

Package ‘bdrift’

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Type Package

Title Beta Drift Analysis

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Maintainer Markus Peter Auer <mp.auer@meanerreversion.com>

Description Beta drift poses a serious challenge to asset managers and financial researchers. Beta drift causes problems in asset pricing models and can have serious ramifications for hedging attempts. Providing users with a tool that allows them to quantify beta drift and form educated opinions about it is the primary purpose of this package.
This package contains the BDA() function that performs a beta drift analysis, typically for multi-factor asset pricing models. The BDA() function tests the underlying model parameters for drift across time, drift across model horizon, and applies a jackknife procedure to the baseline model. This allows the users to draw conclusions about the stability of model parameters or make inferences about the behavior of funds. For example, the drift of parameters for active funds could be interpreted as implicit style drift or, in the case of passive funds, management's inability to track a benchmark completely.

Depends R (>= 3.2.3), graphics, stats, xts, zoo

Imports Quandl, quantmod, scales

Suggests

License GPL-3

LazyData yes

URL <http://github.com/MeanderReversion/bdrift>

BugReports <http://github.com/MeanderReversion/bdrift/issues>

RoxygenNote 5.0.1

NeedsCompilation no

Author Markus Peter Auer [aut, cre]
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bdrift-package	<i>Analyzing Beta Drift</i>
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Description

bdrift provides tools for analyzing and visualizing beta drift in multi-factor models.

BDA	<i>Beta Drift Anaylsis</i>
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Description

BDA performs a range of parameter instability diagnostics for financial multi-factor models and returns data frames containing the drifting parameters and their standard errors, a list of summary statistics and an overview plot for each factor.

Usage

```
BDA(data, spec, horizon = round(nrow(data) * 0.5) - 1, min.hor = 21,
max.hor = 750, family = gaussian, doplot = TRUE, ...)
```

Arguments

<code>data</code>	an xts object containing all relevant time series. Please note that BDA assumes that the data is ordered so that the most recent data is at the tail of the matrix.
<code>spec</code>	contains the formula for the baseline model.
<code>horizon</code>	the time period for which the parameters should be estimated. (e.g. 250 for a year, assuming daily data). By default, half of the data length is used.
<code>min.hor</code>	the minimum horizon used in the analysis, by default one month, assuming daily data (21 obs if available).
<code>max.hor</code>	the maximum horizon used in the analysis, by default three years, assuming daily data (750 obs if available)
<code>family</code>	type of regression family passed to the <code>glm</code> function. For further details on family types refer to family . Please note that at this point the built-in plotting does not support all families.
<code>doplot</code>	logical. If TRUE, the function returns diagnostic plots for each parameter.
<code>...</code>	additional commands passed to the <code>glm</code> function.

Details

BDA performs a threefold analysis of a user-specified baseline model. First, BDA performs a rolling regression across the entire data frame where `horizon` determines the regression window size. The function includes all rolling parameter estimates and standard errors in the output, so users can access them using `$tdrift` and `$tdrift.se` respectively.

Second, BDA estimates the baseline model parameters with estimation windows of varying length from (`min.hor` to `max.hor`). Users can access the resulting parameter estimates and standard errors using `$hdrift` and `$hdrift.se` respectively.

Third, BDA checks the baseline model for observations that have a noteworthy impact on the parameter estimate.

For further details on the summary statistics output and plotting, please reference [summary.BDA](#) and [plot.BDA](#) respectively.

Although BDA was primarily developed to analyze financial multi-factor models, it is capable to analyze any model fit, as long as the underlying data is of class `xts`. However, BDA was developed with large datasets in mind, so that very small datasets might produce errors or non-sensical results.

Value

a list with 8 elements:

<code>CALL</code>	function call
<code>base.model</code>	baseline model
<code>tdrift</code>	xts matrix containing historical estimates of baseline model
<code>tdrift.se</code>	xts matrix containing historical standard errors of baseline model
<code>hdrift</code>	matrix containing estimates of baseline model with varying horizon lengths
<code>hdrift.se</code>	matrix containing standard errors of baseline model with varying horizon lengths
<code>jackknife</code>	jackknife procedure of object class <code>lm.influence</code>
<code>sumstats</code>	list containing various summary statistics

Author(s)

Markus Peter Auer <mp.auer@meanerreversion.com>

Examples

```
## Not run:
#####
#### 3-Factor Stock Example: ExxonMobil ####
#####

results1 <- BDA(data = FFfactors,
                 spec = (XOM~Mkt.RF + SMB + HML),
                 horizon = 250, doplot = TRUE)

#####
#### 5-Factor Active Fund Example: BlackRock ####
#####

results2 <- BDA(data = FFfactors,
                 spec = (MDLRX~Mkt.RF + SMB + HML + RMW + CMA),
                 horizon = 250, doplot = TRUE)

#####
#### 1-Factor Index Fund Example: Vanguard ####
#####

results3 <- BDA(data = FFfactors, spec = (V00~SP500),
                 horizon = 250, doplot = FALSE)

## End(Not run)
#####
#### CRAN-compatible example ####
#####

results <- BDA(data = FFfactors[nrow(FFfactors):(nrow(FFfactors)-300)],
               spec = (V00~SP500), horizon = 250, doplot = TRUE)
message("NOTE: This is a shortened example. Reference the manual for more complex examples")
```

BDA.loader

Beta Drift Analysis Data Loader

Description

BDA.loader prepares a data frame to be used by the BDA function.

Usage

```
BDA.loader(symbol, frequency = "monthly", xbench = NA, type = "log", ...)
```

Arguments

symbol	stock ticker on Yahoo Finance, enter as character.
frequency	the frequency used to calculate returns ("daily", "monthly", or "yearly")
xbench	ticker symbol of an external benchmark, NA by default.
type	type of returns to be calculated ("log" or "arithmetic"). By default, log returns are used.
...	additional commands passed to the getSymbols function.

Details

BDA.loader pulls stock price data from Yahoo Finance, calculates returns on these prices, downloads factor data from Kenneth French's library (via Quandl.com) and bundles all data in a xts-matrix that can be passed on to the BDA function.

Value

a xts-matrix containing the returns of the security, Kenneth French's asset pricing factors and the external benchmark (optional).

Author(s)

Markus Peter Auer <mp.auer@meanerreversion.com>

Examples

```
testframe <- BDA.loader(symbol = "XOM")
```

FFfactors

Dataset to Estimate Multi-Factor Models for Return Samples

Description

A dataset containing simple daily returns of ExxonMobile, BlackRock's Large Cap Core Inv A fund, and Vanguard 500 ETF fund as well as all necessary factor data from Kenneth French's data library to estimate a five-factor model. The dataset contains data from Sep-09-2010 until Nov-30-2015.

Usage

```
FFfactors
```

Format

A xts object with 1316 rows and 10 variables. The variables are as follows:

XOM simple daily returns of ExxonMobile (NYSE:XOM) less the risk-free rate

MDLRX simple daily returns of BlackRock Large Cap Core Inv A fund (MDLRX) less the risk-free rate

VOO simple daily returns of Vanguard 500 ETF (VOO) less the risk-free rate

SP500 simple daily returns of Standard&Poor's 500 index less the risk-free rate

Mkt.RF simple daily returns of the US market (all NYSE, AMEX, and NASDAQ firms) less the risk-free rate

SMB daily small-minus-big factor(size factor)

HML daily high-minus-low factor(value factor)

RMW daily robust-minus-weak factor(profitability factor)

CMA daily conservative-minus-aggressive factor(investment factor)

RF daily risk-free rate

Source

XOM, MDLRX, VOO, and SP500 was retrieved from Yahoo Finance via `getSymbols` from the `quantmod` package. All other factors were retrieved from Kenneth French's data library *Kenneth French's data library* at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html. RF was originally provided by Ibbotson Associates.

References

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of financial economics*, 33(1), 3-56.

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of financial economics*, 116(1), 1-22.

plot.BDA

Plot Beta Drift Analyses

Description

plot.BDA plots results from beta drift analyses.

Usage

```
## S3 method for class 'BDA'
plot(x, single = FALSE, ...)
```

Arguments

<code>x</code>	an object of class BDA.
<code>single</code>	logical. If TRUE, grouping of plots by parameters is disabled.
<code>...</code>	additional parameters.

Details

`plot.BDA` produces three plots for each parameter of the baseline model of the corresponding BDA function. Unless `single` is set to TRUE, all three plots for a parameter are displayed in a single plot window.

The first plot, titled "time drift", displays the drift of the parameter across time. In addition to the parameter itself, a 15-knot cubic smooth spline is displayed as a light-blue dashed line. The solid horizontal red line represents the parameter estimate of the baseline model with the 95 confidence interval as a red-shaded area surrounding it. The solid horizontal blue line represents the mean of the drift series.

The second plot, titled "horizon drift", displays the drift of the parameter with respect to the estimation window size. In addition to the parameter itself, a 5-knot cubic smooth spline is displayed as a light-blue dashed line. The blue-shaded area represents the 95 parameters. The solid red vertical line highlights the estimation window size of the baseline model.

The third plot, titled "jackknife", displays the outcome of the jackknife procedure for the baseline model. The light red-shaded and dark red-shaded areas represent p-values <0.5 and <0.75 respectively, as implied by the baseline model.

IMPORTANT NOTE: This package was developed with the GUI of RStudio in mind. The plotting function creates a potentially large number of plots which can be comfortably viewed in RStudio, but require some preparations in the standard R GUI. Start by executing `dev.new()`, which opens a graphical device. Next, click the "History" tab and then click "Recording" in the drop-down menu. If you run the plotting function now, you can jump through the plots using the PageUp and PageDown key on your keyboard.

Author(s)

Markus Peter Auer <mp.auer@meanerreversion.com>

Examples

```
## Not run:
#####
####          Full example          #####
#####

results <- BDA(data = FFfactors, spec = (V00~SP500),
               horizon = 250, doplot = FALSE)
plot(results)

## End(Not run)

#####
####          CRAN-compatible example          #####
#####
```

```
#####

results <- BDA(data = FFfactors[nrow(FFfactors):(nrow(FFfactors)-300)],,
               spec = (V00~SP500),horizon = 250, doplot = FALSE)
plot(results)
message("NOTE: This is a shortened example. Reference the manual for more complex examples")
```

print.BDA

Print Beta Drift Analyses

Description

print.BDA prints beta drift analyses.

Usage

```
## S3 method for class 'BDA'
print(x, ...)
```

Arguments

x an object of class BDA.
... additional parameters.

Details

This function prints simplified summary statistics of analyses created by the [BDA](#) function.

Author(s)

Markus Peter Auer <mp.auer@meanerreversion.com>

Examples

```
## Not run:
#####
####           Full example           ####
#####

results <- BDA(data = FFfactors, spec = (V00~SP500),
               horizon = 250, doplot = TRUE)
print(results)

## End(Not run)

#####
####           CRAN-compatible example           ####
#####
```

```
results <- BDA(data = FFfactors[nrow(FFfactors):(nrow(FFfactors)-300)],,
               spec = (V00~SP500),horizon = 250, doplot = FALSE)
print(results)
message("NOTE: This is a shortened example. Reference the manual for more complex examples")
```

summary.BDA

*Summarize Beta Drift Analyses***Description**

summary.BDA summarizes the results of beta drift analyses.

Usage

```
## S3 method for class 'BDA'
summary(object, ...)
```

Arguments

```
object      an object of class BDA.
...         additional parameters.
```

Details

This function prints a detailed summary of the analyses produced by the [BDA](#) function.

Author(s)

Markus Peter Auer <mp.auer@meanerreversion.com>

Examples

```
## Not run:
#####
####          Full example          ####
#####

results <- BDA(data = FFfactors, spec = (V00~SP500),
               horizon = 250, doplot = TRUE)
summary(results)

## End(Not run)

#####
####          CRAN-compatible example          ####
#####

results <- BDA(data = FFfactors[nrow(FFfactors):(nrow(FFfactors)-300)],,
               spec = (V00~SP500),horizon = 250, doplot = FALSE)
summary(results)
message("NOTE: This is a shortened example. Reference the manual for more complex examples")
```

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