Roll No:----------------------------

UNIVERSITY OF PETROLEUM & ENERGY STUDIES

DEHRADUN

End Semester Examination-May 2017

Program/course	**: MA Economics (EE)**	**Semester**	**: II**
Subject	**: Econometric Modeling**	**Max. Marks**	**: 100**
Code	**: MECE 731**	**Duration**	**: 3 Hrs**
No. of page/s	**: 14**		

Section-A

Q1. Answer the questions: **20 X 1= 20**

I. If intercept is positive then regression line will ____________________.

a. Cut x-axis c. Cut y-axis.

b. Pass through origin d. Slope upwar

II. Heteroscedasticity is a ______________.

a. Problem of time series data c. Primary data

b. Problem of cross-sectional data d. Secondary data

III. Under the least square procedure, RSS need to be________.

a. Minimize c. Squared

b. Maximize d. Multiplied with error term

IV. When choosing between regression models it is preferable to choose the one with:

a. The highest R^2. c. The highest F value

b. The least number of independent variables.

d. The most number of independent variables.

V. When the estimated slop coefficient in the simple regression model $\hat{\beta}_2$, is zero, then

a. $r^2 = 0$

c. $0 \le r^2 \le 1$

b. $r^2 \le 1$

d. $r^2 \le 0$

VI. For coefficient of determination r^2 for a regression model

a. $r^2 = 0$

c. $0 \le r^2 \le 1$

b. $r^2 \le 1$

d. $r^2 \le 0$

VII. $E(Y \mid X_i) = f(X_i)$ is known as _______.

a. conditional expectation function

c. sample expectation function

b. Cobb-Douglas production function

d. conditional mean function

VIII. $u_i = Y_i - E(Y \mid X_i)$ is known as ________.

a. deviation of an expected Y_i around its mean value

c. deviation of an individual X_i around its expected value

b. deviation of an individual Y_i around its maximum value

d. deviation of an individual Y_i around its expected value

IX. The α in a confidence interval given by $\Pr\left(\hat{\beta}_2 - \delta \le \beta_2 \le \hat{\beta}_2 + \delta\right) = 1 - \alpha$ is known as ___.

a. Confidence coefficient

c. Level of significance

b. Level of confidence

d. Confidence Limit

X. Systematic component of the equation, $Y_i = E(Y \mid X_i) + u_i$ is _______.

a. u_i

c. $E(Y \mid X_i)$

b. Y_i

d. X_i

XI. The α in a confidence interval given by $\Pr\left(\hat{\beta}_2 - \delta \le \beta_2 \le \hat{\beta}_2 + \delta\right) = 1 - \alpha$ should be ___.

a. <0

c. >0 and <1

b. <1 d. >0

XII. In confidence interval estimation, $\alpha = 5\%$, this means that this interval includes the true β with probability of _____.

a. 5% c. 105%

b. 95% d. 100%

XIII. $\hat{Y}_i$ is the estimator of _____________.

a. $E(Y \mid X_i)$ c. $E(X_i)$

b. Y_i d. X_i

XIV. When we do not reject a H_0 for β_2 this means that the value of β_2 under H_0 falls within the confidence interval defined by

a. $(1-\alpha)\%$ c. $100(1+\alpha)\%$

b. $100\,(1-\alpha)\%$ d. $(100-\alpha)\%$

XV. The sample parameter estimator $\hat{\beta}_2$ follows______.

a. t-distribution c. F-distribution

b. Normal distribution d. Chi-square distribution

XVI. When we reject the null hypothesis, our findings is said to be ___.

a. Efficient c. Changing with unit change in explanatory variable

b. Statistically Reliable d. Statistically significant

XVII. The lowest significance level at which a null hypothesis can be rejected is determined by ____.

a. t-value c. F-value

b. p-value d. Chi-square statistic

XVIII. In $Y_i = \beta_1 + \beta_2 X_i + u_i$, β_2 indicates_______________.

a. Change in Y due to unit change in X c. Change in Y due to unit change in u

b. Change in X due to unit change in Y   d. Change in u due to unit change in Y

XIX. The regression line passes through______________________________.

a. the population means of *Y and X*   c. the sample variance of *Y and X*

b. the sample means of *Y and X*   d. the population variance of *Y and X*

XX. Dropping any relevant variable(s) from regression model leads to___________.

a. specification bias   c. systematic bias

b. random bias   d. Bias

Section B

Attempt any four questions **4X5 = 20**

Q2. The VIF of regression considering oil consumption (OC) as dependent variable is given below. Analysis both VIF and TOL and discuss about presence of multicollinearity in the model.

Variable	VIF	1/VIF
om	255.75	0.003910
op	101.03	0.009898
pgdp	60.08	0.016643
co2	47.68	0.020972
ox	23.66	0.042272
or	18.24	0.054812
cop	3.75	0.266887
Mean VIF	72.88	

Q3. State positive or negative relationship between OC and independent variables.

Sl.No.	OC	β Coeff.	Calculated t-Value	Critical t-Value (at 5%)	State positive or negative relationship between OC and independent variables
1	OE	0.018	-2.30	1.697	
2	RT	-0.030	4.70	1.697	
3	P	-0.070	2.56	1.697	
4	OP	-0.862	6.65	1.697	
5	PR	0.073	-1.33	1.697	

6	Const.	55.40	-4.44	1.697	

Q4.Formulate one energy consumption function, write down its functional form and econometric specification for the following variables:

C : amount of energy consumed per annum

Y : GDP of a given country

FDI : FDI inflow for a given country

Q5. Consider the following regression output:

$$\hat{Y}_i = 0.3133 - 0.4563X_t$$

$se =$ (0.0976) (0.1961)

P= (0.005) (0.003)

RSS = 0.0544 ESS = 0.0358 $r^2 = 0.397$

Where, Y = Household Electricity Consumption in rural area (in KW)

X = Electricity tariff (in Rupees)

The regression results were obtained from a sample of 19 households.

a) How do you interpret this regression?

b) Test the hypothesis that H_0: $\beta_2 = 0$ against H_1: $\beta_2 \neq 0$. Which test do you use? And why?

Q6. The ANOVA table of one regression result is given below.

The critical value of F(1, 16) = 2.4904 and α = 5%.

Source	SS	Df	MSS
Model	326765512	1	
Residual	167697811	16	
Total	494463323	17	

Compute (i) Mean sum of squares, (ii) F and (iii) state the overall significance of the model.

Section C

Answer any two questions 2 X 15 = 30

Q7. In the following multiple regression result, Carbon Emission (co2) is estimated using factors such as oil consumption (oc), per capita GDP (pgdp), import of goods and services (om), and export of goods and services (ox).

Source	SS	df	MS
Model	1020938.61	4	255234.652
Residual	21585.3769	29	744.323342
Total	1042523.99	33	31591.6359

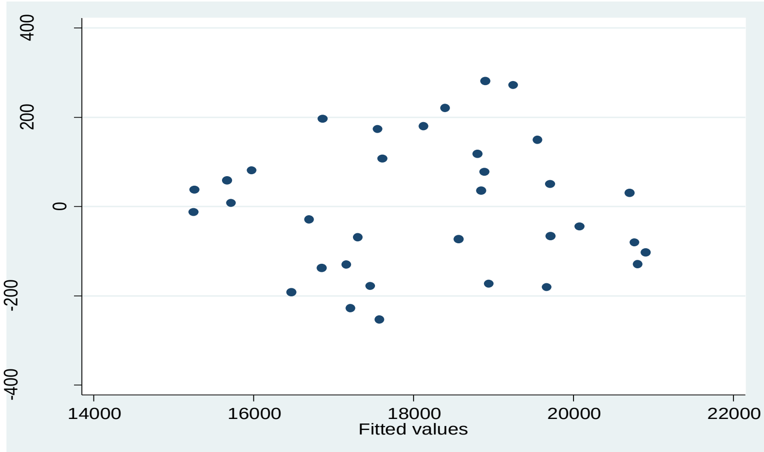
Number of obs =	34
F(4, 29) =	342.91
Prob > F =	0.0000
R-squared =	0.9793
Adj R-squared =	0.9764
Root MSE =	27.282

co2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
oc	.1308342	.0144843	9.03	0.000	.1012106	.1604579
pgdp	-.0136371	.0045878	-2.97	0.006	-.0230202	-.0042539
om	.014613	.0102785	1.42	0.166	-.0064089	.0356349
ox	-.0092261	.0176469	-0.52	0.605	-.0453181	.0268659
_cons	294.4371	170.1929	1.73	0.094	-53.64647	642.5206

Using individual and joint hypothesis testing find out relationship between co2 and its determinants.

Q8. Detect problems of heteroscedasticity for a regression model, where oil consumption (oc) is estimated. The post estimation results are given below. Critically analyze and interpret the results.

i. Graphical Method



ii. Breusch-Pagan/ Cook-Weisberg test

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of oc

         chi2(1)      =     0.05
         Prob > chi2  =   0.8280
```

iii. Park Test: Park suggests that σ^2_i is some function of the explanatory variable X_i. The functional form he suggested was

$$\sigma^2_i = \sigma^2 X^{\beta}_i \, e^{vi}$$

Using this functional form suggest how to detect heteroscedasticity.

Q9. The multiple regression and its post estimation results are given below. Interpret the post estimation results and justify whether multicollinearity is present in the model or not.

Multiple Regression Results

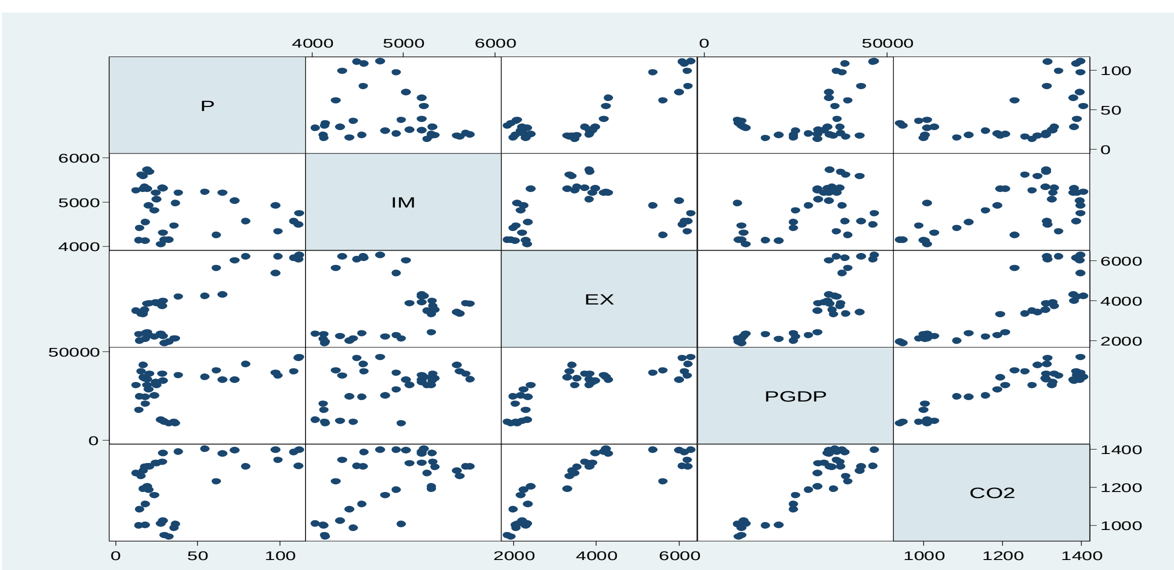
Source	SS	df	MS
Model	7938423.38	5	1587684.68
Residual	123989.991	29	4275.51694
Total	8062413.37	34	237129.805

Number of obs	=	35
F(5, 29)	=	371.34
Prob > F	=	0.0000
R-squared	=	0.9846
Adj R-squared	=	0.9820
Root MSE	=	65.387

oc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
p	-3.834641	.8662552	-4.43	0.000	-5.606331	-2.06295
im	.6252913	.0466814	13.39	0.000	.5298171	.7207655
ex	-.1236515	.0271815	-4.55	0.000	-.1792438	-.0680591
pgdp	.0050046	.0024767	2.02	0.053	-.000061	.0100701
co2	1.122187	.2407524	4.66	0.000	.6297929	1.614581
_cons	1068.624	161.3615	6.62	0.000	738.6027	1398.645

Post Estimation Tests

(i) Scatter Plot Matrix



(ii) Correlation Matrix

	oc	p	im	ex	pgdp	co2
oc	1.0000					
p	-0.5050	1.0000				
im	0.9419	-0.2473	1.0000			
ex	-0.1272	0.8305	0.1329	1.0000		
pgdp	0.3637	0.4548	0.5306	0.7883	1.0000	
co2	0.4391	0.4728	0.6168	0.7948	0.8907	1.0000

(iii) Variance Inflation Factor (VIF) and Tolerance(TOL)

Variable	VIF	1/VIF
ex	13.06	0.076584
co2	10.80	0.092562
pgdp	6.05	0.165358
p	5.92	0.168914
im	4.48	0.223424
Mean VIF	8.06	

Section D

Answer all questions **1 X 30 = 30**

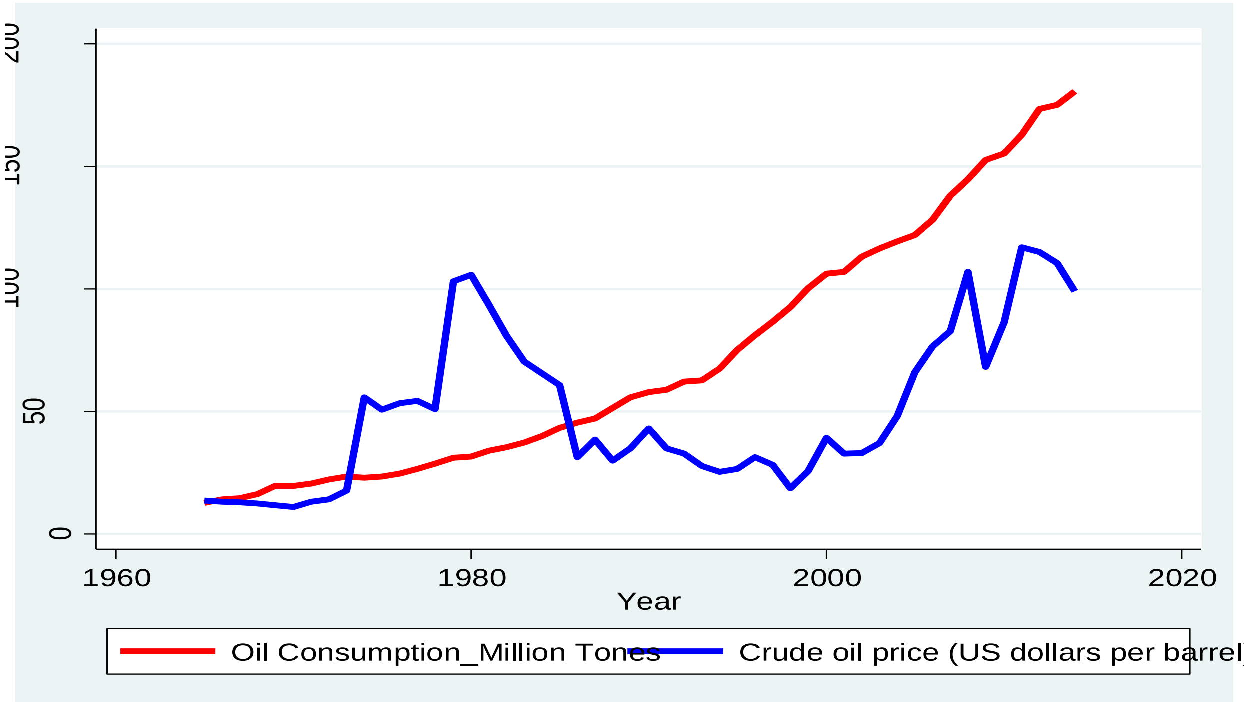
Q10. Results of summery statistics and stationarity of oil consumption (oc) are given below along with some result of crude oil production (cop). Write the name of model specification in each case, analyze critically and test the stationarity of the series.

i. Summery statistics

sum OC COP

Variable	Obs	Mean	Std. Dev.	Min	Max
OC	50	71.622	51.25576	12.6	180.7
COP	50	50.178	32.00747	10.97	117.09

ii. Graphical Method



iii. The Unit Root Test

$$Y_t = \rho Y_{t-1} + u_t \qquad -1 \leq \rho \leq 1$$

regress OC L1.OC, noconstant

Source	SS	df	MS
Model	384839.413	1	384839.413
Residual	217.880685	48	4.53918094
Total	385057.293	49	7858.31211

Number of obs =	49
F(1, 48) =	84781.69
Prob > F =	0.0000
R-squared =	0.9994
Adj R-squared =	0.9994
Root MSE =	2.1305

OC	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
OC L1.	1.044771	.0035881	291.17	0.000	1.037556	1.051985

$$\Delta Y_t = \delta Y_{t-1} + u_t$$

```
reg d1.OC L1.OC

      Source |       SS       df       MS              Number of obs =      49
-------------+------------------------------           F(  1,    47) =   33.80
       Model |  145.529143     1  145.529143           Prob > F      =  0.0000
    Residual |  202.355083    47  4.30542729           R-squared     =  0.4183
-------------+------------------------------           Adj R-squared =  0.4060
       Total |  347.884226    48  7.24758803           Root MSE      =   2.075

------------------------------------------------------------------------------
        D.OC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          OC |
         L1. |   .0353301   .0060768     5.81   0.000     .0231051    .0475551
             |
       _cons |   .9788471   .5154645     1.90   0.064    -.0581337    2.015828
------------------------------------------------------------------------------
```

iv. DF Test

TABLE D.7 1% AND 5% CRITICAL DICKEY–FULLER t ($= \tau$) AND F VALUES FOR UNIT ROOT TESTS

Sample size	t_{nc}*		t_c*		t_{ct}*		$F^{\dagger}$		$F^{\ddagger}$	
	1%	5%	1%	5%	1%	5%	1%	5%	1%	5%
25	−2.66	−1.95	−3.75	−3.00	−4.38	−3.60	10.61	7.24	8.21	5.68
50	−2.62	−1.95	−3.58	−2.93	−4.15	−3.50	9.31	6.73	7.02	5.13
100	−2.60	−1.95	−3.51	−2.89	−4.04	−3.45	8.73	6.49	6.50	4.88
250	−2.58	−1.95	−3.46	−2.88	−3.99	−3.43	8.43	6.34	6.22	4.75
500	−2.58	−1.95	−3.44	−2.87	−3.98	−3.42	8.34	6.30	6.15	4.71
∞	−2.58	−1.95	−3.43	−2.86	−3.96	−3.41	8.27	6.25	6.09	4.68

*Subscripts nc, c, and ct denote, respectively, that there is no constant, a constant, and a constant and trend term in the regression (21.9.5).
†The critical F values are for the joint hypothesis that the constant and δ terms in (21.9.5) are simultaneously equal to zero.
‡The critical F values are for the joint hypothesis that the constant, trend, and δ terms in (21.9.5) are simultaneously equal to zero.

```
reg OC L1.OC, noconstant

      Source |       SS       df       MS              Number of obs =      49
-------------+------------------------------           F(  1,    48) =84781.69
       Model |  384839.413     1  384839.413           Prob > F      =  0.0000
    Residual |  217.880685    48  4.53918094           R-squared     =  0.9994
-------------+------------------------------           Adj R-squared =  0.9994
       Total |  385057.293    49  7858.31211           Root MSE      =  2.1305

------------------------------------------------------------------------------
          OC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          OC |
         L1. |   1.044771   .0035881   291.17   0.000     1.037556    1.051985
------------------------------------------------------------------------------
```

```
reg OC t L1.OC

      Source |       SS       df       MS              Number of obs =      49
-------------+------------------------------           F(  2,    46) =15295.09
       Model |  124987.867     2  62493.9333           Prob > F      =  0.0000
    Residual |  187.950547    46  4.08588145           R-squared     =  0.9985
-------------+------------------------------           Adj R-squared =  0.9984
       Total |  125175.817    48  2607.82952           Root MSE      =  2.0214

------------------------------------------------------------------------------
          OC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           t |   .1409496   .0750684     1.88   0.067    -.0101552    .2920543
             |
          OC |
         L1. |   .9960063   .0217641    45.76   0.000     .9521975    1.039815
             |
       _cons |  -276.7819   147.9335    -1.87   0.068    -574.5566    20.99285
------------------------------------------------------------------------------
```

v. DF using software

```
. dfuller OC, noconstant regress

Dickey-Fuller test for unit root                   Number of obs   =        49

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             12.477            -2.622            -1.950            -1.610

------------------------------------------------------------------------------
        D.OC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          OC |
         L1. |   .0447709   .0035881    12.48   0.000     .0375564    .0519853
------------------------------------------------------------------------------
```

```
. dfuller OC, regress

Dickey-Fuller test for unit root                   Number of obs   =        49

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)              5.814            -3.587            -2.933            -2.601
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 1.0000

------------------------------------------------------------------------------
        D.OC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          OC |
         L1. |   .0353301   .0060768     5.81   0.000     .0231051    .0475551
             |
       _cons |   .9788471   .5154645     1.90   0.064    -.0581337    2.015828
------------------------------------------------------------------------------
```

```
. dfuller OC, trend regress

Dickey-Fuller test for unit root                   Number of obs   =        49

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -0.184            -4.159            -3.504            -3.182
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9918

------------------------------------------------------------------------------
D.OC         |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          OC |
         L1. |  -.0039937   .0217641    -0.18   0.855    -.0478025    .0398151
      _trend |   .1409496   .0750684     1.88   0.067    -.0101552    .2920543
       _cons |   .1840203   .6567739     0.28   0.781    -1.137997    1.506038
------------------------------------------------------------------------------
```

vi. Phillips-Perron test for unit root

```
. pperron OC, noconstant regress

Phillips-Perron test for unit root                 Number of obs   =        49
                                                   Newey-West lags =         3

                               ———————— Interpolated Dickey-Fuller ————————
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(rho)           2.191           -12.860            -7.684            -5.492
 Z(t)            11.501            -2.622            -1.950            -1.610

------------------------------------------------------------------------------
          OC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          OC |
         L1. |   1.044771   .0035881   291.17   0.000     1.037556    1.051985
------------------------------------------------------------------------------
```

```
. pperron OC, regress

Phillips-Perron test for unit root                 Number of obs   =        49
                                                   Newey-West lags =         3

                               ———————— Interpolated Dickey-Fuller ————————
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(rho)           1.729           -18.832           -13.268           -10.680
 Z(t)             5.693            -3.587            -2.933            -2.601
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 1.0000

------------------------------------------------------------------------------
          OC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          OC |
         L1. |    1.03533   .0060768   170.37   0.000     1.023105    1.047555
             |
       _cons |   .9788471   .5154645     1.90   0.064    -.0581337    2.015828
------------------------------------------------------------------------------
```

. **pperron OC, trend regress**

Phillips-Perron test for unit root — Number of obs = **49**; Newey-West lags = **3**

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(rho)	**-0.181**	**-25.572**	**-19.724**	**-16.752**
Z(t)	**-0.172**	**-4.159**	**-3.504**	**-3.182**

MacKinnon approximate p-value for Z(t) = **0.9920**

OC	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
OC L1.	**.9960063**	**.0217641**	**45.76**	**0.000**	**.9521975**	**1.039815**
_trend	**.1409496**	**.0750684**	**1.88**	**0.067**	**-.0101552**	**.2920543**
_cons	**.1840203**	**.6567739**	**0.28**	**0.781**	**-1.137997**	**1.506038**

vii. Augmented Dickey–Fuller (ADF) test

. **dfuller OC, noconstant regress lags(5)**

Augmented Dickey-Fuller test for unit root — Number of obs = **44**

	Test Statistic	Interpolated Dickey-Fuller: 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	**2.053**	**-2.630**	**-1.950**	**-1.608**

D.OC	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
OC L1.	**.0379253**	**.0184745**	**2.05**	**0.047**	**.0005256**	**.075325**
LD.	**.1913583**	**.1700517**	**1.13**	**0.268**	**-.1528934**	**.53561**
L2D.	**-.1835111**	**.1909217**	**-0.96**	**0.343**	**-.5700119**	**.2029897**
L3D.	**.2074853**	**.1967523**	**1.05**	**0.298**	**-.1908188**	**.6057895**
L4D.	**-.0291233**	**.198624**	**-0.15**	**0.884**	**-.4312165**	**.3729699**
L5D.	**-.0247098**	**.208248**	**-0.12**	**0.906**	**-.4462859**	**.3968662**