

Exam in: ECON 5101/9101: Advanced Econometrics - Time series

Exam period: May 19 - May 31, 2011

This is a home exam.

Guidelines:

Submit your exam answer electronically to the e-mail adress
submissions@econ.uio.no.

Last day for submissions of answers is May 31 2011. Kindly submit before 14:00.

Written text should be in the pdf or doc format. Data files should be in Microsoft Excel, PcGive og Stata format. Remember to also submit *Declaration Form for Portfolio assessment/take home exam* which you find on the course web page (<http://www.uio.no/studier/emner/sv/oekonomi/ECON5101/v11/>). This should be submitted as a separate document.

IMPORTANT: Use your candidate number both as the name of the file you submit, and as the author name in the file, do NOT use your own birth-name. You find the number on the student-web. If you have problems, contact Tone Enger. Do not write you name anywhere in the answer document

Answer Question A, and either Question B or Question C.

Question A

1. Consider the stochastic variable y_t given by the difference equation:

$$(1) \quad y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \varepsilon_t + \theta_1 \varepsilon_{t-1}$$

Complete the specification of the model of y_t in such a way that the following become true statements:

- (a) y_t is a weakly stationary time series variable.
 - (b) y_t is a causal and weakly stationary variable.
 - (c) y_t is a non-causal and weakly stationary variable.
 - (d) y_t follows a weakly stationary and invertible process
 - (e) y_t is non-stationary, but Δy_t follows a weakly stationary and invertible process
2. Explain briefly the concept of power spectral density function (PSD) of a time series variable.
 - (a) Draw a graph of the PSD of y_t given by (1) when $\phi_1 = 1.6$, $\phi_2 = -0.9$ and $\theta_1 = 0$. Assume that ε_t is white noise and draw the graph for the case of $Var(\varepsilon_t) = 1$.

- (b) Draw graphs of the PSDs of y_t for the following two cases: i) $\phi_1 = 1.6$, $\phi_2 = -0.6$, $\theta_1 = 0$, and ii) $\phi_1 = 0.6$, $\phi_2 = 0.4$, $\theta_1 = 0$. Assume that ε_t is white noise, and draw both graphs for the case of $Var(\varepsilon_t) = 1$.
- (c) Explain why the two cases in (c) are special cases of the typical PSD of y_t when Δy_t is stationary and given by $\Delta y_t \sim ARMA(p, q)$. Explain briefly why Clive Granger referred to this as the “typical spectral shape of an economic time series”?¹
- (d) Assume that $\Delta y_t \sim ARMA(p, 0)$ and $\Delta x_t \sim ARMA(p, 0)$. Sketch the PSD for the variable $z_t = y_t - \beta x_t$ in two cases: i) β is the cointegration parameter, and ii) β is not the cointegration parameter.

Question B

A data set with private consumption and disposable income data in the USA, called *USconsincQ.xls*, has been posted on the course web page (<http://www.uio.no/studier/emner/sv/oekonomi/ECON5101/v11/>). The data set also contains variables for inflation, interest rates, unemployment and population. A separate pdf file called *USconsincQ variables description.pdf* with brief descriptions of the variables has also been posted.

1. Use the data set to investigate the degree of integration of log private consumption per capita, log disposable income per capita and the savings rate. Use a sample period which ends in 1987(4), and which starts as early as possible. Next, re-do the analysis for a sample period that includes also the last part of the available period, i.e., on a sample that ends in 2010(2).
2. Formulate a VAR of the log of private consumption per capita, and the log of disposable income per capita. Investigate econometrically the hypothesis that the two series are cointegrated. Choose the sample period(s) that you find are most interesting/relevant, and give a brief reason for your choice.
3. Building on your results in B1 and B2, and possibly (but not necessarily) by supplementing the information set by other explanatory variables than just income and consumption, specify and estimate a dynamic econometric model that has (at least) log income per capita and log consumption per capita as endogenous variables. Report your results in the form of a draft to a short research report (or paper). An idea to a working title might be: *A dynamic econometric model of US income, consumption and savings, before, during and after “The Great Moderation”*.

Note:

In case you choose to extend the data set: The most concrete way of doing this is of course to use one of the other variables in *USconsincQ.xls*, or to introduce new data series from other sources. Another possibility might be to try to model/include structural breaks. In any case: give a clear motivation for the new variable(s) that you include.

¹Granger C.W.J (1966), The Typical Spectral Shape of an Economic Variable, *Econometrica*, 34 (1), 150–161

Question C

Present an economic issue, one or more theoretical hypotheses, or discuss a broader topic that interest you, and write a draft of a short paper that includes empirical econometric results or examples. You can have in mind that the paper should demonstrate your competent use of (one of) the methods that we have worked with during the course.

Regarding question B and C. Estimation results can be pasted from a result window and into your document. You do not need to use time to typeset tables. The same applies to figures: Graphs should be easy to read and should be provided with a caption (figure text), but need not have “publishing quality”. It is important that your own empirical results are easy to reproduce from the data set that you submit, and by reading the variable definitions and the explanation of data transformations that you should give. You may find that documentation in the form of a batch file is efficient, although this is not required.