Richaya H. (6004640188)

Assignment 5

1.

Spot

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

To test whether the series spot is stationary or not, we use Augmented Dickey-Fuller Test (ADF test). We first set the null hypothesis for the unit root which is $H_0 : \gamma = 0$. According to the result, MacKinnon approximate p-value for Z(t) is 0.3597 which is greater than p-value of 0.05, hence, we failed to reject H_0. Therefore, we test for the next step which is to test whether the time trend should be dropped out of the model. To do that, set the null hypothesis of $H_0 : \alpha_1 = 0$. The estimated results show the p-value of time trend of t = 2.05 and p-value of 0.04 (< 0.05). H_0 is rejected, and the time trend is significant. Such that, there is unit root or the series spot is nonstationary.

Future

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

To test whether the series future is stationary or not, we use Augmented Dickey-Fuller Test (ADF test). We first set the null hypothesis for the unit root which is $H_0 : \gamma = 0$. According to the result, MacKinnon approximate p-value for Z(t) is 0.2971 (p-value : 0.2971 > 0.05), hence, we failed to reject H_0. Therefore, we test for the second step to test whether the time trend is significant or not. To do that, set the null hypothesis of H_0 : $\alpha_1 = 0$. The results estimated the p-value of time trend is t = 2.22 and p-value of 0.026 (p-value = 0.026 < 0.05). H_0 is rejected, and the time trend is significant. Such that, there is unit root or the series spot is nonstationary.

2.

Spot

```
. 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]
-------------+----------------------------------------------------------------
      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
------------------------------------------------------------------------------
```

To determine order of integration of series spot, we test the level of series by using dfuller d.spot or $Spot_t$ - $Spot_{t-1}$ or $\Delta Spot_t$. According to the result, MacKinnon approximate p-value for Z(t) is 0.0000 (p-value = 0.0000 < 0.05). $H_0 : \gamma = 0$ is rejected, and there is no unit root or the model is stationary at integrated level 1 or I(1) means that $Spot_t$ is nonstationary but $\Delta Spot_t$ is stationary.

Future

```
. 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]
-------------+----------------------------------------------------------------
    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
------------------------------------------------------------------------------
```

To determine order of integration of series spot, we test the level of series by using dfuller d.future or $Future_t$ - $Future_{t-1}$. According to the result, MacKinnon approximate p-value for Z(t) is 0.0000 (p-value = 0.0000 < 0.05). $H_0 : \gamma = 0$ is rejected, and there is no unit root or the model is stationary at integrated level 1 or I(1) means that $Future_t$ is nonstationary but $\Delta Future_t$ is stationary.

3.

rspot

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

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

. dfuller rspot, trend lags(1) regress

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

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical 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

To test whether rspot is stationary or not, we use the ADF test to test it. Set the null hypothesis of $H_0 : \gamma = 0$. According to the result, MacKinnon approximate p-value for Z(t) is 0.0000, p-value is less than 0.05, thus, H_0 is rejected and series rspot has no unit root, the model is stationary.

rfuture

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

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

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical 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

To test whether rfuture is stationary or not, we use the ADF test to test it. Set the null hypothesis of $H_0 : \gamma = 0$. According to the result, MacKinnon approximate p-value for Z(t) is 0.0000, p-value is less than 0.05, thus, H_0 is rejected and series rfuture has no unit root or the model is stationary.