Package 'CommonTrend'

February 19, 2015

Version 0.7-1

Date 2011-11-13

Title Extract and plot common trends from a cointegration system.
Calculate P-value for Johansen Statistics.

Author Fan Yang

Maintainer Fan Yang <yfno1@msn.com>

Depends R (>= 2.10)

Imports methods,MASS,urca

Description Directly extract and plot stochastic common trends from
a cointegration system using different approaches, currently
including Kasa (1992) and Gonzalo and Granger (1995).
The approach proposed by Gonzalo and Granger, also known as
Permanent-Transitory Decomposition, is widely used in
macroeconomics and market microstructure literature.
Kasa's approach, on the other hand, has a nice property that it only
uses the super consistent estimator: the cointegration vector
'beta'.
This package also provides functions calculate P-value
from Johansen Statistics according to the approximation method
proposed by Doornik (1998).
Update:
0.7-1: Fix bugs in calculation alpha. Add formulas and more explanations.
0.6-1: Rewrite the description file.
0.5-1: Add functions to calculate P-value from Johansen statistic, and vice versa.

License GPL (>= 2)

Repository CRAN

Date/Publication 2013-09-05 20:02:29

NeedsCompilation no

R topics documented:

`benchmark` *Data set for logged stock indices in three benchmark markets*

Description

Data set for logged stock indices in three benchmark markets, US,UK and HK. These three markets are generally believed to be fully integrated with the word market, thus they may share a single stochastic common trend.

Usage

```
data(benchmark)
```

Format

A data frame with 6689 observations on the following 4 variables, ranging from 2/1/1986 until 23/8/2011.

`date`	Date vector.
`uk`	Logged price of FTSE 100.
`us`	Logged price of S&P 500.
`hk`	Logged price of HangSeng.

Author(s)

Fan Yang

Source

Datastream

`ComT-class` *Representation of class* `ComT`

Description

This class contains several useful objects about the estimated common trends for further manipulations.

Arguments

method	Character. Method used to extract the common trends.
length	Length of the common trends. It is the length of original series minus lag order.
lag.chosen	Lag order.
beta	The estimated cointegration vector.
othog.beta	The othogonal complement of $\boldsymbol{\beta}$.
alpha	The estimated $\boldsymbol{\alpha}$.
othog.alpha	The othogonal complement of $\boldsymbol{\alpha}$.
common.trend	The common trends after multiplied with the loading matrix.
pure.trend	The 'pure' common trends without multiplying with the loading matrix.
loading.vector	The loading matrix.
stationary	The estimated stationary process.
data.used	The orginal data after adjusted with the lag order. Thus it has the same length with the estimated common trends.

Author(s)

Fan Yang

GG.ComT *Permanent-Transitory Decomposition*

Description

Extract Common Trend(s) from a cointegration system according to Gonzalo and Grange(1995). This method is also known as the Permanent-Transitory Decomposition. Loading Matrix and Othogonal Complement of α and β are also reported.

Usage

```
GG.ComT(data, rank, k)
```

Arguments

data	Data used to construct the cointegration system
rank	Number of cointegration vectors specified
k	Lag order in VECM

Details

Currently functions `GG.ComT` and `Kasa.ComT` assume that no determinstic parts, such as the constant and the trend, are in the Error-Correction Terms (ECT). So that means we have to keep `ecdet = "none"` in the `ca.jo` function (`ca.jo` is the major function in package `urca` to estimate cointegration relations). But it does allow the existence of constant term in the VECM (outside ECT).

The method proposed by Gonzalo and Granger decomposes the time series X_t as

$$X_t = \alpha(\beta'\alpha)\beta' X_t + \beta_\perp(\alpha'_\perp\beta_\perp)^{-1}\alpha_\perp X_t$$

where $\alpha(\beta'\alpha)\beta' X_t$ is *I(0)* and the transitory part, and $\beta_\perp(\alpha'_\perp\beta_\perp)^{-1}\alpha_\perp X_t$ is *I(1)* and the permanent part (see Equation 11 in Gonzalo and Granger 1995). Be cafreful in Gonzalo and Granger's paper they use different notation for α and β.

Kasa's method decomposes the time series as

$$X_t = \beta(\beta'\beta)^{-1}\beta' X_t + \beta_\perp(\beta'_\perp\beta_\perp)^{-1}\beta_\perp X_t$$

where "the first part defines the stationary component and the second part then defines the common stochastic trend" (Kasa 1992) (see Equation 12 in Kasa 1992).

Value

An object of class `ComT`.

Author(s)

Fan Yang

References

Kasa, K., 1992. Common stochastic trends in international stock markets, *Journal of Monetary Economics* **29**, 95-124.

Gonzalo, J., and C. Granger, 1995. Estimation of Common Long-Memory Components in Cointegrated Systems, *Journal of Business & Economic Statistics* **13**, 27-35.

See Also

`ComT-class`,`plotComT`

Examples

```
data(benchmark)
x=seq(1,6689,by=23) ## monthly data
global=data.frame(benchmark[x,2:4])

GG.ComT (global,2,4)

## Plot the Common Trend
```

```
G=GG.ComT (global,2,4)
Date=benchmark[x,1]
plotComT(G,1,x.axis=Date,approx.ticks=12,
        legend=c("S&P 500 Price index", "Common Trend"),
        main="Extract Common Trend(s) from Benchmark Markets",
        ylab="Price", xlab="Time"  )
```

`Kasa.ComT` *Common Trend(s) according to Kasa(1992)*

Description

Extract Common Trend(s) from a cointegration system according to Kasa(1992). Loading Matrix and Othogonal Complement of α and β are also reported.

Usage

```
Kasa.ComT(data, rank, k)
```

Arguments

`data`	Data used to construct the cointegration system
`rank`	Number of cointegration vectors specified
`k`	Lag order in VECM

Details

For all the details, functions and its differences with the method proposed by Gonzalo and Granger, see `GG.ComT`.

Value

An object of class `ComT`.

Author(s)

Fan Yang

References

Kasa, K., 1992. Common stochastic trends in international stock markets, *Journal of Monetary Economics* **29**, 95-124.

Gonzalo, J., and C. Granger, 1995. Estimation of Common Long-Memory Components in Cointegrated Systems, *Journal of Business & Economic Statistics* **13**, 27-35.

See Also

ComT-class, plotComT

Examples

```
data(benchmark)
x=seq(1,6689,by=23) ## monthly data
global=data.frame(benchmark[x,2:4])

Kasa.ComT (global,2,4)

## Plot the Common Trend

K=GG.ComT (global,2,4)

Date=benchmark[x,1]
plotComT(K,1,x.axis=Date,approx.ticks=12,
        legend=c("S&P 500 Price index", "Common Trend"),
        main="Extract Common Trend(s) from Benchmark Markets",
        ylab="Price", xlab="Time"  )
```

---

optimlag *Search the lag order to maximize Johansen Statistics (1988)*

Description

Search the lag order to maximize Johansen Statistics (1988) assuming there is only one common trend.

Usage

```
optimlag(data, k=10, ecdet= "none" )
```

Arguments

data	Data used to construct the cointegration system
k	maximum number of lags to search
ecdet	Character, the same argument used in ca.jo. In the package urca, 'none' is for no intercept in ECT (but there is constant in VECM, just outside ECT), 'const' is for constant term in ECT and 'trend' is for trend in ECT. See Details.

Details

Under the assumption that there is only one common trend, if a lag oder is chosen to maximize the Johansen statistics , then the estimated signle common trend will best fit the original series.

'none' is suggested to be chosen for 'ecdet', since currently this package only supports extrating common trend when intercept is included into VECM (but outside ECT).

Value

`Olag.value`	The maximized Johansen statistics (trace)
`Olag`	The lag order that maximizes Johansen statistics
`list.lags`	A list of all the possible lag orders and their corresponding Johansen Statistics. Note that the value when lag order is one is NA since lag order must bigger than 2.

Author(s)

Fan Yang

References

Johansen, S. (1988), Statistical Analysis of Cointegration Vectors, *Journal of Economic Dynamics and Control*, **12**, 231–254.

See Also

`optimlag-class`

Examples

```
data(benchmark)
x = seq(1, 6689, by = 23)  ## monthly data
global = data.frame(benchmark[x, 2:4])

optimlag(global, 15, "none")
```

`optimlag-class` *Representation of class* `optimlag`

Description

This class contains several useful objects about the optimum lag order for further manipulations.

Arguments

`Olag.value`	Under the assumption of only one common trend, the lag order to maximize Johansen Statistic(1988).
`Olag`	The mazimized corresponding Johansen Statistic.
`list.lags`	A list of all the possible lag orders and their corresponding Johansen Statistics.

Author(s)

Fan Yang

p.Johansen *P-value of Johansen statistics*

Description

Enter Johansen statistics (1998) (trace), then it will calculate its P-value according to the approximation method proposed by Doornik (1998).

Usage

```
p.Johansen (q,nComT,type=c("z","c","lc","l","ql") )
```

Arguments

q	Johansen statistics(trace)
nComT	Number of common trends specified in the model
type	Character. The specification of constant and trend in VECM. see Details

Details

Enter the Johansen statistic(1988)(trace), then it will calculate its P-value according to the approximation method proposed by Doornik (1998). nComT is actually the dimention miinus the specified rank number in VECM. In terms of the specification of constant and trend:

"z": No constant and no trend.
"c": Restriced constant but no trend. This type corresponds with the Case 1* in Osterwal (1992) and the type "const" in ca.jo.
"lc": Unrestricted constant but no trend. This type corresponds with the Case 1 in Osterwal (1992).
"l": Unrestricted constant and restriced trend. This type corresponds with the Case 2* in Osterwal (1992) and the type "trend" in ca.jo.
"ql": Unrestricted constant and Unrestriced trend. This type corresponds with the Case 2 in Osterwal (1992).

More detailed explanation for the different typs above could be found in Osterwal (1992) and Doornik (1998).

Value

P-vlaue of Johansen statistics

Author(s)

Fan Yang

References

Johansen, S. (1988), Statistical Analysis of Cointegration Vectors,*Journal of Economic Dynamics and Control*, **12**, 231–254.

Doornik, J. A. (1998), Approximations to the Asymptotic Distributions of Cointegration Tests, *Journal of Economic Surveys* **12**, 573–593.

See Also

q.Johansen

Examples

```
# when type in \code{ca.jo} is \code{"const"} in Osterwal (1992) and in \code{ca.jo}
# and when there are 1,2 or 3 common trends in the VECM respectively,
# 12.97,24.60 and 41.07 are the corresponding statistics when P-value is 0.01 and
#The examples here show the approximation using Doornik (1998) works very well
p.Johansen(12.97,1,"c")
p.Johansen(24.60,2,"c")
p.Johansen(41.07,3,"c")
```

---

plotComT *Plot the common trend(s)*

Description

Plot the common trends and compare them with the original series.

Usage

```
plotComT(ComT, i, x.axis = NA,
         approx.ticks = 7, legend = c("Original Data", "Common Trend"),
         main = "", ylab = "", xlab = "")
```

Arguments

ComT	A class of ComT
i	The ith orginal series and its common trends you want to plot. Must be equal or less than the dimention of cointegration system. See Details.
x.axis	The vector used as the x-axis. Its length must be equal to the length of original series.
approx.ticks	The number of ticks on the x-axis. If NULL, then 7 is used.
legend	A vector with two characters. The first one is the legend for original series; the second one is that for its common trends.

main	Character. The main title of the graph.
ylab	Character. The title of y-axis.
xlab	Character. The title of x-axis.

Details

This function will plot the ith original series and its estimated common trend in one graph. The estimated trend plotted here is based on ComT$common.trend[i,], wchih is the ComT$pure.trend multiplied its corresonding loading weight in ComT$loading.vector. To better fit the original series, we add the mean of its corresponding estimated stationary process onto the common trends.

Note that if more than one common trends (Pure trends without multiplying loading vector) are identified in the cointegration system, then this function will plot the weighted sum of those pure trends.

Value

A graph of ith original series and its estimated common trend.

Author(s)

Fan Yang

See Also

ComT-class

Examples

```
data(benchmark)
x=seq(1,6689,by=23) ## monthly data
global=data.frame(benchmark[x,2:4])
Date=benchmark[x,1]

G=GG.ComT (global,2,4)

## only the first two arguments in this function are compulsory.

plotComT(G,1)

## The complete set of arguments

plotComT(G,1,x.axis=Date,approx.ticks=12,
         legend=c("S&P 500 Price index", "Common Trend"),
         main="Extract Common Trend(s) from Benchmark Markets according to GG",
         ylab="Price", xlab="Time"  )
```

q.Johansen *Get Johansen statistics from its P-value*

Description

Enter the P-value of Johansen statistics(1988), then it will calculate the Johansen statistic(trace) itself according to the approximation method proposed by Doornik (1998).

Usage

```
q.Johansen (p,nComT,type=c("z","c","lc","l","ql") )
```

Arguments

p	P-value of Johansen statistics
nComT	Number of common trends specified in the model
type	Character. The specification of constant and trend in VECM. see Details

Details

Enter the P-value of Johansen statistics(1988), then it will calculate the Johansen statistic(trace) itself according to the approximation method proposed by Doornik (1998). nComT is actually the dimention miinus the specified rank number in VECM. For the specification of constant and trend, you could directly refer to p.Johansen.

Value

Johansen statistic(trace)

Author(s)

Fan Yang

References

Johansen, S. (1988), Statistical Analysis of Cointegration Vectors,*Journal of Economic Dynamics and Control*, **12**, 231–254.

Doornik, J. A. (1998), Approximations to the Asymptotic Distributions of Cointegration Tests, *Journal of Economic Surveys* **12**, 573–593.

See Also

p.Johansen

Examples

```
#Traces for the fowllowing 3 cases are actually
#12.97,24.60, 41.07 in Osterwal (1992) and in ca.jo of urca package.
#The examples here show the approximation using Doornik (1998) works very well
q.Johansen(0.01,1,"c")
q.Johansen(0.01,2,"c")
q.Johansen(0.01,3,"c")
```

Index