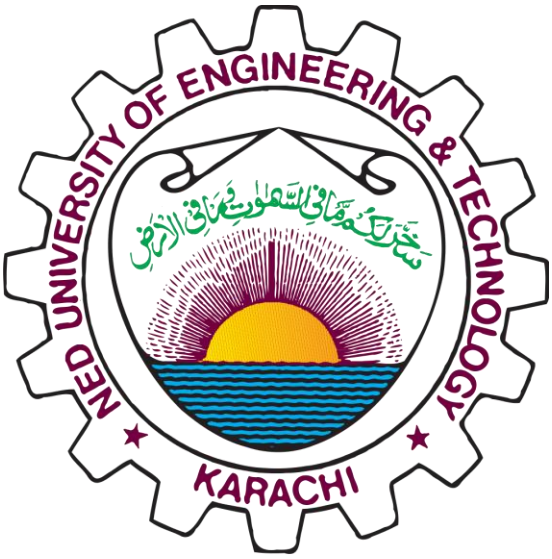


NAME: AYESHA FATIMA

ROLL NUMBER: CF-004

ASSIGNMENT: STOCHASTIC MODELS IN FINANCE

COURSE INSTRUCTOR: MISS MALIHA

DEPENDANT SERIES: IMPORTS

INDEPENDENT SERIES: EXPORTS & WORKERS' REMITTANCES

DEPENDENT SERIES:

M (Imports)

INDEPENDENT SERIES:

X (Exports)

I) ESTIMATING REGRESSION:

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: M
Method: Least Squares
Date: 07/08/19 Time: 22:17
Sample: 2001M07 2018M06
Included observations: 204

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-814.2756	166.4134	-4.893090	0.0000
X	2.397469	0.101292	23.66883	0.0000

R-squared	0.734982	Mean dependent var	2982.390
Adjusted R-squared	0.733670	S.D. dependent var	1226.132
S.E. of regression	632.7713	Akaike info criterion	15.74785
Sum squared resid	80880704	Schwarz criterion	15.78038
Log likelihood	-1604.281	Hannan-Quinn criter.	15.76101
F-statistic	560.2136	Durbin-Watson stat	0.504155
Prob(F-statistic)	0.000000		

T-stats of Beta is greater than 2 which means regression coefficients are statistically significant.

R-squared is nearly close to 1, which means that model is good fitted.

II) ESTIMATING EQUATIONS:

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

```
Estimation Command:
==========================
LS M C X

Estimation Equation:
==========================
M = C(1) + C(2)*X

Substituted Coefficients:
==========================
M = -814.275648647 + 2.39746877214*X
```

II) CHECKING AUTOCORRELATION:

Since DW-Stat is less than 2 hence it means that there is Autocorrelation in the model.

III) REMOVING AUTOCORRELATION (APPLYING LAG):

Equation: UNTITLED Workfile: UNTITLED::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

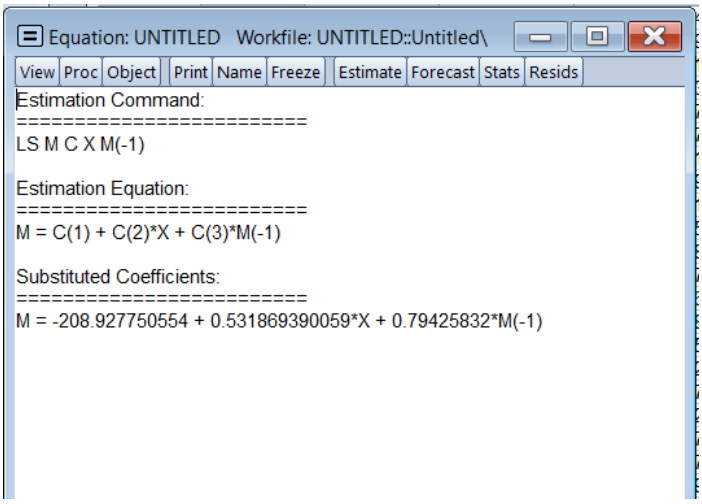
Dependent Variable: M
Method: Least Squares
Date: 07/08/19 Time: 22:29
Sample (adjusted): 2001M08 2018M06
Included observations: 203 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-208.9278	98.41305	-2.122968	0.0350
X	0.531869	0.105906	5.022080	0.0000
M(-1)	0.794258	0.038140	20.82457	0.0000

R-squared	0.915498	Mean dependent var	2993.182
Adjusted R-squared	0.914653	S.D. dependent var	1219.411
S.E. of regression	356.2406	Akaike info criterion	14.60376
Sum squared resid	25381472	Schwarz criterion	14.65272
Log likelihood	-1479.281	Hannan-Quinn criter.	14.62357
F-statistic	1083.410	Durbin-Watson stat	2.587735
Prob(F-statistic)	0.000000		

Since the DW-stat is now greater than 2 which means series has no Autocorrelation.

IV) ESTIMATING LAGGED EQUATIONS:



V) CHECKING HETEROSCADESTICITY:

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Heteroskedasticity Test: White

F-statistic	3.987719	Prob. F(5,197)	0.0018
Obs*R-squared	18.65752	Prob. Chi-Square(5)	0.0022
Scaled explained SS	24.13885	Prob. Chi-Square(5)	0.0002

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/08/19 Time: 22:34
Sample: 2001M08 2018M06
Included observations: 203

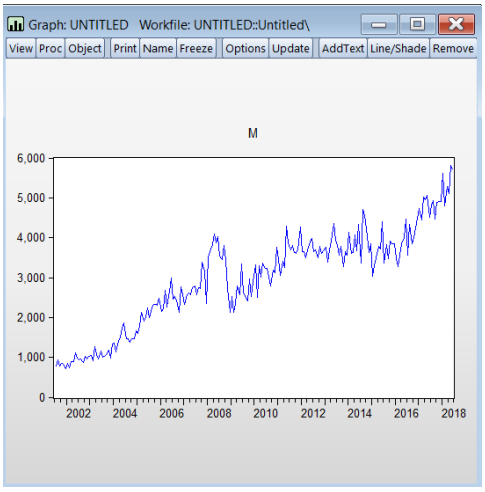
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15187.13	199546.4	0.076108	0.9394
X^2	-0.004508	0.162622	-0.027719	0.9779
X*M(-1)	0.037445	0.106448	0.351765	0.7254
X	-132.5795	393.7118	-0.336743	0.7367
M(-1)^2	-0.017372	0.022329	-0.777979	0.4375
M(-1)	107.1049	121.4119	0.882162	0.3788

R-squared	0.091909	Mean dependent var	125031.9
Adjusted R-squared	0.068861	S.D. dependent var	204647.0
S.E. of regression	197475.3	Akaike info criterion	27.25373
Sum squared resid	7.68E+12	Schwarz criterion	27.35165
Log likelihood	-2760.253	Hannan-Quinn criter.	27.29334
F-statistic	3.987719	Durbin-Watson stat	1.730538
Prob(F-statistic)	0.001813		

Since the P-value of OBS* R-squared is less than 0.05 hence there is no heteroscedasticity. Hence reject the null hypothesis that there exists heteroscedasticity.

V) CHECKING STATIONARITY:

i) Graphical method:



It shows trend which means the series is non- stationary.

ii) Augmented Dicky Fuller Test:

Command | Capture

View | Proc | Object | Properties | Print | Name | Freeze | Push | Sample | Genr | Sheet | Graph | Stats | Ident

Null Hypothesis: LM has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.790613	0.3844
Test critical values:	1% level	-3.462901	
	5% level	-2.875752	
	10% level	-2.574423	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM)
Method: Least Squares
Date: 07/08/19 Time: 22:47
Sample (adjusted): 2001M10 2018M06
Included observations: 201 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM(-1)	-0.027620	0.015425	-1.790613	0.0749
D(LM(-1))	-0.540643	0.069819	-7.743512	0.0000
D(LM(-2))	-0.166883	0.069336	-2.406874	0.0170
C	0.234414	0.121941	1.922347	0.0560

R-squared	0.260124	Mean dependent var	0.009925
Adjusted R-squared	0.248857	S.D. dependent var	0.127922
S.E. of regression	0.110868	Akaike info criterion	-1.541244
Sum squared resid	2.421489	Schwarz criterion	-1.475507
Log likelihood	158.8951	Hannan-Quinn criter.	-1.514644
F-statistic	23.08695	Durbin-Watson stat	1.995843
Prob(F-statistic)	0.000000		

Since the probability of Dicky Fuler Statistics is greater than 0.05 hence the series is non-stationary.

iii) Correlogram:

View | Proc | Object | Properties | Print | Name | Freeze | Push | Sample | Genr | Sheet | Graph | Stats | Ident

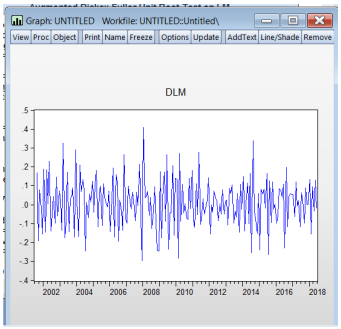
Date: 07/08/19 Time: 22:45
Sample: 2001M07 2018M06
Included observations: 204

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.951	0.951	187.32	0.000
		2	0.934	0.310	368.94	0.000
		3	0.909	0.010	541.69	0.000
		4	0.882	-0.058	705.09	0.000
		5	0.865	0.085	863.19	0.000
		6	0.839	-0.049	1012.5	0.000
		7	0.819	0.009	1155.7	0.000
		8	0.791	-0.078	1289.9	0.000
		9	0.775	0.082	1419.2	0.000
		10	0.751	-0.041	1541.2	0.000
		11	0.738	0.096	1659.8	0.000
		12	0.727	0.069	1775.6	0.000
		13	0.696	-0.192	1882.3	0.000
		14	0.685	0.050	1986.0	0.000
		15	0.658	-0.056	2082.2	0.000
		16	0.636	-0.047	2172.5	0.000
		17	0.622	0.079	2259.5	0.000
		18	0.596	-0.069	2339.7	0.000
		19	0.583	0.060	2417.0	0.000
		20	0.561	-0.028	2488.8	0.000

Since Correlogram shows the systematic decay in the Auto Correlation Function. Hence the series is non-stationary

V) MAKING SERIES STATIONARY (APPLYING DIFFERENCE):

I) Checking Graphically:



Ii) Checking Augmented Dicky Fullar Stats:

View Proc Object Properties Print Name Freeze Push Sample Genr Sheet Graph Sta

Augmented Dickey-Fuller Unit Root Test on D(DLM)

Null Hypothesis: D(DLM) has a unit root
Exogenous: Constant
Lag Length: 10 (Automatic - based on SIC, maxlag=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.929991	0.0000
Test critical values:	1% level	-3.464643	
	5% level	-2.876515	
	10% level	-2.574831	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLM,2)
Method: Least Squares
Date: 07/08/19 Time: 23:59
Sample (adjusted): 2002M08 2018M06
Included observations: 191 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DLM(-1))	-11.26075	1.261004	-8.929991	0.0000
D(DLM(-1),2)	8.879767	1.231012	7.213389	0.0000
D(DLM(-2),2)	7.520214	1.160979	6.477478	0.0000

Iii) Checking Correlogram:

View Proc Object Properties Print Name Freeze Push Sample Genr Sheet Graph Sta

Correlogram of D(DLM)

Date: 07/08/19 Time: 23:58
Sample: 2001M07 2018M06
Included observations: 202

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.690	-0.690	97.469	0.000
		2	0.206	-0.513	106.25	0.000
		3	0.057	-0.211	106.92	0.000
		4	-0.149	-0.211	111.53	0.000
		5	0.104	-0.214	113.78	0.000
		6	-0.059	-0.271	114.51	0.000
		7	0.101	-0.045	116.65	0.000
		8	-0.163	-0.171	122.29	0.000
		9	0.187	-0.047	129.73	0.000
		10	-0.110	0.053	132.33	0.000
		11	-0.119	-0.323	135.40	0.000
		12	0.361	0.044	163.62	0.000
		13	-0.412	-0.055	200.70	0.000
		14	0.274	-0.067	217.11	0.000
		15	-0.048	0.078	217.62	0.000
		16	-0.158	-0.149	223.13	0.000
		17	0.262	0.107	238.39	0.000
		18	-0.250	-0.002	252.33	0.000
		19	0.159	-0.072	258.00	0.000
		20	-0.077	0.017	259.36	0.000

Since all above statistics show that now series has become stationary and is good for forcasting.

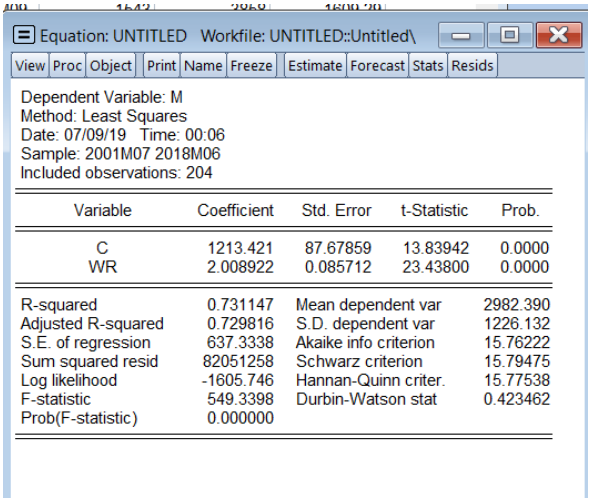
DEPENDENT SERIES:

M (Imports)

INDEPENDENT SERIES:

WR (Worker Remittances)

I) ESTIMATING REGRESSION:



Equation: UNTITLED Workfile: UNTITLED::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

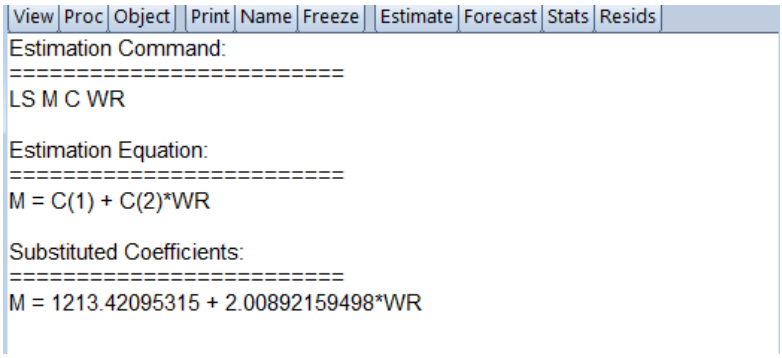
Dependent Variable: M
Method: Least Squares
Date: 07/09/19 Time: 00:06
Sample: 2001M07 2018M06
Included observations: 204

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1213.421	87.67859	13.83942	0.0000
WR	2.008922	0.085712	23.43800	0.0000

R-squared	0.731147	Mean dependent var	2982.390
Adjusted R-squared	0.729816	S.D. dependent var	1226.132
S.E. of regression	637.3338	Akaike info criterion	15.76222
Sum squared resid	82051258	Schwarz criterion	15.79475
Log likelihood	-1605.746	Hannan-Quinn criter.	15.77538
F-statistic	549.3398	Durbin-Watson stat	0.423462
Prob(F-statistic)	0.000000		

T-stats of Beta is greater than 2 which means regression coefficients are statistically significant. R-squared is not nearly close to 1, which means that model is not good fitted.

II) ESTIMATING EQUATIONS:



View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Estimation Command:
==========
LS M C WR

Estimation Equation:
==========
M = C(1) + C(2)*WR

Substituted Coefficients:
==========
M = 1213.42095315 + 2.00892159498*WR

II) CHECKING AUTOCORRELATION:

Since DW-Stat is less than 2 hence it means that there is Autocorrelation in the model.

III) REMOVING AUTOCORRELATION (APPLYING LAG):

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: M
Method: Least Squares
Date: 07/09/19 Time: 00:10
Sample (adjusted): 2001M08 2018M06
Included observations: 203 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	235.0806	68.86374	3.413706	0.0008
WR	0.417919	0.090249	4.630732	0.0000
M(-1)	0.804458	0.038662	20.80719	0.0000

R-squared	0.914057	Mean dependent var	2993.182
Adjusted R-squared	0.913197	S.D. dependent var	1219.411
S.E. of regression	359.2663	Akaike info criterion	14.62067
Sum squared resid	25814455	Schwarz criterion	14.66964
Log likelihood	-1480.998	Hannan-Quinn criter.	14.64048
F-statistic	1063.561	Durbin-Watson stat	2.650337
Prob(F-statistic)	0.000000		

Since the DW-stat is now greater than 2 which means series has no Autocorrelation.

IV) ESTIMATING LAGGED EQUATIONS:

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Estimation Command:
==========
LS M C WR M(-1)

Estimation Equation:
==========
M = C(1) + C(2)*WR + C(3)*M(-1)

Substituted Coefficients:
==========
M = 235.08059709 + 0.417919030427*WR + 0.80445797686*M(-1)

V) CHECKING HETEROSCADESTICITY:

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Heteroskedasticity Test: White

F-statistic	2.466155	Prob. F(5,197)	0.0341
Obs*R-squared	11.95785	Prob. Chi-Square(5)	0.0354
Scaled explained SS	17.98488	Prob. Chi-Square(5)	0.0030

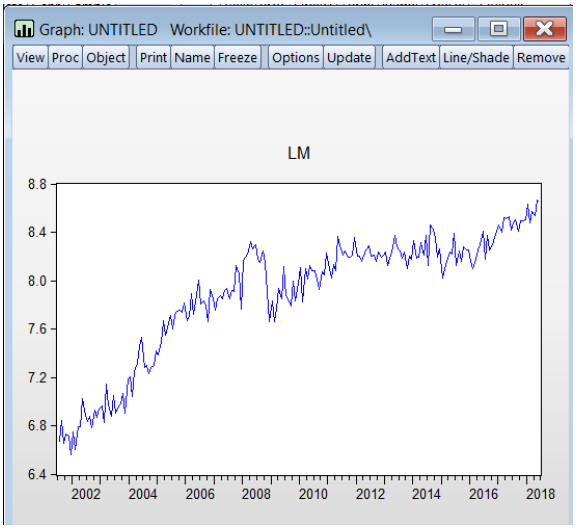
Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/09/19 Time: 00:13
Sample: 2001M08 2018M06
Included observations: 203

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-69415.01	77670.26	-0.893714	0.3726
WR^2	-0.214435	0.141331	-1.517251	0.1308
WR*M(-1)	0.173813	0.120916	1.437472	0.1522
WR	-102.1308	299.8557	-0.340600	0.7338
M(-1)^2	-0.046675	0.030607	-1.524973	0.1289
M(-1)	149.4860	102.5623	1.457514	0.1466

Since the P-value of OBS* R-squared is less than 0.05 hence there is no heteroscedasticity. Hence reject the null hypothesis that there exists heteroscedasticity.

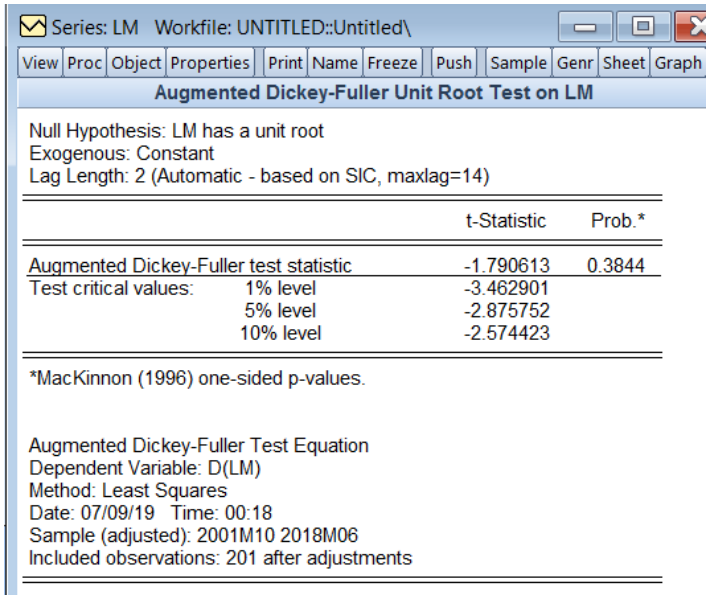
V) CHECKING STATIONARITY:

i) Graphical method:



It shows trend which means the series is non- stationary.

ii) Augmented Dicky Fuller Test:



Series: LM Workfile: UNTITLED::Untitled\

View | Proc | Object | Properties | Print | Name | Freeze | Push | Sample | Genr | Sheet | Graph

Augmented Dickey-Fuller Unit Root Test on LM

Null Hypothesis: LM has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=14)

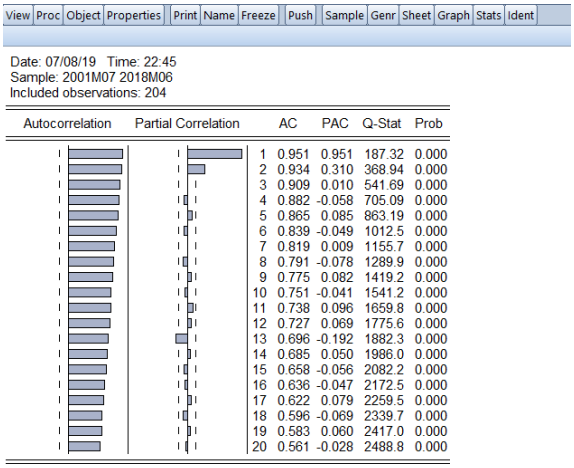
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.790613	0.3844
Test critical values:	1% level	-3.462901	
	5% level	-2.875752	
	10% level	-2.574423	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LM)
Method: Least Squares
Date: 07/09/19 Time: 00:18
Sample (adjusted): 2001M10 2018M06
Included observations: 201 after adjustments

Since the probability of Dicky Fuler Statistics is greater than 0.05 hence the series is non-stationary.

iii) Correlogram:



View | Proc | Object | Properties | Print | Name | Freeze | Push | Sample | Genr | Sheet | Graph | Stats | Ident

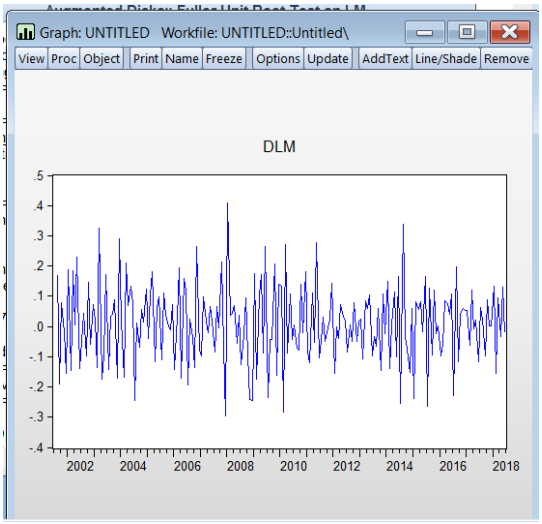
Date: 07/08/19 Time: 22:45
Sample: 2001M07 2018M06
Included observations: 204

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.951	0.951	187.32	0.000
		2	0.934	0.310	368.94	0.000
		3	0.909	0.010	541.69	0.000
		4	0.882	-0.058	705.09	0.000
		5	0.865	0.085	863.19	0.000
		6	0.839	-0.049	1012.5	0.000
		7	0.819	0.009	1155.7	0.000
		8	0.791	-0.078	1289.9	0.000
		9	0.775	0.082	1419.2	0.000
		10	0.751	-0.041	1541.2	0.000
		11	0.738	0.096	1659.8	0.000
		12	0.727	0.069	1775.6	0.000
		13	0.696	-0.192	1882.3	0.000
		14	0.685	0.050	1986.0	0.000
		15	0.658	-0.056	2082.2	0.000
		16	0.636	-0.047	2172.5	0.000
		17	0.622	0.079	2259.5	0.000
		18	0.596	-0.069	2339.7	0.000
		19	0.583	0.060	2417.0	0.000
		20	0.561	-0.028	2488.8	0.000

Since Correlogram shows the systematic decay in the Auto Correlation Function. Hence the series is non-stationary

V) MAKING SERIES STATIONARY (APPLYING DIFFERENCE):

I) Checking Graphically:



Ii) Checking Augmented Dicky Fullar Stats:

View Proc Object Properties Print Name Freeze Push Sample Genr Sheet Graph Sta

Augmented Dickey-Fuller Unit Root Test on D(DLM)

Null Hypothesis: D(DLM) has a unit root
Exogenous: Constant
Lag Length: 10 (Automatic - based on SIC, maxlag=14)

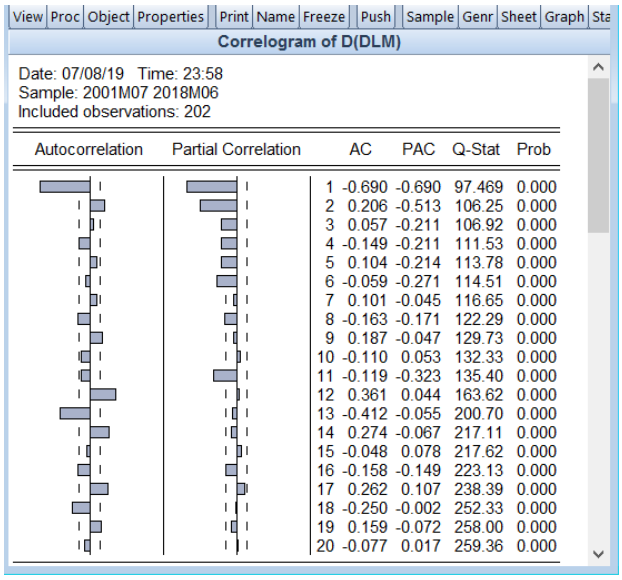
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.929991	0.0000
Test critical values:	1% level	-3.464643	
	5% level	-2.876515	
	10% level	-2.574831	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLM,2)
Method: Least Squares
Date: 07/08/19 Time: 23:59
Sample (adjusted): 2002M08 2018M06
Included observations: 191 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DLM(-1))	-11.26075	1.261004	-8.929991	0.0000
D(DLM(-1),2)	8.879767	1.231012	7.213389	0.0000
D(DLM(-2),2)	7.520214	1.160979	6.477478	0.0000

Iii) Checking Correlogram:



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.690	-0.690	97.469	0.000
		2	0.206	-0.513	106.25	0.000
		3	0.057	-0.211	106.92	0.000
		4	-0.149	-0.211	111.53	0.000
		5	0.104	-0.214	113.78	0.000
		6	-0.059	-0.271	114.51	0.000
		7	0.101	-0.045	116.65	0.000
		8	-0.163	-0.171	122.29	0.000
		9	0.187	-0.047	129.73	0.000
		10	-0.110	0.053	132.33	0.000
		11	-0.119	-0.323	135.40	0.000
		12	0.361	0.044	163.62	0.000
		13	-0.412	-0.055	200.70	0.000
		14	0.274	-0.067	217.11	0.000
		15	-0.048	0.078	217.62	0.000
		16	-0.158	-0.149	223.13	0.000
		17	0.262	0.107	238.39	0.000
		18	-0.250	-0.002	252.33	0.000
		19	0.159	-0.072	258.00	0.000
		20	-0.077	0.017	259.36	0.000

Since all above statistics show that now series has become stationary and is good for forcasting.