PROJECT

ECONOMETRICS ANALYSIS LAB 1

PROBLEM STATEMENT:

The problem statement is to estimate the model of GDP at market prices

on the factors of Exports of Goods and Services and Imports of Goods and Services at constant price.

And to Statistical tests on this model to identify any problem of autocorrelation and resolve it.

MODEL SPECIFICATION:

The model Specification of this model is GDP at market prices as dependent variable and Exports of Goods and Services and Imports of Goods and Service independent variables.

The model is as follows:

$$y_i=\beta_0+ \beta_1 x_{1i}+ \beta_2 x_{2i}+ u_i$$

where: y_i = GDP at market prices ;

x_{1i}= Exports of Goods and Services;

x_{2i} = Imports of Goods and Services;

SOURCE(S) OF DATA:

The data which I used to estimate the above model is obtained from the website of Reserve Bank of India which include data from the year 1960-61to 2014-15, Impact of Exports of Goods and Services and Imports of Goods and Services on GDP at market prices.

MEASUREMENT OF VARIABLES:

The measurement of all the variables in the model is in current Indian rupees (INR billion).

ESTIMATION PROCESS FOLLOWED:

- Get the data from RBI website of
- Regress the dependent variable data with independent variable data, in our case we are regressing GDP at market prices (Dependent variable) on Exports of Goods and Services and Imports of Goods and Services (Independent variables).
- And now check for the p value of each of the independent variables if the p-value of independent variable is greater than 0.05 than we are going to exclude that variable from our model as having p-value greater than 0.05 indicates that that variable doesn't even matter in predicting the outcome. In our case every independent variable's p-value is less than 0.05, so we are not going to exclude any variable from our model.
- And check for the autocorrelation in the model using following tests
    - Run Test
    - Durbin-Watson Test
    - Breusch-Godfrey Test

- If any autocorrelation found in our model then first check whether it is pure autocorrelation or due to model misspecification and if it found it is not pure then use first difference method, Generalized Difference Method and Cochrane-Orcutt method to resolve it.

RESULTS AND DISCUSSIONS

The results of the regression model is as follows:

The regression analysis equation for estimation is:

$$y_i = 8009.108 + 4.9764x_{1i} - 1.0057x_{2i} + u_i$$

where: y_i = GDP at market prices ;

x_{1i}= Exports of Goods and Services;

x_{2i} = Imports of Goods and Services;

```
. regress gdp import exports

      Source |       SS           df       MS      Number of obs   =        55
-------------+----------------------------------   F(2, 52)        =    518.55
       Model |  1.2704e+10         2  6.3522e+09   Prob > F        =    0.0000
    Residual |   637000156        52    12250003   R-squared       =    0.9523
-------------+----------------------------------   Adj R-squared   =    0.9504
       Total |  1.3341e+10        54   247063783   Root MSE        =      3500

------------------------------------------------------------------------------
         gdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      import |  -1.005757     1.1919    -0.84   0.403    -3.397478    1.385965
     exports |   4.976464    1.53704     3.24   0.002     1.892167     8.06076
       _cons |   8009.108   584.0362    13.71   0.000     6837.154    9181.063
------------------------------------------------------------------------------
```

The R-Squared value is 0.952, indicating that the variation in GDP can explain 95.2% of the variation in the independent variables of the model.

Run Test:

N1	31
N2	24
N	55
R	7
ER	28.05455
VAR	13.05359
SD	3.612975
ER-1.96*SDR	26.40157
ER+1.96*SDR	35.13598

```
. runtest resi,mean
 N(resi <= -.000013594193892) = 31
 N(resi >  -.000013594193892) = 24
           obs = 55
       N(runs) = 7
            z  = -5.83
      Prob>|z| = 0

. runtest resi,threshold(0)
 N(resi <= 0) = 31
 N(resi >  0) = 24
           obs = 55
       N(runs) = 7
            z  = -5.83
      Prob>|z| = 0
```

So, here we see that the number of RUN that is 7 is less than ER -1.96*SDE.

Hence, we conclude that there is positive autocorrelation.

Durbin-Watson Test:

```
. dwstat

Durbin-Watson d-statistic(  3,    55) =  .1740993
```

The table value of Durbin-Watson (3,55) is

dL=1.490 and dU=1.641

hence, D-W calculated is less than lower limit of D-W table so we can say that there is positive autocorrelation in the model.

Breusch-Godfrey Test:

Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	46.177	1	0.0000

H0: no serial correlation

Here the Prob >chi2 value is less than 0.05 so can reject the null hypothesis which is there is no autocorrelation.

Hence, there is autocorrelation in our model.

Resolving the Problem of Autocorrelation:

- First difference method

```
. gen dgdp=d.gdp
(1 missing value generated)

. gen dexports=d.exports
(1 missing value generated)

. gen dimport=d.import
(1 missing value generated)

. regress dgdp dexports dimport
```

Source	SS	df	MS			
				Number of obs	=	54
				F(2, 51)	=	266.65
Model	1.0116e+09	2	505778462	Prob > F	=	0.0000
Residual	96734500.8	51	1896754.92	R-squared	=	0.9127
				Adj R-squared	=	0.9093
Total	1.1083e+09	53	20911159	Root MSE	=	1377.2

dgdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dexports	3.281115	.6331431	5.18	0.000	2.010027	4.552203
dimport	.2489311	.5063566	0.49	0.625	-.7676221	1.265484
_cons	-27.93959	188.7361	-0.15	0.883	-406.8431	350.9639

Hence the new model is:

$$\Delta y_t = -27.939 + 3.281\Delta x_{1t} + 0.2489\Delta x_{2t} + \epsilon_t$$

Now check for autocorrelation in this model using Breusch-Godfrey Test.

```
. bgodfrey

Breusch-Godfrey LM test for autocorrelation
```

lags(p)	chi2	df	Prob > chi2
1	3.552	1	0.0595

```
                        H0: no serial correlation

.
```

Here the Prob >chi2 value is greater than 0.05 so can't reject the null hypothesis Ho: there is no autocorrelation.

Hence, there is no autocorrelation in the new modified model.

Cochrane-Orcutt method:

```
. prais gdp exports import,corc

Iteration 0:  rho = 0.0000
Iteration 1:  rho = 0.9306
Iteration 2:  rho = 0.9336
Iteration 3:  rho = 0.9337
Iteration 4:  rho = 0.9337
Iteration 5:  rho = 0.9337
Cochrane-Orcutt AR(1) regression -- iterated estimates

      Source |       SS           df       MS      Number of obs   =        54
-------------+----------------------------------   F(2, 51)        =    269.46
       Model |   993983347         2   496991674   Prob > F        =    0.0000
    Residual |  94065224.9        51  1844416.17   R-squared       =    0.9135
-------------+----------------------------------   Adj R-squared   =    0.9102
       Total |  1.0880e+09        53  20529218.3   Root MSE        =    1358.1

------------------------------------------------------------------------------
         gdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     exports |   3.264348   .6444101     5.07   0.000     1.970641    4.558056
      import |   .2368701   .5145043     0.46   0.647    -.7960404    1.269781
       _cons |    8188.02   2892.024     2.83   0.007     2382.039       13994
-------------+----------------------------------------------------------------
         rho |   .9337171
------------------------------------------------------------------------------
Durbin-Watson statistic (original)    0.174099
Durbin-Watson statistic (transformed) 2.244538
```

Concluding Remarks:

In conclusion, statistical tests for autocorrelation are important tools used in various fields of research to test for the presence of correlation in time series data. These tests help to identify the existence of autocorrelation, which is a common problem in time series analysis.

We found using that statistical tool that our model which was on the impact of export and import of goods and services on GDP at market price has severe positive autocorrelation.

And we can able to resolve this autocorrelation problem using first difference method and Cochrane-Orcutt method.