Assignment 5
Guideline Solution

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

Requirements:

1. Test whether the series spot (`spot`) and future (`future`) are stationary series.

```
. tsset t
        time variable:  t, 1 to 7684
                delta:  1 unit

. dfuller spot, trend lag(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
------------------------------------------------------------------------------

. dfuller future, trend lag(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
------------------------------------------------------------------------------
```

- ***spot and future are nonstationary.***

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

```
. dfuller d.spot, trend lag(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]
-------------+----------------------------------------------------------------
      D.spot |
         L1. |  -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
------------------------------------------------------------------------------

. dfuller d.future , trend lag(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]
-------------+----------------------------------------------------------------
    D.future |
         L1. |  -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
------------------------------------------------------------------------------
```

- ***spot and future are Integrated series of order 1 or I(1).***

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

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

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

. dfuller rspot, trend lag(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
------------------------------------------------------------------------------

. dfuller rspot, lag(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)            -63.791            -3.430            -2.860            -2.570
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
     D.rspot |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       rspot |
         L1. |  -1.005165   .0157571   -63.79   0.000    -1.036053   -.9742771
         LD. |   .0517007   .0113967     4.54   0.000     .0293601    .0740413
             |
       _cons |   .0000235   .0000204     1.15   0.248    -.0000164    .0000635
------------------------------------------------------------------------------

. dfuller rfuture, trend lag(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)            -65.070            -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. |  -1.063572   .0163449   -65.07   0.000    -1.095612   -1.031531
         LD. |     .03575   .0114053     3.13   0.002     .0133924    .0581076
      _trend |   1.17e-09   1.06e-08     0.11   0.912    -1.96e-08    2.19e-08
       _cons |   .0000231    .000047     0.49   0.624    -.0000691    .0001152
------------------------------------------------------------------------------

. dfuller rfuture, lag(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)            -65.074            -3.430            -2.860            -2.570
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0000

------------------------------------------------------------------------------
   D.rfuture |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     rfuture |
         L1. |  -1.063569   .0163439   -65.07   0.000    -1.095608   -1.031531
         LD. |   .0357488   .0114046     3.13   0.002     .0133927    .0581049
             |
       _cons |   .0000276   .0000235     1.17   0.241    -.0000185    .0000736
------------------------------------------------------------------------------
```

- ***rspot and rfuture are stationary.***