Assignment 5

Due: 15/10/2020

From the data set `Assignment 5-8.dta`:

Requirements:

1. Test whether the series spot and future are stationary series.
2. Determine order of integration of the series spot and future.
3. Generate series of the return of spot (*rspot*) and return of future (*rfuture*) and test whether they are stationary.

By Tatre Jantarakolica

1. Test whether the series spot and future are stationary series.

```
. dfuller spot,trend lags(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7682

                     ------------ Interpolated Dickey-Fuller ------------
             Test         1% Critical       5% Critical      10% Critical
          Statistic             Value             Value             Value
------------------------------------------------------------------------------
 Z(t)       -2.438            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.3597

------------------------------------------------------------------------------
D.spot |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------+----------------------------------------------------------------------
spot   |
   L1. |  -.001489   .0006108    -2.44   0.015    -.0026862   -.0002917
   LD. |   .0440347  .0114011     3.86   0.000     .0216855    .0663839
_trend |   .0000171  8.32e-06     2.05   0.040     7.62e-07    .0000334
 _cons |   .7447753  .302873      2.46   0.014     .1510615    1.338489
------------------------------------------------------------------------------
```

$H_0: \hat{\gamma} = 0$

The result shows P-value = 0.3597 (fail to reject null hypothesis of unit roots). Then check whether trend is significant $H_0: \alpha_1 = 0$ and find out that P-value = 0.04. Which is lower than 0.05. Hence, There is Unit Root and the series of spot is nonstationary.

```
. dfuller future,trend lags(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7682

                     ------------ Interpolated Dickey-Fuller ------------
             Test         1% Critical       5% Critical      10% Critical
          Statistic             Value             Value             Value
------------------------------------------------------------------------------
 Z(t)       -2.563            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.2971

------------------------------------------------------------------------------
D.future |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------+----------------------------------------------------------------------
future   |
   L1.   |  -.001768   .0006898    -2.56   0.010    -.0031202   -.0004159
   LD.   |  -.0275938  .0114077    -2.42   0.016    -.0499561   -.0052315
_trend   |   .0000222  .00001       2.22   0.026     2.62e-06    .0000418
 _cons   |   .86276    .3338726     2.58   0.010     .2082785    1.517241
------------------------------------------------------------------------------
```

For futures, we test whether $\gamma = 0$ or $H_0: \hat{\gamma} = 0$. The result shows P-value = 0.2971 which is greater than 0.05 thus, The H_0 is no rejected. Then we check whether trend is significant or $H_0: \hat{\alpha}_1 = 0$ and the P-value is 0.026 which is lower than 0.05 so, we reject the null hypothesis. Hence the futures series is nonstationary and there is a Unit Roots.

2. Determine order of integration of the series spot and future.

```
. dfuller d.spot, trend lags(1) regress

Augmented Dickey-Fuller test for unit root        Number of obs   =      7681

                                 ------------ Interpolated Dickey-Fuller ------------
                    Test         1% Critical       5% Critical      10% Critical
                 Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -63.765            -3.960            -3.410           -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D2.spot |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------+---------------------------------------------------------------------
spot     |
        D1. |  -1.005364   .0157667   -63.77   0.000    -1.036271   -.974457
        LD. |   .0508571   .011398     4.46   0.000     .0285139   .0732003
     _trend |   7.82e-07   4.94e-06     0.16   0.874    -8.90e-06   .0000105
      _cons |   .0088178   .0219189     0.40   0.687    -.0341492   .0517848
------------------------------------------------------------------------------
```

To find the order of integration since we know the series are not integrated at order 0. We need to test whether the series are integrate at order 1 or not by performing unit root test of $\Delta Spot_t = Spot_t - Spot_{t-1}$. $H_0: \gamma = 0$ and we get P-value from Mackinnon approximate equals to $0.000 < 0.05$. Thus we reject the null hypothesis, The series is stationary at I(1)

```
. dfuller d.future, trend lags(1) regress

Augmented Dickey-Fuller test for unit root        Number of obs   =      7681

                                 ------------ Interpolated Dickey-Fuller ------------
                    Test         1% Critical       5% Critical      10% Critical
                 Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -65.269            -3.960            -3.410           -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D2.future |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------+---------------------------------------------------------------------
future     |
        D1. |  -1.067592   .0163567   -65.27   0.000    -1.099655   -1.035528
        LD. |   .038008    .0114045     3.33   0.001     .0156522   .0603639
     _trend |   1.01e-06   5.59e-06     0.18   0.856    -9.94e-06   .000012
      _cons |   .0096235   .0247823     0.39   0.698    -.0389566   .0582036
------------------------------------------------------------------------------
```

To find the order of integration since we know the series are not integrated at order 0. We need to test whether the series are integrate at order 1 or not by performing unit root test of $\Delta future_t = future_t - future_{t-1}$. $H_0: \gamma = 0$

and we got P-value from Mackinnon approximate equals to 0.000 < 0.05. Thus we reject the null hypothesis so, the series is stationary at I(1)

3. Generate series of the return of spot (*rspot*) and return of future (*rfuture*) and test whether they are stationary.

```
. gen rspot=(spot/l.spot)-1
(1 missing value generated)

. gen rfuture=(future/l.spot)-1
(1 missing value generated)

. dfuller rspot, trend lags(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                                 ------------ Interpolated Dickey-Fuller ------------
                    Test         1% Critical       5% Critical      10% Critical
                 Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -63.787            -3.960            -3.410           -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D.rspot |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------+---------------------------------------------------------------------
rspot    |
    L1. |  -1.005168   .0157581   -63.79   0.000    -1.036058   -.9742776
    LD. |   .0517018   .0113974     4.54   0.000     .0293598    .0740439
 _trend |   9.56e-10   9.19e-09     0.10   0.917    -1.71e-08    1.90e-08
  _cons |   .0000199   .0000408     0.49   0.626      -.00006    .0000998
------------------------------------------------------------------------------
```

For Return on spot, $H_0: \gamma = 0$

The result shows P-value = 0.000 (P-value < 0.05 reject null hypothesis of unit roots). Then there is no Unit root, the series of return on spot is stationary

```
. dfuller rfuture, trend lags(1) regress

Augmented Dickey-Fuller test for unit root         Number of obs   =      7681

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -15.760            -3.960            -3.410            -3.120
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
D.rfuture    |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     rfuture |
         L1. |  -.0845954   .0053678   -15.76   0.000    -.0951177   -.0740731
         LD. |  -.3078496   .0108584   -28.35   0.000    -.3291351    -.286564
      _trend |   1.98e-07   1.76e-08    11.26   0.000     1.64e-07    2.33e-07
       _cons |  -.0020118    .000139   -14.47   0.000    -.0022843   -.0017393
------------------------------------------------------------------------------

.
```

For Return on Futures, $H_0 : \gamma = 0$

The result shows P-value = 0.000 (P-value < 0.05 reject null hypothesis of unit roots). Then there is no Unit root, the series of return on future is stationary

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