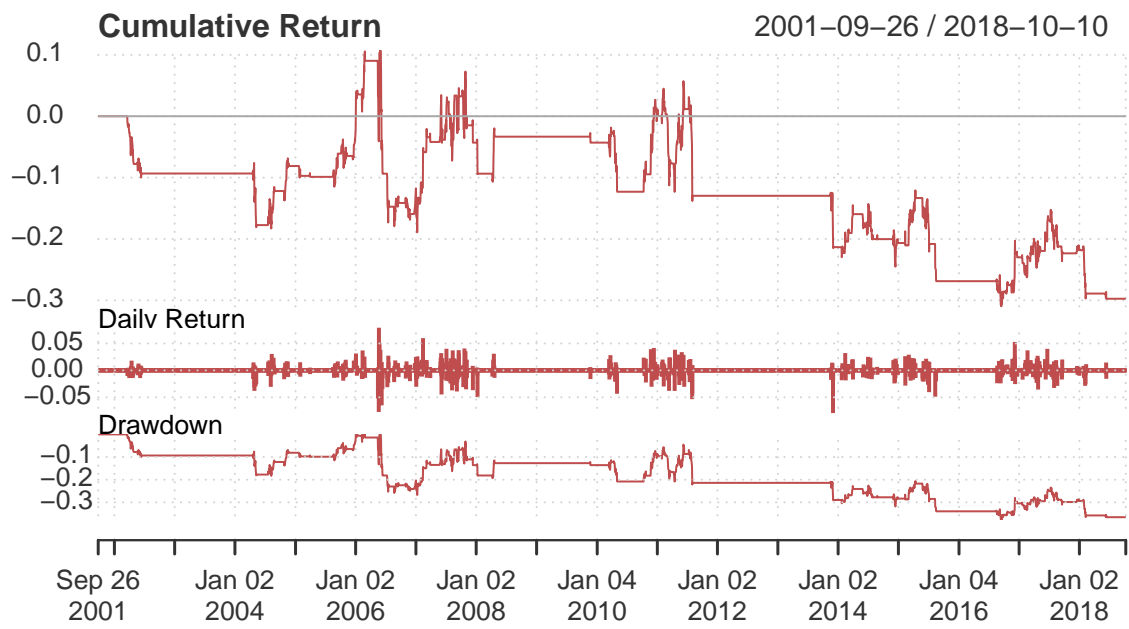
DBK



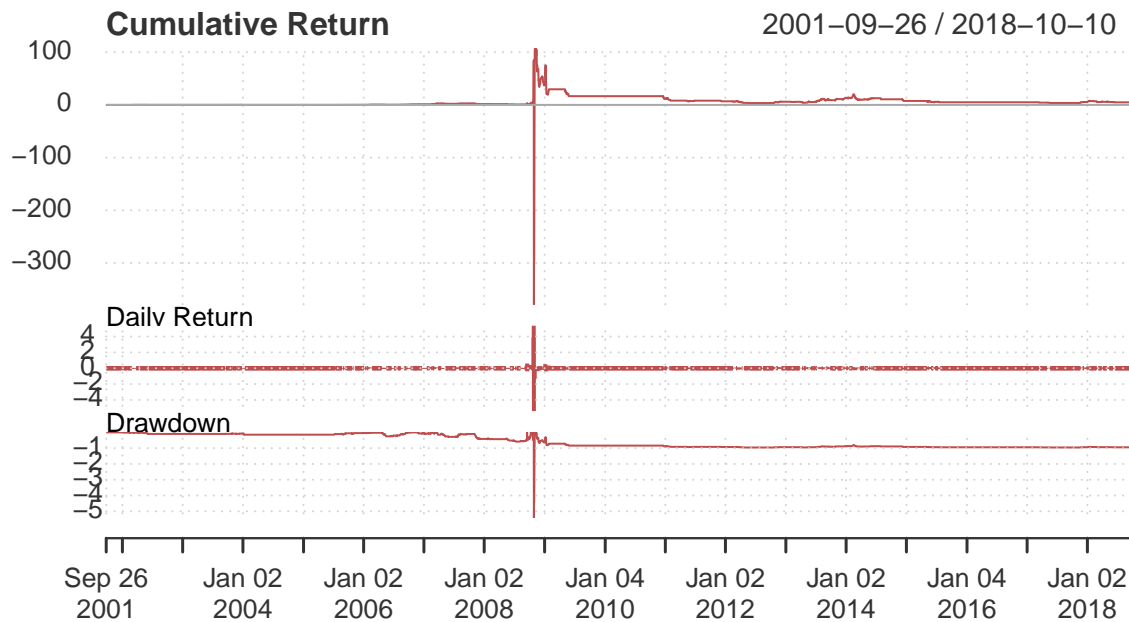
HEI



TKA



VOW



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")

```

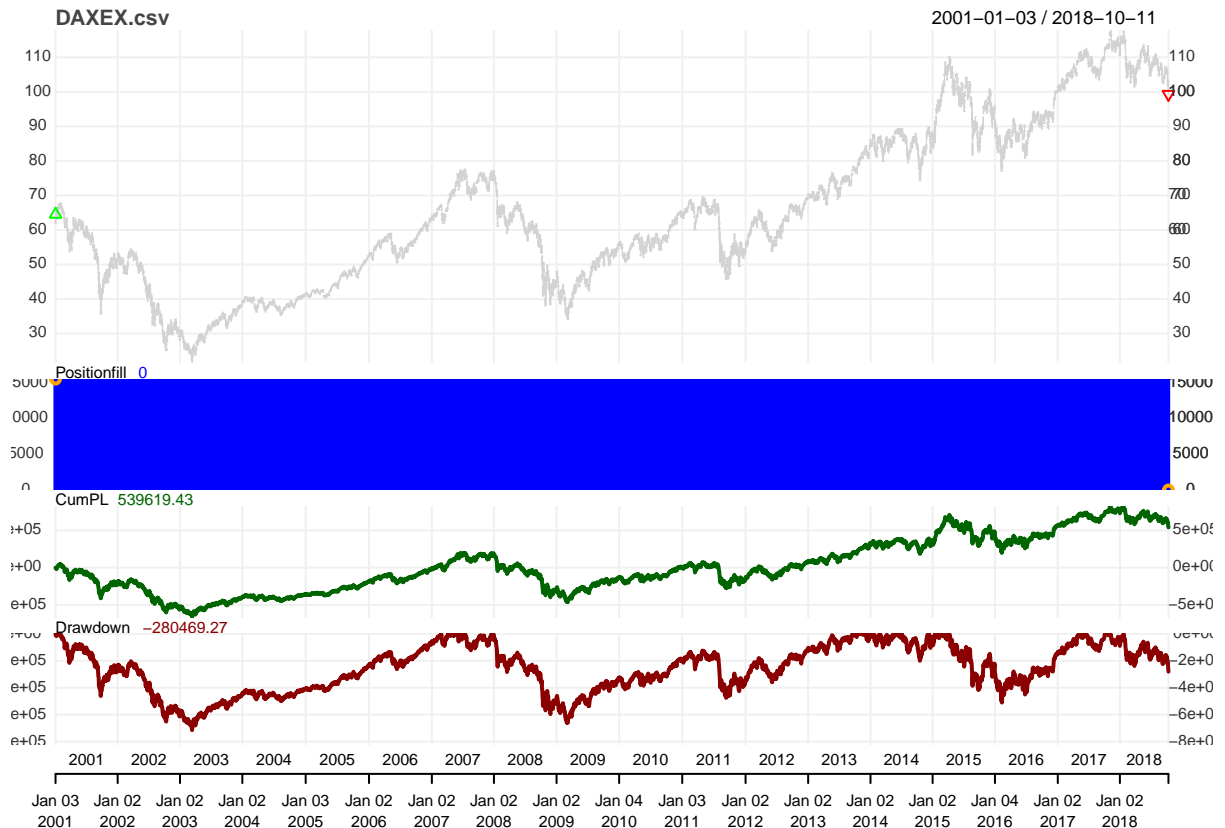
Step 2: Visualize the Buy and Hold strategy

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)
```

```
## Warning in log(1 + x): NaNs produced
```

##	BAY	DBK	HEI	TKA	VOW
## Observations	4329.0000	4329.0000	4329.0000	4329.0000	4329.0000
## NAs	188.0000	188.0000	188.0000	188.0000	188.0000
## Minimum	-0.1095	-0.0465	-0.1064	-0.0793	-5.4046
## 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	0.0000	0.0000	-0.0001	0.0006
## Geometric Mean	0.0001	-0.0001	0.0000	-0.0001	NaN
## Quartile 3	0.0000	0.0000	0.0000	0.0000	0.0000
## Maximum	0.0776	0.0533	0.0653	0.0793	5.3667
## SE Mean	0.0002	0.0001	0.0001	0.0001	0.0021

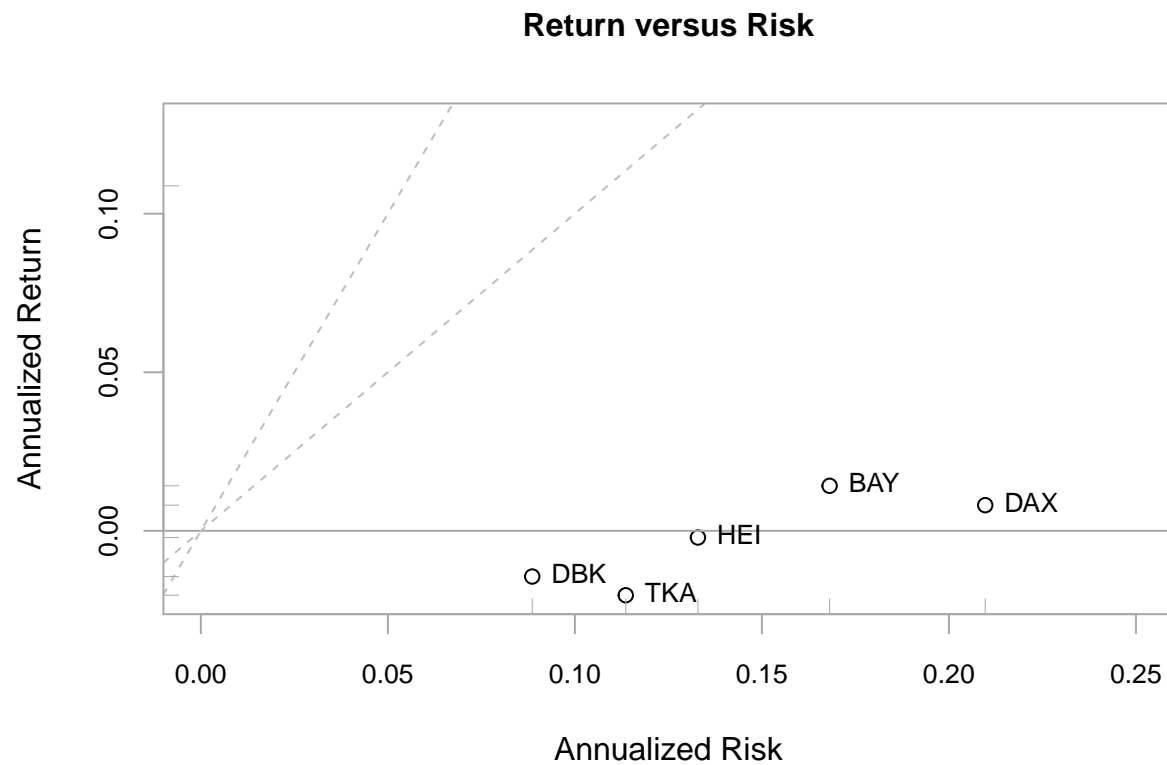

```
## LCL Mean (0.95)    -0.0002    -0.0002    -0.0002    -0.0003    -0.0034
## UCL Mean (0.95)    0.0004     0.0001     0.0003     0.0002     0.0047
## Variance           0.0001     0.0000     0.0001     0.0001     0.0184
## Stdev              0.0106     0.0056     0.0084     0.0072     0.1355
## Skewness           -0.0976     0.1366    -0.4817    -0.5576     4.9957
## Kurtosis           15.1761    25.0046    25.5891    25.9955   1311.6388
##                   DAX
## Observations      4517.0000
## NAs                0.0000
## Minimum           -0.0935
## Quartile 1        -0.0065
## Median             0.0008
## Arithmetic Mean    0.0001
## Geometric Mean     0.0000
## Quartile 3         0.0071
## Maximum            0.0788
## SE Mean            0.0002
## LCL Mean (0.95)    -0.0003
## UCL Mean (0.95)    0.0005
## Variance           0.0002
## Stdev              0.0132
## Skewness           -0.2480
## Kurtosis           2.9187
```

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

```
##                   BAY      DBK      HEI      TKA      VOW      DAX
## Annualized Return    0.0142 -0.0144 -0.0021 -0.0203  0.1088  0.0081
## Annualized Std Dev    0.1681  0.0886  0.1329  0.1136  2.1512  0.2097
## Annualized Sharpe (Rf=0%) 0.0842 -0.1629 -0.0155 -0.1791  0.0506  0.0387
```

```
# 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

2001-09-26 / 2018-10-10



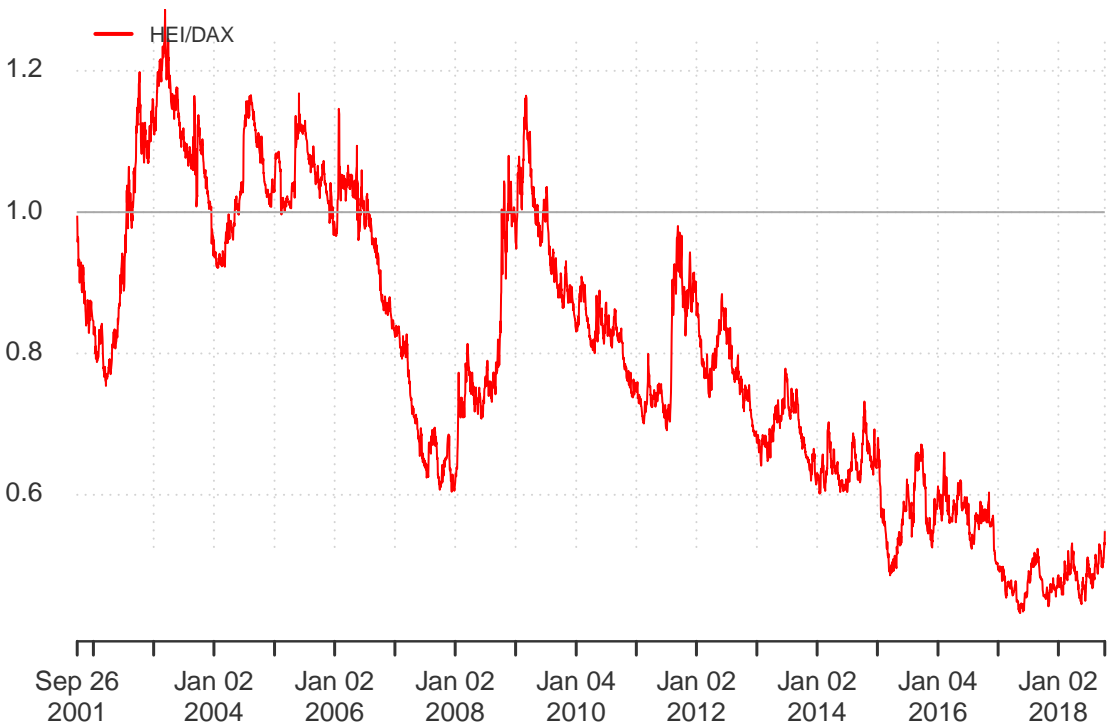
Relative Performance

2001-09-26 / 2018-10-10



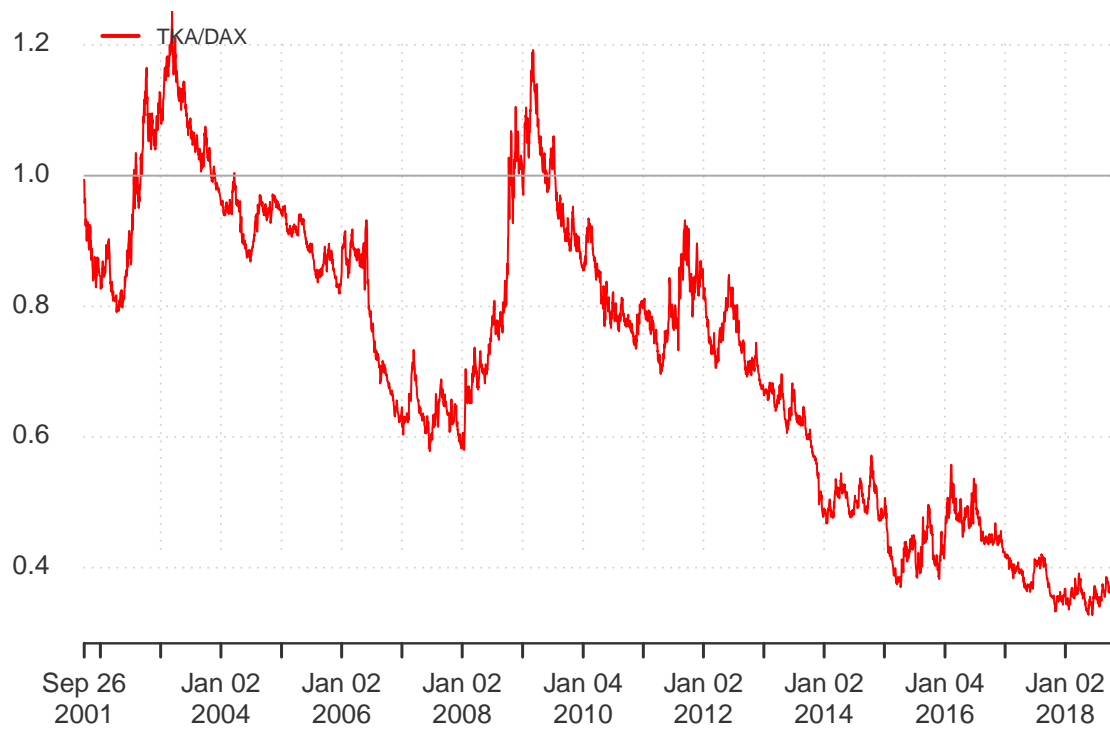
Relative Performance

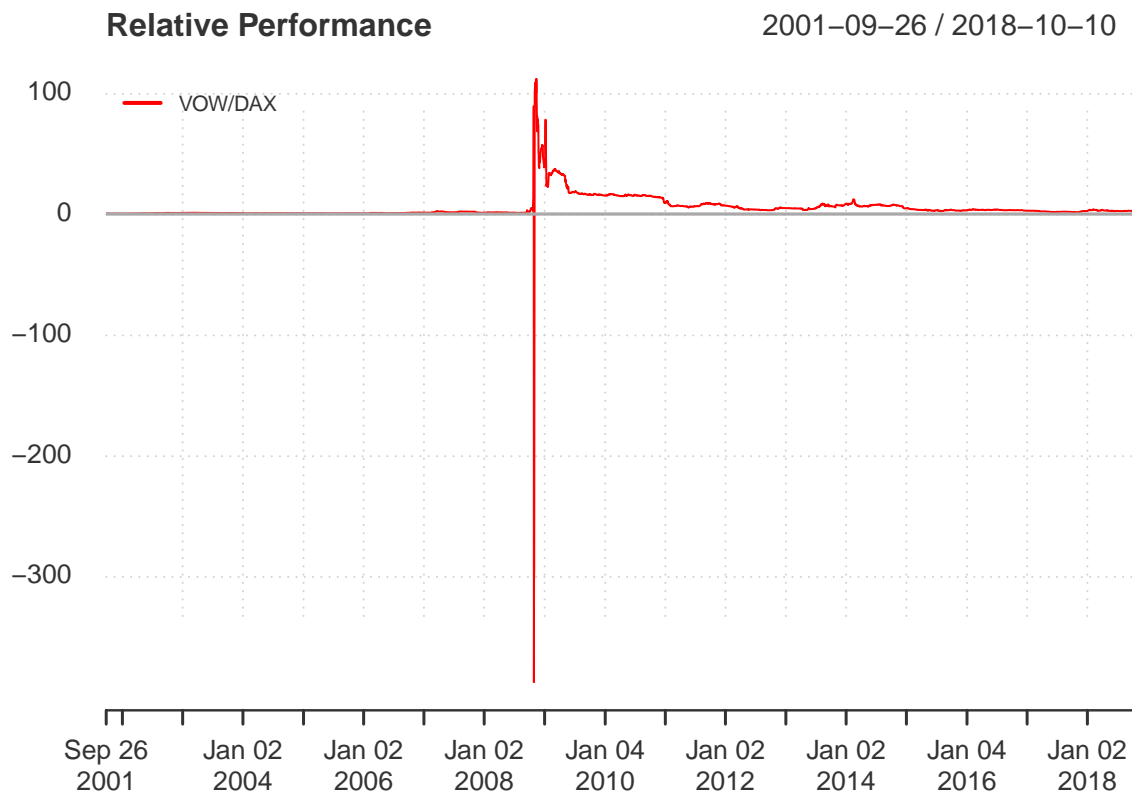
2001-09-26 / 2018-10-10



Relative Performance

2001-09-26 / 2018-10-10

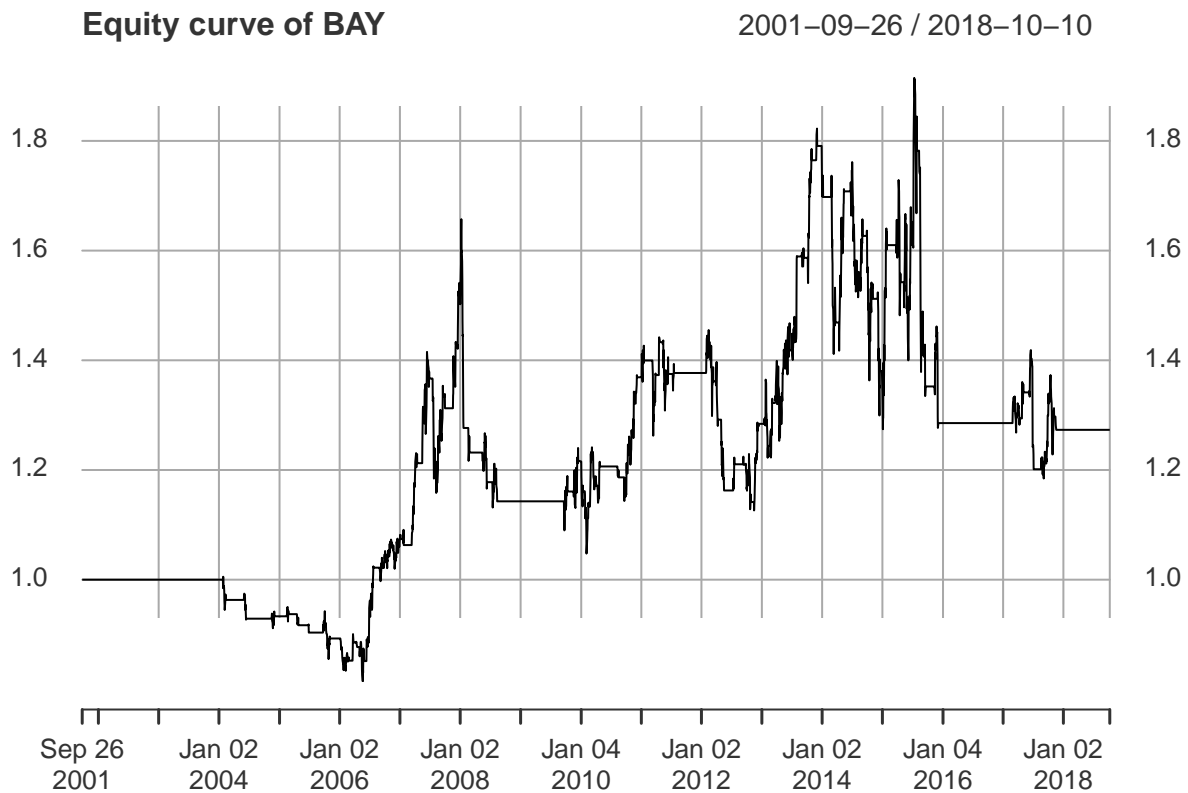
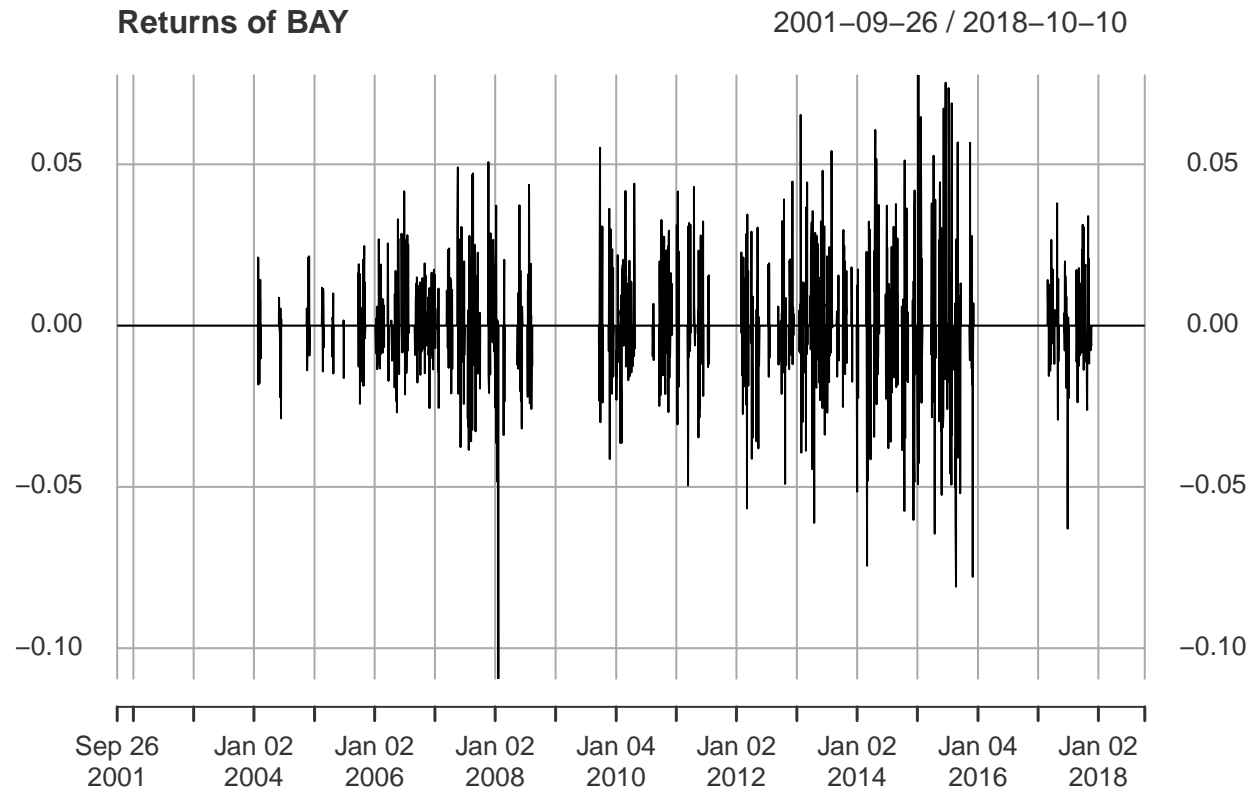




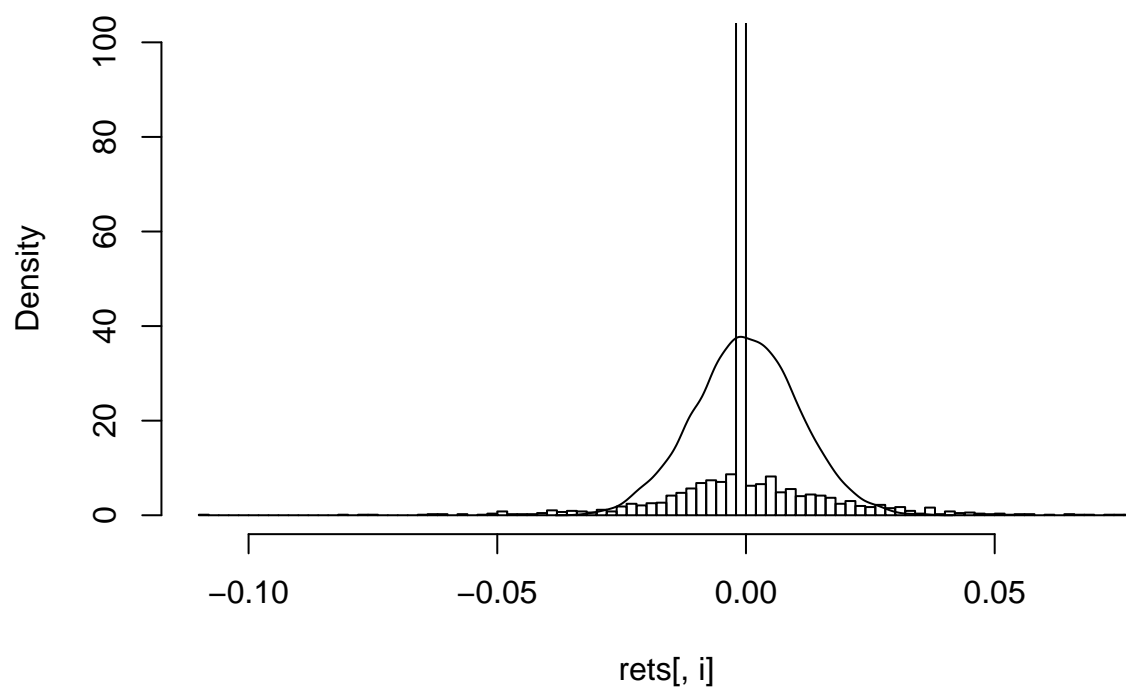
Calculations and visualizations based on returns

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

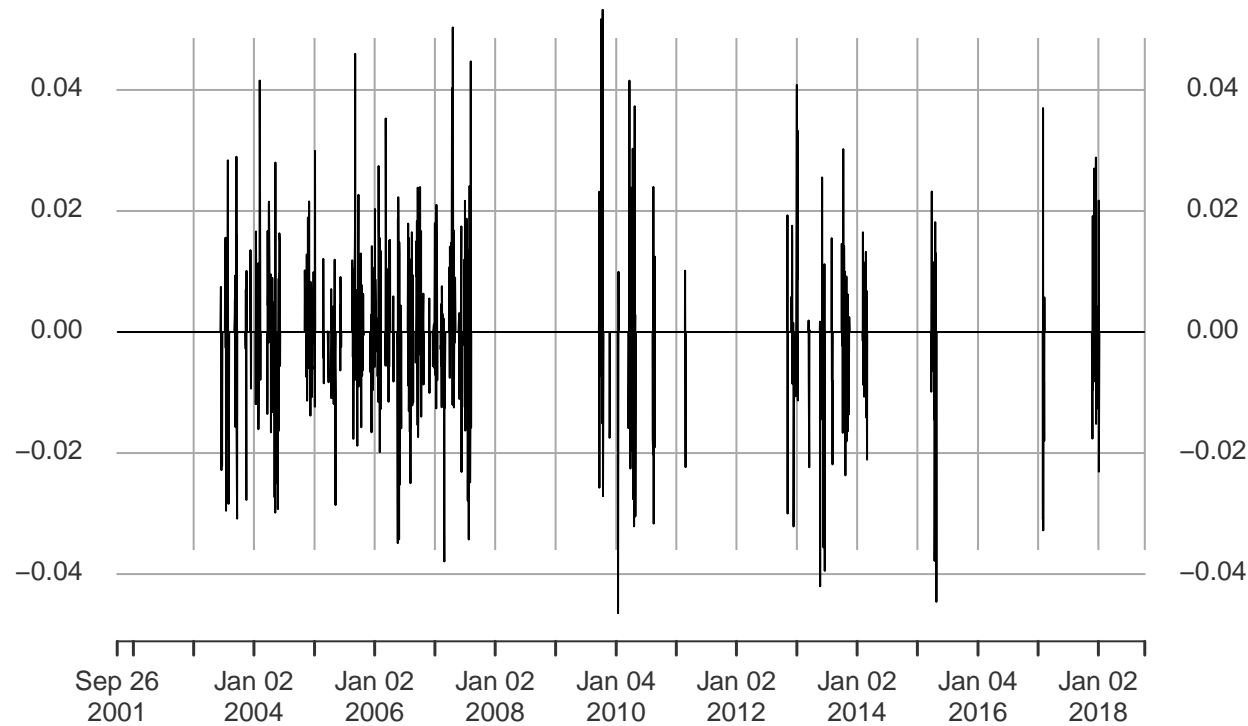


Histogram of Simple Returns of BAY



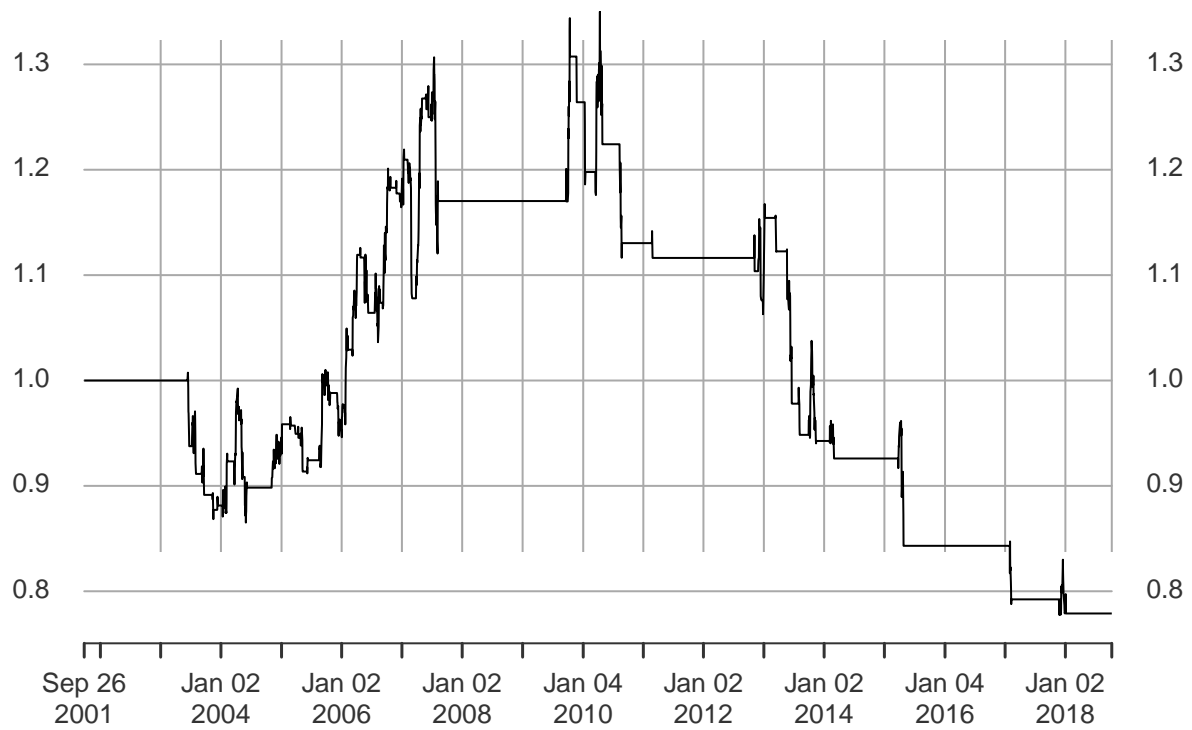
Returns of DBK

2001-09-26 / 2018-10-10

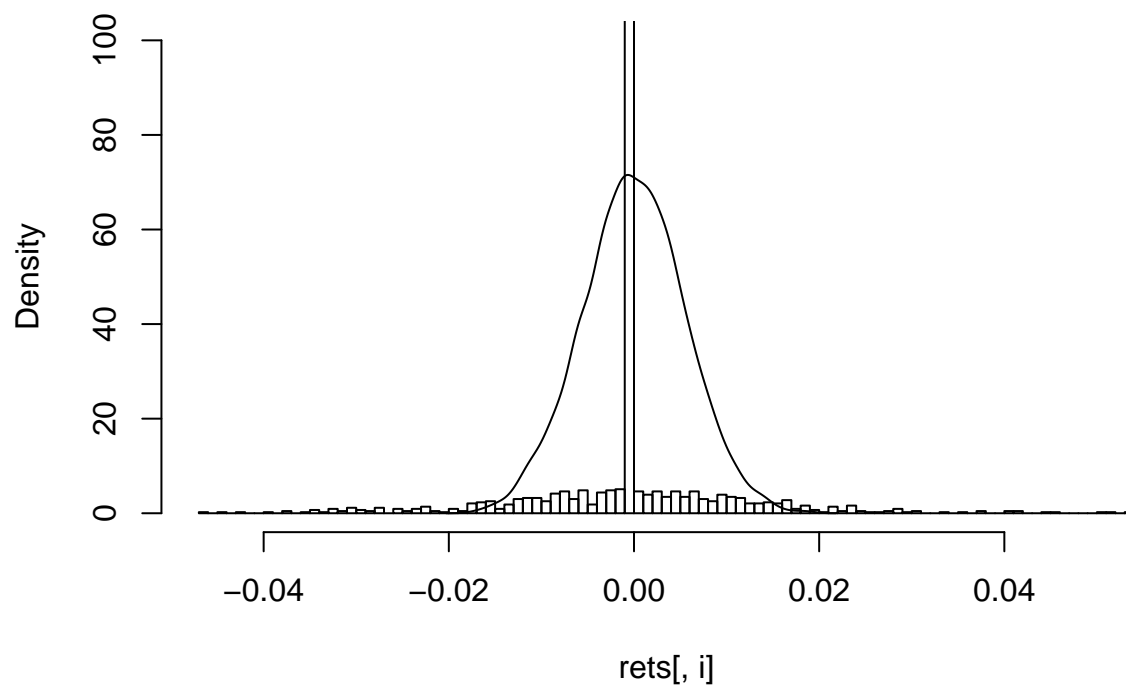


Equity curve of DBK

2001-09-26 / 2018-10-10

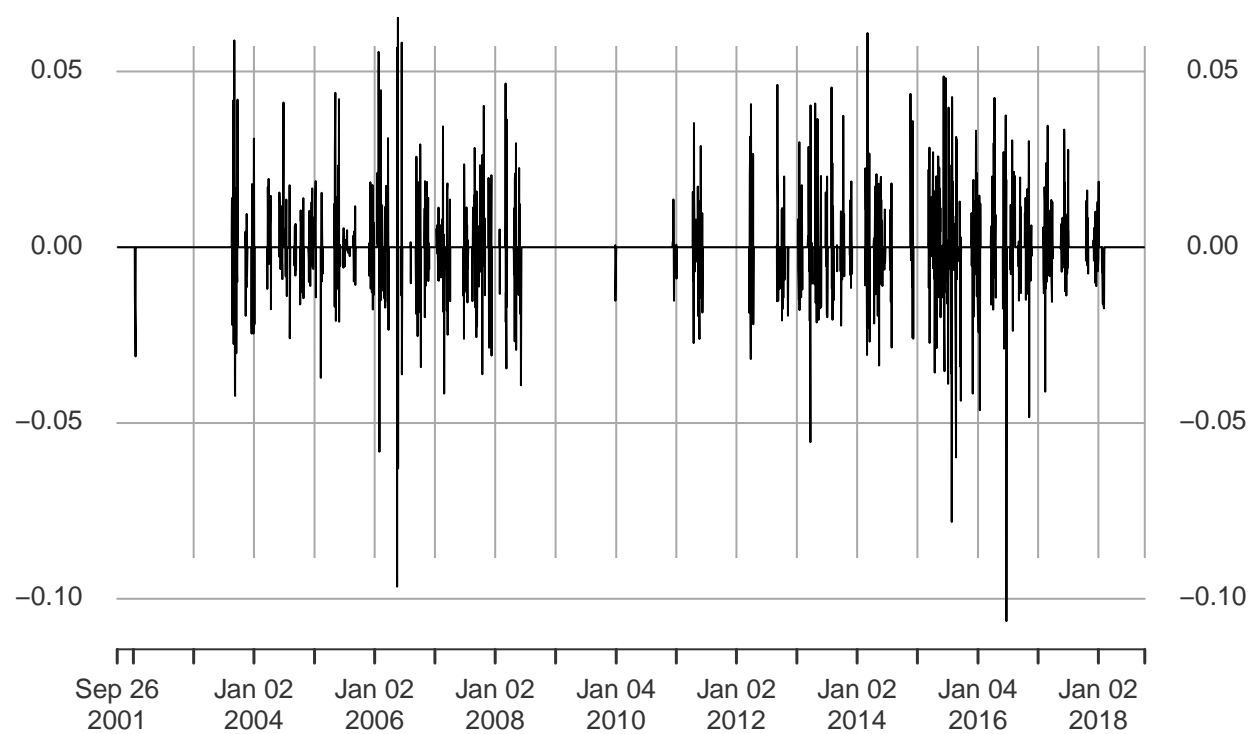


Histogram of Simple Returns of DBK



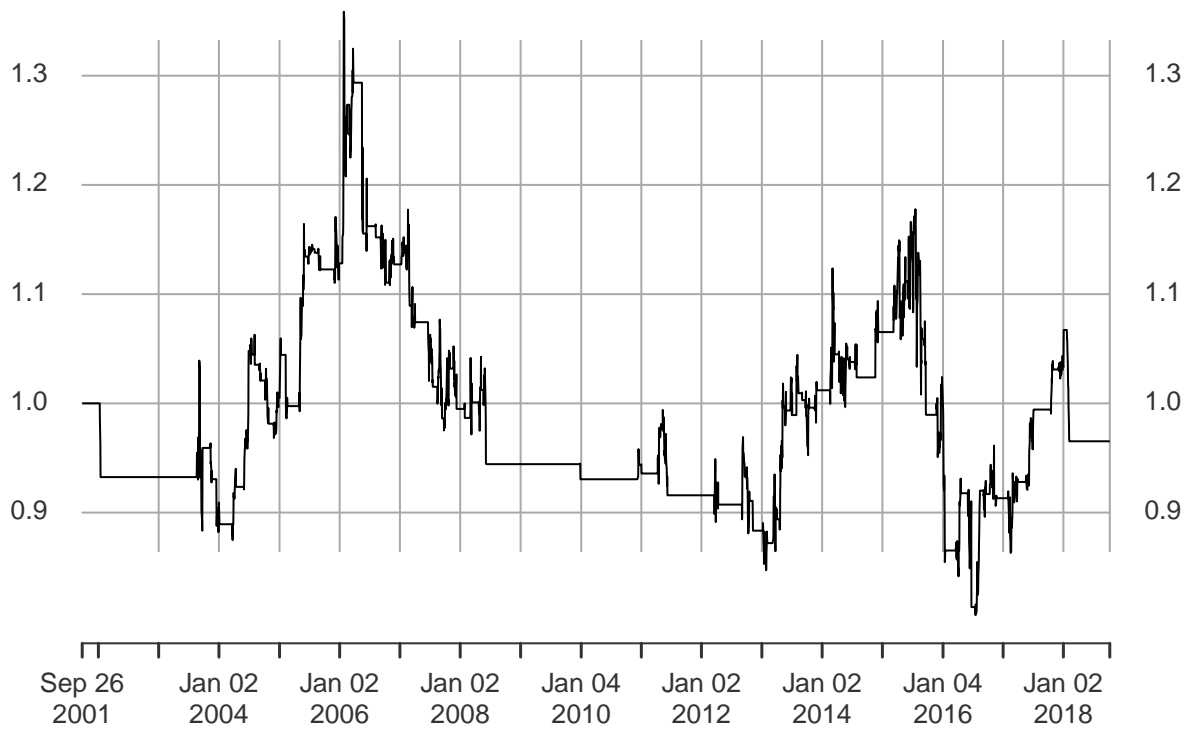
Returns of HEI

2001-09-26 / 2018-10-10

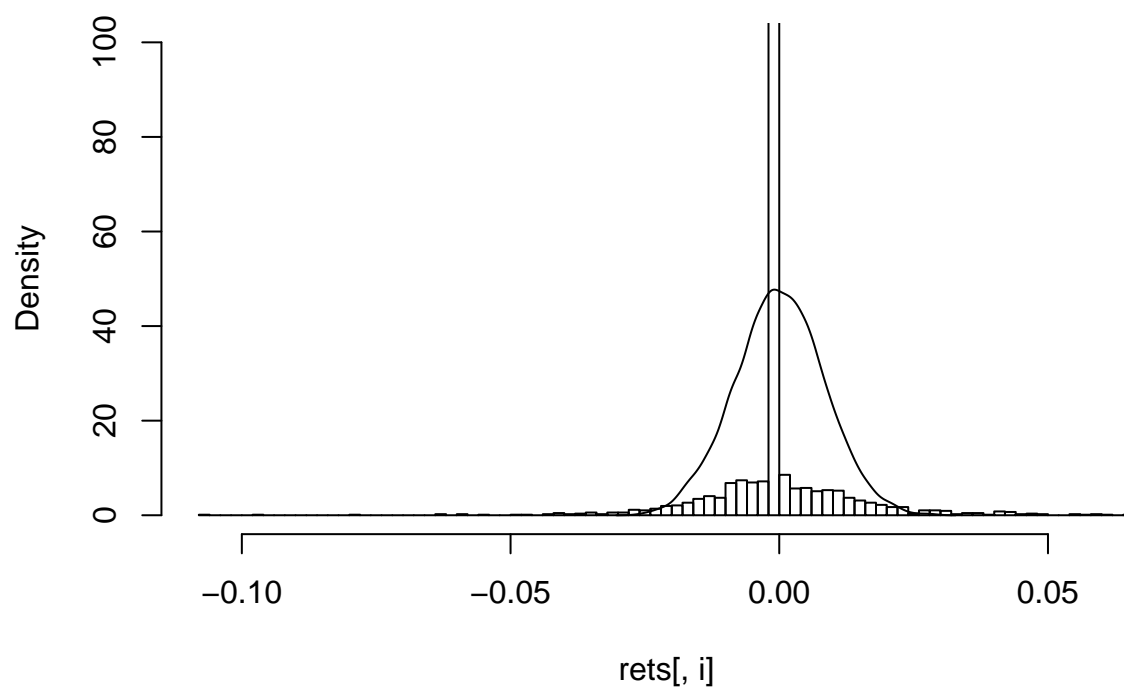


Equity curve of HEI

2001-09-26 / 2018-10-10

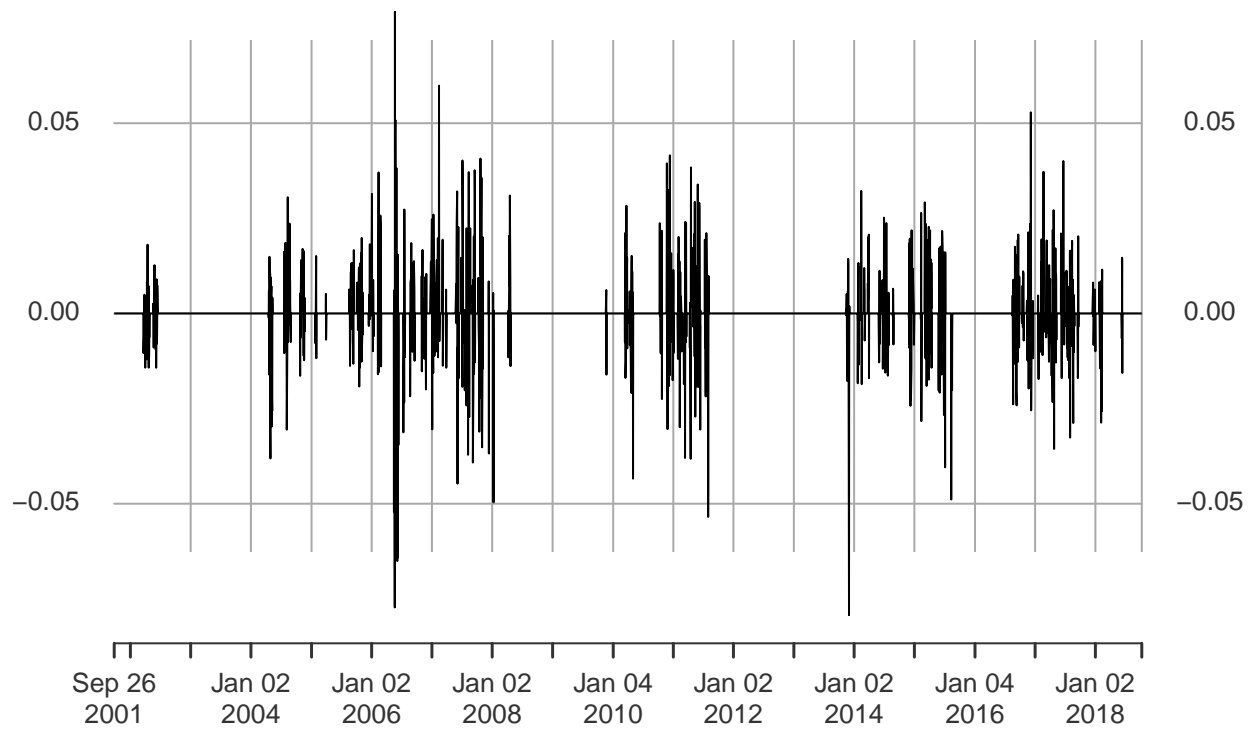


Histogram of Simple Returns of HEI



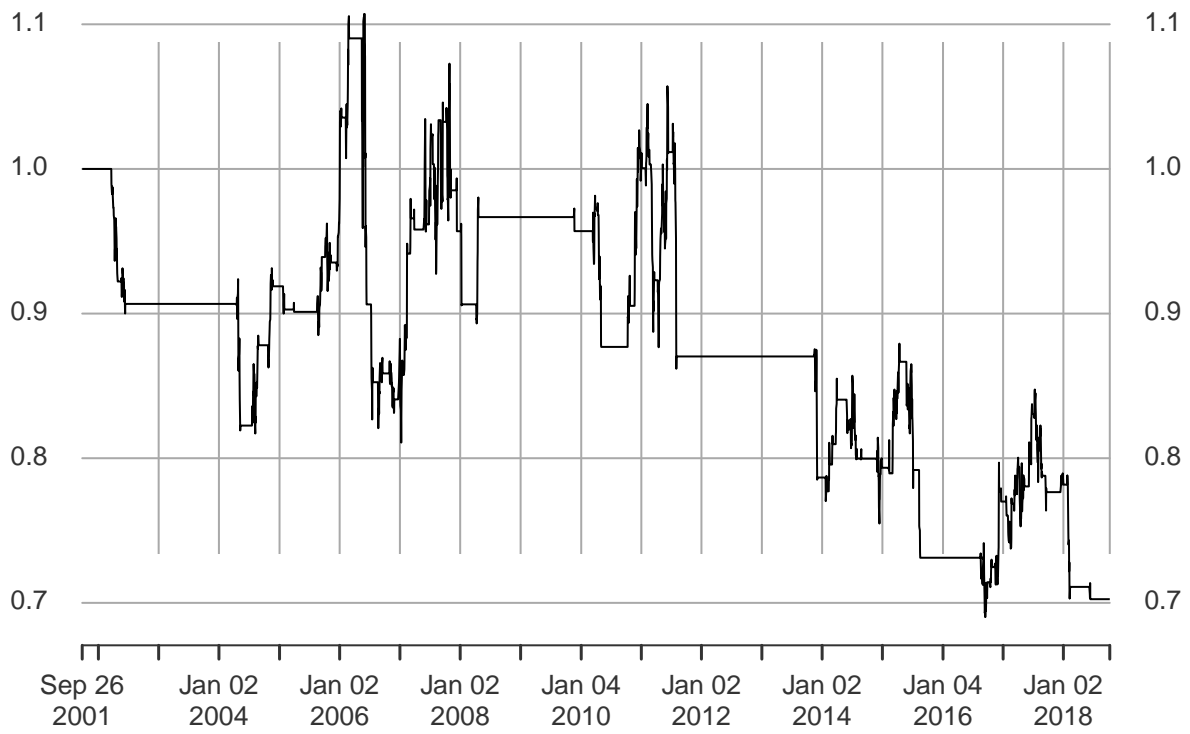
Returns of TKA

2001-09-26 / 2018-10-10

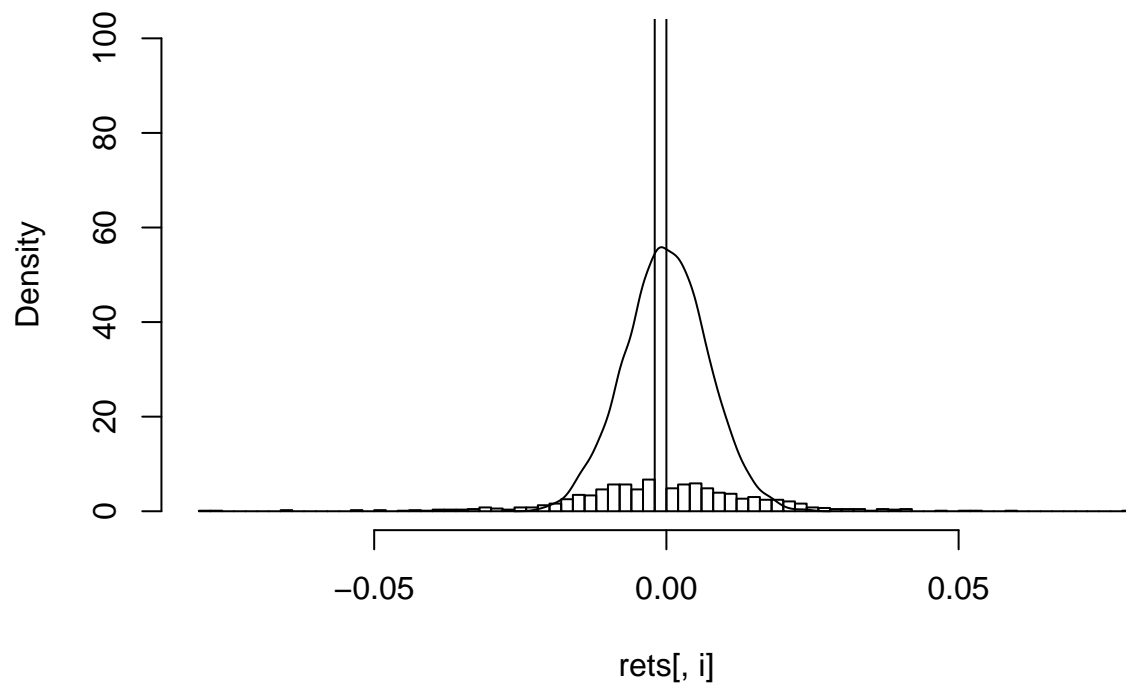


Equity curve of TKA

2001-09-26 / 2018-10-10

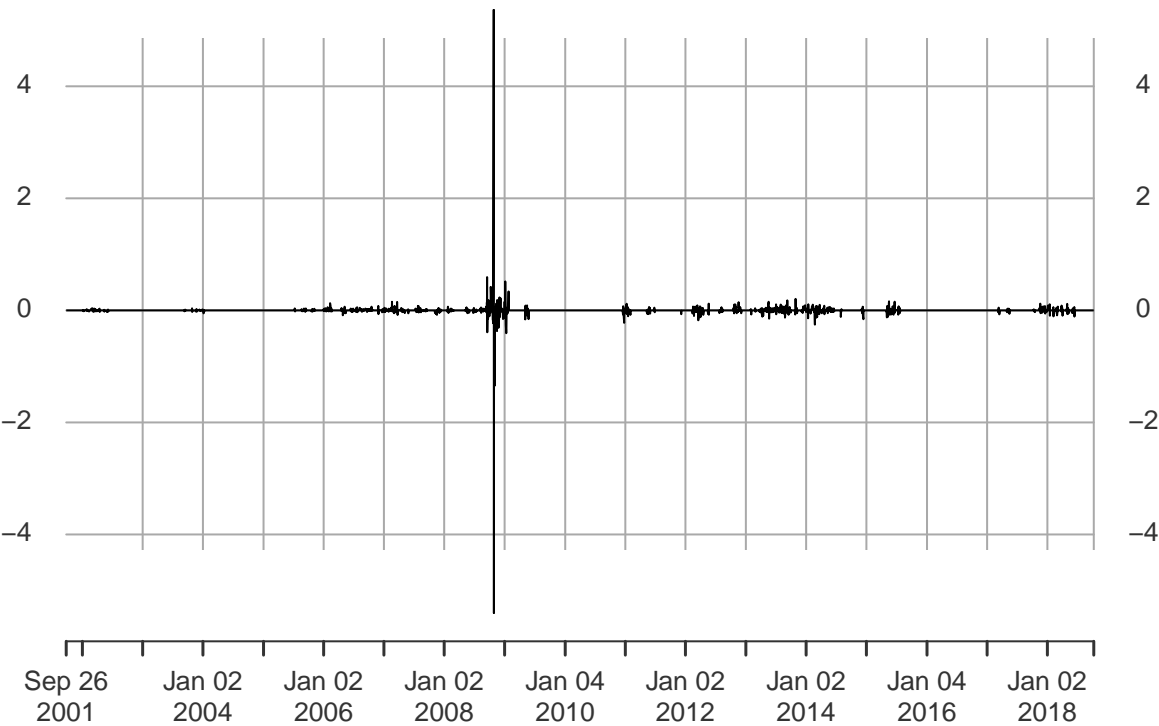


Histogram of Simple Returns of TKA



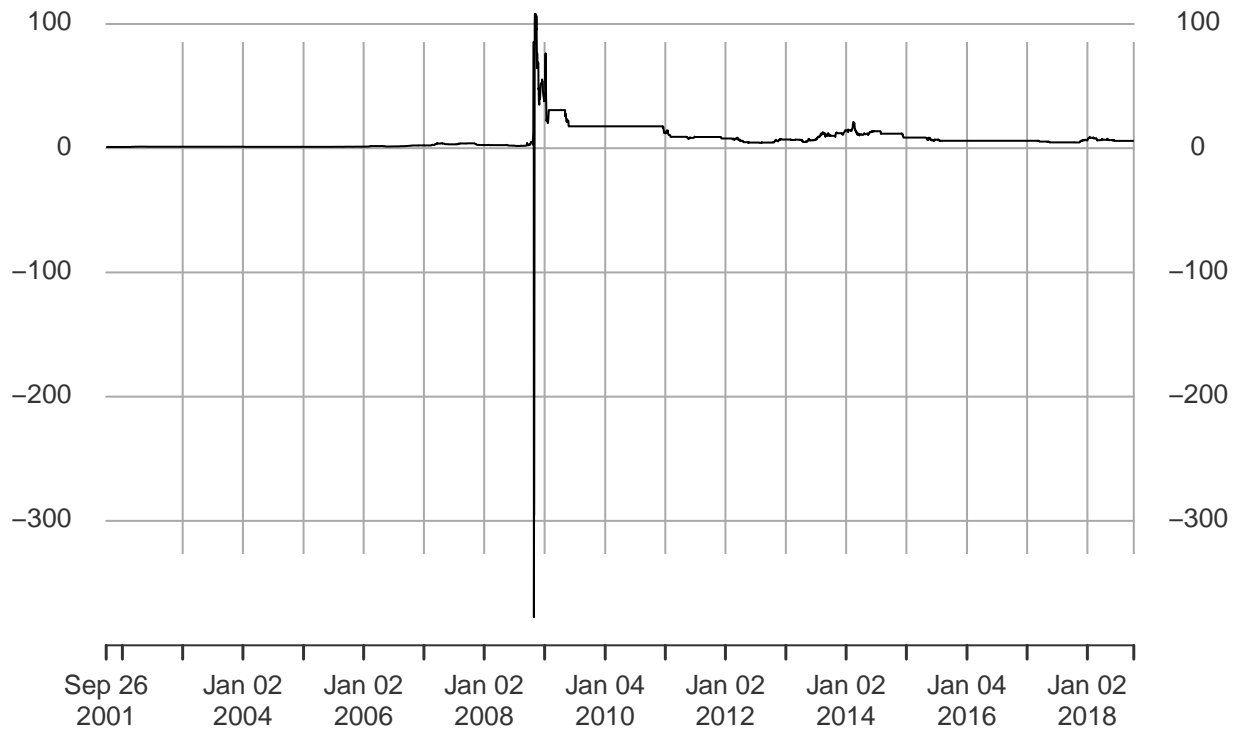
Returns of VOW

2001-09-26 / 2018-10-10

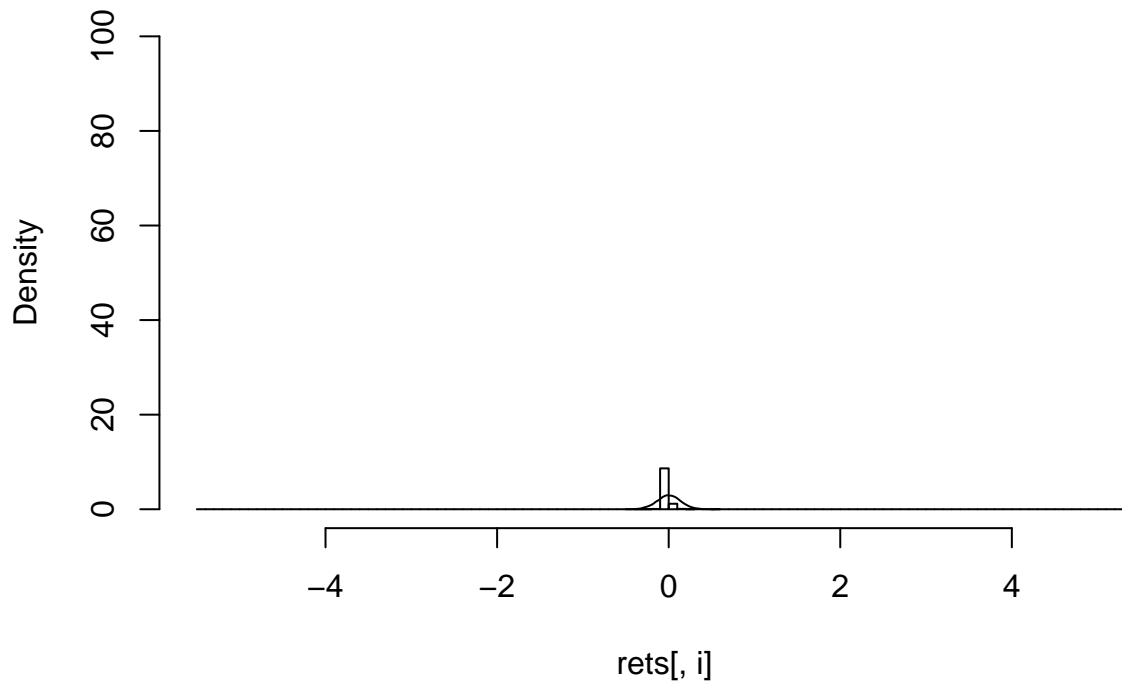


Equity curve of VOW

2001-09-26 / 2018-10-10



Histogram of Simple Returns of VOW



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 BAY we would expect a maximum loss of 373.3 per day."
```

```
## [1] "Given a 10000 investment in DBK we would expect a maximum loss of 226.04 per day."
```

```
## [1] "Given a 10000 investment in HEI we would expect a maximum loss of 263.24 per day."
```

```
## [1] "Given a 10000 investment in TKA we would expect a maximum loss of 250.7 per day."
```

```
## [1] "Given a 10000 investment in VOW we would expect a maximum loss of 957.67 per day."
```

Conclusion and Suggestions