

Assignment 1

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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 Williams’ 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 <- 4

InstrumentDirectory <- "~/Desktop/R/DownloadedData/"
instrumentlist <- c("BMW.csv", "DAI.csv", "DTE.csv", "FME.csv", "FRE.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 today's 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 today's
    # 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)

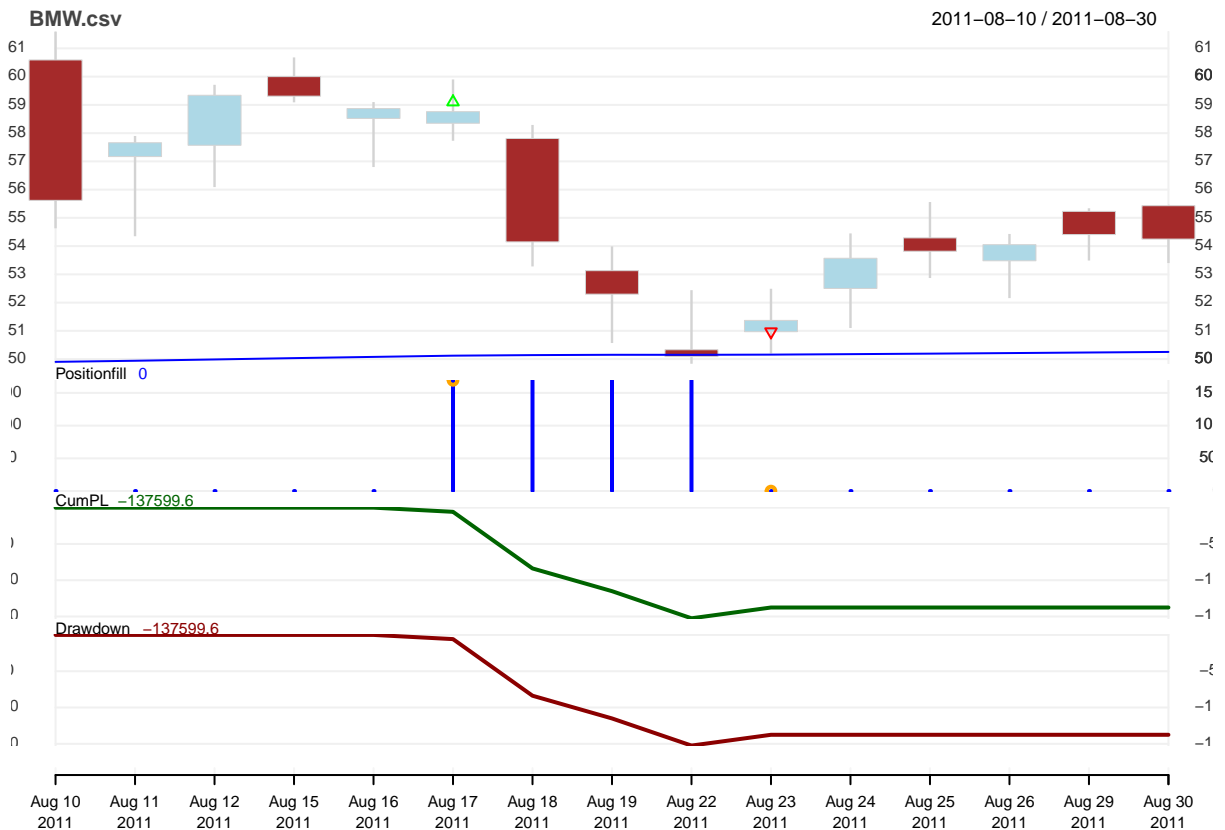
  # Create a list of transactions to check
  for (i in

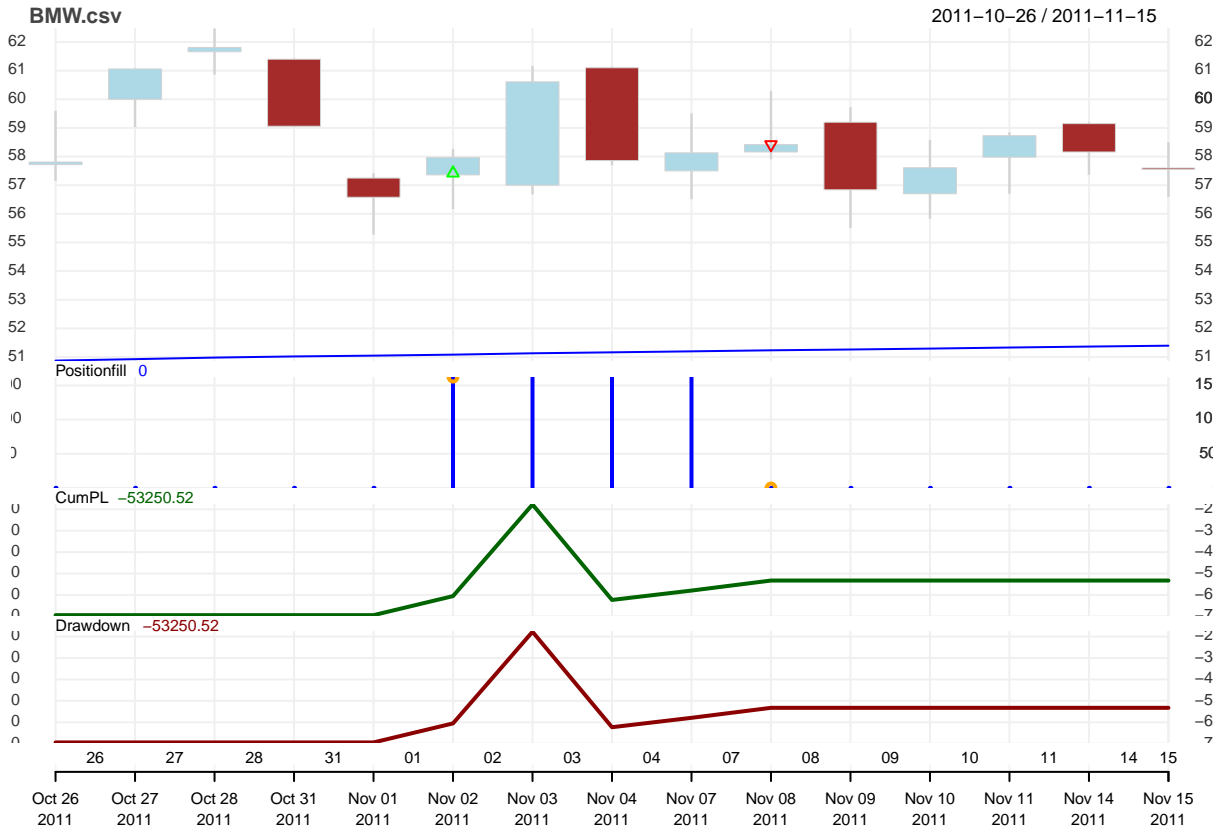
```

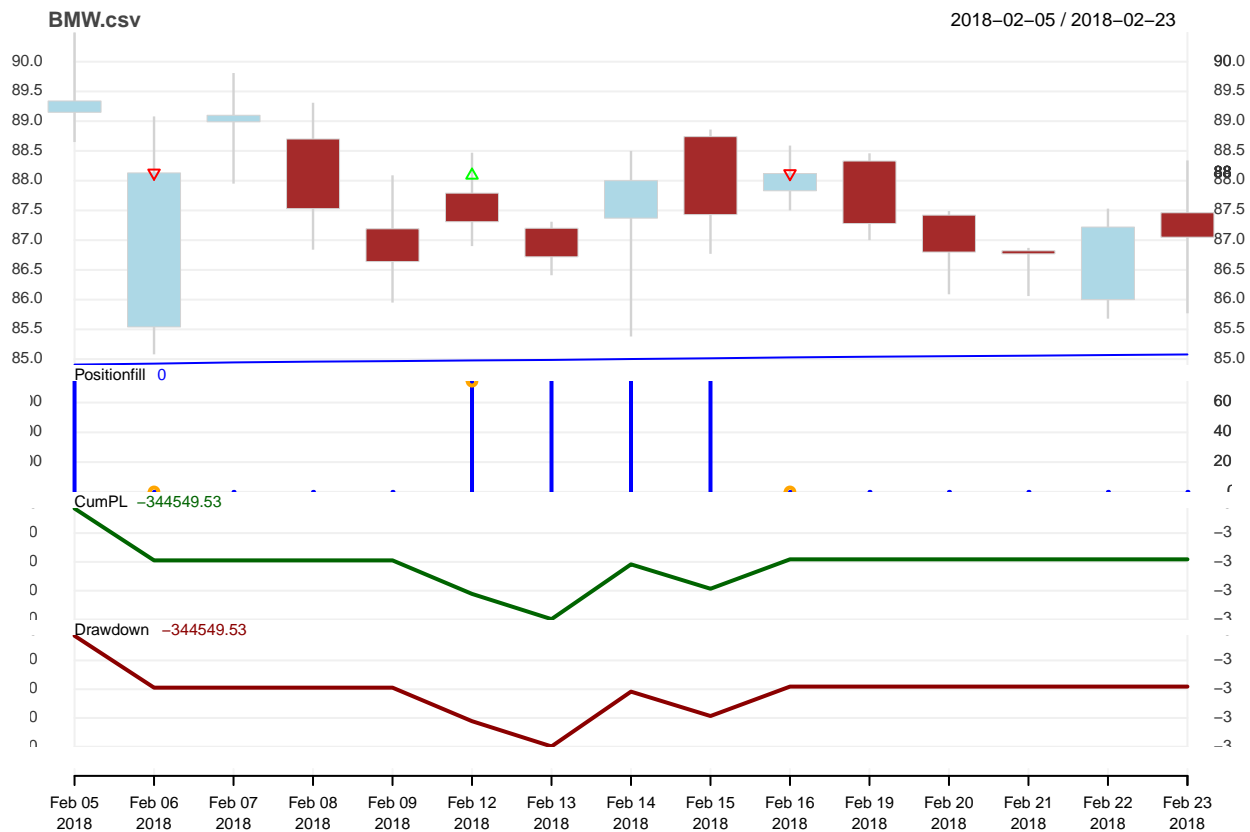
```

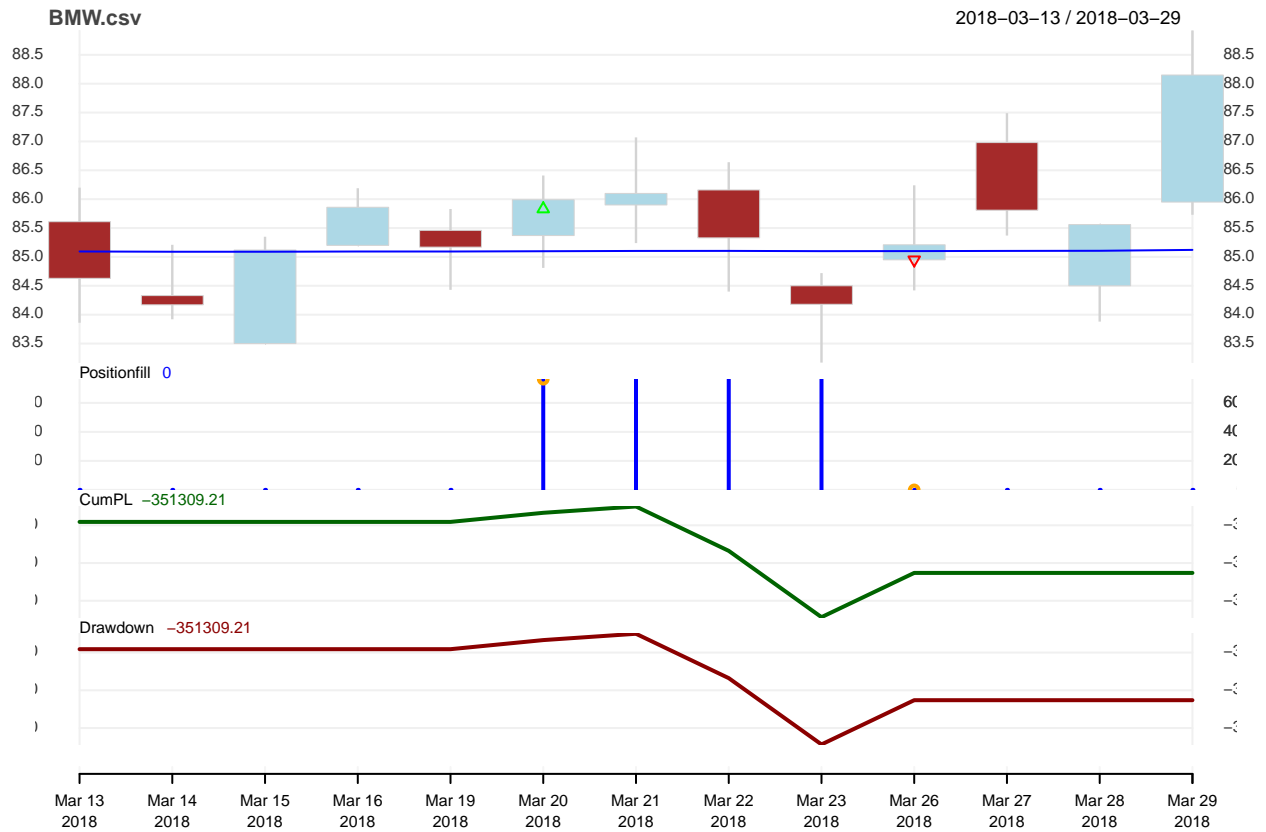
      c(2,6, (nrow(transactionsInstrument)-7),(nrow(transactionsInstrument)-5))) {
    from <- as.Date(index(transactionsInstrument[i,1]))-7
    to <- as.Date(index(transactionsInstrument[i+1,1]))+7
    daterange_check <- c(daterange_check, paste(from, ":", to, sep = ""))
  }
  # Plot the transactions and 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))
  }
}

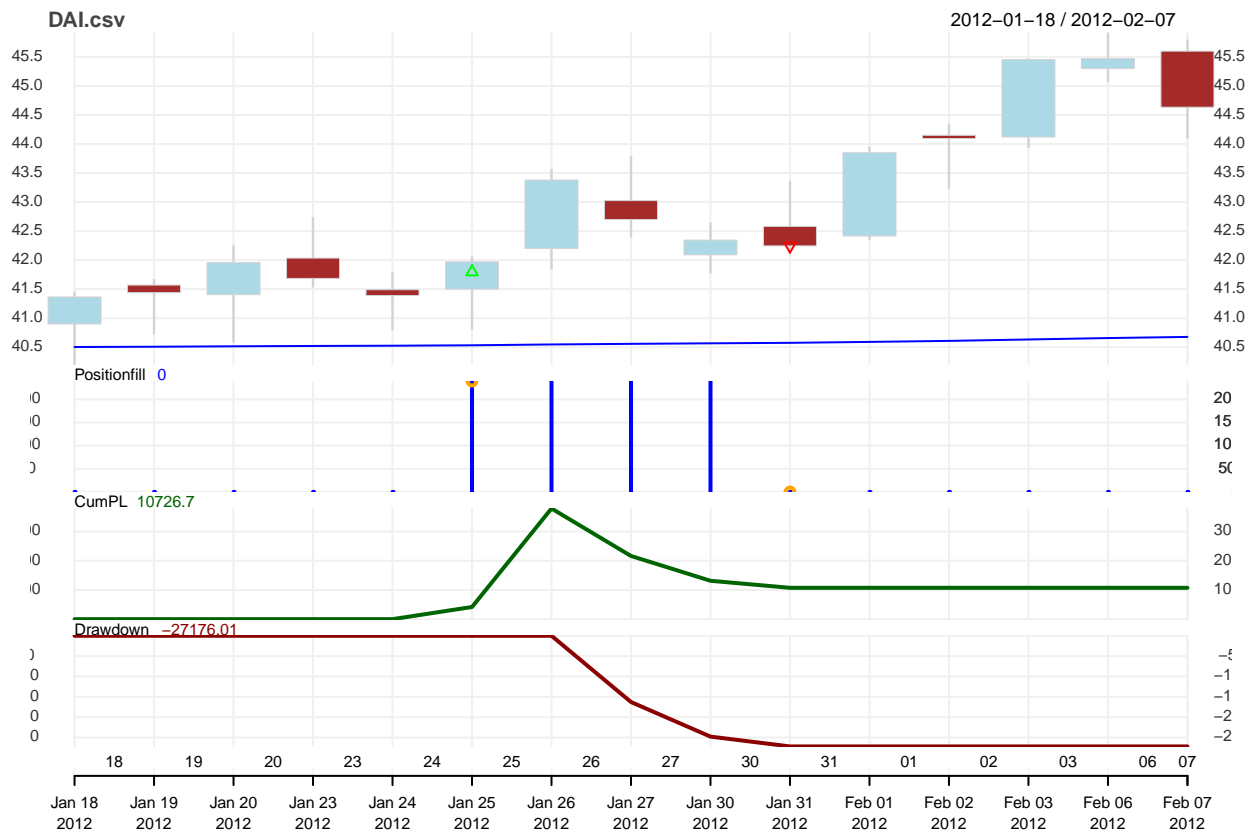
```

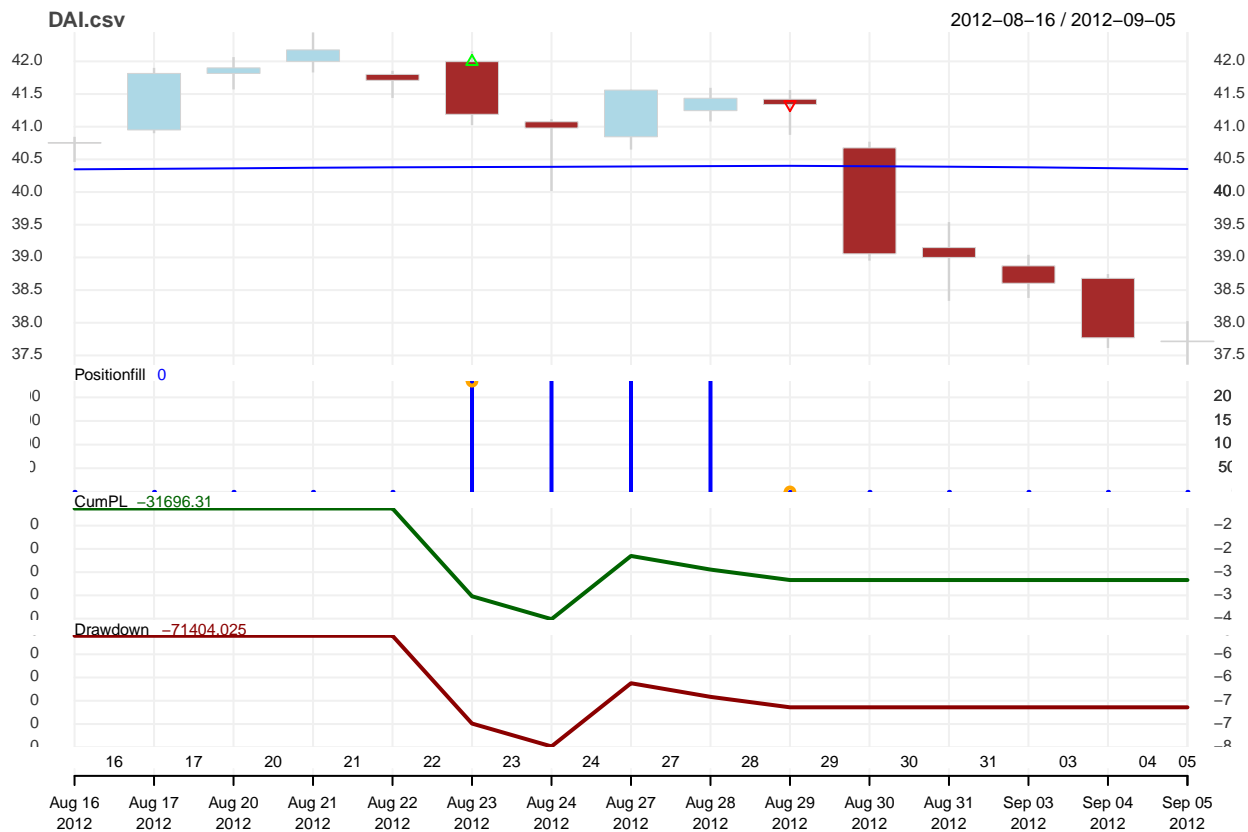


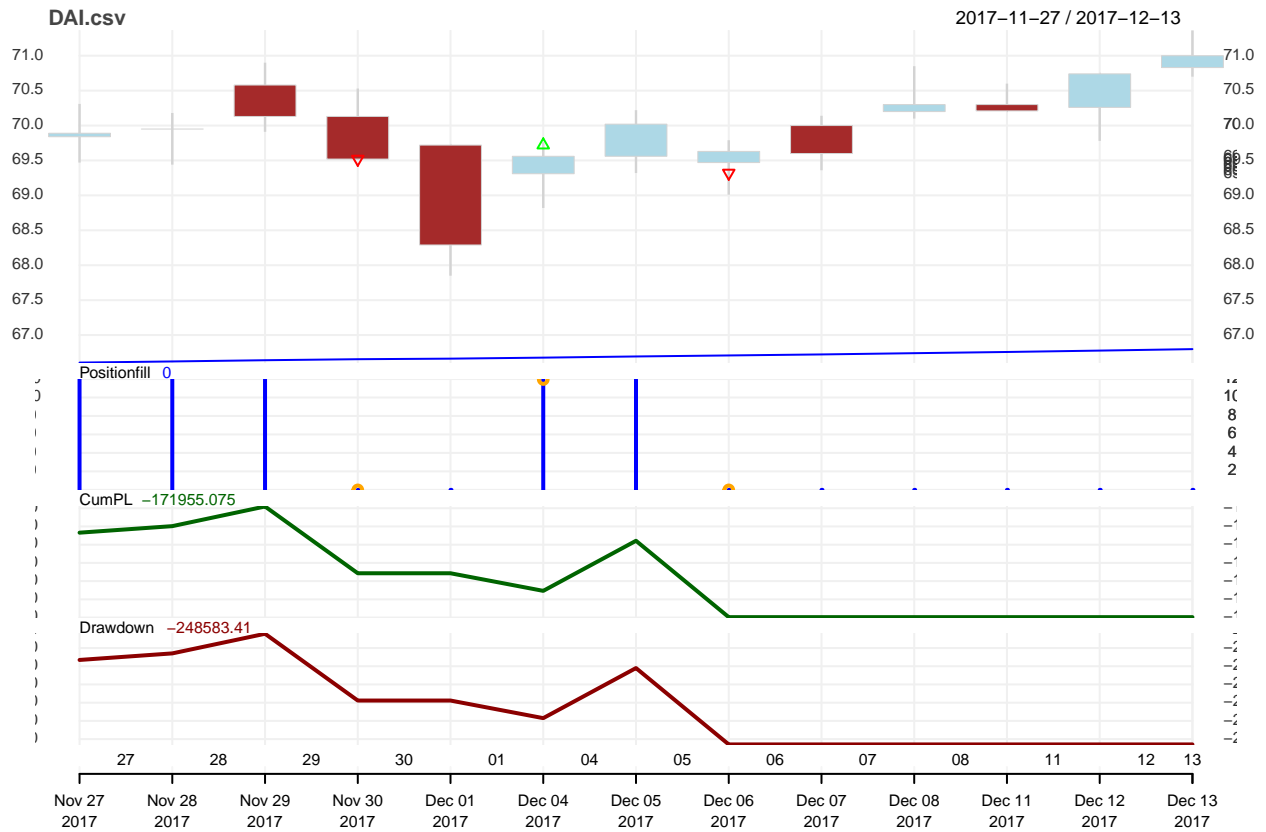


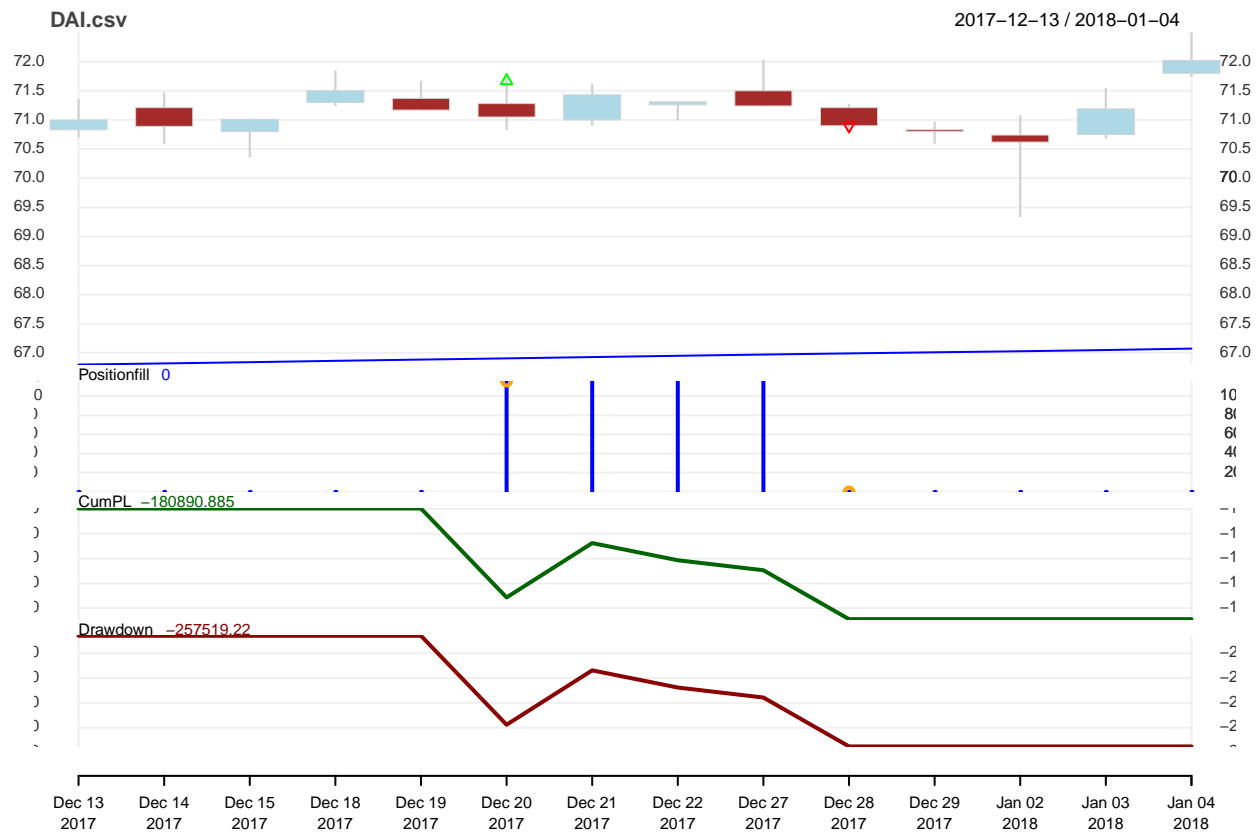


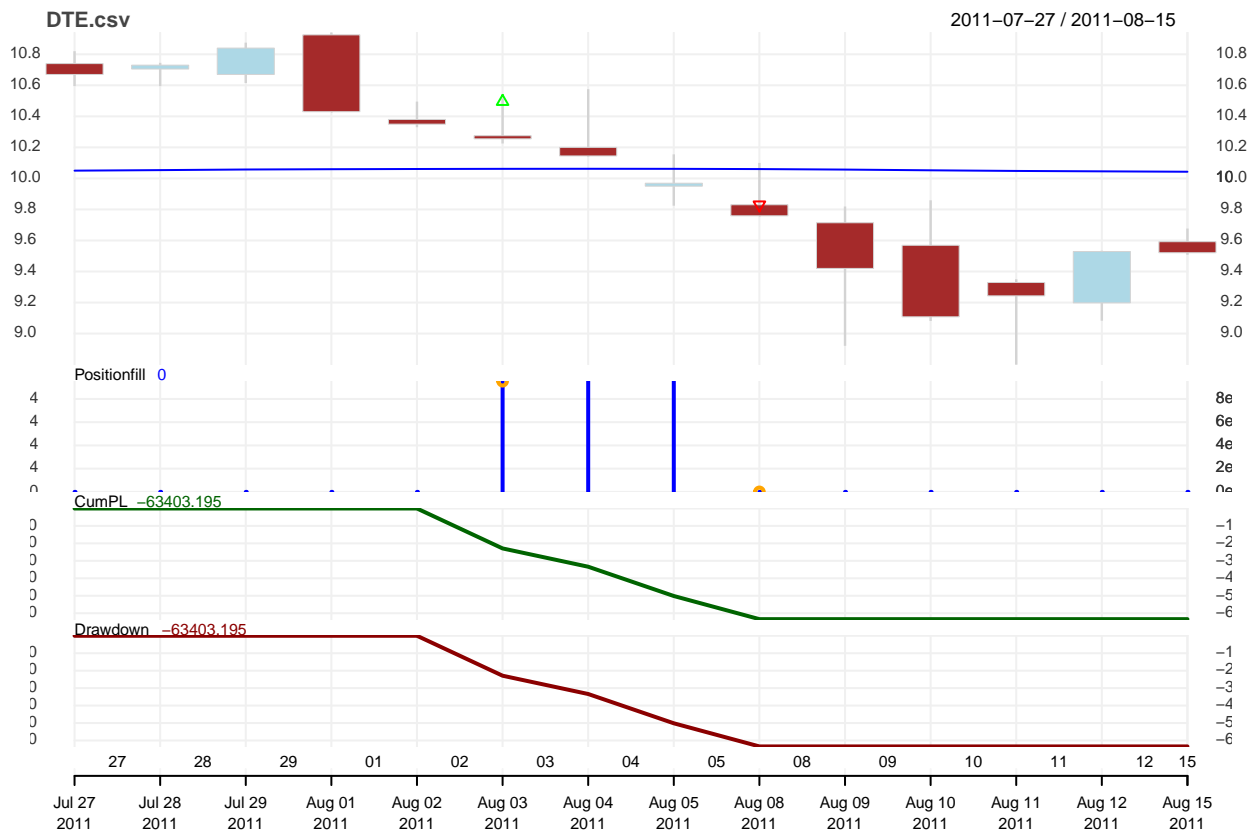


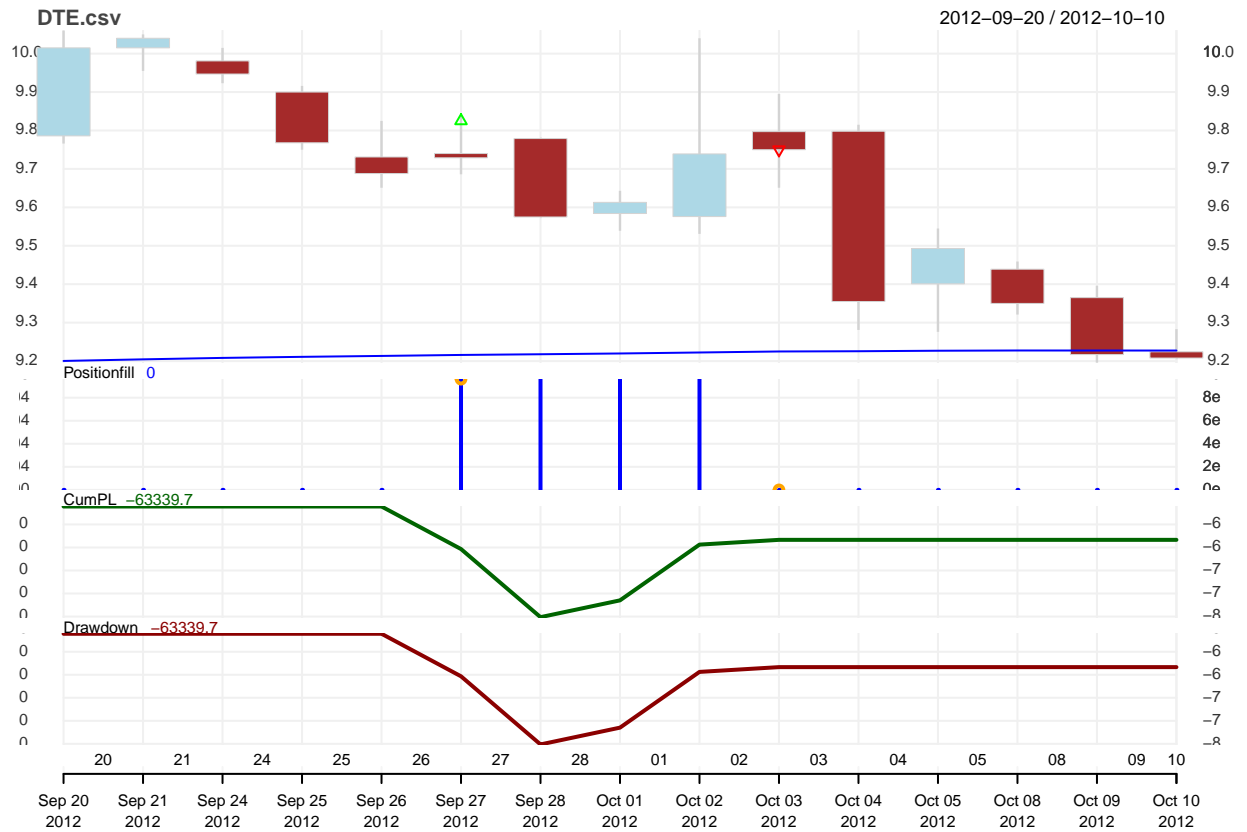


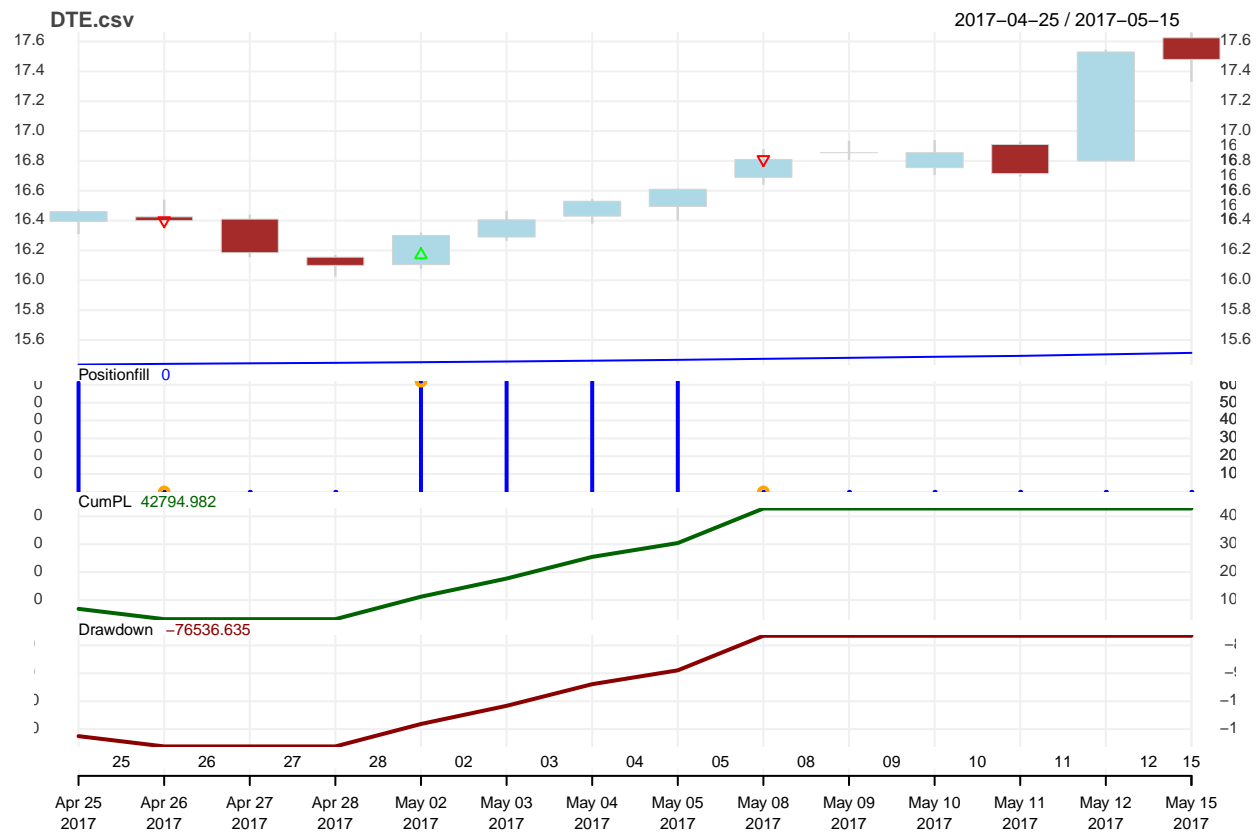


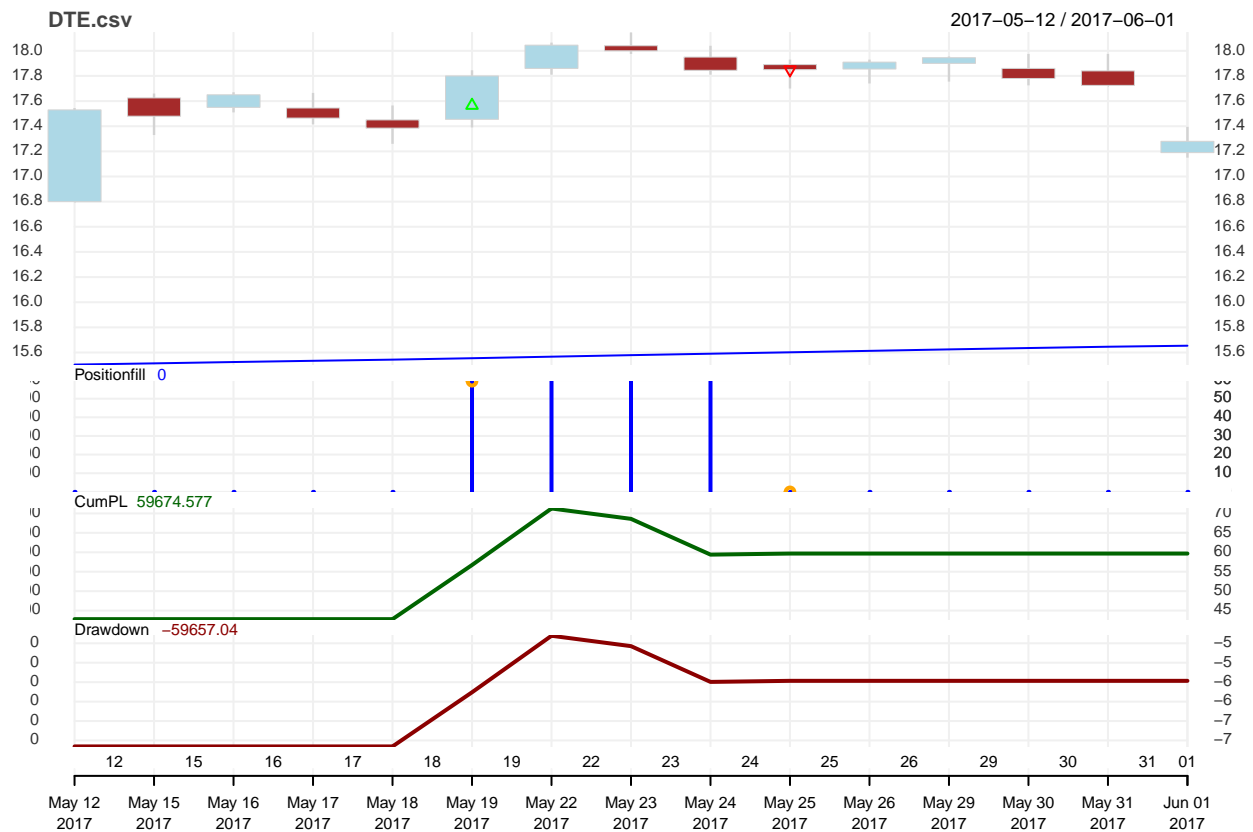


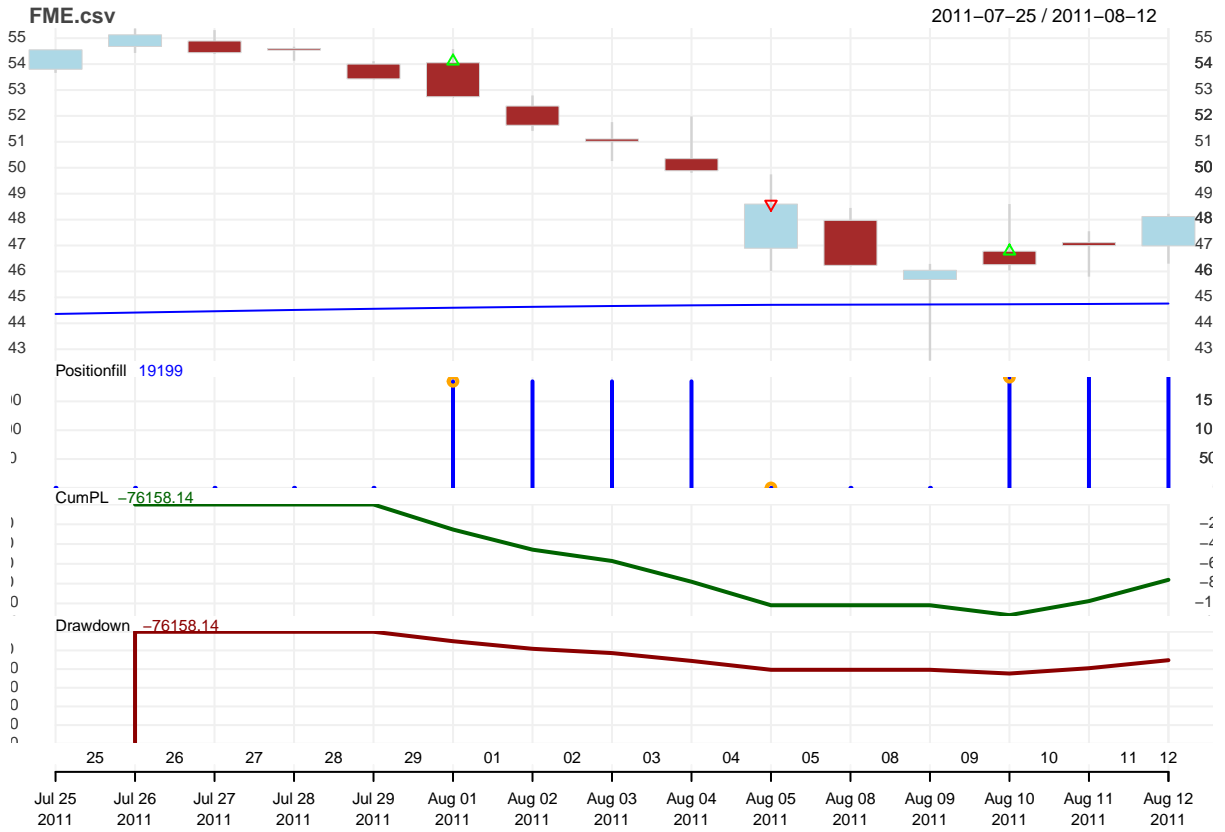


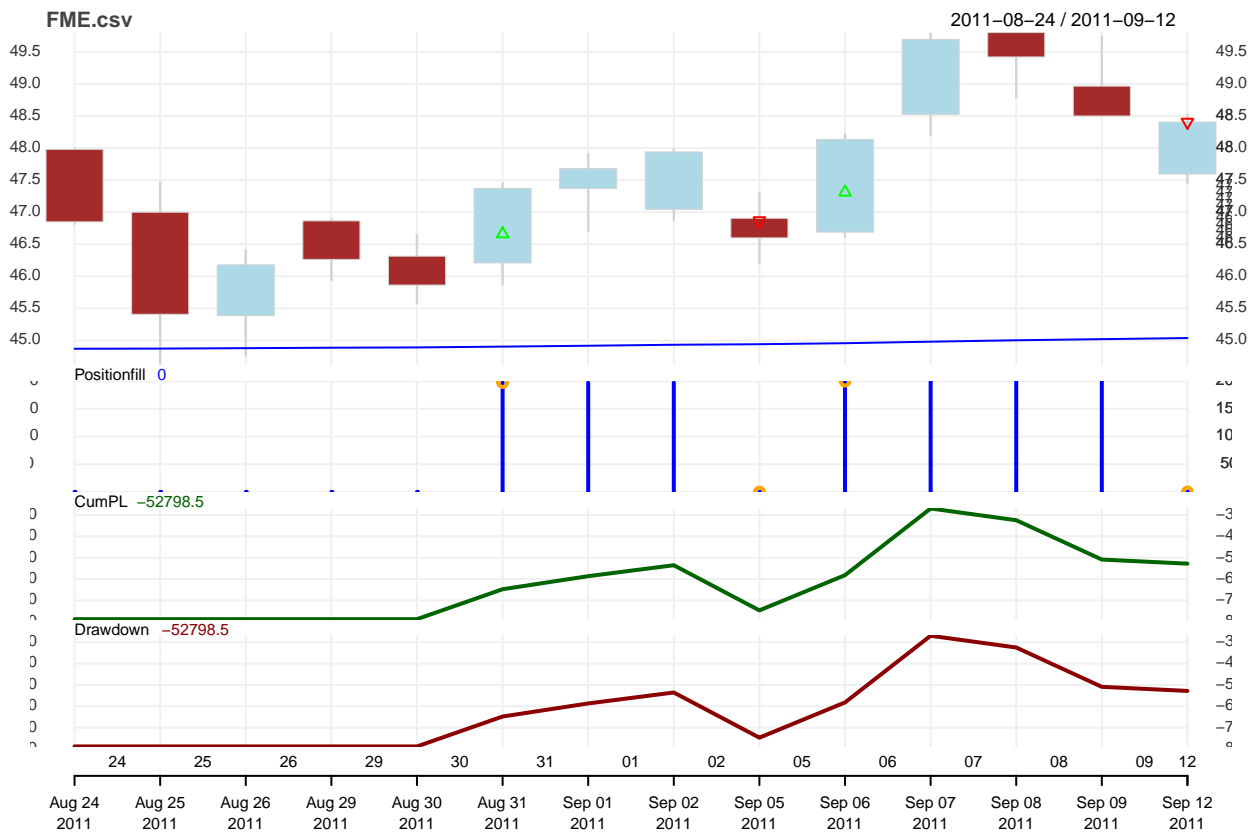


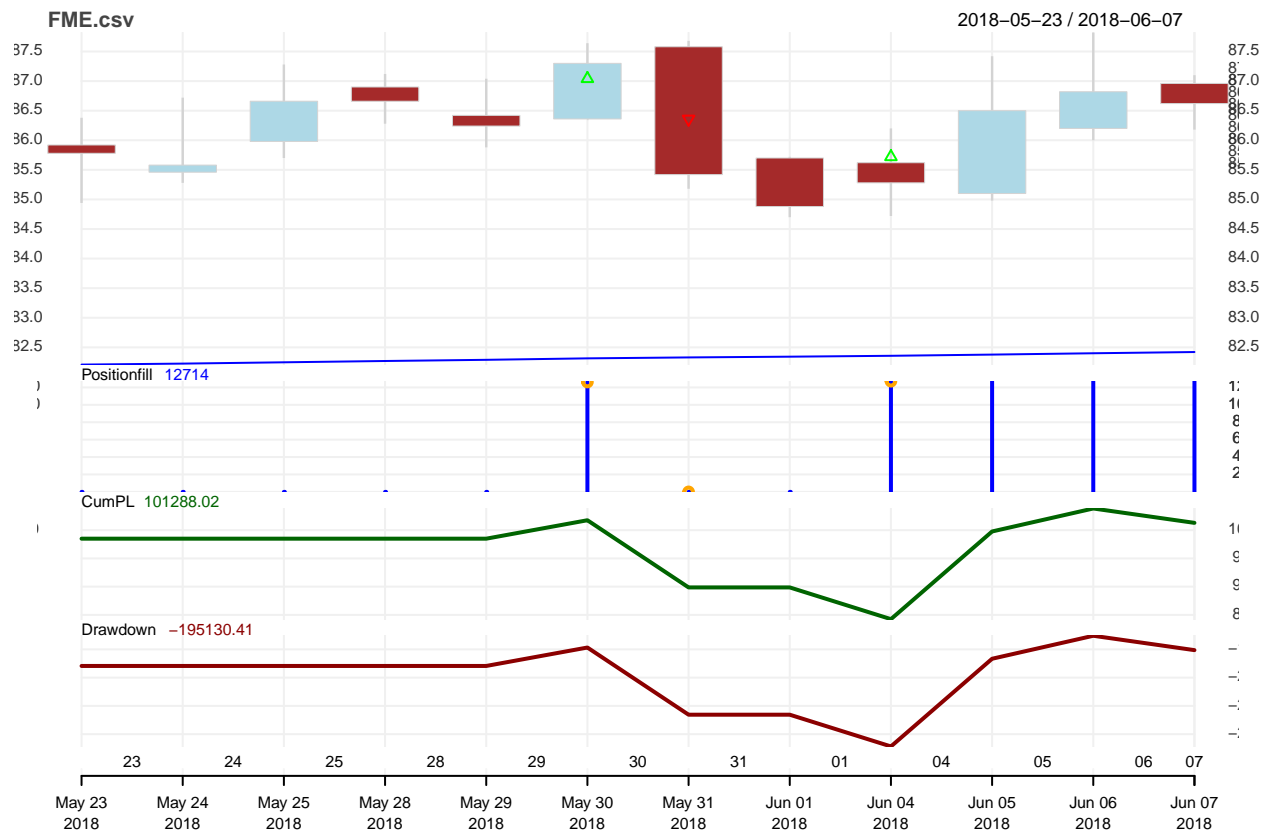


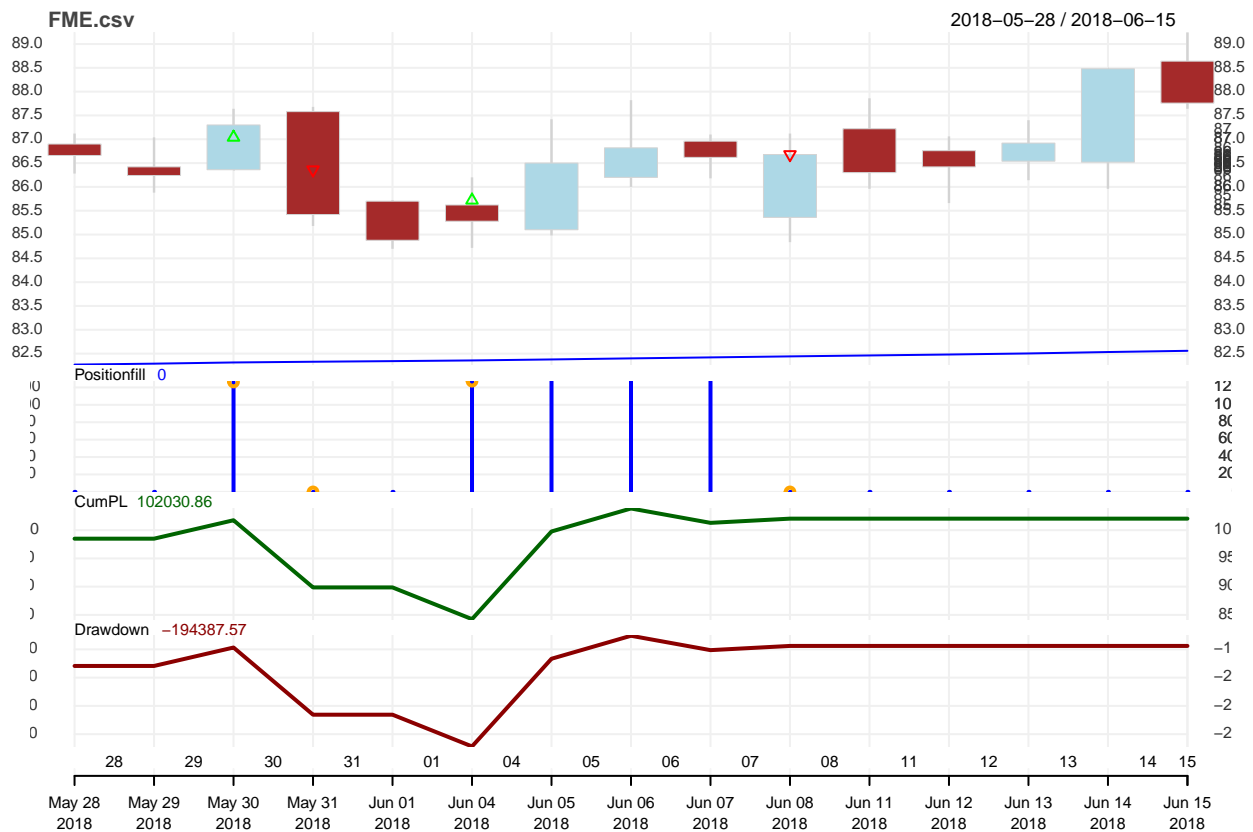


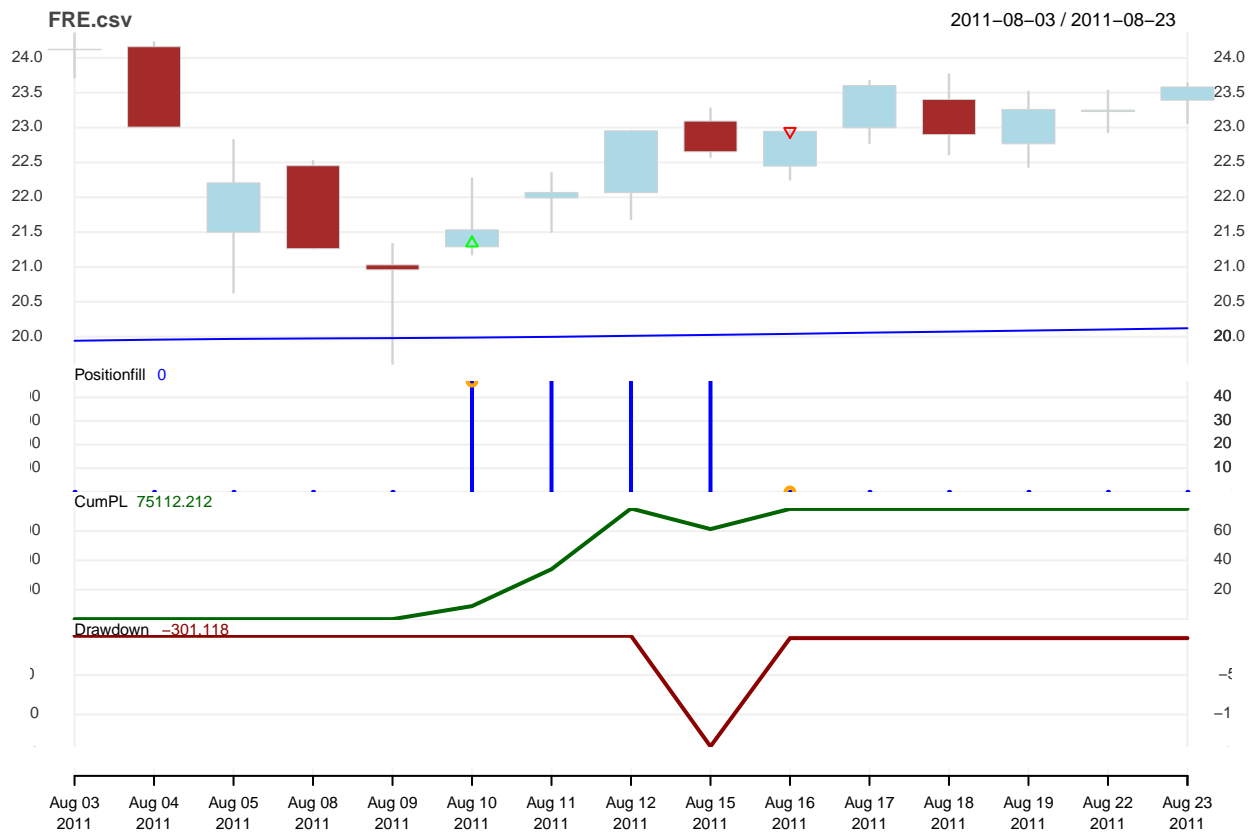


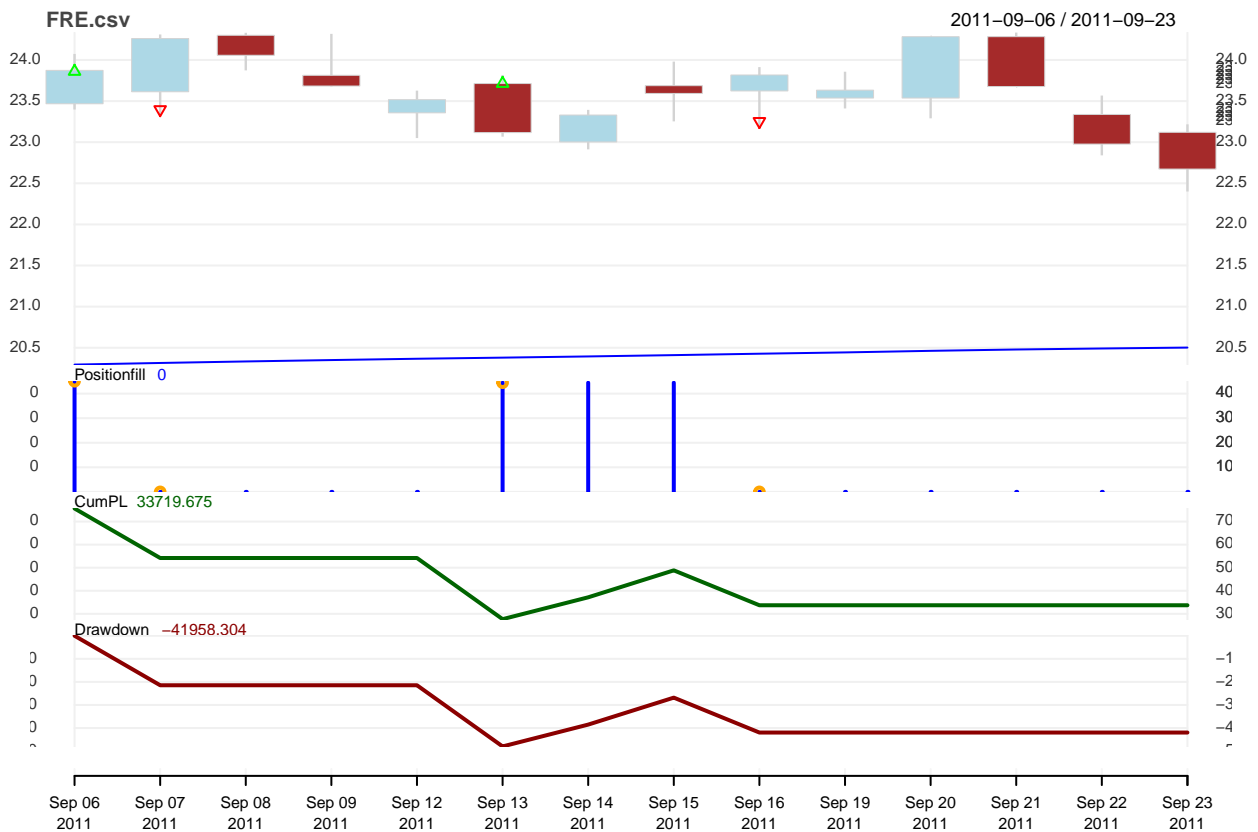


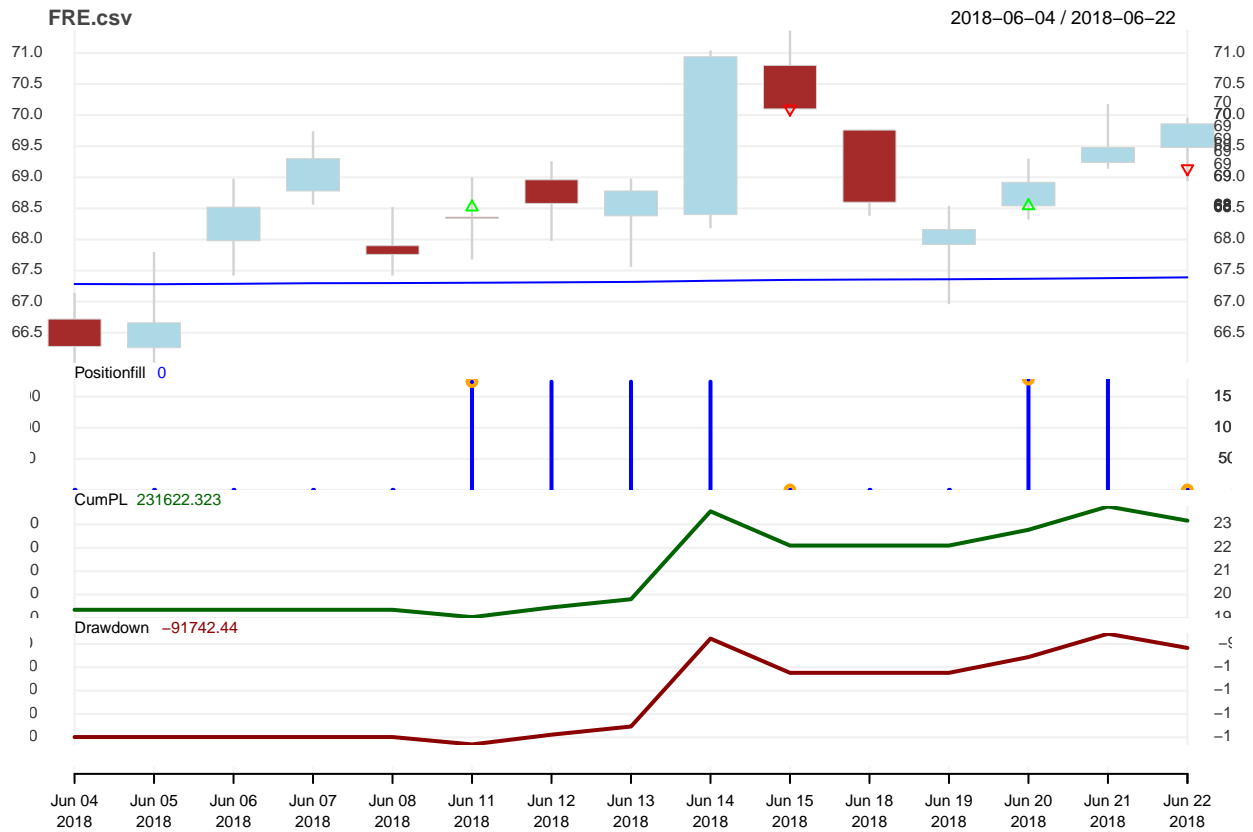


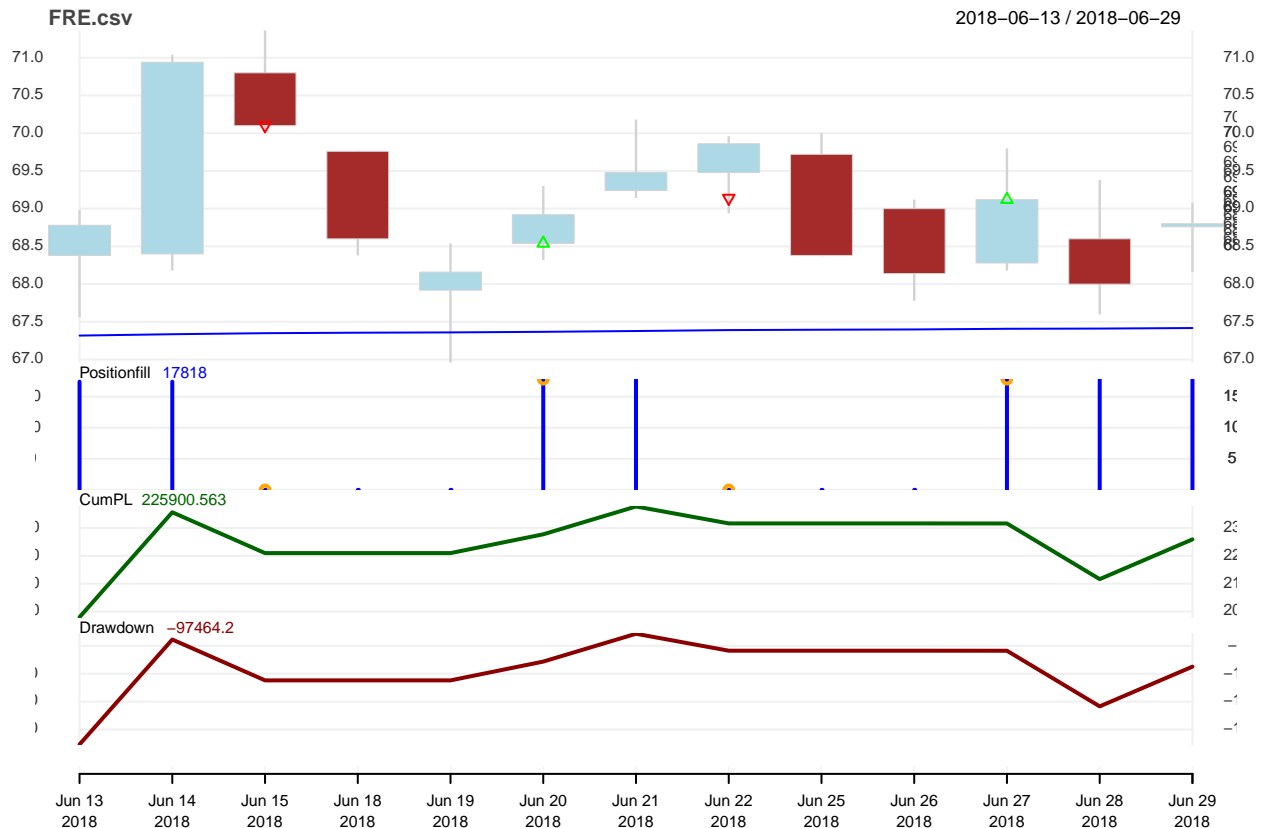










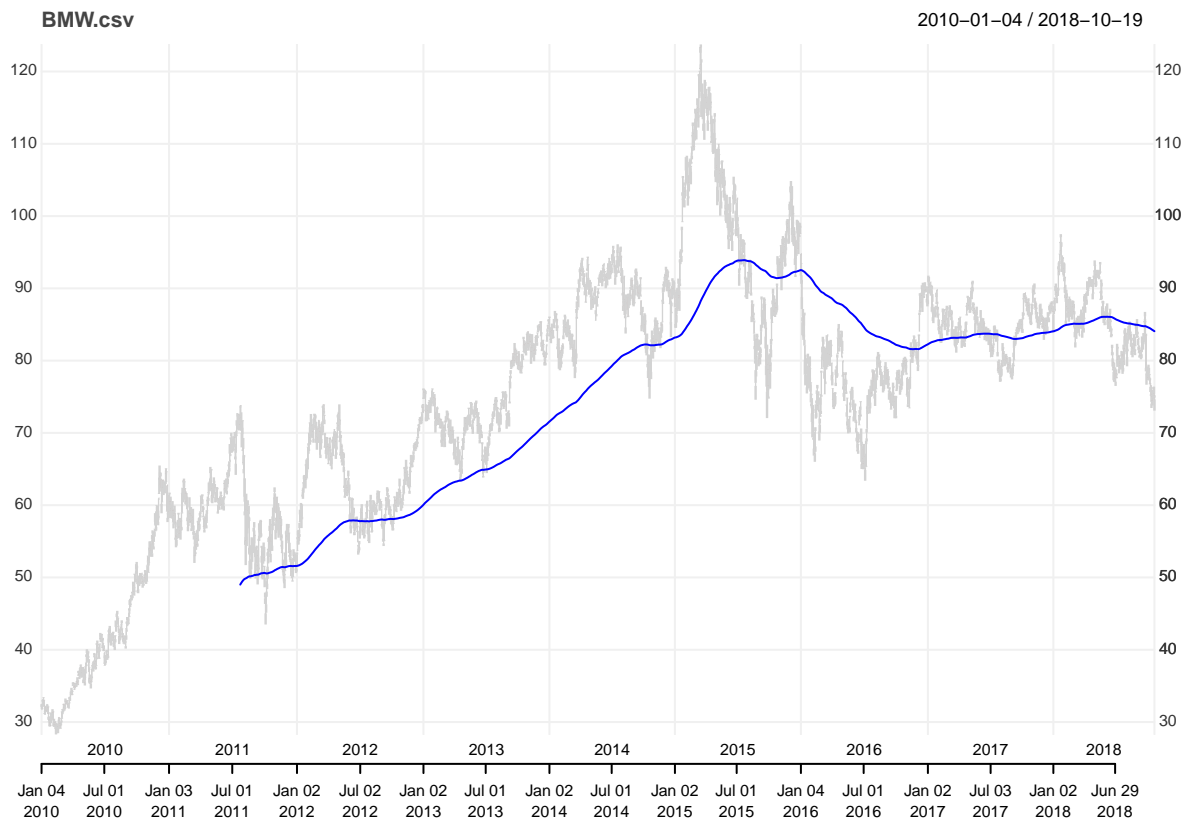


Part C: Analysis and Reporting

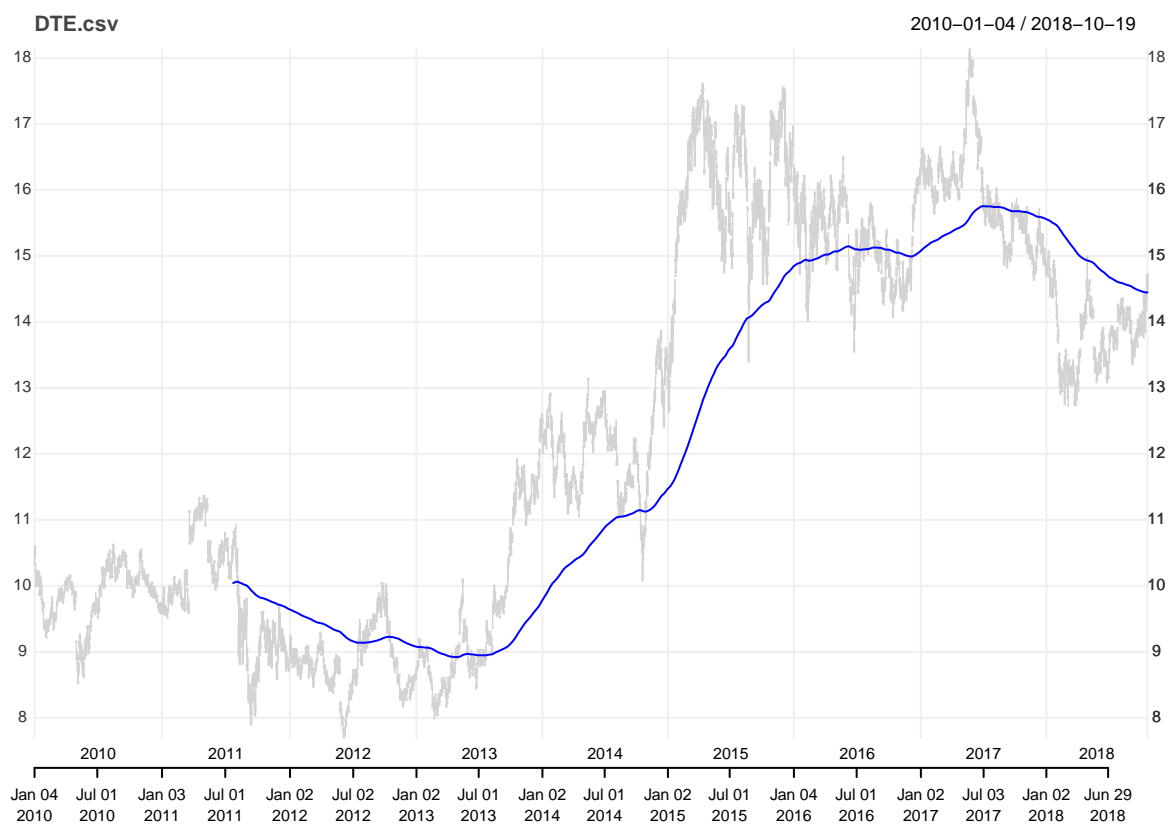
Step 1: Visualize original data

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')"))
}
```

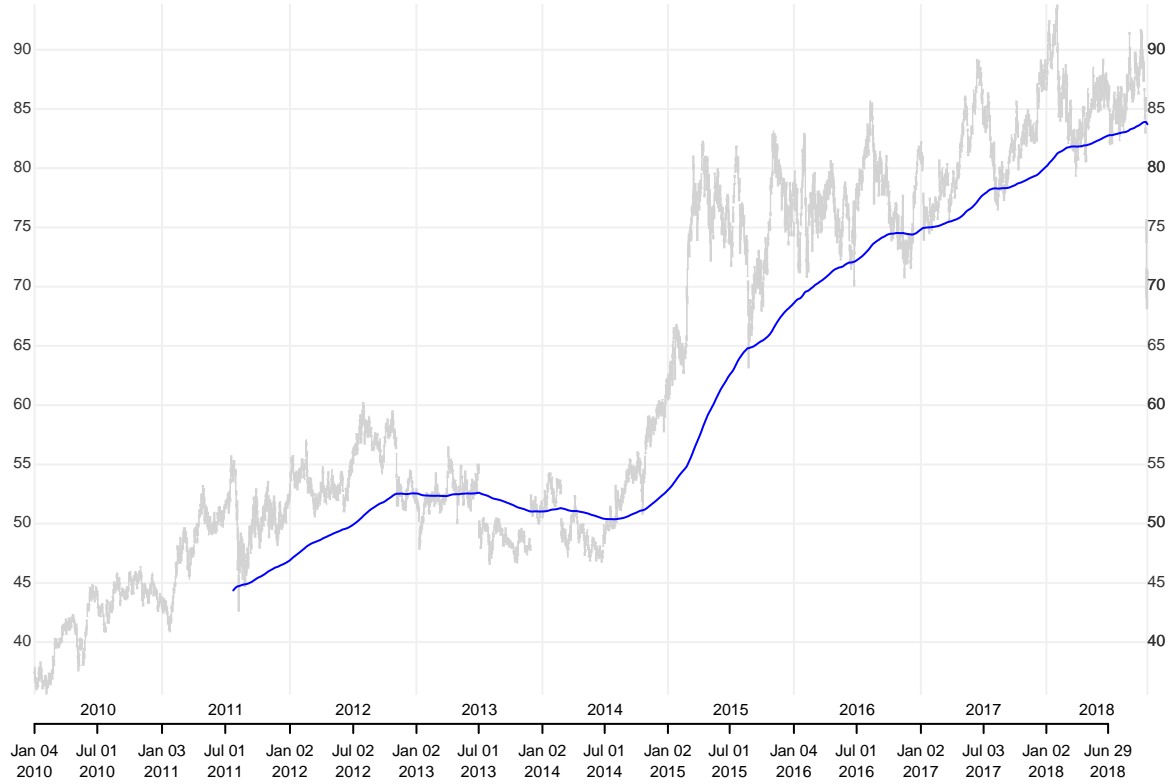


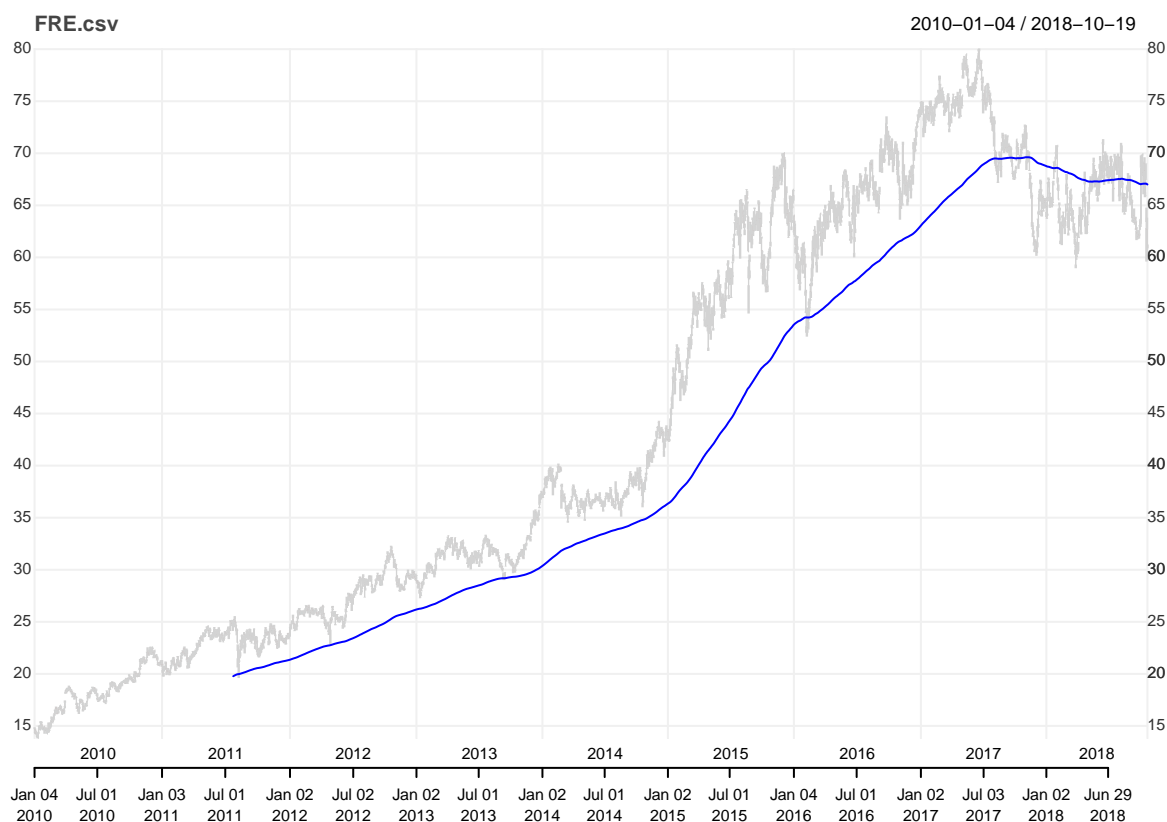




FME.csv

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: BMW.csv"
##      Quantity  Price    Value Net realized Profit
## 1999-12-31      0  0.00      0.0          0.00
## 2011-08-17  16920 59.10 999972.0         -20.00
## 2011-08-23 -16920 50.97 -862412.4       -137579.60
## 2011-09-13  16559 52.08 862392.7         -20.00
## 2011-09-19 -16559 56.20 -930615.8        68203.08
## 2011-11-02  16206 57.42 930548.5         -20.00
## 2011-11-08 -16206 58.42 -946754.5       16186.00
## 2012-02-15  13319 71.08 946714.5         -20.00
## 2012-02-21 -13319 71.62 -953906.8        7172.26
## 2012-02-28  13705 69.60 953868.0         -20.00
## 2012-03-05 -13705 70.63 -967984.1       14096.15
```


## 2012-03-30	14374	67.34	967945.2	-20.00
## 2012-04-05	-14374	66.78	-959895.7	-8069.44
## 2012-04-11	14427	66.53	959828.3	-20.00
## 2012-04-13	-14427	67.26	-970360.0	10511.71
## 2012-05-03	13309	72.91	970359.2	-20.00
## 2012-05-09	-13309	67.70	-901019.3	-69359.89
## 2012-05-21	14476	62.24	900986.2	-20.00
## 2012-05-23	-14476	62.48	-904460.5	3454.24
## 2012-08-27	14897	60.71	904396.9	-20.00
## 2012-08-31	-14897	57.35	-854343.0	-50073.92
## 2012-09-19	13934	61.31	854293.5	-20.00
## 2012-09-25	-13934	58.81	-819458.5	-34855.00
## 2012-10-09	13509	60.66	819455.9	-20.00
## 2012-10-15	-13509	60.46	-816754.1	-2721.80
## 2012-11-19	12943	63.10	816703.3	-20.00
## 2012-11-23	-12943	65.78	-851390.5	34667.24
## 2012-12-05	12390	68.71	851316.9	-20.00
## 2012-12-11	-12390	70.59	-874610.1	23273.20
## 2013-02-01	11685	74.85	874622.2	-20.00
## 2013-02-07	-11685	71.74	-838281.9	-36360.35
## 2013-02-13	11621	72.13	838222.7	-20.00
## 2013-02-19	-11621	71.79	-834271.6	-3971.14
## 2013-03-14	11607	71.87	834195.1	-20.00
## 2013-03-20	-11607	70.15	-814231.1	-19984.04
## 2013-04-16	12061	67.51	814238.1	-20.00
## 2013-04-22	-12061	65.24	-786859.6	-27398.47
## 2013-05-24	10981	71.65	786788.7	-20.00
## 2013-05-29	-10981	71.76	-787996.6	1187.91
## 2013-06-07	10853	72.60	787927.8	-20.00
## 2013-06-13	-10853	69.16	-750593.5	-37354.32
## 2013-06-19	10704	70.12	750564.5	-20.00
## 2013-06-24	-10704	64.52	-690622.1	-59962.40
## 2013-08-08	9715	71.09	690639.3	-20.00
## 2013-08-12	-9715	71.80	-697537.0	6877.65
## 2013-08-29	9592	72.71	697434.3	-20.00
## 2013-09-03	-9592	72.33	-693789.4	-3664.96
## 2013-11-06	8462	81.99	693799.4	-20.00
## 2013-11-12	-8462	81.54	-689991.5	-3827.90
## 2013-11-14	8414	82.00	689948.0	-20.00
## 2013-11-15	-8414	81.42	-685067.9	-4900.12
## 2013-12-02	8060	84.99	685019.4	-20.00
## 2013-12-03	-8060	84.52	-681231.2	-3808.20
## 2013-12-06	8258	82.49	681202.4	-20.00
## 2013-12-12	-8258	79.78	-658823.2	-22399.18
## 2014-01-13	7826	84.18	658792.7	-20.00
## 2014-01-16	-7826	84.61	-662157.9	3345.18
## 2014-02-19	7775	85.15	662041.2	-20.00
## 2014-02-24	-7775	84.15	-654266.2	-7795.00
## 2014-03-04	7875	83.08	654255.0	-20.00
## 2014-03-10	-7875	80.52	-634095.0	-20180.00
## 2014-03-13	7843	80.84	634028.1	-20.00
## 2014-03-19	-7843	86.60	-679203.8	45155.68
## 2014-05-19	7809	86.98	679226.8	-20.00
## 2014-05-23	-7809	89.88	-701872.9	22626.10

## 2014-06-24	7547	92.99	701795.5	-20.00
## 2014-06-25	-7547	92.85	-700738.9	-1076.58
## 2014-07-11	7559	92.70	700719.3	-20.00
## 2014-07-17	-7559	94.47	-714098.7	13359.43
## 2014-07-22	7608	93.85	714010.8	-20.00
## 2014-07-28	-7608	92.21	-701533.7	-12497.12
## 2014-09-11	7713	90.95	701497.3	-20.00
## 2014-09-17	-7713	89.80	-692627.4	-8889.95
## 2014-09-24	8017	86.39	692588.6	-20.00
## 2014-09-30	-8017	85.02	-681605.3	-11003.29
## 2014-12-04	7409	91.99	681553.9	-20.00
## 2014-12-10	-7409	89.79	-665254.1	-16319.80
## 2015-03-11	5787	114.95	665215.7	-20.00
## 2015-03-17	-5787	120.35	-696465.4	31229.80
## 2015-04-09	6048	115.15	696427.2	-20.00
## 2015-04-15	-6048	115.40	-697939.2	1492.00
## 2015-07-23	7256	96.19	697954.6	-20.00
## 2015-07-24	-7256	93.33	-677202.5	-20772.16
## 2015-10-28	7261	93.26	677160.9	-20.00
## 2015-11-03	-7261	92.71	-673167.3	-4013.55
## 2015-11-13	7029	95.76	673097.0	-20.00
## 2015-11-19	-7029	98.73	-693973.2	20856.13
## 2015-11-25	7032	98.68	693917.8	-20.00
## 2015-12-01	-7032	103.30	-726405.6	32467.84
## 2015-12-03	6995	103.85	726430.8	-20.00
## 2015-12-08	-6995	98.94	-692085.3	-34365.45
## 2015-12-21	7024	98.52	692004.5	-20.00
## 2015-12-28	-7024	97.62	-685682.9	-6341.60
## 2017-01-17	7867	87.16	685687.7	-20.00
## 2017-01-23	-7867	86.26	-678607.4	-7100.30
## 2017-02-20	7918	85.70	678572.6	-20.00
## 2017-02-23	-7918	86.22	-682690.0	4097.36
## 2017-05-04	7785	87.68	682588.8	-20.00
## 2017-05-09	-7785	88.90	-692086.5	9477.70
## 2017-05-19	8020	86.29	692045.8	-20.00
## 2017-05-25	-8020	85.24	-683624.8	-8441.00
## 2017-09-29	8040	85.03	683641.2	-20.00
## 2017-10-06	-8040	89.05	-715962.0	32300.80
## 2017-11-16	8328	85.96	715874.9	-20.00
## 2017-11-22	-8328	86.58	-721038.2	5143.36
## 2017-11-24	8275	87.13	721000.8	-20.00
## 2017-11-30	-8275	84.68	-700727.0	-20293.75
## 2017-12-29	8016	87.41	700678.6	-20.00
## 2018-01-05	-8016	87.00	-697392.0	-3306.56
## 2018-01-12	7781	89.62	697333.2	-20.00
## 2018-01-15	-7781	89.02	-692664.6	-4688.60
## 2018-01-31	7435	93.16	692644.6	-20.00
## 2018-02-06	-7435	88.13	-655246.5	-37418.05
## 2018-02-12	7438	88.09	655213.4	-20.00
## 2018-02-16	-7438	88.12	-655436.6	203.14
## 2018-03-20	7636	85.83	655397.9	-20.00
## 2018-03-26	-7636	84.95	-648678.2	-6739.68
## 2018-05-22	7231	89.70	648620.7	-20.00
## 2018-05-23	-7231	89.28	-645583.7	-3057.02

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## 2018-05-25      7342  87.93  645582.1      -20.00
## 2018-05-31     -7342  85.38 -626860.0     -18742.10
##
## [1] "Transactions for the instrument: DAI.csv"
##      Quantity  Price      Value Net realized Profit
## 1999-12-31      0  0.000      0.0      0.00
## 2012-01-25    23926 41.795   999987.2     -20.00
## 2012-01-31   -23926 42.245 -1010753.9    10746.70
## 2012-03-23    22223 45.480  1010702.0     -20.00
## 2012-03-29   -22223 44.265  -983701.1   -27020.94
## 2012-08-23    23423 41.995   983648.9     -20.00
## 2012-08-29   -23423 41.340  -968306.8   -15362.06
## 2013-01-02    23038 42.030   968287.1     -20.00
## 2013-01-08   -23038 42.900  -988330.2    20023.06
## 2013-02-01    22745 43.450   988270.3     -20.00
## 2013-02-07   -22745 44.205 -1005442.7    17152.47
## 2013-02-13    22450 44.785  1005423.2     -20.00
## 2013-02-14   -22450 44.300  -994535.0   -10908.25
## 2013-02-18    22358 44.480   994483.8     -20.00
## 2013-02-22   -22358 44.590  -996943.2     2439.38
## 2013-02-27    22166 44.975   996915.8     -20.00
## 2013-03-01   -22166 45.230 -1002568.2     5632.33
## 2013-05-08    23070 43.455  1002506.8     -20.00
## 2013-05-14   -23070 45.970 -1060527.9    58001.05
## 2013-05-30    21790 48.670  1060519.3     -20.00
## 2013-06-05   -21790 47.945 -1044721.6   -15817.75
## 2013-06-07    21723 48.090  1044659.1     -20.00
## 2013-06-11   -21723 48.400 -1051393.2     6714.13
## 2013-06-14    22192 47.375  1051346.0     -20.00
## 2013-06-18   -22192 47.305 -1049792.6   -1573.44
## 2013-06-19    22224 47.545  1056640.1     -20.00
## 2013-06-25   -22224 45.625 -1013970.0   -42690.08
## 2013-07-24    18859 53.400  1007070.6     -20.00
## 2013-07-26   -18859 52.280  -985948.5   -21142.08
## 2013-08-01    18560 53.120   985907.2     -20.00
## 2013-08-07   -18560 53.740  -997414.4    11487.20
## 2013-08-21    18173 54.880   997334.2     -20.00
## 2013-08-27   -18173 52.890  -961170.0   -36184.27
## 2013-08-29    18200 52.810   961142.0     -20.00
## 2013-09-04   -18200 53.300  -970060.0     8898.00
## 2013-09-18    16882 57.460   970039.7     -20.00
## 2013-09-20   -16882 57.920  -977805.4    7745.72
## 2013-10-03    16893 57.880   977766.8     -20.00
## 2013-10-09   -16893 57.340  -968644.6   -9142.22
## 2013-11-06    16151 59.970   968575.5     -20.00
## 2013-11-08   -16151 59.290  -957592.8   -11002.68
## 2013-11-14    16285 58.800   957558.0     -20.00
## 2013-11-20   -16285 59.640  -971237.4    13659.40
## 2013-12-06    16293 59.610   971225.7     -20.00
## 2013-12-12   -16293 58.880  -959331.8   -11913.89
## 2014-01-28    15195 63.130   959260.4     -20.00
## 2014-02-03   -15195 60.690  -922184.5   -37095.80
## 2014-03-04    13945 66.130   922182.8     -20.00
## 2014-03-10   -13945 66.540  -927900.3    5697.45

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## 2014-03-13	13830	67.090	927854.7	-20.00
## 2014-03-19	-13830	65.940	-911950.2	-15924.50
## 2014-05-02	13604	67.030	911876.1	-20.00
## 2014-05-08	-13604	65.000	-884260.0	-27636.12
## 2014-06-16	12745	69.380	884248.1	-20.00
## 2014-06-20	-12745	70.080	-893169.6	8901.50
## 2014-06-25	12895	69.260	893107.7	-20.00
## 2014-07-01	-12895	69.190	-892205.0	-922.65
## 2014-08-04	14455	61.720	892162.6	-20.00
## 2014-08-08	-14455	59.270	-856747.9	-35434.75
## 2014-08-13	14054	60.960	856731.8	-20.00
## 2014-08-15	-14054	60.110	-844785.9	-11965.90
## 2014-09-11	13199	64.000	844736.0	-20.00
## 2014-09-17	-13199	63.210	-834308.8	-10447.21
## 2014-11-05	13382	62.340	834233.9	-20.00
## 2014-11-07	-13382	61.960	-829148.7	-5105.16
## 2014-12-05	11853	69.950	829117.3	-20.00
## 2014-12-11	-11853	68.310	-809678.4	-19458.92
## 2015-02-10	9897	81.810	809673.6	-20.00
## 2015-02-16	-9897	82.830	-819768.5	10074.94
## 2015-02-18	9851	83.210	819701.7	-20.00
## 2015-02-19	-9851	82.740	-815071.7	-4649.97
## 2015-03-04	9328	87.370	814987.4	-20.00
## 2015-03-10	-9328	88.700	-827393.6	12386.24
## 2015-03-25	9275	89.210	827422.8	-20.00
## 2015-03-31	-9275	89.080	-826217.0	-1225.75
## 2015-04-07	9349	88.370	826171.1	-20.00
## 2015-04-13	-9349	88.170	-824301.3	-1889.80
## 2015-05-14	9512	86.650	824214.8	-20.00
## 2015-05-20	-9512	89.710	-853321.5	29086.72
## 2015-06-25	9809	86.990	853284.9	-20.00
## 2015-07-01	-9809	84.100	-824936.9	-28368.01
## 2015-07-09	10314	79.980	824913.7	-20.00
## 2015-07-14	-10314	82.580	-851730.1	26796.40
## 2015-07-23	9854	86.430	851681.2	-20.00
## 2015-07-29	-9854	81.080	-798962.3	-52738.90
## 2015-11-05	10171	78.550	798932.0	-20.00
## 2015-11-11	-10171	78.330	-796694.4	-2257.62
## 2015-11-25	10017	79.530	796652.0	-20.00
## 2015-12-01	-10017	83.210	-833514.6	36842.56
## 2015-12-21	10633	78.390	833520.9	-20.00
## 2015-12-28	-10633	77.090	-819698.0	-13842.90
## 2016-12-30	11601	70.650	819610.7	-20.00
## 2017-01-02	-11601	70.010	-812186.0	-7444.64
## 2017-01-17	11520	70.500	812160.0	-20.00
## 2017-01-23	-11520	70.170	-808358.4	-3821.60
## 2017-03-01	11681	69.200	808325.2	-20.00
## 2017-03-07	-11681	70.100	-818838.1	10492.90
## 2017-03-23	11616	70.490	818811.8	-20.00
## 2017-03-29	-11616	72.360	-840533.8	21701.92
## 2017-05-19	12338	68.120	840464.6	-20.00
## 2017-05-24	-12338	66.400	-819243.2	-21241.36
## 2017-09-29	12183	67.240	819184.9	-20.00
## 2017-10-06	-12183	68.700	-836972.1	17767.18

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## 2017-10-11      12211 68.540   836941.9        -20.00
## 2017-10-17     -12211 68.720  -839139.9       2177.98
## 2017-11-16      12039 69.700   839118.3        -20.00
## 2017-11-22     -12039 69.980  -842489.2       3350.92
## 2017-11-24      11980 70.320   842433.6        -20.00
## 2017-11-30     -11980 69.520  -832849.6      -9604.00
## 2017-12-04      11945 69.720   832805.4        -20.00
## 2017-12-06     -11945 69.320  -828027.4      -4798.00
## 2017-12-20      11553 71.670   828003.5        -20.00
## 2017-12-28     -11553 70.900  -819107.7      -8915.81
## 2018-01-12      11015 74.360   819075.4        -20.00
## 2018-01-17     -11015 73.770  -812576.5      -6518.85
## 2018-02-07      11516 70.560   812569.0        -20.00
## 2018-02-13     -11516 70.620  -813259.9       670.96
##
## [1] "Transactions for the instrument: DTE.csv"
##           Quantity  Price      Value Net realized Profit
## 1999-12-31         0  0.000         0.0         0.000
## 2011-08-03      95283 10.495   999995.1        -20.000
## 2011-08-08     -95283  9.830  -936631.9      -63383.195
## 2012-09-11      96695  9.686   936587.8        -20.000
## 2012-09-17     -96695  9.762  -943936.6       7328.820
## 2012-09-27      96071  9.825   943897.6        -20.000
## 2012-10-03     -96071  9.750  -936692.2      -7225.325
## 2013-05-20     100651  9.306   936658.2        -20.000
## 2013-05-24    -100651  9.260  -932028.3     -4649.946
## 2013-08-01     101127  9.216   931986.4        -20.000
## 2013-08-02    -101127  9.169  -927233.5     -4772.969
## 2013-08-21      96202  9.638   927194.9        -20.000
## 2013-08-27     -96202  9.691  -932293.6       5078.706
## 2013-08-29      96847  9.626   932249.2        -20.000
## 2013-09-03     -96847  9.759  -945129.9      12860.651
## 2013-10-01      87834 10.760   945093.8        -20.000
## 2013-10-02     -87834 10.715  -941141.3     -3972.530
## 2013-10-10      84177 11.180   941098.9        -20.000
## 2013-10-16     -84177 11.930 -1004231.6      63112.750
## 2013-10-24      86868 11.560  1004194.1        -20.000
## 2013-10-25     -86868 11.490  -998113.3     -6100.760
## 2013-10-28      87054 11.565  1006779.5        -20.000
## 2013-10-30     -87054 11.610 -1010696.9       3897.430
## 2014-03-04      82397 12.160  1001947.5        -20.000
## 2014-03-10     -82397 11.435  -942209.7     -59757.825
## 2014-03-17      83415 11.295   942172.4        -20.000
## 2014-03-21     -83415 11.500  -959272.5      17080.075
## 2014-05-29      77264 12.415   959232.6        -20.000
## 2014-06-03     -77264 12.310  -951119.8     -8132.720
## 2014-06-12      74976 12.685   951070.6        -20.000
## 2014-06-18     -74976 12.660  -949196.2     -1894.400
## 2014-06-24      74590 12.725   949157.8        -20.000
## 2014-06-30     -74590 12.800  -954752.0       5574.250
## 2014-08-01      76377 12.500   954712.5        -20.000
## 2014-08-07     -76377 11.360  -867642.7     -87089.780
## 2014-08-11      77155 11.245   867608.0        -20.000
## 2014-08-15     -77155 11.110  -857192.0     -10435.925

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##	2014-09-24	70868	12.095	857148.5	-20.000
##	2014-09-25	-70868	11.930	-845455.2	-11713.220
##	2014-11-05	70687	11.960	845416.5	-20.000
##	2014-11-11	-70687	12.530	-885708.1	40271.590
##	2015-01-07	68897	12.855	885670.9	-20.000
##	2015-01-13	-68897	13.855	-954567.9	68877.000
##	2015-02-10	60605	15.750	954528.8	-20.000
##	2015-02-16	-60605	15.840	-959983.2	5434.450
##	2015-02-18	60660	15.825	959944.5	-20.000
##	2015-02-24	-60660	16.095	-976322.7	16358.200
##	2015-03-11	58198	16.775	976271.4	-20.000
##	2015-03-17	-58198	16.900	-983546.2	7254.750
##	2015-04-24	57684	17.050	983512.2	-20.000
##	2015-04-30	-57684	16.475	-950343.9	-33188.300
##	2015-06-10	61628	15.420	950303.8	-20.000
##	2015-06-12	-61628	15.260	-940443.3	-9880.480
##	2015-07-07	61686	15.245	940403.1	-20.000
##	2015-07-13	-61686	16.550	-1020903.3	80480.230
##	2015-08-10	59892	17.045	1020859.1	-20.000
##	2015-08-14	-59892	16.415	-983127.2	-37751.960
##	2015-09-02	65213	15.075	983086.0	-20.000
##	2015-09-08	-65213	15.905	-1037212.8	54106.790
##	2015-09-25	65499	15.835	1037176.7	-20.000
##	2015-10-01	-65499	15.720	-1029644.3	-7552.385
##	2015-10-05	67339	15.290	1029613.3	-20.000
##	2015-10-09	-67339	15.205	-1023889.5	-5743.815
##	2015-10-15	68807	14.880	1023848.2	-20.000
##	2015-10-21	-68807	15.735	-1082678.1	58809.985
##	2015-11-06	64061	16.900	1082630.9	-20.000
##	2015-11-12	-64061	16.510	-1057647.1	-25003.790
##	2015-11-25	61686	17.145	1057606.5	-20.000
##	2015-12-01	-61686	17.305	-1067476.2	9849.760
##	2015-12-07	64831	16.465	1067442.4	-20.000
##	2015-12-08	-64831	16.340	-1059338.5	-8123.875
##	2015-12-15	66103	16.025	1059300.6	-20.000
##	2015-12-18	-66103	16.485	-1089708.0	30387.380
##	2015-12-23	65960	16.520	1089659.2	-20.000
##	2015-12-30	-65960	16.680	-1100212.8	10533.600
##	2016-01-12	69106	15.920	1100167.5	-20.000
##	2016-01-18	-69106	15.255	-1054212.0	-45975.490
##	2016-01-21	69377	15.195	1054183.5	-20.000
##	2016-01-26	-69377	15.570	-1080199.9	25996.375
##	2016-02-04	68149	15.850	1080161.6	-20.000
##	2016-02-08	-68149	14.930	-1017464.6	-62717.080
##	2016-02-25	66174	15.375	1017425.2	-20.000
##	2016-03-02	-66174	15.705	-1039262.7	21817.420
##	2016-06-07	66319	15.670	1039218.7	-20.000
##	2016-06-10	-66319	14.950	-991469.0	-47769.680
##	2016-07-20	64715	15.320	991433.8	-20.000
##	2016-07-26	-64715	15.140	-979785.1	-11668.700
##	2017-01-11	59740	16.400	979736.0	-20.000
##	2017-01-12	-59740	16.195	-967489.3	-12266.700
##	2017-01-13	60199	16.240	977631.8	-20.000
##	2017-01-19	-60199	16.220	-976427.8	-1223.980

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## 2017-02-03      60219 16.045   966213.9          -20.000
## 2017-02-09     -60219 15.930  -959288.7        -6945.185
## 2017-02-15      60254 15.920   959243.7          -20.000
## 2017-02-21     -60254 16.295  -981838.9       22575.250
## 2017-03-09      61228 16.035   981791.0          -20.000
## 2017-03-15     -61228 15.990  -979035.7       -2775.260
## 2017-04-20      61169 16.005   979009.8          -20.000
## 2017-04-26     -61169 16.400 -1003171.6      24141.755
## 2017-05-02      62036 16.170  1003122.1          -20.000
## 2017-05-08     -62036 16.810 -1042825.2     39683.040
## 2017-05-19      59367 17.565  1042781.4          -20.000
## 2017-05-25     -59367 17.850 -1059701.0     16899.595
## 2017-06-02      60883 17.405  1059668.6          -20.000
## 2017-06-09     -60883 17.125 -1042621.4     -17067.240
## 2017-06-16      62617 16.650  1042573.0          -20.000
## 2017-06-22     -62617 16.695 -1045390.8      2797.765
##
## [1] "Transactions for the instrument: FME.csv"
##           Quantity  Price      Value Net realized Profit
## 1999-12-31         0  0.000         0.0          0.00
## 2011-08-01      18480 54.110   999952.8          -20.00
## 2011-08-05     -18480 48.600  -898128.0     -101844.80
## 2011-08-10      19199 46.780   898129.2          -20.00
## 2011-08-16     -19199 47.985  -921264.0      23114.79
## 2011-08-31      19743 46.660   921208.4          -20.00
## 2011-09-05     -19743 46.870  -925354.4      4126.03
## 2011-09-06      20005 47.310   946436.6          -20.00
## 2011-09-12     -20005 48.405  -968342.0     21885.47
## 2011-10-28      17838 53.100   947197.8          -20.00
## 2011-11-03     -17838 50.920  -908311.0     -38906.84
## 2011-12-29      17330 52.410   908265.3          -20.00
## 2012-01-04     -17330 54.420  -943098.6     34813.30
## 2012-02-10      17234 54.720   943044.5          -20.00
## 2012-02-16     -17234 55.670  -959416.8     16352.30
## 2012-03-08      18421 52.080   959365.7          -20.00
## 2012-03-14     -18421 52.380  -964892.0     5506.30
## 2012-03-26      18544 52.030   964844.3          -20.00
## 2012-03-30     -18544 53.140  -985428.2     20563.84
## 2012-04-12      18670 52.780   985402.6          -20.00
## 2012-04-18     -18670 53.020  -989883.4     4460.80
## 2012-05-08      18620 53.160   989839.2          -20.00
## 2012-05-14     -18620 52.350  -974757.0    -15102.20
## 2012-06-06      18792 51.870   974741.0          -20.00
## 2012-06-12     -18792 52.500  -986580.0     11818.96
## 2012-06-18      18649 52.900   986532.1          -20.00
## 2012-06-22     -18649 55.070 -1027000.4     40448.33
## 2012-07-13      18064 56.850  1026938.4          -20.00
## 2012-07-19     -18064 58.600 -1058550.4     31592.00
## 2012-08-20      18269 57.940  1058505.9          -20.00
## 2012-08-24     -18269 56.660 -1035121.5    -23404.32
## 2012-09-05      18036 57.390  1035086.0          -20.00
## 2012-09-11     -18036 56.710 -1022821.6    -12284.48
## 2012-09-20      18596 55.000  1022780.0          -20.00
## 2012-09-26     -18596 56.540 -1051417.8     28617.84

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## 2012-10-15	18127	58.000	1051366.0	-20.00
## 2012-10-19	-18127	59.250	-1074024.8	22638.75
## 2012-10-25	18559	57.870	1074009.3	-20.00
## 2012-10-31	-18559	54.190	-1005712.2	-68317.12
## 2013-12-10	19520	51.520	1005670.4	-20.00
## 2013-12-11	-19520	50.900	-993568.0	-12122.40
## 2014-02-03	18835	52.750	993546.2	-20.00
## 2014-02-07	-18835	51.840	-976406.4	-17159.85
## 2014-02-19	18246	53.510	976343.5	-20.00
## 2014-02-25	-18246	49.820	-909015.7	-67347.74
## 2014-08-11	17467	52.040	908982.7	-20.00
## 2014-08-15	-17467	51.180	-893961.1	-15041.62
## 2014-09-29	16466	54.290	893939.1	-20.00
## 2014-10-06	-16466	54.920	-904312.7	10353.58
## 2014-10-17	17313	52.230	904258.0	-20.00
## 2014-10-23	-17313	55.650	-963468.4	59190.46
## 2014-11-04	16418	58.680	963408.2	-20.00
## 2014-11-10	-16418	58.620	-962423.2	-1005.08
## 2014-11-13	16471	58.430	962400.5	-20.00
## 2014-11-19	-16471	58.100	-956965.1	-5455.43
## 2014-12-01	15981	59.880	956942.3	-20.00
## 2014-12-05	-15981	59.590	-952307.8	-4654.49
## 2014-12-16	15929	59.780	952235.6	-20.00
## 2014-12-22	-15929	61.610	-981385.7	29130.07
## 2015-01-05	15729	62.390	981332.3	-20.00
## 2015-01-09	-15729	62.260	-979287.5	-2064.77
## 2015-02-17	15397	63.600	979249.2	-20.00
## 2015-02-23	-15397	65.130	-1002806.6	23537.41
## 2015-03-24	12976	77.280	1002785.3	-20.00
## 2015-03-25	-12976	76.310	-990198.6	-12606.72
## 2015-03-27	12986	76.250	990182.5	-20.00
## 2015-04-02	-12986	77.680	-1008752.5	18549.98
## 2015-04-20	12591	80.110	1008665.0	-20.00
## 2015-04-24	-12591	79.790	-1004635.9	-4049.12
## 2015-04-30	12726	78.940	1004590.4	-20.00
## 2015-05-07	-12726	74.940	-953686.4	-50924.00
## 2015-05-21	12132	78.610	953696.5	-20.00
## 2015-05-28	-12132	79.190	-960733.1	7016.56
## 2015-06-03	12261	78.350	960649.3	-20.00
## 2015-06-09	-12261	75.070	-920433.3	-40236.08
## 2015-06-16	12331	74.640	920385.8	-20.00
## 2015-06-22	-12331	76.350	-941471.8	21066.01
## 2015-07-07	12736	73.920	941445.1	-20.00
## 2015-07-13	-12736	77.720	-989841.9	48376.80
## 2015-08-13	13358	74.100	989827.8	-20.00
## 2015-08-19	-13358	73.450	-981145.1	-8702.70
## 2015-08-25	14670	66.880	981129.6	-20.00
## 2015-08-26	-14670	65.620	-962645.4	-18504.20
## 2015-09-02	14305	67.290	962583.5	-20.00
## 2015-09-08	-14305	70.570	-1009503.8	46900.40
## 2015-09-21	14040	71.900	1009476.0	-20.00
## 2015-09-25	-14040	71.820	-1008352.8	-1143.20
## 2015-09-30	14394	70.050	1008299.7	-20.00
## 2015-10-06	-14394	71.620	-1030898.3	22578.58

## 2015-10-15	14311	72.030	1030821.3	-20.00
## 2015-10-21	-14311	74.910	-1072037.0	41195.68
## 2015-10-28	13549	79.120	1071996.9	-20.00
## 2015-11-03	-13549	81.860	-1109121.1	37104.26
## 2015-12-15	14735	75.270	1109103.4	-20.00
## 2015-12-18	-14735	77.160	-1136952.6	27829.15
## 2015-12-23	14948	76.060	1136944.9	-20.00
## 2016-01-04	-14948	74.600	-1115120.8	-21844.08
## 2016-01-21	15427	72.280	1115063.6	-20.00
## 2016-01-27	-15427	81.350	-1254986.4	139902.89
## 2016-02-25	16456	76.260	1254934.6	-20.00
## 2016-03-02	-16456	77.790	-1280112.2	25157.68
## 2016-03-17	16543	77.380	1280097.3	-20.00
## 2016-03-22	-16543	75.140	-1243041.0	-37076.32
## 2016-03-29	16157	76.930	1242958.0	-20.00
## 2016-04-04	-16157	78.260	-1264446.8	21468.81
## 2016-04-06	16343	77.370	1264457.9	-20.00
## 2016-04-12	-16343	78.340	-1280310.6	15832.71
## 2016-04-18	16179	79.130	1280244.3	-20.00
## 2016-04-22	-16179	79.050	-1278949.9	-1314.32
## 2016-05-12	16930	75.540	1278892.2	-20.00
## 2016-05-19	-16930	73.060	-1236905.8	-42006.40
## 2016-06-03	15941	77.590	1236862.2	-20.00
## 2016-06-08	-15941	76.380	-1217573.6	-19308.61
## 2016-06-15	16663	73.070	1217565.4	-20.00
## 2016-06-17	-16663	72.250	-1203901.8	-13683.66
## 2016-07-07	15398	78.180	1203815.6	-20.00
## 2016-07-12	-15398	79.200	-1219521.6	15685.96
## 2016-09-02	15328	79.560	1219495.7	-20.00
## 2016-09-08	-15328	79.880	-1224400.6	4884.96
## 2016-09-13	15483	79.080	1224395.6	-20.00
## 2016-09-19	-15483	78.540	-1216034.8	-8380.82
## 2016-09-28	15410	78.910	1216003.1	-20.00
## 2016-10-05	-15410	76.090	-1172546.9	-43476.20
## 2016-12-15	15028	78.020	1172484.6	-20.00
## 2016-12-21	-15028	81.080	-1218470.2	45965.68
## 2017-01-02	14935	81.580	1218397.3	-20.00
## 2017-01-06	-14935	80.600	-1203761.0	-14656.30
## 2017-01-13	15820	76.090	1203743.8	-20.00
## 2017-01-17	-15820	75.960	-1201687.2	-2076.60
## 2017-02-01	15893	75.610	1201669.7	-20.00
## 2017-02-07	-15893	75.940	-1206914.4	5224.69
## 2017-02-15	15643	77.150	1206857.5	-20.00
## 2017-02-21	-15643	77.620	-1214209.7	7332.21
## 2017-02-27	15526	78.200	1214133.2	-20.00
## 2017-03-03	-15526	79.070	-1227640.8	13487.62
## 2017-03-20	15526	79.070	1227640.8	-20.00
## 2017-03-21	-15526	77.010	-1195657.3	-32003.56
## 2017-05-02	14433	82.840	1195629.7	-20.00
## 2017-05-08	-14433	84.830	-1224351.4	28701.67
## 2017-05-25	14936	81.970	1224303.9	-20.00
## 2017-05-31	-14936	85.160	-1271949.8	47625.84
## 2017-06-22	14437	88.100	1271899.7	-20.00
## 2017-06-28	-14437	86.200	-1244469.4	-27450.30

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## 2017-07-12      14793 84.120 1244387.2      -20.00
## 2017-07-17     -14793 85.160 -1259771.9     15364.72
## 2017-07-20      14924 84.410 1259734.8      -20.00
## 2017-07-26     -14924 81.410 -1214962.8    -44792.00
## 2017-07-31      15057 80.690 1214949.3      -20.00
## 2017-08-03     -15057 77.760 -1170832.3    -44137.01
## 2017-08-22      14790 79.160 1170776.4      -20.00
## 2017-08-28     -14790 78.240 -1157169.6    -13626.80
## 2017-09-05      14587 79.330 1157186.7      -20.00
## 2017-09-06     -14587 78.800 -1149455.6    -7751.11
## 2017-09-22      13966 82.300 1149401.8      -20.00
## 2017-09-28     -13966 82.670 -1154569.2     5147.42
## 2017-10-11      14201 81.300 1154541.3      -20.00
## 2017-10-17     -14201 80.850 -1148150.8    -6410.45
## 2017-11-01      13595 84.450 1148097.8      -20.00
## 2017-11-07     -13595 84.190 -1144563.1    -3554.70
## 2017-11-09      13552 84.450 1144466.4      -20.00
## 2017-11-15     -13552 83.000 -1124816.0    -19670.40
## 2017-11-16      13565 83.440 1131863.6      -20.00
## 2017-11-22     -13565 82.700 -1121825.5    -10058.10
## 2017-11-24      13453 82.860 1114715.6      -20.00
## 2017-11-30     -13453 82.600 -1111217.8    -3517.78
## 2017-12-21      12630 87.980 1111187.4      -20.00
## 2017-12-29     -12630 87.780 -1108661.4    -2546.00
## 2018-01-03      12656 87.600 1108665.6      -20.00
## 2018-01-09     -12656 92.040 -1164858.2     56172.64
## 2018-01-16      13000 89.600 1164800.0      -20.00
## 2018-01-22     -13000 90.300 -1173900.0     9080.00
## 2018-01-26      12784 91.820 1173826.9      -20.00
## 2018-02-01     -12784 90.240 -1153628.2    -20218.72
## 2018-02-07      13309 86.680 1153624.1      -20.00
## 2018-02-08     -13309 84.960 -1130732.6    -22911.48
## 2018-02-12      13178 85.800 1130672.4      -20.00
## 2018-02-16     -13178 87.880 -1158082.6     27390.24
## 2018-02-28      13235 87.500 1158062.5      -20.00
## 2018-03-06     -13235 83.000 -1098505.0    -59577.50
## 2018-05-30      12620 87.040 1098444.8      -20.00
## 2018-05-31     -12620 86.360 -1089863.2    -8601.60
## 2018-06-04      12714 85.720 1089844.1      -20.00
## 2018-06-08     -12714 86.680 -1102049.5     12185.44
## 2018-07-24      13085 84.220 1102018.7      -20.00
## 2018-07-30     -13085 85.720 -1121646.2     19607.50
## 2018-09-07      12954 86.580 1121557.3      -20.00
## 2018-09-13     -12954 89.040 -1153424.2     31846.84
##
## [1] "Transactions for the instrument: FRE.csv"
##      Quantity Price      Value Net realized Profit
## 1999-12-31         0 0.000         0.0         0.000
## 2011-08-10      46853 21.343   999983.6        -20.000
## 2011-08-16     -46853 22.947 -1075135.8     75132.212
## 2011-09-06      45059 23.860  1075107.7        -20.000
## 2011-09-07     -45059 23.397 -1054245.4    -20882.317
## 2011-09-13      44457 23.713  1054208.8        -20.000
## 2011-09-16     -44457 23.253 -1033758.6    -20470.220

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## 2011-09-26	44524	23.217	1033713.7	-20.000
## 2011-09-30	-44524	22.217	-989189.7	-44544.000
## 2011-11-02	42002	23.550	989147.1	-20.000
## 2011-11-08	-42002	24.327	-1021782.7	32615.554
## 2011-12-07	43547	23.463	1021743.3	-20.000
## 2011-12-13	-43547	23.303	-1014775.7	-6987.520
## 2011-12-15	43500	23.327	1014724.5	-20.000
## 2011-12-21	-43500	23.433	-1019335.5	4591.000
## 2011-12-29	42913	23.753	1019312.5	-20.000
## 2012-01-04	-42913	24.560	-1053943.3	34610.791
## 2012-04-02	40901	25.767	1053896.1	-20.000
## 2012-04-10	-40901	24.867	-1017085.2	-36830.900
## 2012-04-12	40612	25.043	1017046.3	-20.000
## 2012-04-13	-40612	24.683	-1002426.0	-14640.320
## 2012-04-24	41409	24.207	1002387.7	-20.000
## 2012-04-26	-41409	24.250	-1004168.2	1760.587
## 2012-05-08	38729	25.927	1004126.8	-20.000
## 2012-05-09	-38729	25.517	-988247.9	-15898.890
## 2012-09-11	33696	29.327	988202.6	-20.000
## 2012-09-17	-33696	28.763	-969198.0	-19024.544
## 2012-10-25	31535	30.733	969165.2	-20.000
## 2012-10-26	-31535	30.503	-961912.1	-7273.050
## 2012-11-27	33191	28.980	961875.2	-20.000
## 2012-12-03	-33191	29.800	-989091.8	27196.620
## 2012-12-14	33433	29.583	989048.4	-20.000
## 2012-12-17	-33433	29.427	-983832.9	-5235.548
## 2012-12-27	33334	29.513	983786.3	-20.000
## 2013-01-04	-33334	28.807	-960252.5	-23553.804
## 2013-01-08	33422	28.730	960214.1	-20.000
## 2013-01-14	-33422	27.567	-921344.3	-38889.786
## 2013-02-21	30950	29.767	921288.7	-20.000
## 2013-02-27	-30950	31.103	-962637.9	41329.200
## 2013-04-02	29402	32.740	962621.5	-20.000
## 2013-04-08	-29402	32.617	-959005.0	-3636.446
## 2013-05-22	30140	31.817	958964.4	-20.000
## 2013-05-28	-30140	31.460	-948204.4	-10779.980
## 2013-06-03	30678	30.907	948164.9	-20.000
## 2013-06-07	-30678	30.573	-937918.5	-10266.452
## 2013-07-03	30463	30.787	937864.4	-20.000
## 2013-07-05	-30463	30.980	-943743.7	5859.359
## 2013-12-05	26835	35.167	943706.4	-20.000
## 2013-12-11	-26835	34.833	-934743.6	-8982.890
## 2014-01-03	25081	37.267	934693.6	-20.000
## 2014-01-07	-25081	37.333	-936349.0	1635.346
## 2014-02-26	24532	38.167	936312.8	-20.000
## 2014-03-03	-24532	36.883	-904813.8	-31519.088
## 2014-03-04	24885	37.000	920745.0	-20.000
## 2014-03-05	-24885	36.767	-914946.8	-5818.205
## 2014-03-11	25005	35.950	898929.8	-20.000
## 2014-03-17	-25005	35.633	-891003.2	-7946.585
## 2014-03-25	24355	36.583	890979.0	-20.000
## 2014-03-31	-24355	37.867	-922250.8	31251.820
## 2014-04-16	25856	35.667	922206.0	-20.000
## 2014-04-24	-25856	36.433	-942011.6	19785.696

## 2014-04-29	25937	36.317	941954.0	-20.000
## 2014-05-06	-25937	35.767	-927688.7	-14285.350
## 2014-06-02	25346	36.600	927663.6	-20.000
## 2014-06-06	-25346	36.867	-934431.0	6747.382
## 2014-06-24	25553	36.567	934396.6	-20.000
## 2014-06-30	-25553	36.300	-927573.9	-6842.651
## 2014-07-10	24911	37.233	927511.3	-20.000
## 2014-07-16	-24911	37.850	-942881.4	15350.087
## 2014-09-24	24534	38.430	942841.6	-20.000
## 2014-09-30	-24534	39.195	-961610.1	18748.510
## 2014-10-08	25215	38.135	961574.0	-20.000
## 2014-10-14	-25215	37.960	-957161.4	-4432.625
## 2014-10-17	25654	37.310	957150.7	-20.000
## 2014-10-23	-25654	38.655	-991655.4	34484.630
## 2014-12-04	22864	43.370	991611.7	-20.000
## 2014-12-09	-22864	43.070	-984752.5	-6879.200
## 2015-01-23	20299	48.510	984704.5	-20.000
## 2015-01-29	-20299	50.520	-1025505.5	40780.990
## 2015-02-05	20552	49.895	1025442.0	-20.000
## 2015-02-11	-20552	48.480	-996361.0	-29101.080
## 2015-03-24	18020	55.290	996325.8	-20.000
## 2015-03-30	-18020	56.020	-1009480.4	13134.600
## 2015-04-09	18188	55.500	1009434.0	-20.000
## 2015-04-15	-18188	56.250	-1023075.0	13621.000
## 2015-04-30	18347	55.760	1023028.7	-20.000
## 2015-05-07	-18347	53.860	-988169.4	-34879.300
## 2015-06-10	17827	55.430	988150.6	-20.000
## 2015-06-12	-17827	55.470	-988863.7	693.080
## 2015-06-16	17907	55.220	988824.5	-20.000
## 2015-06-22	-17907	57.950	-1037710.7	48866.110
## 2015-07-07	17943	57.830	1037643.7	-20.000
## 2015-07-13	-17943	61.260	-1099188.2	61524.490
## 2015-07-24	17312	63.490	1099138.9	-20.000
## 2015-07-30	-17312	62.050	-1074209.6	-24949.280
## 2015-08-10	16688	64.370	1074206.6	-20.000
## 2015-08-14	-16688	65.390	-1091228.3	17001.760
## 2015-08-25	18457	59.120	1091177.8	-20.000
## 2015-08-31	-18457	63.050	-1163713.8	72516.010
## 2015-09-02	18637	62.440	1163694.3	-20.000
## 2015-09-04	-18637	62.380	-1162576.1	-1138.220
## 2015-10-05	19571	59.400	1162517.4	-20.000
## 2015-10-09	-19571	57.670	-1128659.6	-33877.830
## 2015-10-15	19656	57.420	1128647.5	-20.000
## 2015-10-21	-19656	60.050	-1180342.8	51675.280
## 2015-11-25	17273	68.330	1180264.1	-20.000
## 2015-12-01	-17273	68.770	-1187864.2	7580.120
## 2015-12-23	18465	64.330	1187853.4	-20.000
## 2016-01-04	-18465	62.570	-1155355.1	-32518.400
## 2016-01-08	18697	61.790	1155287.6	-20.000
## 2016-01-14	-18697	60.050	-1122754.8	-32552.780
## 2016-01-21	19179	58.540	1122738.7	-20.000
## 2016-01-26	-19179	59.670	-1144410.9	21652.270
## 2016-03-08	19009	60.200	1144341.8	-20.000
## 2016-03-10	-19009	60.100	-1142440.9	-1920.900

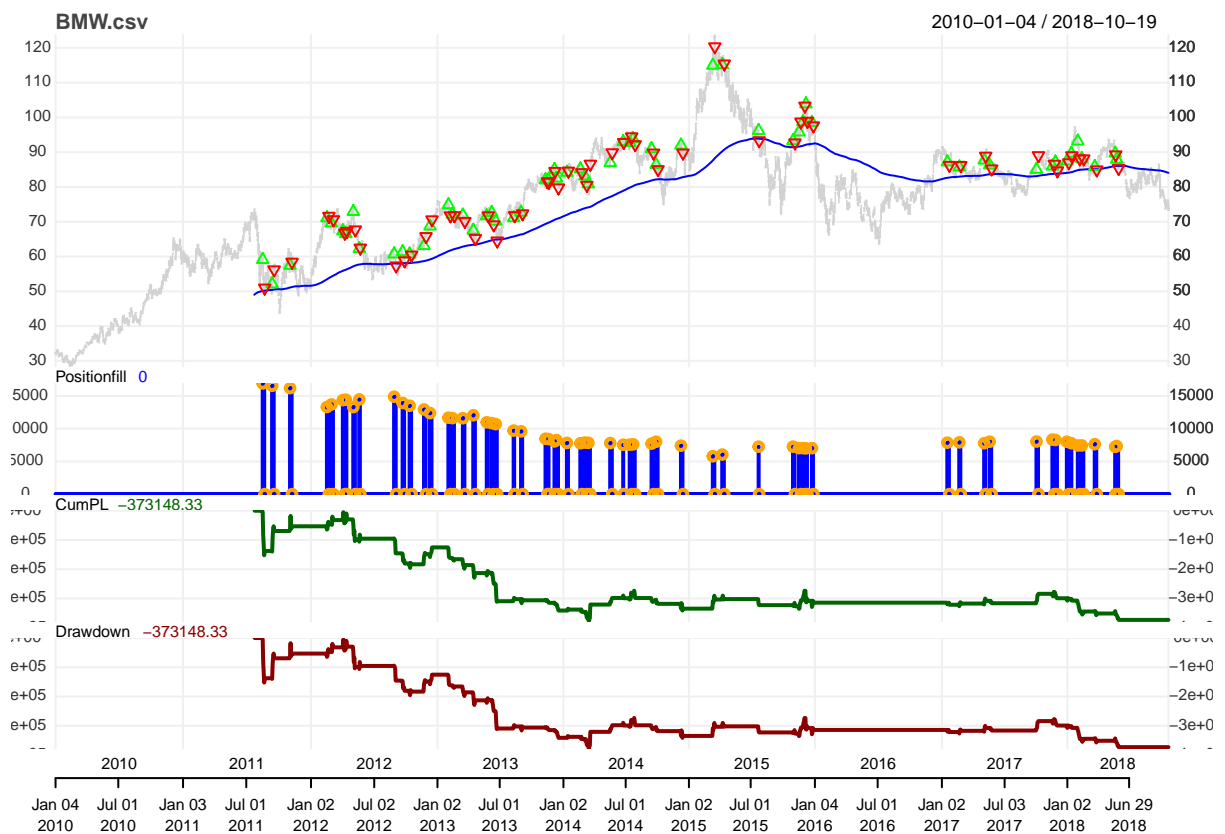
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##	2016-03-24	-18382	62.220	-1143728.0	1266.740
##	2016-03-29	18493	62.490	1155627.6	-20.000
##	2016-04-01	-18493	63.350	-1171531.6	15883.980
##	2016-04-04	18430	63.780	1175465.4	-20.000
##	2016-04-08	-18430	63.360	-1167724.8	-7760.600
##	2016-04-18	17651	65.250	1151727.8	-20.000
##	2016-04-22	-17651	65.260	-1151904.3	156.510
##	2016-06-03	17055	67.540	1151894.7	-20.000
##	2016-06-08	-17055	66.580	-1135521.9	-16392.800
##	2016-06-15	18049	62.910	1135462.6	-20.000
##	2016-06-21	-18049	64.620	-1166326.4	30843.790
##	2016-07-07	17801	65.520	1166321.5	-20.000
##	2016-07-13	-17801	67.200	-1196227.2	29885.680
##	2016-07-14	17756	67.740	1202791.4	-20.000
##	2016-07-20	-17756	67.210	-1193380.8	-9430.680
##	2016-08-01	17488	67.860	1186735.7	-20.000
##	2016-08-05	-17488	67.210	-1175368.5	-11387.200
##	2016-09-02	17897	65.670	1175296.0	-20.000
##	2016-09-08	-17897	70.520	-1262096.4	86780.450
##	2016-09-13	18156	69.510	1262023.6	-20.000
##	2016-09-16	-18156	69.400	-1260026.4	-2017.160
##	2016-10-10	17916	70.330	1260032.3	-20.000
##	2016-10-14	-17916	69.860	-1251611.8	-8440.520
##	2016-10-18	17959	69.690	1251562.7	-20.000
##	2016-10-20	-17959	70.130	-1259464.7	7881.960
##	2016-10-27	18348	68.640	1259406.7	-20.000
##	2016-11-02	-18348	66.100	-1212802.8	-46623.920
##	2016-11-07	18398	65.920	1212796.2	-20.000
##	2016-11-11	-18398	68.020	-1251432.0	38615.800
##	2016-11-24	18809	66.530	1251362.8	-20.000
##	2016-11-30	-18809	67.750	-1274309.8	22926.980
##	2017-01-25	17239	73.920	1274306.9	-20.000
##	2017-01-27	-17239	73.980	-1275341.2	1014.340
##	2017-03-28	17360	73.460	1275265.6	-20.000
##	2017-04-03	-17360	74.840	-1299222.4	23936.800
##	2017-04-24	17397	74.680	1299208.0	-20.000
##	2017-04-25	-17397	74.520	-1296424.4	-2803.520
##	2017-05-31	17035	76.100	1296363.5	-20.000
##	2017-06-06	-17035	76.290	-1299600.2	3216.650
##	2017-06-07	17126	76.400	1308426.4	-20.000
##	2017-06-13	-17126	77.790	-1332231.5	23785.140
##	2017-06-22	16759	78.960	1323290.6	-20.000
##	2017-06-28	-16759	76.600	-1283739.4	-39571.240
##	2017-07-05	17003	75.500	1283726.5	-20.000
##	2017-07-06	-17003	74.700	-1270124.1	-13622.400
##	2017-08-01	17468	72.710	1270098.3	-20.000
##	2017-08-02	-17468	70.650	-1234114.2	-36004.080
##	2017-09-05	17428	70.810	1234076.7	-20.000
##	2017-09-11	-17428	70.490	-1228499.7	-5596.960
##	2017-10-26	17220	71.340	1228474.8	-20.000
##	2017-11-02	-17220	69.310	-1193518.2	-34976.600
##	2018-06-11	17418	68.520	1193481.4	-20.000
##	2018-06-15	-17418	70.100	-1221001.8	27500.440

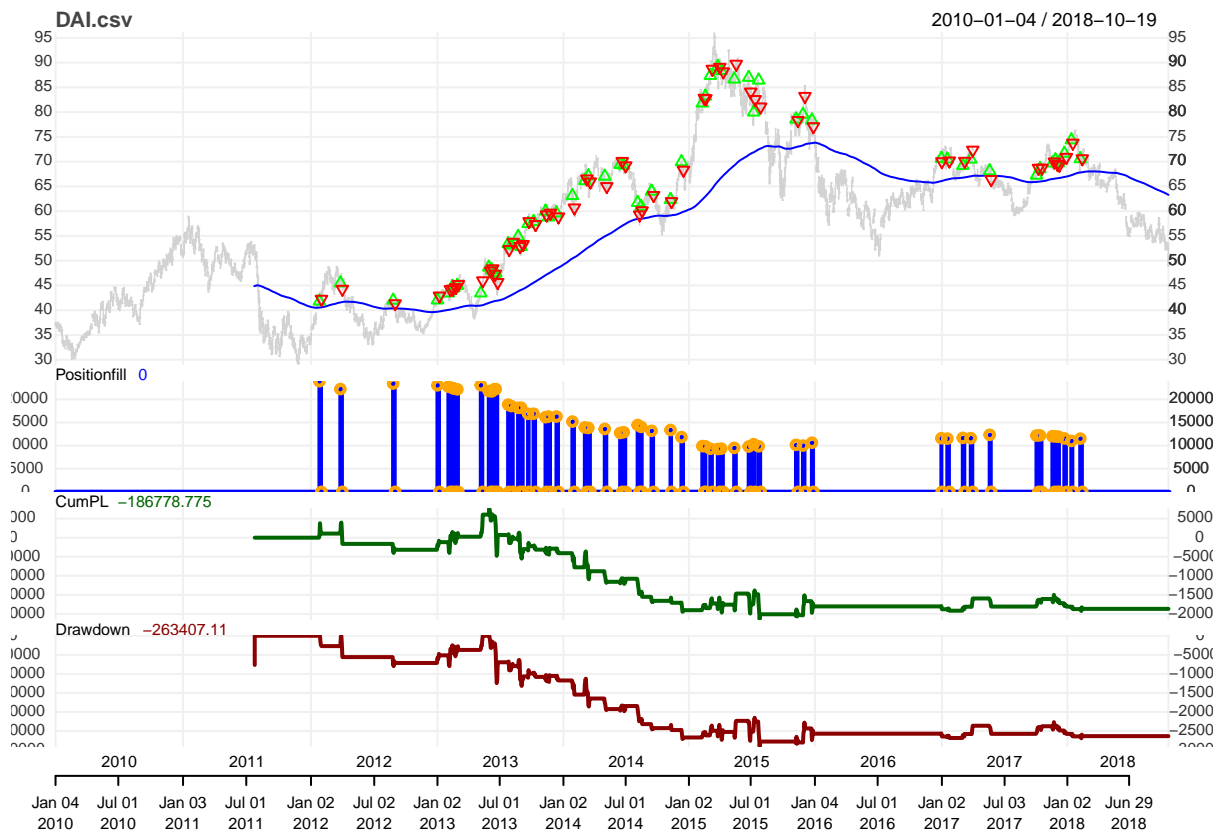
```
## 2018-06-20    17814 68.540  1220971.6                -20.000
## 2018-06-22   -17814 69.140 -1231660.0                10668.400
## 2018-06-27    17818 69.120  1231580.2                -20.000
## 2018-07-03   -17818 67.720 -1206635.0               -24965.200
## 2018-07-24    17421 69.260  1206578.5                -20.000
## 2018-07-30   -17421 69.300 -1207275.3                676.840
```

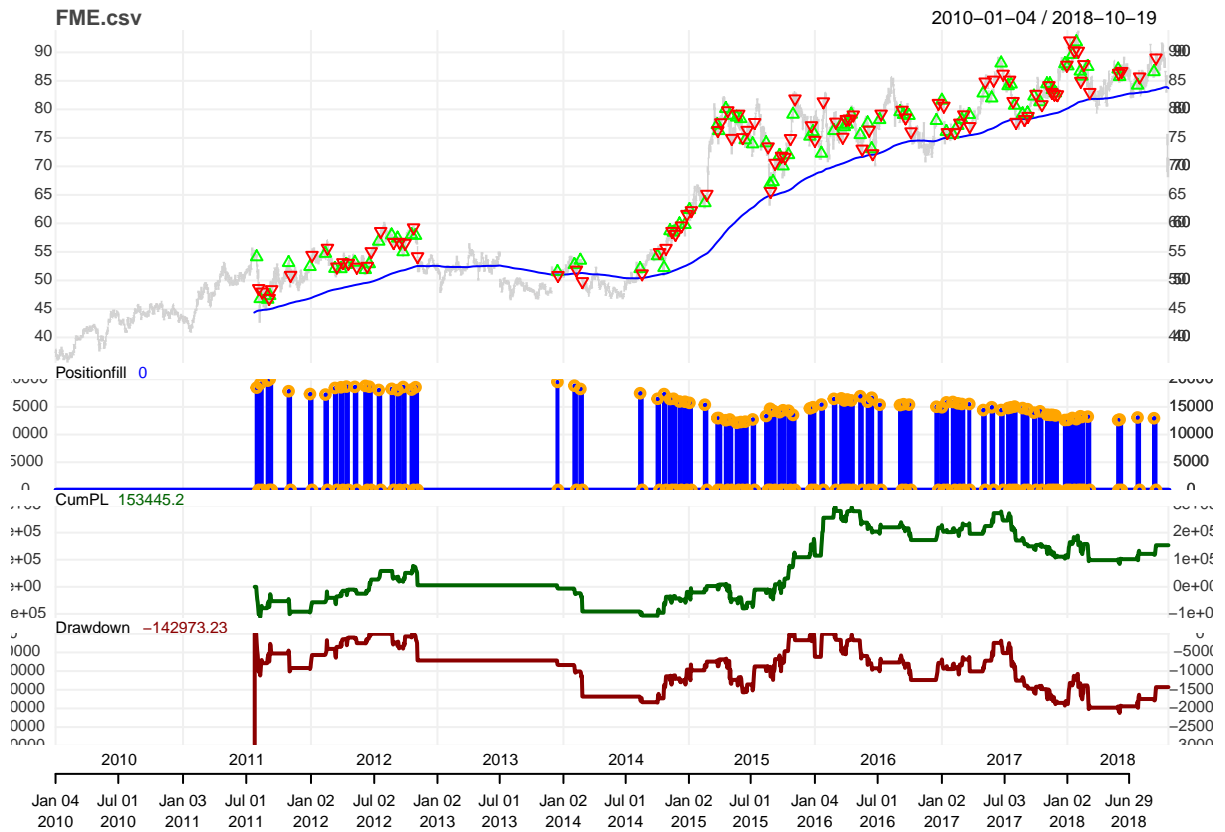
Step 3: Graph which visualize transactions

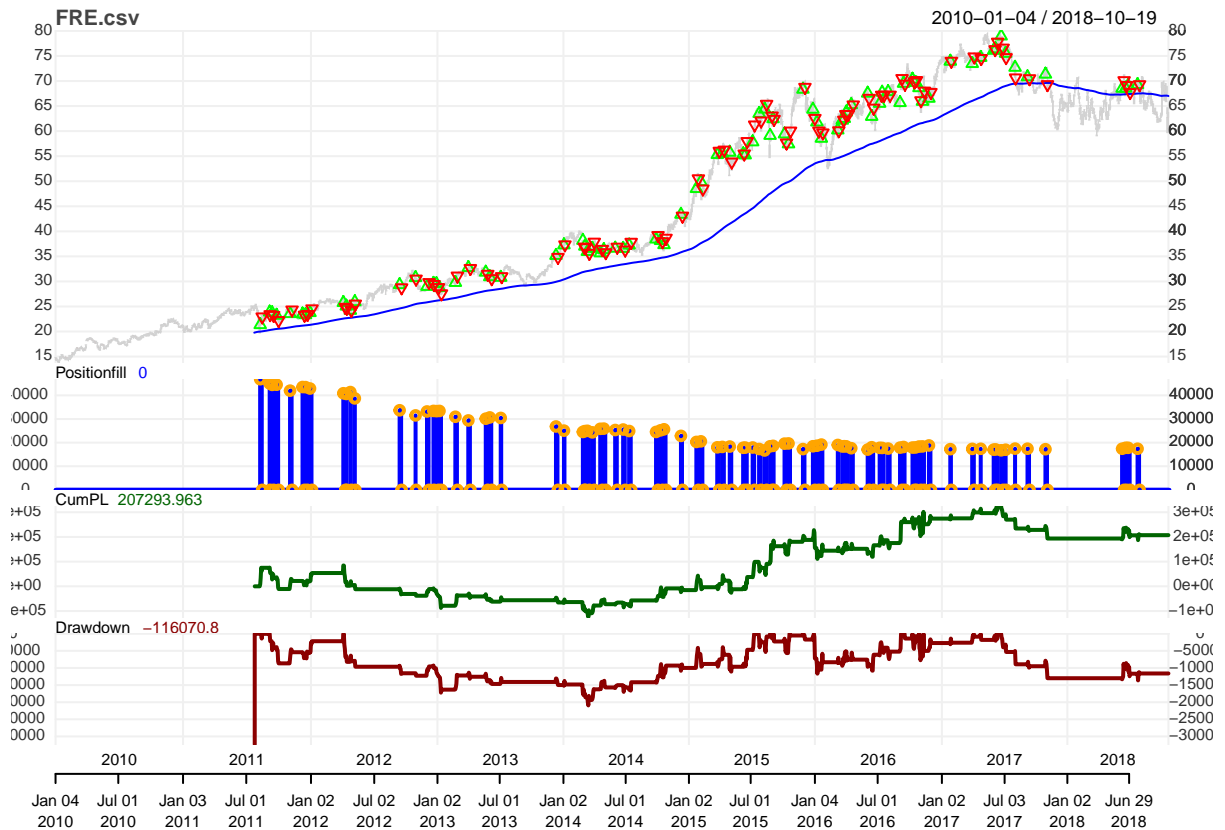
The following graphs show the combined view of the performance of the Smash Day trading system. It visualizes the trades (buy-transactions are visualized in green and sell-transactions are visualized in red). Moreover, the size of the blue squares indicates the size of the position (height) and the holding 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] "BMW.csv"
##      Trades  Win Percent Loss Percent      W/L Ratio
##      "60"    "38.33"    "61.67"    "0.62"
##
## [1] "DAI.csv"
##      Trades  Win Percent Loss Percent      W/L Ratio
##      "58"    "41.38"    "58.62"    "0.71"
##
## [1] "DTE.csv"
##      Trades  Win Percent Loss Percent      W/L Ratio
##      "53"    "47.17"    "52.83"    "0.89"
##
## [1] "FME.csv"
##      Trades  Win Percent Loss Percent      W/L Ratio
##      "93"    "49.46"    "50.54"    "0.98"
##
## [1] "FRE.csv"
##      Trades  Win Percent Loss Percent      W/L Ratio
##      "87"    "48.28"    "51.72"    "0.93"
```

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

Performance Metrics

```
##
##           BMW           DAI           DTE           FME
## Cumulative Return   -0.32762748 -0.18720197 0.023002144 0.11680473
## Annualized Return   -0.05305288 -0.02806338 0.003127977 0.01528671
## Annualized Sharp Ratio -0.65949132 -0.37472672 0.039653154 0.14082053
## Calmar Ratio        -0.16193050 -0.10722540 0.019181163 0.07585962
##
##           FRE
## Cumulative Return    0.1727417
## Annualized Return    0.0221239
## Annualized Sharp Ratio 0.1920964
## Calmar Ratio         0.1149527
```

Risk Metrics

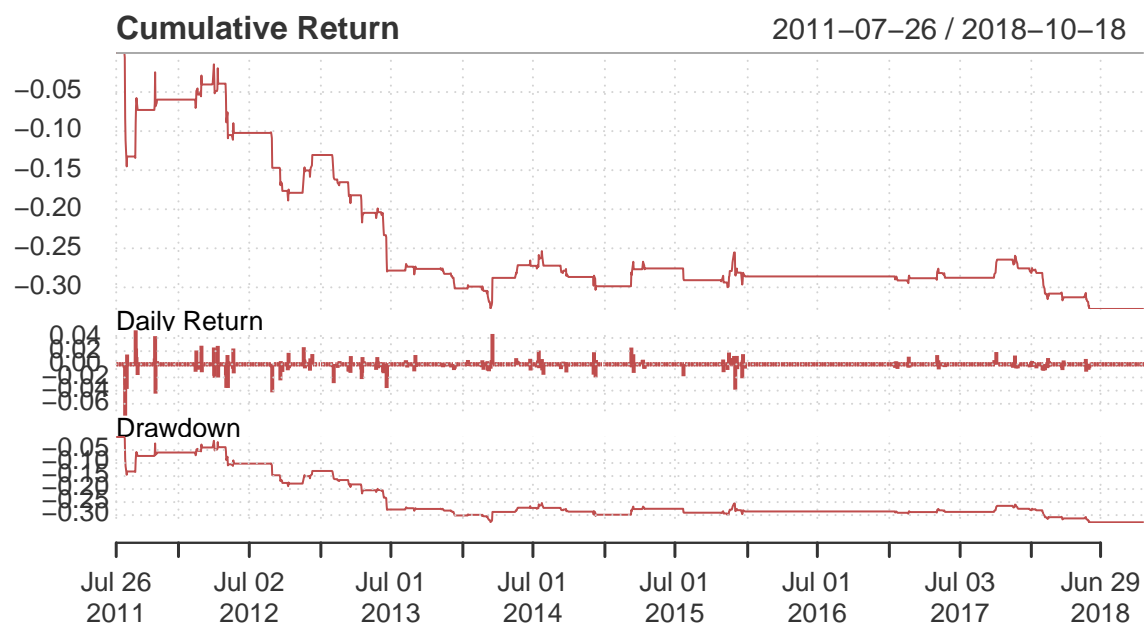
```
##
##           BMW           DAI           DTE           FME
## Annualized StdDev   0.080445155 0.074890269 0.078883427 0.108554546
## Max Drawdown        0.327627477 0.261723289 0.163075446 0.201513123
## Value-at-Risk       -0.004675982 -0.003978794 -0.002069902 -0.009295077
## Conditional VaR     -0.013265098 -0.012786338 -0.012764697 -0.018358099
##
##           FRE
## Annualized StdDev   0.115170820
## Max Drawdown        0.192460843
## Value-at-Risk       -0.008596259
## Conditional VaR     -0.018374019
```

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

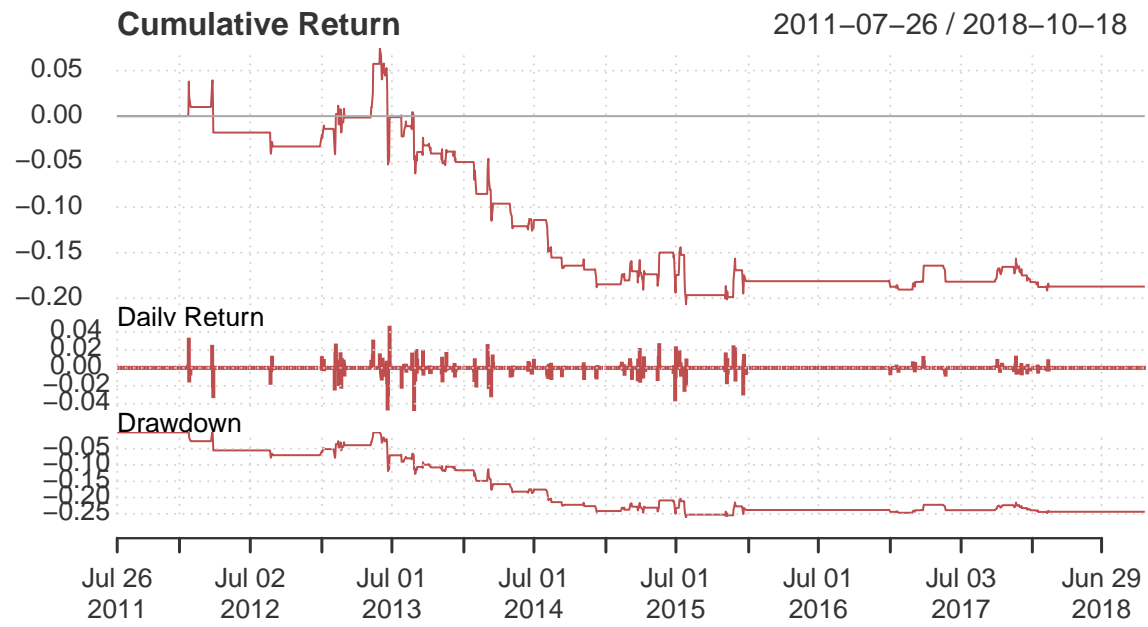
The following plots visualizes some important information about the returns of the strategy applied to the instruments on the instrumentlist. The cumulative return over the entire period, the daily returns and the drawdown for each instrument is illustrated.

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

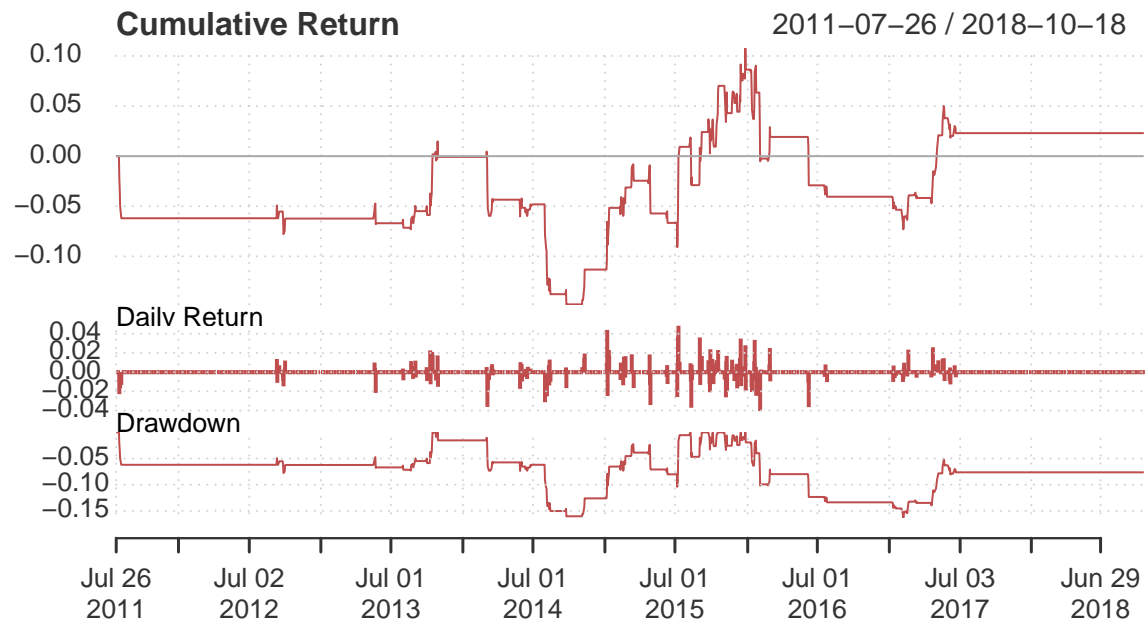
BMW



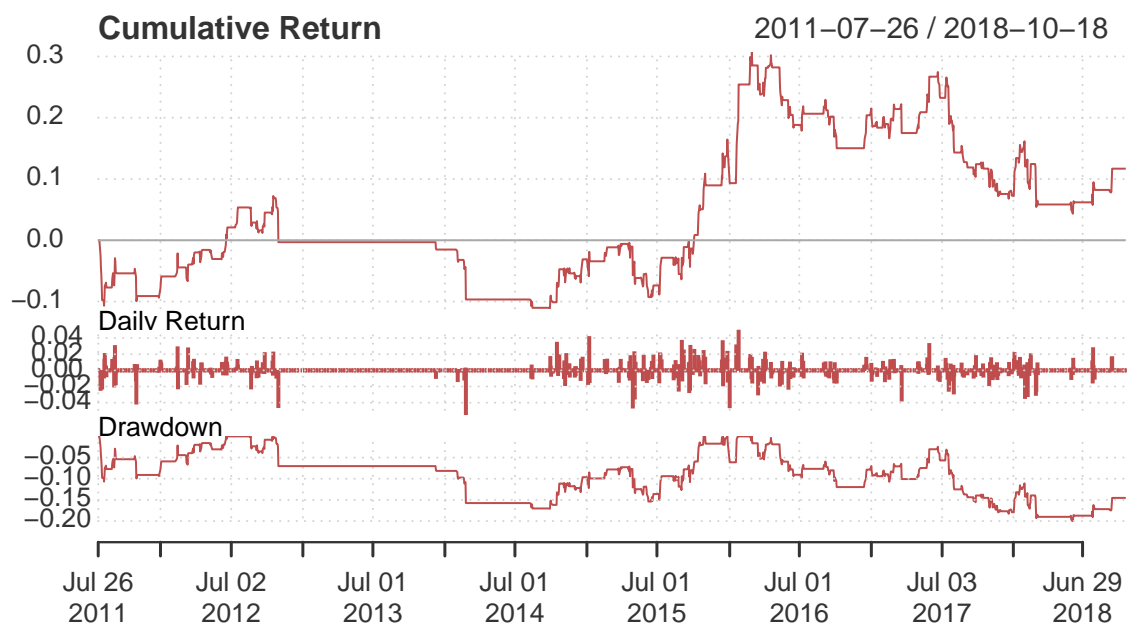
DAI



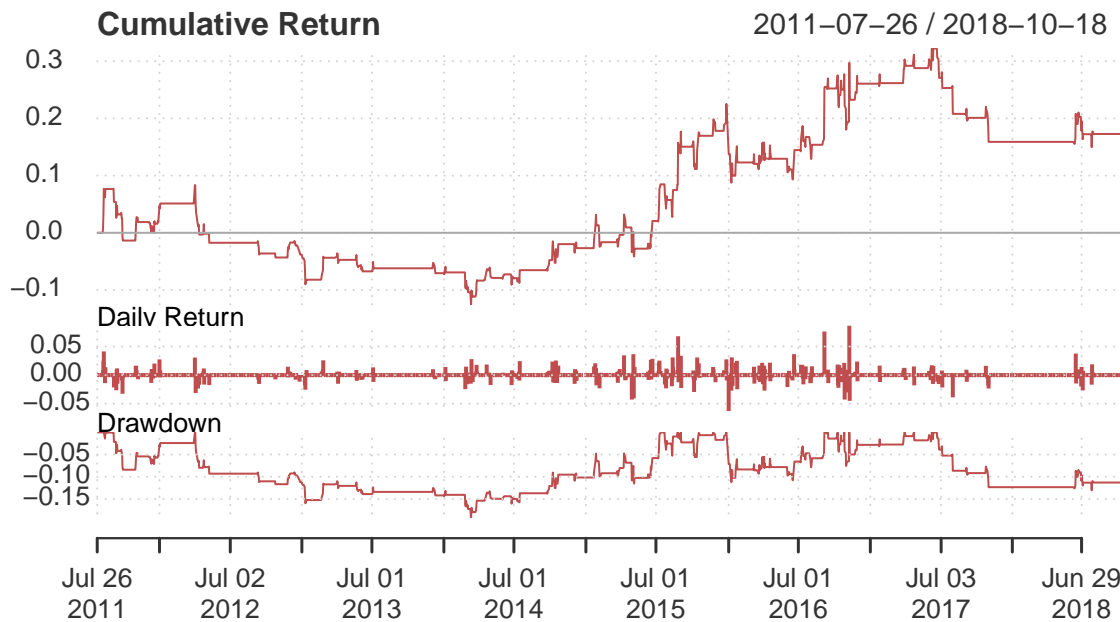
DTE



FME



FRE



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)
```

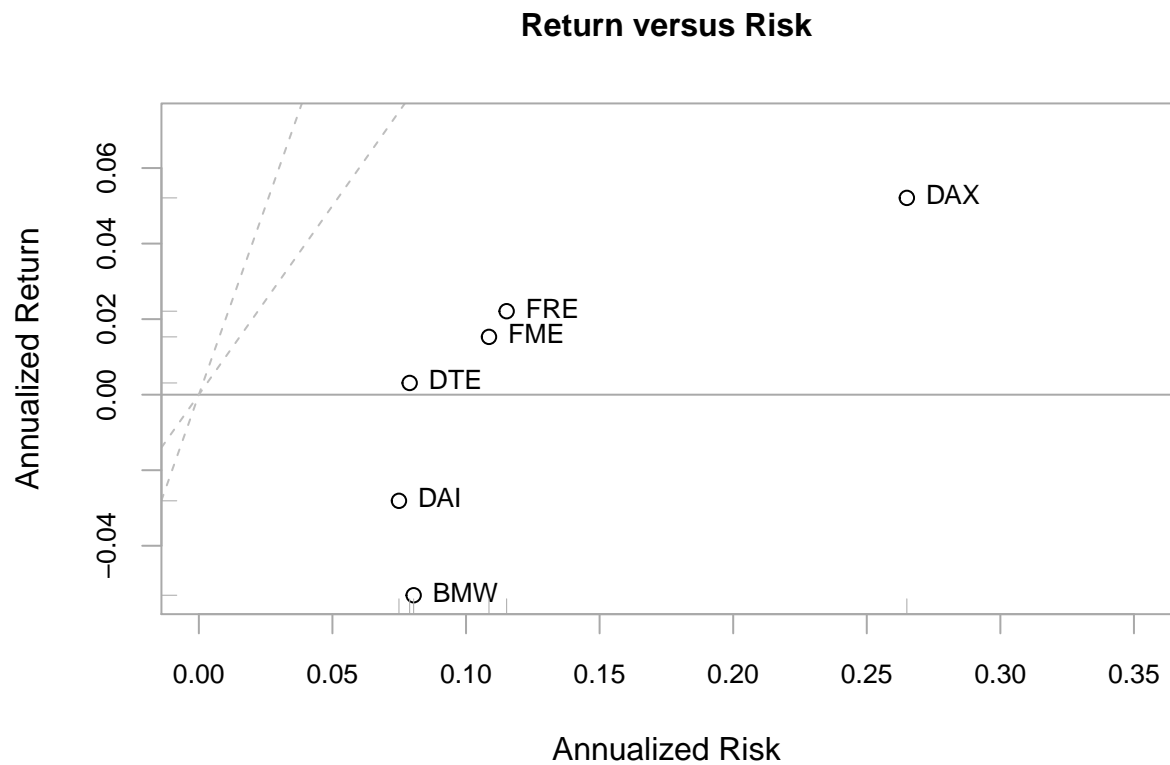
##	BMW	DAI	DTE	FME	FRE
## Observations	1835.0000	1835.0000	1835.0000	1835.0000	1835.0000
## NAs	400.0000	400.0000	400.0000	400.0000	400.0000
## Minimum	-0.0780	-0.0482	-0.0405	-0.0553	-0.0628
## Quartile 1	0.0000	0.0000	0.0000	0.0000	0.0000
## Median	0.0000	0.0000	0.0000	0.0000	0.0000
## Arithmetic Mean	-0.0002	-0.0001	0.0000	0.0001	0.0001
## Geometric Mean	-0.0002	-0.0001	0.0000	0.0001	0.0001
## Quartile 3	0.0000	0.0000	0.0000	0.0000	0.0000
## Maximum	0.0517	0.0471	0.0484	0.0503	0.0863
## SE Mean	0.0001	0.0001	0.0001	0.0002	0.0002
## LCL Mean (0.95)	-0.0004	-0.0003	-0.0002	-0.0002	-0.0002
## UCL Mean (0.95)	0.0000	0.0001	0.0003	0.0004	0.0004

```
## Variance      0.0000    0.0000    0.0000    0.0000    0.0001
## Stdev         0.0051    0.0047    0.0050    0.0068    0.0073
## Skewness      -2.2403   -0.9807    0.3760   -0.3805    1.5511
## Kurtosis      60.5235   33.3592   29.1568   15.7172   32.1933
##              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)
```

```
##              BMW      DAI      DTE      FME      FRE      DAX
## Annualized Return  -0.0531 -0.0281 0.0031 0.0153 0.0221 0.0521
## Annualized Std Dev   0.0804 0.0749 0.0789 0.1086 0.1152 0.2650
## Annualized Sharpe (Rf=0%) -0.6595 -0.3747 0.0397 0.1408 0.1921 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

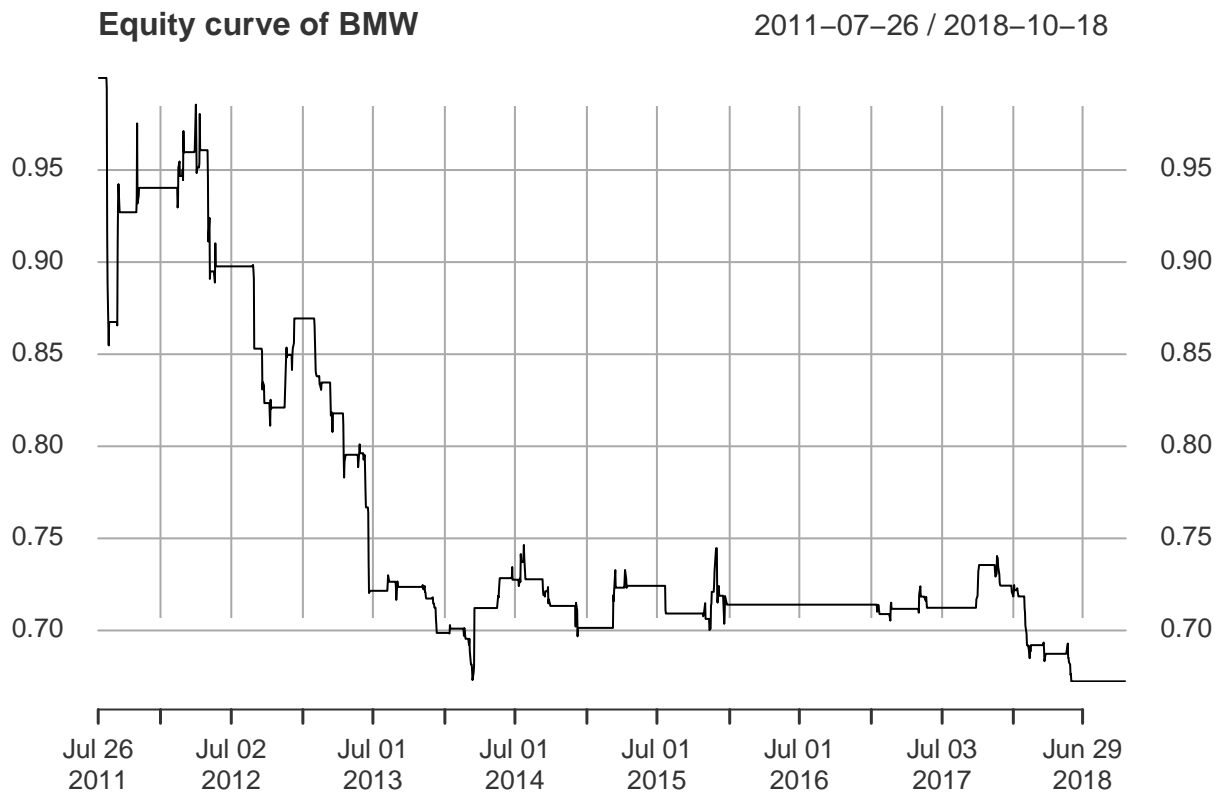
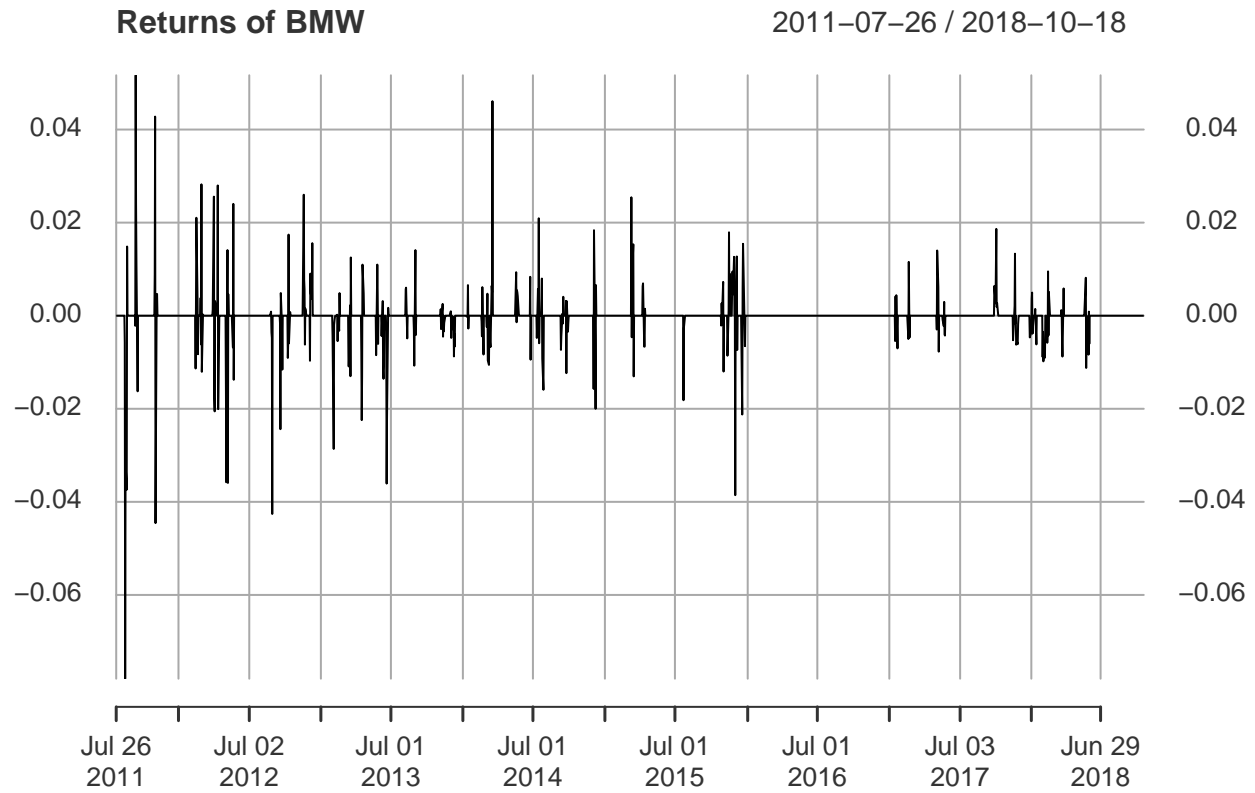
2011-07-26 / 2018-10-11



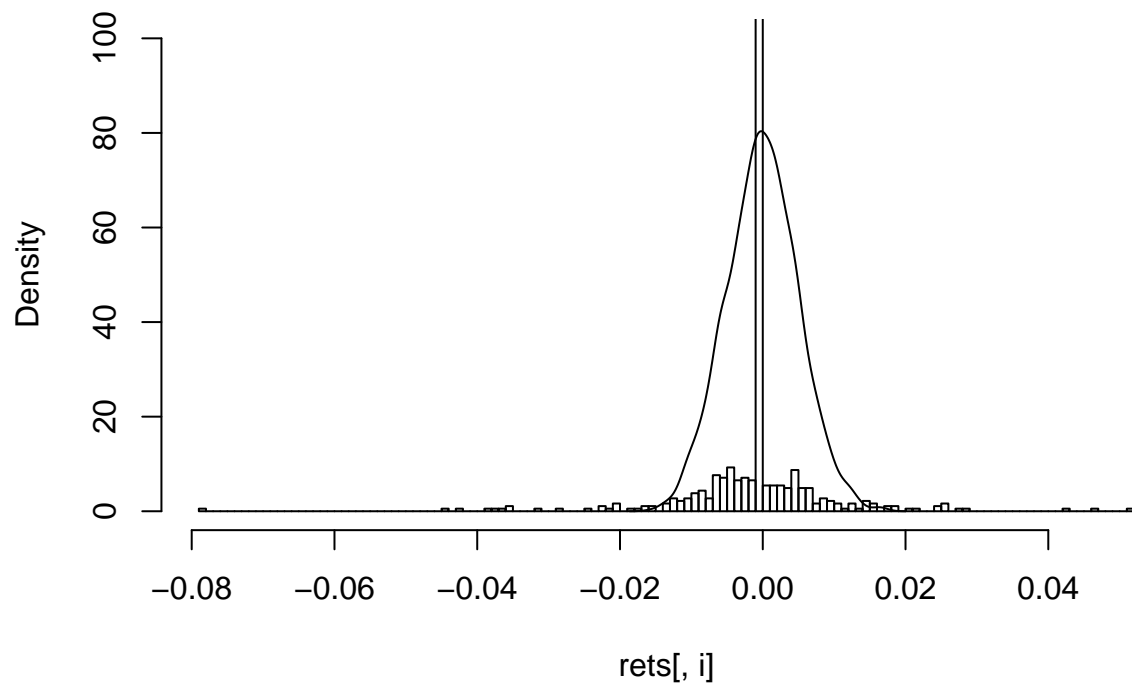
Calculations and visualizations based on returns

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

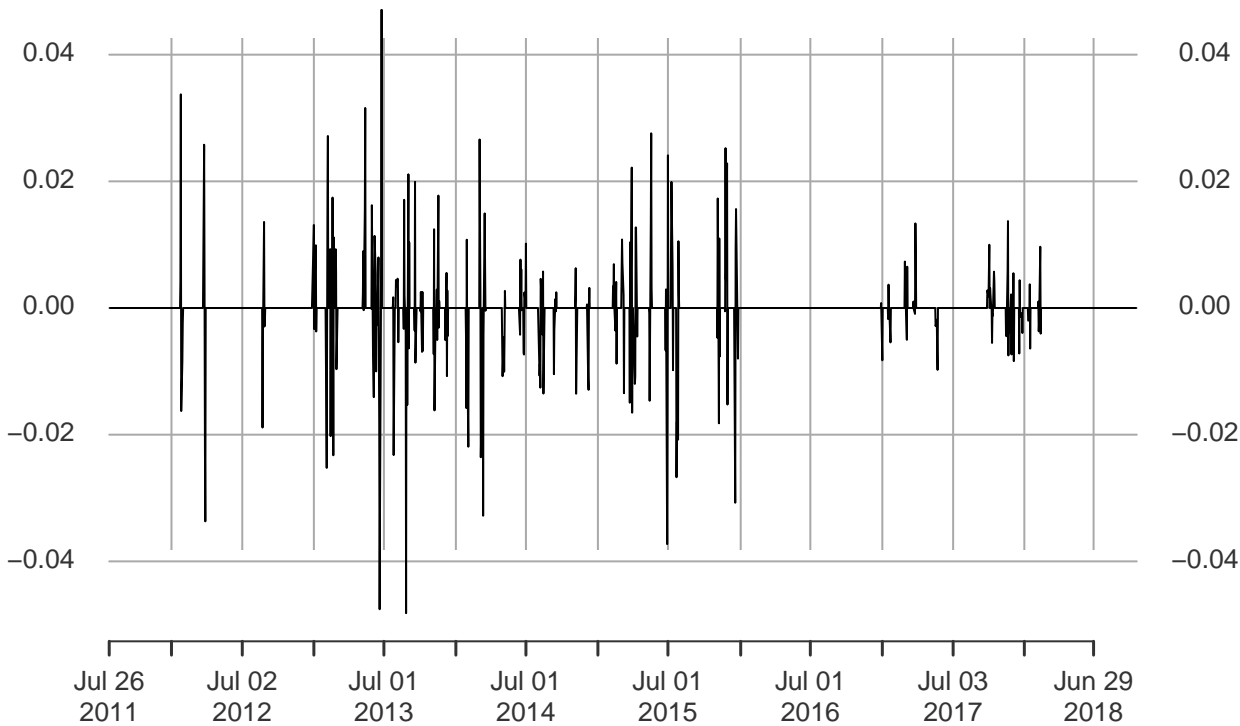


Histogram of Simple Returns of BMW



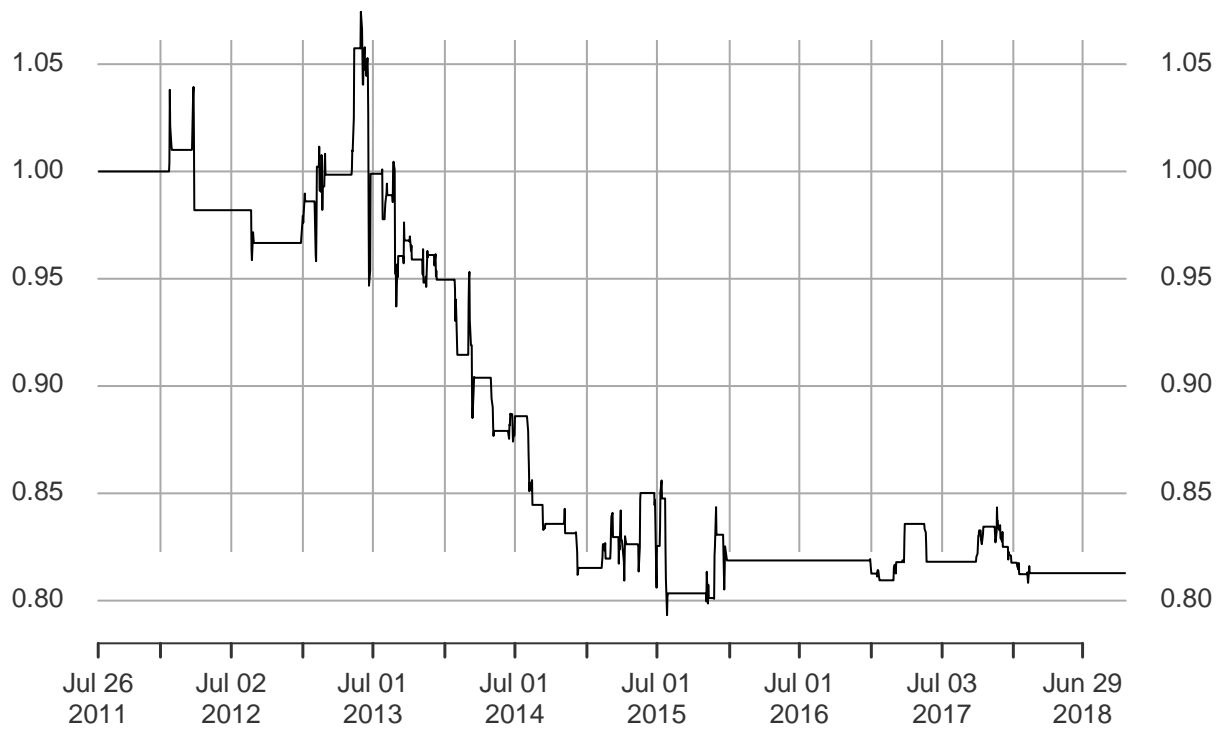
Returns of DAI

2011-07-26 / 2018-10-18

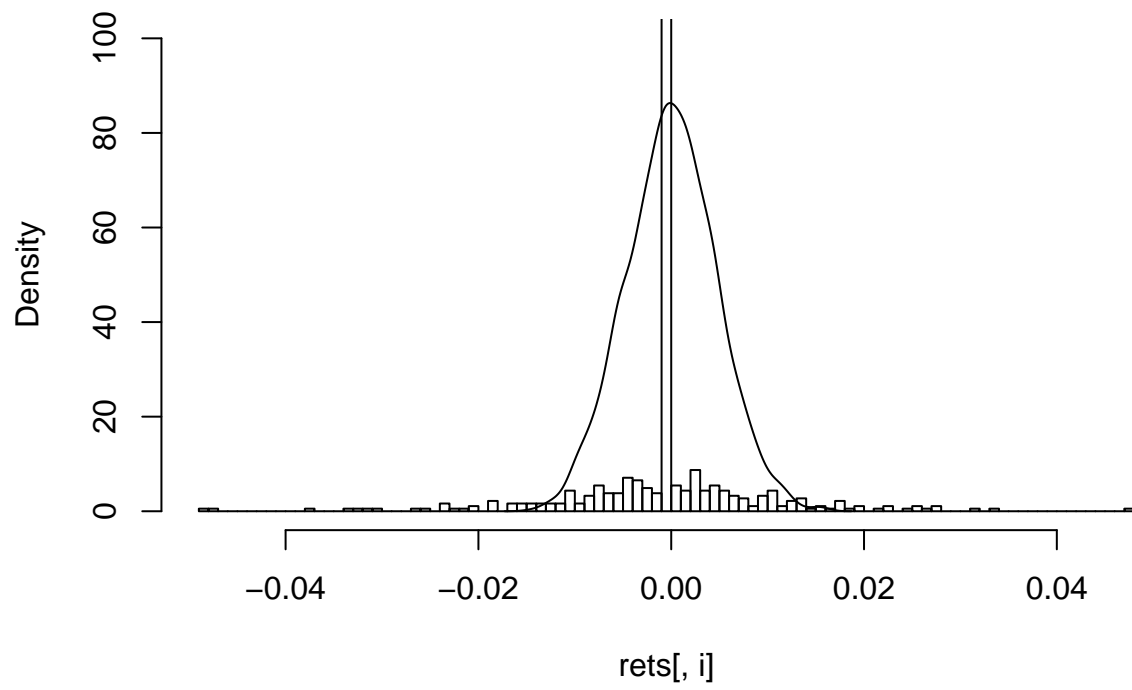


Equity curve of DAI

2011-07-26 / 2018-10-18

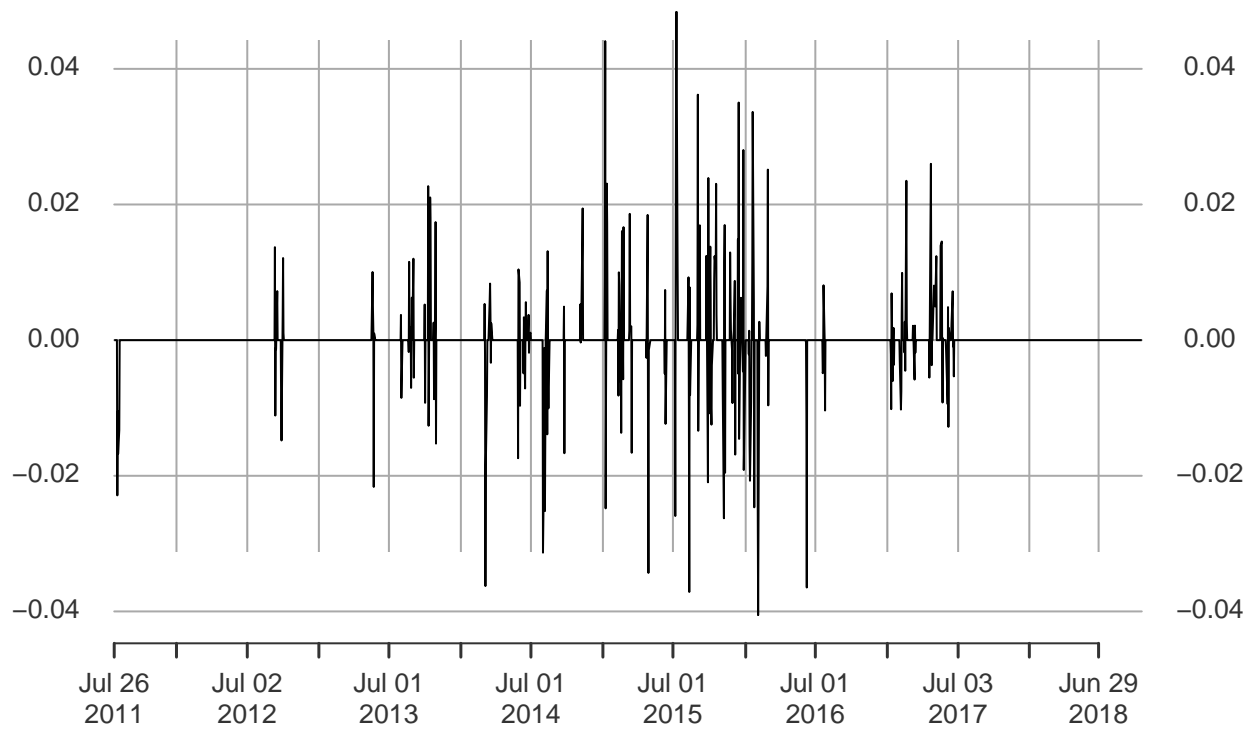


Histogram of Simple Returns of DAI



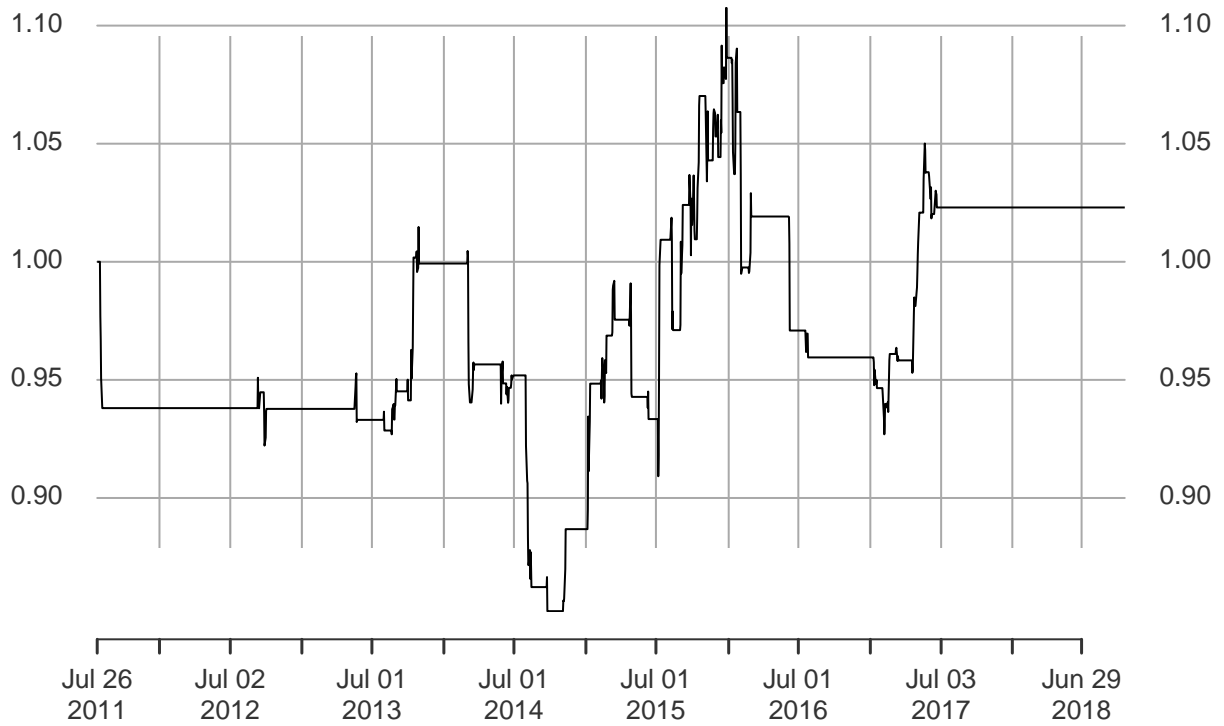
Returns of DTE

2011-07-26 / 2018-10-18

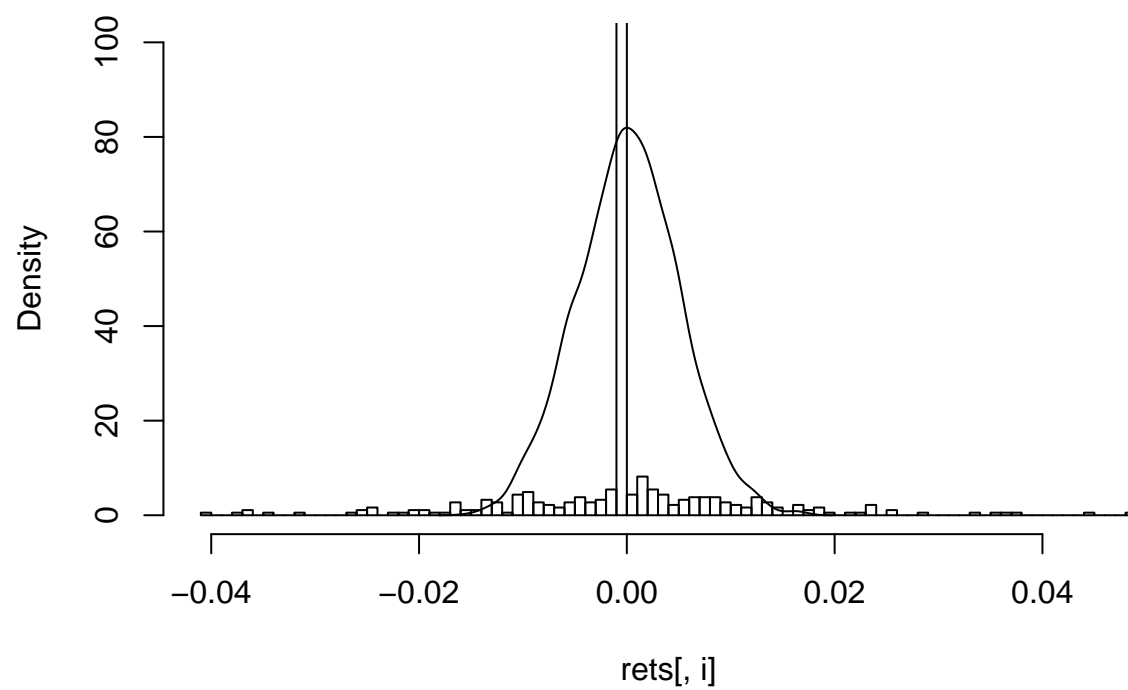


Equity curve of DTE

2011-07-26 / 2018-10-18

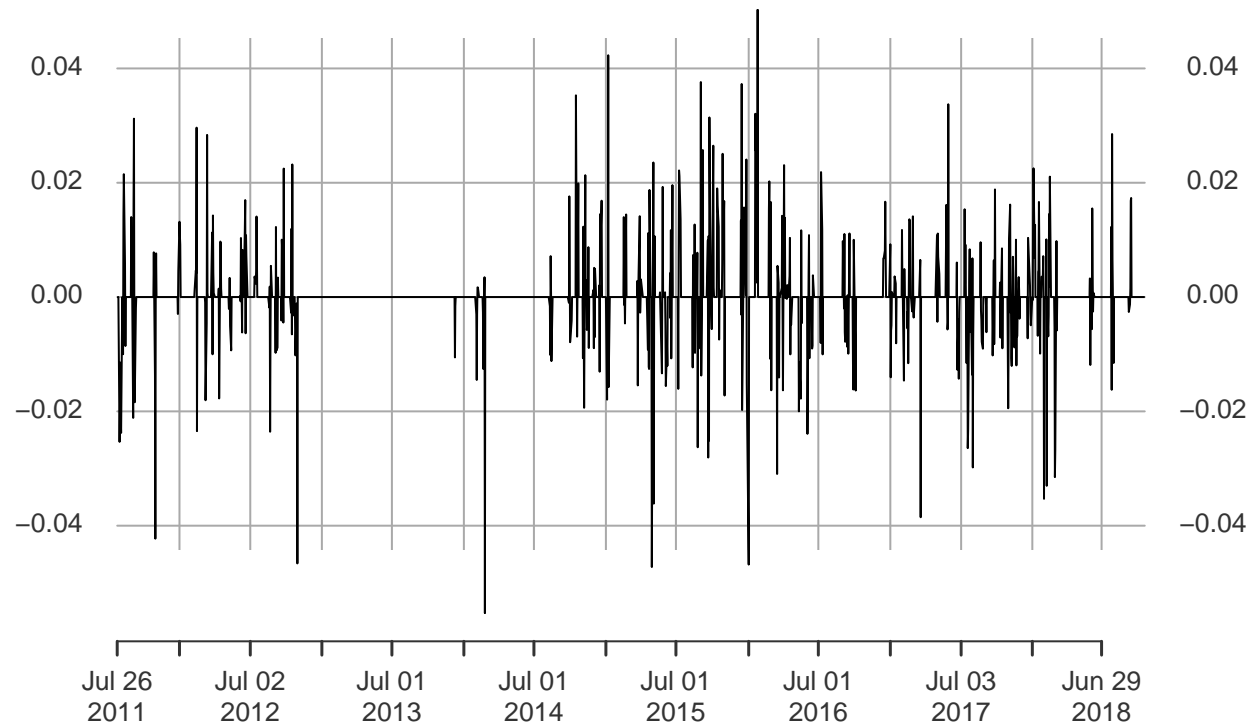


Histogram of Simple Returns of DTE



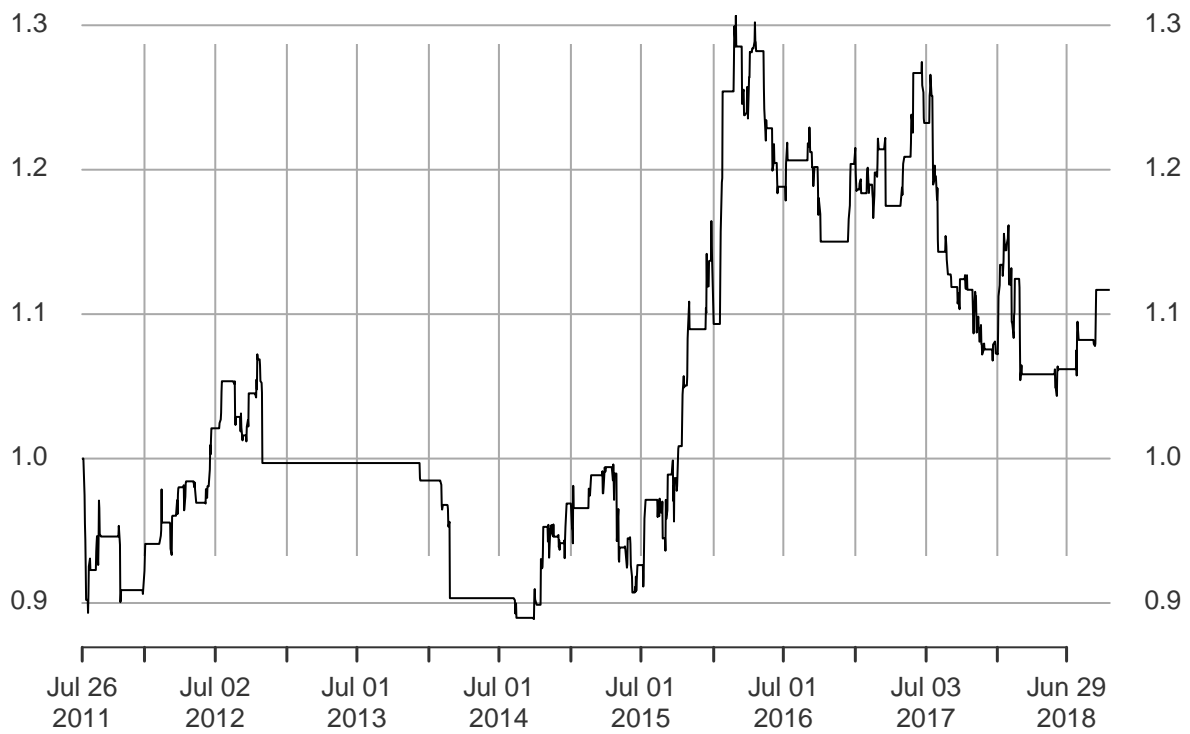
Returns of FME

2011-07-26 / 2018-10-18

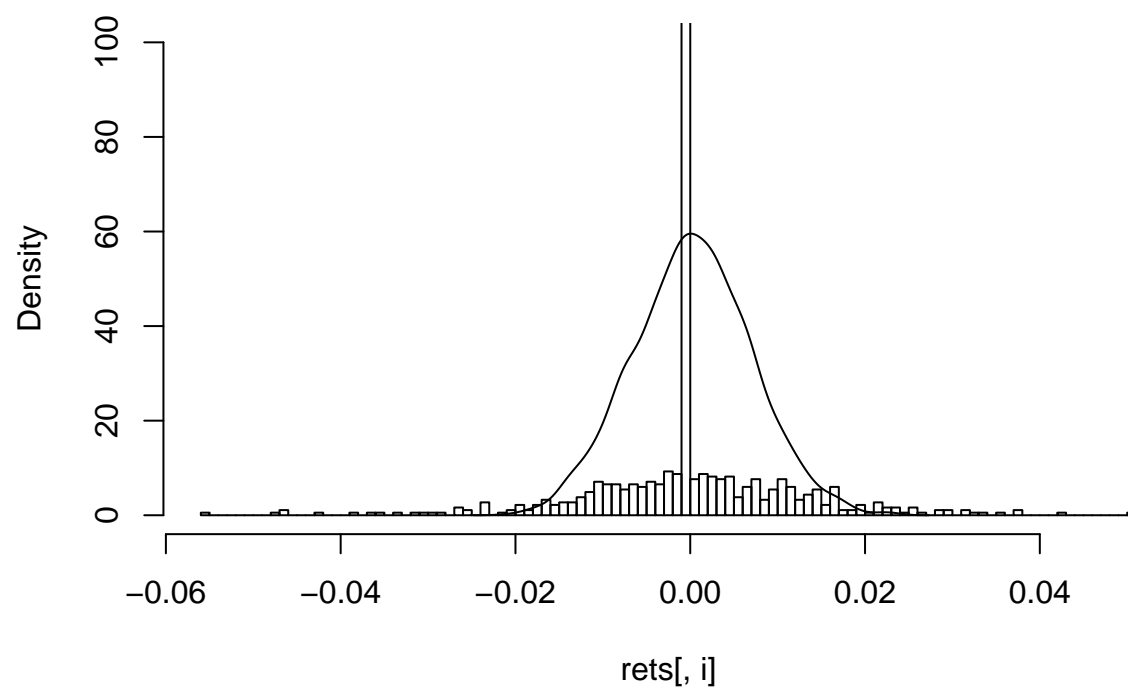


Equity curve of FME

2011-07-26 / 2018-10-18

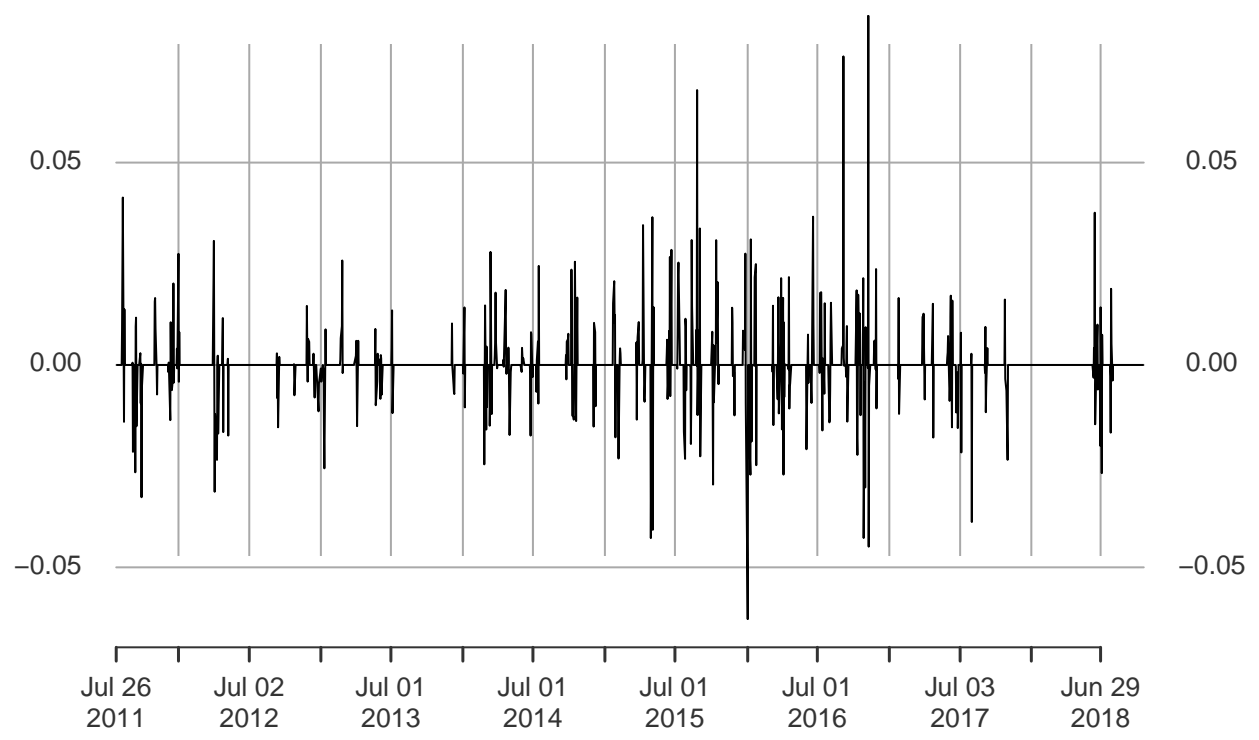


Histogram of Simple Returns of FME



Returns of FRE

2011-07-26 / 2018-10-18

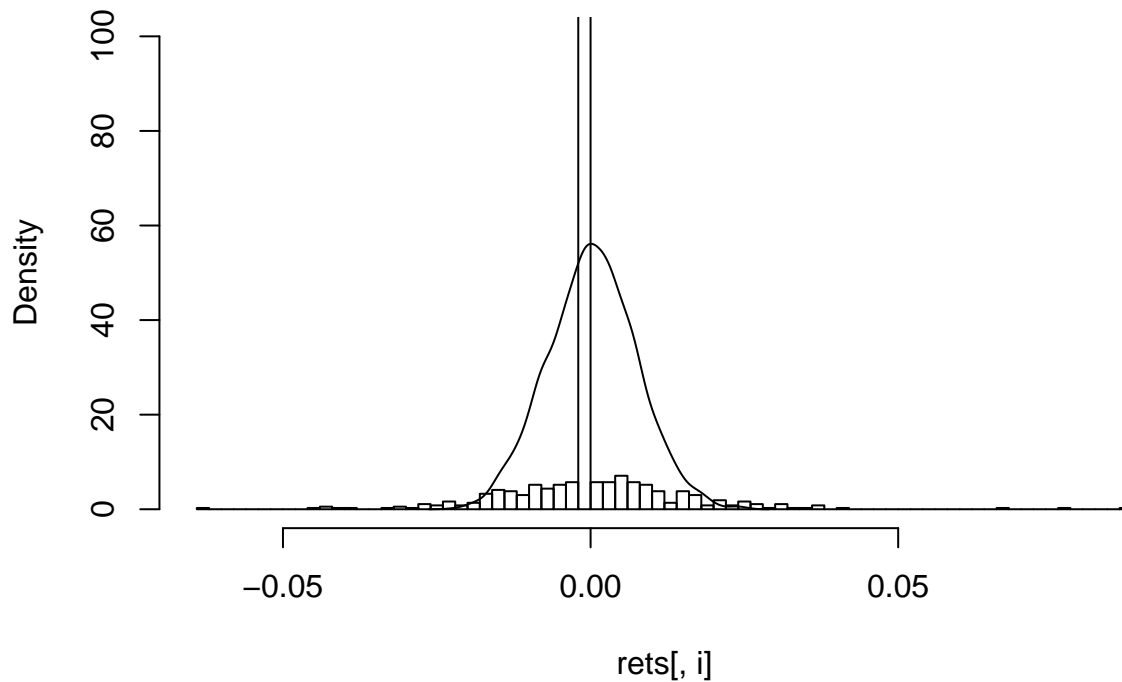


Equity curve of FRE

2011-07-26 / 2018-10-18



Histogram of Simple Returns of FRE



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 BMW we would expect a maximum loss of 171.47 per day."
```

```
## [1] "Given a 10000 investment in DAI we would expect a maximum loss of 181.47 per day."
```

```
## [1] "Given a 10000 investment in DTE we would expect a maximum loss of 181.53 per day."
```

```
## [1] "Given a 10000 investment in FME we would expect a maximum loss of 238.76 per day."
```

```
## [1] "Given a 10000 investment in FRE we would expect a maximum loss of 233.57 per day."
```

Conclusion and Suggestions