Package ‘ycinterextra’

February 20, 2015

Type Package
Title Yield curve or zero-coupon prices interpolation and extrapolation
Version 0.1
Date 2013-12-18
Author Thierry Moudiki
Maintainer Thierry Moudiki <thierry.moudiki@gmail.com>
Description Yield curve or zero-coupon prices interpolation and extrapolation using the Nelson-Siegel, Svensson, Smith-Wilson models, and Hermite cubic splines.
License GPL-2 | GPL-3
Depends compiler, methods
Imports graphics, mcGlobaloptim
Collate fonctions.R ClassycInterp.R
NeedsCompilation no
Repository CRAN
Date/Publication 2013-12-18 07:32:51

R topics documented:

ycinterextra-package .............................................. 2
as.list .............................................................. 3
coeffs ............................................................... 4
deviance ............................................................ 5
fitted ................................................................. 6
forwardrates ......................................................... 7
residuals ............................................................ 8
ycextra ............................................................... 9
ycinter ............................................................... 10
ycplot .............................................................. 12
ycsummary ......................................................... 13

Index 15
ycinterextra-package  
Yield curve or zero-coupon prices interpolation and extrapolation

Description

Yield curve or zero-coupon prices interpolation and extrapolation using the Nelson-Siegel, Svensson, Smith-Wilson models, and Hermite cubic splines.

Details

Package: ycinterextra
Type: Package
Version: 0.1
Date: 2013-12-18
License: GPL-2 | GPL-3

Author(s)

Thierry Moudiki Maintainer: <thierry.moudiki@gmail.com>

References


CEIOPS (2010). Qis 5 risk-free interest rates extrapolation method. Technical report, CEIOPS.


---

**as.list**

*Conversion to a list*

**Description**

This function converts the object obtained with `ycinter` and `ycextra` into a list.

**Usage**

```r
as.list(.Object)
```

**Arguments**

- `.Object` An S4 object created by `ycinter` or `ycextra`.

**Value**

A list of the object’s features in a user-friendly format

**Author(s)**

Thierry Moudiki

**See Also**

`ycinter`, `ycextra`

**Examples**

```r
# Prices
p <- c(0.9859794, 0.9744879, 0.9602458, 0.9416551, 0.9196671, 0.8957363, 0.8716268, 0.8482628,
      0.8255457, 0.8034710, 0.7819525, 0.7612284, 0.7416912, 0.7237042, 0.7072136,
      0.6922140, 0.6785227, 0.6660095, 0.6546902, 0.6441639, 0.6343366, 0.6250234, 0.6162910, 0.6080358,
      0.6003302, 0.5929791, 0.5858711, 0.5789552, 0.5722868, 0.5653231)

cor(p)

# Observed maturities
u <- 1:30

# Output maturities
v <- seq(from = 1, to = 60, by = 0.5)

# Svensson interpolation
yc <- ycextra(p = p, matsin = u, matsout = v, method="SV", typeres="prices", UFR = 0.018)

as.list(yc)
```

coeffs

Extraction of estimated coefficients

Description

Extraction of estimated coefficients obtained from interpolation or extrapolation

Usage

coeffs(.Object)

Arguments

_Object_ An S4 object created by ycinter or ycextra.

Details

This function returns the coefficients obtained from interpolation or extrapolation into a vector.

Value

A vector of estimated coefficients depending on the method used in ycinter or ycextra

Author(s)

Thierry Moudiki

See Also

ycsummary

Examples

# Prices
p <- c(0.9859794, 0.9744879, 0.9602458, 0.9416551, 0.9196671, 0.8957363, 0.8716268, 0.8482628, 0.8255457, 0.8034710, 0.7819525, 0.7612284, 0.7416912, 0.7237042, 0.7072136, 0.6922140, 0.6785227, 0.6660995, 0.6546902, 0.6441639, 0.6343366, 0.6250234, 0.6162910, 0.6080358, 0.6003302, 0.5929791, 0.5858711, 0.5789852, 0.5722068, 0.5653231)

# Observed maturities
u <- 1:30

# Output maturities
t <- seq(from = 1, to = 60, by = 0.5)

# Svensson extrapolation
yc <- ycextra(p = p, matsin = u, matsout = t, method="SV", type="prices", UFR = 0.018)

coeffs(yc)
deviance

---

**deviance**

*Residual sum of squares*

### Description

Extracting the residual sum of squares

### Usage

```r
deviance(.Object)
```

### Arguments

- `.Object` An S4 object created by `ycinter` or `ycextra`.

### Details

This function extracts the residual sum of squares after the interpolation or extrapolation. When extrapolation is carried out, the function uses the values observed in the liquid part of the curve.

### Value

A numeric giving the residual sum of squares

### Author(s)

Thierry Moudiki

### See Also

`ycsummary`

### Examples

```r
# Prices
p <- c(0.9859794, 0.9744879, 0.9602458, 0.9416551, 0.9196671, 0.8957363, 0.8716268, 0.8482628, 
0.8255457, 0.8034710, 0.7819525, 0.7612284, 0.7416912, 0.7237042, 0.7072136, 
0.6922140, 0.6785227, 0.6660095, 0.6546902, 0.6441639, 0.6343366, 0.6250234, 0.6162910, 0.6080358, 
0.6003302, 0.5929791, 0.5858711, 0.5789852, 0.5722068, 0.5653231)

# Observed maturities
u <- 1:30

# Output maturities
t <- seq(from = 1, to = 30, by = 0.5)

# Svensson interpolation
yc <- ycinter(p = p, matsin = u, matsout = t, 
method="SW", typeres="prices")
```
deviance(yc)

fitted

Description
Extracting the model’s fitted or extrapolated values

Usage
fitted(.Object)

Arguments
/Object An S4 object created by ycinter or ycextra.

Details
This function extracts the model’s fitted or extrapolated values.

Value
A time series object giving the fitted or extrapolated values.

Author(s)
Thierry Moudiki

See Also
ycsummary

Examples
# Prices
p <- c(0.9859794, 0.9744879, 0.9602458, 0.9416551, 0.9196671, 0.8957363, 0.8716268, 0.8482628, 0.8255457, 0.8034710, 0.7819525, 0.7612284, 0.7416912, 0.7237042, 0.7072136, 0.6922140, 0.6785227, 0.6660995, 0.6546902, 0.6441639, 0.6343366, 0.6250234, 0.6162910, 0.6080358, 0.6003302, 0.5929791, 0.5858711, 0.5789852, 0.5722068, 0.5653231)

# Observed maturities
u <- 1:30

# Output maturities
t <- seq(from = 1, to = 30, by = 0.5)

# Svensson interpolation
Forward rates extraction

Description

This function extracts the forward rates from the results obtained with `ycinter` and `ycextra`.

Usage

```r
forwardrates(.Object)
```

Arguments

- `.Object` An S4 object created by `ycinter` or `ycextra`.

Value

A time series object giving the instantaneous forward rates for methods "NS", "SV" and the forward rates for methods "HCSPL", "SW".

Author(s)

Thierry Moudiki

See Also

`ycinter`, `ycextra`

Examples

```r
# Prices
p <- c(0.9859794, 0.9744879, 0.9602458, 0.9416551, 0.9196671, 0.8957363, 0.8716268, 0.8482628,
      0.8255457, 0.8034710, 0.7819525, 0.7612284, 0.7416912, 0.7237042, 0.7072136,
      0.6922140, 0.6785227, 0.6660095, 0.6546902, 0.6441639, 0.6343366, 0.6250234, 0.6162910, 0.6080358,
      0.6003302, 0.5929791, 0.5858711, 0.5789852, 0.5722068, 0.5653231)

# Observed maturities
u <- 1:38

# Output maturities
t <- seq(from = 1, to = 60, by = 0.5)

# Svensson interpolation
yc <- ycextra(p = p, matsin = u, matsout = t,
               method="SV", typeres="prices", UFR = 0.018)
```
residuals

plot(forwardrates(yc))

residuals

Model residuals

Description
Extracting the residuals of the model

Usage
residuals(.Object)

Arguments
.Object An S4 object created by ycinter or ycextra.

Details
This function extracts the residuals sum of the model after the interpolation. When extrapolation is carried out, the function uses the values observed in the liquid part of the curve.

Value
A time series object giving the residuals

Author(s)
Thierry Moudiki

See Also
ycsummary

Examples
# Prices
p <- c(0.9859794, 0.9744879, 0.9602458, 0.9416551, 0.9196671, 0.8957363, 0.8716268, 0.8482628, 0.8255457, 0.8034710, 0.7819525, 0.7612284, 0.7416912, 0.7237042, 0.7072136, 0.6922140, 0.6785227, 0.6660995, 0.6546902, 0.6441639, 0.6343366, 0.6250234, 0.6162910, 0.6080358, 0.6003302, 0.5929791, 0.5858711, 0.5789852, 0.5722068, 0.5653231)

# Observed maturities
u <- 1:30

# Output maturities
t <- seq(from = 1, to = 30, by = 0.5)

# Svensson interpolation
ycextra

Yield curve or zero-coupon prices extrapolation

Description

Yield curve or zero-coupon bonds prices curve extrapolation using the Nelson-Siegel, Svensson, Smith-Wilson models.

Usage

```r
ycextra(ym = p = NULL, matsin, matsout, method = c("NS", "SV", "SW"),
        typeres = c("rates", "prices"), UFR, T_UFR = NULL)
```

Arguments

- `ym`: A vector of non-negative numerical quantities, containing the yield to maturities.
- `p`: A vector of non-negative numerical quantities, containing the zero-coupon prices.
- `matsin`: A vector containing the observed maturities.
- `matsout`: the output maturities needed.
- `method`: A character string giving the type of method used for interpolation and extrapolation. Method can be either "NS" for Nelson-Siegel, "SV" for Svensson, or "SW" Smith-Wilson.
- `typeres`: A character string, giving the type of return. Either "prices" or "rates".
- `UFR`: The ultimate forward rate.
- `T_UFR`: The number of years after which the yield curve converges to the UFR. `T_UFR` is used only when `method` is "SW".

Details

This function interpolates between observed points of a yield curve, or zero-coupon prices, and extrapolates the curve using the Nelson-Siegel, Svensson, Smith-Wilson models. The result can be either prices or zero rates. For the purpose of extrapolation, an ultimate forward rate (UFR) to which the yield curve converges must be provided. With the Smith-Wilson method, a period of convergence (number of years) to the ultimate forward rate, after the last liquid point, must be provided.

Value

An S4 Object, that can be easily converted into a list with `as.list`
Yield curve or zero-coupon prices interpolation

Yield curve or zero-coupon bonds prices curve interpolation using the Nelson-Siegel, Svensson, Smith-Wilson models and an Hermite cubic spline.

Author(s)
Thierry Moudiki

See Also
ycsummary

Examples

```r
taxZc <- c(0.01422, 0.01309, 0.01380, 0.01549, 0.01747, 0.01940, 0.02104, 0.02236, 0.02348, 0.02446, 0.02535, 0.02614, 0.02679, 0.02727, 0.02760, 0.02779, 0.02787, 0.02786, 0.02776, 0.02762, 0.02745, 0.02727, 0.02707, 0.02686, 0.02663, 0.02640, 0.02618, 0.02597, 0.02578, 0.02563)

t <- seq(1, to = 60, by = 0.5)

# Svensson extrapolation
yc <- ycextra(p = p, matsin = u, matsout = t, method="SV", typeres="prices", UFR = 0.018)

ycsummary(yc)

# Smith-Wilson extrapolation
yc <- ycextra(p = p, matsin = u, matsout = t, method="SW", typeres="rates", UFR = 0.019, T_UFR = 20)

ycsummary(yc)

# Nelson-Siegel extrapolation
yc <- ycextra(pM = taxZc, matsin = u, matsout = t, method="NS", typeres="prices", UFR = 0.029)

ycsummary(yc)
```
ycinter

Usage

ycinter(yM = NULL, p = NULL, matsin, matsout,
    method = c("NS", "SV", "SW", "HCSPL"),
    typeres = c("rates", "prices"))

Arguments

yM A vector of non-negative numerical quantities, containing the yield to maturities.
p A vector of non-negative numerical quantities, containing the zero-coupon prices.
matsin A vector containing the observed maturities.
matsout the output maturities needed.
method A character string giving the type of method used for interpolation. method can be either "NS" for Nelson-Siegel, "SV" for Svensson, "HCSPL" for Hermite cubic spline, or "SW" Smith-Wilson.
typeres A character string, giving the type of return. Either "prices" or "rates".

Details

This function interpolates between observed points of a yield curve, or zero-coupon prices, using the Nelson-Siegel, Svensson, Smith-Wilson models and an Hermite cubic spline. The result can be either prices or zero rates.

Value

An S4 Object, that can be easily converted into a list with as.list

Author(s)

Thierry Moudiki

See Also

ycsummary

Examples

## Interpolation of yields to maturities with prices as outputs

```r
# Yield to maturities
txZC <- c(0.01422, 0.01309, 0.01380, 0.01549, 0.01747, 0.01940, 0.02104, 0.02236, 0.02348,
    0.02446, 0.02535, 0.02614, 0.02679, 0.02727, 0.02760, 0.02779, 0.02787, 0.02786, 0.02776,
    0.02762, 0.02745, 0.02727, 0.02707, 0.02686, 0.02663, 0.02640, 0.02618, 0.02597, 0.02578, 0.02563)

# Zero-coupon prices
p <- c(0.9859794, 0.9744879, 0.9602458, 0.9416551, 0.9196671, 0.8957363, 0.8716268, 0.8482628,
    0.8255457, 0.8034710, 0.7819525, 0.7612204, 0.7416912, 0.7237042, 0.7072136,
    0.6922140, 0.6785227, 0.6660095, 0.6546902, 0.641639, 0.6343366, 0.6250234, 0.6162910, 0.6080358,
    0.6003302, 0.5929791, 0.5858711, 0.5789852, 0.5722068, 0.5653231)
```
# Observed maturities
u <- 1:30

# Output maturities
t <- seq(from = 1, to = 30, by = 0.5)

# Cubic splines interpolation
yc <- ycinter(yM = txZC, matsin = u, matsout = t, method="HCSPL", typeres="rates")
ycsummary(yc)

# Nelson-Siegel interpolation
yc <- ycinter(yM = txZC, matsin = u, matsout = t, method="NS", typeres="prices")
ycsummary(yc)

# Svensson interpolation
yc <- ycinter(p = p, matsin = u, matsout = t, method="SV", typeres="prices")
ycsummary(yc)

#Smith-Wilson interpolation
yc <- ycinter(p = p, matsin = u, matsout = t, method="SW", typeres="rates")
ycsummary(yc)

ycplot

## Diagnostic plot

**Description**

Draw some diagnostic plots from the results obtained with **ycinter** and **ycextra**

**Usage**

ycplot(.Object)

**Arguments**

/Object An S4 object created by **ycinter** or **ycextra**.

**Author(s)**

Thierry Moudiki
ycsummary

See Also

ycinter, ycextra

Examples

# Prices
p <- c(0.9859794, 0.9744879, 0.9602458, 0.9416551, 0.9196671, 0.8957363, 0.8716268, 0.8482628,
0.8255457, 0.8034710, 0.7819525, 0.7612204, 0.7416912, 0.7237042, 0.7072136,
0.6922140, 0.6785227, 0.6660095, 0.6546902, 0.6441639, 0.6343366, 0.6250234, 0.6162910, 0.6080358,
0.6003302, 0.5929791, 0.5858711, 0.5789852, 0.5722068, 0.5653231)

# Observed maturities
u <- 1:30

# Output maturities
t <- seq(from = 1, to = 30, by = 0.5)

# Svensson interpolation
yc <- ycinter(p = p, matsin = u, matsout = t,
method = "SW", typeset = "prices")

ycplot(yc)

---

ycsummary

Comprehensive summary

Description

Extracting a comprehensive summary of the results obtained from ycinter and ycextra

Usage

ycsummary(.Object)

Arguments

.Object An S4 object created by ycinter or ycextra.

Author(s)

Thierry Moudiki

See Also

ycinter, ycextra
Examples

# Prices
p <- c(0.9859794, 0.9744879, 0.9602458, 0.9416551, 0.9196671, 0.8957363, 0.8716268, 0.8482628,
      0.8255457, 0.8034710, 0.7819525, 0.7612204, 0.7416912, 0.7237042, 0.7072136,
      0.6922140, 0.6785227, 0.6660095, 0.6546902, 0.6441639, 0.6343366, 0.6250234, 0.6162910,
      0.6080358, 0.6003302, 0.5929791, 0.5858711, 0.5789852, 0.5722068, 0.5653231)

# Observed maturities
u <- 1:30

# Output maturities
t <- seq(from = 1, to = 30, by = 0.5)

# Svensson interpolation
yc <- ycinter(p = p, matsin = u, matsout = t,
        method="SW", typeres="prices")

ycsummary(yc)
Index

*Topic **curve**
  as.list, 3
  coeffs, 4
  deviance, 5
  fitted, 6
  forwardrates, 7
  residuals, 8
  ycextra, 9
  ycinter, 10
  ycplot, 12
  ycssummary, 13

*Topic **extrapolation**, asNlist, 3
  coeffs, 4
  deviance, 5
  fitted, 6
  forwardrates, 7
  residuals, 8
  ycextra, 9
  ycinter, 10
  ycplot, 12
  ycssummary, 13

*Topic **interpolation**, asNlist, 3
  coeffs, 4
  deviance, 5
  fitted, 6
  forwardrates, 7
  residuals, 8
  ycextra, 9
  ycinter, 10
  ycplot, 12
  ycssummary, 13

*Topic **yield**
  as.list, 3
  coeffs, 4
  deviance, 5
  fitted, 6
  forwardrates, 7
  residuals, 8
  ycextra, 9
  ycinter, 10
  ycplot, 12
  ycssummary, 4–6, 8, 10, 11, 13

as.list, 3, 9, 11
coeffs, 4
deviance, 5
fitted, 6
forwardrates, 7
residuals, 8
ycextra, 3–8, 9, 12, 13
ycinter, 3–8, 10, 12, 13
ycinterextra (ycinterextra-package), 2
ycinterextra-package, 2
ycplot, 12
ycsummary, 4–6, 8, 10, 11, 13