Johansen_Test_VECM.R

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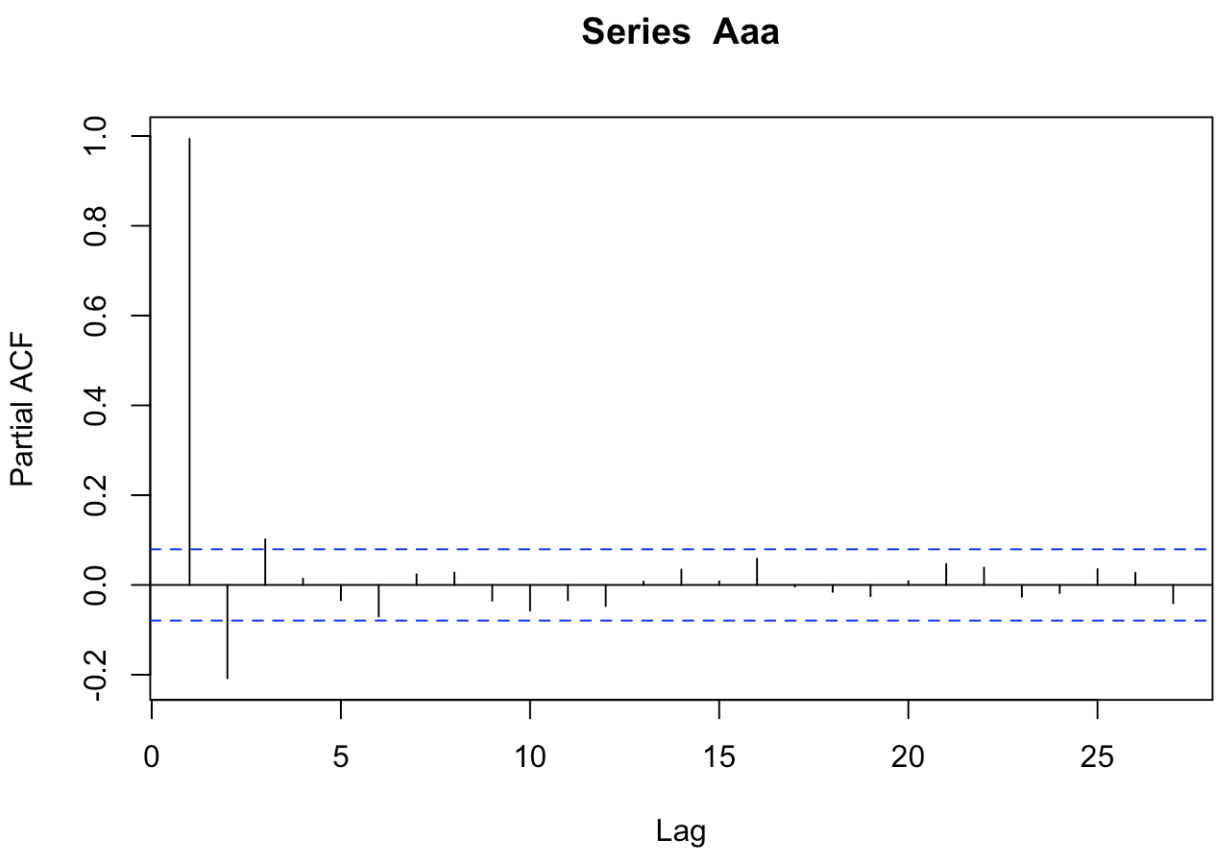
```
#EE435 Wasin Siwasarit  2/2019
#Step1: You need to set your current directory
setwd("/Users/wasin_siwasarit/Desktop/Solution_EE435")
require(urca)
```

```
## Loading required package: urca
```

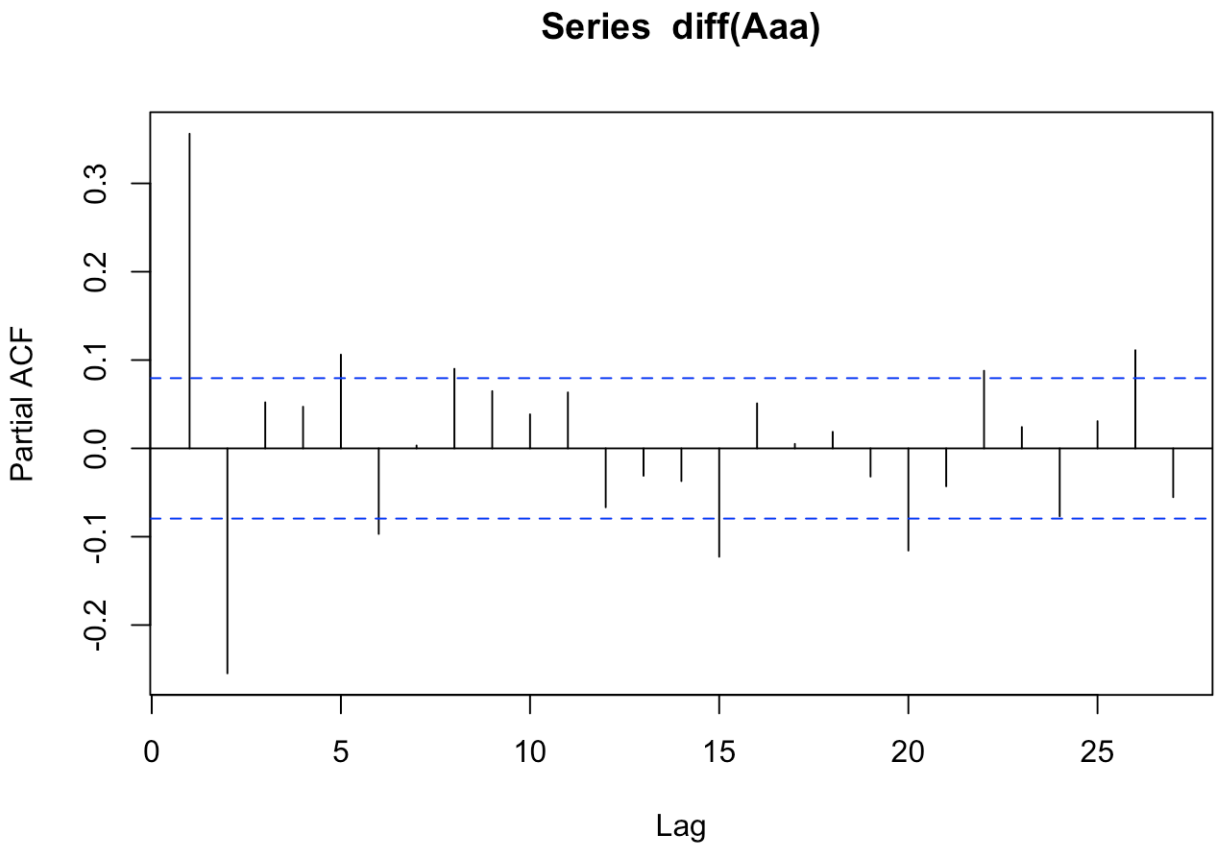
```
da=read.table("m-bnd.txt",header=T)
head(da)
```

```
##   year mon day  Aaa  Baa
## 1 1954   7   1 2.89 3.50
## 2 1954   8   1 2.87 3.49
## 3 1954   9   1 2.89 3.47
## 4 1954  10   1 2.87 3.46
## 5 1954  11   1 2.89 3.45
## 6 1954  12   1 2.90 3.45
```

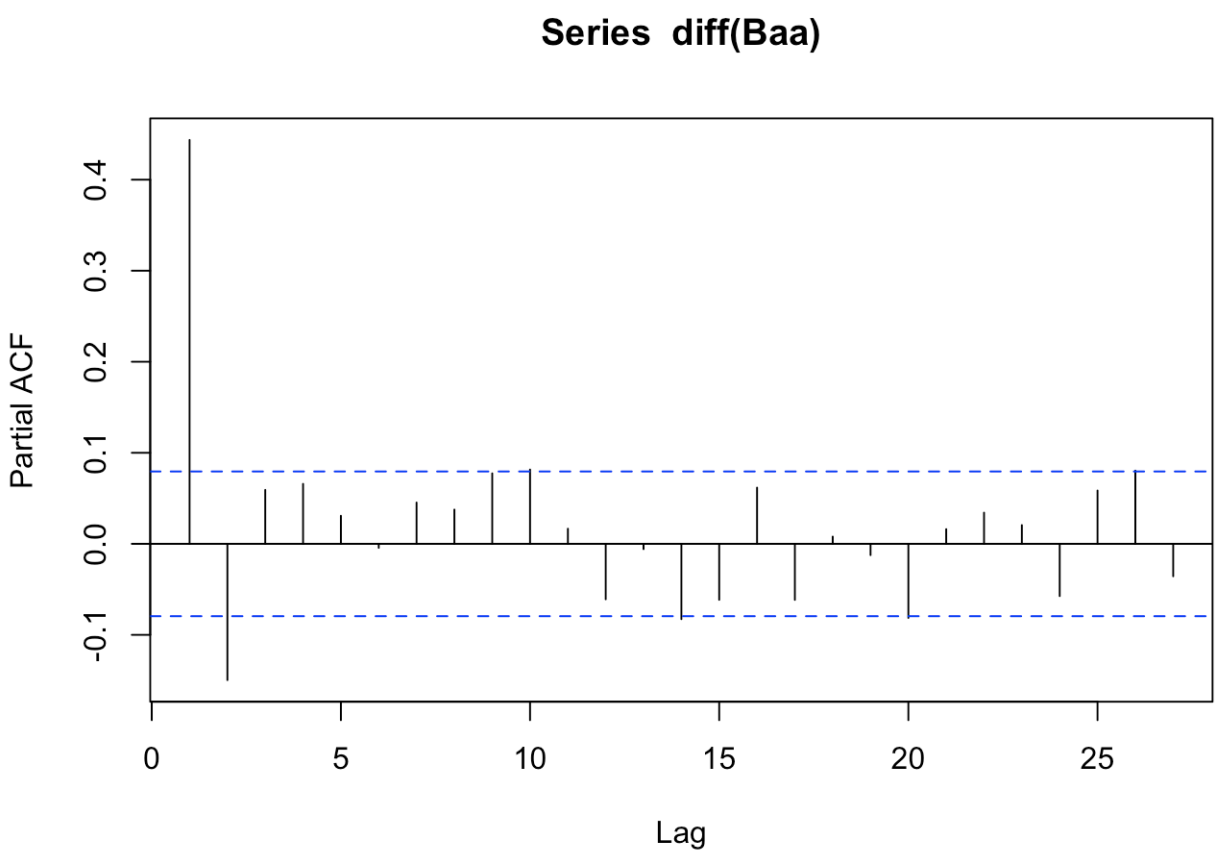
```
Aaa=da$Aaa
Baa=da$Baa
pacf(Aaa)
```




```
pacf(diff(Aaa))
```



```
pacf(diff(Baa))
```




```
t1=ur.df(Aaa,type="drift",lags=2)
summary(t1)
```

```
##
## ###############################################
## # Augmented Dickey-Fuller Test Unit Root Test #
## ###############################################
##
## Test regression drift
##
##
## Call:
## lm(formula = z.diff ~ z.lag.1 + 1 + z.diff.lag)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.95120 -0.08220 -0.00833  0.08141  1.14282
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.040738   0.024016   1.696   0.0903 .
## z.lag.1     -0.005011   0.003037  -1.650   0.0995 .
## z.diff.lag1  0.448426   0.039361  11.393  < 2e-16 ***
## z.diff.lag2 -0.253349   0.039417  -6.427 2.64e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2006 on 602 degrees of freedom
## Multiple R-squared:  0.1878, Adjusted R-squared:  0.1838
## F-statistic:  46.4 on 3 and 602 DF,  p-value: < 2.2e-16
##
##
## Value of test-statistic is: -1.6501 1.4516
##
## Critical values for test statistics:
##       1pct  5pct 10pct
## tau2 -3.43 -2.86 -2.57
## phi1  6.43  4.59  3.78
```

```
t2=ur.df(Baa,type="drift",lags=2)
summary(t2)
```

```
##
## ###############################################
## # Augmented Dickey-Fuller Test Unit Root Test #
## ###############################################
##
## Test regression drift
##
##
## Call:
## lm(formula = z.diff ~ z.lag.1 + 1 + z.diff.lag)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.73501 -0.07152 -0.01012  0.07380  0.98906
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.036012   0.021660   1.663 0.096919 .
## z.lag.1     -0.003940   0.002429  -1.622 0.105310
## z.diff.lag1  0.512124   0.040305  12.706  < 2e-16 ***
## z.diff.lag2 -0.149930   0.040367  -3.714 0.000223 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1798 on 602 degrees of freedom
## Multiple R-squared:  0.2192, Adjusted R-squared:  0.2153
## F-statistic: 56.32 on 3 and 602 DF,  p-value: < 2.2e-16
##
##
## Value of test-statistic is: -1.6221 1.3963
##
## Critical values for test statistics:
##       1pct  5pct 10pct
## tau2 -3.43 -2.86 -2.57
## phi1  6.43  4.59  3.78
```

```
m1=lm(Baa~Aaa)
m1
```

```
##
## Call:
## lm(formula = Baa ~ Aaa)
##
## Coefficients:
## (Intercept)          Aaa
##      0.1002       1.1150
```

```
xt=m1$residuals
t3=ur.df(xt,type="none",lags=9)
summary(t3)
```

```
##
## ###############################################
## # Augmented Dickey-Fuller Test Unit Root Test #
## ###############################################
##
## Test regression none
##
##
## Call:
## lm(formula = z.diff ~ z.lag.1 - 1 + z.diff.lag)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.44912 -0.05129 -0.00585  0.03864  0.67555
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## z.lag.1     -0.08793    0.01773  -4.960 9.25e-07 ***
## z.diff.lag1  0.25533    0.04155   6.145 1.48e-09 ***
## z.diff.lag2 -0.14633    0.04280  -3.419 0.000671 ***
## z.diff.lag3  0.00381    0.04262   0.089 0.928789
## z.diff.lag4 -0.03262    0.04233  -0.771 0.441236
## z.diff.lag5  0.18445    0.04217   4.374 1.44e-05 ***
## z.diff.lag6 -0.03004    0.04257  -0.706 0.480631
## z.diff.lag7 -0.08559    0.04244  -2.017 0.044177 *
## z.diff.lag8  0.05683    0.04149   1.370 0.171288
## z.diff.lag9  0.09192    0.04099   2.242 0.025310 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1031 on 589 degrees of freedom
## Multiple R-squared:  0.1806, Adjusted R-squared:  0.1667
## F-statistic: 12.99 on 10 and 589 DF,  p-value: < 2.2e-16
##
##
## Value of test-statistic is: -4.9597
##
## Critical values for test statistics:
##       1pct  5pct 10pct
## tau1 -2.58 -1.95 -1.62
```

```
######################
# Johansen-Procedure #
######################

#help(ca.jo)
zt = cbind(Aaa,Baa)

coint=ca.jo(zt,ecdet="const",type="trace",K=11,spec="transitory")
summary(coint)
```

```
##
## ######################
## # Johansen-Procedure #
## ######################
##
## Test type: trace statistic , without linear trend and constant in cointegrat
ion
##
## Eigenvalues (lambda):
## [1]  3.238825e-02  6.411194e-03 -2.981556e-19
##
## Values of teststatistic and critical values of test:
##
##           test 10pct  5pct  1pct
## r <= 1 |  3.85  7.52  9.24 12.97
## r = 0  | 23.54 17.85 19.96 24.60
##
## Eigenvectors, normalised to first column:
## (These are the cointegration relations)
##
##               Aaa.l1      Baa.l1   constant
## Aaa.l1    1.00000000  1.00000000  1.0000000
## Baa.l1   -0.89524332  0.01040343 -0.6277559
## constant  0.07220773 -7.92815599  3.7410585
##
## Weights W:
## (This is the loading matrix)
##
##             Aaa.l1       Baa.l1      constant
## Aaa.d -0.009405741 -0.005811070 -1.755209e-19
## Baa.d  0.060413181 -0.004738242 -9.403527e-18
```

```
coint1=ca.jo(zt,ecdet="const",type="eigen",K=11,spec="transitory")
summary(coint1)
```

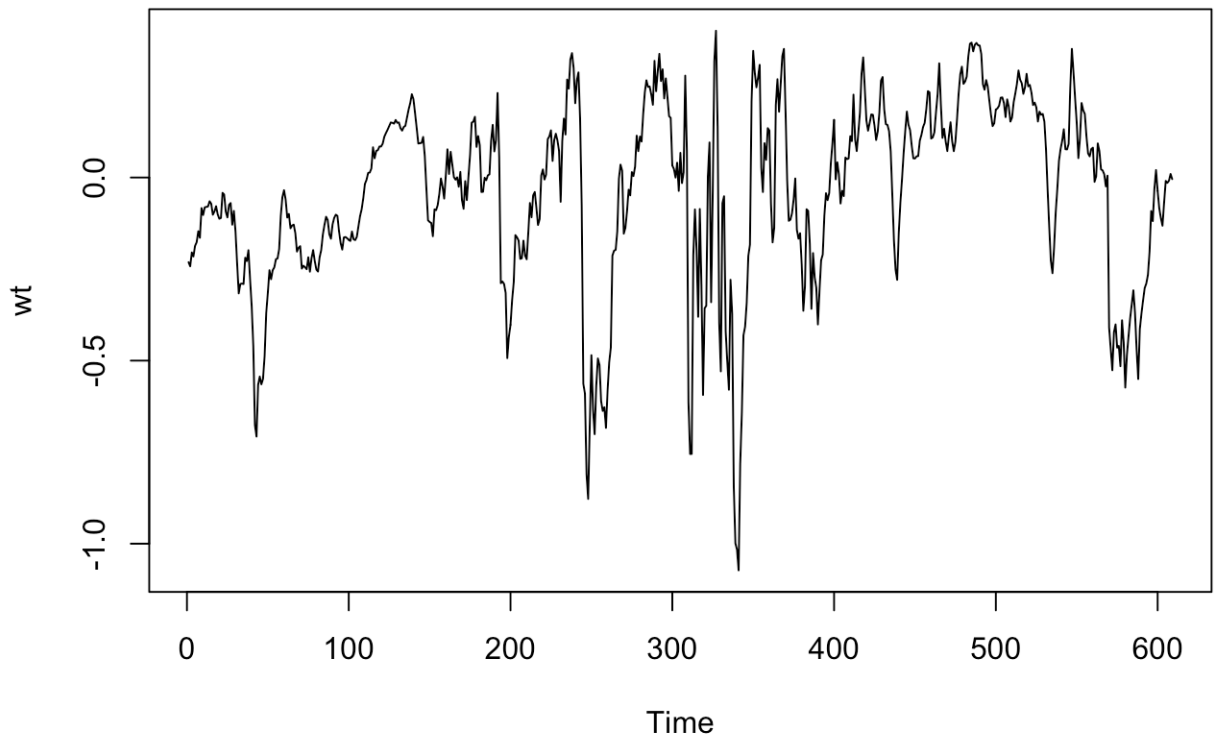
```
##
## ######################
## # Johansen-Procedure #
## ######################
##
## Test type: maximal eigenvalue statistic (lambda max) , without linear trend
and constant in cointegration
##
## Eigenvalues (lambda):
## [1]  3.238825e-02  6.411194e-03 -2.981556e-19
##
## Values of teststatistic and critical values of test:
##
##           test 10pct  5pct  1pct
## r <= 1 |  3.85  7.52  9.24 12.97
## r = 0  | 19.69 13.75 15.67 20.20
##
## Eigenvectors, normalised to first column:
## (These are the cointegration relations)
##
##               Aaa.l1      Baa.l1   constant
## Aaa.l1    1.00000000  1.00000000  1.0000000
## Baa.l1   -0.89524332  0.01040343 -0.6277559
## constant  0.07220773 -7.92815599  3.7410585
##
## Weights W:
## (This is the loading matrix)
##
##             Aaa.l1       Baa.l1      constant
## Aaa.d -0.009405741 -0.005811070 -1.755209e-19
## Baa.d  0.060413181 -0.004738242 -9.403527e-18
```

```
#### Estimation of ECM model
require(MTS)
```

```
## Loading required package: MTS
```

```
## Warning in as.POSIXlt.POSIXct(Sys.time()): unknown timezone 'zone/tz/2019c.
## 1.0/zoneinfo/Asia/Bangkok'
```

```
#help(ECMvar1)
wt=zt[,1]-0.8918*zt[,2]
ts.plot(wt)
```




```
n1=ECMvar1(zt,3,wt,include.const=T)
```

```
## alpha:
##          Aaa    Baa
## [1,] 0.00348 0.0673
## standard error
##        [,1]   [,2]
## [1,] 0.0347 0.0306
## constant term:
##     Aaa     Baa
## 0.00363 0.00602
## standard error
## [1] 0.0083 0.0073
## AR coefficient matrix
## AR( 1 )-matrix
##       Aaa       Baa
## Aaa 0.450 -0.000499
## Baa 0.291  0.204948
## standard error
##        [,1]   [,2]
## [1,] 0.0879 0.1008
## [2,] 0.0774 0.0887
## AR( 2 )-matrix
##        Aaa    Baa
## Aaa -0.302 0.0543
## Baa -0.153 0.0285
## standard error
##        [,1]   [,2]
## [1,] 0.0860 0.0940
## [2,] 0.0757 0.0827
## -----
## Residuals cov-mtx:
##            Aaa        Baa
## Aaa 0.04007258 0.03164530
## Baa 0.03164530 0.03102383
##
## det(sse) =  0.0002417797
## AIC =  -8.288075
## BIC =  -8.201142
```

```
n1=ECMvar1(zt,3,wt)
```

```
## alpha:
##          Aaa    Baa
## [1,] 0.00339 0.0672
## standard error
##        [,1]   [,2]
## [1,] 0.0347 0.0306
## AR coefficient matrix
## AR( 1 )-matrix
##       Aaa       Baa
## Aaa 0.450 -0.000502
## Baa 0.291  0.204945
## standard error
##        [,1]   [,2]
## [1,] 0.0879 0.1008
## [2,] 0.0774 0.0887
## AR( 2 )-matrix
##        Aaa    Baa
## Aaa -0.302 0.0546
## Baa -0.153 0.0288
## standard error
##        [,1]   [,2]
## [1,] 0.0860 0.0940
## [2,] 0.0757 0.0827
## -----
## Residuals cov-mtx:
##            Aaa        Baa
## Aaa 0.04008455 0.03165509
## Baa 0.03165509 0.03103184
##
## det(sse) =  0.0002418523
## AIC =  -8.294343
## BIC =  -8.221899
```

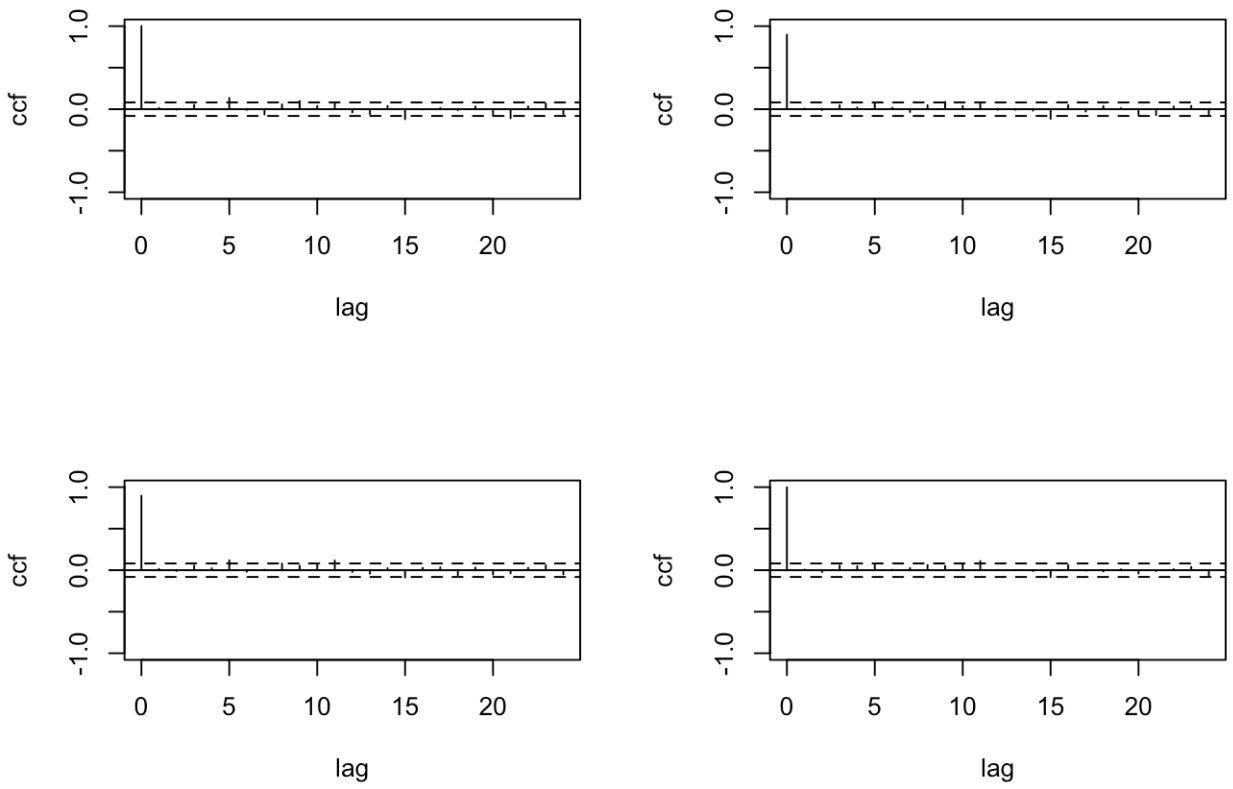
```
n1a=refECMvar1(n1,thres=1)
```

```
## Equation:  1  npar =  2
## Equation:  2  npar =  4
## alpha:
##      [,1]   [,2]
## [1,]    0 0.0662
## standard error
##      [,1]   [,2]
## [1,]    1 0.0304
## AR coefficient matrix
## AR( 1 )-matrix
##       [,1]  [,2]
## [1,] 0.448 0.000
## [2,] 0.284 0.213
## standard error
##        [,1]   [,2]
## [1,] 0.0393 1.0000
## [2,] 0.0746 0.0855
## AR( 2 )-matrix
##        [,1] [,2]
## [1,] -0.256    0
## [2,] -0.130    0
## standard error
##        [,1] [,2]
## [1,] 0.0393    1
## [2,] 0.0382    1
## -----
## Residuals cov-mtx:
##            [,1]       [,2]
## [1,] 0.04010853 0.03166685
## [2,] 0.03166685 0.03103804
##
## det(sse) =  0.0002421006
## AIC =  -8.306453
## BIC =  -8.262987
```

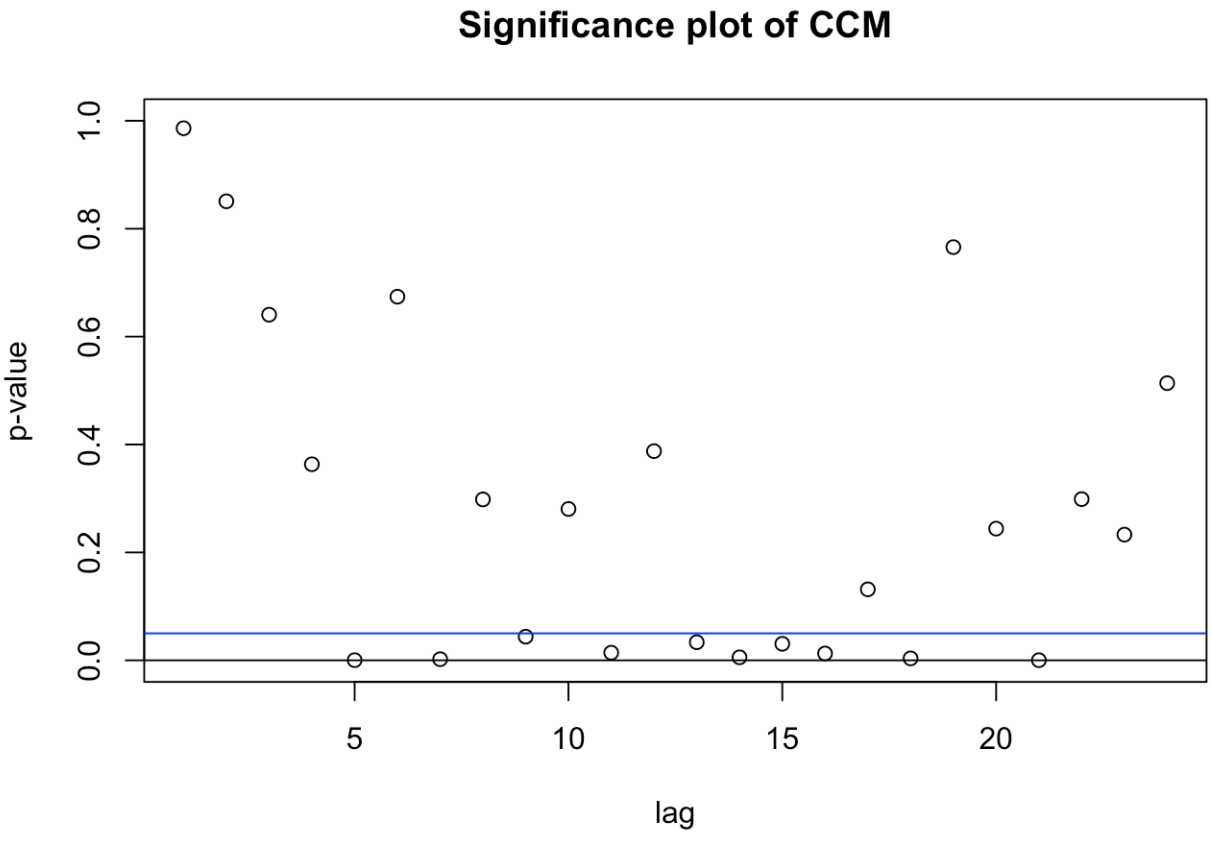
```
MTSdiag(n1a)
```

```
## [1] "Covariance matrix:"
##        Aaa    Baa
## Aaa 0.0402 0.0317
## Baa 0.0317 0.0311
## CCM at lag:  0
##       [,1]  [,2]
## [1,] 1.000 0.897
## [2,] 0.897 1.000
## Simplified matrix:
## CCM at lag:  1
## . .
## . .
## CCM at lag:  2
## . .
## . .
## CCM at lag:  3
## . .
## . .
## CCM at lag:  4
## . .
## . .
## CCM at lag:  5
## + .
## + .
## CCM at lag:  6
## . .
## . .
## CCM at lag:  7
## . .
## . .
## CCM at lag:  8
## . .
## . .
## CCM at lag:  9
## + +
## . .
## CCM at lag:  10
## . .
## . .
## CCM at lag:  11
## . .
## + +
## CCM at lag:  12
## . .
## . .
## CCM at lag:  13
## . .
## . .
## CCM at lag:  14
## . .
## . .
## CCM at lag:  15
```

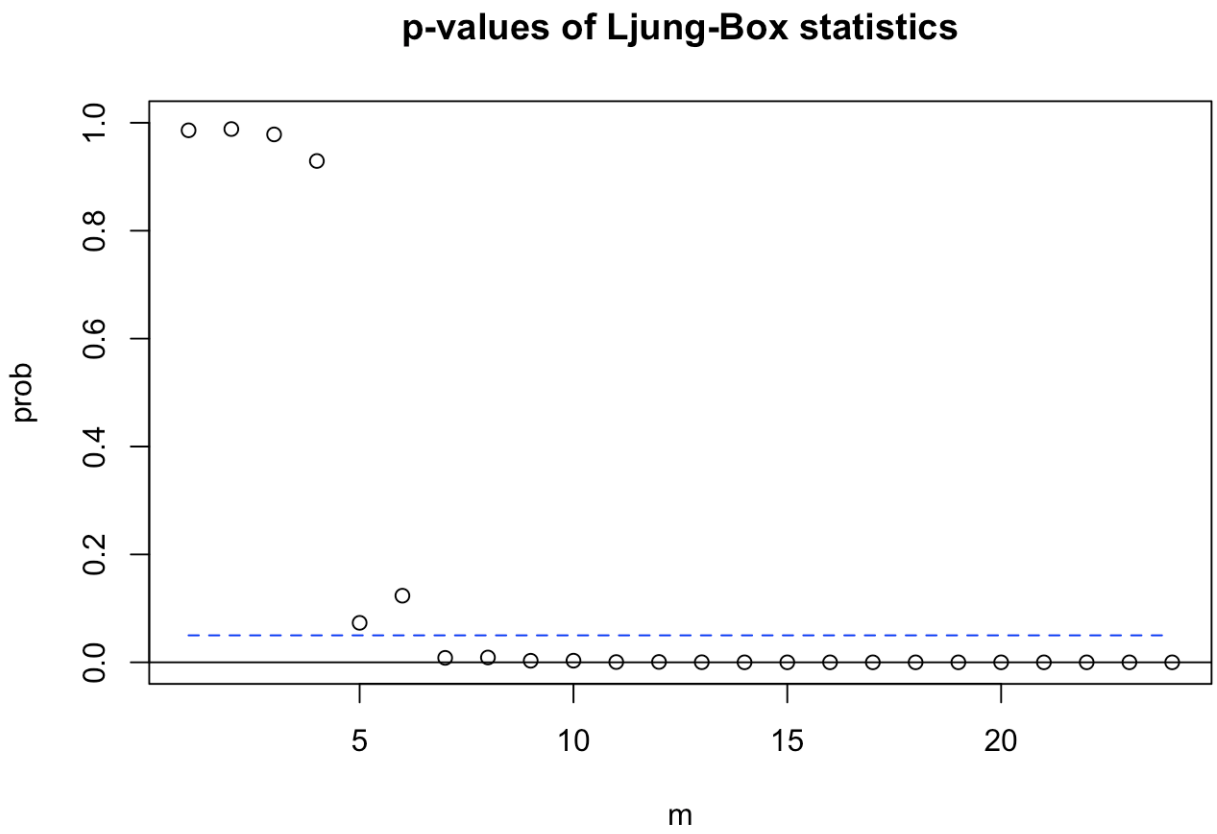
```
## - -
## - -
## CCM at lag:  16
## . .
## . .
## CCM at lag:  17
## . .
## . .
## CCM at lag:  18
## . .
## . .
## CCM at lag:  19
## . .
## . .
## CCM at lag:  20
## . .
## . .
## CCM at lag:  21
## - .
## . .
## CCM at lag:  22
## . .
## . .
## CCM at lag:  23
## . .
## . .
## CCM at lag:  24
## . .
## . .
```




```
## Hit Enter for p-value plot of individual ccm:
```



```
## Hit Enter to compute MQ-statistics:
##
## Ljung-Box Statistics:
##           m       Q(m)     df    p-value
##  [1,]   1.000     0.354   4.000     0.99
##  [2,]   2.000     1.721   8.000     0.99
##  [3,]   3.000     4.251  12.000     0.98
##  [4,]   4.000     8.594  16.000     0.93
##  [5,]   5.000    29.798  20.000     0.07
##  [6,]   6.000    32.143  24.000     0.12
##  [7,]   7.000    49.021  28.000     0.01
##  [8,]   8.000    53.932  32.000     0.01
##  [9,]   9.000    63.773  36.000     0.00
## [10,]  10.000    68.856  40.000     0.00
## [11,]  11.000    81.369  44.000     0.00
## [12,]  12.000    85.521  48.000     0.00
## [13,]  13.000    96.002  52.000     0.00
## [14,]  14.000   110.648  56.000     0.00
## [15,]  15.000   121.345  60.000     0.00
## [16,]  16.000   134.115  64.000     0.00
## [17,]  17.000   141.222  68.000     0.00
## [18,]  18.000   156.885  72.000     0.00
## [19,]  19.000   158.727  76.000     0.00
## [20,]  20.000   164.195  80.000     0.00
## [21,]  21.000   185.796  84.000     0.00
## [22,]  22.000   190.702  88.000     0.00
## [23,]  23.000   196.298  92.000     0.00
## [24,]  24.000   199.578  96.000     0.00
```




```
## Hit Enter to obtain residual plots:
```