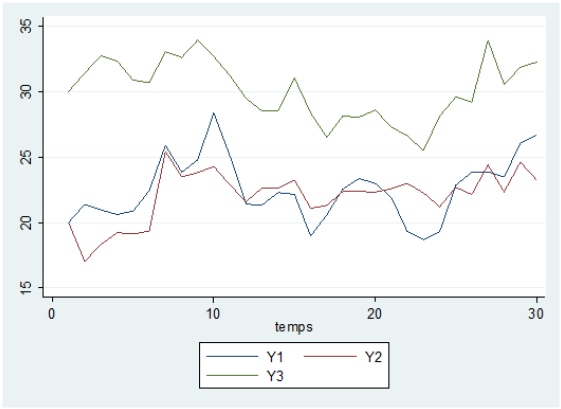
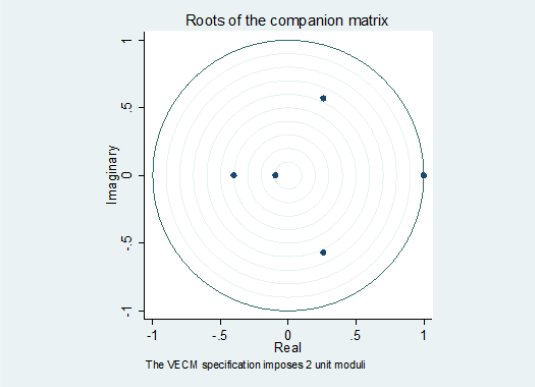
```
. *CORRIGE DE L'EXERCICE CHAPITRE 11-EXERCICE 2
. *Dalila Chenaf-Nicet  Université de Bordeaux.
.
. * Tout d'abord s'assurer d'avoir ouvert le fichier de données stata C11EX2 avant d'ouvrir
le do.fileC11EX2 qui est le fichier programme.
.
. * Une fois le fichier de données ouvert ainsi que le do-file apppuyer sur Run  (Execute en
haut à droite de la barre de menu du dofile)
. *pour démarrer le programme. Il sera exécuté dans son intégralité.
.
. * Toutefois il est possible en sélectionnant les parties du programme de l'exécuter pas à
pas afin de voir apparaître pas à pas les
. * différents résultats.
.
.
.  *                 CHAPITRE 11 EXERCICE 2
.
.                    * Test de cointégration et et estimation d'un VEC
.  * Il faut définir la variable du temps
.  gen temps=(_n)

.  tsset temps
        time variable:  temps, 1 to 30
                delta:  1 unit


.
.  * Une représentaion graphique des données nous donne :
.
.  twoway (tsline y1 y2 y3)
```




```
.
.  * //////Le test de longueur de retard est proposé dans l'étape 2
>
. varsoc y1 y2 y3, lutstat

   Selection-order criteria (lutstats)
   Sample:  5 - 30                                 Number of obs      =        26
  +---------------------------------------------------------------------------+
  |lag |    LL      LR      df    p      FPE       AIC      HQIC      SBIC    |
  |----+----------------------------------------------------------------------|
  |  0 |  -146.48                       19.7851   2.75404   2.75404   2.75404  |
  |  1 |  -127.82   37.32    9  0.000  9.47948   2.01097   2.13638*  2.44647* |
  |  2 |  -118.04   19.56    9  0.021  9.23092*  1.95097   2.20178   2.82196  |
  |  3 | -108.585   18.91*   9  0.026   9.6971   1.91596*  2.29218   3.22244  |
  |  4 | -103.858  9.4539    9  0.396  15.9787   2.24465   2.74628   3.98663  |
  +---------------------------------------------------------------------------+
   Endogenous:  y1 y2 y3
    Exogenous:  _cons


.
. * Dans la mesure où 2 des 4 critères pointent 2 retards et que le nombre d'observations
est faible nous utiliserons 2 retatrds.
. * Nous allons donc procéder au test de Johansen sur un VECM(1)
.
. *////// Etape 2 on procéde au test de Johansen
.
. *   - Existence d'une constante dans la relation de long terme  et pas dans les données
```

```
(pas de tendance déterminsite), spécification b
.
. vec y1 y2 y3

Vector error-correction model

Sample:  3 - 30                                 Number of obs     =         28
                                                AIC               =   10.77846
Log likelihood = -133.8985                      HQIC              =   11.02573
Det(Sigma_ml)  =  2.859217                      SBIC              =    11.5873

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_y1                   5     1.75372   0.3260    11.1256   0.0489
D_y2                   5     1.50886   0.3033    10.0149   0.0748
D_y3                   5      1.6041   0.3182   10.73413   0.0569
------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_y1         |
        _ce1 |
         L1. |  -.8700277   .3237387    -2.69   0.007    -1.504544   -.2355116
             |
          y1 |
         LD. |   .7660836   .2729956     2.81   0.005     .2310221    1.301145
             |
          y2 |
         LD. |  -.7290306   .2758203    -2.64   0.008    -1.269628   -.1884327
             |
          y3 |
         LD. |  -.2607221   .2420003    -1.08   0.281    -.7350339    .2135897
             |
       _cons |   .1004801   .3358319     0.30   0.765    -.5577384    .7586986
-------------+----------------------------------------------------------------
D_y2         |
        _ce1 |
         L1. |   .3066352   .2785375     1.10   0.271    -.2392882    .8525587
             |
          y1 |
         LD. |   .1010004   .2348793     0.43   0.667    -.3593546    .5613553
             |
          y2 |
         LD. |  -.3559121   .2373096    -1.50   0.134    -.8210303    .1092061
             |
          y3 |
         LD. |  -.0818033   .2082116    -0.39   0.694    -.4898905     .326284
             |
       _cons |   .2848923   .2889423     0.99   0.324    -.2814242    .8512087
-------------+----------------------------------------------------------------
D_y3         |
        _ce1 |
         L1. |   .0088712   .2961178     0.03   0.976    -.5715091    .5892514
             |
          y1 |
         LD. |   .5293304   .2497041     2.12   0.034     .0399195    1.018741
             |
          y2 |
         LD. |  -.4579263   .2522878    -1.82   0.070    -.9524012    .0365486
             |
          y3 |
         LD. |  -.2457833   .2213532    -1.11   0.267    -.6796276     .188061
             |
       _cons |   .0070379   .3071793     0.02   0.982    -.5950225    .6090983
------------------------------------------------------------------------------

Cointegrating equations

Equation           Parms      chi2     P>chi2
----------------------------------------------
```

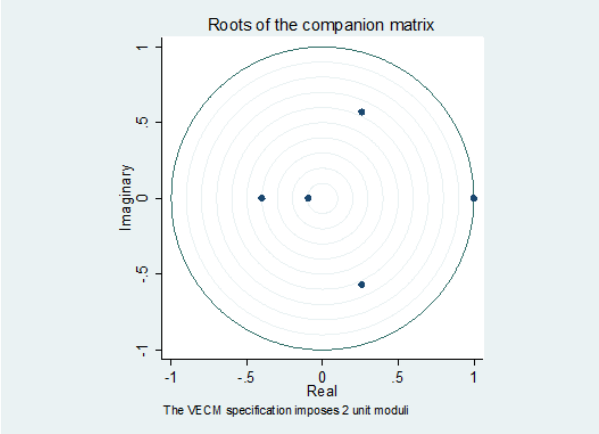
```
_ce1                  2   111.6801   0.0000
------------------------------------------

Identification:  beta is exactly identified

                 Johansen normalization restriction imposed
------------------------------------------------------------------------------
       beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
_ce1        |
         y1 |          1          .       .       .            .           .
         y2 |  -.8619331   .1022031    -8.43   0.000    -1.062247   -.6616186
         y3 |  -.5395468   .0825008    -6.54   0.000    -.7012453   -.3778482
      _cons |   12.68323          .       .       .            .           .
------------------------------------------------------------------------------

. vecstable, graph

   Eigenvalue stability condition
  +---------------------------------------+
  |        Eigenvalue         |  Modulus  |
  |---------------------------+-----------|
  |          1                |         1 |
  |          1                |         1 |
  |    .259191 +  .5703292i   |  .626463  |
  |    .259191 -  .5703292i   |  .626463  |
  |  -.3990731                |  .399073  |
  | -.09403389                |  .094034  |
  +---------------------------------------+
   The VECM specification imposes 2 unit moduli.
```




```
. vecrank y1 y2 y3 , trend(rconstant)

                     Johansen tests for cointegration
Trend: rconstant                                         Number of obs =      28
Sample:  3 - 30                                                Lags =       2
------------------------------------------------------------------------------
                                                              5%
maximum                                       trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       9      -147.41745            .     38.5069    34.91
    1      15       -134.4182     0.60486     12.5084*   19.96
    2      19      -130.26026     0.25695      4.1926     9.42
    3      21      -128.16399     0.13906
------------------------------------------------------------------------------

.
. * Les trois valeurs propres de la matrice Pi estimées par le maximum de vraisemblance sont
égales à alpha1=0.60, alpha 2=0.23 et alpha3=0.13.
. * Pour 0 relation de cointégration le test de trace 38,5 (5%), est supérieur à la valeur
critique de 34.91
. * Nous rejetons l'hypothèse.
.
. *Pour un relation le test de trace est de 12.50 < à la valeur critique de 19.96, nous
acceptons l'hypothèse d'une relation
```

```
. * de cointégration.
. * Le test indique qu'il n'y en a pas 2 .
. * On notera que Stata met une étoile dans la ligne du "bon nombre de relations de
cointégration. Ce qui est pratique !
.
. *   - Existence d'une constante dans la relation de long terme  et dans les données,
spécification c
.
. vec y1 y2 y3

Vector error-correction model

Sample:  3 - 30                                 Number of obs     =         28
                                                AIC               =   10.77846
Log likelihood = -133.8985                      HQIC              =   11.02573
Det(Sigma_ml)  =  2.859217                      SBIC              =    11.5873

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_y1                   5     1.75372   0.3260    11.1256   0.0489
D_y2                   5     1.50886   0.3033    10.0149   0.0748
D_y3                   5      1.6041   0.3182   10.73413   0.0569
------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_y1         |
        _ce1 |
         L1. |  -.8700277   .3237387    -2.69   0.007    -1.504544   -.2355116
             |
          y1 |
         LD. |   .7660836   .2729956     2.81   0.005     .2310221    1.301145
             |
          y2 |
         LD. |  -.7290306   .2758203    -2.64   0.008    -1.269628   -.1884327
             |
          y3 |
         LD. |  -.2607221   .2420003    -1.08   0.281    -.7350339    .2135897
             |
       _cons |   .1004801   .3358319     0.30   0.765    -.5577384    .7586986
-------------+----------------------------------------------------------------
D_y2         |
        _ce1 |
         L1. |   .3066352   .2785375     1.10   0.271    -.2392882    .8525587
             |
          y1 |
         LD. |   .1010004   .2348793     0.43   0.667    -.3593546    .5613553
             |
          y2 |
         LD. |  -.3559121   .2373096    -1.50   0.134    -.8210303    .1092061
             |
          y3 |
         LD. |  -.0818033   .2082116    -0.39   0.694    -.4898905     .326284
             |
       _cons |   .2848923   .2889423     0.99   0.324    -.2814242    .8512087
-------------+----------------------------------------------------------------
D_y3         |
        _ce1 |
         L1. |   .0088712   .2961178     0.03   0.976    -.5715091    .5892514
             |
          y1 |
         LD. |   .5293304   .2497041     2.12   0.034     .0399195    1.018741
             |
          y2 |
         LD. |  -.4579263   .2522878    -1.82   0.070    -.9524012    .0365486
             |
          y3 |
         LD. |  -.2457833   .2213532    -1.11   0.267    -.6796276     .188061
             |
       _cons |   .0070379   .3071793     0.02   0.982    -.5950225    .6090983
```

```
------------------------------------------------------------------------------

Cointegrating equations

Equation           Parms    chi2     P>chi2
-------------------------------------------
_ce1                   2   111.6801   0.0000
-------------------------------------------

Identification:  beta is exactly identified

                 Johansen normalization restriction imposed
------------------------------------------------------------------------------
        beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_ce1         |
          y1 |          1          .       .       .            .           .
          y2 |  -.8619331   .1022031    -8.43   0.000    -1.062247   -.6616186
          y3 |  -.5395468   .0825008    -6.54   0.000    -.7012453   -.3778482
       _cons |   12.68323          .       .       .            .           .
------------------------------------------------------------------------------

. vecstable, graph

   Eigenvalue stability condition
  +---------------------------------------+
  |        Eigenvalue         |   Modulus   |
  |---------------------------+-------------|
  |          1                |         1   |
  |          1                |         1   |
  |    .259191 +  .5703292i   |   .626463   |
  |    .259191 -  .5703292i   |   .626463   |
  |  -.3990731                |   .399073   |
  | -.09403389                |   .094034   |
  +---------------------------------------+
   The VECM specification imposes 2 unit moduli.
```




```
. vecrank y1 y2 y3

                    Johansen tests for cointegration
Trend: constant                                      Number of obs =      28
Sample:  3 - 30                                             Lags =       2
------------------------------------------------------------------------------
                                                              5%
maximum                                          trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0      12     -146.85843            .     37.3889    29.68
    1      17     -133.89851      0.60375     11.4690*   15.41
    2      20     -130.25192      0.22931      4.1759     3.76
    3      21     -128.16399      0.13855
------------------------------------------------------------------------------

.
. * Les trois valeurs propres de la matrice Pi estimées par le maximum de vraisemblance sont
égales à alpha1=0.60 , alpha 2=0.23 et alpha3=0.13.
. * Pour 0 relation de cointégration le test de trace 37,38 (5%), est supérieur à la valeur
```

```
critique de 29.68.
. * Nous rejetons l'hypothèse
. * Pour un relation le test de trace est de 11,46 < à la valeur critique de 15,41, nous
acceptons l'hypothèse d'une relation
. * de cointégration.
. * Le test indique qu'il n'y en a pas 2.
.
. * On peut faire à présent le test de la valeur propre maximum
. vec y1 y2 y3

Vector error-correction model

Sample:  3 - 30                                 Number of obs     =         28
                                                AIC               =   10.77846
Log likelihood = -133.8985                      HQIC              =   11.02573
Det(Sigma_ml)  =  2.859217                      SBIC              =    11.5873

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_y1                   5     1.75372   0.3260    11.1256   0.0489
D_y2                   5     1.50886   0.3033    10.0149   0.0748
D_y3                   5      1.6041   0.3182   10.73413   0.0569
------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_y1         |
        _ce1 |
         L1. |  -.8700277   .3237387    -2.69   0.007    -1.504544   -.2355116
             |
          y1 |
         LD. |   .7660836   .2729956     2.81   0.005     .2310221    1.301145
             |
          y2 |
         LD. |  -.7290306   .2758203    -2.64   0.008    -1.269628   -.1884327
             |
          y3 |
         LD. |  -.2607221   .2420003    -1.08   0.281    -.7350339    .2135897
             |
       _cons |   .1004801   .3358319     0.30   0.765    -.5577384    .7586986
-------------+----------------------------------------------------------------
D_y2         |
        _ce1 |
         L1. |   .3066352   .2785375     1.10   0.271    -.2392882    .8525587
             |
          y1 |
         LD. |   .1010004   .2348793     0.43   0.667    -.3593546    .5613553
             |
          y2 |
         LD. |  -.3559121   .2373096    -1.50   0.134    -.8210303    .1092061
             |
          y3 |
         LD. |  -.0818033   .2082116    -0.39   0.694    -.4898905     .326284
             |
       _cons |   .2848923   .2889423     0.99   0.324    -.2814242    .8512087
-------------+----------------------------------------------------------------
D_y3         |
        _ce1 |
         L1. |   .0088712   .2961178     0.03   0.976    -.5715091    .5892514
             |
          y1 |
         LD. |   .5293304   .2497041     2.12   0.034     .0399195    1.018741
             |
          y2 |
         LD. |  -.4579263   .2522878    -1.82   0.070    -.9524012    .0365486
             |
          y3 |
         LD. |  -.2457833   .2213532    -1.11   0.267    -.6796276     .188061
             |
       _cons |   .0070379   .3071793     0.02   0.982    -.5950225    .6090983
```

```
------------------------------------------------------------------------------

Cointegrating equations

Equation           Parms    chi2     P>chi2
-------------------------------------------
_ce1                   2   111.6801   0.0000
-------------------------------------------

Identification:  beta is exactly identified

                 Johansen normalization restriction imposed
------------------------------------------------------------------------------
        beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_ce1         |
          y1 |          1          .       .       .            .           .
          y2 |  -.8619331   .1022031    -8.43   0.000    -1.062247   -.6616186
          y3 |  -.5395468   .0825008    -6.54   0.000    -.7012453   -.3778482
       _cons |   12.68323          .       .       .            .           .
------------------------------------------------------------------------------

. vecstable, graph

   Eigenvalue stability condition
  +---------------------------------------+
  |        Eigenvalue         |  Modulus  |
  |---------------------------+-----------|
  |          1                |         1 |
  |          1                |         1 |
  |    .259191 +  .5703292i   |  .626463  |
  |    .259191 -  .5703292i   |  .626463  |
  |  -.3990731                |  .399073  |
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  +---------------------------------------+
   The VECM specification imposes 2 unit moduli.
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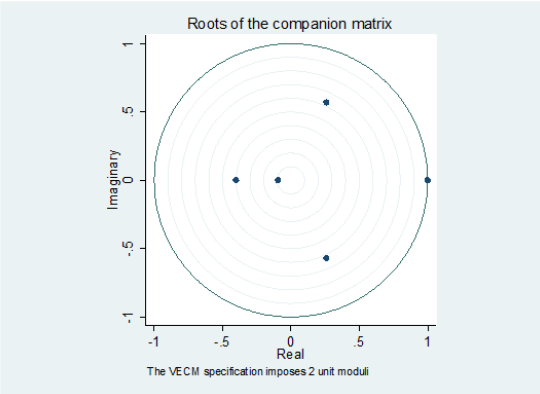


```
. vecrank y1 y2 y3, max levela notrace

                     Johansen tests for cointegration
Trend: constant                                      Number of obs =      28
Sample:  3 - 30                                            Lags =       2
------------------------------------------------------------------------------
maximum                                        max      5% critical  1% critical
  rank    parms       LL       eigenvalue  statistic       value        value
    0       12     -146.85843                25.9198       20.97        25.52
    1       17     -133.89851     0.60375     7.2932       14.07        18.63
    2       20     -130.25192     0.22931     4.1759        3.76         6.65
    3       21     -128.16399     0.13855
------------------------------------------------------------------------------

.
.
. * L'hypothèse d'une relation de cointégration est vérifiée. On estime donc le VEC
```

```
.
. vec y1 y2 y3

Vector error-correction model

Sample:  3 - 30                                 Number of obs     =         28
                                                AIC               =   10.77846
Log likelihood = -133.8985                      HQIC              =   11.02573
Det(Sigma_ml)  =  2.859217                      SBIC              =    11.5873

Equation           Parms      RMSE     R-sq      chi2     P>chi2
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D_y3                   5      1.6041   0.3182   10.73413   0.0569
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------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_y1         |
        _ce1 |
         L1. |  -.8700277   .3237387    -2.69   0.007    -1.504544   -.2355116
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          y1 |
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         LD. |  -.0818033   .2082116    -0.39   0.694    -.4898905     .326284
             |
       _cons |   .2848923   .2889423     0.99   0.324    -.2814242    .8512087
-------------+----------------------------------------------------------------
D_y3         |
        _ce1 |
         L1. |   .0088712   .2961178     0.03   0.976    -.5715091    .5892514
             |
          y1 |
         LD. |   .5293304   .2497041     2.12   0.034     .0399195    1.018741
             |
          y2 |
         LD. |  -.4579263   .2522878    -1.82   0.070    -.9524012    .0365486
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Cointegrating equations

Equation           Parms      chi2     P>chi2
----------------------------------------------
_ce1                   2   111.6801   0.0000
```

```
------------------------------------------

Identification:  beta is exactly identified

                 Johansen normalization restriction imposed
------------------------------------------------------------------------------
       beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
_ce1        |
         y1 |          1          .       .       .            .           .
         y2 |  -.8619331   .1022031    -8.43   0.000    -1.062247   -.6616186
         y3 |  -.5395468   .0825008    -6.54   0.000    -.7012453   -.3778482
      _cons |   12.68323          .       .       .            .           .
------------------------------------------------------------------------------

. vecstable, graph

   Eigenvalue stability condition
  +---------------------------------------+
  |        Eigenvalue         |  Modulus  |
  |---------------------------+-----------|
  |          1                |         1 |
  |          1                |         1 |
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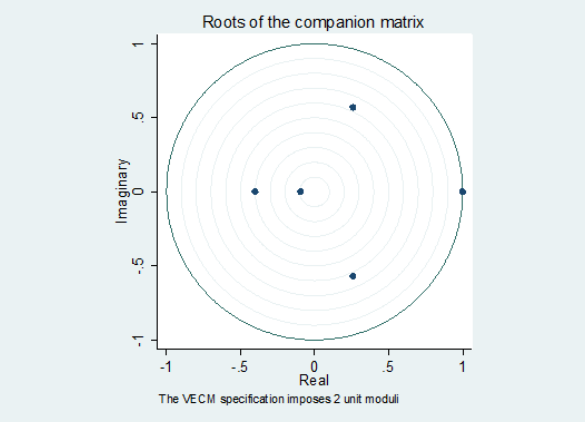
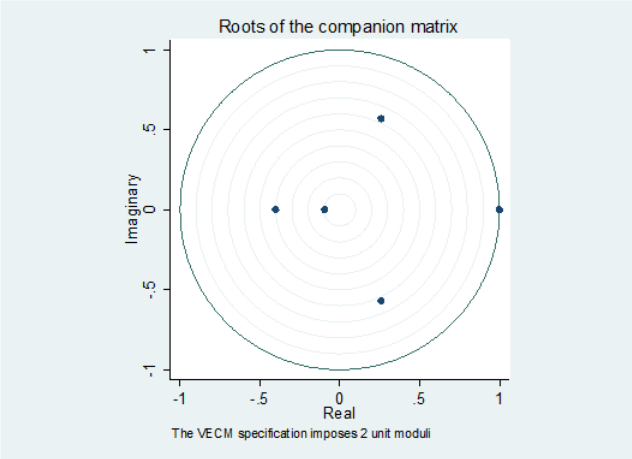



```
. vecrank y1 y2 y3, max levela notrace

                     Johansen tests for cointegration
Trend: constant                                      Number of obs =      28
Sample:  3 - 30                                             Lags =       2
------------------------------------------------------------------------------
maximum                                      max      5% critical  1% critical
  rank    parms       LL       eigenvalue  statistic      value        value
    0       12     -146.85843                25.9198      20.97        25.52
    1       17     -133.89851     0.60375     7.2932      14.07        18.63
    2       20     -130.25192     0.22931     4.1759       3.76         6.65
    3       21     -128.16399     0.13855
------------------------------------------------------------------------------


.
. * Le test des valeurs propres maximales corroborent le résultat
.
. * L'étoile indique le rejet de l'hypothèse (On rejet 0 relation contre 1 relation, On
accepte 1 contre 2, on rejete 2 contre 1)
.
. * Quatrième étape
.
. vec  y1 y2 y3, rank(1)

Vector error-correction model
```

```
Sample:  3 - 30                                 Number of obs     =         28
                                                AIC               =   10.77846
Log likelihood = -133.8985                      HQIC              =   11.02573
Det(Sigma_ml)  =  2.859217                      SBIC              =    11.5873

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_y1                   5     1.75372   0.3260    11.1256   0.0489
D_y2                   5     1.50886   0.3033    10.0149   0.0748
D_y3                   5      1.6041   0.3182   10.73413   0.0569
------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_y1         |
        _ce1 |
         L1. |  -.8700277   .3237387    -2.69   0.007    -1.504544   -.2355116
             |
          y1 |
         LD. |   .7660836   .2729956     2.81   0.005     .2310221    1.301145
             |
          y2 |
         LD. |  -.7290306   .2758203    -2.64   0.008    -1.269628   -.1884327
             |
          y3 |
         LD. |  -.2607221   .2420003    -1.08   0.281    -.7350339    .2135897
             |
       _cons |   .1004801   .3358319     0.30   0.765    -.5577384    .7586986
-------------+----------------------------------------------------------------
D_y2         |
        _ce1 |
         L1. |   .3066352   .2785375     1.10   0.271    -.2392882    .8525587
             |
          y1 |
         LD. |   .1010004   .2348793     0.43   0.667    -.3593546    .5613553
             |
          y2 |
         LD. |  -.3559121   .2373096    -1.50   0.134    -.8210303    .1092061
             |
          y3 |
         LD. |  -.0818033   .2082116    -0.39   0.694    -.4898905     .326284
             |
       _cons |   .2848923   .2889423     0.99   0.324    -.2814242    .8512087
-------------+----------------------------------------------------------------
D_y3         |
        _ce1 |
         L1. |   .0088712   .2961178     0.03   0.976    -.5715091    .5892514
             |
          y1 |
         LD. |   .5293304   .2497041     2.12   0.034     .0399195    1.018741
             |
          y2 |
         LD. |  -.4579263   .2522878    -1.82   0.070    -.9524012    .0365486
             |
          y3 |
         LD. |  -.2457833   .2213532    -1.11   0.267    -.6796276     .188061
             |
       _cons |   .0070379   .3071793     0.02   0.982    -.5950225    .6090983
------------------------------------------------------------------------------

Cointegrating equations

Equation           Parms    chi2     P>chi2
-------------------------------------------
_ce1                   2   111.6801   0.0000
-------------------------------------------

Identification:  beta is exactly identified
```

```
                Johansen normalization restriction imposed
------------------------------------------------------------------------------
       beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
_ce1        |
         y1 |          1          .       .       .            .           .
         y2 |  -.8619331   .1022031    -8.43   0.000    -1.062247   -.6616186
         y3 |  -.5395468   .0825008    -6.54   0.000    -.7012453   -.3778482
      _cons |   12.68323          .       .       .            .           .
------------------------------------------------------------------------------

. vecstable, graph

   Eigenvalue stability condition
  +---------------------------------------+
  |        Eigenvalue         |  Modulus  |
  |---------------------------+-----------|
  |          1                |         1 |
  |          1                |         1 |
  |    .259191 +  .5703292i   |  .626463  |
  |    .259191 -  .5703292i   |  .626463  |
  |  -.3990731                |  .399073  |
  | -.09403389                |  .094034  |
  +---------------------------------------+
   The VECM specification imposes 2 unit moduli.

.
```




```
end of do-file

. exit, clear
```