Package ‘sym.arma’

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Author Vinicius Quintas Souto Maior [aut,cre,cph] and Francisco Jose A Cysneiros [aut]
Maintainer Vinicius Quintas Souto Maior <vinicius@de.ufpe.br>
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Description

This package provides a set of functions to fitting of autoregressive and moving average symmetric models.

Details

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Author(s)

Vinicius Quintas Souto Maior and Francisco Jose A. Cysneiros
Maintainer: Vinicius Quintas Souto Maior <vinicius@de.ufpe.br>

References


Examples

library(sym.arma)
data(assets)
fit <- elliptical.ts(assets$msf[2122:2240],order=c(1,0,0),trace=TRUE)
qqplot(fit,envelope=FALSE)
**assets**

*Returns of the daily closing prices of assets, Standard and Poors 500 Index and T-bill rates*

**Description**

Returns for all the trading days from November 1, 1993 to April 3, 2003.

**Usage**

```r
data("assets")
```

**Format**

A data frame with 2363 observations on the following 8 variables.

- `tbill`: a vector of returns of the T-bill rates for the trading days.
- `msf`: a vector of returns of the daily closing prices of Microsoft Corporation.
- `sp500`: a vector of returns of the Standard and Poors 500 index for the trading days.
- `ge`: a vector of returns of the daily closing prices of General Electric Company.
- `ford`: a vector of returns of the daily closing prices of Forward Industries Inc.
- `day`: day of trading.
- `month`: month of trading.
- `year`: year of trading.

**References**


---

**clr.test**

*Conditional Likelihood Ratio Test*

**Description**

Likelihood ratio test for objects of class SYMARMA.

**Usage**

```r
clr.test(model1, model2)
```

**Arguments**

- `model1, model2`: two models of class SYMARMA having the same set of records and the same type ("family").
Details

Likelihood ratio test checks the difference between -2*logLikelihood of the two models against the change in degrees of freedom using a chi-squared test. The records used in the dataset for both models MUST be the same.

Author(s)

Vinicius Quintas Souto Maior and Francisco Jose A. Cysneiros
Maintainer: Vinicius Quintas Souto Maior <vinicius@de.ufpe.br>

Examples

```r
serie <- symarma.sim(model=list(ar=c(0.2,0.5)),n=70,family="Normal", varphi=1)
model0 <- elliptical.ts(serie,order=c(2,0,0))
model1 <- elliptical.ts(serie,order=c(1,0,0))
clr.test(model0,model1)
```

Description

Fit an SYMARMA model to a univariate time series. Fitting method: conditional maximum likelihood estimation.

Usage

```r
elliptical.ts(Y, family="Normal", order=c(0,0,0), xreg=NULL, include.mean=TRUE, epsilon=0.0001, maxit=100, trace="TRUE", index1=NULL, index2=NULL, fixed=NULL)
```

Arguments

- `Y` a univariate time series.
- `family` a description of the conditional distribution of each $Y[t]$, given the set of past information. Symmetric distributions available for adjustment: Normal (`Normal`), Student-\(t\) (`Student`), Generalized Student-\(t\) (`Gstudent`), Exponential Power (`ExpPower`) (by Box & Tiao, 1973, ch 3), Logistic I (`LogisticI`), Logistic II (`LogisticII`), Generalized Logistic (`Glogistic`), Cauchy (`Cauchy`) and Contaminated Normal (`Cnormal`). The default is to normal distribution.
- `order` a specification of the SYMARMA model: the three integer components (p, d, q) are the AR order, the degree of differencing, and the MA order.
- `xreg` optionally, a vector or matrix of external regressors, which must have the same number of rows as \(Y\).
should the SYMARMA model include a mean/intercept term? The default is TRUE.

epsilon

positive convergence tolerance \( e \); the iterations converge when \( |\text{fit} - \text{fit}_\text{old}|/|\text{fit}| < e \). Default is \( e=1e-04 \).

maxit

integer giving the maximal number of iterations. Default is 100 iterations.

trace

a logical indicating if output should be produced.

index1

The parameter to Student-\( t \) and Exponential Power distributions or the first argument to Generalized Student-\( t \), Generalized Logistic and Contaminated Normal distributions.

index2

The second argument to Generalized Student-\( t \), Generalized Logistic (\( \text{index2} = \text{index2(index1)} \)) and Contaminated Normal distributions.

fixed

a optional numeric vector of the same length as the total number of parameters. If supplied, only NA entries in fixed will be varied.

Details

Different definitions of autoregressive and moving average models have different signs for the AR and/or MA coefficients. The dynamic component in SYMARMA model used here has

\[
\]

The estimation of the parameters that index the SYMARMA model is obtained by maximum conditional likelihood method on the first \( m \) observations, where \( m = \max(np,nq) \).

The variance matrix of the estimates is found from the Hessian of the log-likelihood, and so may only be a rough guide.

Value

A list of class “Symarma” with components:

- coefficients
- dispersion
- resid.raw
- resid.stand
- fitted.values
- loglik
- aic
- bic
- rmse
- iter
- n
- sd.coef
- sd.disp
- family
- X
Author(s)
Vinicius Quintas Souto Maior and Francisco Jose A. Cysneiros
Maintainer: Vinicius Quintas Souto Maior <vinicius@de.ufpe.br>

References


Examples
```r
data(assets)
attach(assets)

# Return in the prices on Microsoft and SP500 index
N = length(msf)
.sp500 = ((sp500[2:N]-sp500[1:(N-1)])/sp500[1:(N-1)])*100
.msf = ((msf[2:N]-msf[1:(N-1)])/msf[1:(N-1)])*100

# The T-bill rates were divided by 253 to convert to a daily rate
.tbill = tbill/253

# Excess return in the prices on Microsoft and SP500 index
Y = .msf - .tbill[1:(N-1)]
X = .sp500 - .tbill[1:(N-1)]

# Period from April 4, 2002 to October 4, 2002
serie = Y[2122:2240]
aux = cbind(X[2122:2240])

# Returns best ARIMA model according to either AIC value.
# auto.arima(Y,xreg=aux,seasonal=FALSE,ic=c("aic"))

# Fit SYMARMA models
fit.1 = elliptical.ts(serie,order=c(0,0,1),xreg=aux,include.mean=FALSE,
                     family="Normal")
fit.2 = elliptical.ts(serie,order=c(0,0,1),xreg=aux,include.mean=FALSE,
                     family="Student", index=1)
fit.3 = elliptical.ts(serie,order=c(3,0,1),xreg=aux,family="ExpPower",
                     index1=0, fixed=c(0,0,NA,NA,NA,NA))
```
Assessment of local influence in SYMARMA models

Description

This function discusses local influence analysis in SYMARMA models with Student-\(t\) and Gaussian distributions through Billor and Loyne’s slope, Cook’s curvature and Lesaffre and Verbeke’s curvature using the methodology of benchmarks proposed by Zhang and King. Although this function is concerned primarily with local influence, some discussion of assessing global influence is presented.

Usage

```r
influence(model, diag="slope", scheme="additive", iter=2000, alpha=0.95, theta=0.05, plot="TRUE")
```

Arguments

- `model`: a result of a call to `elliptical.ts`.
- `diag`: a description of the diagnostic method: “slope” for Billor and Loyne’s, “cook” for Cook’s and “lv” for Lesaffre and Verbeke’s. The default is to `slope`.
- `scheme`: a description of the perturbation scheme: “additive” for data additive perturbation and “dispersion” for dispersion parameter perturbation. The default is to `additive`.
- `iter`: integer giving the number of iterations for construction of benchmarks. Default is 2,000 iterations.
- `alpha`: percentile for benchmarks in assessing global influence (\(BS_0\) and \(BC_0\)) and first assessing local influence (\(BS_1\) and \(BC_1\)), e.g., 0.95.
- `theta`: percentile for benchmarks in assessing global influence second assessing local influence (\(BS_2\) and \(BC_2\)), e.g., 0.05.
- `plot`: a logical indicating if plot should be produced.

Value

- `Indiv1`: individual benchmark type I.
- `Indiv2`: individual benchmark type II.
- `VectorInd`: slope or curvature vector.

Author(s)

Vinicius Quintas Souto Maior and Francisco Jose A. Cysneiros
Maintainer: Vinicius Quintas Souto Maior <vinicius@de.ufpe.br>
References


Examples

```r
data(assets)
attach(assets)

# Return in the prices on Microsoft and SP500 index

N = length(msf)
.sp500 = ((sp500[2:N]-sp500[1:(N-1)])/sp500[1:(N-1)])*100
.msf = ((msf[2:N]-msf[1:(N-1)])/msf[1:(N-1)])*100

# The T-bill rates were divided by 253 to convert to a daily rate

.tbill = tbill/253

# Excess return in the d prices on Microsoft and SP500 index

Y = .msf - .tbill[1:(N-1)]
X = .sp500 - .tbill[1:(N-1)]

# Period from April 4, 2002 to October 4, 2002

serie = Y[2122:2240]
aux = cbind(X[2122:2240])

# Fit SYMARMA models

fit.1 = elliptical.ts(serie,order=c(0,0,1),xreg=aux,include.mean=FALSE,
family="Normal")
fit.2 = elliptical.ts(serie,order=c(0,0,1),xreg=aux,include.mean=FALSE,
family="Student", index1=4)

# Assessment of local influence

influence(fit.1,diag="slope",scheme="additive",iter=20,plot="FALSE")
influence(fit.2,diag="l1v",scheme="additive",iter=20,plot="FALSE")
```

*influence*
**predict**

**Forecasts from a fitted SYMARMA model**

**Description**

See Maior and Cysneiros (2018) for details on this function.

**Usage**

```r
predict(model, h, xreg = NULL)
```

**Arguments**

- `model`: a result of a call to `elliptical.ts`.
- `h`: number of periods for forecasting. If `xreg` is used, `h` is ignored and the number of forecast periods is set to the number of rows of `xreg`.
- `xreg`: future values of an regression variables.

**Value**

- `pred`: predicted values.

**Author(s)**

Vinicius Quintas Souto Maior and Francisco Jose A. Cysneiros
Maintainer: Vinicius Quintas Souto Maior <vinicius@de.ufpe.br>

**References**


**Examples**

```r
data(assets)
attach(assets)

# Return in the prices on Microsoft and SP500 index

N = length(msf)
.sp500 = ((sp500[2:N]-sp500[1:(N-1)])/sp500[1:(N-1)])*100
.msf = ((msf[2:N]-msf[1:(N-1)])/msf[1:(N-1)])*100
```
The T-bill rates were divided by 253 to convert to a daily rate

```
.tbill = tbill/253
```

Excess return in the d prices on Microsoft and SP500 index

```
Y = .msf - .tbill[1:(N-1)]
X = .sp500 - .tbill[1:(N-1)]
```

Period from April 4, 2002 to October 4, 2002

```
serie = Y[2122:2240]
aux = cbind(X[2122:2240])
```

Fit SYMARMA models

```
fit.1 = elliptical.ts(serie,order=c(0,0,1),include.mean=FALSE,
                      family="Normal")
```

Forecasts

```
predict(fit.1, h=10)
```

---

**qqplot**

**Quantile-Quantile Plots**

**Description**

This function produces Q-Q plot with envelopes for a time series following conditional symmetric distribution.

**Usage**

```
qqplot(model, envelope = 0.95, B = 400)
```

**Arguments**

- **model**: a result of a call to `elliptical.ts`.
- **envelope**: confidence level for point-wise confidence envelope, or FALSE for no envelope.
- **B**: integer; number of bootstrap replications for confidence envelope. Default is 400 iterations.

**Author(s)**

Vinicius Quintas Souto Maior and Francisco Jose A. Cysneiros

Maintainer: Vinicius Quintas Souto Maior <vinicius@de.ufpe.br>
symarma.sim

References


Examples

```r
data(assets)
attach(assets)

# Return in the prices on Microsoft and SP500 index
N = length(msf)
.sp500 = ((sp500[2:N]-sp500[1:(N-1)])/sp500[1:(N-1)])*100
.msfr = ((msfr[2:N]-msfr[1:(N-1)])/msfr[1:(N-1)])*100

# The T-bill rates were divided by 253 to convert to a daily rate
.tbill = tbill/253

# Excess return in the d prices on Microsoft and SP500 index
Y = .msfr - .tbill[1:(N-1)]
X = .sp500 - .tbill[1:(N-1)]

# Period from April 4, 2002 to October 4, 2002
serie = Y[2122:2240]
aux = cbind(X[2122:2240])

# Fit SYMARMA models
fit.1 = elliptical.ts(serie,order=c(0,0,1),xreg=aux,include.mean=FALSE, family="Normal")
fit.2 = elliptical.ts(serie,order=c(0,0,1),xreg=aux,include.mean=FALSE, family="Student",index=4)

# Q-Q Plots
qqplot(fit.1, B = 50)
qqplot(fit.2, envelope = FALSE)
```

Description

Simulate from an SYMARMA model.
Usage

symarma.sim(model, n, family="Normal", index1, index2, varphi=1)

Arguments

model  a list with component ar and/or ma giving the AR and MA coefficients respectively. Optionally a component order can be used. An empty list gives an SYMARMA(0,0) model, that is white noise.

n  length of output series, before un-differencing. A strictly positive integer.

family  a description of the conditional distribution of each $Y[t]$, given the set of past information.

index1, index2  the arguments of the symmetric distributions indexed by parameters.

varphi  the dispersion parameter of the innovations generated. Default is varphi=1.

Details

See elliptical.ts for the precise definition of an SYMARMA model.

The SYMARMA model is checked for stationarity.

SYMARMA models are specified via the order component of model, in the same way as for elliptical.ts. Other aspects of the order component are ignored, but inconsistent specifications of the MA and AR orders are detected. The un-differencing assumes previous values of zero, and to remind the user of this, those values are returned.

Value

A time-series object of class “ts”.

See Also

elliptical.ts and arima.sim

Examples

serie0 <- symarma.sim(model=list(ar=c(0.3,0.2),ma=c(0.34)),n=70, varphi=1)
serie1 <- symarma.sim(model=list(ar=c(0,0,0.65)),n=70,family="Student", index1 = 4, varphi=1)
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