Assignment 1

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Introduction

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Trading Idea

Explain here the traiding idea, where I found it. What the theoretical foundation is –> Long Term positive autocorreleation –> Short term negative autocorreleation

Trade reverse patterns. When observing a fallback, trade to profit from the upward trend after the fallback. etc. . . .

Implementation of the trading idea

Short paragraph about what is needed for the implementation

Part A: Initialization

General Setup

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

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

Setting the Variables

The variables set in the next section can be adjusted to test the strategy with different parameters.

```
# Set values:
startCapital <- 1e+6
transactionCost <- -20
daterange <- '2003::2018'
emaPeriod <- 200
maxHoldingPeriod <- 30

InstrumentDirectory <- "~/Desktop/R/DownloadedData/"
instrumentlist <- c("SAP.csv", "DBK.csv")
BuyHoldDirectory <- InstrumentDirectory
BuyHoldInstrument <- "DAXEX.csv"

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

```r
portfolioname <- "Smash Day"
accountname <- portfolioname
```

Initializing the portfolio

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

# 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

Loading the instrument, initializing it and adding the ema to the data.

```r
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)
```

```r
  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 (Long).
    # Smash Day (Long) is when Todays Close is below Yesterdays Low.
    if (CloseToday < LowYesterday) {
      # Smash Day (Long)

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

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

        # Simulate STOP BUY order:

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

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

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

        } else {
          # Check Option 2
          if (HighToday < HighTomorrow) {
            # Don't trade at the day before the last day
            if (CurrentDate != time(symbol[nrow(symbol) - 1])) {
              # Calculate the buy quantity
              BuyQuantity <- as.numeric(trunc(Equity / HighToday))
              # Add transaction
```

```
            addTxn(
              portfolioname,
              Symbol = instrument,
              TxnDate = TomorrowDate ,
              TxnPrice = HighToday,
              TxnQty = BuyQuantity,
              TxnFees = transactionCost
            )
            # Store the bar at which we placed the transaction
            BuyBar <- i
          }
        }
      }
    }
  }
} else {
  # We already have a position

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

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

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

  # Rule 3: Sell if we meet the Smash Day (Short) 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,
```

```r
      TxnDate = time(symbol[i + 1]),
      TxnPrice = OpenTomorrow,
      TxnQty = -Position,
      TxnFees = transactionCost
    )

  } else {
    # Check Rule 3:

    # Sell Rule 3: If today was a smash day (short) place an order at todays
    # low price. (Buy tomorrow for 'price <= todays low')

    # Simulate this behaviour:

    # Option 1 to check: Check whether the open price tomorrow is below today's
    # low and add the transaction tomorrow at tomorrows 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 (Short)
    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
              )
            }
          }
        }
      }
    }

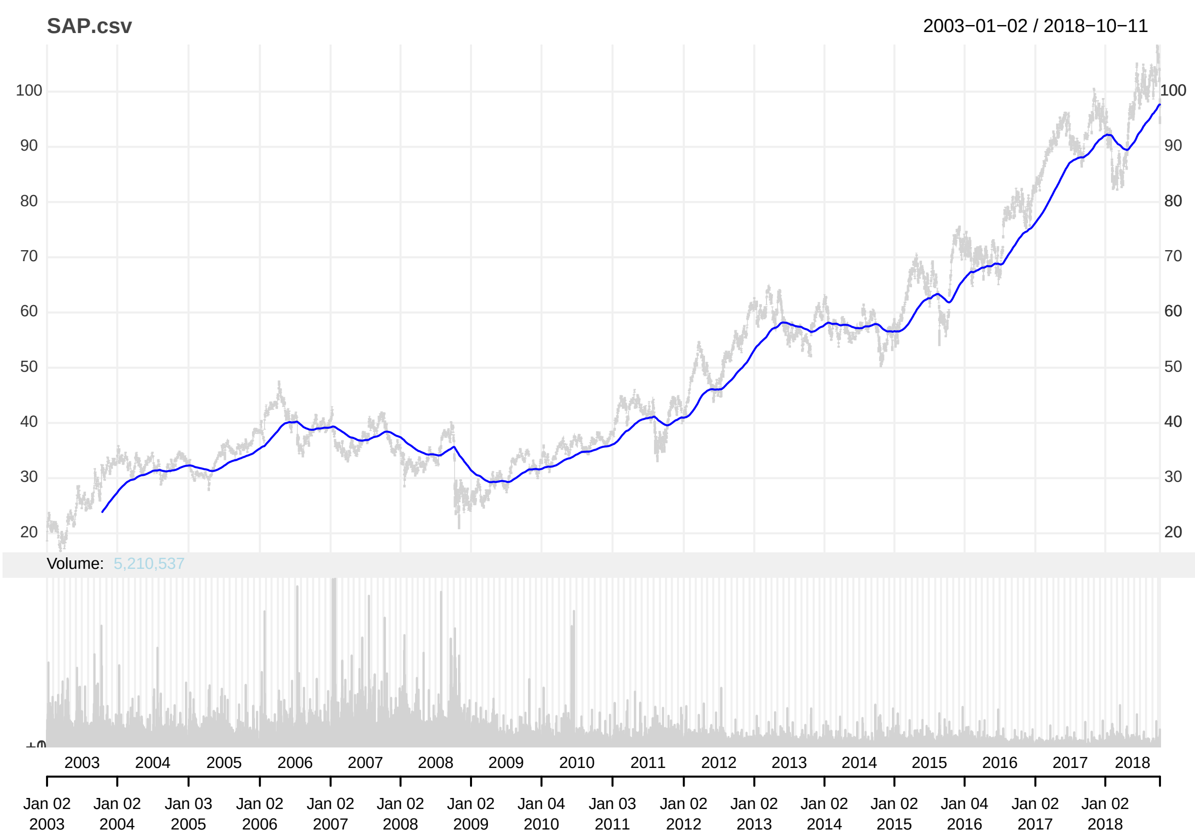
    updatePortf(portfolioname, Symbols = instrument, Dates = CurrentDate)
    updateAcct(accountname, Dates = CurrentDate)
    updateEndEq(accountname, CurrentDate)

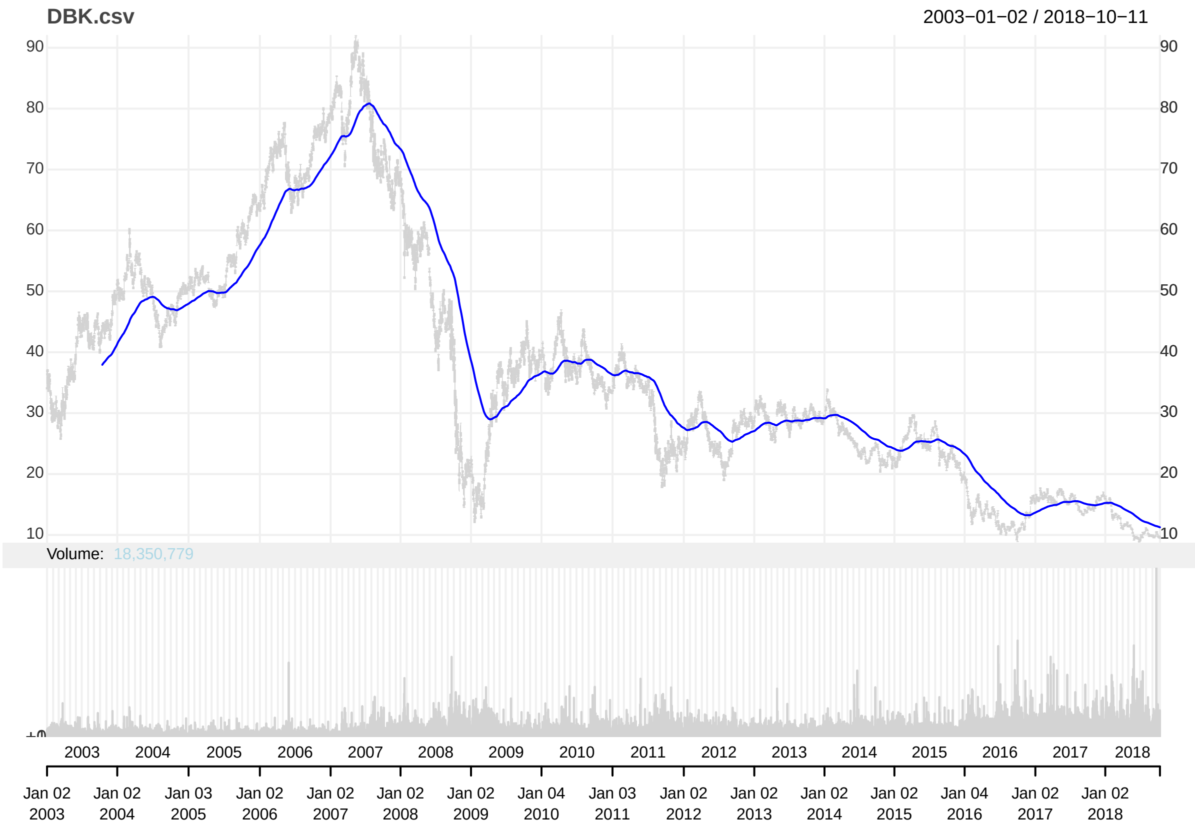
  } # End Bar-by-bar processing
} # End for loop for multiple instruments
```

Part C: Analysis and Reporting

Visualize original data

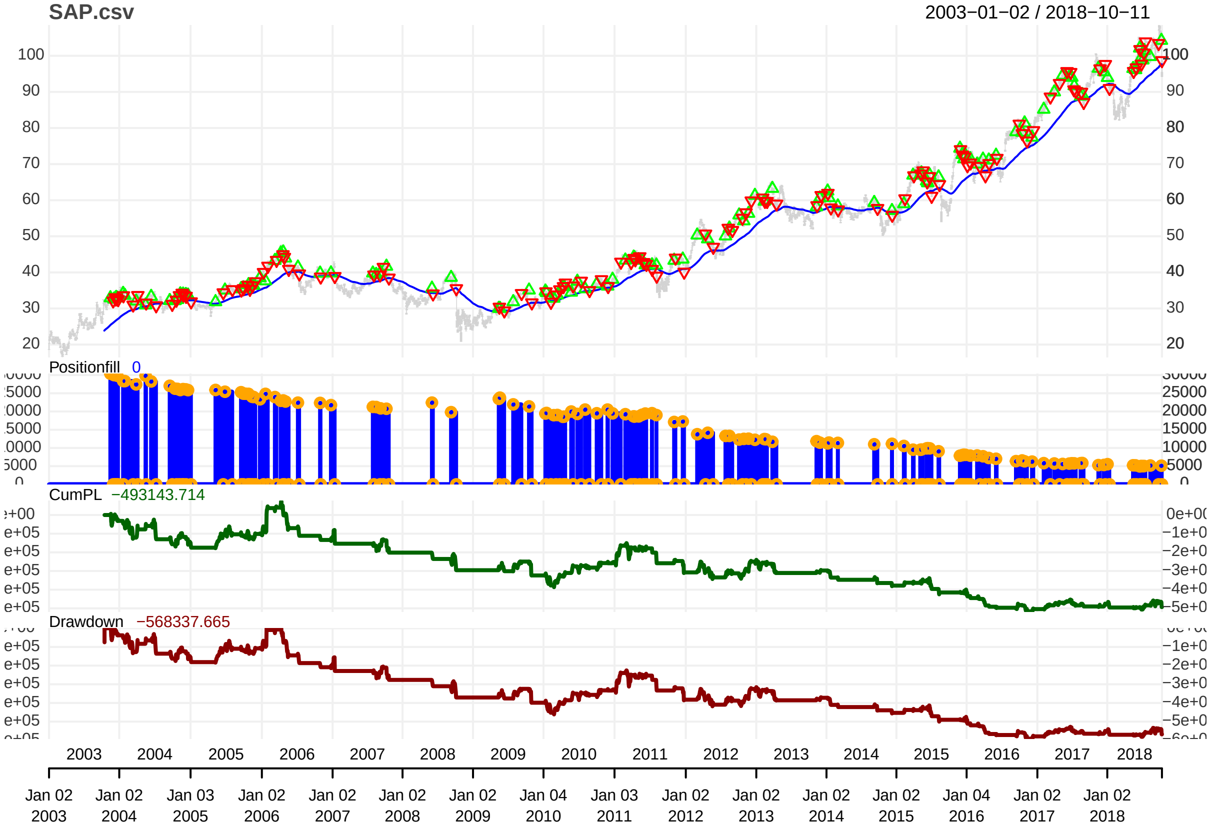
Plot of the instrument with the EMA line which indicates the general trend of the stock exponentially smoothed for the last 200 days. Moreover, the tradevolume is added below the graph.



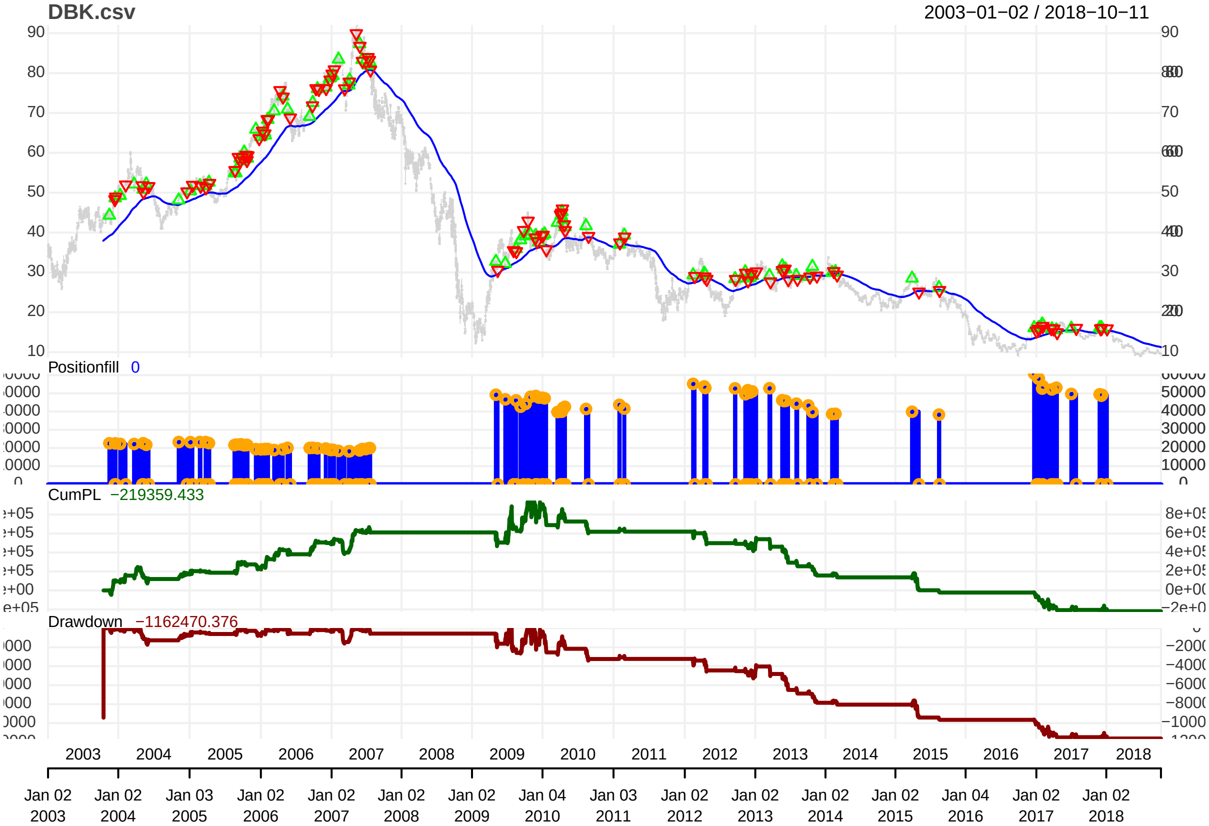


Graph which visualize the transactions

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



SAP.csv
2003−01−02 / 2018−10−11
Positionfill 0
CumPL −493143.714
Drawdown −568337.665



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 per transaction.

```
## [1] "SAP.csv"
##            Txn.Qty Txn.Price Txn.Fees  Txn.Value Txn.Avg.Cost
## 1999-12-31       0     0.000        0        0.0        0.000
## 2003-11-12   30376    32.920      -20   999977.9       32.920
## 2003-11-26  -30376    32.155      -20  -976740.3       32.155
## 2003-12-01   29990    32.568      -20   976714.3       32.568
## 2003-12-05  -29990    33.030      -20  -990569.7       33.030
## 2003-12-09   30130    32.875      -20   990523.8       32.875
## 2003-12-10  -30130    32.663      -20  -984136.2       32.663
## 2003-12-11   30105    33.040      -20   994669.2       33.040
## 2003-12-12  -30105    32.898      -20  -990394.3       32.898
## 2003-12-17   29805    32.873      -20   979779.8       32.873
## 2003-12-22  -29805    32.500      -20  -968662.5       32.500
## 2004-01-22   28370    34.143      -20   968636.9       34.143
## 2004-01-23  -28370    33.575      -20  -952522.8       33.575
## 2004-01-30   28345    33.603      -20   952477.0       33.603
## 2004-03-12  -28345    31.000      -20  -878695.0       31.000
## 2004-03-29   27436    32.025      -20   878637.9       32.025
## 2004-04-06  -27436    33.643      -20  -923029.3       33.643
## 2004-05-18   29834    30.938      -20   923004.3       30.938
## 2004-05-20  -29834    31.550      -20  -941262.7       31.550
## 2004-06-15   28254    33.313      -20   941225.5       33.313
```

```
## 2004-07-09  -28254    30.800       -20  -870223.2        30.800
## 2004-09-16   27051    32.168       -20   870176.6        32.168
## 2004-09-29  -27051    31.200       -20  -843991.2        31.200
## 2004-10-13   26264    32.133       -20   843941.1        32.133
## 2004-10-20  -26264    32.350       -20  -849640.4        32.350
## 2004-10-26   26204    32.423       -20   849612.3        32.423
## 2004-11-04  -26204    33.618       -20  -880926.1        33.618
## 2004-11-09   25897    34.015       -20   880886.5        34.015
## 2004-11-18  -25897    34.278       -20  -887697.4        34.278
## 2004-11-23   26146    33.950       -20   887656.7        33.950
## 2004-11-24  -26146    33.750       -20  -882427.5        33.750
## 2004-12-07   26069    33.848       -20   882383.5        33.848
## 2004-12-08  -26069    33.425       -20  -871356.3        33.425
## 2004-12-17   25874    33.675       -20   871306.9        33.675
## 2005-01-05  -25874    31.888       -20  -825070.1        31.888
## 2005-05-11   25918    31.833       -20   825047.7        31.833
## 2005-06-20  -25918    34.395       -20  -891449.6        34.395
## 2005-06-28   25425    35.060       -20   891400.5        35.060
## 2005-08-04  -25425    35.265       -20  -896612.6        35.265
## 2005-09-16   25298    35.440       -20   896561.1        35.440
## 2005-09-19  -25298    35.138       -20  -888921.1        35.138
## 2005-09-28   24909    35.685       -20   888877.7        35.685
## 2005-09-29  -24909    35.543       -20  -885340.6        35.543
## 2005-10-07   24884    35.578       -20   885323.0        35.578
## 2005-10-21  -24884    36.500       -20  -908266.0        36.500
## 2005-10-25   24842    36.560       -20   908223.5        36.560
## 2005-11-01  -24842    35.353       -20  -878239.2        35.353
## 2005-11-11   24044    36.525       -20   878207.1        36.525
## 2005-11-14  -24044    36.293       -20  -872628.9        36.293
## 2005-11-18   23993    36.368       -20   872577.4        36.368
## 2005-11-29  -23993    37.450       -20  -898537.9        37.450
## 2005-12-21   23351    38.478       -20   898499.8        38.478
## 2006-01-10  -23351    40.025       -20  -934623.8        40.025
## 2006-01-19   24839    37.625       -20   934567.4        37.625
## 2006-02-01  -24839    41.750       -20 -1037028.2        41.750
## 2006-03-08   23963    43.275       -20  1036998.8        43.275
## 2006-03-16  -23963    43.375       -20 -1039395.1        43.375
## 2006-04-06   22945    45.298       -20  1039362.6        45.298
## 2006-04-20  -22945    44.950       -20 -1031377.8        44.950
## 2006-04-21   23032    45.625       -20  1050835.0        45.625
## 2006-04-27  -23032    44.225       -20 -1018590.2        44.225
## 2006-05-04   22738    43.938       -20   999062.2        43.938
## 2006-05-22  -22738    40.888       -20  -929711.3        40.888
## 2006-07-06   22434    41.440       -20   929665.0        41.440
## 2006-07-13  -22434    39.618       -20  -888790.2        39.618
## 2006-10-26   22359    39.748       -20   888725.5        39.748
## 2006-10-30  -22359    38.750       -20  -866411.2        38.750
## 2006-12-20   21758    39.820       -20   866403.6        39.820
## 2007-01-12  -21758    38.900       -20  -846386.2        38.900
## 2007-07-30   21270    39.790       -20   846333.3        39.790
## 2007-08-03  -21270    39.320       -20  -836336.4        39.320
## 2007-08-15   21226    39.400       -20   836304.4        39.400
## 2007-09-04  -21226    39.310       -20  -834394.1        39.310
## 2007-09-06   20858    40.000       -20   834320.0        40.000
```

```
## 2007-09-20  -20858    41.450      -20  -864564.1       41.450
## 2007-10-05   20757    41.650      -20   864529.0       41.650
## 2007-10-18  -20757    38.470      -20  -798521.8       38.470
## 2008-06-03   22442    35.580      -20   798486.4       35.580
## 2008-06-09  -22442    34.070      -20  -764598.9       34.070
## 2008-09-08   19823    38.570      -20   764573.1       38.570
## 2008-10-03  -19823    35.530      -20  -704311.2       35.530
## 2009-05-18   23476    30.000      -20   704280.0       30.000
## 2009-05-20  -23476    30.400      -20  -713670.4       30.400
## 2009-05-22   23803    29.980      -20   713613.9       29.980
## 2009-06-15  -23803    29.365      -20  -698975.1       29.365
## 2009-07-29   21955    31.835      -20   698937.4       31.835
## 2009-09-09  -21955    34.190      -20  -750641.4       34.190
## 2009-10-16   21403    35.070      -20   750603.2       35.070
## 2009-10-30  -21403    31.600      -20  -676334.8       31.600
## 2010-01-13   19437    34.795      -20   676310.4       34.795
## 2010-01-15  -19437    34.675      -20  -673978.0       34.675
## 2010-01-19   19602    34.380      -20   673916.8       34.380
## 2010-02-10  -19602    31.770      -20  -622755.5       31.770
## 2010-02-24   18991    32.790      -20   622714.9       32.790
## 2010-03-08  -18991    33.800      -20  -641895.8       33.800
## 2010-03-15   19046    33.700      -20   641850.2       33.700
## 2010-03-26  -19046    35.230      -20  -670990.6       35.230
## 2010-04-14   18545    36.180      -20   670958.1       36.180
## 2010-04-16  -18545    36.110      -20  -669659.9       36.110
## 2010-04-20   18590    36.020      -20   669611.8       36.020
## 2010-04-27  -18590    37.085      -20  -689410.2       37.085
## 2010-05-26   19994    34.480      -20   689393.1       34.480
## 2010-06-04  -19994    36.265      -20  -725082.4       36.265
## 2010-06-25   19337    37.495      -20   725040.8       37.495
## 2010-07-15  -19337    37.605      -20  -727167.9       37.605
## 2010-08-04   20529    35.420      -20   727137.2       35.420
## 2010-08-26  -20529    35.000      -20  -718515.0       35.000
## 2010-10-01   19523    36.800      -20   718446.4       36.800
## 2010-10-26  -19523    38.025      -20  -742362.1       38.025
## 2010-11-25   20532    36.155      -20   742334.5       36.155
## 2010-11-29  -20532    36.110      -20  -741410.5       36.110
## 2010-12-21   19487    38.045      -20   741382.9       38.045
## 2011-02-03  -19487    42.870      -20  -835407.7       42.870
## 2011-02-25   19265    43.360      -20   835330.4       43.360
## 2011-03-28  -19265    42.810      -20  -824734.7       42.810
## 2011-04-08   18667    44.180      -20   824708.1       44.180
## 2011-04-11  -18667    43.925      -20  -819948.0       43.925
## 2011-04-13   18615    44.045      -20   819897.7       44.045
## 2011-04-18  -18615    43.545      -20  -810590.2       43.545
## 2011-05-06   18647    43.470      -20   810585.1       43.470
## 2011-05-12  -18647    44.380      -20  -827553.9       44.380
## 2011-05-24   19106    43.310      -20   827480.9       43.310
## 2011-06-01  -19106    42.775      -20  -817259.2       42.775
## 2011-06-09   19437    42.045      -20   817228.7       42.045
## 2011-06-15  -19437    42.270      -20  -821602.0       42.270
## 2011-07-13   19540    42.045      -20   821559.3       42.045
## 2011-07-14  -19540    40.870      -20  -798599.8       40.870
## 2011-08-04   19023    41.980      -20   798585.5       41.980
```

```
## 2011-08-05  -19023    38.995      -20  -741801.9        38.995
## 2011-11-02   17126    43.310      -20   741727.1        43.310
## 2011-11-09  -17126    44.000      -20  -753544.0        44.000
## 2011-12-15   17267    43.640      -20   753531.9        43.640
## 2011-12-22  -17267    40.110      -20  -692579.4        40.110
## 2012-02-28   13768    50.300      -20   692530.4        50.300
## 2012-04-12  -13768    50.670      -20  -697624.6        50.670
## 2012-04-24   14164    49.250      -20   697577.0        49.250
## 2012-05-23  -14164    47.000      -20  -665708.0        47.000
## 2012-07-24   13300    50.050      -20   665665.0        50.050
## 2012-08-07  -13300    52.270      -20  -695191.0        52.270
## 2012-08-13   13304    52.250      -20   695134.0        52.250
## 2012-08-28  -13304    51.680      -20  -687550.7        51.680
## 2012-10-01   12306    55.870      -20   687536.2        55.870
## 2012-10-17  -12306    55.040      -20  -677322.2        55.040
## 2012-10-24   12487    54.240      -20   677294.9        54.240
## 2012-11-05  -12487    56.560      -20  -706264.7        56.560
## 2012-11-16   12539    56.320      -20   706196.5        56.320
## 2012-11-30  -12539    59.840      -20  -750333.8        59.840
## 2012-12-19   12240    61.300      -20   750312.0        61.300
## 2013-02-04  -12240    60.640      -20  -742233.6        60.640
## 2013-02-12   12438    59.670      -20   742175.5        59.670
## 2013-02-14  -12438    59.730      -20  -742921.7        59.730
## 2013-02-19   12382    60.000      -20   742920.0        60.000
## 2013-02-26  -12382    59.700      -20  -739205.4        59.700
## 2013-03-25   11690    63.230      -20   739158.7        63.230
## 2013-04-17  -11690    58.970      -20  -689359.3        58.970
## 2013-11-06   11860    58.120      -20   689303.2        58.120
## 2013-11-08  -11860    58.530      -20  -694165.8        58.530
## 2013-11-22   11456    60.590      -20   694119.0        60.590
## 2013-11-29  -11456    61.340      -20  -702711.0        61.340
## 2014-01-08   11243    62.500      -20   702687.5        62.500
## 2014-01-09  -11243    61.940      -20  -696391.4        61.940
## 2014-01-15   11479    60.660      -20   696316.1        60.660
## 2014-01-24  -11479    57.900      -20  -664634.1        57.900
## 2014-02-28   11386    58.370      -20   664600.8        58.370
## 2014-03-03  -11386    57.350      -20  -652987.1        57.350
## 2014-09-04   11006    59.330      -20   652986.0        59.330
## 2014-09-22  -11006    57.760      -20  -635706.6        57.760
## 2014-12-04   11130    57.110      -20   635634.3        57.110
## 2014-12-05  -11130    55.880      -20  -621944.4        55.880
## 2015-02-10   10544    58.980      -20   621885.1        58.980
## 2015-02-16  -10544    60.440      -20  -637279.4        60.440
## 2015-03-27    9526    66.900      -20   637289.4        66.900
## 2015-04-01   -9526    66.820      -20  -636527.3        66.820
## 2015-05-07    9494    67.040      -20   636477.8        67.040
## 2015-05-12   -9494    67.310      -20  -639041.1        67.310
## 2015-05-13    9558    67.530      -20   645451.7        67.530
## 2015-05-21   -9558    68.170      -20  -651568.9        68.170
## 2015-06-10    9881    65.280      -20   645031.7        65.280
## 2015-06-12   -9881    65.110      -20  -643351.9        65.110
## 2015-06-16    9931    64.780      -20   643330.2        64.780
## 2015-06-24   -9931    66.590      -20  -661305.3        66.590
## 2015-06-25    9886    66.940      -20   661768.8        66.940
```

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## 2015-07-06   -9886    61.130       -20  -604331.2        61.130
## 2015-08-10    9091    66.420       -20   603824.2        66.420
## 2015-08-13   -9091    64.360       -20  -585096.8        64.360
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## 2015-11-27   -7869    74.050       -20  -582699.4        74.050
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## 2015-12-08   -8024    72.550       -20  -582141.2        72.550
## 2015-12-15    8150    71.420       -20   582073.0        71.420
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## 2015-12-23    8104    72.440       -20   587053.8        72.440
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## 2016-01-21    7892    71.460       -20   563962.3        71.460
## 2016-01-22   -7892    70.340       -20  -555123.3        70.340
## 2016-02-25    7932    69.980       -20   555081.4        69.980
## 2016-03-10   -7932    69.400       -20  -550480.8        69.400
## 2016-03-29    7717    71.330       -20   550453.6        71.330
## 2016-04-11   -7717    66.800       -20  -515495.6        66.800
## 2016-04-27    7250    71.100       -20   515475.0        71.100
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## 2016-09-13    6376    78.940       -20   503321.4        78.940
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## 2016-10-14    6565    78.770       -20   517125.0        78.770
## 2016-10-17   -6565    78.490       -20  -515286.8        78.490
## 2016-10-27    6332    81.370       -20   515234.8        81.370
## 2016-11-09   -6332    76.450       -20  -484081.4        76.450
## 2016-12-05    6253    77.410       -20   484044.7        77.410
## 2016-12-12   -6253    79.320       -20  -495988.0        79.320
## 2017-02-02    5824    85.150       -20   495913.6        85.150
## 2017-03-08   -5824    88.620       -20  -516122.9        88.620
## 2017-03-28    5737    89.960       -20   516100.5        89.960
## 2017-04-26   -5737    92.390       -20  -530041.4        92.390
## 2017-05-12    5606    94.540       -20   529991.2        94.540
## 2017-06-06   -5606    95.680       -20  -536382.1        95.680
## 2017-06-16    5701    94.080       -20   536350.1        94.080
## 2017-06-23   -5701    95.440       -20  -544103.4        95.440
## 2017-06-29    5787    94.010       -20   544035.9        94.010
## 2017-07-11   -5787    90.620       -20  -524417.9        90.620
## 2017-07-12    5765    91.660       -20   528419.9        91.660
## 2017-07-20   -5765    90.180       -20  -519887.7        90.180
## 2017-08-14    5810    88.790       -20   515869.9        88.790
## 2017-08-17   -5810    89.960       -20  -522667.6        89.960
## 2017-08-22    5855    89.250       -20   522558.8        89.250
## 2017-08-29   -5855    87.140       -20  -510204.7        87.140
## 2017-11-14    5286    96.510       -20   510151.9        96.510
## 2017-11-22   -5286    96.440       -20  -509781.8        96.440
## 2017-12-12    5335    95.550       -20   509759.2        95.550
## 2017-12-19   -5335    97.650       -20  -520962.8        97.650
## 2018-01-03    5545    93.950       -20   520952.8        93.950
## 2018-01-12   -5545    91.000       -20  -504595.0        91.000
## 2018-05-16    5232    96.440       -20   504574.1        96.440
## 2018-05-18   -5232    95.720       -20  -500807.0        95.720
## 2018-05-30    5209    96.120       -20   500689.1        96.120
```

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## 2018-06-04   -5209    96.720      -20  -503814.5        96.720
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## 2018-06-28   -5051    97.750      -20  -493735.2        97.750
## 2018-07-05    4997    98.800      -20   493703.6        98.800
## 2018-07-11   -4997   100.820      -20  -503797.5       100.820
## 2018-07-12    5033   101.440      -20   510547.5       101.440
## 2018-07-19   -5033   103.900      -20  -522928.7       103.900
## 2018-08-13    5174    99.760      -20   516158.2        99.760
## 2018-09-24   -5174   103.460      -20  -535302.0       103.460
## 2018-10-09    5135   104.240      -20   535272.4       104.240
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## 2006-01-19             -20.000
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## 2010-02-10          -51181.220
## 2010-02-24             -20.000
```

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## 2010-03-08            19160.910
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## 2010-12-21              -20.000
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## 2011-05-24              -20.000
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## 2012-02-28              -20.000
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## 2012-04-24              -20.000
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## 2012-11-05            28949.840
## 2012-11-16              -20.000
## 2012-11-30            44117.280
## 2012-12-19              -20.000
```

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## 2014-01-15             -20.000
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## 2014-02-28             -20.000
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## 2015-05-13             -20.000
## 2015-05-21            6097.120
## 2015-06-10             -20.000
## 2015-06-12           -1699.770
## 2015-06-16             -20.000
## 2015-06-24           17955.110
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## 2015-12-15             -20.000
## 2015-12-18            4951.500
## 2015-12-23             -20.000
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## 2016-01-21             -20.000
## 2016-01-22           -8859.040
## 2016-02-25             -20.000
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## 2016-04-27             -20.000
## 2016-04-28           -6690.000
## 2016-06-03             -20.000
```

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## 2016-06-08          -5430.020
## 2016-09-13            -20.000
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## 2016-10-14            -20.000
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## 2016-12-12          11923.230
## 2017-02-02            -20.000
## 2017-03-08          20189.280
## 2017-03-28            -20.000
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## 2017-05-12            -20.000
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## 2017-06-16            -20.000
## 2017-06-23           7733.360
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## 2018-07-11          10073.940
## 2018-07-12            -20.000
## 2018-07-19          12361.180
## 2018-08-13            -20.000
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## 2018-10-09            -20.000
## 2018-10-11         -28416.550
## [1] "DBK.csv"
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## 2003-12-11   22507    48.664      -20  1095280.6       48.664
## 2003-12-15  -22507    48.936      -20 -1101402.6       48.936
```

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## 2004-01-13   22244    49.270      -20  1095961.9       49.270
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## 2004-05-06  -22173    51.786      -20 -1148251.0       51.786
## 2004-05-11   22593    50.823      -20  1148244.0       50.823
## 2004-05-12  -22593    50.147      -20 -1132971.2       50.147
## 2004-05-26   21720    52.159      -20  1132893.5       52.159
## 2004-06-08  -21720    51.576      -20 -1120230.7       51.576
## 2004-11-05   23272    48.135      -20  1120197.7       48.135
## 2004-12-17  -23272    50.248      -20 -1169371.5       50.248
## 2005-01-06   23189    50.427      -20  1169351.7       50.427
## 2005-01-18  -23189    51.887      -20 -1203207.6       51.887
## 2005-02-23   23265    51.716      -20  1203172.7       51.716
## 2005-02-28  -23265    51.654      -20 -1201730.3       51.654
## 2005-03-24   23239    51.709      -20  1201665.5       51.709
## 2005-03-29  -23239    51.274      -20 -1191556.5       51.274
## 2005-04-13   22659    52.586      -20  1191546.2       52.586
## 2005-04-15  -22659    52.377      -20 -1186810.4       52.377
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## 2005-08-23  -21589    55.608      -20 -1200521.1       55.608
## 2005-08-26   21847    54.948      -20  1200449.0       54.948
## 2005-09-08  -21847    58.886      -20 -1286482.4       58.886
## 2005-09-16   21939    58.637      -20  1286437.1       58.637
## 2005-09-19  -21939    57.954      -20 -1271452.8       57.954
## 2005-09-23   21942    57.946      -20  1271451.1       57.946
## 2005-09-27  -21942    58.824      -20 -1290716.2       58.824
## 2005-10-07   21454    60.160      -20  1290672.6       60.160
## 2005-10-18  -21454    59.422      -20 -1274839.6       59.422
## 2005-10-20   21683    58.793      -20  1274808.6       58.793
## 2005-10-21  -21683    58.101      -20 -1259804.0       58.101
## 2005-10-24   21613    58.606      -20  1266651.5       58.606
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## 2005-12-06   19349    65.884      -20  1274789.5       65.884
## 2005-12-22  -19349    63.593      -20 -1230461.0       63.593
## 2006-01-02   19220    64.020      -20  1230464.4       64.020
## 2006-01-10  -19220    65.465      -20 -1258237.3       65.465
## 2006-01-19   19315    65.139      -20  1258159.8       65.139
## 2006-01-20  -19315    64.805      -20 -1251708.6       64.805
## 2006-01-24   19426    64.432      -20  1251656.0       64.432
## 2006-02-02  -19426    68.370      -20 -1328155.6       68.370
## 2006-02-06   19430    68.354      -20  1328118.2       68.354
## 2006-02-08  -19430    68.409      -20 -1329186.9       68.409
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## 2006-09-25   20084    72.588      -20  1457857.4       72.588
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## 2006-10-25  -19822    75.967      -20 -1505817.9       75.967
```

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## 2006-12-20   19051    78.740       -20  1500075.7        78.740
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## 2006-12-27   18878    79.027       -20  1491871.7        79.027
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## 2007-01-09   18981    79.361       -20  1506351.1        79.361
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## 2007-02-06   18391    83.462       -20  1534949.6        83.462
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## 2007-06-28   19371    83.089       -20  1609517.0        83.089
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## 2007-07-17  -19838    83.245       -20 -1651414.3        83.245
## 2007-07-19   19950    82.779       -20  1651441.0        82.779
## 2007-07-23  -19950    80.782       -20 -1611600.9        80.782
## 2009-05-07   49223    32.740       -20  1611561.0        32.740
## 2009-05-18  -49223    30.573       -20 -1504894.8        30.573
## 2009-06-24   46684    32.235       -20  1504858.7        32.235
## 2009-08-05  -46684    35.505       -20 -1657515.4        35.505
## 2009-08-18   46137    35.925       -20  1657471.7        35.925
## 2009-08-19  -46137    35.257       -20 -1626652.2        35.257
## 2009-09-09   42658    38.131       -20  1626592.2        38.131
## 2009-09-24  -42658    40.554       -20 -1729952.5        40.554
## 2009-10-05   44211    39.129       -20  1729932.2        39.129
## 2009-10-16  -44211    42.904       -20 -1896828.7        42.904
## 2009-10-29   48108    39.428       -20  1896802.2        39.428
## 2009-11-24  -48108    38.706       -20 -1862068.2        38.706
## 2009-11-25   48526    39.234       -20  1903869.1        39.234
## 2009-12-02  -48526    37.758       -20 -1832244.7        37.758
## 2009-12-10   47651    37.572       -20  1790343.4        37.572
## 2009-12-29  -47651    39.191       -20 -1867490.3        39.191
## 2010-01-04   47570    39.257       -20  1867455.5        39.257
## 2010-01-06  -47570    39.358       -20 -1872260.1        39.358
## 2010-01-14   47261    39.614       -20  1872197.3        39.614
## 2010-01-22  -47261    35.731       -20 -1688682.8        35.731
## 2010-03-19   39729    42.504       -20  1688641.4        42.504
## 2010-04-07  -39729    44.477       -20 -1767026.7        44.477
## 2010-04-09   39889    44.298       -20  1767002.9        44.298
## 2010-04-13  -39889    44.927       -20 -1792093.1        44.927
## 2010-04-14   39930    45.246       -20  1806672.8        45.246
## 2010-04-16  -39930    45.945       -20 -1834583.9        45.945
## 2010-04-20   42027    43.304       -20  1819937.2        43.304
## 2010-04-27  -42027    41.991       -20 -1764755.8        41.991
## 2010-04-29   42608    41.417       -20  1764695.5        41.417
## 2010-04-30  -42608    40.523       -20 -1726604.0        40.523
```

```
## 2010-08-13   41431    41.673       -20  1726554.1        41.673
## 2010-08-26  -41431    39.071       -20 -1618750.6        39.071
## 2011-02-01   43705    37.038       -20  1618745.8        37.038
## 2011-02-03  -43705    37.455       -20 -1636970.8        37.455
## 2011-02-25   41636    39.315       -20  1636919.3        39.315
## 2011-02-28  -41636    38.907       -20 -1619931.9        38.907
## 2012-02-13   55190    29.351       -20  1619881.7        29.351
## 2012-02-21  -55190    29.036       -20 -1602496.8        29.036
## 2012-04-11   53808    29.781       -20  1602456.0        29.781
## 2012-04-13  -53808    28.900       -20 -1555051.2        28.900
## 2012-04-17   52919    29.385       -20  1555024.8        29.385
## 2012-04-24  -52919    28.317       -20 -1498507.3        28.317
## 2012-09-14   52735    28.415       -20  1498465.0        28.415
## 2012-09-18  -52735    28.279       -20 -1491293.1        28.279
## 2012-11-06   49514    30.118       -20  1491262.7        30.118
## 2012-11-07  -49514    29.841       -20 -1477547.3        29.841
## 2012-11-19   51742    28.555       -20  1477492.8        28.555
## 2012-11-20  -51742    27.921       -20 -1444688.4        27.921
## 2012-11-29   50426    28.649       -20  1444654.5        28.649
## 2012-12-06  -50426    29.539       -20 -1489533.6        29.539
## 2012-12-11   51050    29.177       -20  1489485.9        29.177
## 2013-01-08  -51050    30.169       -20 -1540127.4        30.169
## 2013-03-14   52808    29.164       -20  1540092.5        29.164
## 2013-03-20  -52808    27.666       -20 -1460986.1        27.666
## 2013-05-22   46222    31.607       -20  1460938.8        31.607
## 2013-05-23  -46222    30.518       -20 -1410603.0        30.518
## 2013-05-30   45774    30.816       -20  1410571.6        30.816
## 2013-06-05  -45774    30.867       -20 -1412906.1        30.867
## 2013-06-07   45837    30.824       -20  1412879.7        30.824
## 2013-06-21  -45837    28.202       -20 -1292695.1        28.202
## 2013-08-01   44335    29.156       -20  1292631.3        29.156
## 2013-08-07  -44335    28.304       -20 -1254857.8        28.304
## 2013-10-01   43349    28.947       -20  1254823.5        28.947
## 2013-10-09  -43349    28.858       -20 -1250965.4        28.858
## 2013-10-22   39754    31.467       -20  1250939.1        31.467
## 2013-11-13  -39754    29.113       -20 -1157358.2        29.113
## 2014-02-05   38634    29.956       -20  1157320.1        29.956
## 2014-02-13  -38634    30.249       -20 -1168639.9        30.249
## 2014-02-21   38741    30.164       -20  1168583.5        30.164
## 2014-03-03  -38741    29.368       -20 -1137745.7        29.368
## 2015-03-27   39897    28.516       -20  1137702.9        28.516
## 2015-05-06  -39897    25.106       -20 -1001654.1        25.106
## 2015-08-17   38322    26.137       -20  1001622.1        26.137
## 2015-08-19  -38322    25.508       -20  -977517.6        25.508
## 2016-12-20   60778    16.083       -20   977492.6        16.083
## 2017-01-03  -60778    15.302       -20  -930025.0        15.302
## 2017-01-11   58048    16.021       -20   929987.0        16.021
## 2017-01-12  -58048    15.771       -20  -915475.0        15.771
## 2017-01-13   58111    16.110       -20   936168.2        16.110
## 2017-01-16  -58111    15.744       -20  -914899.6        15.744
## 2017-01-31   52589    17.002       -20   894118.2        17.002
## 2017-02-02  -52589    16.494       -20  -867403.0        16.494
## 2017-02-03   53791    16.735       -20   900192.4        16.735
## 2017-03-17  -53791    15.940       -20  -857428.5        15.940
```

```
## 2017-03-21   52138    15.815      -20   824562.5        15.815
## 2017-03-30  -52138    15.830      -20  -825344.5        15.830
## 2017-04-12   53091    15.545      -20   825299.6        15.545
## 2017-04-19  -53091    14.925      -20  -792383.2        14.925
## 2017-07-03   49677    15.950      -20   792348.1        15.950
## 2017-07-27  -49677    16.000      -20  -794832.0        16.000
## 2017-11-24   49473    16.065      -20   794783.7        16.065
## 2017-11-30  -49473    15.885      -20  -785878.6        15.885
## 2017-12-04   48674    16.145      -20   785841.7        16.145
## 2017-12-05  -48674    15.980      -20  -777810.5        15.980
## 2017-12-07   49148    15.825      -20   777767.1        15.825
## 2018-01-05  -49148    15.884      -20  -780666.8        15.884
##            Net.Txn.Realized.PL
## 1999-12-31               0.000
## 2003-11-12             -20.000
## 2003-12-10           89905.510
## 2003-12-11             -20.000
## 2003-12-15            6101.904
## 2004-01-13             -20.000
## 2004-02-10           60105.532
## 2004-03-23             -20.000
## 2004-05-06           -7780.550
## 2004-05-11             -20.000
## 2004-05-12          -15292.868
## 2004-05-26             -20.000
## 2004-06-08          -12682.760
## 2004-11-05             -20.000
## 2004-12-17           49153.736
## 2005-01-06             -20.000
## 2005-01-18           33835.940
## 2005-02-23             -20.000
## 2005-02-28           -1462.430
## 2005-03-24             -20.000
## 2005-03-29          -10128.965
## 2005-04-13             -20.000
## 2005-04-15           -4755.731
## 2005-08-19             -20.000
## 2005-08-23           13732.193
## 2005-08-26             -20.000
## 2005-09-08           86013.486
## 2005-09-16             -20.000
## 2005-09-19          -15004.337
## 2005-09-23             -20.000
## 2005-09-27           19245.076
## 2005-10-07             -20.000
## 2005-10-18          -15853.052
## 2005-10-20             -20.000
## 2005-10-21          -15024.636
## 2005-10-24             -20.000
## 2005-10-26           15087.487
## 2005-12-06             -20.000
## 2005-12-22          -44348.559
## 2006-01-02             -20.000
## 2006-01-10           27752.900
```

```
## 2006-01-19             -20.000
## 2006-01-20           -6471.210
## 2006-01-24             -20.000
## 2006-02-02           76479.588
## 2006-02-06             -20.000
## 2006-02-08            1048.650
## 2006-03-09             -20.000
## 2006-04-07           97693.660
## 2006-04-25             -20.000
## 2006-04-26           -2866.484
## 2006-05-19             -20.000
## 2006-06-02          -42768.191
## 2006-09-08             -20.000
## 2006-09-22           54792.580
## 2006-09-25             -20.000
## 2006-10-11           71258.116
## 2006-10-18             -20.000
## 2006-10-25           -1387.718
## 2006-11-29             -20.000
## 2006-11-30           -5673.039
## 2006-12-20             -20.000
## 2006-12-21           -8173.828
## 2006-12-27             -20.000
## 2007-01-04           14497.182
## 2007-01-09             -20.000
## 2007-01-16           28584.367
## 2007-02-06             -20.000
## 2007-03-08         -135304.196
## 2007-03-29             -20.000
## 2007-04-02           14961.968
## 2007-04-03             -20.000
## 2007-05-10          212441.650
## 2007-05-29             -20.000
## 2007-05-30          -10156.352
## 2007-06-11             -20.000
## 2007-06-12           -7252.097
## 2007-06-28             -20.000
## 2007-07-10           16697.173
## 2007-07-12             -20.000
## 2007-07-17           25253.612
## 2007-07-19             -20.000
## 2007-07-23          -39860.150
## 2009-05-07             -20.000
## 2009-05-18         -106686.241
## 2009-06-24             -20.000
## 2009-08-05          152636.680
## 2009-08-18             -20.000
## 2009-08-19          -30839.516
## 2009-09-09             -20.000
## 2009-09-24          103340.334
## 2009-10-05             -20.000
## 2009-10-16          166876.525
## 2009-10-29             -20.000
## 2009-11-24          -34753.976
```

```
## 2009-11-25           -20.000
## 2009-12-02        -71644.376
## 2009-12-10           -20.000
## 2009-12-29         77126.969
## 2010-01-04           -20.000
## 2010-01-06          4784.570
## 2010-01-14           -20.000
## 2010-01-22       -183534.463
## 2010-03-19           -20.000
## 2010-04-07         78365.317
## 2010-04-09           -20.000
## 2010-04-13         25070.181
## 2010-04-14           -20.000
## 2010-04-16         27891.070
## 2010-04-20           -20.000
## 2010-04-27        -55201.451
## 2010-04-29           -20.000
## 2010-04-30        -38111.552
## 2010-08-13           -20.000
## 2010-08-26       -107823.462
## 2011-02-01           -20.000
## 2011-02-03         18204.985
## 2011-02-25           -20.000
## 2011-02-28        -17007.488
## 2012-02-13           -20.000
## 2012-02-21        -17404.850
## 2012-04-11           -20.000
## 2012-04-13        -47424.848
## 2012-04-17           -20.000
## 2012-04-24        -56537.492
## 2012-09-14           -20.000
## 2012-09-18         -7191.960
## 2012-11-06           -20.000
## 2012-11-07        -13735.378
## 2012-11-19           -20.000
## 2012-11-20        -32824.428
## 2012-11-29           -20.000
## 2012-12-06         44859.140
## 2012-12-11           -20.000
## 2013-01-08         50621.600
## 2013-03-14           -20.000
## 2013-03-20        -79126.384
## 2013-05-22           -20.000
## 2013-05-23        -50355.758
## 2013-05-30           -20.000
## 2013-06-05          2314.474
## 2013-06-07           -20.000
## 2013-06-21       -120204.614
## 2013-08-01           -20.000
## 2013-08-07        -37793.420
## 2013-10-01           -20.000
## 2013-10-09         -3878.061
## 2013-10-22           -20.000
## 2013-11-13        -93600.916
```

```
## 2014-02-05              -20.000
## 2014-02-13            11299.762
## 2014-02-21              -20.000
## 2014-03-03           -30857.836
## 2015-03-27              -20.000
## 2015-05-06          -136068.770
## 2015-08-17              -20.000
## 2015-08-19           -24124.538
## 2016-12-20              -20.000
## 2017-01-03           -47487.618
## 2017-01-11              -20.000
## 2017-01-12           -14532.000
## 2017-01-13              -20.000
## 2017-01-16           -21288.626
## 2017-01-31              -20.000
## 2017-02-02           -26735.212
## 2017-02-03              -20.000
## 2017-03-17           -42783.845
## 2017-03-21              -20.000
## 2017-03-30              762.070
## 2017-04-12              -20.000
## 2017-04-19           -32936.420
## 2017-07-03              -20.000
## 2017-07-27             2463.850
## 2017-11-24              -20.000
## 2017-11-30            -8925.140
## 2017-12-04              -20.000
## 2017-12-05            -8051.210
## 2017-12-07              -20.000
## 2018-01-05             2879.732
```

Performance Statistics

The following table summarizes some important trading statistics for all instruments.

```r
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"],tstats[i,"Percent.Positive"],tstats[i,"Percent.Negative"],tstats[i,"Percen
  print(row.names(tstats[i,]))
  print(trades.tab)
  }
```

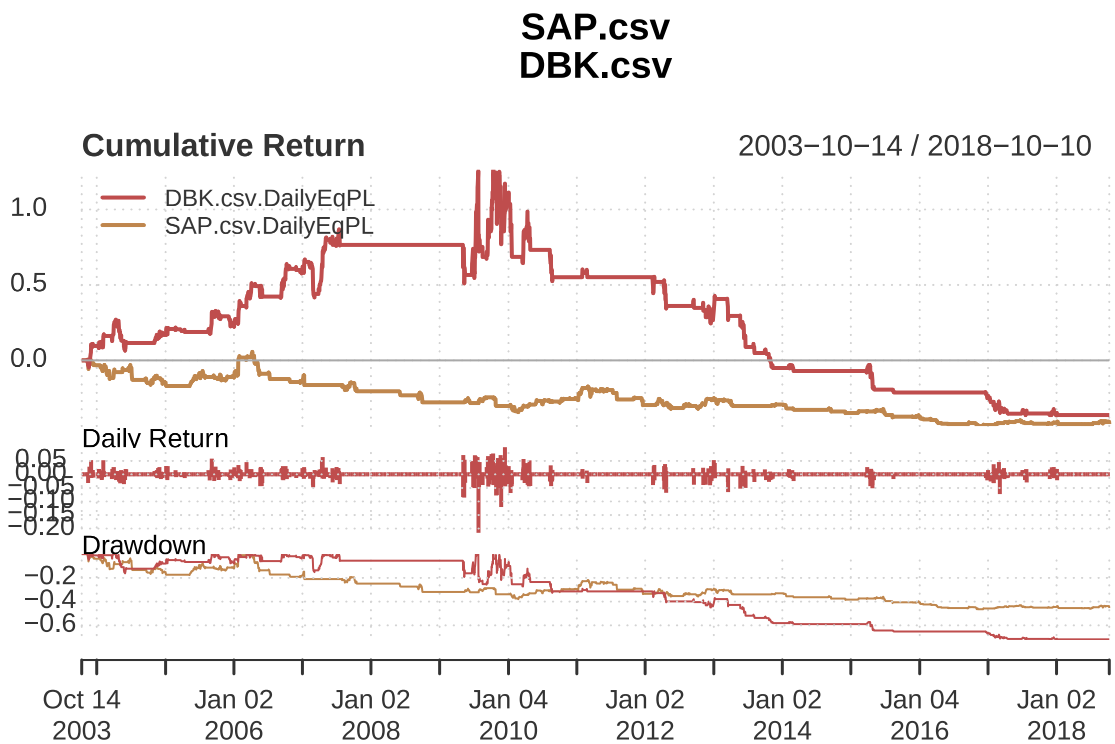
```
## [1] "SAP.csv"
##      [,1]           [,2]
## [1,] "Trades"       "124"
## [2,] "Win Percent"  "40.3225806451613"
## [3,] "Loss Percent" "59.6774193548387"
## [4,] "W/L Ratio"    "0.675675675675676"
## [1] "DBK.csv"
##      [,1]           [,2]
## [1,] "Trades"       "89"
## [2,] "Win Percent"  "41.5730337078652"
## [3,] "Loss Percent" "58.4269662921348"
```

```
## [4,] "W/L Ratio"    "0.711538461538462"
```

Visualize returns of the trading strategy

```
library(PerformanceAnalytics) # contains lots of methods to investigate performance
# obtain the portfolio returns - with these you can compute virtually any financial metrics you wish
rets <- PortfReturns(Account=accountname)
rownames(rets) <- NULL # this step is important!
```

```
charts.PerformanceSummary(rets,colorset=rainbow12equal,main=instrumentlist)
```



Calculate statistics of the Portfolio

```
tab.perf <- table.Arbitrary(rets, metrics=c("Return.cumulative", "Return.annualized","SharpeRatio.annual
                             metricsNames=c("Cumulative Return", "Annualized Return", "Annualized Sharp
tab.risk <- table.Arbitrary(rets, metrics=c("StdDev.annualized", "maxDrawdown","VaR","ES"),
                             metricsNames=c("Annualized StdDev", "Max Drawdown", "Value-at-Risk","Condit
# present the portfolio statistics
for (i in 1:ncol(tab.perf)) {
somestats <- data.frame(rownames(tab.perf),tab.perf[i,1], rownames(tab.risk),tab.risk[i,1])
colnames(rets[,i])
colnames(somestats) <- c("Performance Metric", "Performance Value", "Risk Metric", "Risk Value")
print(somestats)
}
```

```
##      Performance Metric Performance Value       Risk Metric Risk Value
## 1     Cumulative Return        -0.3620567 Annualized StdDev  0.1727776
```

```
## 2      Annualized Return        -0.3620567      Max Drawdown  0.1727776
## 3 Annualized Sharp Ratio        -0.3620567     Value-at-Risk  0.1727776
## 4           Calmar Ratio        -0.3620567   Conditional VaR  0.1727776
##       Performance Metric Performance Value       Risk Metric Risk Value
## 1      Cumulative Return        -0.0292859 Annualized StdDev  0.7186242
## 2      Annualized Return        -0.0292859      Max Drawdown  0.7186242
## 3 Annualized Sharp Ratio        -0.0292859     Value-at-Risk  0.7186242
## 4           Calmar Ratio        -0.0292859   Conditional VaR  0.7186242
```

Compare with Buy and Hold Strategy

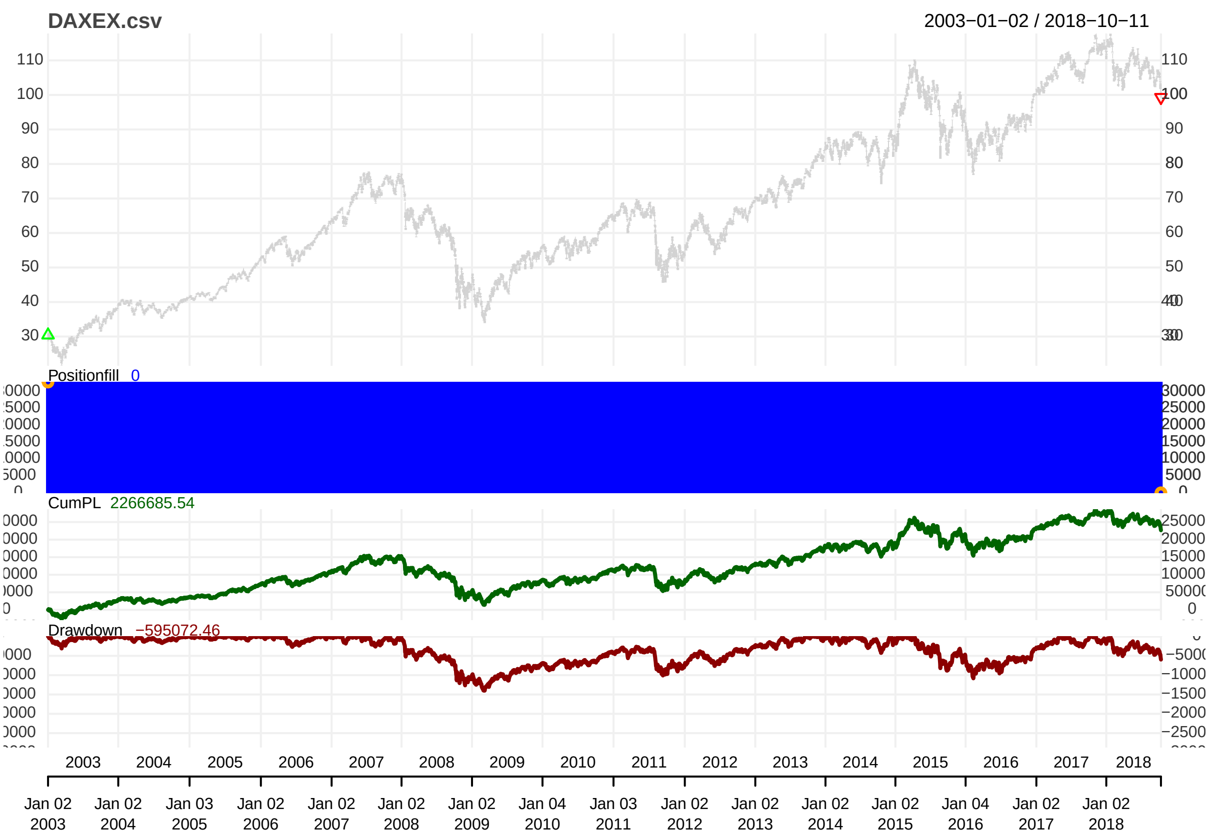
In order to compare the trading strategy properly we need to define a benchmark against which we can measure the results. In this case a simple buy and hold strategy is used. At the first date of the trading period we place a buy order and sell our position at the last day of the selected period. In order to do this we create a new Portfolio and a new Account.

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

# The Buy and hold symbol 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,TxnF

# 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

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

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.

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



Compare the returns of the trading strategy with the buy and hold strategy

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

```r
rets.bh <- PortfReturns(Account='buyhold')
returns <- cbind(rets,rets.bh)
#rulecol <- paste(portfolioname,instrument,sep="-")
#colnames(returns) <- c(rulecol,"Buy-and-hold")
```

We compare the two strategies by showing some statistical metrics of the returns and plot the returns in one chart to directly compare the performance of the strategies.

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

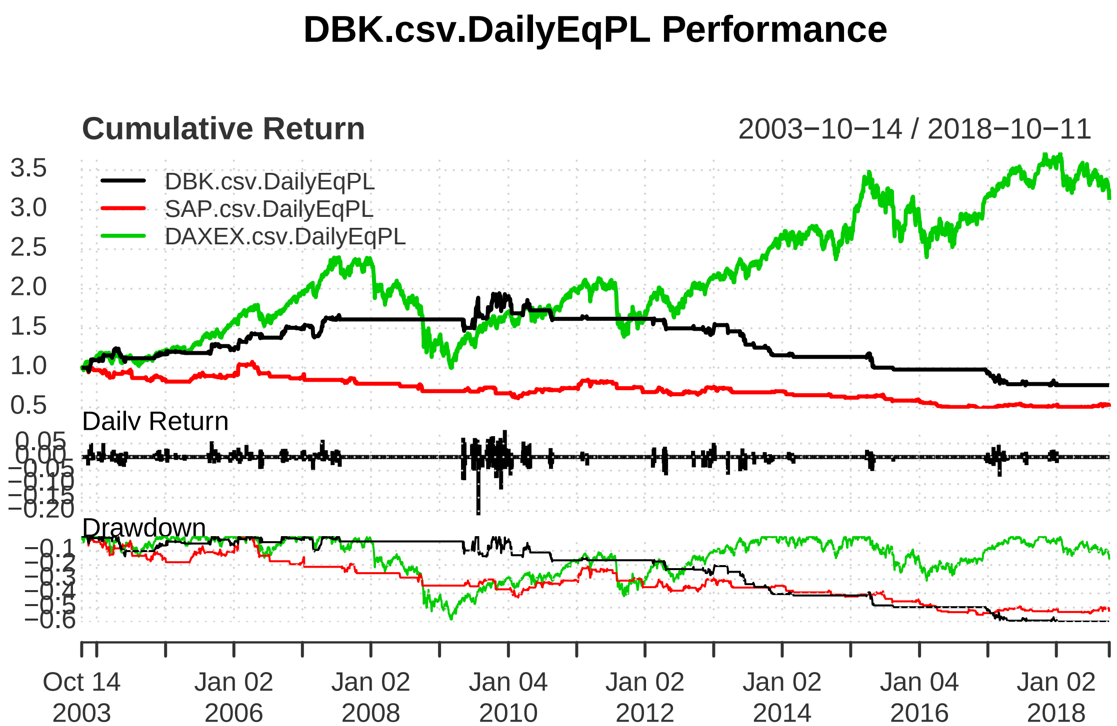
```
##                 DBK.csv.DailyEqPL SAP.csv.DailyEqPL DAXEX.csv.DailyEqPL
## Observations            3811.0000         3811.0000           4012.0000
## NAs                      201.0000          201.0000              0.0000
## Minimum                   -0.2154           -0.0733             -0.1984
## Quartile 1                 0.0000            0.0000             -0.0125
```

```
## Median                         0.0000             0.0000               0.0020
## Arithmetic Mean               -0.0001            -0.0001               0.0006
## Geometric Mean                -0.0001            -0.0001               0.0002
## Quartile 3                     0.0000             0.0000               0.0148
## Maximum                        0.1000             0.0941               0.1671
## SE Mean                        0.0002             0.0001               0.0004
## LCL Mean (0.95)               -0.0004            -0.0003              -0.0003
## UCL Mean (0.95)                0.0003             0.0000               0.0014
## Variance                       0.0001             0.0000               0.0008
## Stdev                          0.0109             0.0053               0.0277
## Skewness                      -2.1291            -0.1984              -0.2892
## Kurtosis                      60.0278            47.0826               3.3673
```

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

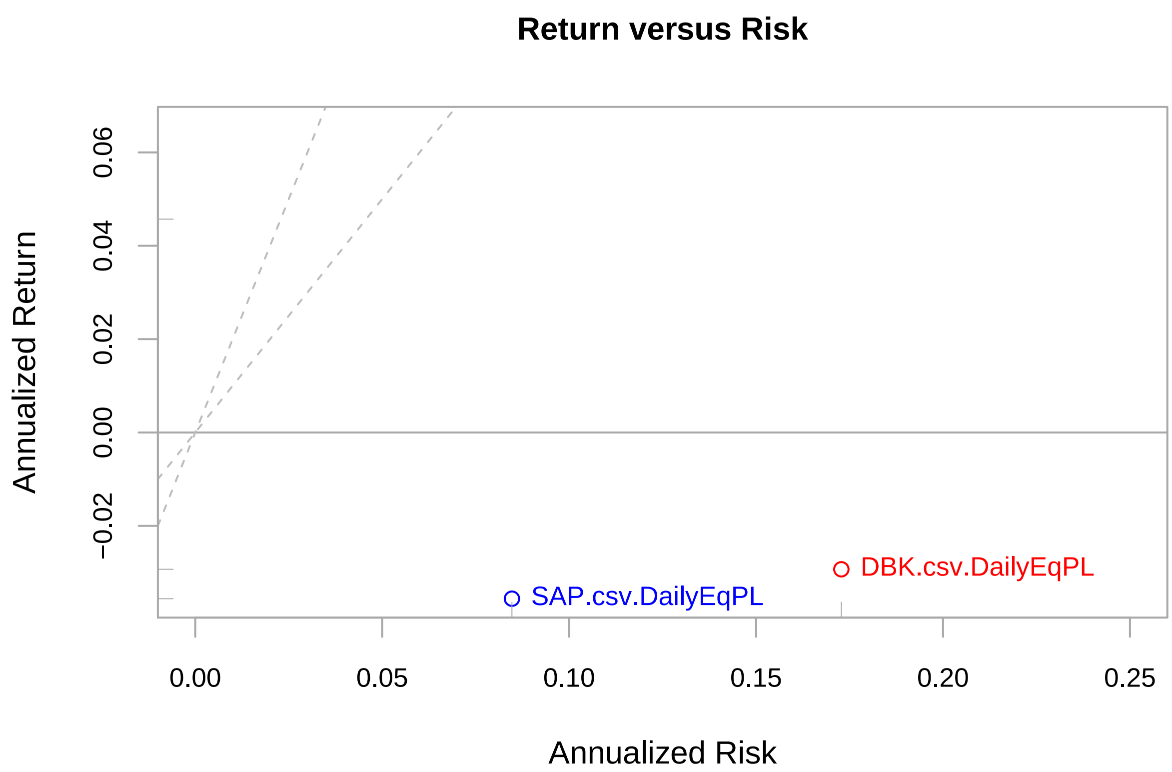
```
##                           DBK.csv.DailyEqPL SAP.csv.DailyEqPL
## Annualized Return                   -0.0293           -0.0356
## Annualized Std Dev                   0.1728            0.0847
## Annualized Sharpe (Rf=0%)           -0.1695           -0.4198
##                           DAXEX.csv.DailyEqPL
## Annualized Return                      0.0457
## Annualized Std Dev                     0.4405
## Annualized Sharpe (Rf=0%)              0.1038
```

```
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",colorse
```

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




```
chart.RelativePerformance(returns[,1],returns[,2],colorset=c("red","blue"),lwd=2,legend.loc="topleft")
```

Backtest

Approach

Implementation

System Check

To make sure that our system worked properly some transactions were observed to make sure that the trades were performed according to the defined rules. Prepare the chart. Check 4 transactions.

Visualize the charts with the transactions which should be checked

Analysis

Returns

Historical VaR

Equity curve

Conclusion and Suggestions