Package 'ycinterextra'

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Type Package

Title Yield curve or zero-coupon prices interpolation and
extrapolation

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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

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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.

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Author(s)

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

References

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Smith, A. and Wilson, T. (2001). Fitting yield curves with long term constraints. Technical report, Bacon & Woodrow. Research Notes, Bacon and Woodrow.

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---

as.list	*Conversion to a list*

Description

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

Usage

```
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

```
# 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 = 60, by = 0.5)

 # Svensson interpolation
 yc <- ycextra(p = p, matsin = u, matsout = t,
 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,
 0.8255457,0.8034710,0.7819525,0.7612204,0.7416912,0.7237042,0.7072136
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 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", typeres="prices", UFR = 0.018)

 coeffs(yc)
```

deviance	*Residual sum of squares*

Description

Extracting the residual sum of squares

Usage

```
deviance(.Object)
```

Arguments

.Object   An S4 object created by ycinter or ycextra.

Details

This function extracts the residual sum of squares after the intepolation 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

```
# 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")
```

```
deviance(yc)
```

---

fitted   *Model fitted values*

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,
 0.8255457,0.8034710,0.7819525,0.7612204,0.7416912,0.7237042,0.7072136
 ,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")

fitted(yc)
```

---

forwardrates   *Forward rates extraction*

Description

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

Usage

```
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

```
# 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 = 60, by = 0.5)

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

```
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 ot the model after the intepolation. 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,
0.8255457,0.8034710,0.7819525,0.7612204,0.7416912,0.7237042,0.7072136
,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")

residuals(yc)
```

---

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

```
ycextra(yM = NULL, 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 fo intepolation 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

Author(s)

Thierry Moudiki

See Also

ycsummary

Examples

```
# 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)

 # 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 = 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(yM = txZC, matsin = u, matsout = t,
 method="NS", typeres="prices", UFR = 0.029)
 ycsummary(yc)
```

---

ycinter   *Yield curve or zero-coupon prices interpolation*

Description

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

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 fo intepolation. 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 matuities with prices as outputs

# 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
,0.6922140,0.6785227,0.6660095,0.6546902,0.6441639,0.6343366,0.6250234,0.6162910,0.6080358,
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)

# 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

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")

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)
```

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