Package 'PANICr'

September 24, 2016

Title PANIC Tests of Nonstationarity

Description A methodology that makes use of the factor structure of large dimensional panels to understand the nature of nonstationarity inherent in data. This is referred to as PANIC, Panel Analysis of Nonstationarity in Idiosyncratic and Common Components.
PANIC (2004)<doi:10.1111/j.1468-0262.2004.00528.x> includes valid pooling methods that allow panel tests to be constructed.
PANIC (2004) can detect whether the nonstationarity in a series is pervasive, or variable specific, or both.
PANIC (2010) <doi:10.1017/s0266466609990478> includes two new tests on the idiosyncratic component that estimates the pooled autoregressive coefficient and sample moment, respectively. The PANIC model approximates the number of factors based on Bai and Ng (2002) <doi:10.1111/1468-0262.00273>.

Depends R(>= 2.10.0)

Version 1.0.0

License GPL-3

LazyData no

Author Steve Bronder <sbronder@stevebronder.com>

Maintainer Steve Bronder <sbronder@stevebronder.com>

URL stevebronder.com, https://github.com/Stevo15025/PANICr

Suggests knitr, testthat

VignetteBuilder knitr

Imports MCMCpack, xts, coda

RoxygenNote 5.0.1

NeedsCompilation no

Repository CRAN

Date/Publication 2016-09-24 13:01:08

R topics documented:

`adf` *ADF test for PANIC (2010)*

Description

This function performs the ADF tests on the idiosyncratic and common components for PANIC (2010).

Usage

```
adf(y,k,p)
```

Arguments

y	An NxT matrix of data.
k	An integer specifying the maximum lag order for individual ADF regressions. Bai and Ng (2004) suggest 4*(Time)^(.25) rounded to the nearest whole number as the maximum number of lags.
p	An integer that is either 0 or 1. p is the order of the deterministic function in the regression. 0 is for constant only and 1 is to include a trend.

Value

tstat A vector of t statistics for each column of the input matrix

---

adf04 *ADF test for PANIC (2004)*

Description

This function performs the ADF tests on the idiosyncratic and common components for PANIC (2004).

Usage

```
adf04(y,k,p)
```

Arguments

y	A matrix containing the data.
k	An integer specifying the maximum lag order for individual ADF regressions. Bai and Ng (2004) suggest 4*(Time/100)^(.25) rounded to the nearest whole number as the maximum number of lags.
p	An integer of value either 0 or 1. p is the order of the deterministic function in the regression. 0 is for constant only and 1 is to include a trend.

Value

tstat A vector of t statistics for each column of the input matrix

---

adfc2 *ADF critical values for PANIC (2004) demeaned data*

Description

A dataset containing critical values for PANIC (2004) demeaned data ADF test

adfnc *ADF test critical values for PANIC (2004) idiosyncratic test*

Description

A dataset containing critical values for PANIC (2004) idiosyncratic pooled test

adfp *Generalized Least Squares Modified Dickey-Fuller t test*

Description

This function performs a modified Dickey-Fuller t test for a unit root in which the series has been modified by a generalized least squares regression.

Usage

```
adfp(y, penalty, kmax, kmin, p)
```

Arguments

y	A matrix of data
penalty	An integer value of either 0 or 1. 0 uses the MAIC, a penalty on k that accounts for the bias in the sum of the autoregressive coefficient. 1 uses the more general form MIC.
kmax	An integer of the maximum number of lags for the vector autoregressions. An upper bound of (12*(T/100)^.25)^8 is suggested in Schwert (1989)
kmin	An integer of the minimum number of lags for the vector autoregression. k = 0 is a reasonable point.
p	An integer with value of either 0 or -1. a value of -1 will modify the series with a generalized least squares regression.

Value

adf A numeric vector of t tests for the dfgls of each column. Will have to find rejection levels

kstar A numeric vector of the lags for each column's vector autoregression.

coint0 *Cointegration test critical values for PANIC (2004)*

Description

A dataset containing critical values for PANIC (2004) cointegration test

getnfac *Determining The Number of Factors In Approximate Factor Model*

Description

This function approximates the number of factors in an approximate factor model for large N by T matrices using the methods and criteria found in Bai and Ng (2002)

Usage

```
getnfac(x,kmax,criteria)
```

Arguments

x	A matrix containing the data.
kmax	An integer with the maximum number of common factors to search over. This methodology is weak to underestimation of the number of common factors so setting this value higher is preferred.
criteria	a character vector of length one with values of either IC1, IC2, IC3, AIC1, BIC1, AIC3, BIC3, or eigen. Choosing eigen makes the number of factors equal to the number of columns whose sum of eigenvalues is less than or equal to .5.

Details

This function approximates the number of factors in an approximate factor model. Amongst the penalty functions BIC(3) has been found to be strict against cross-sectional dependence and is recommended for panels with greater than 18 series. IC(1) is most commonly used. BIC(1) is not recommended for small N relative to T. AIC(3) and BIC(3) take into account the panel structure of the data. AIC(3) performs consistently across configurations of the data while BIC(3) performs better on large N data sets.

Value

ic Integer of the approximate number of factors based off of the chosen penalty function

lambda A matrix of the estimated factor loadings associated with common factors.

Fhat A matrix of the estimated common components

References

Jushan Bai and Serena Ng. 'Determining the Number of Factors in Approximate Factor Models.' Econometrica 70.1 (2002): 191-221. Print.

glsd *General Least Squares Detrending*

Description

This function detrends the data by general least squares.

Usage

```
glsd(y,p)
```

Arguments

y	A matrix containing the data to be detrended
p	An integer with value of either 0 or 1 which decides the value of the penalty term, chat. This is either either -7 or -13.5, respectively

Value

yt A matrix of the detrended data

lagn *Create lags for matrix*

Description

This function adds lags to a vector.

Usage

```
lagn(x,n)
```

Arguments

x	A vector to apply the lag to
n	The number of lags to add to the vector

Value

y A vector with a lag n added

lm1 — *KPSS test critical values for PANIC (2004) idiosyncratic test*

Description

A dataset containing critical values for PANIC (2004) idiosyncratic pooled KPSS test

MCMCpanic04 — *PANIC (2004) MCMC Non-Stationarity Tests on Common and Idiosyncratic Components*

Description

This function performs an MCMC over the tests on the idiosyncratic and common component from PANIC (2004).

Usage

```
MCMCpanic04(x, nfac, k1, criteria = NULL,burn = 1000,
mcmc = 10000, thin = 10, verbose = 0, seed = NA,
lambda.start = NA, psi.start = NA, l0 = 0, L0 = 0,
a0 = 0.001, b0 = 0.001, std.var = TRUE,...)
```

Arguments

x	An object of class xts with each column being a time series
nfac	An integer specifying the maximum number of factors allowed while estimating the factor model.
k1	an integer that is the maximum lag allowed in the ADF test.
criteria	a character vector of length one with a value of either IC1, IC2, IC3, AIC1, BIC1, AIC3, BIC3, or eigen. Choosing eigen makes the number of factors equal to the number of columns whose sum of eigenvalues is less than or equal to .5.
burn	Integer of the number of burn in iterators for the sampler
mcmc	Integer of the number of iterations in the sampler
thin	Integer of the thinning interval used in the simulation. mcmc must be divisible by this value.
verbose	A positive integer which determines whether or not the progress of the sampler is printed to the screen. If verbose is greater than 0 the iteration number and the factor loadings and uniquenesses are printed to the screen every verboseth iteration.
seed	The seed for the random number generator.
lambda.start	Starting values for the factor loading matrix Lambda.

psi.start	Starting values for the uniqueness
l0	The means of the independent Normal prior on the factor loadings
L0	A scalar or a matrix with the same dimensions as lambda. The precision (inverse variances) of the independent Normal prior on the factor loadings.
a0	scalar or a k-vector. Controls the shape of the inverse Gamma prior on the uniqueness.
b0	Controls the scale of the inverse Gamma prior on the uniqueness.
std.var	if TRUE the variables are rescaled to have zero mean and unit variance. Otherwise, the variables are rescaled to have zero mean, but retain their observed variances
...	extra parameters to pass to MCMCfactanal

Value

mcmc_tests An mcmc object containing the resampled tests on the common components as well as the test on the idiosyncratic component.

factor_mcmc The results from MCMCfactanal()

References

Bai, Jushan, and Serena Ng. 'A PANIC Attack on Unit Roots and Cointegration.' Econometrica 72.4 (2004): 1127-1177. Print.

Andrew D. Martin, Kevin M. Quinn, Jong Hee Park (2011). MCMCpack: Markov Chain Monte Carlo in R. Journal of Statistical Software. 42(9): 1-21. URL http://www.jstatsoft.org/v42/i09/.

MCMCpanic10 *MCMC PANIC (2010) Sample Moment and PAC tests for Idiosyncratic Component*

Description

This function performs the tests of PANIC (2010) with a Monte Carlo Markov chain based on a Gibbs sampler. One test estimates the pooled autoregressive coefficient, and one uses a sample moment. The sample moments test is based off of the modified Sargan-Bhargava test (PMSB) while the pooled autoregressive component is based on the Moon and Perron test as well a biased corrected pooled coefficient from PANIC (2004).

Usage

```
MCMCpanic10(x = NULL, nfac = NULL, k1 = NULL, criteria = NULL,
demean = FALSE, burn = 100, mcmc = 100, thin = 10,
verbose = 0, seed = NA, lambda.start = NA, psi.start = NA,
 l0 = 0, L0 = 0, a0 = 0.001, b0 = 0.001, std.var = TRUE,...)
```

Arguments

x	An object of class xts holding the time series data
nfac	An integer speciyfing the maximum number of factors allowed while estimating the factor model.
k1	an Integer that is the maximum lag allowed in the ADF test.
criteria	a character vector with values of either IC1, IC2, IC3, AIC1, BIC1, AIC3, BIC3, or eigen. Choosing eigen makes the number of factors equal to the number of columns whose sum of eigenvalues is less than or equal to .5.
demean	logical argument. If TRUE, function performs tests on demeaned data. If FALSE, uses non-demeanded data generating process.
burn	The number of burn in iterators for the sampler
mcmc	The number of iterations in the sampler
thin	The thinning interval used in the simulation. mcmc must be divisible by this value.
verbose	A positive integer which determines whether or not the progress of the sampler is printed to the screen. If verbose is greater than 0 the iteration number and the factor loadings and uniqueness are printed to the screen every verboseth iteration.
seed	The seed for the random number generator.
lambda.start	Starting values for the factor loading matrix Lambda.
psi.start	Starting values for the uniqueness
l0	The means of the independent Normal prior on the factor loadings
L0	A scalar or a matrix with the same dimensions as lambda. The precision (inverse variances) of the independent Normal prior on the factor loadings.
a0	scalar or a k-vector. Controls the shape of the inverse Gamma prior on the uniqueness.
b0	Controls the scale of the inverse Gamma prior on the uniqueness.
std.var	if TRUE the variables are rescaled to have zero mean and unit variance. Otherwise, the variables are rescaled to have zero mean, but retain their observed variances
...	extra parameters to be passed to MCMCfactanal

Value

mcmc_tests An mcmc object containing the resamples of the test statistics. When demeaned, the results will be for model P, PMSB, Model C, and rho1. When not demeaned, the results will be for model A, model B, PMSB, rho1, and the pooled values on the idiosyncratic component of PANIC (2004).

References

Bai, Jushan, and Serena Ng. 'Panel Unit Root Tests With Cross-Section Dependence: A Further Investigation.' Econometric Theory 26.04 (2010): 1088-1114. Print.

Andrew D. Martin, Kevin M. Quinn, Jong Hee Park (2011). MCMCpack: Markov Chain Monte Carlo in R. Journal of Statistical Software. 42(9): 1-21. URL http://www.jstatsoft.org/v42/i09/.

minindc *Create an Index of lowest values of each column*

Description

This function creates a vector filled with the row position of the lowest value within each column of a matrix.

Usage

```
minindc(x)
```

Arguments

x	A matrix that will be be used to create the index of lowest values.

Value

pos A vector containing an index of the row position of the lowest value within each column of a matrix.

mydiff *Difference a matrix*

Description

This function differences an entire matrix by some defined constant k.

Usage

```
mydiff(x,k)
```

Arguments

x	The matrix to be differenced.
k	An integer of the length of difference to perform on each vector of the NxT matrix.

Value

xx A matrix that has been differenced k times.

myols *Beta Coefficients for standard OLS*

Description

Returns the Beta values for an Ordinary Least Squares.

Usage

```
myols(x,y)
```

Arguments

x	A matrix of dependent variables.
y	A vector that is used as the independent variable.

NIPA_agg_5 *NIPA Aggregate Level 5*

Description

A dataset containing an aggregate of the National Income and Product Account monthly data

Format

An xts object with 677 rows and 17 columns. All columns are numeric with titles above

Source

http://www.bea.gov/iTable/iTable.cfm?ReqID=12&step=1#reqid=12&step=1&isuri=1

NIPA_agg_9 *NIPA Aggregate Level 9*

Description

A dataset containing an aggregate of the National Income and Product Account monthly data

Format

An xts object with 677 rows and 232 columns. All columns are numeric with titles above

Source

http://www.bea.gov/iTable/iTable.cfm?ReqID=12&step=1#reqid=12&step=1&isuri=1

nuisance *Estimate the nuisance parameters of the error term*

Description

This function estimates the short-run, long-run, and one sided variance of the error term

Usage

```
nuisance(res,k)
```

Arguments

res	A matrix consisting of the residuals from a factor model.
k	If fixk is 0, then automatic bandwidth selection is performed. Otherwise, the integer placed here will be the selected bandwidth.

Value

A data frame containing the following columns

sig2 The vector of short run variances

omega2 The vector of long run variances

half The vector of one-sided variances

nw *Bandwidth Selection*

Description

This function at fixk 0 finds the bandwidth, or lag length, of the short, long, and run variance of a residual.

Usage

```
nw(v,fixk)
```

Arguments

v	A cector of error terms from a factor model
fixk	If fixk is 0, then this function will perform automatic bandwidth selection. Otherwise, the integer placed here will be the selected bandwidth.

Value

k An integer that is the bandwidth chosen by `nw()`

w The vector of long run variance

References

Moon, R. & B. Perron (2004) Testing for a unit root in panels with dynamic factors. Journal of Econometrics 122, 81-126.

`panic04` *PANIC (2004) Non-Stationarity Tests on Common and Idiosyncratic Components*

Description

Performs the tests on the idiosyncratic and common component from PANIC (2004).

Usage

```
panic04(x, nfac, k1, criteria)
```

Arguments

`x`	An object of class xts with each column being a time series
`nfac`	An integer speciyfing the maximum number of factors allowed while estimating the factor model.
`k1`	an integer that is the maximum lag allowed in the ADF test.
`criteria`	a character vector of length one with a value of either IC1, IC2, IC3, AIC1, BIC1, AIC3, BIC3, or eigen. Choosing eigen makes the number of factors equal to the number of columns whose sum of eigenvalues is less than or equal to .5.

Value

pooladf A data frame containing the pooled tests for the demeaned data, idiosyncratic component, and the cointegration test. The first row is Fisher's method applied to the p values of the respective test. The second row is the correction from PANIC (2004) applied to the first row.

Common A data frame of the test results on the common component

adff A data frame containing pooled demeaned critical values, demeaned error term critical values, demeaned and detrended critical values, R squared for principle component, and the significance of the error components.

nfac An integer specifying the maximum number of factors allowed while estimating the factor model.

k1 An integer that is the maximum lag allowed in the ADF test.

criteria A character vector with a value of either IC1, IC2, IC3, AIC1, BIC1, AIC3, BIC3, or eigen. Choosing eigen makes the number of factors equal to the number of columns whose sum of eigenvalues is less than or equal to .5.

func A character vector representing which function was run

ic A numeric vector containing the number of components that were estimated

References

Bai, Jushan, and Serena Ng. 'A PANIC Attack on Unit Roots and Cointegration.' Econometrica 72.4 (2004): 1127-1177. Print.

`panic10` *PANIC (2010) Sample Moment and PAC tests for Idiosyncratic Component*

Description

This function performs the tests of PANIC (2010) and models A, B, and C from Moon and Perron (2004). One PMSB test estimates the pooled autoregressive coefficient, and the other uses a sample moment. The sample moments test is based off of the modified Sargan-Bhargava test (MSB). Each test rejects after the test statistic goes below the critical value of -1.64.

Usage

```
panic10(x, nfac, k1, criteria, demean)
```

Arguments

`x`	A NxT matrix containing the data
`nfac`	An integer specifying the maximum number of factors allowed while estimating the factor model.
`k1`	The maximum lag allowed in the ADF test.
`criteria`	a character vector with values of either IC1, IC2, IC3, AIC1, BIC1, AIC3, BIC3, or eigen. Choosing eigen makes the number of factors equal to the number of columns whose sum of eigenvalues is less than or equal to .5.
`demean`	logical argument. If TRUE, function performs tests on demeaned data. If FALSE, uses non-demeanded data generating process.

Details

This function gives results for Moon and Perron tests with models A, B, and C as well as the pooled tests from PANIC (2010) and the panel. A assumes no deterministic component. B assumes a constant and allows for a fixed effect model. C allows a constant and trend. pa-pb Pooled test from PANIC (2010). Null of nonstationarity. If both reject conclude stationarity. However, if only one rejects the panel is nonstationary.

Value

rho1 Estimation of the Pooled Autoregressive Coefficient.

MP.tests A data frame containing either the test statistics for the Moon and Perron model A and B tests if demeaned = FALSE or a data frame containing the test statistics for the pooled tests as well as Moon and Perron's model C

PMSB.tests a data frame containing the test statistic for the PMSB test, the rho coefficient, and either the LM test from Bai and Ng (2004) or the ADF test from Bai and Ng (2004)

nfac An integer speciyfing the maximum number of factors allowed while estimating the factor model.

k1 an integer that is the maximum lag allowed in the ADF test.

criteria a character vector with values of either IC1, IC2, IC3, AIC1, BIC1, AIC3, BIC3, or eigen. Choosing eigen makes the number of factors equal to the number of columns whose sum of eigenvalues is less than or equal to .5.

func a character vector representing which function was run

ic a numeric vector containing the number of components that were estimated

PMSB Unit root test tends to zero. The unit root hypothesis is rejected in favor of stationarity when the PMSB test goes below a critical value.

References

Bai, Jushan, and Serena Ng. 'Panel Unit Root Tests With Cross-Section Dependence: A Further Investigation.' Econometric Theory 26.04 (2010): 1088-1114. Print.

Bai, Jushan, and Serena Ng. 'A PANIC Attack on Unit Roots and Cointegration.' Econometrica 72.4 (2004): 1127-1177. Print.

---

pc *Principle Component Analysis for PANIC (2004)*

Description

This function performs the principle component analysis in order to determine the Common and Idiosyncratic Components of the factor model.

Usage

```
pc(y,nfac)
```

Arguments

y	An NxT matrix containing the data
nfac	An integer specifying the maximum number of factors allowed while estimating the factor model.

Value

ehat A matrix with the Idiosyncratic component of the factor model

fhat A matrix with the factors of the approximate factor model

lambda A matrix with the factor loadings of the approximate factor model

---

pool *Pooling Function for PANIC (2010)*

Description

This function find the P values for the pooled test in PANIC (2010)

Usage

```
pool(p_values,test_values)
```

Arguments

p_values	a data frame containing the p values
test_values	a matrix of adf test values to be pooled

Value

adf31a a numeric vector of the fisher sum of the p-values

adf31b a numeric vector containing the critical value of the pooling test

---

poolcoint *Pooling Function for Cointegration test PANIC (2004)*

Description

This function find the P values for the pooled cointegration test in PANIC (2010)

Usage

```
poolcoint(a,x,r)
```

Arguments

a	A matrix containing the p values
x	A matrix containing the adf test to be pooled
r	An integer for the number of factors determined by getnfac()

Value

pvala a numeric vector of the fisher sum of the p-values for the cointegration test

pvalb a numeric vector containing the critical value of the cointegration test

s2ar *Finding optimal lag for dfgls test*

Description

This function finds the optimal lag kstar for the dfgls test.

Usage

```
s2ar(yts, penalty, kmax, kmin)
```

Arguments

yts	A matrix containing the data to find kstar for.
penalty	a binary selection of 0 or 1. 0 uses the MAIC, a penalty on k that accounts for the bias in the sum of the autoregressive coefficients. 1 uses the more general form MIC.
kmax	An integer of the maximum number of lags for the vector autoregressions. An upper bound of `(12x(T/100)^.25)^8` is suggested in Schwert (1989)
kmin	An integer of the minimum number of lags for the vector autoregression. k equal to 0 is a reasonable point.

Value

kstar A vector of optimal lags for each column of yts

References

Schwert, G. W. 1989. Tests for unit roots: A Monte Carlo investigation. Journal of Business and Economic Statistics 2: 147-159.

Serana Ng and P. Perron. 2000. Lag length selection and the construction of unit root tests with good size and power. Econometrica 69:1519-1554.

trimr *Trim dataset*

Description

This function trims the dataset by n and/or t rows and columns

Usage

```
trimr(x,a,b)
```

Arguments

x	A NxT matrix containing the data to be trimmed
a	number of columns to trim from matrix
b	number of rows to trim from matrix

Value

xx the trimmed data set

Index