ARDL MODEL ESTIMATION

Dr. Tony Orji
Department of Economics
University of Nigeria, Nsukka
Email: anthony.orji@unn.edu.ng
Visit:www.successtonicsblog.com

INTRODUCTION

- The University is a place of learning, light and liberty……Ben Disreali
- Excellence is in the Student, not just in the University…. Ben Disreali
- You have what it takes to succeed, if only you can pay the price of diligence, determination and discipline!

INTRODUCTION

Types of Lag

- Autoregressive refers to lags in the dependent variable
- Distributed lag refers to lags of the explanatory variables
- Moving average refers to lags in the error term .

INTRODUCTION

- The autoregressive distributed lag (ARDL) model has used for decades to model the relationship between (economic) variables in a single-equation time-series setup.

INTRODUCTION

- The existence of a long-run / cointegrating relationship can be tested based on the Error Correction representation. A bounds testing procedure is available to draw conclusive inference without knowing whether the variables are integrated of order zero or one, $I(0)$ or $I(1)$, respectively (Pesaran, Shin, and Smith, 2001).

INTRODUCTION contd…

- Autoregressive Distributed Lag (ARDL) model is often used to estimate the impact of independent variable(s) on the dependent variable.

- The Autoregressive nature of the model implies that there is possibility of the lag value(s) of the dependent variable explaining their current value.

INTRODUCTION contd…

- An Autoregressive Distributed lag model or ARDL model refers to a model with lags of both the dependent and explanatory variables. An ARDL(1,1) model would have 1 lag on both variables:

$$y_t = \alpha_0 + \alpha_1 x_t + \alpha_2 x_{t-1} + \alpha_3 y_{t-1} + u_t$$

INTRODUCTION contd…

- This is different from distributed lag model where only the explanatory variables are in their lag forms.

- Theory has it that past values of variables such as Gross domestic product, Investment etc. have effect on their current values.

INTRODUCTION contd…

- So, estimating a model with any of these variables as dependent variable would require the use of an ARDL model.

INTRODUCTION contd…

- Without much stress, we can successfully conduct ARDL model estimation using e-views 9. Although other versions of e-views can perform this task but using e-views 9 saves time, stress and rigorous steps associated with others.

INTRODUCTION contd…

- Here, we shall be making use of e-views 9. The superiority of this version over others is that after evaluating several models, it has the possibility of selecting the best lags for the model.

Estimation of ARDL Model …

- Steps in estimating ARDL model using E-views 9 econometrics software.

- There are several steps involved in conducting autoregressive distributed lag model using E-views 9.

Estimation of ARDL Model …

Assumptions of ARDL approach

An ARDL is a least squares regression containing lags of the dependent and explanatory variables

1. First assumption we cant run ARDL if we have any variable I(2)
2. Lags must be appropriate
3. Error must be serially independent
4. Model must be dynamically stable
5. If variables are stationary at level we can apply ARDL
6. If variables are stationary at first difference we also can run ARDL
7. If variables are stationary at level and first difference here also we can run ARDL (mixture stationary).

Estimation of ARDL Model …

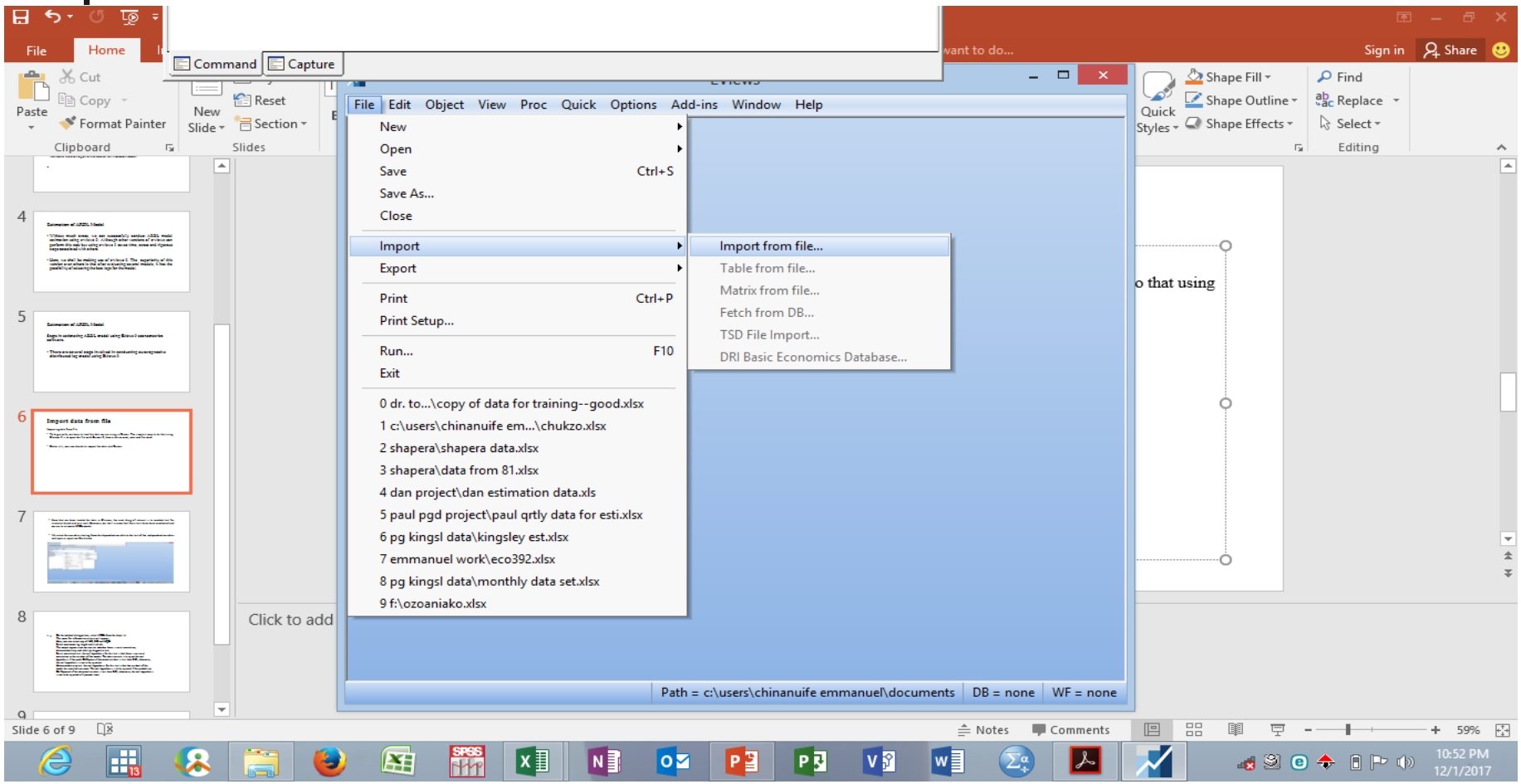
- Importing data from file

- To begin with, we have to load the data we are using in E-views. The simplest way to do that using E-views 9 is to open the file with E-views 9, then click on next, next and finished.

Estimation of ARDL Model …

- Better still, one can decide to import the data into E-views by going to file-import-import from file. This will take you to the destination where the saved data is. Click on it and watch as it uploads.

Estimation of ARDL Model …



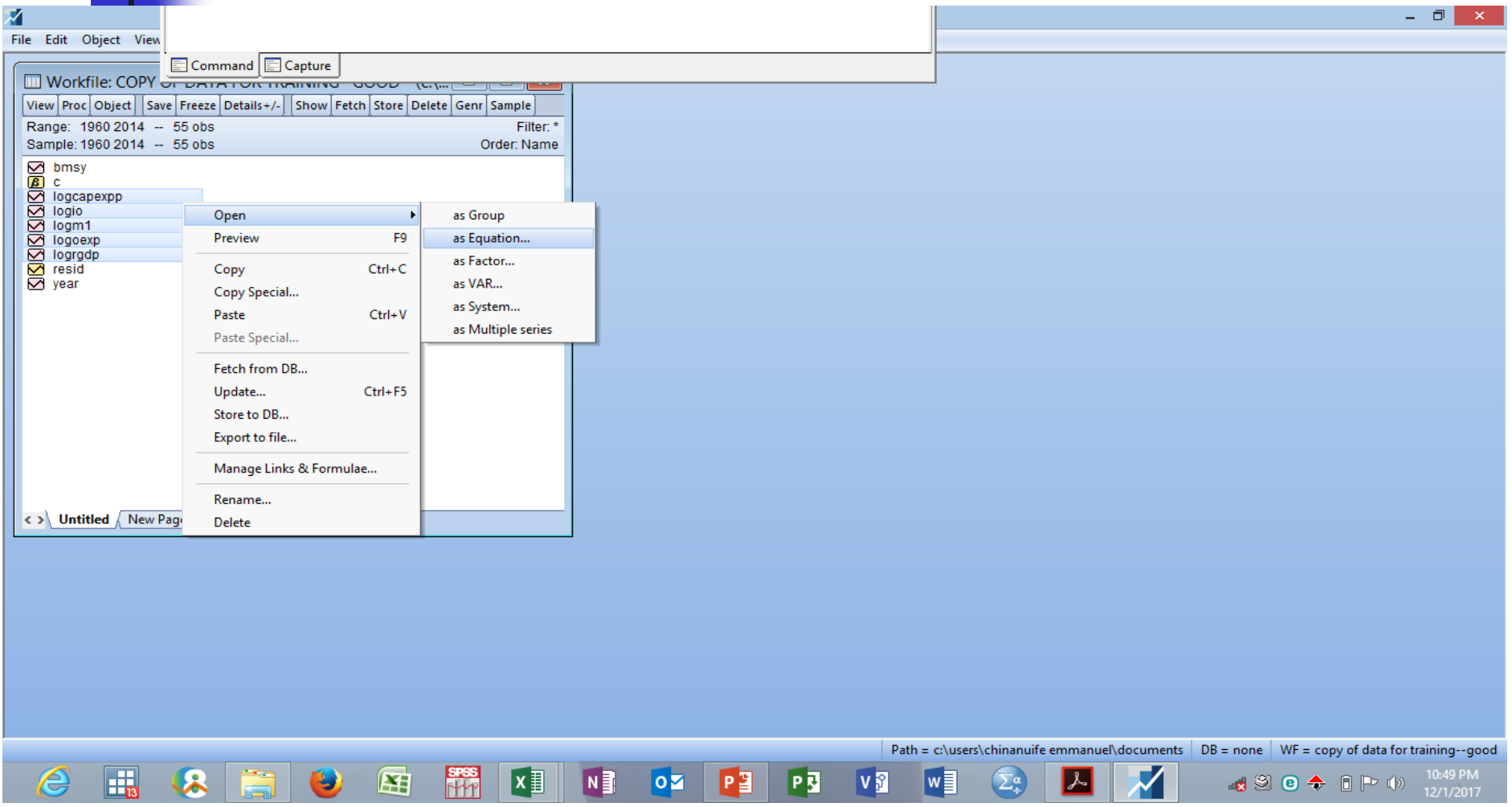
Estimation of ARDL Model …

- Now that we have loaded the data in E-views, the next thing of interest is to conduct test for structural break and unit root. However, we shall assume that these tests have been conducted and we are to estimate ARDL model.

Estimation of ARDL Model …

- We select the variables starting from the dependent variable to the last of the independent variables and open as equation. See below

Estimation of ARDL Model …



Estimation of ARDL Model …

- Click on the method dialogue box and select ARDL at the end. Also, within this window, we are to select the maximum lags for both the dependent and independent variables. For the purpose of our study, lets assume lags 6 for both the dependent and the independent variables.

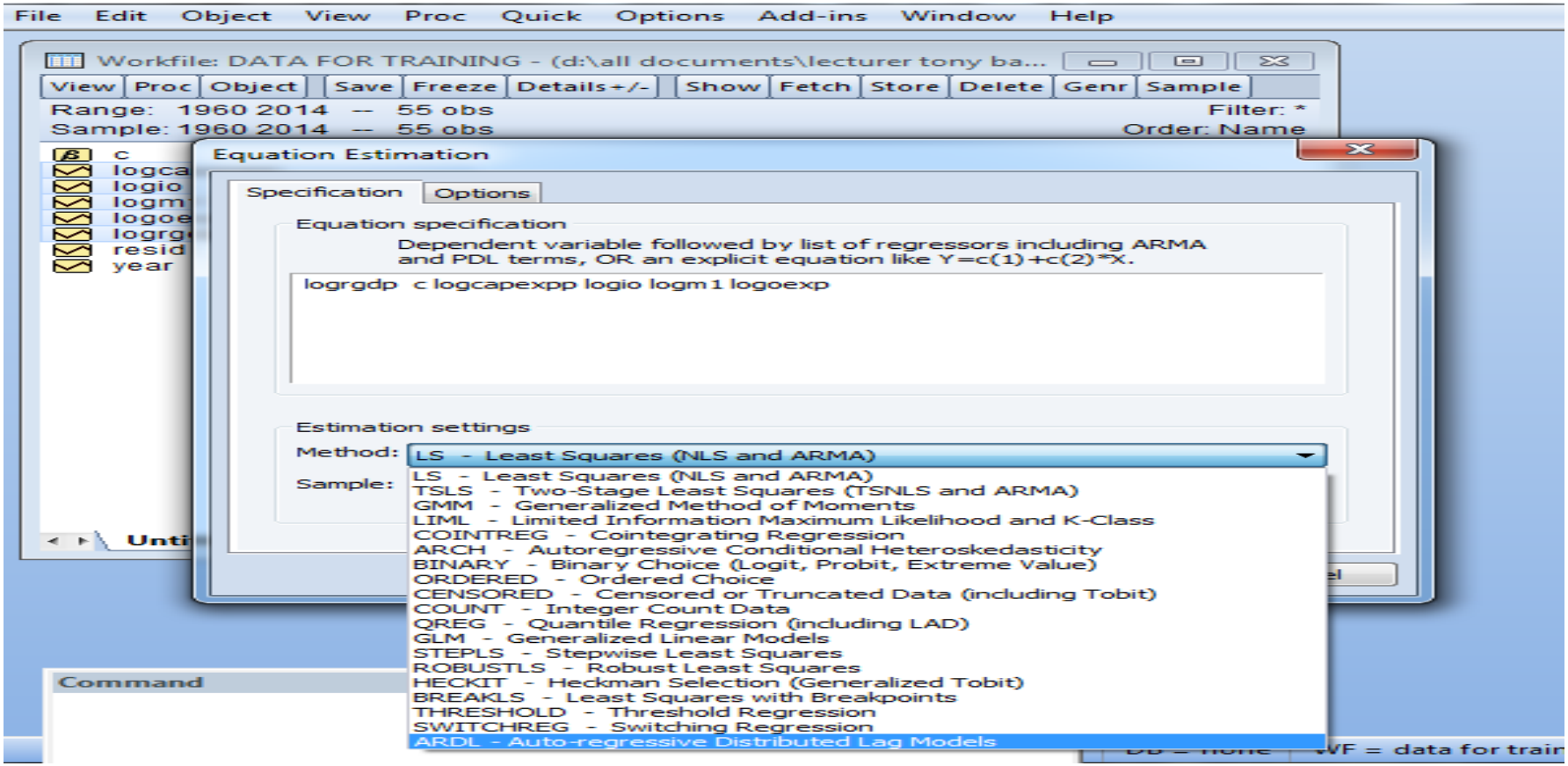
Estimation of ARDL Model …

- Note that it is logical to select higher lags and allow the system to make adjustment than to restrict the system on lesser lags.

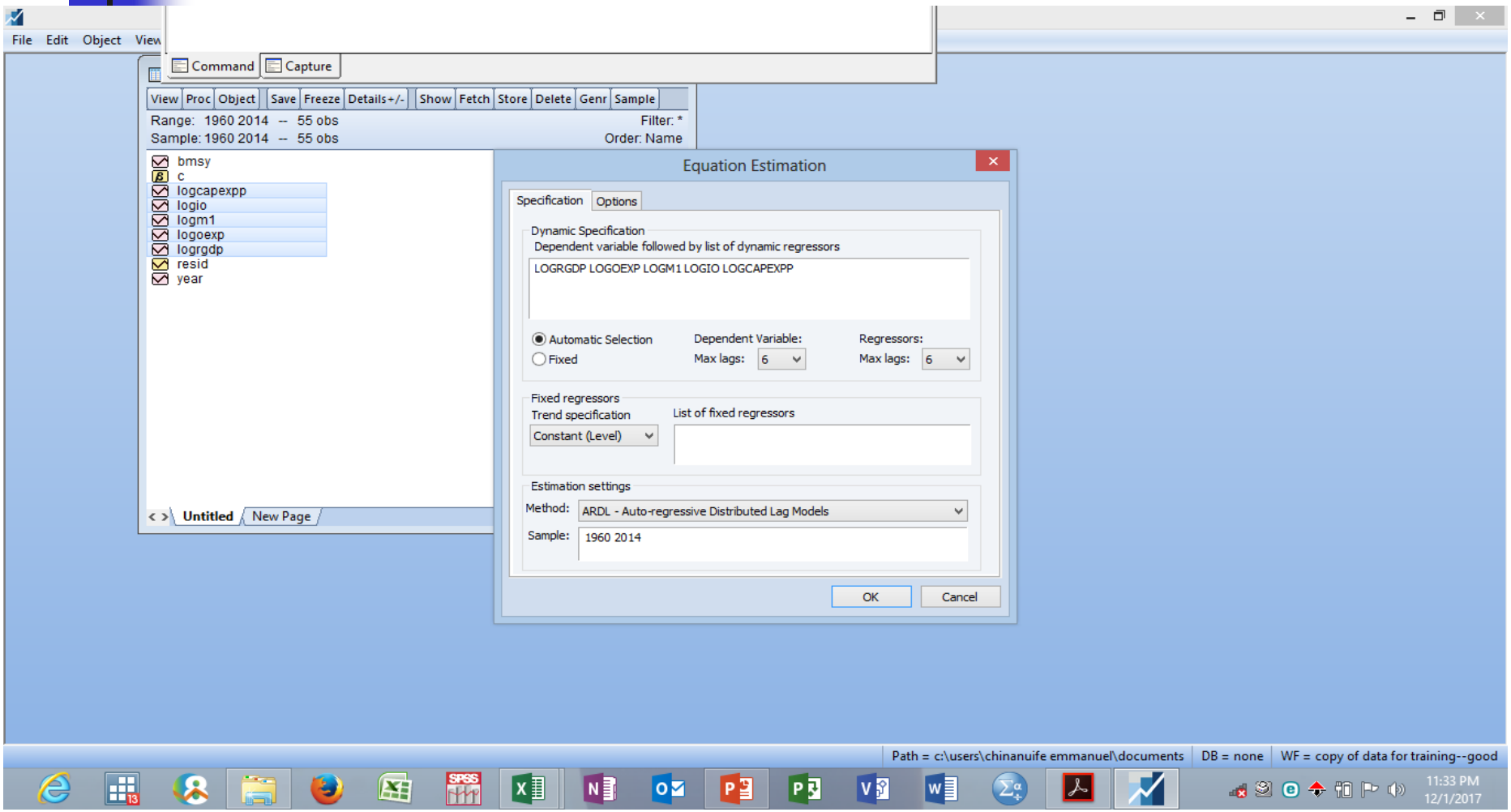
- Still on the same window, we select the information criterion of interest. Note that the choice of selecting information depends on the results each produces. Here, we are selecting AIC

Estimation of ARDL Model …

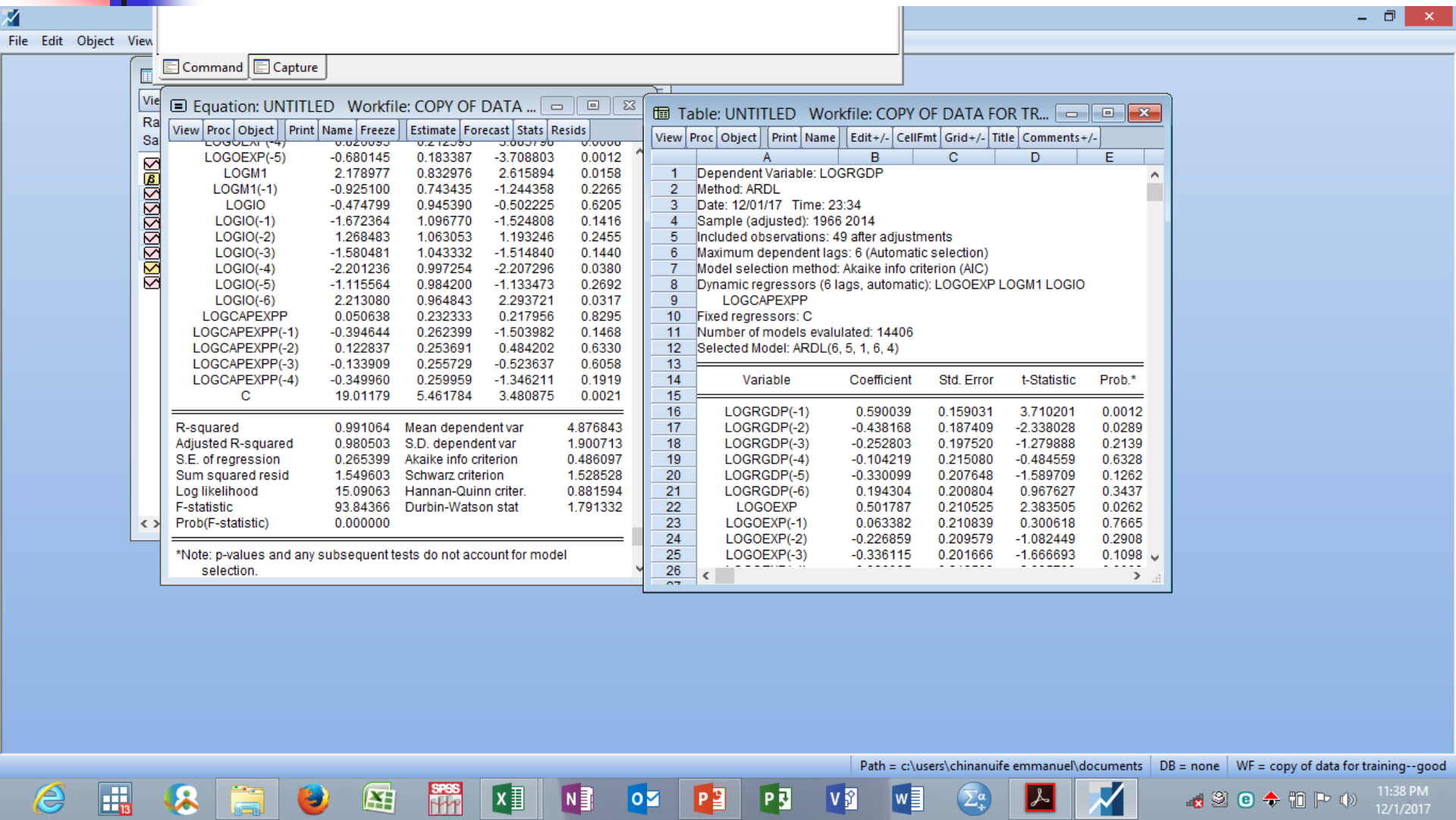
- To choose ARDL, open the equation estimation box and scroll down the "method menu. Different Methosds will appear and you will choose ARDL



Estimation of ARDL Model …



Regression Output



Cointegration Tests …

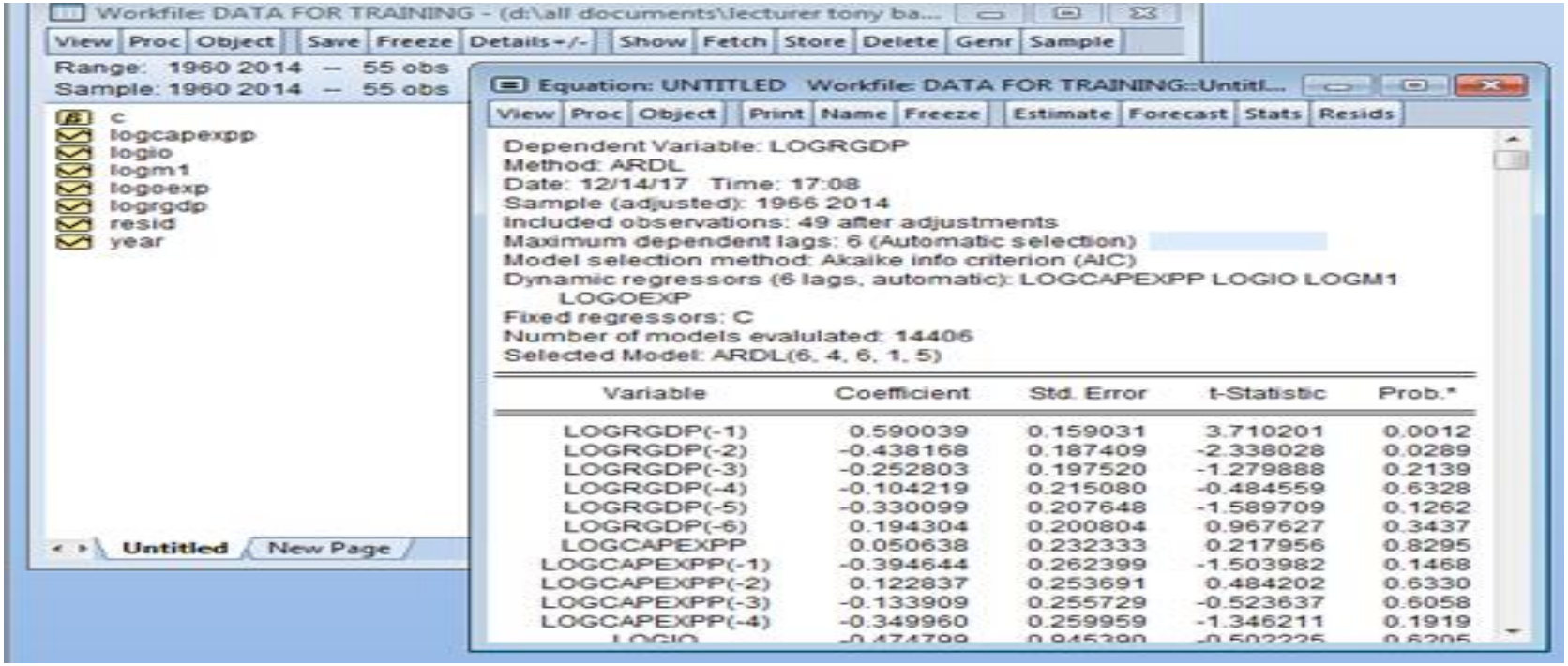
- It is also interesting to check for the existence of long run association among the variables in our model. This can be done using bound testing approach proposed by Pesaran and Shin (2001).

Cointegration Tests …

- It is common to see time series variables wondering about in the short run. However, there should be long run association or convergence among them. This is the idea behind cointegration analysis.

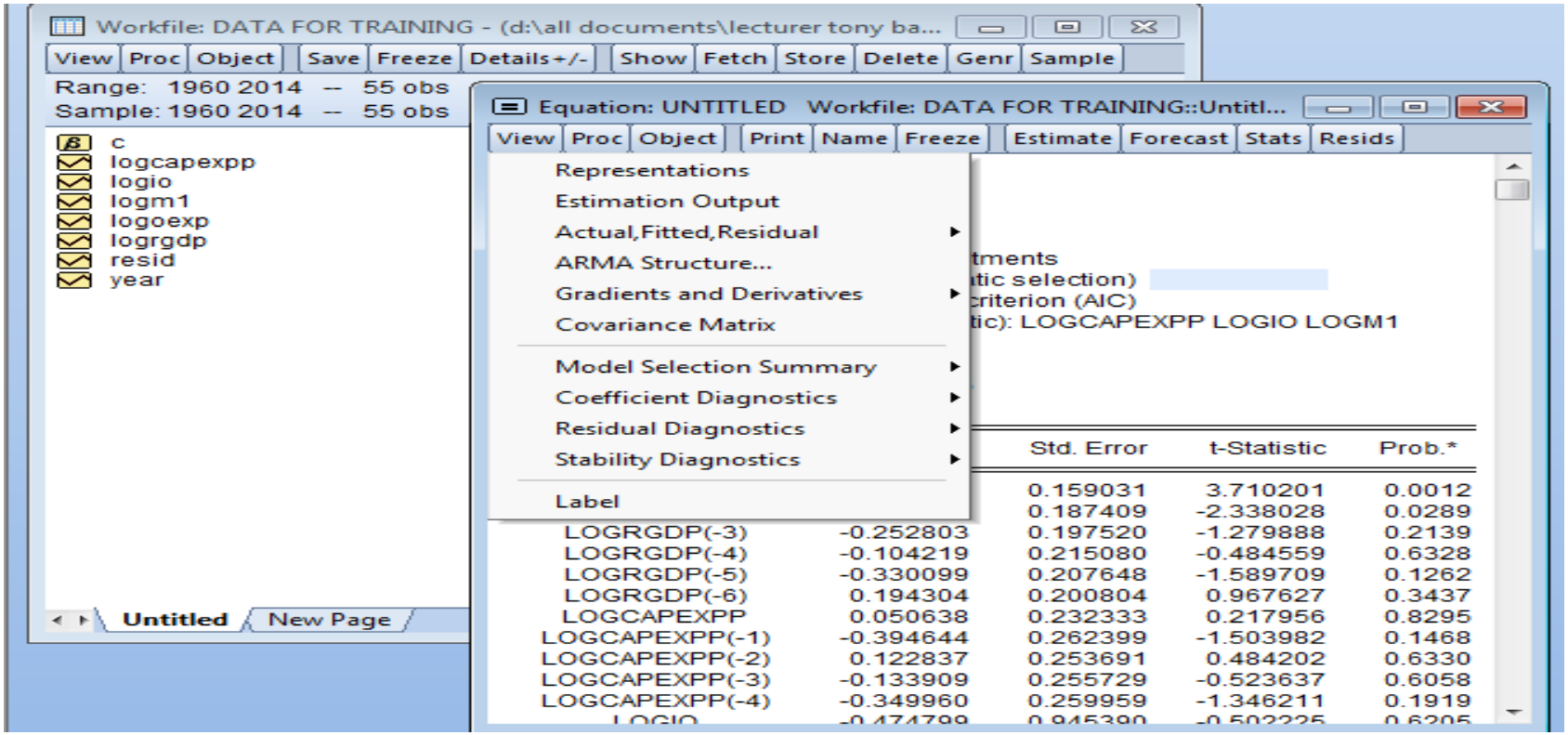
Cointegration Tests …

- To perform the cointegration analysis or bounds test procedure in eviews 9:
- After estimating the model as shown below:
-



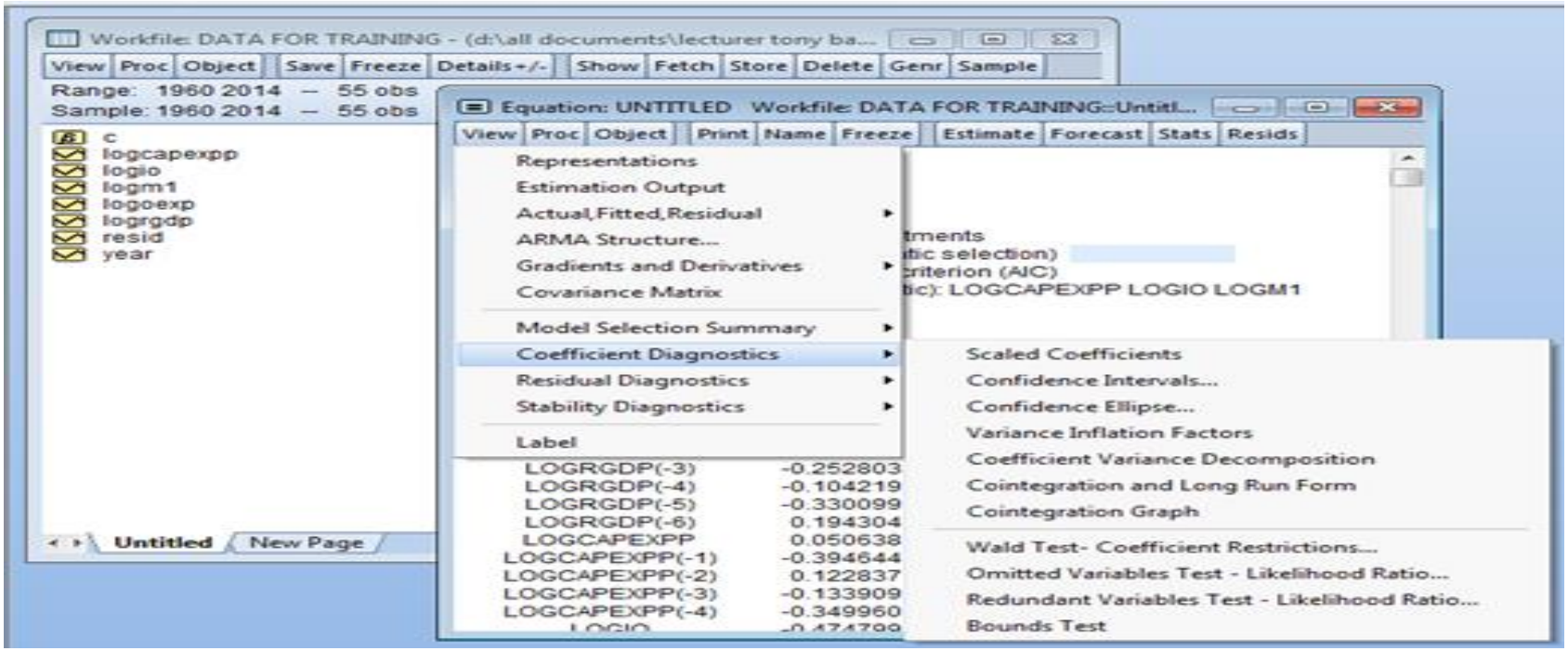
Cointegration Tests …

- Place your cursor on "view" and you will see a drop down



Cointegration Tests …

- Place your cursor on coefficient diagnostics, see the drop down and click on bounds test



Cointegration Tests …

- In conducting cointegration test, the null hypothesis is
- H0: there is no long run association among the variables in our model
- Decision Rule is to reject H0 if the F-statistic value from lies above the upper bound of Pesaran test statistic table.

Cointegration Tests …

- Note that Pesaran table has lower (I0) bound and upper (I1) bound. The critical values are arranged in descending order from 10%, 5%, 2.5% and 1%. So, you can see our bound test result below

Cointegration Tests …

Test Statistic	Value	K
F-statistic	4.507318	4
Critical Value Bounds		
Sig.	**I0 bound**	**I1 bound**
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49

Cointegration Tests …

- It could be observed from the bound test table that the value of F-statistic is greater than the upper bound of Pesaran test statistic at 5%. This implies that there is long run association or relationship or convergence.

Cointegration Tests …

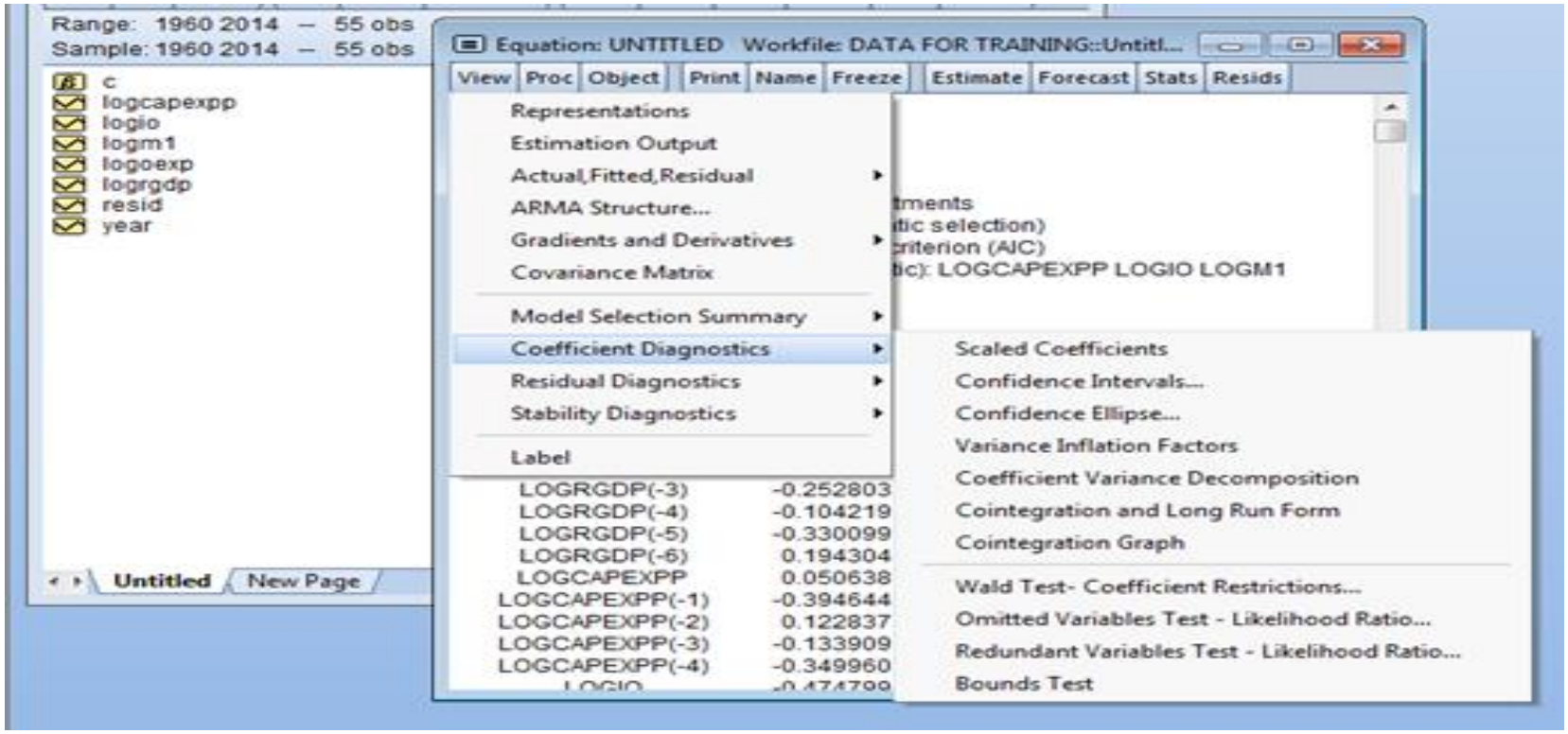
- With the establishment of long run association among the variables, we can now test for the cointegrating and long run form. Note that e-views 9 makes it simpler to test for the short run and long run at the same time using cointegration and long run form.

Cointegration Tests … …

- Other version of e-views requires that we estimate the long run, generate the error correction mechanism and then estimate the short run form. Where the coefficient of the error correction mechanism would adjust for short run dynamics in the system.

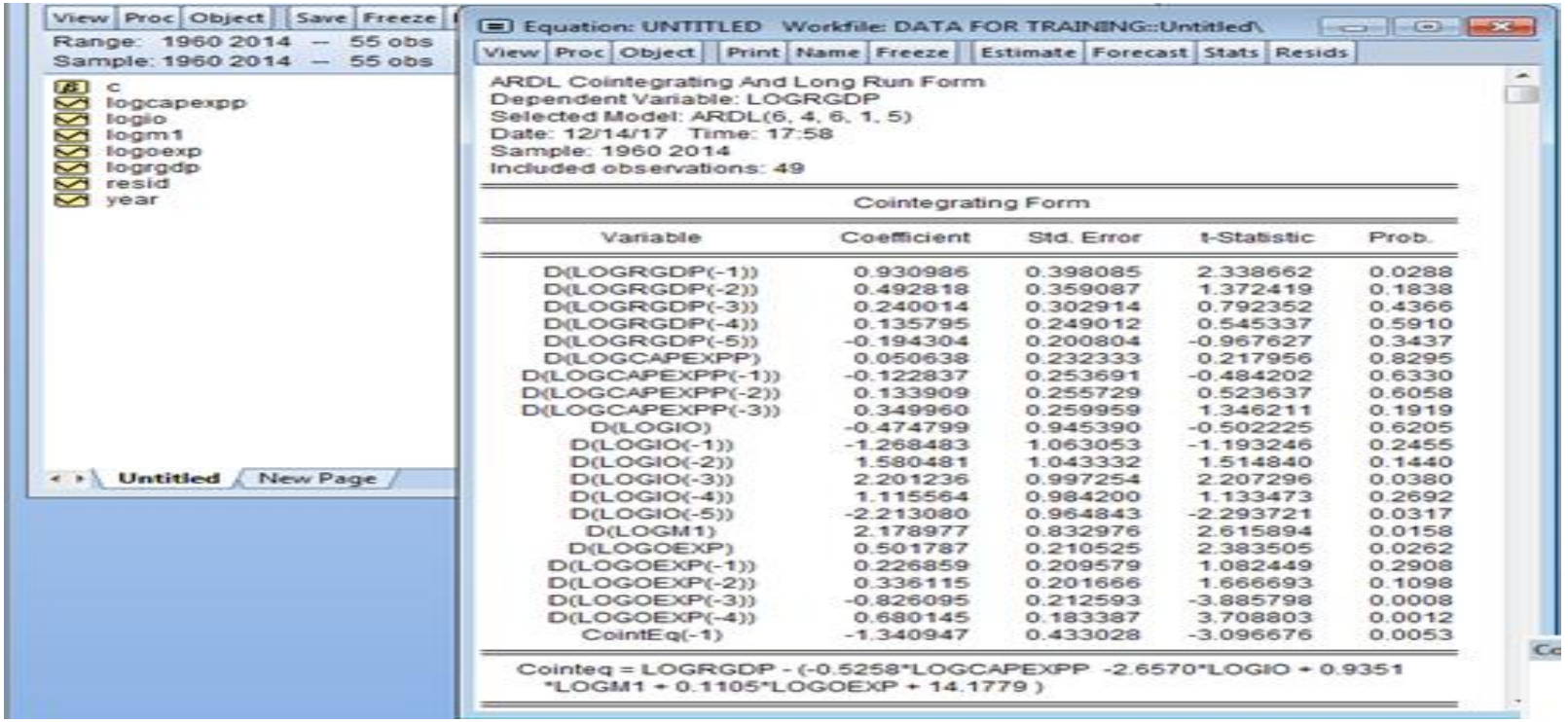
Cointegration Tests …

- Place your cursor on coefficient diagnostics, see the drop down and click on Cointegration and Long Run Form



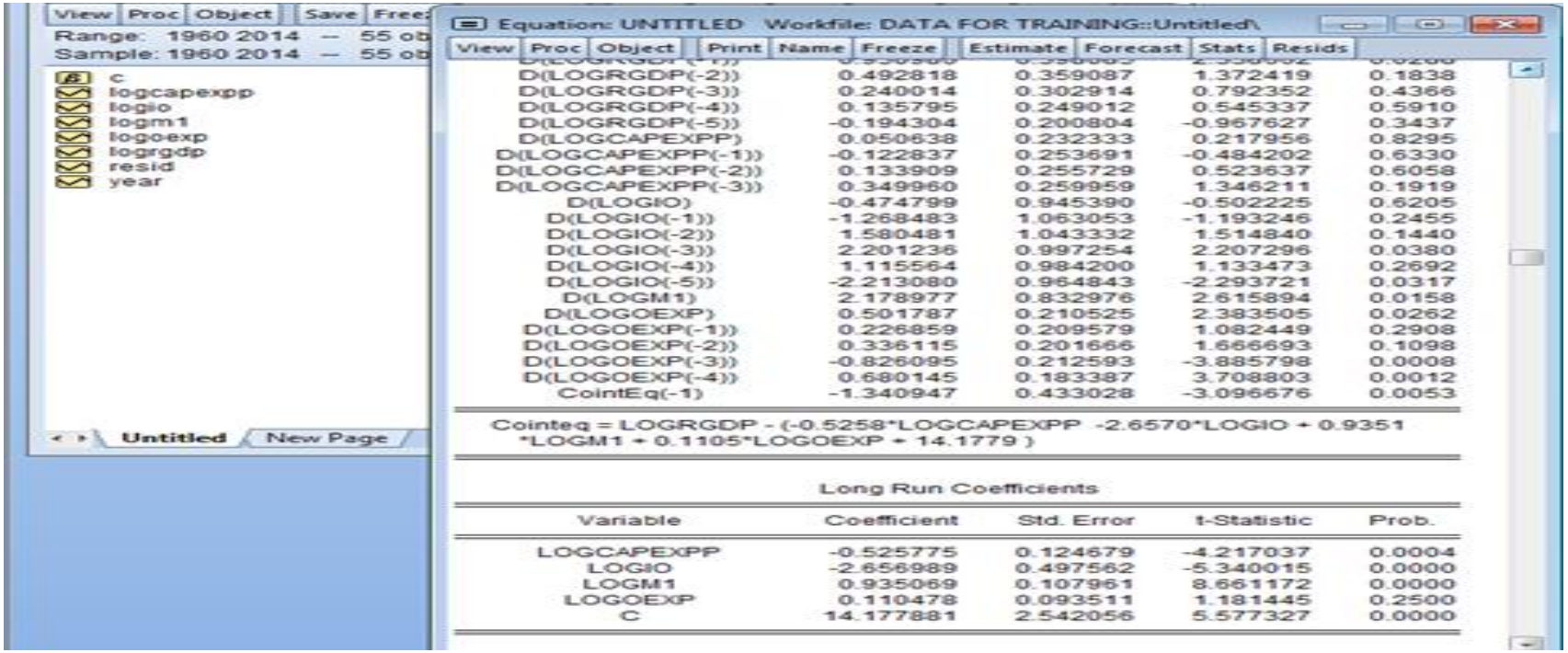
Cointegration Tests …

- Place your cursor on coefficient diagnostics, see the drop down and click on Cointegration and Long Run Form
- Short Run Form



Cointegration Tests …

- Place your cursor on coefficient diagnostics, see the drop down and click on Cointegration and Long Run Form
- Long Run Coefficient



Cointegration Tests …

- The a priori expectation of the coefficient of Cointegrating equation (cointeq) or ECM (-1) is that it should be negative and statistically significant at 5 percent. The value is converted to percentage and thus measures the sped of adjustment of short run disequilibrium to long run equilibrium. Put differently, it measures the speed of convergence of short run towards long run equilibrium.

Cointegration Tests …

- Assume for instance that the coefficient of our ECM or cointegrating equation is -1.340947 and that the probability is 0.0053.
- Interpreting this result, we could say that the ECM was inline with a priori expectation (i.e. has negative value and statistically significant at 5%).

Cointegration Tests …

- Also, it could be seen that annually, about 134% of the disequilibrium in the short run is corrected towards long run equilibrium. We can also say that about 134% gap between long run equilibrium value and the actual value of the dependent variable(LogRGDP) has been corrected. It can be also said that speed of adjustment towards long run equilibrium is 134% annually (since data is annual). Also we can say that system corrects its previous period disequilibrium at a speed of 134% annually.
- ****Don't worry about this…that's just what our data suggest****

Cointegration Tests …

- Lastly, the coefficients of the short run and long run model could be interpreted in the same way we interpret impact models. The only difference is whether the variables are in rate, log or not.
- But the interpretation of the ECM coefficient is very vital.

Other tests …

- Serial correlation test
- Serial correlation test is a residual diagnostic test. It is used to ensure that the residual of our model, that is, the Selected Model: ARDL(6, 5, 1, 6, 4) is not correlated with the independent variables.
  H0 = there is no serial correlation
- Decision rule is to reject H0 if prob. Chi-Square of Observed R-Squared (obs*resid) is less than 0.05. Otherwise, t he null hypothesis may not be rejected at 5 percent level.

Other tests …

- Serial correlation test
- To conduct this test from our regression output, go to view and select residual diagnostic test, select Breusch-Godfrey serial correlation LM test.

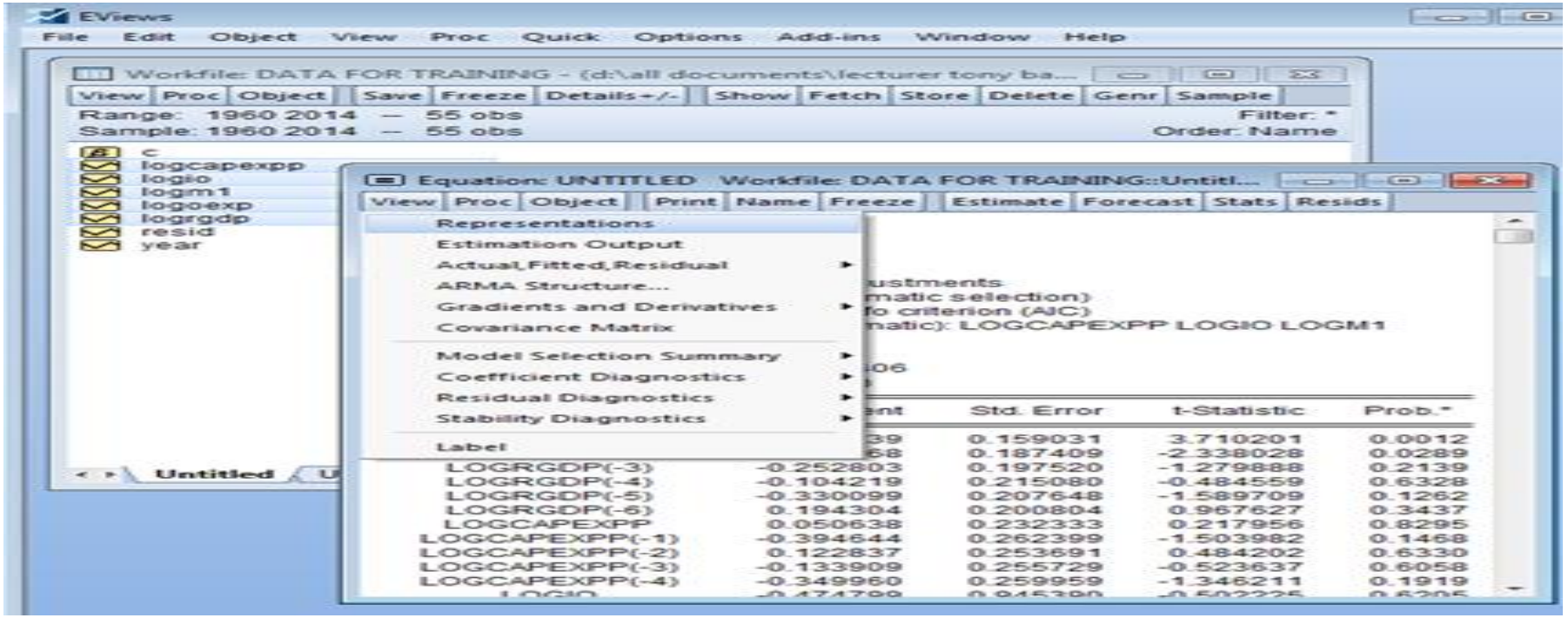
- In the dialogue box that appears requesting for number of lags, select two.

Other tests …

- Serial correlation test
- The result of our model shows that the prob. Chi-Square of Obs*R-squared (0.0503) is greater than 0.05. this means that we are not to reject H0. This means no serial correlation in our model.

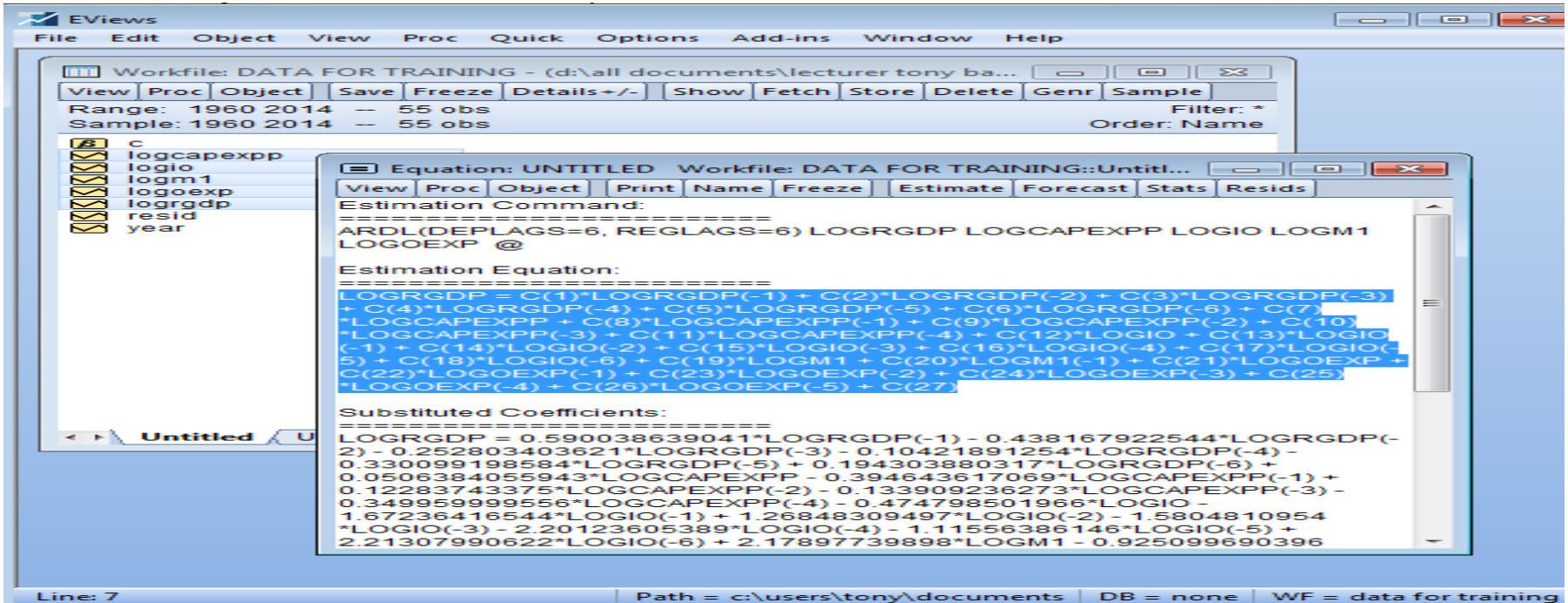
Other tests …

- **Stability test**
- Click on view on the page of the estimated result and you will see a drop down, then click on "representation"



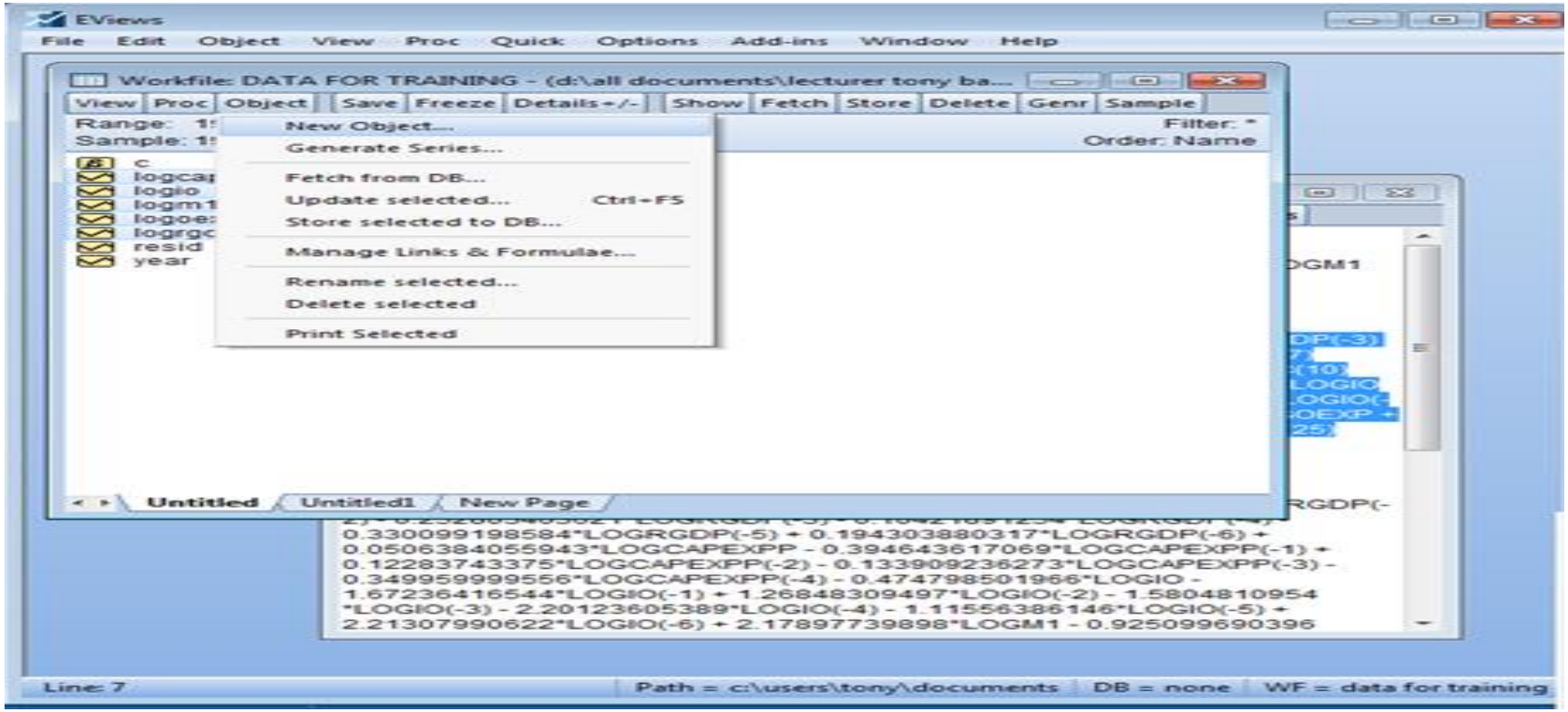
Other tests …

- **Stability test**
  - It will show the equation form and the representation which this ARDL is using in the background. Here you have to highlight the estimation equation and copy it like in the image below.



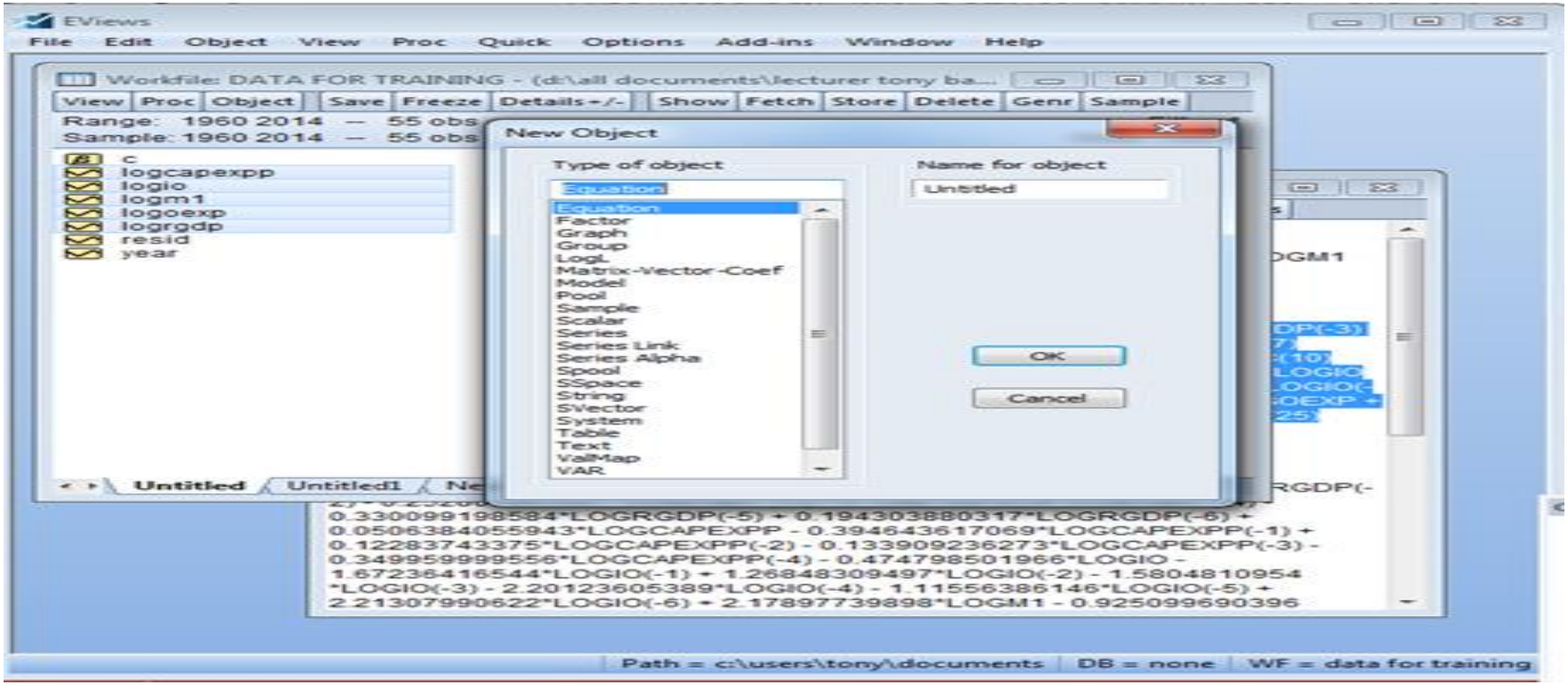
Other tests …

- **Stability test**
- Then go to Object option above and then new object



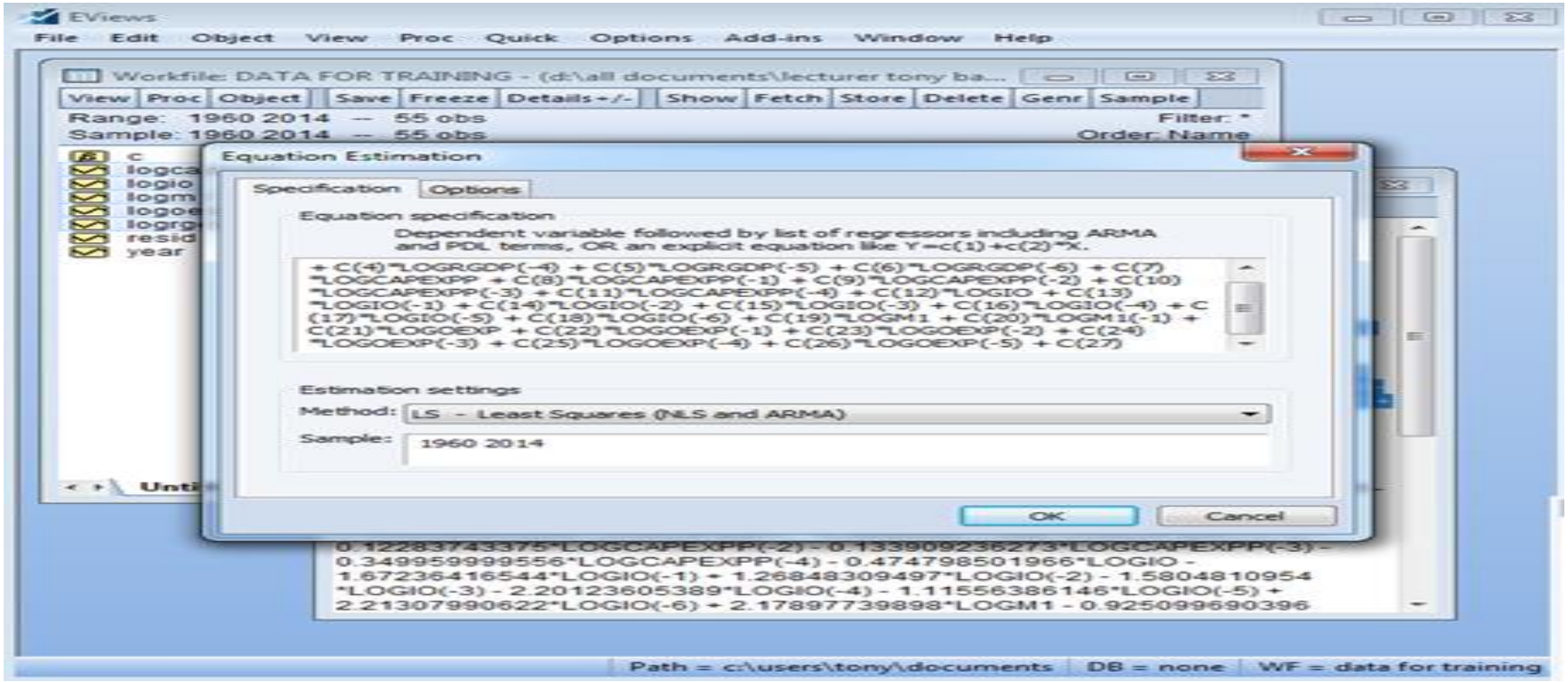
Other tests …

- **Stability test**
- Then click on new object and ok.



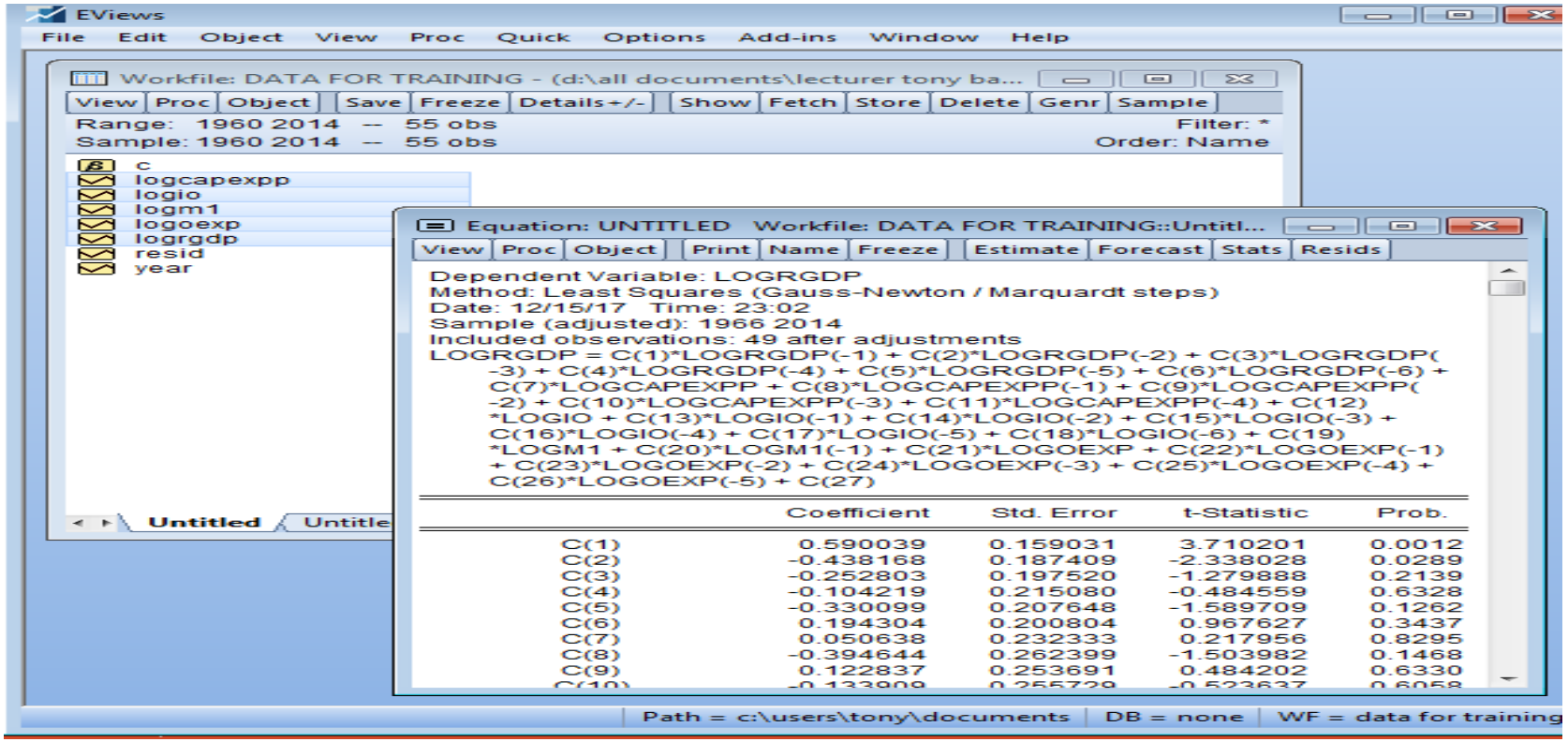
Other tests …

- **Stability test**
  - An equation estimation dialogue box appears and then you paste the estimation equation which you copied earlier and press OK.



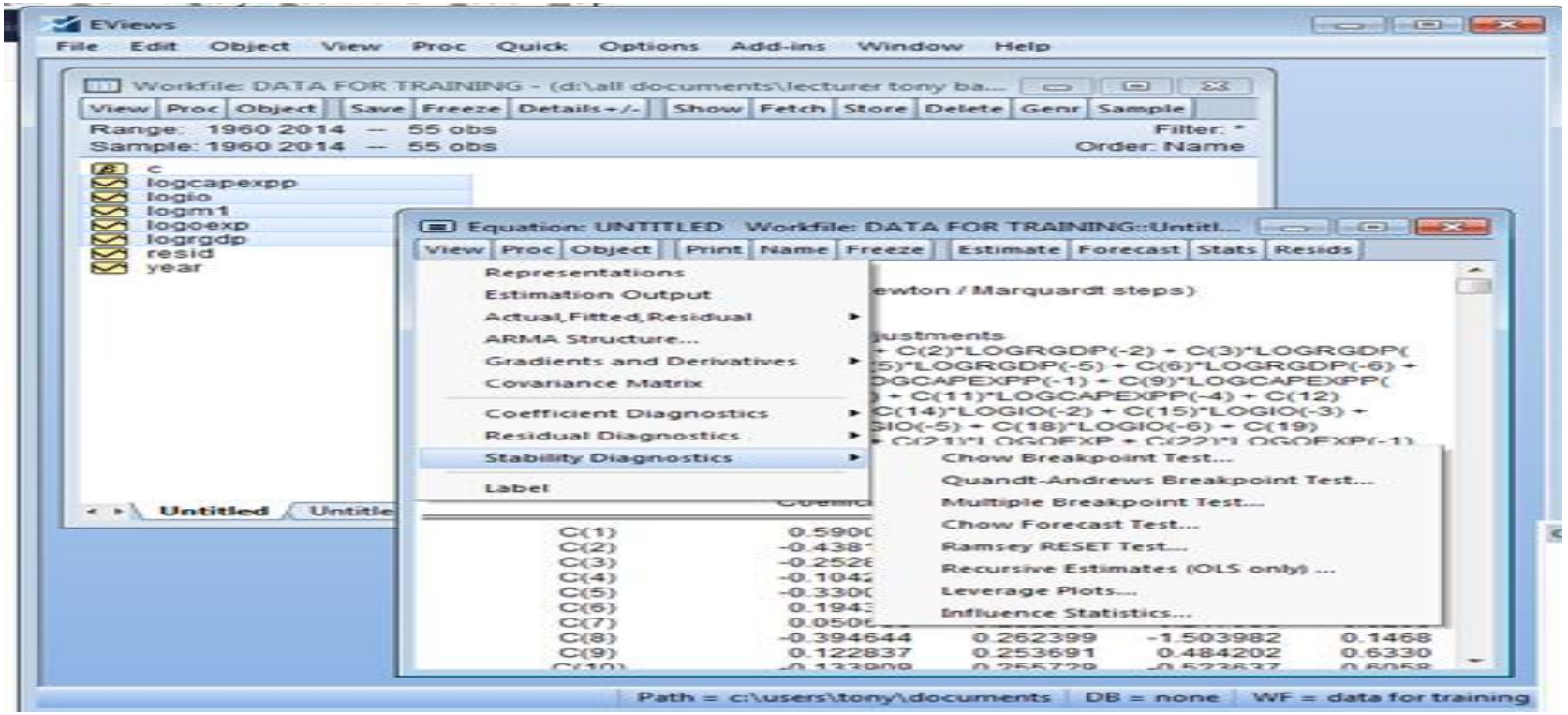
Other tests …

- **Stability test**
- It will show the same ARDL output in OLS format here.
-



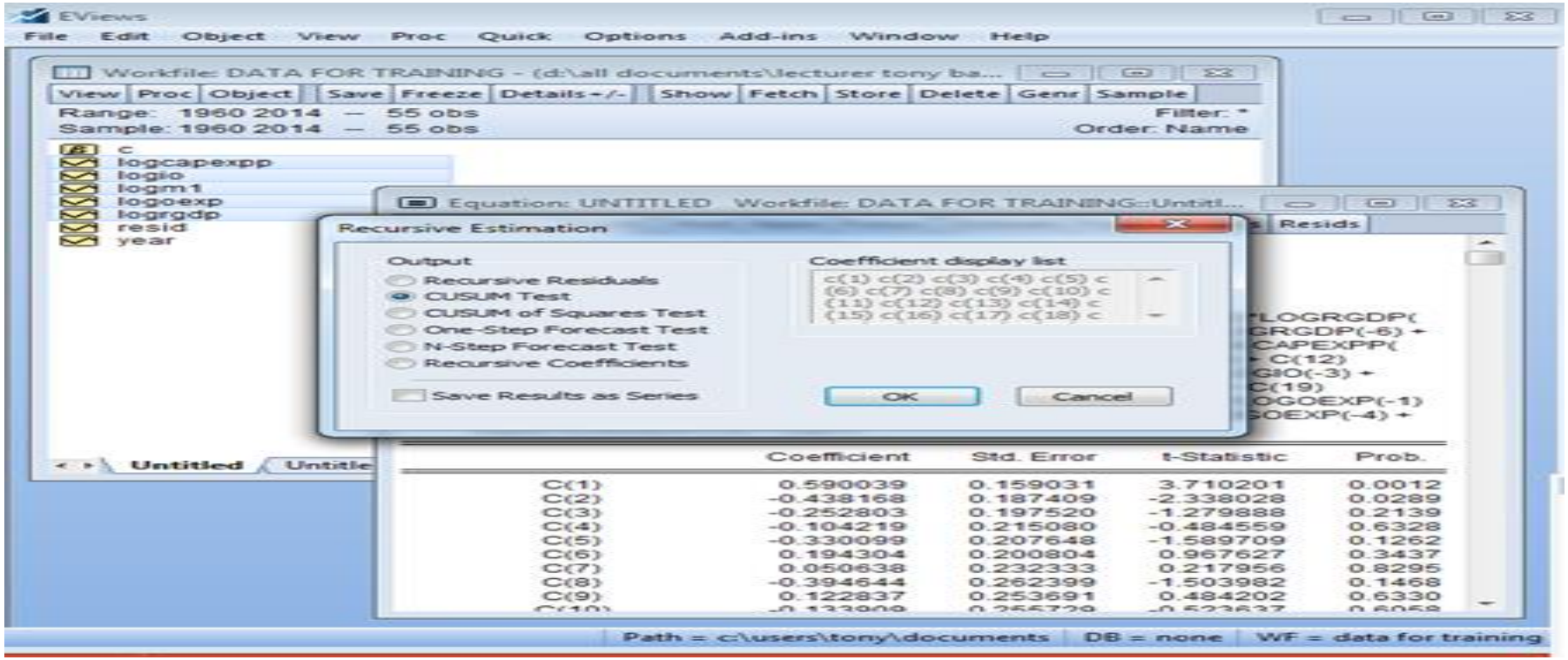
Other tests …

- **Stability test**
  - From here press the view button and go to stability diagnostics



Other tests …

- **Stability test**
  - Click on Recursive Estimates (OLS only).. You will get following options.

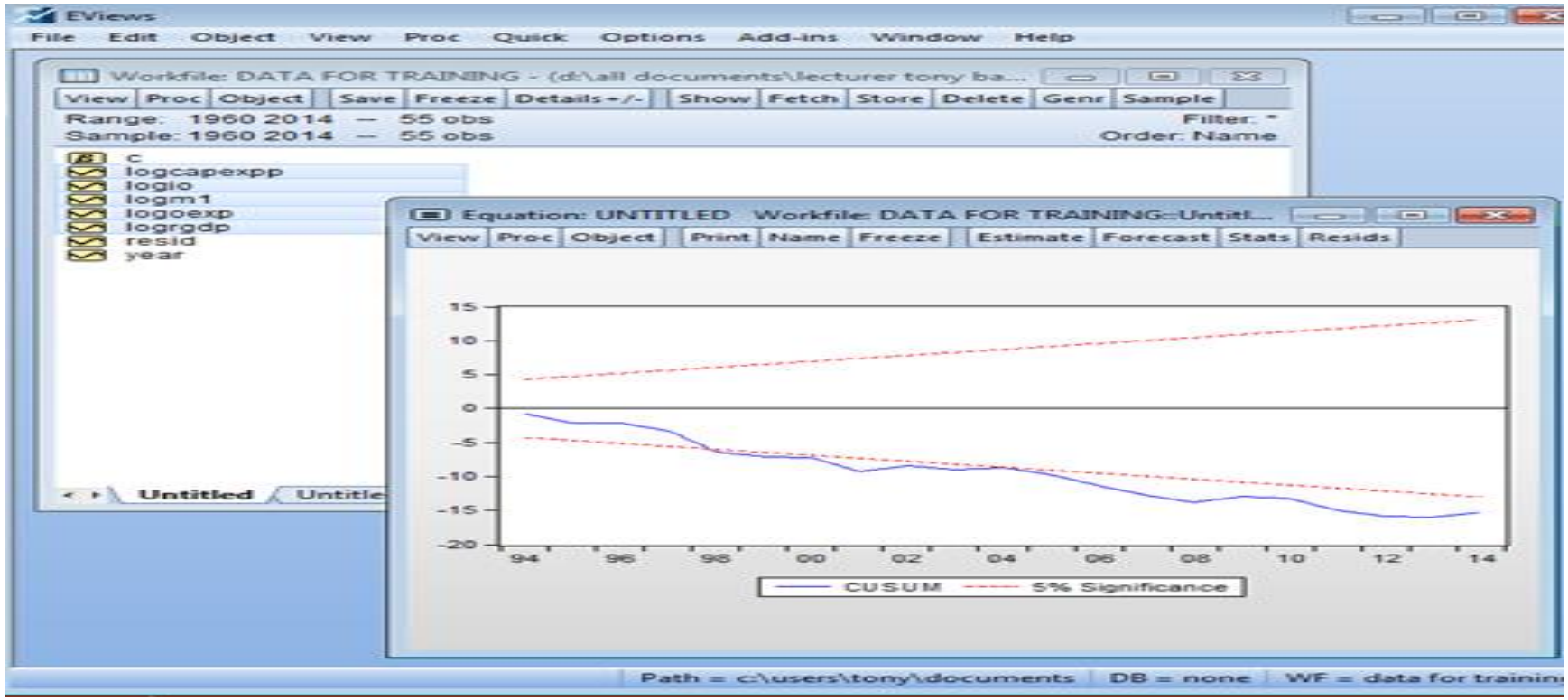


Other tests …

- **Stability test**
- Here select the CUSUM test and press OK to get the CUSUM chart for the ARDL and then do it again for CUSUM sq. This way you can generate your CUSUM and CUSUMsq charts, which were not there in the default package.

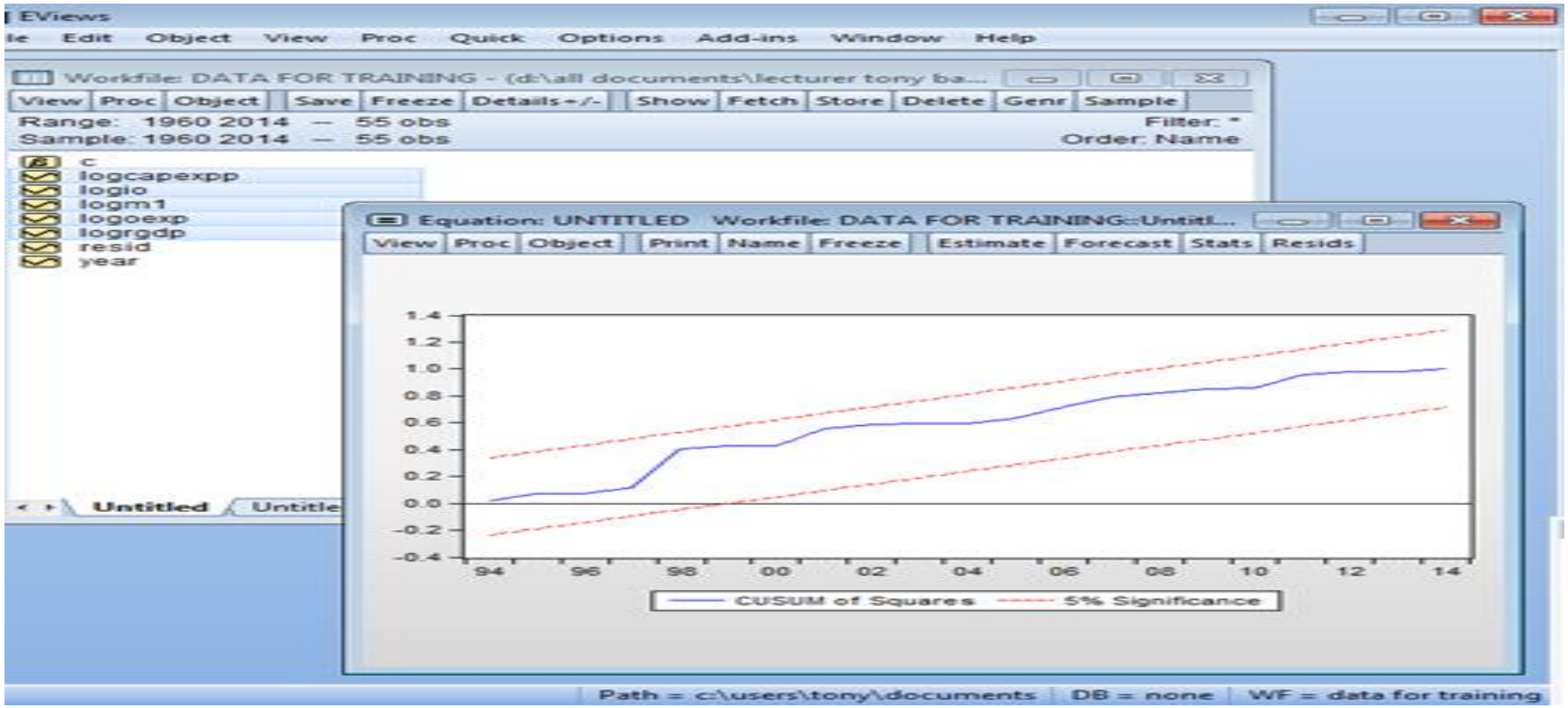
Other tests …

- **Stability test**
- **Cusum Test**



Other tests …

- **Stability test**
- **Cusum of Squares Test**



Wald Test…

- Another important test which we shall consider is the Wald test. This test is conducted on the coefficients of the estimated model. Thus, it is a coefficient diagnostic test.

Wald Test…

- The essence of Wald test is to examine the joint significance of the coefficients from estimated model.

- Some times, looking at individual impact of variables, one may observe that they are statistically insignificant. However, combination of this variables could produce significant result.

Wald Test…

- Now, this is where Wald test comes to play.

- This test follows Chi-square distribution. As a result of that, the probability Chi-square of F-statistic is considered during interpretation.

Wald Test…

- The null hypothesis for this test is that the coefficients of the variable of interest (in most cases, we consider the coefficient of a variable and its lags) is zero.

Wald Test…

- Consider performing a Wald test on LOGOEXP whose coefficients and some of its lag coefficient are statistically zero.

- We can perform Wald test on them to check if they can jointly impact significantly on LOGRGDP. To do this, we check the positions of the coefficients of LOGOEXP.

Wald Test…

- That is, assuming that the positions of the coefficients of LOGOEXP and its lags are C7, C8, C9, C10, C11, and C12. See C7 is coefficient of LOGOEXP, C8 is the coefficient of LOGOEXP(-1), C9 is the coefficient of LOGOEXP(-2), C10 is the coefficient of LOGOEXP(-3), C11 is the coefficient of LOGOEXP(-4) and C12 is the coefficient of LOGOEXP(-4). We can conduct coefficient restriction test on them. The null hypothesis is that:

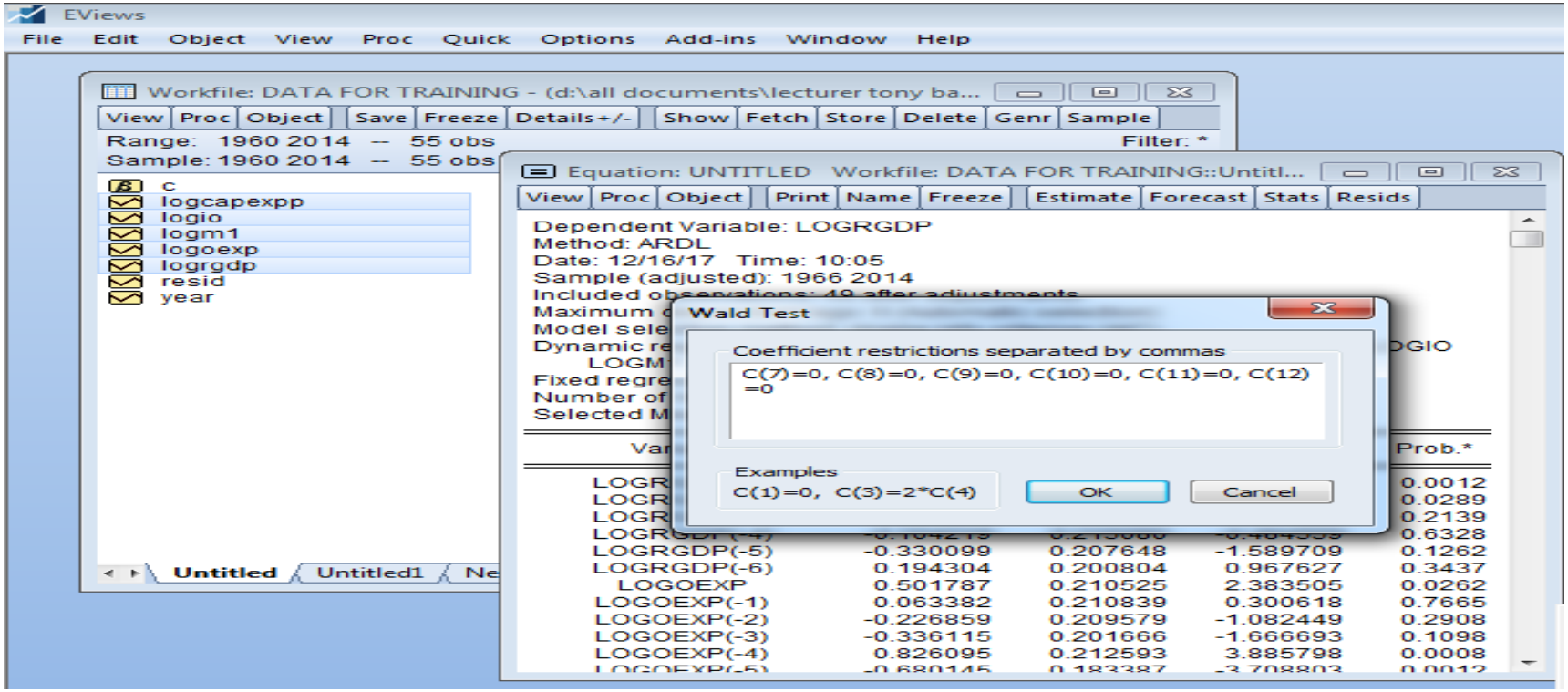
Wald Test…

- H0: C(7)=C(8)=C(9)=C(10)=C(11)=C(12)=0
- The decision is to reject the null hypothesis if the probability Chi-square of F-statistic from the result is less than 0.05. Otherwise, the null hypothesis should not be rejected.

- Note that rejecting the null hypothesis means that the coefficients of LOGOEXP jointly affect LOGRGDP.

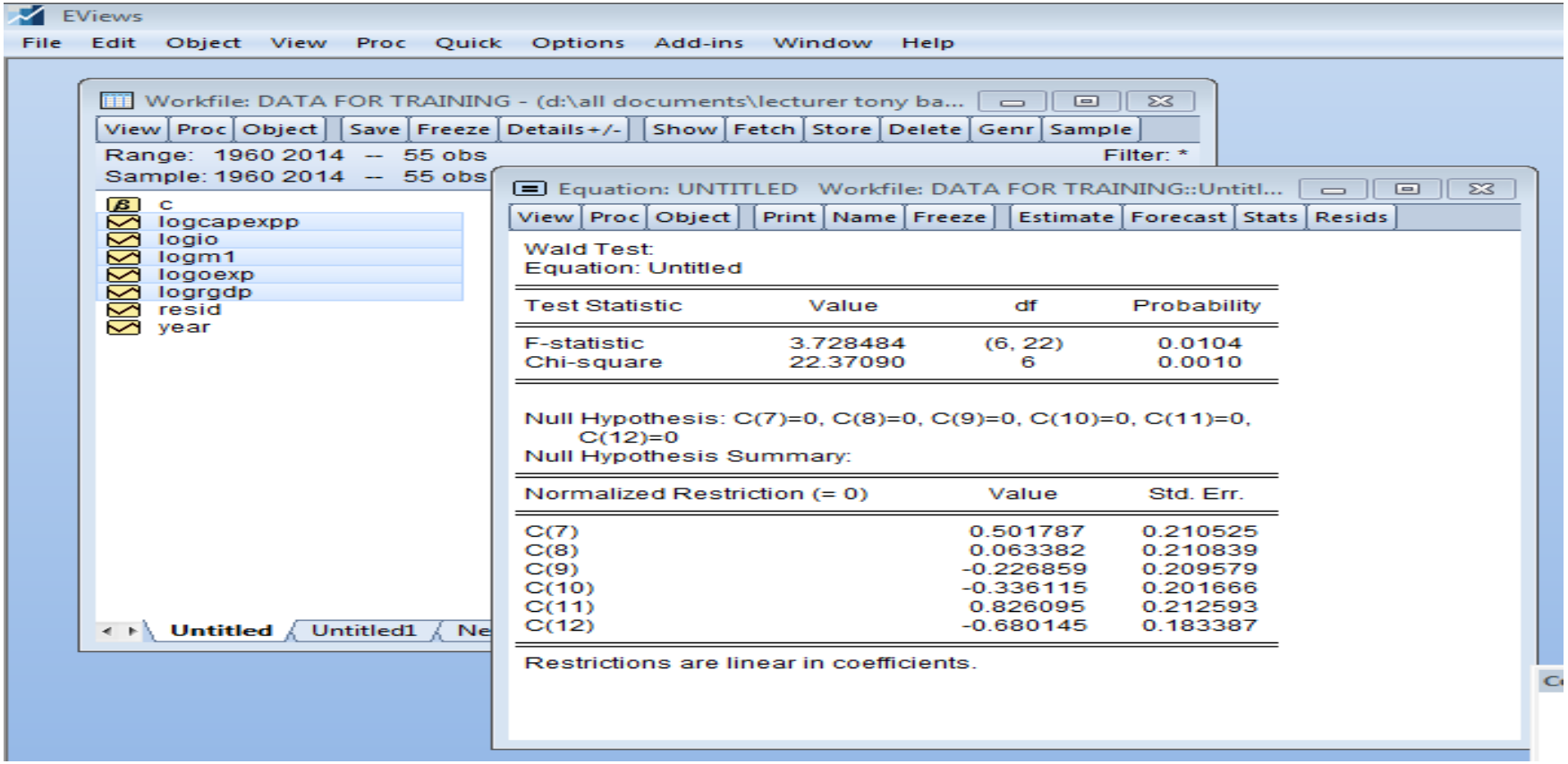
Wald Test…

- Go to view, coefficient diagnotics, click on Wald Test- Coefficient Restrictions and put in the numbers of the coefficient you want to test



Result of Wald Test…

Click ok and the result of the wald test will show as follows



Wald Test…

- The result shows that the probability Chi-square of F-statistic is less than 0.05. This implies that the null hypothesis can be rejected. This mean that the coefficients of LOGOEXP can jointly affect (explain) LOGRGDP.

Hope you have learnt something today?


THANK
YOU
VERY
MUCH
GOD BLESS YOU