ECON 4160: Seminars autumn 2011

26 August, 2011.

Exercise set to seminar 1 (5 and 6 Sep)

1. Download *KonsDataSim.zip* and *Seminar_PcGive_intro.pdf* from the course web page. Follow the step-by-step instructions and become acquainted with simple regression in OxMetrics-PcGive. (This is basically a review of some of the things from the first computer class).

2. Estimate the same relationship using recursive estimation (see the note *Seminar_PcGive_intro.pdf*). In the **Model-Test** menu choose **Recursive graphics** and then *Beta Coefficient* $\pm 2SE$. This should produce graphs with the sequences of point estimates as a function of the sample, both for the constant and for the regression coefficient, with ± 2 estimated coefficient standard errors.

   - The graphs can be said to "contain" the sequences of approximate 95 % confidence intervals. Why?
   - The graphs show that the confidence intervals are wider for shorter samples than for the longer sample. Can you briefly explain this feature?
   - The estimates of the coefficients are unstable at the start but the variability becomes less as the sample becomes longer. Explain briefly.

3. Write the model we have estimated in Question 2 as

   (1) $$C_t = \beta_0 + \beta_1 I_t + \varepsilon_i$$

   with C_t for consumption and I_t for income.

   (a) Let $\hat{\beta}_1$ denote the OLS estimator and show that it can be expressed as:

   $$\hat{\beta}_1 = r_{CI} \frac{\hat{\sigma}_C}{\hat{\sigma}_I}$$

   where r_{CI} is the correlation coefficient and $\hat{\sigma}_C$ and $\hat{\sigma}_I$ are the two variables' empirical standard deviations.

   (b) Consider the "inverse regression"

   (2) $$I_t = \beta_0^{'} + \beta_1^{'} I_t + \varepsilon_i^{'}$$

   and show that

   $$\hat{\beta}_1 = \hat{\beta}_1^{'} \frac{\hat{\sigma}_C^2}{\hat{\sigma}_I^2}$$

   where $\hat{\beta}_1^{'}$ is the OLS estimator for the "inverse regression".

(c) Assume that the sequence of recursive $\hat{\beta}_1$ estimates supports the interpretation that β_1 in (1) is a parameter which is *stable* over time. Assume next that the ratio $\hat{\sigma}_C^2/\hat{\sigma}_I^2$ is *unstable* over time. We may call this a *regime-shift* in the system that determines C_t and I_t. Can $\hat{\beta}_1^{'}$ be recursively stable in this case Explain and show the graph!

(d) Can this finding tell us anything about the status of I_t as an endogenous or exogenous variable (in the econometric meaning of these terms)?

(e) What about the discussion about causality, from I_t to C_t, from C_t to I_t or both ways? Are our findings of any relevance?

4. Download *KonsData1Nor.zip* from the course web page.

(a) Use the data for Norwegian consumption and income to estimate a log-linear "consumption function". Use the data series *CP* and *RCa* (click the variable names to see a short description) and transform to logs, before estimation. The data is quarterly and unadjusted, as a plot of the data will show, so include three seasonal dummies in the model . You do not have to create the dummies, just add *Seasonal* from the **Formulate** menu and Seasonal, Seasonal_1 and Seasonal_2 will be added to the model, representing dummies for the first, second and third quarter each year. Use the full sample, 1967(1)-2004(4).

(b) What is the estimated elasticity of consumption with respect to income?

(c) Define a variable s_t by $s_t = \ln(CP_t) - \ln(RCa_t)$. Explain why this variable is approximately equal to the savings rate.

(d) Regress s_t on $\ln(RCa_t)$, the constant and the three seasonal dummies. Compared to the regression in 4(a), why has R^2 changed, while the estimated standard error of the regression ($\hat{\sigma}$) is unchanged?

(e) Review the mis-specification tests, and re-estimate both regressions after choosing *Robust (HACSE)* as *Standard errors* at the bottom of the **Estimation** menu. (See Greene p 960 and 960 on autocovariance consistent (i.e., robust) estimation).

(f) Test the hypothesis that the savings rate is independent of income.

(g) For the regression 4(a): Investigate the empirical *stability* of the income elasticity over the sample. Do the same for the "inverted regression". Is there a clear picture emerging regarding the "direction of causality"?

(h) Assume that the DGP contains a variable W_t that affects CP_t. How would this affect the "consumption function" that you estimated in 4(a)?

5. Problem 1, 2, 4 from *Forty exercises* by Erik Biørn.

Exercise set to seminar 2 (19 and 20 Sep)

1. Download *KonsData2Nor.zip* from the course web page. In this exercise we work with the three variables *LCP*, *LRCa* and *LF*. They are the natural logs of private consumption and income in Norway (known from seminar 1) and *LF* is the natural logarithm of total household wealth.

   In this exercise we will attempt to model the three variable system made up of LC, $LRCa, LF$ by means of one conditional model and two marginal models.

   (a) Start with the marginal model for $LRCa$. Specify it as:

   $$LRCa_t = \sum_{i=1}^{4} a_{RRi} LRCa_{t-i} + const + seasonals + \epsilon_{Rt} \tag{1}$$

   and estimate the equation for the sample 1968q2-2004q4. Use recursive OLS.

   i. Investigate the stability of this marginal model for income over the sample. What do you find?
   ii. There a signs of residual autocorrelation for this equation. How might this affect the estimates, for example $\hat{a}_{21}$?
   iii. Test if the autocorrelation can be explained by omitted variables: Test for omission of four lags of LC and LF. Remember: do not include the current value of LC, and LF, just the lags.

   (b) Next, consider a marginal model for LF. Specify it as

   $$\begin{aligned} LF_t &= a_{FD} LF_{t-1} + \sum_{i=1}^{4} a_{FRi} LRCa_{t-i} + \sum_{i=1}^{4} a_{FCi} LCP_{t-i} \\ &\quad + Const + Seasonals + \epsilon_{Ft} \end{aligned} \tag{2}$$

   and estimate by recursive OLS for the sample 1968q2-2004q4. Investigate stability of this equation. What do you find?

   (c) Finally, estimate a conditional model for LCP:

   $$\begin{aligned} LCP_t &= \sum_{i=1}^{4} a_{CC_i} LCP_{t-1} + \sum_{i=0}^{4} a_{CRi} LRCa_{t-i} + \sum_{i=0}^{4} a_{CFi} LF_{t-i} \\ &\quad + Const + Seasonals + a_{CD} D_t + \varepsilon_{Ct} \end{aligned} \tag{3}$$

   with the same sample size as for the two marginal equations above.
   D_t is a dummy variable which is 1 in 1969q4, -1 in 1970q1 and 0 otherwise. (Create it in Calculator or Algebra)

   i. Comment on the mis-specification tests for this model
   ii. Investigate the empirical stability of (3) and use the joint evidence from the estimation of the three equations to characterize income and wealth as strongly exogenous or super exogenous, with respect to the parameters of the conditional consumption function

iii. There is one clear sign of structural break in the consumption function. Where is it?

iv. The estimated model in (3) has several irrelevant variables. Try to simplify the conditional model of LCP_t by omitting the irrelevant variables and report your parsimonious equation (see for example the short explanation on page 178-179 in Greene's book).

(d) The estimated versions of (1), (2) and (3), or a simplified version of that equation, represents a model of the system. Suppose that you want to estimate the dynamic effects on LCP of a shock income. How can you achieve this?

2. Exercise 5,7, 9, 10 from *Forty exercises* by Erik Biørn.

Exercise set to seminar 3 (10 and 11 Oct)

1. In Computer Class 2 we studied the VAR:

$$(1)\qquad \begin{pmatrix} y_t \\ x_t \end{pmatrix} = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} y_{t-1} \\ x_{t-1} \end{pmatrix} + \begin{pmatrix} \epsilon_{yt} \\ \epsilon_{xt} \end{pmatrix}$$

$$(2)\qquad \begin{pmatrix} \epsilon_{xt} \\ \epsilon_{yt} \end{pmatrix} \sim N\left(\mathbf{0}, \begin{pmatrix} \sigma_x^2 & \omega_{xy} \\ \omega_{xy} & \sigma_y^2 \end{pmatrix}\right).$$

and showed that one econometric model of this VAR was:

$$(3)\qquad y_t = \phi_1 y_{t-1} + \beta_1 x_t + \beta_2 x_{t-1} + \varepsilon_t$$

$$(4)\qquad x_t = a_{21} y_{t-1} + a_{22} x_{t-1} + \epsilon_{xt}$$

where the expressions for the parameters of the conditional equation (3) is given in the slide set to Computer class 2, along with other results, specifically that $E(\varepsilon_t, \varepsilon_{xt}) = 0$.

(a) Use the data set ADLfromVAR_d.in7/bn7 to estimate, by OLS, the ADL in (3) as a single equation.

Note: Let *Ya* in the data set represent y_t and let *Yb* in the data set represent x_t. Note also that we can drop the constant from the model in this specific case, Use the longest available sample. Confirm that the results come close to what we expect from the known properties of this artificial VAR.

(b) Use *Test Menu–Dynamic Analysis* and check the box *Static-long run solution.* This produces an estimated static long solution of (3):

$$y^* = \underbrace{\frac{\beta_1 + \beta_2}{1 - \phi_1}}_{B} x^*$$

where y^* and x^* represent stationary values of the two variables. The parameter

$$B = \frac{\beta_1 + \beta_2}{1 - \phi_1}$$

is called the long-run derivative coefficient (it is also known as the long-run multiplier). It gives the long-run effect on y of a permanent increase in x by one unit. The reported standard error of the estimated long-run coefficient is obtained by the so-called Delta-method described in Greene's book (p. 109). Use the reported standard error to test the null hypothesis of $\frac{\beta_1+\beta_2}{1-\phi_1} = 1$.

(c) Re-write (3) in so called Equilibrium Correction form, as

$$(5)\qquad \Delta y_t = (\phi_1 - 1) y_{t-1} + \beta_1 \Delta x_t + (\beta_1 + \beta_2) x_{t-1} + \varepsilon_t$$

where $\Delta y_t = y_t - y_{t-1}$ and $\Delta x_t = x_t - x_{t-1}$. Estimate (5) and compare with the estimation results from (3). What is unchanged, and what is different? Can you explain?

(d) How can you estimate the long-run coefficient B from the (5)?

2. **Exercise in practical estimation and analysis of a conditional model of the VAR system.**

   (a) The batch file *CondMofVar.fl* contains commands that let you estimate the three variables $LCP, LRCa$ and LF in *KonsData2Nor.in7* (used in Seminar 2) as a system, using *Multiple-Equation Dynamic Modelling* in PcGive. There are several comments that will help you understand both the input and the output.

   Run the file, and prepare a short oral presentation of the models and the results.

   (b) The last model in *CondMofVar.fl* estimates a model that has 4 parameters less than the VAR. Specify another model that has even fewer parameters, and test whether that model is a valid simplification of the VAR, in terms of no significant loss of explanatory power.

   (c) Use your preferred model to create graphs with forecasts for $LCP, LRCa$ and LF, for the four quarters of 2005.

   Hint: Use *Test Menu-Forecast*, set the number of forecasts to 4 and push the radio button for *Dynamic forecasts.* Keep the default settings for the rest

   (d) Try to give an intuitive explanation of how the forecasts have been calculated, and of the interpretation of the graphs.

   (e) Use your preferred model to create a graph that shows the dynamic effects on LCP, $LRCa$ and LF of a shock to income.

   Hint: Use *Test Menu-Dynamic Simulation and Impulse Responses.* Choose *Impulse responses* and check the box *Impulse response* and set the radio button to *Custom.* Then choose *Values for custom impulse* and replace the 0 in the box for $LRCa$ by 0.01. This means that the shock corresponds to a 1 % shock to income.

   (f) Create a graph that shows the dynamic effects of a *permanent* change in income.

   Hint: Same as above with one change: Choose *Accumulated impulse responses* instead of *Impulse responses.*

3. Refering back to Question 1: Estimate the model (3)-(4) in *Multiple-Equation Dynamic Modelling using Pc-Give.* Create a graph that shows the effects of a *permanent* change in x_t (i.e. Yb). Comment on how this graph "shows" the estimates of the parameters β_1 and B .

4. The following is an example of a linear econometric model with rational expectations:

$$y_t = \beta_0 + \beta_1 E(x_t \mid x_{t-1}) + \varepsilon_t \quad (6)$$

$$x_t = \lambda x_{t-1} + \epsilon_{xt}, \quad (7)$$

We assume that the disturbances ε_t and ϵ_{xt} are uncorrelated, that they have zero conditional expectations, and that they are homoskedastic and that there is no autocorrelation.

Assume that y_t is regressed on x_t. Show that the OLS estimator will in general be inconsistent for the parameter β_1.

5. Exercise 16 in *Forty exercises.*

6. With reference to your answer to Question 5: Explain what is meant by the econometric concept known as *simultaneity bias* of OLS estimators.

Exercise set to seminar 4 (24 and 25 Oct)

1. Problem 1 and 3a-3d in *Postponed Exam, spring 2006*. For problem 3, *Lecture note 6N F* is a very useful reference.

2. Download the data set in *FOLIORENTE.zip*. The data is in PcGive format and in xls format. PcGive format contains brief variables definitions in the usual way. The data is quarterly and seasonally unadjusted.

   Use the data set to investigate the monetary policy response function in Norway (often called the "Taylor rule"). Use 2001q1 as the start of the estimation period.

   The data set contains two variables that are candidates for measuring the business-cycle element in the response function: The unemployment rate (*UAKU*) and mainland economy GDP in fixed prices (*YF*). You may want to experiment with both of these variables. In the case of YF, you can construct a HP-filtered trend GDP by using the *smooth_hp(VAR,LAMDA,VAR_DSET)* function in Calculator, and then construct a deviation from trend to use in your models. It is custom to take log of *YF* first, so that *VAR* in the smooth_hp function becomes *LYF*. *LAMDA* is the smoothing parameter. A popular choice is 1600, but this is for US data. Both Norges Bank and Statistics Norway use much higher values for Norwegian mainland GDP in their publications.

   (a) Formulate and estimate a model that contains contemporaneous and/or lagged values of the explanatory variables. Use OLS as the estimation method. Use a sample that ends before the financial crisis. Then re-estimate the model on a sample that includes the periods of the financial crisis and after. How do you interpret the outcome? Can you model the impact of the financial crisis on your monetary policy response function.

   (b) Experiment with IV estimation. You then need to instrument the contemporaneous variables. There are candidates for instruments in the data set.

   (c) Explore the hypothesis that Norges Bank reacts to the expected rate of inflation one quarter ahead. Why is IV estimation necessary in this case ? (Note: To include the lead of inflation you need to create that variable in Calculator, set *Lag-Length* to -1).

Exercise set to seminar 5 (7 and 8 Nov)

1. Exam question set for spring 2009, except question 5f.

Exercise set to seminar 6 (21 and 22 Nov)

1. Part I, Postponed Exam, Spring 2005

2. Postponed Exam, autumn 2010, question 1 and 3.