Package ‘YieldCurve’

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

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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=c(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=c(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.

**Source**


**Examples**

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

first(ECBYieldCurve, '3 day')
FedYieldCurve

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="Maturity in years", ylab="IR 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 https://home.treasury.gov/policy-issues/financing-the-government/interest-rate-statistics) 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

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="Maturity in years", ylab="IR values")
  title(main=paste("Federal Reserve yield curve observed at",time(FedYieldCurve[i], sep=" ")))
  grid()
}
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 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 Nelson-Siegel’s model to describe the yield curve is:

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

Value

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

Author(s)

Sergio Salvino Guirrerri

References


See Also

NelsonSiegel, 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="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**

```r
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 Guirreri
Srates

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 $\lambda_1$ and $\lambda_2$.
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 Guirrerí

References


Examples

data(ECBYieldCurve)
rate.ECB = first(ECBYieldCurve,'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:

\[ y_s(\tau) = \beta_0 + \beta_1 \frac{1 - \exp \left( -\frac{\tau}{\lambda_1} \right)}{\frac{\tau}{\lambda_1}} + \beta_2 \left[ \frac{1 - \exp \left( -\frac{\tau}{\lambda_1} \right)}{\frac{\tau}{\lambda_1}} - \exp \left( -\frac{\tau}{\lambda_1} \right) \right] + \beta_3 \left[ \frac{1 - \exp \left( -\frac{\tau}{\lambda_2} \right)}{\frac{\tau}{\lambda_2}} - \exp \left( -\frac{\tau}{\lambda_2} \right) \right] \]

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

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