Package: cif (via r-universe)

August 21, 2024

Title Cointegrated ICU Forecasting

Description Set of forecasting tools to predict ICU beds using a Vector Error Correction model with a single cointegrating vector. Method described in Berta, P. Lovaglio, P.G. Paruolo, P. Verzillo, S., 2020. ``Real Time Forecasting of Covid-19 Intensive Care Units demand" Health, Econometrics and Data Group (HEDG) Working Papers 20/16, HEDG, Department of Economics, University of York, <https://www.york.ac.uk/media/economics/documents/hedg/workingpapers/2020/2016.pdf>.

Version 0.1.1

Date 2022-03-01

Maintainer Paolo Paruolo <Paolo.PARUOLO@ec.europa.eu>

Encoding UTF-8

Depends R (>= 3.6.0)

License GPL-3

Imports stats, lubridate, graphics, grDevices

LazyData true

RoxygenNote 7.1.1

Suggests testthat (>= 3.0.0)

Config/testthat/edition 3

NeedsCompilation no

Author Paolo Berta [aut], Paolo Paruolo [aut, cre] (<https://orcid.org/0000-0002-3982-4889>), Stefano Verzillo [ctb], Pietro Giorgio Lovaglio [ctb]

Repository CRAN

Date/Publication 2022-03-01 16:30:02 UTC

Contents

crossing . . . 2
diffe . . . 3
ec.companion . . . 4
ec.datadet1 . . . 4
ec.datadet2 . . . 5
ec.datalag . . . 6
ec.EG1 . . . 6
ec.gfd . . . 7
ec.gfl . . . 8
ec.gfld . . . 9
ec.ifp . . . 10
ec.main . . . 10
ec.plotfor . . . 12
ec.plotroots . . . 13
ec.predict . . . 13
ec.searchbreaks . . . 14
iculomb . . . 15
lagn . . . 16
listsize . . . 16
mls . . . 17
summary.cif . . . 18
Wald.mls . . . 18

Index **20**

`crossing` *computes at which observation a vector y crosses ref for the first time*

Description

Computes at which observation vector yfor crosses yref for the first time if it is not crossed, then 0 is returned

Usage

```
crossing(yfor, ref = 0)
```

Arguments

`yfor`	yfor is either a vector and a matrix
`ref`	ref is the refence value

Value

whensign, a matrix with observation number at which there is crossing

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

`diffe` *appends NA at beginning of diff(y)*

Description

appends NA at beginning of diff(y) and creates column names accordingly when y is either a vector and a matrix

Usage

```
diffe(y)
```

Arguments

`y`	either a vector and a matrix

Value

Dy contains the differences of y, with NA appended at the start

Author(s)

P. Paruolo

References

Berta et al. 2020

`ec.companion` *computes companion matrix of the VAR*

Description

builds the companion matrix of the VAR

Usage

```
ec.companion(est, p = 2, nlag = 4)
```

Arguments

`est`	is the output of ec.EG1.R
`p`	(positive integer) is the dimension of the VAR
`nlag`	(positive integer) is the number of lags in the VAR

Value

mA companion matrix

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

`ec.datadet1` *prepares deterministics D^(1)*

Description

Prepares deterministic data

Usage

```
ec.datadet1(n, befpn, breaks)
```

Arguments

`n`	is the number of obs in available data
`befpn`	is a vector with (begtrim,endtrim,nforecast,npred,nhstar)
`breaks`	is a vector of integers where the trend breaks should be

Value

matdet1 a matrix with the following columns (1_vec, t_vec) and (n+npred) rows

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

`ec.datadet2` *prepares deterministics D^(2)*

Description

Prepares deterministic dummies for de-meaned daily seasonal and difference point dummies

Usage

```
ec.datadet2(det1, booseas = NA, pntdates = NA)
```

Arguments

`det1`	is the det term with constant and trend created by ec.datadet1.R
`booseas`	is a boolean for daily seasonal dummies
`pntdates`	is a vector of integers where the point dummies should be

Value

det2mat a matrix with the following columns (daily_seas, point_dummies) and n+npred rows

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

ec.datalag *prepares Dy y_1 Dy_1 ... Dy_nlag-1 for estimation*

Description

Prepares data for estimation

Usage

```
ec.datalag(y, nlag = 4)
```

Arguments

y	is the data matrix of variables in the VAR
nlag	is the number of lags in the VAR (min = 2)

Value

ymat contains the folloiwing columns Dy y_1 Dy_1 ... Dy_nlag-1

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

ec.EG1 *estimates the VECM with the 2-stage procedure of Engle & Granger*

Description

Estimates the EC with EG. Cointegration rank fixed at 1

Usage

```
ec.EG1(det1, det2, ymat, npl, befpn, ndet, drop1 = NA, drop2 = NA)
```

Arguments

det1	deterministic matrix of constant(s) and trend(s)
det2	deterministic matrix of seasonals and point dummies
ymat	matrix of lags
npl	n, p, nlag
befpn	begtrim, endtrim, nforecast, npred
ndet	order of the model d(i,j)
drop1	selection of det1 regressors in first stage to drop
drop2	selection of det1 regressors in second stage to drop

Value

out a list with estimates

Author(s)

P. Berta, P. Paruolo, S. Verzillo, P.G. Lovaglio

References

Berta et al. 2020

---

ec.gfd *plots forecasts of difference with confidence bars*

Description

plots forecasts of difference with confidence bars

Usage

```
ec.gfd(obj, whichseries = 1, nsigma = 3, xvec, yvec, cal, lar = 0.025, ...)
```

Arguments

obj	output of ec.main
whichseries	series number
nsigma	how many standard deviations in confidence bars
xvec	vector of dates to place on x axis
yvec	vector of exp(y) values to display on y axis
cal	calendar vector
lar	length of arrows in error bars
...	other plot parameters

Value

does not return output, just creates a graph

Author(s)

P. Paruolo,

`ec.gfl` *plots level forecasts with confidence bars*

Description

plots level forecasts with confidence bars

Usage

```
ec.gfl(obj, whichseries = 1, nsigma = 3, xvec, yvec, cal, lar = 0.025, ...)
```

Arguments

`obj`	output of ec.main
`whichseries`	series number
`nsigma`	how many standard deviations in confidence bars
`xvec`	vector of dates to place on x axis
`yvec`	vector of exp(y) values to display on y axis
`cal`	calendar vector
`lar`	length of arrows in error bars
`...`	other plot parameters

Value

does not return output, just creates a graph

Author(s)

P. Paruolo

ec.gfld *ec.gfld plots forecasts of levels and difference with confidence bars*

Description

plots forecasts of levels and difference with confidence bars

Usage

```
ec.gfld(
  obj,
  whichseries = 1,
  nsigma = 3,
  jointboo = TRUE,
  epsboo = TRUE,
  filename = "whatever",
  xvec,
  yvec,
  cal,
  lar = 0.025,
  ...
)
```

Arguments

obj	output of ec.main
whichseries	series number
nsigma	how many standard deviations in confidence bars
jointboo	boolean: TRUE if 1x2 graph, FALSE otherwise
epsboo	boolean: TRUE eps graph, FALSE pdf graph
filename	string, name of the file (no extension)
xvec	vector of dates to place on x axis
yvec	vector of exp(y) values to display on y axis
cal	calendar vector
lar	length of arrows in error bars
...	other plot parameters

Value

does not return output, just creates a double graph

Author(s)

P. Paruolo

ec.ifp *Computes Indices of Forecast Performance*

Description

indices of forecast performance

Usage

```
ec.ifp(afdlin, rwsigma, rwabsmean, kval = 1.959964)
```

Arguments

afdlin	actual + forecast values + fcse
rwsigma	standard deviation of Random Walk in sample
rwabsmean	mean absolute deviation of Random Walk in sample
kval	how many se to use, default kval = 1.959964

Value

list of indices of forecast performance 1: index for model forecast 0: index for Random Walk forecast

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

ec.main *Forecast with Vector Error Correction Model*

Description

This function estimate VECM model. Selects begtrim and entrim period, define lag and run.

Usage

```
ec.main(
  y,
  ndet = c(2, 1),
  nlag,
  befpn,
  breaks = NA,
  booseas = NA,
  pntdates = NA,
  drop1 = NA,
  drop2 = NA,
  cal,
  kval = 1.959964
)
```

Arguments

y	matrix with time across rows and variables in columns
ndet	vector of lenght 3, (i,j,q): i for EG1-st stage, j for EG-2nd stage, q number of breaks i,j=0 no deterministics i,j=1 constant i,j=2 constant and trend
nlag	number of lags in the VAR
befpn	begtrim, endtrim, nforecast, npred
breaks	vector with observation numbers for T1,T2,...
booseas	boolean =T if seasonal dummies, =F otherwise
pntdates	vector with observation numbers for point dummies
drop1	selection of det1 regressors in first stage to drop
drop2	selection of det1 regressors in second stage to drop
cal	calendar for the y matrix
kval	how many se to use, default kval=1.959964

Value

results Output contains the a set of estimates and forecasting results.

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

`ec.plotfor` *plots forecasts*

Description

plot actual and forecast intervals

Usage

```
ec.plotfor(
  y,
  x = NA,
  lcolact = NA,
  lcolfor = NA,
  ltypefor = NA,
  polycol = NA,
  myylim = NA,
  ...
)
```

Arguments

`y`	actual values and forecasts (point forecast, lower bound, upper bound)
`x`	time calendar
`lcolact`	color actual (scalar)
`lcolfor`	color forecasts
`ltypefor`	type forecasts
`polycol`	color polygons if one wishes to have different lcolfor,ltypefor,polycol by week > make linecol, linetype, polycol vectors, indexed by week
`myylim`	vector with min and max for y axis
`...`	other plot parameters

Value

does not return output, just creates a graph

Author(s)

P. Paruolo

References

Berta et al. 2020

ec.plotroots *Companion matrix of the VAR*

Description

plots roots and the unit circle

Usage

```
ec.plotroots(roots)
```

Arguments

roots	are the roots of the companion matrix, see ec.companion.R

Value

does not return output, just creates a graph

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

ec.predict *produces predictions for the VECM via its VAR companion form*

Description

Predicts both in-sample (1 step ahead) and out-of-sample (1 step ahead and dynamic forecasts)

Usage

```
ec.predict(est, det1, det2, ymat, npl, befpn, ndet, cal, kval = 1.959964)
```

Arguments

est	output from estimation by ec.EG1.R
det1	deterministic matrix of constant(s) and trend(s)
det2	deterministic matrix of seasonals and point dummies
ymat	matrix of lags
npl	n, p, nlag
befpn	begtrim, endtrim, nforecast, npred, nhstar
ndet	order of the model d(i,j)
cal	calendar, should match the number of rows in ymat
kval	how many se to use, default kval= 1.959964

Value

list with contains: afl (actual and 1 step ahead fitted levels) afd (actual and 1 step ahead fitted differences) fit (1 step ahead fit) dynpred (dynamic predictions) mAt mB (companion matrix and selection of it) Sigmah (Sigmah for dyn forecasts) forstartdate (starting date for dyn forecast) outcal (dates for the prediction) h1star (h1star) cspred (table with change in sign of pred for Dx_1) indexfa (indices of forecast accuracy)

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

---

ec.searchbreaks *search for breaks dates for given q (=1,2,3,4)*

Description

Search for location of break points in 1st-stage of Engle-Granger

Usage

```
ec.searchbreaks(qse, ymat, npl, befpn, ndet, gfillmin = 10, fixed = NA)
```

Arguments

qse	q: number of (additional) breaks, s: start date for search, e: end date for search
ymat	matrix of lags
npl	n, p, nlag
befpn	begtrim, endtrim, nforecast, npred
ndet	order of the model d(i,j)
gfillmin	gfill value
fixed	vector of breaks to be taken as fixed (not between s=start and e=end)

Value

out list with break dates and values of regression average sum of squares

Author(s)

P. Paruolo

References

Berta et al. 2020

---

iculomb *Data from Italian Civil Protection*

Description

Data from Italian Civil Protection

Usage

```
data(iculomb)
```

Format

A dataset including 324 obs and 24 columns.

Source

https://github.com/pcm-dpc/COVID-19/

References

Italian Civil Protection

Examples

```
data(iculomb)
```

lagn *lag j of matrix or vector y*

Description

lagn(y,j,fill=NA) produces lag j of matrix or vector y, with fill in missing j cells REM: alternative to "lead-lag" dplyr which applies to vector y

Usage

```
lagn(y, j, fill = NA)
```

Arguments

y	column vector or matrix
j	number of lags
fill	value to be used to fill the missing values at the beginning, default = NA

Value

y lagged j cells, with fill in the missing j positions

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

listsize *listsize number of terms in the search for 1,2,3,4 number of breaks*

Description

computes length-4 vector with number of terms in the search for 1,2,3,4 number of breaks

Usage

```
listsize(myT, gfill, start)
```

Arguments

myT	sample size
gfill	number of gap periods
start	beginning

Value

a vector of 4 elements, with the number of candidate models for 1,2,3,4 breaks

Author(s)

P. Paruolo

`mls` *Multivariate Least-Squares regression*

Description

Multivariate Least-Squares regression y = x beta + u

Usage

```
mls(y, x, df_flag = FALSE)
```

Arguments

`y`	left hand side data matrix (one or more columns)
`x`	right hand side data matrix (one or more columns)
`df_flag`	flag = TRUE for degrees of freedom correction for the variance

Value

out regression coefficients and related statistics

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

summary.cif *summary function for cif*

Description

Summary function for presize

Usage

```
## S3 method for class 'cif'
summary(object, ..., digits = 4)
```

Arguments

object	is the name of the cif object created by cif
...	other parameters
digits	integer indicating the number of decimal places (round) or significant digits (signif) to be used.

Value

returns summary output from model estimation and forecasting

Author(s)

P. Berta, P. Paruolo, S. Verzillo, PG. Lovaglio

References

Berta et al. 2020

Wald.mls *Wald test for Multivariate Least-Squares regression*

Description

Wald test for multivariate Least-Squares regression

Usage

```
Wald.mls(mlsresults)
```

Arguments

mlsresults	output of mls, mlsresults<-mls(y, x, df_flag)

Value

wald table of Wald tests on significance of single regressors and pvalues based on chi square distribution

Author(s)

P. Paruolo

References

Berta et al. 2020

Index

∗ **datasets**
iculomb, 15

crossing, 2

diffe, 3

ec.companion, 4
ec.datadet1, 4
ec.datadet2, 5
ec.datalag, 6
ec.EG1, 6
ec.gfd, 7
ec.gfl, 8
ec.gfld, 9
ec.ifp, 10
ec.main, 10
ec.plotfor, 12
ec.plotroots, 13
ec.predict, 13
ec.searchbreaks, 14

iculomb, 15

lagn, 16
listsize, 16

mls, 17

summary.cif, 18

Wald.mls, 18