Package ‘backtest’

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backtest-package

Exploring portfolio-based conjectures about financial instruments

Description

The backtest package provides facilities for exploring portfolio-based conjectures about financial instruments (stocks, bonds, swaps, options, et cetera).

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- starmine: StarMine Rankings, 1995

Further information is available in the following vignettes:

- backtest: Using the backtest package (source, pdf)

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Description

Conducts a backtest and returns the results as an object of class backtest.
Usage

backtest(x,
    in.var,
    ret.var,
    universe,
    by.var = NULL,
    date.var = NULL,
    id.var = NULL,
    buckets = 5,
    natural = FALSE,
    do.spread = TRUE,
    by.period = TRUE,
    overlaps = 1)

Arguments

x A data frame containing the data to be analysed in the backtest. The details of what this data frame must contain are given below.

in.var A character vector which indicates the name of the column or columns in x to be used as input variables.

ret.var A character vector which indicates the name of the column or columns in x to be used as return variables.

by.var An optional character value, specifying a second variable in x to be used for categorising the data. The details of how categories are created are given below.

id.var An optional character value which indicates the name of the column in x containing a unique identifier for each observation. id.var must be specified if natural is TRUE.

date.var An optional character vector which indicates the name of the column in x to be used as a date for each observation. date.var must be specified if natural is TRUE. In order to call plot, the contents of date.var must be of class Date or be coercible to an object of class Date via as.Date.

buckets An optional numeric vector which specifies how many quantiles to create according to in.var and by.var.

universe An optional expression for selecting a subset of x. The details of how this expression may be constructed are given below.

natural An optional logical value. If TRUE, the summary method returns additional information and the backtest object may be plotted. The details of how a natural backtest differs from a pooled backtest are given below.

do.spread Object of class "logical". If TRUE the summary method displays information about the spread between the extreme quantiles. If FALSE this information is suppressed. Defaults to TRUE.

by.period Object of class "logical". If TRUE the quantiles are recalculated within each date period. If FALSE the quantiles are calculated all at once. Defaults to TRUE.

overlaps An object of class "numeric" which specifies the number of prior periods to include in the current period’s portfolio weights calculation. If overlaps is
the default of 1, backtest behaves as usual and only uses a period's own data to
determine its portfolio. If overlaps is set to \( n > 1 \), a period's portfolio comprises
the weighted mean of portfolio weights from the previous \( n \) periods, with period
\( n \) having a weight of \( 1/n \).

Details

Data frames for backtest must, at a minimum, contain a column of class numeric to be referenced
by the in.var and ret.var arguments.

The in.var is the primary variable by which the backtest categorises observations. It must reference
a numeric column in \( x \). Using the values in \( x \), backtest breaks the values into equal sized quantiles,
or buckets.

The by.var is the secondary variable by which the backtest categorises observations. When specifying both in.var and by.var, backtest organises the observations into a \( n \) by \( j \) matrix where
\( n \) is the number of quantiles or categories created for the by.var and \( j \) is the number of quantiles
created for the in.var. By default, backtest creates 5 quantiles.

If natural is TRUE, the data and arguments must meet certain requirements. First, the frequency
of the observations and ret.var must be the same. Second, an id.var and date.var are required.
Third, a by.var is not allowed. Note that the code does not verify that the backtest is truly natural;
backtest accepts the value passed by the user as valid.

Value

Returns an object of class backtest.

The functions show and summary are used to obtain and print a short description and longer sum-
mary of the results of the backtest. The accessor functions counts, totalCounts, marginals,
means, naCounts, and turnover extract different parts of the value returned by backtest.

Author(s)

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See Also

backtest-class

Examples

data(starmine)

## Backtest with 1 'in.var' and 1 'ret.var'

bt <- backtest(starmine, in.var = "smi", ret.var = "ret.0.1.m", by.period = FALSE)
summary(bt)

## Backtest with 2 'in.var' values, 1 'ret.var', and a 'by.var'

bt <- backtest(starmine, in.var = c("smi", "cap.usd"),

backtest-class

Class "backtest"

Description

Contains results from the backtest function.
Details

The primary method for accessing the backtest results is through the summary method. summary
provides different displays depending on the type of backtest object. These displays are shown in
the examples section. Accessor methods such as means, counts, marginals, naCounts, turnover,
and ci may be used to extract other types of information from the object.

A backtest object with a natural value of TRUE may be graphed by calling the plot method. The
default plot method graphs return. The other plots, turnover and cumulative return, must be explic-
itly specified as plot(object, type = "turnover") or plot(object, type = "cumreturn").

The backtest object does not store the data frame used to create the backtest. It only stores the
results and the names of the vectors used in calculating these results.

The results of a backtest are stored in a 5-dimensional array, results. The 1st dimension contains
one value for every element of ret.var. The 2nd dimension contains one value for every element of
in.var. The 3rd dimension contains one value for every element in 1:buckets[1], a vector from 1
through the number of by.var buckets. The 4th dimension contains one value for every element in
1:buckets[2], a vector from 1 through the number of in.var buckets. The 5th dimension contains
4 elements: means, counts, trim.mMeans, and NAs.

Objects from the Class

Objects can be created by calls to the function backtest(data, in.var, ret.var, ...).

Slots

in.var: Object of class "character" specifying the in.var values for this backtest.
ret.var: Object of class "character" containing the ret.var values for this backtest.
by.var: Object of class "character" containing the by.var, if specified, for this backtest.
date.var: Object of class "character" containing the date.var, if specified, for this backtest.
buckets: Object of class "numeric" containing the number(s) of buckets used create quantiles
from the in.var and by.var values.
results: A 5-dimensional "array" containing the results of the backtest.
ret.stats: Object of class "array" containing return statistics for the backtest.
turnover: Object of class "array" containing turnover statistics for the backtest.
natural: Object of class "logical" expressing whether or not the intervals between observations,
as specified by date.var, and returns, as specified by ret.var, match. If the interval between
dates is one month, the interval between returns should also be one month.
do.spread: Object of class "logical". If TRUE the summary method displays information about
the spread between the extreme quantiles. If FALSE this information is suppressed. Defaults
to TRUE.

by.period: Object of class "logical". If TRUE the quantiles are recalculated within each date
period. If FALSE the quantiles are calculated all at once. Defaults to TRUE.
overlaps: An object of class "numeric" which specifies the number of prior periods to include
in the current period’s portfolio weights calculation. If overlaps is the default of 1, backtest
behaves as usual and only uses a periods own data to determine its portfolio. If overlaps is
set to n > 1, a period’s portfolio comprises the weighted mean of portfolio weights from the
previous n periods, with period n having a weight of 1/n.
Methods

- **show** signature(object = "backtest"): Prints the variables used in this backtest.
- **summary** signature(object = "backtest"): Prints the results of the backtest.
- **summaryStats** signature(object = "backtest"): Returns a data frame with spreads for each date.var value and each in.var.
- **means** signature(object = "backtest"): Returns a list of matrices, with one matrix for each in.var, where the value of each cell is the mean of the returns for that in.var and by.var combination.
- **counts** signature(object = "backtest"): Returns a list of matrices, with one matrix for each in.var, where the value of each cell is the number of observations for that in.var and by.var combination.
- **totalCounts** signature(object = "backtest"): Returns a data frame in the same format as the spreads data frame returned by summaryStats: contains the sum of counts for all buckets (or high and low buckets if argument low/high/only is set to TRUE) of non-NA in.var values that went into the spread calculations.
- **marginals** signature(object = "backtest"): Returns a list of matrices, one matrix for each in.var, where the value of each cell is the number of observations for that in.var and by.var combination. Different from counts because the marginal sums have been appended to the matrices.
- **naCounts** signature(object = "backtest"): Returns a list of matrices, with one matrix for each in.var, where the value of each cell is the number of NA observations for that in.var and by.var combination.
- **ci** signature(object = "backtest"): Returns a matrix of confidence intervals for spreads.
- **turnover** signature(object = "backtest"): Returns a data.frame of the turnovers if the backtest is natural.
- **plot** signature(x = "backtest", y = "missing"): Plots returns, cumulative returns, or turnover, when passed a type argument of return, cumreturn, or turnover, respectively.

Author(s)

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See Also

- backtest

Examples

```r
data(starmine)
b <- backtest(starmine, in.var = "smi", ret.var = "ret.0.1.m", by.period = FALSE)

## Summary for a pooled backtest

summary(b)
```
## A natural backtest

```r
bt <- backtest(starmine, in.var = "smi", ret.var = "ret.0.1.m",
                 date.var = "date", id.var = "id", natural = TRUE, by.period = FALSE)
```

## Summary for a natural backtest

```r
summary(bt)
```

## Other access methods

```r
means(bt)
counts(bt)
marginals(bt)
naCounts(bt)
```

## Plotting methods

```r
plot(bt, type = "turnover")
plot(bt, type = "return")
plot(bt, type = "cumreturn")
```

### Description

StarMine rankings of some stocks in 1995, with corresponding returns and other data.

### Usage

```r
data(starmine)
```

### Format

A data frame containing 53328 observations on the following 23 variables.

- **date**: Date on which the observation was recorded. The dates have a monthly frequency. Dates range from 1995-01-31 to 1995-11-30.
- **id**: Unique identifier for each stock.
- **symbol**: Company symbol.
- **name**: Full company name.
- **country**: Country of the exchange on which the company is listed. This factor has levels AUS, CHE, DEU, DNK, ESP, FIN, FRA, GBR, HKG, ITA, JPN, NLD, NOR, NZL, SWE and USA.
- **sector**: Sector specification. This factor has levels Durbl, Enrgy, HiTec, HLth, Manuf, Money, NoDur, Other, Shops, Telcm and Utilis.
sec  An alternative sector specification. This factor has levels CND, CNS, COM, ENE, FIN, HTH, IND, MAT, TEC and UTL.

ind Industry specification. This factor has levels AERDF, AIRLN, AUTOP, AUTOS, BANKS, BEVGS, BIOTC, BUILD, CHEMS, CNEC, CNFIN, CNMAT, COMEQ, COMPT, COMSS, CONGL, CPMKT, DICNS, DISTR, DVFIN, DVTEL, ELEQI, ELEQT, ELUTL, ENQIQS, FDPRD, FDRET, GSUTL, HEPSV, HEQSP, HETEC, HOTEL, HSURD, HSPRD, INSUR, INTSS, IPPET, ICTAT, ITCON, LEISR, LFSCI, LOGIS, MACHN, MEDIA, METAL, MGFIN, MLRET, MLUTL, OFFIC, OILGS, PACKG, PAPER, PHARM, PRPRD, REALE, REDEV, REITS, RRAIL, SEMIP, SEMIS, SHIPS, SMOKE, SOFTW, SPRET, TEXAP, TRADE, TRINF, WIREL and WTUTL

size cap.usd normalized to N(0,1).

smi StarMine Indicator (smi) score

liq Liquidity of the company.

ret.0.1.m One-month forward return of the company.

ret.0.6.m Six-month forward return of the company.

ret.1.0.m One-month prior return of the company.

ret.6.0.m Six-month prior return of the company.

ret.12.0.m Twelve-month prior return of the company.

mn.dollar.volume.20.d Mean dollar volume of the past 20 days.

md.dollar.volume.120.d Median dollar volume of the past 120 days.

cap.usd Market capitalisation of the company in USD.

cap Market capitalisation of the company in local currency.

sales Annual gross sales of the company.

net.income Annual net income of the company.

common.equity Annual common equity of the company.

Details

starmine contains selected attributes such as sector, market capitalisation, country, and various measures of return for a universe of approximately 6,000 stocks. The data is on a monthly frequency from January 31, 1995 to November 30, 1995.

Note

We would like to thank StarMine Corporation for allowing us to include this data in the backtest package.

Source

StarMine Corporation. For more information, see http://www.starmine.com.

Examples

data(starmine)
head(starmine)
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