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Description The package offers a wide range of functions for term structure estimation based on static and dynamic coupon bond and yield data sets. The implementation focuses on the cubic splines approach of McCulloch (1971, 1975) and the Nelson and Siegel (1987) method with extensions by Svensson (1994),Diebold and Li (2006) and De Pooter (2007). We propose a weighted constrained optimization procedure with analytical gradients and a globally optimal start parameter search algorithm. Extensive summary statistics and plots are provided to compare the results of the different estimation methods. Several demos are available using data from European government bonds and yields.

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termstrc-package . . . 4
aabse . . . 5
bond_prices . . . 6
bond_yields . . . 7
create_cashflows_matrix . . . 7
create_maturities_matrix . . . 8
cSums . . . 9
datadyncouponbonds . . . 10
duration . . . 10
estimateyieldcurve . . . 11
estimatezcyieldcurve . . . 12
estim_cs . . . 12
estim_cs.couponbonds . . . 13
estim_nss . . . 15
estim_nss.couponbonds . . . 16
estim_nss.dyncouponbonds . . . 18
estim_nss.zeroyields . . . 19
fcontrib . . . 21
fcontrib.dyntermstrc_param . . . 21
findstartparambonds . . . 22
findstartparamyields . . . 23
forwardrates . . . 23
fwr_asv . . . 24
fwr_dl . . . 25
fwr_ns . . . 26
fwr_sv . . . 27
get_constraints . . . 28
get_grad_objfct . . . 28
get_grad_objfct_bonds . . . 28
get_objfct . . . 29
get_objfct_bonds . . . 29
get_paramnames . . . 29
get_realnames . . . 30
gi . . . 30
govbonds . . . 31
grad_asv . . . 32
grad_asv_bonds . . . 32
grad_asv_bonds_grid . . . 33
grad_asv_grid . . . 34
grad_dl . . . 34
grad_dl_bonds . . . 35
grad_ns . . . 35

grad_ns_bonds . . . 36
grad_ns_bonds_grid . . . 36
grad_ns_grid . . . 37
grad_sv . . . 37
grad_sv_bonds . . . 38
grad_sv_bonds_grid . . . 38
grad_sv_grid . . . 39
impl_fwr . . . 39
loss_function . . . 40
maturity_range . . . 40
objfct_asv . . . 41
objfct_asv_bonds . . . 41
objfct_asv_bonds_grid . . . 42
objfct_asv_grid . . . 42
objfct_dl . . . 43
objfct_dl_bonds . . . 43
objfct_ns . . . 44
objfct_ns_bonds . . . 44
objfct_ns_bonds_grid . . . 45
objfct_ns_grid . . . 45
objfct_sv . . . 46
objfct_sv_bonds . . . 46
objfct_sv_bonds_grid . . . 47
objfct_sv_grid . . . 47
param . . . 48
param.dyntermstrc_nss . . . 48
param.dyntermstrc_yields . . . 49
plot.df_curves . . . 49
plot.dyntermstrc_nss . . . 50
plot.dyntermstrc_param . . . 51
plot.dyntermstrc_yields . . . 51
plot.error . . . 52
plot.fwr_curves . . . 53
plot.ir_curve . . . 54
plot.spot_curves . . . 54
plot.spsearch . . . 55
plot.s_curves . . . 56
plot.termstrc_cs . . . 57
plot.termstrc_nss . . . 58
plot.zeroyields . . . 59
postpro_bond . . . 59
prepro_bond . . . 60
print.couponbonds . . . 61
print.dyncouponbonds . . . 61
print.dyntermstrc_nss . . . 62
print.dyntermstrc_yields . . . 62
print.summary.dyntermstrc_nss . . . 63
print.summary.dyntermstrc_param . . . 63

print.summary.dyntermstrc_yields . . . 64
print.summary.termstrc_cs . . . 64
print.summary.termstrc_nss . . . 65
print.termstrc_cs . . . 65
print.termstrc_nss . . . 66
print.zeroyields . . . 66
rmse . . . 67
rm_bond . . . 67
rm_bond.couponbonds . . . 68
rm_bond.dyncouponbonds . . . 68
spotrates . . . 69
spr_asv . . . 70
spr_dl . . . 71
spr_ns . . . 72
spr_sv . . . 73
summary.dyntermstrc_nss . . . 74
summary.dyntermstrc_param . . . 74
summary.dyntermstrc_yields . . . 75
summary.termstrc_cs . . . 75
summary.termstrc_nss . . . 76
summary.zeroyields . . . 77
zeroyields . . . 77
zyields . . . 78

Index **79**

`termstrc-package` *Zero-coupon Yield Curve Estimation*

Description

The package offers a wide range of functions for term structure estimation based on static and dynamic coupon bond and yield data sets. The implementation focuses on the cubic splines approach of McCulloch (1971, 1975) and the Nelson and Siegel (1987) method with extensions by Svensson (1994), Diebold and Li (2006) and De Pooter (2007). We propose a weighted constrained optimization procedure with analytical gradients and a globally optimal start parameter search algorithm. Extensive summary statistics and plots are provided to compare the results of the different estimation methods. Several demos are available using data from European government bonds and yields.

References

Robert Ferstl and Josef Hayden (2010): Zero-Coupon Yield Curve Estimation with the Package **termstrc**, *Journal of Statistical Software*, **36(1)**, 1-34. URL http://www.jstatsoft.org/v36/i01/

J. Huston McCulloch (1971): Measuring the Term Structure of Interest Rates. *The Journal of Business, **44** 19–31.*

J. Huston McCulloch (1975): The Tax-Adjusted Yield Curve. *The Journal of Finance, **30** 811–830.*

Charles R. Nelson and Andrew F. Siegel (1987): Parsimonious Modeling of Yield Curves. *The Journal of Business*, **60(4)**:473–489.

Lars E.O. Svensson (1994): Estimating and Interpreting Forward Interest Rates: Sweden 1992 -1994. *Technical Reports 4871, National Bureau of Economic Research*.

Robert R. Bliss (1997): Testing Term Structure Estimation Methods. *Advances in Futures and Options Research, **9** 197–232*.

Bank for International Settlements (2005): Zero-Coupon Yield Curves: Technical Documentation. *BIS Papers, **No. 25***.

F.X. Diebold and C. Li (2006): Forecasting the Term Structure of Government Bond Yields. *Journal of Econometrics*, **130**:337–364.

Michiel De Pooter (2007): Examining the Nelson-Siegel Class of Term Structure Models: In-Sample Fit versus Out-of-Sample Forecasting Performance, *Working paper*.

`aabse` *Average Absolute Mean Error*

Description

Calculation of the average absolute mean error (AABSE). The AABSE is also called mean absolute error (MAE).

Usage

```
aabse(actual, estimated)
```

Arguments

`actual`	vector, consisting of the observed values.
`estimated`	vector, consisting of the estimated values.

Details

Calculation of the AABSE according to the formula:

$$\text{AABSE} = \frac{1}{m}|\boldsymbol{\epsilon}|\boldsymbol{\iota},$$

whereas $\boldsymbol{\epsilon}$ is the vector of the yield or price errors of the bonds and $\boldsymbol{\iota}$ is a column vector filled with ones. m is the number of bonds, for which $\boldsymbol{\epsilon}$ has been calculated.

See Also

`rmse`

bond_prices *Bond Price Calculation*

Description

Function for the calculation of bond prices according to the chosen approach (Diebold/Li, Nelson/Siegel, Svensson) based on the cashflows and maturities matrix of the bonds.

Usage

```
bond_prices(method = "ns", beta, m, cf, lambda)
```

Arguments

method	defines the desired method: "ns" for the Nelson/Siegel,"dl" for Diebold/Li, "sv" for the Svensson approach.
beta	parameter vector, is linked to the chosen approach.
m	maturities matrix, consists of the maturity dates which are appended to the cashflows of the bonds.
cf	cashflows matrix.
lambda	additional parameter for the "dl" spot rate function

Value

Returns a list with:

spot_rates	spot rates matrix
discount_factors	discount factors matrix
bond_prices	bond prices vector

See Also

spotrates

Examples

```
data(govbonds)
cf <- create_cashflows_matrix(govbonds[[1]])
m <- create_maturities_matrix(govbonds[[1]])
beta <- c(0.0511,-0.0124,-0.0303,2.5429)
bond_prices(method="ns",beta,m,cf)$bond_prices
```

bond_yields *Bond Yield Calculation*

Description

Function for the calculation of bond yields.

Usage

```
bond_yields(cashflows, m, searchint = c(-1, 1), tol = 1e-10)
```

Arguments

cashflows	matrix with the cashflows of the bonds, including the current dirty price.
m	maturity matrix of the bonds
searchint	search interval for root finding.
tol	desired accuracy for function uniroot.

Value

The function returns a matrix with the yields of the bonds and the associated maturities.

See Also

uniroot

Examples

```
data(govbonds)
cf_p <- create_cashflows_matrix(govbonds[[1]],include_price=TRUE)
m_p <- create_maturities_matrix(govbonds[[1]],include_price=TRUE)
bond_yields(cf_p,m_p)
```

create_cashflows_matrix *Cashflows Matrix Creation*

Description

Creates a matrix of cashflows for a specified group of bonds for a static bond data set. The number of rows is the number of cashflows for the bond with the longest maturity.

Usage

```
create_cashflows_matrix(group, include_price = FALSE)
```

Arguments

group	static bond data set for a certain group of bonds.
include_price	if TRUE the dirty price is included (default: FALSE).

Value

Returns a matrix which consits of the calculated cashflows.

See Also

create_maturities_matrix

Examples

```
data(govbonds)
(cf <- create_cashflows_matrix(govbonds[[1]]))

## cf matrix with included current dirty price
(cf_p <- create_cashflows_matrix(govbonds[[1]],include_price=TRUE))
```

---

create_maturities_matrix

Maturity Matrix Creation

Description

Creates a matrix of maturities for a specified group of bonds for a static bond data set. The number of rows is the number of cashflows for the bond with the longest maturity.

Usage

```
create_maturities_matrix(group, include_price = FALSE)
```

Arguments

group	static bond data set for a certain group of bonds.
include_price	if TRUE the dirty price is included (default: FALSE).

Value

The maturity matrix is returned.

See Also

create_cashflows_matrix

Examples

```
data(govbonds)
(m <- create_maturities_matrix(govbonds[[1]]))

## maturities matrix with included maturity of the current
## dirty price, i.e., zero.
(m_p <- create_maturities_matrix(govbonds[[1]],include_price=TRUE))
```

---

cSums *Form Column Sums*

Description

Calculates column sums for numer matrices

Usage

```
cSums(x, na.rm = FALSE, dims = 1L)
```

Arguments

x	matrix
na.rm	logical. Should missing values (including NaN) be omitted from the calculations?
dims	integer. Which dimensions are regarded as rows or columns to sum over

Note

The function is an optimized version of colSums and only used for internaly calculations.

See Also

colSums

datadyncouponbonds *German Government Bond Data Set*

Description

Dynamic German government coupon bond data set

Usage

```
data(datadyncouponbonds)
```

Note

If you use your own data set, make sure that the structure is identical to the provided data sets. Use the function `str()` to explore the data set.

duration *Duration, modified Duration and Duration based Weights*

Description

The function calculates the Macauly duration, modified duration and duration based weights.

Usage

```
duration(cf_p, m_p, y)
```

Arguments

`cf_p`	cashflows matrix including the current dirty prices of the bonds.
`m_p`	maturity matrix, the first row is filled with zeros.
`y`	yields of the bonds.

Details

The duration vector is calculated using the following formula:

$$\boldsymbol{d} = \frac{\boldsymbol{\iota}'(\boldsymbol{C} \cdot \boldsymbol{M} \cdot \boldsymbol{D})}{\boldsymbol{\iota}'(\boldsymbol{C} \cdot \boldsymbol{D})},$$

whereas $\boldsymbol{C}$ is the cashflow matrix and $\boldsymbol{M}$ is the maturity matrix. $\boldsymbol{\iota}$ is a column vector filled with ones. $(\cdot)$ denotes a elementwise matrix mulitplication and "$'$" the transpose of a vector (matrix).

The weight ω_j for one bond j is defined as

$$\omega_j = \frac{\frac{1}{d_j}}{\sum_{i=1}^{m} \frac{1}{d_i}},$$

where d_j is the duration of the j-th bond.

Value

The function returns a matrix with three columns, i.e,. duration, modified duration and duration based weights.

Examples

```
data(govbonds)
cf_p <- create_cashflows_matrix(govbonds[[1]],include_price=TRUE)
m_p <- create_maturities_matrix(govbonds[[1]],include_price=TRUE)
y <- bond_yields(cf_p,m_p)
duration(cf_p,m_p,y[,2])
```

---

estimateyieldcurve *Estimate Zero-coupon Yield Curves*

Description

Estimate Zero-coupon Yield curves assuming a certain spot rate function

Usage

```
estimateyieldcurve(method, y, m, beta, lambda,
 objfct, grad_objfct, constraints, constrOptimOptions)
```

Arguments

method	form of the spot rate function
y	yields
m	maturities
beta	parameter vector
lambda	parameter for Diebold/Li
objfct	objective function
grad_objfct	grad_objfct
constraints	parameter constraints
constrOptimOptions	solver options

Details

internal helper function

estimatezcyieldcurve *Estimate Zero-coupon Yield Curves*

Description

Estimate Zero-coupon Yield curves assuming a certain spot rate function

Usage

```
estimatezcyieldcurve(method, startparam, lambda, objfct, grad_objfct,
 constraints, constrOptimOptions, m, cf, weights, p)
```

Arguments

method	form of the spot rate function
startparam	start parameter vector
lambda	parameter for Diebold/Li
objfct	objective function, e.g., sum of the weighted squared price errors
grad_objfct	gradient
constraints	constraints for the solver
constrOptimOptions	solver options
m	maturities
cf	cash flows
weights	weights
p	prices

Details

Used as internal helper function

estim_cs *Cubic Splines Term Structure Estimation*

Description

Function for estimating the term structure of coupon bonds based on cubic splines.

Usage

```
estim_cs(bonddata, group, matrange="all", rse=TRUE)
```

Arguments

bonddata	a data set of bonds in list format.
group	vector defining the group of bonds used for the estimation, e.g., c("GERMANY","AUSTRIA").
matrange	use "all" for no restrictions, or restrict the maturity range used for the estimation with c(lower,upper).
rse	TRUE (default) calculates robust standard erros for the confidence intervalls of the discount curve

See Also

estim_cs.couponbonds

---

estim_cs.couponbonds *S3 Estim_cs Method*

Description

S3 estim.cs method for an object of the class "couponbonds". The method estimates the discount curve with the cubic splines approach by McCulloch (1975).

Usage

```
## S3 method for class 'couponbonds'
estim_cs(bonddata, group, matrange = "all", rse = TRUE)
```

Arguments

bonddata	a data set of bonds in list format.
group	vector defining the group of bonds used for the estimation, e.g., c("GERMANY","AUSTRIA").
matrange	use "all" for no restrictions, or restrict the maturity range used for the estimation with c(lower,upper).
rse	TRUE (default) calculates robust standard erros for the confidence intervalls of the discount curve

Details

- groupThe first element of the vector will be used as the reference country for the spread curve calculation. group can be either a vector of bond groups or a scalar.
- bonddataThe package is designed to work with a certain list data structure. For more information use the function str() to explore the structure of the example data sets.

Value

The function returns an object of the class "termstrc_cs". The object contains the following items (mainly lists):

group	group of bonds (e.g. countries) used for the estimation.
matrange	"none" or a vector with the maturity range.
n_group	length of object group, i.e. the number of countries.
knotpoints	selected knot points for the cubic splines estimation.
spot	zero-coupon yield curves as object of the class "spot_curves".
spread	spread curves as object of the class "s_curves".
forward	forward curves as object of the class "fwr_curves".
discount	discount curves as object of the class "df_curves".
cf	cashflow matrices.
m	maturity matrices.
p	dirty prices.
phat	estimated bond prices.
perrors	pricing errors and maturities as object of the class "error".
y	bond yields.
yhat	one list for each group with the theoretical bond yields calculated with the estimated bond prices phat.
yerrors	yield errors and maturities as object of the class "error".
alpha	OLS coefficients of cubic splines estimation.
regout	OLS estimation results as object of the class "lm".
rse	robust standard errors for confidence interval calculation

Note

For objects of the class "spot_curves", "s_curves", "df_curves", "fwr_curves", "error" appropriate plot methods are offered. For objects of the list item regout standard lm methods apply. For objects of the class "termstrc_cs" print, summary and plot methods are available. Another term structure estimation method is provided by the method

estim_nss.couponbonds.

References

J.Huston McCulloch (1971): Measuring the Term Structure of Interest Rates. *The Journal of Business,* ***44*** *19–31.*

J. Huston McCulloch (1975): The Tax-Adjusted Yield Curve. *The Journal of Finance,* ***30*** *811–830.*

See Also

print.termstrc_cs, summary.termstrc_cs, plot.termstrc_cs,

estim_nss.couponbonds, plot.spot_curves, plot.s_curves, plot.df_curves,

plot.fwr_curves, plot.error, summary.lm, plot.lm.

Examples

```
# load data set
data(govbonds)

# define countries, for which the estimation
# of the zero-coupon yield curves will be carried out
group <- c("GERMANY", "AUSTRIA")

# set maturtiy range
matrange <- c(0, 19)

# perform estimation
x <- estim_cs(govbonds, group, matrange)

# print the obtained parameters of the estimation
print(x)

# goodness of fit measures
summary(x)

# plot the zero-coupon yield curve for each country
plot(x,errors="none")

# plot all zero-coupon yield curves together
plot(x,multiple=TRUE,errors="none")

# spread curve splot
plot(x,ctype="spread",errors="none")

# price error plot for all countries
plot(x,ctype="none")
```

`estim_nss` *Parametric Term Structure Estimation*

Description

Function for estimating the term structure of coupon bonds and yields, with the spot rate function of Diebold/Li, Nelson/Siegel or Svensson.

Usage

```
estim_nss(dataset, ...)
```

Arguments

`dataset`	object of the class `"zeroyields"`, `"couponbonds"` or `"dyncouponbonds"`
`...`	further arguments

See Also

estim_nss.zeroyields, estim_nss.couponbonds, estim_nss.dyncouponbonds

---

estim_nss.couponbonds *S3 Estim_nss Method*

Description

Zero-coupon yield curve estimation with the parametric Nelson/Siegel (1987), Svensson (1994) and Diebold/Li (2006) method. The method requires an object of the class "couponbonds".

Usage

```
## S3 method for class 'couponbonds'
estim_nss(dataset, group, matrange = "all", method = "ns",
 startparam = NULL, lambda = 0.0609 * 12, tauconstr = NULL,
constrOptimOptions = list(control = list(maxit = 2000),
 outer.iterations = 200, outer.eps = 1e-04),...)
```

Arguments

dataset	a static coupon bond data set of the class "couponbonds"
group	vector defining the group of bonds used for the estimation, e.g., c("GERMANY","AUSTRIA"). The spot rate curve of the first group element will be used as the reference curve for the spread curve calculation.
matrange	use "all" for no restrictions, or restrict the maturity range (in years) used for the estimation with c(lower,upper).
method	"ns" for Nelson/Siegel (default), "dl" for Diebold/Li, "sv" for Svensson or "asv" for adjusted Svensson.
startparam	matrix of start parameters (number of columns is the number of parameters). If no start parameters are given, globally optimal parameters are searched automatically (default: NULL)
lambda	parameter on a yearly time scale with fixed value for "dl" spot rate function (default: 0.0609*12)
tauconstr	
constrOptimOptions	list with solver control parameters (default: control=list(), outer.interations=30, outer.eps.=1e-04). For further documentation please refer to optim
...	further arguments

Value

The function nelson_estim returns an object of the class "nelson". The object contains the following items (mainly lists):

group	group of bonds (e.g. countries) used for the estimation.
matrange	"none" or a vector with the maturity range.
method	estimation method ("Nelson/Siegel" or "Svensson").
startparam	calculated starparameters.
n_group	length of object group, i.e. the number of countries.
lambda	lambda parameter of "dl" spot rate function.
spsearch	detailed data from the start parameter search algorithm
spot	zero-coupon yield curves as object of the class "spot_curves".
spread	spread curves as object of the class "s_curves".
forward	forward curves as object of the class "fwr_curves".
discount	discount curves as object of the class "df_curves".
expoints	extrapolation points for Nelson/Siegel method.
cf	cashflow matrices.
m	maturity matrices.
duration	duration matrix, including the modified duration and duration based weights.
p	dirty prices.
phat	estimated bond prices.
perrors	pricing errors and maturities, object of the class "error".
ac	accrued interest
y	bond yields.
yhat	one list for each group with the theoretical bond yields calculated with the estimated bond prices phat.
yerrors	yield errors and maturities as object of the class "error".
opt_result	optimization results from optim, e.g. optimal parameters, convergence info.

Note

An error message concerning the function uniroot() is in general caused by wrongly specified start parameters or by data issues.

For objects of the class "spot_curves", "s_curves", "df_curves", "fwr_curves", "error" appropriate plot methods are offered. For objects of the class "termstrc_nss" print, summary and plot methods are available. Another term structure estimation method is provided by the function estim_cs.

References

Charles R. Nelson and Andrew F. Siegel (1987): Parsimonious Modeling of Yield Curves. *The Journal of Business*, **60(4)**:473–489.

Lars E.O. Svensson (1994): Estimating and Interpreting Forward Interest Rates: Sweden 1992 -1994. *Technical Reports 4871, National Bureau of Economic Research*.

F.X. Diebold and C. Li: Forecasting the Term Structure of Government Bond Yields. *Journal of Econometrics*, **130**:337–364.

See Also

print.termstrc_nss, summary.termstrc_nss, plot.termstrc_nss, estim_cs, plot.spot_curves, plot.s_curves, plot.df_curves, plot.fwr_curves,

plot.error, uniroot.

Examples

```
## Run: demo(nss_static)
```

---

estim_nss.dyncouponbonds

S3 Estim_nss method

Description

The method performs an iterative term structure estimation procedure on a dynamic bond data set of the class "dyncouponbonds". Available methods are Nelson/Siegel, Diebold/Li and (adjusted) Svensson.

Usage

```
## S3 method for class 'dyncouponbonds'
estim_nss(dataset, group, matrange = "all", method = "ns",
 lambda = 0.0609 * 12, tauconstr = NULL, optimtype = "firstglobal",
constrOptimOptions = list(control = list(maxit = 2000),
outer.iterations = 200, outer.eps = 1e-04), ...)
```

Arguments

dataset	dynamic bond data set of the class "dyncouponbonds".
group	vector defining the group of bonds used for the estimation, e.g., c("GERMANY","AUSTRIA").
matrange	use "all" for no restrictions, or restrict the maturity range (in years) used for the estimation with c(lower,upper).
method	"ns" for Nelson/Siegel (default), "dl" for Diebold/Li, "sv" for Svensson or "asv" for adjusted Svensson.

lambda	parameter on a yearly time scale with fixed value for "dl" spot rate function (default: 0.0609*12)
tauconstr	
optimtype	use "firstglobal" for an inital search for globally optimal start parameters or "allglobal" for a search at every iteration.
constrOptimOptions	list with solver control parameters (default: control=list(), outer.interations=30, outer.eps.=1e-04). For further documentation please refer to optim
...	further arguments

Details

The method iteratively applies the method "estim_nss.couponbonds".

Value

The method returns an object of the class "dyntermstrc_nss". The object is a list with sublists of the class "termstrc_nss".

See Also

estim_nss.couponbonds

Examples

```
## Run: demos(nss_dynamic)
```

---

estim_nss.zeroyields *S3 estim_nss Method*

Description

The method performs an iterative term structure estimation procedure on a dynamic yield data set of the class "zeroyields". Available methods are Nelson/Siegel, Diebold/Li and (adjusted) Svensson.

Usage

```
## S3 method for class 'zeroyields'
estim_nss(dataset, method = "ns",
 lambda = 0.0609 *12, tauconstr = NULL, optimtype = "firstglobal",
 constrOptimOptions = list(control = list(),
 outer.iterations = 200, outer.eps = 1e-04), ...)
```

Arguments

`dataset`	dynamic bond data set of the class `"zeroyields"`
`method`	`"ns"` for Nelson/Siegel (default), `"dl"` for Diebold/Li, `"sv"` for Svensson or `"asv"` for adjusted Svensson.
`lambda`	parameter on a yearly time scale with fixed value for `"dl"` spot rate function (default: 0.0609*12)
`tauconstr`	This is vector with parameters for the grid search procedure containing: For parametrizations except Diebold/Li, a grid search for the tau-parameter is performed. The parameters must lie within the following bounds. lower bound < [tau_1, tau_2] < upper bound The width of the grid is given by gridsize. tau_2 - tau_1 > taudistance (upper bound, lower bound, gridsize, tau distance)
`optimtype`	use `"firstglobal"` for an inital search for globally optimal start parameters or `"allglobal"` for a search at every iteration.
`constrOptimOptions`	list with solver control parameters (default: control=list(), outer.interations=30, outer.eps.=1e-04). For further documentation please refer to `optim`
`...`	further arguments

Value

The method returns an object of the class `"dyntermstrc_yields"`. There are print, plot and summary method available.

References

Michiel De Pooter (2007): Examining the Nelson-Siegel Class of Term Structure Models: In-Sample Fit versus Out-of-Sample Forecasting Performance, *Working paper*.

F.X. Diebold and C. Li: Forecasting the Term Structure of Government Bond Yields. *Journal of Econometrics*, **130**:337–364.

Charles R. Nelson and Andrew F. Siegel (1987): Parsimonious Modeling of Yield Curves. *The Journal of Business*, **60(4)**:473–489.

Lars E.O. Svensson (1994): Estimating and Interpreting Forward Interest Rates: Sweden 1992 -1994. *Technical Reports 4871, National Bureau of Economic Research*.

Examples

```
## Run: demo(zeroyields)
```

`fcontrib` *Plot Factor Contribution*

Description

The function plots the factor contribution of the parameters of the different spot rate functions at a certain point in time.

Usage

```
fcontrib(x, method = "ns", lambda = 0.0609 * 12, index = 1,
 m = 1:10, ylim = NULL, ...)
```

Arguments

`x`	object of the class `dyntermstrc_param`
`method`	Spot rate function, one of the following `"ns","sv","dl","sv"`
`lambda`	additional parameter for `"dl"` spot rate function.
`index`	specific point in time
`m`	maturity spectrum for the plot, e.g., `"c(min,max)"`
`ylim`	range of the y axis.
`...`	further arguments

`fcontrib.dyntermstrc_param` *S3 fcontrib Method*

Description

S3 fcontrib method for objects of the class `"dyntermstrc_param"`. The function plots the factor contribution of the parameters of the different spot rate functions at a certain point in time.

Usage

```
## S3 method for class 'dyntermstrc_param'
fcontrib(x, method = "ns", lambda = 0.0609 * 12, index = 1,
m = 1:10, ylim = NULL, ...)
```

Arguments

x	object of the class dyntermstrc_param
method	Spot rate function, one of the following "ns","sv","dl","sv"
lambda	additional parameter for "dl" spot rate function.
index	specific point in time
m	maturity spectrum for the plot, e.g., "c(min,max)"
ylim	range of the y axis.
...	further arguments

---

findstartparambonds *Find Globally Optimal Startparameters*

Description

Start parameter search routine for term structure estimation based on a coupon bond data set. The algorithm searches for the parameters over a grid spanned over tau1 (tau2).

Usage

```
findstartparambonds(p, m, cf, weights, method, tauconstr,
 control = list(), outer.iterations = 30, outer.eps = 1e-04)
```

Arguments

p	price vector
m	maturites matrix
cf	cashflows matrix
weights	duration based weights
method	form of the spot rate function
tauconstr	
control	solver control parameters, for details see optim
outer.iterations	see constrOptim
outer.eps	see constrOptim

Details

Used as internal helper function

Value

Returns an object of the class "spsearch", which includes the startparameters and details concerning the optimization.

findstartparamyields *Find Globally Optimal Start Parameters*

Description

Start parameter search routine for term structure estimation based on a yield data set. The algorithm searches for the parameters over a grid spanned over tau1 (tau2).

Usage

```
findstartparamyields(y,m, method, tauconstr,
control = list(), outer.iterations = 30, outer.eps = 1e-04)
```

Arguments

y	yields
m	maturities
method	type of spot rate function
tauconstr	tau parameter constraints
control	solver control parameters, for details see optim
outer.iterations	see constrOptim
outer.eps	see constrOptim

Details

Used as internal helper function

Value

Returns an object of the class "spsearch", which includes the startparameters and details concerning the optimization.

forwardrates *Forward Rate Calculation*

Description

Calculates forward rates according to the Diebold/Li, Nelson/Siegel, Svensson approach.

Usage

```
forwardrates(method, beta, m, lambda)
```

Arguments

method	forward rate function type: "dl" for Diebold/Li, "ns" for Nelson/Siegel, "sv" for Svensson,"asv" for adjusted Svensson.
beta	parameter vector $\boldsymbol{\beta}$.
m	maturity or a vector of maturities.
lambda	$= 1/\tau_1$, a scalar; only required for Diebold/Li forward rate function

Value

The function returns a vector with the calculated forward rates.

See Also

fwr_dl, fwr_ns, fwr_sv

Examples

```
forwardrates(method="ns",beta=c(0.03,0.02,0.01,5),m=1:30)
```

---

fwr_asv *Forward Rate Calculation according to an adjusted Svensson Version*

Description

The function calculates the forward rates based on a given parameter and maturity vector.

Usage

```
fwr_asv(beta, m)
```

Arguments

beta	parameter vector $\boldsymbol{\beta} = (\beta_0, \beta_1, \beta_2, \tau_1, \beta_3, \tau_2)$.
m	maturity or vector of maturities.

Details

The forward rate for a maturity m is calculated according to the following formula:

$$f(m, \boldsymbol{\beta}) = \beta_0 + \beta_1 \exp\left(-\frac{m}{\tau_1}\right) + \beta_2 \left[\left(\frac{m}{\tau_1}\right) \exp\left(-\frac{m}{\tau_1}\right)\right] + \beta_3 \left[\exp\left(-\frac{m}{\tau_2}\right) + \left(\frac{2m}{\tau_2} - 1\right) \exp\left(-\frac{2m}{\tau_2}\right)\right].$$

Value

Returns the a vector with the calculated forward rate (vector).

References

Lars E.O. Svensson (1994): Estimating and Interpreting Forward Interest Rates: Sweden 1992 -1994. *Technical Reports 4871, National Bureau of Economic Research*.

See Also

forwardrates

Examples

```
fwr_asv(c(0.03,0.02,0.01,5,0.01,10),1:30)
```

`fwr_dl` *Forward Rate Calculation according to Diebold/Li.*

Description

Calculate forward rates according to Diebold/Li(2006).

Usage

```
fwr_dl(beta, m, lambda)
```

Arguments

`beta`	parameter vector $\boldsymbol{\beta} = (\beta_0, \beta_1, \beta_2)$.
`m`	maturity or maturity vector.
`lambda`	$= \frac{1}{\tau_1}$, a scalar

Details

The forward rate for a maturity m is calculated according to the following formula:

$$f(m, \boldsymbol{\beta}, \lambda) = \beta_0 + \beta_1 \exp(-m\lambda) + \beta_2 \left[(m\lambda) \exp(-m\lambda)\right].$$

Value

The function returns the calculated forward rate (vector).

References

F.X. Diebold and C. Li: Forecasting the Term Structure of Government Bond Yields. *Journal of Econometrics*, **130**:337–364.

See Also

fwr_sv,fwr_ns, forwardrates

Examples

```
fwr_dl(beta=c(0.03,0.02,0.01),1:30,lambda=1/5)
```

`fwr_ns` *Forward Rate Calculation according to Nelson/Siegel.*

Description

Calculate forward rates according to Nelson/Siegel(1987).

Usage

```
fwr_ns(beta, m)
```

Arguments

`beta`	parameter vector $\boldsymbol{\beta} = (\beta_0, \beta_1, \beta_2, \tau_1)$.
`m`	maturity or maturity vector.

Details

The forward rate for a maturity m is calculated using the following relation:

$$f(m, \boldsymbol{\beta}) = \beta_0 + \beta_1 \exp\left(-\frac{m}{\tau_1}\right) + \beta_2 \left[\left(\frac{m}{\tau_1}\right) \exp\left(-\frac{m}{\tau_1}\right)\right].$$

Value

The function returns the calculated forward rate (vector).

References

Charles R. Nelson and Andrew F. Siegel (1987): Parsimonious Modeling of Yield Curves. *The Journal of Business*, **60(4)**:473–489.

See Also

`fwr_sv`,`fwr_dl`, `forwardrates`

Examples

```
fwr_ns(beta=c(0.03,0.02,0.01,5),1:30)
```

`fwr_sv` *Forward Rate Calculation according to Svensson (1994).*

Description

Calculate forward rates according to Svensson (1994).

Usage

```
fwr_sv(beta, m)
```

Arguments

`beta`	parameter vector $\boldsymbol{\beta} = (\beta_0, \beta_1, \beta_2, \tau_1, \beta_3, \tau_2)$.
`m`	maturity or vector of maturities.

Details

The forward rate for a maturity m is calculated according to the following formula:

$$f(m, \boldsymbol{\beta}) = \beta_0 + \beta_1 \exp\left(-\frac{m}{\tau_1}\right) + \beta_2 \left[\left(\frac{m}{\tau_1}\right) \exp\left(-\frac{m}{\tau_1}\right)\right] + \beta_3 \left[\left(\frac{m}{\tau_2}\right) \exp\left(-\frac{m}{\tau_2}\right)\right].$$

Value

Returns the a vector with the calculated forward rate (vector).

References

Lars E.O. Svensson (1994): Estimating and Interpreting Forward Interest Rates: Sweden 1992 -1994. *Technical Reports 4871, National Bureau of Economic Research*.

See Also

`fwr_ns`,`fwr_dl` `forwardrates`

Examples

```
fwr_sv(c(0.03,0.02,0.01,5,0.01,10),1:30)
```

get_constraints *Constraints Selection*

Description

Selection of the appropriate contraints for constrOptim()

Usage

```
get_constraints(method, tauconstr)
```

Arguments

method	term structure estimation method
tauconstr	constraints on tau parameters

get_grad_objfct *Gradient Selection Function*

Description

Selects the appropriate gradient of the objective function

Usage

```
get_grad_objfct(method)
```

Arguments

method	term structure estimation method

get_grad_objfct_bonds *Gradient Selection Function*

Description

Selects the appropriate gradient of the objective function for a bond data set

Usage

```
get_grad_objfct_bonds(method)
```

Arguments

method	term structure estimation method

get_objfct *Objective Function Selection*

Description

Based on a chosen method the objective function is selected

Usage

```
get_objfct(method)
```

Arguments

method	term structure estimation method

get_objfct_bonds *Objective Function Selection*

Description

Based on a chosen method the objective function for a bond data set is selected

Usage

```
get_objfct_bonds(method)
```

Arguments

method	term structure estimation method

get_paramnames *Parameter Names*

Description

Parameter Names for term structure estimation methods

Usage

```
get_paramnames(method)
```

Arguments

method	form of the spot rate function,i.e., one of the following "ns","sv","asv","dl"

Value

Returns a character string with the names of the elements of the parameter vector.

Examples

```
get_paramnames("ns")
```

---

get_realnames *Name Conversion*

Description

Converts Term Structure Method Into Real Name

Usage

```
get_realnames(method)
```

Arguments

method	form of the spot rate function, i.e., "ns","sv","asv","dl"

Value

Returns a character string with the real name

Examples

```
get_realnames("asv")
```

---

gi *Cubic Functions*

Description

Calculation of the cubic functions according to the approach of McCulloch (1975).

Usage

```
gi(t, T, i, s)
```

Arguments

t	maturity.
T	knot points.
i	index.
s	number of basis functions.

References

J. Huston McCulloch (1975): The Tax-Adjusted Yield Curve. *The Journal of Finance, **30** 811–830.*

---

govbonds *European Government Bonds*

Description

European government bonds.

Usage

```
data(govbonds)
```

Details

The data set bonds consists of German, Austrian and French government bonds.

Note

If you use your own data set, make sure that the structure is identical to the provided data sets. Use the function `str()` to explore the data set.

Examples

```
data(govbonds)
str(govbonds)



# The following code may be used to generate an empty data set,
# which can then be filled with bond data:

ISIN <- vector()
MATURITYDATE <- vector()
ISSUEDATE <- vector()
COUPONRATE <- vector()
PRICE <- vector()
ACCRUED <- vector()

CFISIN <- vector()
CF <- vector()
DATE <- vector()

CASHFLOWS <- list(CFISIN,CF,DATE)
names(CASHFLOWS) <- c("ISIN","CF","DATE")

TODAY <- vector()
```

```
mycountry1 <- list(ISIN,MATURITYDATE,ISSUEDATE,
                   COUPONRATE,PRICE,ACCRUED,CASHFLOWS,TODAY)
mycountry2 <- list(ISIN,MATURITYDATE,ISSUEDATE,
                   COUPONRATE,PRICE,ACCRUED,CASHFLOWS,TODAY)

names(mycountry1) <- c("ISIN","MATURITYDATE","ISSUEDATE","COUPONRATE",
                       "PRICE","ACCRUED","CASHFLOWS","TODAY")
names(mycountry2) <- c("ISIN","MATURITYDATE","ISSUEDATE","COUPONRATE",
                       "PRICE","ACCRUED","CASHFLOWS","TODAY")

mybonds <- list(mycountry1,mycountry2)

names(mybonds) <- c("mycountry1","mycountry2")
class(mybonds) <- "couponbonds"
```

---

grad_asv *Gradient of the adjusted Svensson Loss Function for Yields*

Description

Calculates the gradient of the adjusted Svensson Loss Function for Yields

Usage

```
grad_asv(beta, m, y)
```

Arguments

beta	Parameter of the adjusted Svensson spot rate function (for details see spr_asv).
m	maturity vector
y	yield vector

See Also

objfct_asv,spr_asv

---

grad_asv_bonds *adjusted Svensson Gradient Function*

Description

Calculates the gradient of the objective function. The objective function minimizes the sum of the weighted squared price errors. The spot rate function is based on an adjusted version of Svensson.

Usage

```
grad_asv_bonds(beta,m, cf, w, p)
```

Arguments

beta	Spot rate parameter vector
m	maturity matrix
cf	cashflow matrix
w	weights vector
p	price vector

Value

returns the gradient vector

---

grad_asv_bonds_grid *adjusted Svensson Gradient Function for the Grid Search*

Description

Calculates the gradient of the objective function for the grid search. The objective function minimizes the sum of the weighted squared price errors. The spot rate function is based on an adjusted version of Svensson.

Usage

```
grad_asv_bonds_grid(beta, tau, m, cf, w, p)
```

Arguments

beta	Spot rate parameter vector
tau	fixed parameters
m	maturity matrix
cf	cashflow matrix
w	weights vector
p	price vector

Value

returns the gradient vector

grad_asv_grid *Adjusted Svensson Gradient Function for the Grid Search*

Description

Calculates the gradient of the objective function for the grid search. The objective function minimizes the sum of the squared yield errors. The spot rate function is based on the adjusted version of Svensson.

Usage

```
grad_asv_grid(beta, tau, m, y)
```

Arguments

beta	Spot rate function parameter vector
tau	fixed parameters
m	maturity vector
y	yield vector

grad_dl *Gradient of the Diebold/Li Loss Function for Yields*

Description

Calculates the gradient of the Diebold/Li Loss Function for Yields

Usage

```
grad_dl(beta, lambda, m, y)
```

Arguments

beta	Parameter of the Diebold/Li spot rate function
lambda	constant parameter of the Diebold/Li spot rate function
m	maturity vector
y	yield vector

grad_dl_bonds *Diebold/Li Gradient function*

Description

Calculates the gradient of the objective function. The objective function minimizes the sum of the weighted squared price errors. The spot rate function is based on Diebold/Li.

Usage

```
grad_dl_bonds(beta, lambda, m, cf, w, p)
```

Arguments

beta	Spot rate parameter vector
lambda	fixed spot rate parameter
m	maturity matrix
cf	cashflow matrix
w	weights vector
p	price vector

Value

returns the gradient vector

grad_ns *Gradient of the Nelson/Siegel Loss Function for Yields*

Description

Calculates the gradient of the Nelson/Siegel Loss Function for Yields

Usage

```
grad_ns(beta, m, y)
```

Arguments

beta	Parameter of the Nelson/Siegel spot rate function (for details see spr_ns).
m	maturity vector
y	yield vector

See Also

objfct_ns,spr_ns

grad_ns_bonds *Nelson/Siegel Gradient Function*

Description

Calculates the gradient of the objective function. The objective function minimizes the sum of the weighted squared price errors. The spot rate function is based on Nelson/Siegel.

Usage

```
grad_ns_bonds(beta, m, cf, w, p)
```

Arguments

beta	Spot rate parameter vector
m	maturity matrix
cf	cashflow matrix
w	weights vector
p	price vector

Value

returns the gradient vector

grad_ns_bonds_grid *Nelson/Siegel Gradient Function for the Grid Search*

Description

Calculates the gradient of the objective function for the grid search. The objective function minimizes the sum of the weighted squared price errors. The spot rate function is based on Nelson/Siegel.

Usage

```
grad_ns_bonds_grid(beta, tau, m, cf, w, p)
```

Arguments

beta	Spot rate parameter vector
tau	fixed parameters
m	maturity matrix
cf	cashflow matrix
w	weights vector
p	price vector

Value

returns the gradient vector

`grad_ns_grid` *Nelson/Siegel Gradient Function for the Grid Search*

Description

Calculates the gradient of the objective function for the grid search. The objective function minimizes the sum of the squared yield errors. The spot rate function is based on Nelson/Siegel.

Usage

```
grad_ns_grid(beta, tau, m, y)
```

Arguments

`beta`	Spot rate function parameter vector
`tau`	fixed parameters
`m`	maturity vector
`y`	yield vector

`grad_sv` *Gradient of the Svensson Loss Function for Yields*

Description

Calculates the gradient of the Svensson Loss Function for Yields

Usage

```
grad_sv(beta, m, y)
```

Arguments

`beta`	Parameter of the Svensson spot rate function.
`m`	maturity vector
`y`	yield vector

grad_sv_bonds *Svensson Gradient Function*

Description

Calculates the gradient of the objective function. The objective function minimizes the sum of the weighted squared price errors. The spot rate function is based on Svensson.

Usage

```
grad_sv_bonds(beta, m, cf, w, p)
```

Arguments

beta	Spot rate parameter vector
m	maturity matrix
cf	cashflow matrix
w	weights vector
p	price vector

Value

returns the gradient vector

grad_sv_bonds_grid *Svensson Gradient Function for the Grid Search*

Description

Calculates the gradient of the objective function for the grid search. The objective function minimizes the sum of the weighted squared price errors. The spot rate function is based on Svensson.

Usage

```
grad_sv_bonds_grid(beta, tau, m, cf, w, p)
```

Arguments

beta	Spot rate parameter vector
tau	fixed parameters
m	maturity matrix
cf	cashflow matrix
w	weights vector
p	price vector

Value

returns the gradient vector

`grad_sv_grid` *Svensson Gradient Function for the Grid Search*

Description

Calculates the gradient of the objective function for the grid search. The objective function minimizes the sum of the squared yield errors. The spot rate function is based on Svensson.

Usage

```
grad_sv_grid(beta, tau, m, y)
```

Arguments

`beta`	Spot rate function parameter vector
`tau`	fixed parameters
`m`	maturity vector
`y`	yield vector

`impl_fwr` *Implied Forward Rate Calculation*

Description

Calculates the implied forward rates from given spot rates.

Usage

```
impl_fwr(m, s)
```

Arguments

`m`	maturity vector.
`s`	spot rate vector.

Details

Implied forward rates can be calculated using the following relationship:

$$f(t', T) = \frac{s(m_T)m_T - s(m_{t'})m_{t'}}{m_T - m_{t'}},$$

whereas $s(m_T), s(m_{t'})$ is the spot rate for a maturity $m_T, m_{t'}$ respectively.

Value

The function returns the calculated forward rate vector.

Examples

```
s <-  spr_ns(c(0.03,0.02,0.01,5),1:30)
impl_fwr(s,m=1:30)
```

`loss_function` *Loss Function used for the Term Structure Estimation*

Description

The loss function defines the objective function used for the optimisation. In case of term structure estimation the objective function is the sum of the weighted squared price errors.

Usage

```
loss_function(p, phat, omega)
```

Arguments

`p`	vector of observed prices.
`phat`	vector of estimated prices.
`omega`	weights vector, e.g., duration based weights.

`maturity_range` *Restricting a Bond Dataset*

Description

The function restricts a bond data set to a specified maturity range.

Usage

```
maturity_range(bonddata, lower, upper)
```

Arguments

`bonddata`	bond data set.
`lower`	lower bound of maturity spectrum.
`upper`	upper bound of maturity spectrum.

Note

Internal helper function.

objfct_asv *Adjusted Svensson Loss Function for Yields*

Description

Calculates the sum of the squared spot rate error.

Usage

```
objfct_asv(beta, m, y)
```

Arguments

beta	Paramter vector of the adjusted Svensson spot rate function (for details see: spr_asv),
m	maturity vector
y	observed yield vector

See Also

spotrates, spr_asv

objfct_asv_bonds *Adjusted Svensson Loss Function for Bonds*

Description

Calculates the sum of the weighted squared price error.

Usage

```
objfct_asv_bonds(beta, m, cf, w, p)
```

Arguments

beta	Paramter vector of the adjusted Svensson spot rate function
m	maturity matrix
cf	cashflow matrix
w	weights
p	price vector

objfct_asv_bonds_grid *Adjusted Svensson Grid Loss Function for Bonds*

Description

Calculates the sum of the weighted squared price error.

Usage

```
objfct_asv_bonds_grid(beta, tau, m, cf, w, p)
```

Arguments

beta	Beta parameters of adjusted Svensson spot rate function
tau	Tau parameters of adjusted Svensson spot rate function
m	maturity matrix
cf	cashflow matrix
w	weights vector
p	price vector

objfct_asv_grid *Adjusted Svensson Grid Loss Function for Yields*

Description

Calculates the sum of the squared yield error.

Usage

```
objfct_asv_grid(beta, tau,  m, y)
```

Arguments

beta	Beta parameters of adjusted Svensson spot rate function
tau	Tau parameters of adjusted Svensson spot rate function
m	maturity vector
y	yield vector

objfct_dl *Diebold/Li Loss Function for Yields*

Description

Calculates the sum of the squared spot rate error.

Usage

```
objfct_dl(beta, lambda, m, y)
```

Arguments

beta	Paramter vector of the Diebold/Li spot rate function (for details see: spr_dl),
lambda	Fixed spot rate function parameter
m	maturity vector
y	observed yield vector

objfct_dl_bonds *Diebold/Li Loss Function for Bonds*

Description

Calculates the sum of the weighted squared price error.

Usage

```
objfct_dl_bonds(beta, lambda, m, cf, w, p)
```

Arguments

beta	Paramter vector of the Diebold/Li spot rate function
lambda	Lambda of the Diebold/Li spot rate function
m	maturity matrx
cf	cashflow matrix
w	weights vector
p	price vector

objfct_ns — *Nelson/Siegel Loss Function for Yields*

Description

Calculates the sum of the squared spot rate error.

Usage

```
objfct_ns(beta, m, y)
```

Arguments

beta	Paramter vector of the Nelson/Siegel spot rate function (for details see: spr_ns),
m	maturity vector
y	observed yield vector

See Also

spotrates, spr_ns

objfct_ns_bonds — *Nelson/Siegel Loss Function for Bonds*

Description

Calculates the sum of the weighted squared price error.

Usage

```
objfct_ns_bonds(beta, m, cf, w, p)
```

Arguments

beta	Parameter vector of the Nelson/Siegel spot rate function
m	maturity matrix
cf	cashflow matrix
w	weights
p	price vector

objfct_ns_bonds_grid *Nelson/Siegel Grid Loss Function for Bonds*

Description

Calculates the sum of the weighted squared price error.

Usage

```
objfct_ns_bonds_grid(beta, tau, m, cf, w, p)
```

Arguments

beta	Beta parameters of the Svensson spot price function
tau	Tau parameters of the Svensson spot price function
m	maturities matrix
cf	cash flows matrix
w	weights vector
p	price vector

objfct_ns_grid *Nelson/Siegel Grid Loss Function for Yields*

Description

Calculates the sum of the squared yield error.

Usage

```
objfct_ns_grid(beta, tau,  m, y)
```

Arguments

beta	Beta parameters of the Nelson/Siegel spot rate function
tau	Tau parameter of Nelson/Siegel spot rate function
m	maturity vector
y	yield vector

objfct_sv *Svensson Loss Function for Yields*

Description

Calculates the sum of the squared spot rate error.

Usage

```
objfct_sv(beta, m, y)
```

Arguments

beta	Paramter vector of the Svensson spot rate function (for details see: spr_sv),
m	maturity vector
y	observed yield vector

See Also

spotrates, spr_sv

objfct_sv_bonds *Svensson Loss Function for Bonds*

Description

Calculates the sum of the weighted squared price error.

Usage

```
objfct_sv_bonds(beta, m, cf, w, p)
```

Arguments

beta	Parameter vector of the Svensson spot rate function.
m	maturity matrix
cf	cashflow matrix
w	weights
p	price vector

objfct_sv_bonds_grid *Svensson Grid Loss Function for Bonds*

Description

Calculates the sum of the weighted squared price error.

Usage

```
objfct_sv_bonds_grid(beta, tau, m, cf, w, p)
```

Arguments

beta	Beta parameters of the Svensson spot price function
tau	Tau parameters of the Svensson spot price function
m	maturities matrix
cf	cash flows matrix
w	weights vector
p	price vector

objfct_sv_grid *Svensson Grid Loss Function for Bonds*

Description

Calculates the sum of the squared yield error.

Usage

```
objfct_sv_grid(beta, tau,  m, y)
```

Arguments

beta	Beta parameters of the Svensson spot rate function
tau	Tau parameters of the Svensson spot rate function
m	maturity vector
y	yield vector

param *Term Structure Parameter Extraction*

Description

The function extracts the estimated term structure parameters

Usage

```
param(x, ...)
```

Arguments

x	object of the class "dyntermstrc_yields" or "dyntermstrc_nss"
...	further arguments

Details

For the class "dyntermstrc_param" print, summary and plot methods are offered.

Value

Returns a list of the class "dyntermstrc_param"

See Also

param.dyntermstrc_nss, param.dyntermstrc_yields, summary.dyntermstrc_param, plot.dyntermstrc_param

param.dyntermstrc_nss *S3 Param Method*

Description

The function extracts the estimated term structure parameters from an object of the class "dyntermstrc_nss".

Usage

```
## S3 method for class 'dyntermstrc_nss'
param(x, ...)
```

Arguments

x	object of the class "dyntermstrc_nss"
...	further arguments

See Also

param

`param.dyntermstrc_yields` *S3 Param Method*

Description

The function extracts the estimated term structure parameters from an object of the class "dyntermstrc_yields".

Usage

```
## S3 method for class 'dyntermstrc_yields'
param(x, ...)
```

Arguments

x	object of the class "dyntermstrc_yields"
...	further arguments

See Also

param

`plot.df_curves` *S3 Plot Method*

Description

S3 plot method for an object of the class "df_curves".

Usage

```
## S3 method for class 'df_curves'
plot(x, multiple = FALSE,
ylim = c(range(mapply(function(i) range(x[[i]][, 2]),
seq(x)))) * 100, xlim = c(), type = "l", lty = 1, lwd = 2,
expoints = NULL, ylab = "Discount factor (percent)",
xlab = "Maturity (years)", main = "Discount factor curves", ...)
```

Arguments

x	object of the class "df_curves".
multiple	if TRUE all discount factor curves are plotted togehter (default: FALSE).
ylim	the y limits of the plot, for details see plot.default.
xlim	the x limits of the plot, for details see plot.default.
type	1-character string giving the type of plot desired, for details see plot.default.
lty	the line type, for details see par.
lwd	the line width, for details see par.
expoints	extrapolation points (default: NULL).
ylab	a label for the y axis, for details see plot.default.
xlab	a label for the x axis, for details see plot.default.
main	a main title for the plot, for details see title.
...	other graphical parameters, see par.

See Also

plot.fwr_curves, plot.s_curves, plot.spot_curves

---

plot.dyntermstrc_nss *S3 Plot Method*

Description

Plot method for objects of the class "dyntermstrc_nss". The method plots the estimated three-dimensional spot rate curve.

Usage

```
## S3 method for class 'dyntermstrc_nss'
plot(x, range = c(0, 20), ...)
```

Arguments

x	object of the class "dyntermstrc_nss"
range	maturity range, e.g., c(0,20) (default)
...	further arguments

plot.dyntermstrc_param

S3 Plot Method

Description

Plot method for objects of the class "dyntermstrc_param". The method is able to plot the time series of the parameter levels and first differences and the empirical (partial) autocorrelation function.

Usage

```
## S3 method for class 'dyntermstrc_param'
plot(x, type = "param", ...)
```

Arguments

x	object of the class "dyntermstrc_param"
type	"param" (default) for the parameters, "diffparam" for the parameter differences and "acf" for the plot of the (partial) autocorrelation function of the parameters.
...	further arguments

plot.dyntermstrc_yields

S3 Plot Method

Description

Plot method for object of the class "dyntermstrc_yields". The method plot the estimated three-dimensional spot rate curve.

Usage

```
## S3 method for class 'dyntermstrc_yields'
plot(x, ...)
```

Arguments

x	object of the class "dyntermstrc_yields".
...	further arguments.

plot.error *S3 Plot Method*

Description

S3 plot method for an object of the class error.

Usage

```
## S3 method for class 'error'
plot(x, type = "b", main = "", mar = c(7, 6, 6, 2) + 0.1,
oma = c(4, 2, 2, 2) + 0.1, ylab = "Error", ...)
```

Arguments

x	object of the class error.
type	1-character string giving the type of plot desired, for details see plot.default.
main	a main title for the plot, for details see title.
mar	A numerical vector of the form 'c(bottom, left, top, right)' which gives the number of lines of margin to be specified on the four sides of the plot, for details see par.
oma	A vector of the form 'c(bottom, left, top, right)' giving the size of the outer margins in lines of text.
ylab	a label for the y axis, for details see plot.default.
...	other graphical parameters, see par.

Details

Absolute yield and price errors as a resuslt of the term structure estimation can be plotted. The scaling of the x axis depends on the maturity of the bonds, each bond is labeled with its ISIN number. The error plots seems especially useful in identifying misspriced bonds. For removing them, the function rm_bond may be applied.

See Also

rm_bond

plot.fwr_curves *S3 Plot Method*

Description

S3 plot method for an object of the class "fwr_curves".

Usage

```
## S3 method for class 'fwr_curves'
plot(x, multiple = FALSE,
ylim = c(range(mapply(function(i) range(x[[i]][, 2]),
seq(x)))) * 100, xlim = c(), type = "l", lty = 1,
lwd = 2, expoints = NULL, ylab = "Forward rate (percent)",
xlab = "Maturity (years)", main = "Forward rate curves", ...)
```

Arguments

x	object of the class "fwr_curves".
multiple	if TRUE all forward rate curves are plotted together (default: FALSE).
ylim	the y limits of the plot, for details see plot.default.
xlim	the x limits of the plot, for details see plot.default.
type	1-character string giving the type of plot desired, for details see plot.default.
lty	the line type, for details see par.
lwd	the line width, for details see par.
expoints	extrapolation points (default: NULL).
ylab	a label for the y axis, for details see plot.default.
xlab	a label for the x axis, for details see plot.default.
main	a main title for the plot, for details see title.
...	other graphical parameters, see par.

See Also

plot.df_curves, plot.s_curves, plot.spot_curves

plot.ir_curve *S3 Plot Method*

Description

S3 plot method for an object of the class "ir_curve".

Usage

```
## S3 method for class 'ir_curve'
plot(x, ylim = c(), xlim = c(), lwd = 2, type = "l",
xlab = "Maturity (years)", ylab = "Zero-coupon yields (in percent)",
col = "steelblue", lty = 1, ...)
```

Arguments

x	object of the class "ir_curve".
ylim	the y limits of the plot, for details see plot.default.
xlim	the x limits of the plot, for details see plot.default.
lwd	the line width, for details see par.
type	1-character string giving the type of plot desired, for details see plot.default.
xlab	a label for the x axis, for details see plot.default.
ylab	a label for the y axis, for details see plot.default.
col	the colors for lines and points.
lty	the line type, for details see par.
...	other graphical parameters, see par.

plot.spot_curves *S3 Plot Method*

Description

S3 plot method for an object of the class "spot_curves".

Usage

```
## S3 method for class 'spot_curves'
plot(x, multiple = FALSE,
ylim = c(range(mapply(function(i) range(x[[i]][, 2]),
seq(x)))) * 100, xlim = c(), type = "l", lty = 1,
lwd = 2, expoints = NULL, ylab = "Zero-coupon yields (percent)",
xlab = "Maturity (years)", main = "Zero-coupon yield curves", ...)
```

Arguments

x	object of the class "spot_curves".
multiple	if TRUE all zero-coupon yield curves are plotted together (default: FALSE).
ylim	the y limits of the plot, for details see plot.default.
xlim	the x limits of the plot, for details see plot.default.
type	1-character string giving the type of plot desired, for details see plot.default.
lty	the line type, for details see par.
lwd	the line width, for details see par .
expoints	extrapolation points (default: NULL.)
ylab	a label for the y axis, for details see plot.default.
xlab	a label for the x axis, for details see plot.default.
main	a main title for the plot, for details see title.
...	other graphical parameters, see par.

See Also

plot.df_curves, plot.fwr_curves, plot.s_curves

---

plot.spsearch *S3 Plot Method*

Description

S3 plot method for objects of the class "spsearch". The methods plot details on the objective function of the start parameter search.

Usage

```
## S3 method for class 'spsearch'
plot(x, main = "Start parameter search", rgl=TRUE, ...)
```

Arguments

x	object of the class "spsearch".
main	title.
rgl	if TRUE (default) the rgl device will be used for the plot.
...	further arguments.

`plot.s_curves` *S3 Plot Method*

Description

S3 plot method for an object of the class `"s_curves"`.

Usage

```
## S3 method for class 's_curves'
plot(x, xlim = c(range(mapply(function(i) range(x[[i]][, 1]), seq(x)))),
ylim = c(range(mapply(function(i) range(x[[i]][, 2]),
seq(x)))) * 10000, expoints = NULL,
xlab = "Maturity (years)", ylab = "Spread (basis points)",
lwd = 2, lty = 1, main = "Spread curves", ...)
```

Arguments

`x`	object of the class `"s_curves"`.
`ylim`	the y limits of the plot, for details see `plot.default`.
`xlim`	the x limits of the plot, for details see `plot.default`.
`lty`	the line type, for details see `par`.
`lwd`	the line width, for details see `par`.
`expoints`	extrapolation points (default: `NULL`).
`ylab`	a label for the y axis, for details see `plot.default`.
`xlab`	a label for the x axis, for details see `plot.default`.
`main`	a main title for the plot, for details see `title`.
`...`	other graphical parameters, see `par`.

Details

The spread curves (the difference of zero-coupon yield curves) are plotted, if at least two groups of bonds were specified.

See Also

`plot.df_curves`, `plot.fwr_curves`, `plot.spot_curves`

plot.termstrc_cs *S3 Plot Method for Cubic Splines*

Description

S3 plot method for an object of the class "termstrc_cs".

Usage

```
## S3 method for class 'termstrc_cs'
plot(x, matrange = c(min(mapply(function(i) min(x$y[[i]][, 1]),
seq(x$n_group))), max(mapply(function(i) max(x$y[[i]][, 1]),
seq(x$n_group)))), multiple = FALSE,
ctype = "spot", lwd=2, lty=1, type = "l",
errors = "none", inset = c(0.1, 0.3), ask=TRUE, ...)
```

Arguments

x	object of the class "termstrc_cs".
matrange	maturity range for the plot, e.g. c(2,10).
multiple	if TRUE all curves are plotted together (default: FALSE).
ctype	parameter setting for the desired curve type, "spot" ("forward", "discount", "spread") for the spot rate (forward rate, discount factor, spread) curves. Use "none" if no curve plot is desired.
errors	Specify the type of the error plot. If "price" ("yield") the price (yield) errors will be plot. Use "none" if no error plot is desired.
lwd	the line width, for details see par.
lty	the line type, for details see par.
type	1-character string giving the type of plot desired, for details see plot.default.
inset	inset distance(s) from the margins as a fraction of the plot region, for details see legend.
ask	if TRUE (and the R session is interactive) the user is asked for input, before a new figure is drawn, see par for details.
...	other graphical parameters, see par.

Details

Depending on the choice of the curve type ("spot", "forward", "discount", "spread") the corresponding curves will be plotted. Either separately or together (mulitple = TRUE). If the curves are plotted separately also the knot points used for the estimation of the cubic splines and the yield-to-maturities will be plotted. In addition, with a zero-coupon yield curve plot the 95 % confidence interval of the curve will be plotted. To ease the analysis of the goodness of the estimation, serveral error plots for the yield and price error are offered.

See Also

plot.df_curves, plot.error, plot.fwr_curves, plot.ir_curve, plot.s_curves, plot.spot_curves, plot.termstrc_cs

---

plot.termstrc_nss *S3 Plot Method*

Description

S3 plot method for an object of the class "termstrc_nss".

Usage

```
## S3 method for class 'termstrc_nss'
plot(x, matrange = c(min(mapply(function(i) min(x$y[[i]][, 1]),
seq(x$n_group))),max(mapply(function(i) max(x$y[[i]][, 1]),
seq(x$n_group)))), multiple = FALSE, expoints = unlist(x$expoints),
ctype = "spot",errors = "none", lwd = 2, lty = 1, type ="l",
  inset = c(0.8, 0.1), ask = TRUE, ...)
```

Arguments

x	object of the class "termstrc_nss".
matrange	maturity range for the plot, e.g., c(2,10). Only a range within the maturity range of the estimation is allowed.
multiple	if TRUE all curves are plotted together (default: FALSE).
expoints	extrapolation points (default: NULL).
ctype	parameter setting for the desired curve type, "spot" ("forward", "discount", "spread") for the spot rate (forward rate, discount factor, spread) curves. Use "none" if no curve plot is desired.
errors	Specify the type of the error plot. If "price" ("yield") the pricing (yield) errors will be plotted . Use "none" if no error plot is desired.
lwd	the line width, for details see par.
lty	the line type, for details see par.
type	1-character string giving the type of plot desired, for details see plot.default.
inset	inset distance(s) from the margins as a fraction of the plot region, for details see legend.
ask	if TRUE (and the R session is interactive) the user is asked for input, before a new figure is drawn, see par for details.
...	other graphical parameters, see par.

Details

Depending on the choice of the curve type (`"spot"`, `"forward"`, `"discount"`, `"spread"`) the corresponding curves will be plot. Either separately or together (`multiple = TRUE`). If the curves are plotted together a dashed line indicates that the corresponding curve has been extrapolated. In addition, with a separate zero-coupon yield curve plot the yield-to-maturity will be plot. To ease the analysis of the goodness of the estimation, several error plots are offered.

See Also

`plot.df_curves`, `plot.error`, `plot.fwr_curves`, `plot.ir_curve`, `plot.s_curves`, `plot.spot_curves`, `plot.termstrc_nss`

---

plot.zeroyields *S3 Plot Method*

Description

S3 plot method for objects of the class `"zeroyields"`. The method plots the estimated three-dimensional spot rate curve.

Usage

```
## S3 method for class 'zeroyields'
plot(x, ...)
```

Arguments

`x`	object of the class `"zeroyields"`
`...`	further arguments

---

postpro_bond *Post Processing of Term Structure Estimation Results*

Description

The function calculates based on the term structure estimation results the errors for prices and yields and differnt curves (spot, forward, discount curve).

Usage

```
postpro_bond(opt_result, m, cf, sgroup, n_group, y, p,
 ac, m_p, method, lambda)
```

Arguments

opt_result	parameter vector
m	maturities matrices
cf	cahsflows matrices
sgroup	sequence of the group length
n_group	lenght of the group
y	yield-to-maturity matrices
p	dirty price vectors
ac	accrued interest vectors
m_p	maturity matrices including the maturities for the current dirty prices
method	form of the spot rate function
lambda	additional paramter for the Diebold/Li spot rate function

Note

Used as internal helper function

---

prepro_bond *Bonddata preprocess function*

Description

Preprocessing a static coupon bond data set, i.e., calculation of cashflows, maturities matrices, price, accrued interest vectors, yield-to-maturity and duration matrices.

Usage

```
prepro_bond(group, bonddata, matrange = "all")
```

Arguments

group	character, specifies group of a bond data set.
bonddata	Static bond data set.
matrange	bond data set is filtered according to chosen maturity spectrum c(min,max).

Value

n_group	group length
sgroup	sequence of the group length
cf	list with cashflows matrices
cf_p	list with cashflows matrices including the current dirty prices
m	list with maturites matrices

m_p	list with cashflows matrices including the maturities of the current dirty prices
p	list with the dirty price vectors
ac	list with the accrued interest vectors
y	list with the yield-to-maturity matrices
duration	list with the duration, duration based weights matrices
timestamp	date of the data

Examples

```
data(govbonds)
bdata <- prepro_bond("GERMANY",govbonds,c(0,10))
## print maturites matrix
bdata$m
```

---

print.couponbonds *S3 Print Method*

Description

Prints basic information of an coupon bond data set.

Usage

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

Arguments

x	object of the class "couponbonds"
...	futher arguments

---

print.dyncouponbonds *S3 Print Method*

Description

The method prints basic information of a dynamic bond data set.

Usage

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

Arguments

x	object of the class "dyncouponbonds"
...	further arguments

print.dyntermstrc_nss *S3 Print Method*

Description

S3 print method for objects of the class "dyntermstrc_nss". The basic parameter and a summary of the estimated term structure parameters are printed.

Usage

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

Arguments

x	object of the class "dyntermstrc_nss"
...	further arguments

print.dyntermstrc_yields *S3 Print Method*

Description

S3 print method for objects of the class "dyntermstrc_yields". The method prints information from the term structure estimation and a summary of the estimated parameters.

Usage

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

Arguments

x	object of the class "dyntermstrc_yields"
...	further arguments

print.summary.dyntermstrc_nss
S3 Print Method

Description

Print method for objects of the class "summary.dyntermstrc_nss"

Usage

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

Arguments

x	object of the class "summary.dyntermstrc"
...	further arguments

print.summary.dyntermstrc_param
S3 Print Method

Description

S3 print method for an object of the class "summary.dyntermstrc_param"

Usage

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

Arguments

x	object of the class "summary.dyntermstrc_param"
...	further arguments

print.summary.dyntermstrc_yields
S3 Print Method

Description

S3 print method for objects of the class "summary.dyntermstrc_yields".

Usage

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

Arguments

x	object of the class "summary.dyntermstrc_yields"
...	further arguments.

print.summary.termstrc_cs
S3 Print Method

Description

S3 print method for an object of the class "summary.termstrc_cs".

Usage

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

Arguments

x	object of the class "summary.termstrc_cs".
...	other arguments.

print.summary.termstrc_nss *S3 Print Method*

Description

S3 print method for an object of the class "summary.termstrc_nss".

Usage

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

Arguments

x	object of the class "summary.termstrc_nss".
...	other arguments.

print.termstrc_cs *S3 Print Method for termstrc_cs*

Description

S3 print method for an object of the class "termstrc_cs".

Usage

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

Arguments

x	object of the class "termstrc_cs".
...	other arguments.

Details

The print method for an object of the class "termstrc_cs" prints the parameter estimates and the associated (robust) standard errors of the cubic spline functions.

See Also

plot.termstrc_cs, summary.termstrc_cs

print.termstrc_nss *S3 Print Method*

Description

Print method for objects of the class "termstrc_nss".

Usage

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

Arguments

x	objects of the class "termstrc_nss"
...	further arguments

Details

The print method for an object of the class "nelson" prints important input parameters of the optimisation and the results (the optimal parameter vector)

print.zeroyields *S3 Print Method*

Description

S3 print method for objects of the class "zeroyields". The method prints basic information of a zeroyields data set.

Usage

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

Arguments

x	object of the class "zeroyields"
...	further arguments

rmse *Root Mean Squared Error*

Description

Calulates the root mean squared error (RMSE).

Usage

```
rmse(actual, estimated)
```

Arguments

actual	vector, consisting of the observed values.
estimated	vector, consisting of the estimated values.

Details

Calculation of the RMSE according to the formula:

$$\text{RMSE} = \sqrt{\frac{1}{m}\boldsymbol{\epsilon}^2\boldsymbol{\iota}},$$

whereas $\boldsymbol{\epsilon}$ is the vector of the yield or price errors of the bonds and $\boldsymbol{\iota}$ is a column vector filled with ones. m is the number of bonds, for which $\boldsymbol{\epsilon}$ has been calculated.

See Also

aabse

rm_bond *Bond Removal Function*

Description

Specified bonds and their associated data are removed from a static or dynamic bond data set

Usage

```
rm_bond(bonddata, group, ISIN)
```

Arguments

bonddata	bond data set of the class "couponbond" or "dyncouponbond"
group	the group where the bonds to be removed belong to.
ISIN	the ISIN numbers of the bonds to remove.

rm_bond.couponbonds *S3 Remove Bond Method*

Description

Specified bonds and their associated data are removed from a static bond data set of the class "couponbonds".

Usage

```
## S3 method for class 'couponbonds'
rm_bond(bonddata, group, ISIN)
```

Arguments

bonddata	bond data set.
group	the group where the bonds to be removed belong to.
ISIN	the ISIN numbers of the bonds to remove.

Value

The function returns the new bond data set.

Examples

```
data(govbonds)
newgovbonds <- rm_bond(govbonds,"GERMANY","DE0001135150")
```

rm_bond.dyncouponbonds *S3 Remove Bond Method*

Description

Specified bonds and their associated data are removed from a dynamic bond data set of the class "dyncouponbonds".

Usage

```
## S3 method for class 'dyncouponbonds'
rm_bond(bonddata, group, ISIN)
```

Arguments

bonddata	bond data set.
group	the group where the bonds to be removed belong to.
ISIN	the ISIN numbers of the bonds to remove.

Value

The function returns the new bond data set.

Examples

```
data(datadyncouponbonds)
newdynbonddata <- rm_bond(datadyncouponbonds,"GERMANY","DE0001135150")
```

`spotrates` *Function for the Calculation of the Spot Rates*

Description

The function calculates the spot rates for the chosen spot rate function (Diebold/Li, Nelson/Siegel, Svensson) , a provided maturity and parameter vector.

Usage

```
spotrates(method, beta, m, lambda)
```

Arguments

`method`	spot rate function type: `"dl"` for Diebold/Li, `"ns"` for Nelson/Siegel, `"sv"` for Svensson, `"asv"` for adjusted Svensson.
`beta`	parameter vector β.
`m`	maturity or a vector of maturities.
`lambda`	$= 1/\tau_1$, a scalar; only required for Diebold/Li spot rate function

Value

Returns a vector with the calculated spot rates.

See Also

`spr_dl`, `spr_ns`, `spr_sv`

Examples

```
spotrates(method="ns",beta=c(0.03,0.02,0.01,5),m=1:30)
```

spr_asv *Adjusted Svensson Spot rate function*

Description

This function calculates the spot rates for certain maturity dates and a parameter vector according to an adjusted version of Svensson (1994).

Usage

```
spr_asv(beta, m)
```

Arguments

beta	a vector of parameters $\boldsymbol{\beta} = (\beta_0, \beta_1, \beta_2, \tau_1, \beta_3, \tau_2)$.
m	one maturity (or a vector of maturities).

Details

The adjusted Svensson spot rate function is defined as:

$$s(m, \boldsymbol{\beta}) = \beta_0 + \beta_1 \frac{1 - \exp(-\frac{m}{\tau_1})}{\frac{m}{\tau_1}} + \beta_2 \left(\frac{1 - \exp(-\frac{m}{\tau_1})}{\frac{m}{\tau_1}} - \exp(-\frac{m}{\tau_1}) \right) + \beta_3 \left(\frac{1 - \exp(-\frac{m}{\tau_2})}{\frac{m}{\tau_2}} - \exp(-\frac{2m}{\tau_2}) \right)$$

Value

Returns a vector consisting of the calculated spot rates.

References

Lars E.O. Svensson (1994): Estimating and Interpreting Forward Interest Rates: Sweden 1992 -1994. *Technical Reports 4871, National Bureau of Economic Research*.

Examples

```
spr_asv(c(0.07,0.03,0.05,2,0.08,7),1:30)
```

spr_dl *Spot Rate Function according to the Diebold and Li Version of the Nelson/Siegel Spot Rate Function*

Description

This function calculates the spot rates for certain maturity dates and a parameter vector according to Diebold/Li (2006).

Usage

```
spr_dl(beta, m, lambda)
```

Arguments

beta	a vector of parameters $\boldsymbol{\beta} = (\beta_0, \beta_1, \beta_2)$.
m	one maturity (or a vector of maturities).
lambda	$= \frac{1}{\tau_1}$, a scalar

Details

The spot rate according to Diebold/Li for a maturity m is defined as:

$$s(m, \boldsymbol{\beta}, \lambda) = \beta_0 + \beta_1 \frac{1 - \exp(-m\lambda)}{m\lambda} + \beta_2 \left(\frac{1 - \exp(-m\lambda)}{m\lambda} - \exp(-m\lambda) \right).$$

Value

Returns a vector consisting of the calculated spot rates.

References

F.X. Diebold and C. Li: Forecasting the Term Structure of Government Bond Yields. *Journal of Econometrics*, **130**:337–364.

See Also

codespr_ns

Examples

```
spr_dl(c(0.1,0.03,0.01),1:30,0.0609)
```

spr_ns *Spot Rate Function according to Nelson and Siegel*

Description

This function calculates the spot rates for certain maturity dates and a parameter vector according to Nelson/Siegel (1987).

Usage

```
spr_ns(beta, m)
```

Arguments

beta	a vector of parameters $\boldsymbol{\beta} = (\beta_0, \beta_1, \beta_2, \tau_1)$.
m	one maturity (or a vector of maturities).

Details

The spot rate according to Nelson/Siegel for a maturity m is defined as:

$$s(m, \boldsymbol{\beta}) = \beta_0 + \beta_1 \frac{1 - \exp(-\frac{m}{\tau_1})}{\frac{m}{\tau_1}} + \beta_2 \left(\frac{1 - \exp(-\frac{m}{\tau_1})}{\frac{m}{\tau_1}} - \exp(-\frac{m}{\tau_1}) \right).$$

Value

Returns a vector consisting of the calculated spot rates.

References

Charles R. Nelson and Andrew F. Siegel (1987): Parsimonious Modeling of Yield Curves. *The Journal of Business*, **60(4)**:473–489.

Examples

```
spr_ns(rep(0.01,4),1:30)
```

spr_sv *Spot Rate Function according to Svensson*

Description

This function calculates the spot rates for certain maturity dates and a parameter vector according to Svensson (1994).

Usage

```
spr_sv(beta, m)
```

Arguments

beta	a vector of parameters $\boldsymbol{\beta} = (\beta_0, \beta_1, \beta_2, \tau_1, \beta_3, \tau_2)$.
m	one maturity (or a vector of maturities).

Details

The spot rate according to Svensson for a maturity m is calculated using the following function:

$$s(m, \boldsymbol{\beta}) = \beta_0 + \beta_1 \frac{1 - \exp(-\frac{m}{\tau_1})}{\frac{m}{\tau_1}} + \beta_2 \left(\frac{1 - \exp(-\frac{m}{\tau_1})}{\frac{m}{\tau_1}} - \exp(-\frac{m}{\tau_1}) \right) + \beta_3 \left(\frac{1 - \exp(-\frac{m}{\tau_2})}{\frac{m}{\tau_2}} - \exp(-\frac{m}{\tau_2}) \right)$$

Value

Returns a vector consisting of the calculated spot rates.

References

Lars E.O. Svensson (1994): Estimating and Interpreting Forward Interest Rates: Sweden 1992 -1994. *Technical Reports 4871, National Bureau of Economic Research*.

Examples

```
spr_sv(c(0.07,0.3,0.05,2,0.08,7),1:30)
```

summary.dyntermstrc_nss *S3 Summary Method*

Description

Summary method for objects of the class "dyntermstrc_nss". The average RMSE and AABSE for the prices and yields is calculated. Additionally convergence information and the message from the used solver is printed.

Usage

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

Arguments

object	object of the class "dyntermstrc_nss".
...	further arguments

Value

The method returns an object of the class "summary.dyntermstrc_nss".

summary.dyntermstrc_param *S3 Summary Method*

Description

S3 summary method for objects of the class "dyntermstrc_param".

Usage

```
## S3 method for class 'dyntermstrc_param'
summary(object, type = "none", lags = 1, selectlags = "Fixed", ...)
```

Arguments

object	object of the class "dyntermstrc_param".
type	use "trend" and a trend is considered for the unit root test (default: "none").
lags	number of lags for unit root test function ur.df from package urca (default:1)
selectlags	leg selection flag for function ur.df from package urca (default: "Fixed").
...	further arguments

Details

The function calculates from an object of the class "dyntermstrc_param" the augmented Dickey Fuller test for the levels and first differences for each of the estimated term structure parameters. Additionally, the correlation of the parameter levels and differences are calculated.

Value

an object with the class "summary.dyntermstrc_param"

---

summary.dyntermstrc_yields *S3 Summary Method*

Description

Summary method for objects of the class "dyntermstrc_yields". The mean RMSE and AABSE of the yields is calculated

Usage

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

Arguments

object	object of the class "dyntermstrc_yields"
...	further arguments

---

summary.termstrc_cs *S3 Summary Method for Termstrc_cs*

Description

S3 summary method for objects of the class "termstrc_cs".

Usage

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

Arguments

object	object of the class "termstrc_cs".
...	other arguments.

Details

The summary method for an object of the class "termstrc_cs" calculates goodness of fit statistics (RMSE, AABSE) of the price and yield errors. Additionally, summary statistics of the regression analysis of the parameters are printed.

See Also

plot.termstrc_cs, print.termstrc_cs, rmse, aabse, summary.lm

---

summary.termstrc_nss *S3 Summary Method*

Description

S3 summary method for objects of the class "termstrc_nss".

Usage

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

Arguments

object	object of the class "termstrc_nss".
...	other arguments.

Details

The summary method for an object of the class "termstrc_nss" prints the solution of the goodness of fit statistics (RMSE,AABSE) of the optimisation. Moreover a convergence information of the used optimiser (optim) is printed.

See Also

nlminb, plot.termstrc_nss, print.termstrc_nss, rmse, aabse

summary.zeroyields *S3 Summary Method*

Description

S3 summary method for objects of the class "zeroyields". The method calculates basic summary statistics of the data.

Usage

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

Arguments

object	object of the class "zeroyields"
...	further arguments

Value

returns an object of the class "summary.zeroyields"

zeroyields *Zeroyields Data Set Generation*

Description

The function generates a zeroyield data set out of yield, date and maturities data.

Usage

```
zeroyields(maturities, yields, dates)
```

Arguments

maturities	maturities vector of the yields
yields	yields matrix
dates	vector of the observations dates in the format "

Value

returns a list, which belongs to the class "zeroyields". For the class plot, print and summary methods are offered.

See Also

print.zeroyields,summary.zeroyields, plot.zeroyields

zyields *Zero Coupon Yield Data Set*

Description

Zero Coupon Yield Data Set

Usage

```
data(zyields)
```

Note

If you use your own data set, make sure that the structure is identical to the provided data set. Use the function `str()` to explore the data set.

Index

∗Topic **datasets**
datadyncouponbonds, 10
govbonds, 31
zyields, 78
∗Topic **package**
termstrc-package, 4

aabse, 5, *67*, *76*

bond_prices, 6
bond_yields, 7

colSums, *9*
constrOptim, *22, 23*
create_cashflows_matrix, 7, *8*
create_maturities_matrix, *8*, 8
cSums, 9

datadyncouponbonds, 10
duration, 10

estim_cs, 12, *17, 18*
estim_cs.couponbonds, *13*, 13
estim_nss, 15
estim_nss.couponbonds, *14*, *16*, 16, *19*
estim_nss.dyncouponbonds, *16*, 18
estim_nss.zeroyields, *16*, 19
estimateyieldcurve, 11
estimatezcyieldcurve, 12

fcontrib, 21
fcontrib.dyntermstrc_param, 21
findstartparambonds, 22
findstartparamyields, 23
forwardrates, 23, *25–27*
fwr_asv, 24
fwr_dl, *24*, 25, *26, 27*
fwr_ns, *24, 25*, 26, *27*
fwr_sv, *24–26*, 27

get_constraints, 28
get_grad_objfct, 28
get_grad_objfct_bonds, 28
get_objfct, 29
get_objfct_bonds, 29
get_paramnames, 29
get_realnames, 30
gi, 30
govbonds, 31
grad_asv, 32
grad_asv_bonds, 32
grad_asv_bonds_grid, 33
grad_asv_grid, 34
grad_dl, 34
grad_dl_bonds, 35
grad_ns, 35
grad_ns_bonds, 36
grad_ns_bonds_grid, 36
grad_ns_grid, 37
grad_sv, 37
grad_sv_bonds, 38
grad_sv_bonds_grid, 38
grad_sv_grid, 39

impl_fwr, 39

legend, *57, 58*
loss_function, 40

maturity_range, 40

nlminb, *76*

objfct_asv, *32*, 41
objfct_asv_bonds, 41
objfct_asv_bonds_grid, 42
objfct_asv_grid, 42
objfct_dl, 43
objfct_dl_bonds, 43
objfct_ns, *35*, 44
objfct_ns_bonds, 44
objfct_ns_bonds_grid, 45

objfct_ns_grid, 45
objfct_sv, 46
objfct_sv_bonds, 46
objfct_sv_bonds_grid, 47
objfct_sv_grid, 47
optim, *16*, *19, 20*, *22, 23*

par, *50*, *52–58*
param, 48, *49*
param.dyntermstrc_nss, *48*, 48
param.dyntermstrc_yields, *48*, 49
plot.default, *50*, *52–58*
plot.df_curves, *14*, *18*, 49, *53*, *55, 56*, *58, 59*
plot.dyntermstrc_nss, 50
plot.dyntermstrc_param, *48*, 51
plot.dyntermstrc_yields, 51
plot.error, *14*, *18*, 52, *58, 59*
plot.fwr_curves, *14*, *18*, *50*, 53, *55, 56*, *58, 59*
plot.ir_curve, 54, *58, 59*
plot.lm, *14*
plot.s_curves, *14*, *18*, *50*, *53*, *55*, 56, *58, 59*
plot.spot_curves, *14*, *18*, *50*, *53*, 54, *56*, *58, 59*
plot.spsearch, 55
plot.termstrc_cs, *14*, 57, *58*, *65*, *76*
plot.termstrc_nss, *18*, 58, *59*, *76*
plot.zeroyields, 59, *77*
postpro_bond, 59
prepro_bond, 60
print.couponbonds, 61
print.dyncouponbonds, 61
print.dyntermstrc_nss, 62
print.dyntermstrc_yields, 62
print.summary.dyntermstrc_nss, 63
print.summary.dyntermstrc_param, 63
print.summary.dyntermstrc_yields, 64
print.summary.termstrc_cs, 64
print.summary.termstrc_nss, 65
print.termstrc_cs, *14*, 65, *76*
print.termstrc_nss, *18*, 66, *76*
print.zeroyields, 66, *77*

rm_bond, *52*, 67
rm_bond.couponbonds, 68
rm_bond.dyncouponbonds, 68
rmse, *5*, 67, *76*

spotrates, *6*, *41*, *44*, *46*, 69
spr_asv, *32*, *41*, 70
spr_dl, *43*, *69*, 71
spr_ns, *35*, *44*, *69*, *71*, 72
spr_sv, *46*, *69*, 73
summary.dyntermstrc_nss, 74
summary.dyntermstrc_param, *48*, 74
summary.dyntermstrc_yields, 75
summary.lm, *14*, *76*
summary.termstrc_cs, *14*, *65*, 75
summary.termstrc_nss, *18*, 76
summary.zeroyields, *77*, 77

termstrc *(*termstrc-package*)*, 4
termstrc-package, 4
title, *50*, *52, 53*, *55, 56*

uniroot, *7*, *18*

zeroyields, 77
zyields, 78