Package ‘YieldCurve’

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Type Package

Title Modelling and estimation of the yield curve

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Description Modelling the yield curve with some parametric models. The models implemented are: Nelson-Siegel, Diebold-Li and Svensson. The package also includes the data of the term structure of interest rate of Federal Reserve Bank and European Central Bank.

License GPL (>= 2)

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YieldCurve-package  Modelling and estimation of the yield curve

Description

Modelling the yield curve with some parametric models. The models implemented are: Nelson-Siegel, Diebold-Li and Svensson. The package also includes the data of the term structure of interest rate of Federal Reserve Bank and European Central Bank.

Details

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Version: 4.1
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License: GPL (>= 2)
LazyLoad: yes

DieboldLi

Author(s)

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References


**Examples**

```r
### Nelson.Siegel function and Fed data-set ###
data(FedYieldCurve)
rate.Fed = first(FedYieldCurve,'5 month')
maturity.Fed <- c(3/12, 0.5, 1,2,3,5,7,10)
y <- NSrates(NSParameters[5,], maturity.Fed)
lines(maturity.Fed,y, col=2)
legend("topleft",legend=c("observed yield curve","fitted yield curve"),
        col=(1,2),lty=1)

### Svensson function and ECB data-set ###
data(ECBYieldCurve)
rate.ECB = ECBYieldCurve[1:5,]
maturity.ECB = c(0.25,0.5,seq(1,30,by=1))
SvenssonParameters <- Svensson(rate.ECB, maturity.ECB)
Svensson.rate <- Srates( SvenssonParameters ,maturity.ECB,"Spot")
plot(maturity.ECB, rate.ECB[5,,main="Fitting Svensson yield curve", type="o")
lines(maturity.ECB, Svensson.rate[5,, col=2)
legend("topleft",legend=c("observed yield curve","fitted yield curve"),
        col=(1,2),lty=1)
```

**ECBYieldCurve**

Yield curve data spot rate, AAA-rated bonds, maturities from 3 months to 30 years

**Description**

Government bond, nominal, all triple A issuer companies. The maturities are 3 and 6 months and from 1 year to 30 years with frequency business day, provided by European Central Bank. The range date is from 2006-12-29 to 2009-07-24.

**Usage**

data(ECBYieldCurve)

**Format**

It is an *xts* object with 32 interest rate at different maturities and 655 observations.
FedYieldCurve

Source


Examples

```r
### plot ECB Yield Curve ###
data(ECBYieldCurve)

first(ECBYieldCurve,'3 day')
last(ECBYieldCurve,'3 day')

mat.ECB <- tau <- c(3/12,6/12,1:30)

par(mfrow=c(2,3))
for( i in c(1,2,3,653,654,655) ){
  plot(mat.ECB, ECBYieldCurve[i,], type="o", xlab="Maturities structure in years", ylab="Interest rates values")
title(main=paste("European Central Bank yield curve observed at",time(ECBYieldCurve[i], sep=" ") ))
grid()
}
```

FedYieldCurve  Federal Reserve interest rates

Description

The data-set contains the interest rates of the Federal Reserve, from January 1982 to December 2012. The interest rates are Market yield on U.S. Treasury securities constant maturity (CMT) (more information on the Treasury yield curve can be found at the following website http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/yieldmethod.aspx) at different maturities (3 months, 6 months, 1 year, 2 years, 3 years, 5 years, 7 years and 10 years), quoted on investment basis and have been gathered with monthly frequency.

Usage

data(FedYieldCurve)

Format

An object with class attributes xts.

Source

Examples

```r
require(xts)
require(YieldCurve)
data(FedYieldCurve)

first(FedYieldCurve, '3 month')
last(FedYieldCurve, '3 month')
mat<-c(3/12, 0.5, 1, 2, 3, 5, 7, 10)

par(mfrow=c(2,3))
for( i in c(1,2,3,370,371,372) ){
  plot(mat, FedYieldCurve[i,], type="o", xlab="Maturities structure in years", ylab="Interest rates values")
title(main=paste("Federal Reserve yield curve observed at",time(FedYieldCurve[i], sep=" ")))
grid()
}
```

---

**Nelson.Siegel**

Estimation of the Nelson-Siegel parameters

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**Description**

Returns the estimated coefficients of the Nelson-Siegel’s model.

**Usage**

Nelson.Siegel( rate, maturity )

**Arguments**

- **rate**: vector or matrix which contains the interest rates.
- **maturity**: vector wich contains the maturity (in months) of the rate. The vector's length must be the same of the number of columns of the rate.

**Details**

The Nelson-Siegel’s model to describe the yield curve is:

\[
y_t(\tau) = \beta_0 + \beta_1 \frac{1 - \exp(-\lambda \tau)}{\lambda \tau} + \beta_2 \left( \frac{1 - \exp(-\lambda \tau)}{\lambda \tau} - \exp(-\lambda \tau) \right)
\]

**Value**

Returns a data frame with the estimated coefficients: \( \beta_0, \beta_1, \beta_2, \) and \( \lambda \).

**Author(s)**

Sergio Salvino Guirreri
References


See Also

Nelson-Siegel, Svensson

Examples

```r
data(FedYieldCurve)
maturity.Fed <- c(3/12, 0.5, 1,2,3,5,7,10)
NSParameters <- Nelson.Siegel( rate=first(FedYieldCurve,'10 month'),maturity=maturity.Fed)
y <- NSrates(NSParameters[5,], maturity.Fed)
     xlab=c("Pillars in months"), type="o")
lines(maturity.Fed,y, col=2)
legend("topleft",legend=c("observed yield curve","fitted yield curve"),
       col=c(1,2),lty=1)
grid()
```

## NSrates

*Interest rates of the Nelson-Siegel’s model.*

### Description

Returns the interest rates by Nelson-Siegel’s model.

### Usage

`NSrates(Coeff, maturity)`

### Arguments

- **Coeff**: Vector or matrix of the beta’s coefficients and lambda as the function `Nelson.Siegel` returns.
- **maturity**: maturity of the yield curve of which want to return the interest rates.

### Details

`Coeff` is a vector or matrix of the four coefficients of the Nelson-Siegel’s model: $(\beta_0; \beta_1; \beta_2; \lambda)$. 
Value

Return interest rates in matrix object with number of rows equal to nrow(betacoeff) and number of columns equal to length(maturity).

Author(s)

Sergio Salvino Guirrer

References


Examples

data(FedYieldCurve)
maturity.Fed <- c(3/12, 0.5, 1, 2, 3, 5, 7, 10)
NSParameters <- Nelson.Siegel( rate = first(FedYieldCurve,'10 month'), maturity=maturity.Fed )
y <- NSrates(NSParameters[5,],maturity.Fed)
plot(maturity.Fed,FedYieldCurve[10,:],main="Fitting Nelson-Siegel yield curve", type="o")
lines(maturity.Fed,y, col=2)
legend("topleft",legend=c("observed yield curve","fitted yield curve"),
col=c(1,2),lty=1)
grid()

Srates

*Interest rates of the Svensson’s model.*

Description

Returns the interest rates by Svensson’s model.

Usage

Srates(Coeff, maturity, whichRate = "Forward")

Arguments

Coeff        vector or matrix of the beta’s coefficients and of λ₁ and λ₂.
maturity     maturity of the yield curve of which want to return the interest rates.
whichRate     which rate want to return: "Spot" or "Forward" rates.
Details

Coeff is a vector or matrix of the four coefficients of the Svensson’s model, while lambdaValues is a vector or matrix of two lambda values of Svensson’s model.

Value

Return interest rates in matrix object with number of rows equal to nrow(Coeff) and number of columns equal to length(maturity).

Author(s)

Sergio Salvino Guirreri

References


Examples

data(ECB Yield Curve)
rate.ECB = first(ECB Yield Curve,'2 day')
maturity.ECB = c(0.25,0.5,seq(1,30,by=1))
SvenssonParameters <- Svensson(rate.ECB, maturity.ECB)
Svensson.rate <- Srates(SvenssonParameters ,maturity.ECB,"Spot")

plot(maturity.ECB, last(rate.ECB,'1 day'),main="Fitting Svensson yield curve",
     xlab=c("Pillars in years"), ylab=c("Rates"),type="o")
lines(maturity.ECB, last(Svensson.rate,'1 day'), col=2)
legend("topleft", legend=c("observed yield curve","fitted yield curve"),
        col=c(1,2),lty=1)
grid()

Svensson

Estimation of the Svensson parameters

Description

Returns the estimated coefficients of the Svensson’s model.

Usage

Svensson(rate, maturity )
Arguments
rate vector or matrix which contains the interest rates.
maturity vector which contains the maturity (in months) of the rate. The vector’s length must be the same of the number of columns of the rate.

Details
The Svensson’s model to describe the forward rate is:
\[ y_t(\tau) = \beta_0 + \beta_1 \exp\left( -\frac{\tau}{\lambda_1} \right) + \beta_2 \frac{\tau}{\lambda_1} \exp\left( -\frac{\tau}{\lambda_1} \right) + \beta_3 \frac{\tau}{\lambda_2} \exp\left( -\frac{\tau}{\lambda_2} \right) \]

The spot rate can be derived from forward rate and it is given by:
\[ y_t(\tau) = \beta_0 + \beta_1 \frac{1 - \exp\left( -\frac{\tau}{\lambda_1} \right)}{\frac{\tau}{\lambda_1}} + \beta_2 \left[ \frac{1 - \exp\left( -\frac{\tau}{\lambda_1} \right)}{\frac{\tau}{\lambda_1}} - \exp\left( -\frac{\tau}{\lambda_1} \right) \right] + \beta_3 \left[ \frac{1 - \exp\left( -\frac{\tau}{\lambda_2} \right)}{\frac{\tau}{\lambda_2}} - \exp\left( -\frac{\tau}{\lambda_2} \right) \right] \]

Value
Returns a data frame with the estimated coefficients: \( \beta_0, \beta_1, \beta_2, \beta_3, \lambda_1 \) and \( \lambda_2 \).

Author(s)
Sergio Salvino Guirreri

References

Examples
```r
data(ECB Yield Curve)
maturity.ECB <- c(0.25, 0.5, seq(1, 30, by=1))
A <- Svensson(ECB Yield Curve[1:10,], maturity.ECB)
Svensson.rate <- Srates( A, maturity.ECB, "Spot")
plot(maturity.ECB, Svensson.rate[5,], main="Fitting Svensson yield curve",
xlab="Pillars in years", type="l", col=3)
lines( maturity.ECB, ECB Yield Curve[5,], col=2)
legend("topleft", legend=c("fitted yield curve","observed yield curve"),
col=c(3,2), lty=1)
grid()
```
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