C | A | U Christian-Albrechts-Universität zu Kiel | Wirtschafts- und Sozialwissenschaftliche Fakultät

Exam for the lecture

# "Econometrics II"

for students in the M.Sc. programmes

summer term 2018

16.07.2018

Please fill in using block letters:

**Seat location:**

| | | |
|---|---|---|
| Name:<br>*Surname* | | Vornasme:<br>*Name* |
| Studiengang<br>*Course of study:* | | Geburtsort:<br>*Place of birth* |
| Matrikelnummer:<br>*Student ID* | | Bachelor<br>University: |

**Declaration:**

| PLEASE SIGN!!! |
|---|
| I hereby declare that I am able to be examined.<br><br>Signature: |

**Preliminary remarks:**

- Write down your name and enrolment/matriculation number on all paper sheets provided for answers by the examiner.
- To write down your answers, use only the paper provided by the examiner.

**Result: (TO BE FILLED IN ONLY BY THE EXAMINER!)**

| Problem | 1 | 2 | 3 | 4 | 5 | Home Assignment | Σ |
|---|---|---|---|---|---|---|---|
| Points earned | | | | | | | |
| Grade | | | | | | | |

Kiel,

Professor Dr. Jens Boysen-Hogrefe

Prof. Dr. Jens Boysen-Hogrefe

# Examination in Econometrics II

## (Summer Term 2018)

July 16, 2018 , 8.30 - 9.30

Preliminary remarks:

1. Please read these instructions carefully!
2. At the beginning of the exam, fill in the cover sheet and hand in after the exam is finished!
3. You are permitted to use the following auxiliary tools:
   (a) a non–programable pocket calculator,
   (b) **the formulary for Econometrics II without notes!**
4. **Conduct each test at the 5% level**.
5. Write your name and enrolment (matriculation) number on every sheet of paper!
6. Don't use a pencil!
7. The exam problems are printed on 2 pages plus 2 double sheets for answers. Check your exam for completeness!
8. Round your solutions to 4 decimal places.
9. You have 60 minutes in total to answer the exam questions.

Good luck!

## Part 1 - Time Series (41 credits)

1. Consider the ADL model $a(L)y_t = \mu + b(L)x_t + \varepsilon_t$ with lag orders $p = 3$ and $q = 3$.
   (a) (**6P**) Find $\frac{\partial \mathrm{E}(y_t|y_{t-1},y_{t-2},\ldots;x_t,x_{t-1},\ldots)}{\partial x_{t-2}}$ and $\frac{\partial \mathrm{E}(y_t|x_t,x_{t-1},\ldots)}{\partial x_{t-2}}$.
   (b) (**4P**) Find the long-run impact parameter of $x$ on $y$.
   (c) (**5P**) Briefly explain the usage of information criteria to select. Using the AIC as an example, describe in a few sentences the trade-off they try to balance.

2. You are given the following time series regression results for the model $y_t = \mu + \alpha y_{t-1} + \epsilon_t$, where $\epsilon_t$ is assumed to be iid with $E(\epsilon_t) = 0$ and $Var(\epsilon_t) = \sigma^2$:

Model 1: OLS, using observations 1960:2–2017:3 ($T = 230$)
Dependent variable: $y_t$
HAC standard errors, bandwidth 4 (Bartlett kernel)

| | Coefficient | Std. Error | $t$-ratio | p-value |
|---|---|---|---|---|
| const | 0.818698 | 0.129018 | 6.346 | 0.0000 |
| $y_{t-1}$ | 0.657092 | 0.0491173 | 13.38 | 0.0000 |

| | | | |
|---|---|---|---|
| Mean dependent var | 2.391305 | S.D. dependent var | 1.366490 |
| Sum squared resid | 243.4168 | S.E. of regression | 1.033256 |
| $R^2$ | 0.430751 | Adjusted $R^2$ | 0.428254 |
| $F(1, 228)$ | 178.9712 | P-value($F$) | 1.63e–30 |
| Log-likelihood | −332.8759 | Akaike criterion | 669.7518 |
| Schwarz criterion | 676.6280 | Hannan–Quinn | 672.5255 |
| $\hat{\rho}$ | 0.007957 | Durbin's $h$ | 0.180877 |

   (a) (**6P**) From these estimation results derive and estimate the (unconditional) mean of $y_t$. To this end, make and justify an appropriate assumption concerning the properties of $y_t$.
   (b) (**3P**) Calculate the average effect of a shock of size 1 in t on $y_{t+2}$ given your estimation results. How does the effect of the shock evolve over time?
   (c) (**5P**) Suppose an LM test for autocorrelation clearly indicates first order autocorrelation of your residuals. Therefore you set up the following model 2:

$$y_t = \mu + \alpha y_{t-1} + e_t \qquad\qquad e_t = \phi e_{t-1} + u_t,$$

   where $u_t$ is iid white noise. Assuming this is the correct model, what does this mean for your previous estimation results of model 1? How can you rearrange model 2 to obtain an equation that is consistently estimable by OLS? Show it step by step!

3. You estimated the model $y_t = \rho y_{t-1} + u_t$ by OLS and received the following estimates (T=500):

$$\hat{\rho} = 0.962 \qquad SE(\hat{\rho}) = 0.0125 \qquad \hat{\sigma}_u^2 = 1.371$$

The autocovariances of $\hat{u}_t$ are estimated as

$$\hat{\gamma}_0 = 0.856 \qquad \hat{\gamma}_1 = 0.564 \qquad \hat{\gamma}_2 = -0.257$$

Note that those autocovariances are significant and autocovariances higher than order 2 are not.

(**12P**) Estimate the long-run variance of $u_t$ and perform a Phillips-Perron test at the 5% level. Carefully state the null and alternative hypothesis, find the test statistic and describe your test decision.
(If you are not able to estimate a long-run variance, take 1.564.)

## <u>Part 2 - Cross Section</u> (19 credits)

4. Consider a random sample of size $N$ from the geometric distribution

$$f(y) = \theta(1-\theta)^y, \qquad 0<\theta<1, y \in \{0, 1, 2, ...\}.$$

Recall that $\mathrm{E}(y) = \frac{1-\theta}{\theta}$ and $\mathrm{Var}(y) = \frac{1-\theta}{\theta^2}$.

(a) (**2P**) Write down the log likelihood function.

(b) (**4P**) Find the ML estimator of $\theta$.

(c) (**2P**) Show that the ML estimator of $\theta$ is consistent.

(d) (**2P**) Find the Hessian with respect to $\theta$.

(e) (**4P**) Find the asymptotic distribution of the ML estimator assuming that the CIME holds.

5. (**5P**) For the model $y = x\beta + u$ explain in a few sentences why OLS is a special case of GMM estimation. Futhermore shortly explain whether the special case OLS is exactly or overidentified.