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Assignment 9

1. Perform unit root test of series *y* and *x*.

We test the unit root test in order to check that the variables are stationary series or not. The hypothesis is H_0: $\boldsymbol{\beta} = 1$. The results show that both y and x are nonstationary series since the Mackinnon p-values are 1.00 and 0.997, respectively, which are larger than 0.05. Then, we fail to reject the hypothesis.

Since both variables are nonstationary, the next step is to test whether the variables are integrated at level 1 or not. The null hypotheses are H_0: $\boldsymbol{\gamma}_i = 0$. The results show that both y and x are integrated at level 1 since the Mackinnon p-values are 0.00. Then we can reject the null hypothesis at 95% confidence level.

```
 tsset t
        time variable:  t, 1 to 500
                delta:  1 unit

.
. dfuller y, trend lag(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =       498

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)              1.000            -3.980            -3.420            -3.130
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 1.0000

------------------------------------------------------------------------------
D.y          |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           y |
         L1. |   .0001178   .0001179     1.00   0.318    -.0001137    .0003494
         LD. |   .6997015   .0248993    28.10   0.000     .6507799    .7486231
      _trend |   2.897751   1.159296     2.50   0.013      .619992    5.175511
       _cons |   1811.233   147.0426    12.32   0.000     1522.327    2100.139
------------------------------------------------------------------------------

. dfuller d.y, trend lag(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =       497

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -10.554            -3.980            -3.420            -3.130
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000
```

```
------------------------------------------------------------------------------
D2.y         |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         D.y |
         L1. |  -.2787856   .0264156   -10.55   0.000    -.3306866   -.2268845
         LD. |    -.32127   .0373756    -8.60   0.000    -.3947051   -.2478349
      _trend |   3.631984   .3708318     9.79   0.000     2.903379     4.36059
       _cons |   1678.082   154.4788    10.86   0.000     1374.564      1981.6
------------------------------------------------------------------------------

.
. dfuller x, trend lag(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =       498

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)              0.601            -3.980            -3.420            -3.130
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9970

------------------------------------------------------------------------------
D.x          |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           x |
         L1. |   .0001061   .0001764     0.60   0.548    -.0002405    .0004526
         LD. |     .46018   .0349881    13.15   0.000     .3914361    .5289239
      _trend |   4.166909    1.14105     3.65   0.000     1.924999    6.408818
       _cons |   2128.626   140.0551    15.20   0.000     1853.449    2403.803
------------------------------------------------------------------------------

. dfuller d.x, trend lag(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =       497

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -10.657            -3.980            -3.420            -3.130
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D2.x         |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         D.x |
         L1. |  -.4007114   .0376021   -10.66   0.000    -.4745915   -.3268312
         LD. |   -.414172   .0358603   -11.55   0.000    -.4846298   -.3437141
      _trend |   3.508317   .3506567    10.00   0.000     2.819351    4.197283
       _cons |   1596.429   147.0971    10.85   0.000     1307.415    1885.444
------------------------------------------------------------------------------
```

2. Perform cointegration test of series *y* and *x* using set up of (i) linear trend; (ii) restricted trend; (iii) unrestricted constant; (iv) restricted constant; and (v) no trend, with one lag term.

```
. vecrank y x, trend(t) lags(1/1) max

                       Johansen tests for cointegration
Trend: trend                                            Number of obs =     499
Sample:  2 - 500                                                 Lags =       1
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL        eigenvalue  statistic    value
    0       4     -7387.4577            .    790.3357    18.17
    1       7     -6992.3441      0.79477      0.1085*    3.74
    2       8     -6992.2899      0.00022
-------------------------------------------------------------------------------
                                                         5%
maximum                                        max    critical
  rank    parms       LL        eigenvalue  statistic    value
    0       4     -7387.4577            .    790.2272    16.87
    1       7     -6992.3441      0.79477      0.1085     3.74
    2       8     -6992.2899      0.00022
-------------------------------------------------------------------------------

. vecrank y x, trend(rt) lags(1/1) max

                       Johansen tests for cointegration
Trend: rtrend                                           Number of obs =     499
Sample:  2 - 500                                                 Lags =       1
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL        eigenvalue  statistic    value
    0       2     -8050.4781            .   2116.3764    25.32
    1       6     -7075.2453      0.97993    165.9107    12.25
    2       8     -6992.2899      0.28286
-------------------------------------------------------------------------------
                                                         5%
maximum                                        max    critical
  rank    parms       LL        eigenvalue  statistic    value
    0       2     -8050.4781            .   1950.4657    18.96
    1       6     -7075.2453      0.97993    165.9107    12.52
    2       8     -6992.2899      0.28286
-------------------------------------------------------------------------------

. vecrank y x, trend(c) lags(1/1) max

                       Johansen tests for cointegration
Trend: constant                                         Number of obs =     499
Sample:  2 - 500                                                 Lags =       1
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL        eigenvalue  statistic    value
    0       2     -8050.4781            .   2086.8946    15.41
    1       5     -7083.8611      0.97923    153.6607     3.76
    2       6     -7007.0308      0.26504
-------------------------------------------------------------------------------
                                                         5%
maximum                                        max    critical
  rank    parms       LL        eigenvalue  statistic    value
    0       2     -8050.4781            .   1933.2339    14.07
    1       5     -7083.8611      0.97923    153.6607     3.76
    2       6     -7007.0308      0.26504
-------------------------------------------------------------------------------

. vecrank y x, trend(rc) lags(1/1) max
```

```
                       Johansen tests for cointegration
Trend: rconstant                                        Number of obs =     499
Sample:  2 - 500                                                 Lags =       1
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       0     -8811.3759           .   3607.1930    19.96
    1       4     -7092.1887     0.99898    168.8185     9.42
    2       6     -7007.7794     0.28703
-------------------------------------------------------------------------------
                                                         5%
maximum                                       max     critical
  rank    parms       LL       eigenvalue  statistic    value
    0       0     -8811.3759           .   3438.3745    15.67
    1       4     -7092.1887     0.99898    168.8185     9.24
    2       6     -7007.7794     0.28703
-------------------------------------------------------------------------------

. vecrank y x, trend(n) lags(1/1) max

                       Johansen tests for cointegration
Trend: none                                             Number of obs =     499
Sample:  2 - 500                                                 Lags =       1
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       0     -8811.3759           .   3204.1193    12.53
    1       3     -7211.7592     0.99836      4.8860     3.84
    2       4     -7209.3163     0.00974
-------------------------------------------------------------------------------
                                                         5%
maximum                                       max     critical
  rank    parms       LL       eigenvalue  statistic    value
    0       0     -8811.3759           .   3199.2333    11.44
    1       3     -7211.7592     0.99836      4.8860     3.84
    2       4     -7209.3163     0.00974
-------------------------------------------------------------------------------
```

3. Perform cointegration test of series *y* and *x* using set up of linear trend with (i) one lag term; (ii) two lag terms; and (iii) three lag terms.

```
. vecrank y x, trend(t) lags(2) max

                       Johansen tests for cointegration
Trend: trend                                            Number of obs =     498
Sample:  3 - 500                                                 Lags =       2
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       8     -6795.5337           .    187.5771    18.17
    1      11     -6703.3826     0.30932      3.2749*    3.74
    2      12     -6701.7451     0.00655
-------------------------------------------------------------------------------
                                                         5%
maximum                                       max     critical
  rank    parms       LL       eigenvalue  statistic    value
    0       8     -6795.5337           .    184.3022    16.87
    1      11     -6703.3826     0.30932      3.2749     3.74
    2      12     -6701.7451     0.00655
-------------------------------------------------------------------------------
```

```
. vecrank y x, trend(rt) lags(2) max

                       Johansen tests for cointegration
Trend: rtrend                                          Number of obs =     498
Sample:  3 - 500                                                Lags =       2
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6     -6851.6363          .     299.7823    25.32
    1      10     -6758.7153     0.31146    113.9404    12.25
    2      12     -6701.7451     0.20451
-------------------------------------------------------------------------------
                                                         5%
maximum                                       max     critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6     -6851.6363          .     185.8419    18.96
    1      10     -6758.7153     0.31146    113.9404    12.52
    2      12     -6701.7451     0.20451
-------------------------------------------------------------------------------

. vecrank y x, trend(c) lags(2) max

                       Johansen tests for cointegration
Trend: constant                                        Number of obs =     498
Sample:  3 - 500                                                Lags =       2
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6     -6851.6363          .     296.2211    15.41
    1       9     -6758.8991     0.31095    110.7467     3.76
    2      10     -6703.5257     0.19939
-------------------------------------------------------------------------------
                                                         5%
maximum                                       max     critical
  rank    parms       LL       eigenvalue  statistic    value
    0       6     -6851.6363          .     185.4743    14.07
    1       9     -6758.8991     0.31095    110.7467     3.76
    2      10     -6703.5257     0.19939
-------------------------------------------------------------------------------

. vecrank y x, trend(rc) lags(2) max

                       Johansen tests for cointegration
Trend: rconstant                                       Number of obs =     498
Sample:  3 - 500                                                Lags =       2
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       4     -6863.4864          .     319.9311    19.96
    1       8     -6770.5739     0.31143    134.1061     9.42
    2      10     -6703.5209     0.23608
-------------------------------------------------------------------------------
                                                         5%
maximum                                       max     critical
  rank    parms       LL       eigenvalue  statistic    value
    0       4     -6863.4864          .     185.8250    15.67
    1       8     -6770.5739     0.31143    134.1061     9.24
    2      10     -6703.5209     0.23608
```

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

. vecrank y x, trend(n) lags(2) max

                       Johansen tests for cointegration
Trend: none                                          Number of obs =     498
Sample:  3 - 500                                              Lags =       2
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       4     -6863.4864           .    180.9227    12.53
    1       7     -6773.0418     0.30457      0.0335*    3.84
    2       8     -6773.0251     0.00007
-------------------------------------------------------------------------------
                                                         5%
maximum                                        max    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       4     -6863.4864           .    180.8892    11.44
    1       7     -6773.0418     0.30457      0.0335     3.84
    2       8     -6773.0251     0.00007
-------------------------------------------------------------------------------

.
. vecrank y x, trend(t) lags(3) max

                       Johansen tests for cointegration
Trend: trend                                         Number of obs =     497
Sample:  4 - 500                                              Lags =       3
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0      12      -6756.658           .    140.0434    18.17
    1      15      -6688.113     0.24106      2.9534*    3.74
    2      16     -6686.6363     0.00592
-------------------------------------------------------------------------------
                                                         5%
maximum                                        max    critical
  rank    parms       LL       eigenvalue  statistic    value
    0      12      -6756.658           .    137.0900    16.87
    1      15      -6688.113     0.24106      2.9534     3.74
    2      16     -6686.6363     0.00592
-------------------------------------------------------------------------------

. vecrank y x, trend(rt) lags(3) max

                       Johansen tests for cointegration
Trend: rtrend                                        Number of obs =     497
Sample:  4 - 500                                              Lags =       3
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0      10     -6796.0141           .    218.7555    25.32
    1      14     -6727.4211     0.24121     81.5696    12.25
    2      16     -6686.6363     0.15136
-------------------------------------------------------------------------------
                                                         5%
maximum                                        max    critical
  rank    parms       LL       eigenvalue  statistic    value
    0      10     -6796.0141           .    137.1859    18.96
```

```
    1      14     -6727.4211     0.24121     81.5696    12.52
    2      16     -6686.6363     0.15136
-------------------------------------------------------------------------------

. vecrank y x, trend(c) lags(3) max

                       Johansen tests for cointegration
Trend: constant                                        Number of obs =     497
Sample:  4 - 500                                                Lags =       3
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0      10     -6796.0141           .    215.9613    15.41
    1      13     -6727.4393     0.24115     78.8116     3.76
    2      14     -6688.0334     0.14664
-------------------------------------------------------------------------------
                                                         5%
maximum                                       max     critical
  rank    parms       LL       eigenvalue  statistic    value
    0      10     -6796.0141           .    137.1496    14.07
    1      13     -6727.4393     0.24115     78.8116     3.76
    2      14     -6688.0334     0.14664
-------------------------------------------------------------------------------

. vecrank y x, trend(rc) lags(3) max

                       Johansen tests for cointegration
Trend: rconstant                                       Number of obs =     497
Sample:  4 - 500                                                Lags =       3
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       8     -6803.1482           .    230.2398    19.96
    1      12     -6734.4526     0.24152     92.8484     9.42
    2      14     -6688.0283     0.17041
-------------------------------------------------------------------------------
                                                         5%
maximum                                       max     critical
  rank    parms       LL       eigenvalue  statistic    value
    0       8     -6803.1482           .    137.3913    15.67
    1      12     -6734.4526     0.24152     92.8484     9.24
    2      14     -6688.0283     0.17041
-------------------------------------------------------------------------------

. vecrank y x, trend(n) lags(3) max

                       Johansen tests for cointegration
Trend: none                                            Number of obs =     497
Sample:  4 - 500
    Lags =       3
-------------------------------------------------------------------------------
                                                         5%
maximum                                      trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       8     -6803.1482           .    137.2657    12.53
    1      11     -6734.5433     0.24124      0.0558*    3.84
    2      12     -6734.5154     0.00011
-------------------------------------------------------------------------------
                                                         5%
maximum                                       max     critical
```

```
  rank     parms        LL       eigenvalue  statistic    value
    0       8      -6803.1482            .    137.2099    11.44
    1       11     -6734.5433     0.24124       0.0558     3.84
    2       12     -6734.5154     0.00011
-------------------------------------------------------------------------------
```

4. From (2) & (3), determine the most appropriated set up and make the conclusion of the test whether *y* and *x* are cointegrated series? If yes, how many cointegrating equations.

With one lag term, the model with the linear trend is statistically insignificant since the trace statistic falls into 5% critical region (0.1085 < 3.74). The rank is 1 which is equal to the number of lag. So, all variables are stationary and VAR is integrating at 0. There is no cointegration relation.

With two lag term, the model with the linear trend is statistically insignificant since the trace statistic falls into 5% critical region (3.2749 < 3.74). Also, the model with no trend is significant (0.0335 < 3.84). Both tests show the rank is equal to 1 while lag terms are 2. So, the cointegration equation is at most 1.

With three lag term, the model with the linear trend is statistically insignificant since the trace statistic falls into 5% critical region (2.9534 < 3.74). Also, the model with no trend is significant (0.0558 < 3.84). Both tests show the rank is equal to 1 while lag terms are 3. So, the cointegration equation is at most 1.

5. Estimated VECM models of *y* and *x* using (i) one lag term; (ii) two lag terms; and (iii) three lag terms. Determine the optimal lags. Specify cointegrating equation and speed of adjustment parameters.

For all models, the overall tests for cointegrated equations are statistically significant since the P>chi2 is 0.00 which is less than 0.05, meaning it's cointegrating relations.

The optimal lags would be 3 since it has the lowest SBIC of 27.23459.

The cointegrating equation is $u_t = y_t - \boldsymbol{\beta}_0 - \boldsymbol{\beta}_1 x_1$ or $y_t = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1 x_1$. Then, the CE for the lag-3 model is $y_t = 92.13439 + 1.50049x_t$.

The speed of adjustment parameters of 3-lag model is -0.3193909 for y and 0.4434064 for x.

```
vec y x
Vector error-correction model
Sample:  3 - 500                                Number of obs     =        498
                                                AIC               =   27.18032
```

```
Log likelihood = -6758.899                        HQIC            =   27.21018
Det(Sigma_ml)  =  2.11e+09                        SBIC            =   27.25641

Equation           Parms      RMSE     R-sq      chi2     P>chi2
----------------------------------------------------------------
D_y                  4     213.415   0.9995   964110.3   0.0000
D_x                  4     263.876   0.9982   280728.2   0.0000
----------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_y          |
        _ce1 |
         L1. |   -.427199   .0483639    -8.83   0.000    -.5219905   -.3324075
             |
           y |
         LD. |   .4022605   .0224005    17.96   0.000     .3583563    .4461646
             |
           x |
         LD. |   .4814843   .0598769     8.04   0.000     .3641276    .5988409
             |
       _cons |   171.4546   44.03061     3.89   0.000     85.15624    257.7531
-------------+----------------------------------------------------------------
D_x          |
        _ce1 |
         L1. |   .2903827   .0597995     4.86   0.000     .1731779    .4075875
             |
           y |
         LD. |   .5734396   .0276971    20.70   0.000     .5191544    .6277249
             |
           x |
         LD. |   .3676105   .0740347     4.97   0.000     .2225051    .5127159
             |
       _cons |    252.237   54.44157     4.63   0.000     145.5335    358.9405
------------------------------------------------------------------------------

Cointegrating equations

Equation           Parms    chi2     P>chi2
-------------------------------------------
_ce1                 1   8.09e+08   0.0000
-------------------------------------------

Identification:  beta is exactly identified

                 Johansen normalization restriction imposed
------------------------------------------------------------------------------
        beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_ce1         |
           y |          1          .        .       .            .           .
           x |  -1.500176   .0000527 -2.8e+04   0.000     -1.50028   -1.500073
       _cons |  -577.9622          .        .       .            .           .
------------------------------------------------------------------------------

. vec y x, lags(2)

Vector error-correction model

Sample:  3 - 500                                  Number of obs   =        498
                                                  AIC             =   27.18032
```

```
Log likelihood = -6758.899                        HQIC            =   27.21018
Det(Sigma_ml)  =  2.11e+09                        SBIC            =   27.25641

Equation           Parms      RMSE     R-sq      chi2     P>chi2
----------------------------------------------------------------
D_y                   4     213.415   0.9995   964110.3   0.0000
D_x                   4     263.876   0.9982   280728.2   0.0000
----------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_y          |
        _ce1 |
         L1. |   -.427199   .0483639    -8.83   0.000    -.5219905   -.3324075
             |
           y |
         LD. |   .4022605   .0224005    17.96   0.000     .3583563    .4461646
             |
           x |
         LD. |   .4814843   .0598769     8.04   0.000     .3641276    .5988409
             |
       _cons |   171.4546   44.03061     3.89   0.000     85.15624    257.7531
-------------+----------------------------------------------------------------
D_x          |
        _ce1 |
         L1. |   .2903827   .0597995     4.86   0.000     .1731779    .4075875
             |
           y |
         LD. |   .5734396   .0276971    20.70   0.000     .5191544    .6277249
             |
           x |
         LD. |   .3676105   .0740347     4.97   0.000     .2225051    .5127159
             |
       _cons |    252.237   54.44157     4.63   0.000     145.5335    358.9405
------------------------------------------------------------------------------

Cointegrating equations

Equation           Parms    chi2     P>chi2
-------------------------------------------
_ce1                  1   8.09e+08   0.0000
-------------------------------------------

Identification:  beta is exactly identified

                 Johansen normalization restriction imposed
------------------------------------------------------------------------------
        beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_ce1         |
           y |          1          .        .       .            .           .
           x |  -1.500176   .0000527 -2.8e+04   0.000     -1.50028   -1.500073
       _cons |  -577.9622          .        .       .            .           .
------------------------------------------------------------------------------

. vec y x, lags(3)

Vector error-correction model

Sample:  4 - 500                                  Number of obs     =        497
                                                  AIC               =    27.1245
```

```
Log likelihood = -6727.439                        HQIC            =   27.16771
Det(Sigma_ml)  =  1.96e+09                        SBIC            =   27.23459

Equation           Parms      RMSE     R-sq      chi2     P>chi2
----------------------------------------------------------------
D_y                  6     211.673   0.9995   980003.4   0.0000
D_x                  6     253.098   0.9984   305162.2   0.0000
----------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_y          |
        _ce1 |
         L1. |  -.3193909    .058155    -5.49   0.000    -.4333726   -.2054092
             |
           y |
         LD. |   .3553209   .0559202     6.35   0.000     .2457194    .4649225
        L2D. |   .0174858   .0312998     0.56   0.576    -.0438607    .0788323
             |
           x |
         LD. |   .6042668   .0763396     7.92   0.000     .4546439    .7538896
        L2D. |   .0521968   .0634683     0.82   0.411    -.0721988    .1765925
             |
       _cons |   181.5838   45.38519     4.00   0.000     92.63049    270.5372
-------------+----------------------------------------------------------------
D_x          |
        _ce1 |
         L1. |   .4434064   .0695359     6.38   0.000     .3071185    .5796943
             |
           y |
         LD. |   .4713427   .0668638     7.05   0.000     .3402922    .6023932
        L2D. |    .012763   .0374252     0.34   0.733     -.060589    .0861151
             |
           x |
         LD. |   .5220109   .0912792     5.72   0.000     .3431069     .700915
        L2D. |   .0911602   .0758891     1.20   0.230    -.0575797    .2399001
             |
       _cons |    130.797   54.26707     2.41   0.016     24.43548    237.1585
------------------------------------------------------------------------------

Cointegrating equations

Equation           Parms    chi2     P>chi2
-------------------------------------------
_ce1                 1   6.64e+08   0.0000
-------------------------------------------

Identification:  beta is exactly identified

                 Johansen normalization restriction imposed
------------------------------------------------------------------------------
        beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_ce1         |
           y |          1          .        .       .            .           .
           x |  -1.500049   .0000582 -2.6e+04   0.000    -1.500163   -1.499935
       _cons |  -92.13439          .        .       .            .           .
------------------------------------------------------------------------------
```

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