# ECON 4160: Seminars autumn semester 2013—SECOND SEMINAR

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## Exercise set to seminar 2 (week 40, 30 Sep & 3 Oct)

These questions relate mainly to Lecture 3 and 4. In question B it is also useful to review NLS and the principle of Wald and LR statistics from Lecture 2.

**Question A**

Download the *SimdataLECT3.fl* posted on the web page (under **Data set and code**: *Batch file for AR(2) example in Lecture 3*).

1. Read the code down to the *break;* command and note that there are three variables that are created here: *eps1*, *YM1* and *YM1H*. *eps1* is the white-noise input series in the AR(2) model. It is generated as $N(0,1)$. Line 18 an 19 give the solutions of the AR(2) with autoregressive coefficients 1.6 and $-0.9$. Line 18 is for the full solution, and line 19 is for the homogenous solutions. The two solutions are dubbed *YM1* (full) and *YM1H* (homogenous). (The initial condition is 4 for both.)

   (a) Run SimdataLECT3.fl and plot the three variables *eps1*, *YM1* and *YM1H* in a single figure. Use the full sample (default). Explain briefly the differences and similarities between the three graphs.

   (b) Change the autoregressive coefficient to 0.6 (first lag) and 0.20 (second lag). Run the modified file and make a plot with the three series. Compare with the figure from (a) and explain the differences.

   (c) Change the autoregressive coefficients back to 1.6 and $-0.9$. Multiply *rann()* by 0.5. What is the effect of this? Run the modified file, make the graphs and compare to the graph from (a). What has happened?

   (d) Keep *rann()*0.5*, but change the file in such a way that the expectation *YM1* is 1.0 and not zero. Run the file and graph *YM1H* as a check that you got it right.

2. Assume that the we know that *YM1* is generated by an AR(2) process, but that we need to estimate the parameters. Use the data set from (1d) and use PcGive (*Models for time series data—Single Equation Dynamic Modeling*) to obtain the OLS estimates of the two parameters. Use a sample that begins in 1962 and ends in 2012. Comment on the results.

3. Use the Menu *Test-Dynamic Analysis* and check the box *Roots of the lag polynomial*. What do you find? Are the estimated roots logically consistent with the assumed stationarity of AR(2) in this case? Explain briefly.

4. What is the (approximate) ML estimate of the expectation of *YM1*? Give also an approximate 95 % interval for this parameter.

5. Assume that we do not know the order of the AR process. How could you proceed to try to identify empirically the correct lag-order? Apply your approach in PcGive, and report the result.

6. Since there is no observable explanatory variables in this models, we do not get any lag-weights (aka dynamic multipliers). To obtain them, go to *Models for time series data—Multiple Equation Dynamic Modeling*. Formulate the AR(2) model with Constant included. Use *Unrestricted estimation* in the next menu (*Choose a model type*). Observe that the OLS estimates are exactly the same as you obtained in the *Single Equation Dynamic Modeling*. Since we have now estimated a (single equation) system, a VAR(2) with only one row, we can get hold of the impulse response functions! After estimation, go to *Test-Dynamic Simulation and Impulse Responses,* choose *Impulse responses* and check *Impulse responses* and *Cumulated Impulse Responses. (*Note the similarity between the graph for the impulse responses (the responses to a change in the disturbance) and the graph of the homogenous solution that you found in (1d) above!

**Question B**

Download the file *pcmbynls.zip* by using the link *Code and data for NLS estimation of natural rate*. We will use the data set *forlengetNORKPI_agg0.xls* (or in7/bn7) with annual data for CPI inflation (in percent) in Norway (*INF*) and the unemployment percentage. Use the variable named $U$ for unemployment.

1. Use the sample 1981-2012, and estimate the derived parameter called the Phillips curve natural rate of unemployment $U^{nat}$ with the use of a regression that linear both in parameters and in variables. Give a Wald type 95 % confidence interval for $U^{nat}$. (In this exercise we close our eyes to the misspecification tests).

2. Use NLS (see batch file example in *pcmbynls.zip*) to estimate $U^{nat}$ and the standard error. Compare the results with (1b).

3. Consider another parameter called the target rate of unemployment, $U^{target}$, and estimate it by creating a new regressand $INFTARG = INF - 2.5$ and regress $INFTARG$ on *Constant* and $U$. The estimated value of $U^{target} < U^{nat}$. Is that reasonable? Explain briefly. Use the 1981-2012 sample

4. Give a Wald type 95 % interval for $U^{targ}$.

5. Try to find a method to calculate a Likelihood Ratio-type confidence interval for $U^{targ}$.

Hint: Start with the estimated $U^{targ}$ from problem 1. and call it $U_U^{targ}$. This estimate gives the lowest $SSR$, call it $SSR_U$, and the highest likelihood value, in the Phillips curve regression. Then impose a lower value of $U^{targ}$, call it $U_R^{targ}$. Find the corresponding restricted $SSR$ and call it $SSR_R$ by running the regression between $INFTARG$ and $U - U_R^{targ}$ (no Constant term in this regression). If $SSR_R$ is significantly higher than $SSR_U$ (using a 2.5 % significance level) we know that $U_R^{targ}$ is outside the lower boundary of a 95 % interval. With a little experimentation it is easy to estimate the lower bound of the intervall. Use the same procedure to estimate the upper bound of the interval.

6. What is the most notable difference between the Wald-type confidence interval and the LR-type interval in this case?

**Question C**

Use the data set in Question B and formulate an ADL(1,1) model for *INF* with $U$ as the explanatory variable. Use 1981-2012 as the sample.

1. What is the estimate of $U^{targ}$ based on this model? (No standard-error required here).

2. Test the hypothesis that a static model with first order autoregressive residuals is a valid simplification of the ADL(1,1), i.e. a so called common factor model.