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1.

```
. use "C:\Users\Win10x64_Bit\Downloads\Assignment 5-8.dta", clear

. 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. |    .044034   .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
------------------------------------------------------------------------------
```

spot

H0: $\gamma = 0$ or $\beta = 1$

$z = 0.359770.05$ fail to reject, $\gamma = 0$ so $\beta = 1$

Hence, the series has unit root and cause it is nonstationary

Take a look at α_1 to know that we can use this model or not

H0: $\alpha_1 = 0$, $z = 0.0+0 < 0.05$ this null hypothesis is rejected

and $\alpha_1 \neq 0$. so, we can use this model. series spot is "nonstationary"

```
. 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
------------------------------------------------------------------------------
```

H0: $\gamma = 0$ or $\beta = 1$ $z = 0.29770.05$, we failed to reject.

and $\alpha_1 = 0.026 < 0.05$ which means that we rejected null hypothesis, $\alpha_1 = 0$.

This future model has unit root and it is "nonstationary"

2.

```
. 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
------------------------------------------------------------------------------
```

we use the same model because time trend is significant.

spot is nonstationary or I(1) but $\Delta^2 y_t$: Δspot: stationary

since $\Delta^2 y_t$ H0: $\gamma = 0$ $z = 0.000 < 0.05$, hypothesis rejected

in this case spot is nonstationary but the first difference make

it to be "stationary"

```
. 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
------------------------------------------------------------------------------
```

As the same in spot, series future itself is nonstationary. But after 1st difference Δy_t : Δfuture. $z = 0.000 < 0.05$. The hypothesis is rejected hence $\gamma \neq 0$. series future turn to be "stationary"

"Conclusion, spot & future are integrated series of 1st order" → stationary.

3.

```
. 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
------------------------------------------------------------------------------
```

H0: $\gamma = 0$

from z score : $0.000 < 0.05$. The hypothesis is rejected. so, $\gamma \neq 0$. There is no unit root. It is stationary

```
. 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
------------------------------------------------------------------------------
```

H0: $\gamma = 0$

$z = 0.000 < 0.05$. The hypothesis is rejected, $\gamma \neq 0$. There is no unit root it is stationary.

Both return of spot & future are stationary