Prof. Dr. Kai Carstensen
Chair of Econometrics

Examination in Econometrics II

Summer Term 2020

October 20, 2020, 12:00

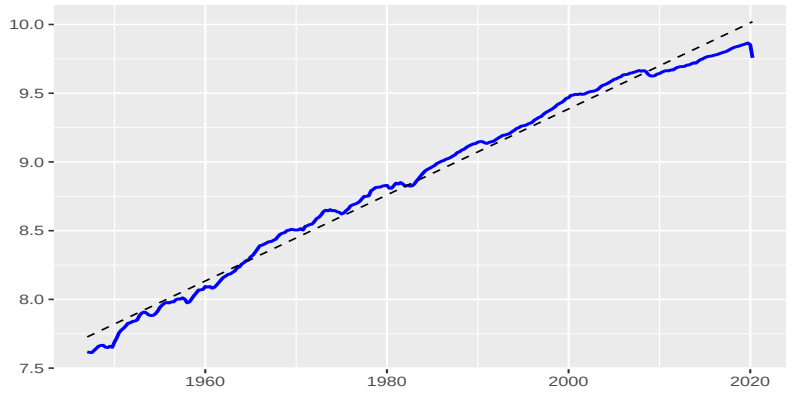
Preliminary remarks:

1. Please read these instructions carefully!
2. You have to solve all questions on your own!
3. Conduct each test at the 5% level.
4. Write your name and enrolment (matriculation) number on every sheet of paper!
5. Don't use a pencil!
6. The exam is composed by 3 problems. Check your exam for completeness!
7. Round your solutions to 4 decimal places.
8. You have 60 minutes in total to answer the questions.

Good luck!

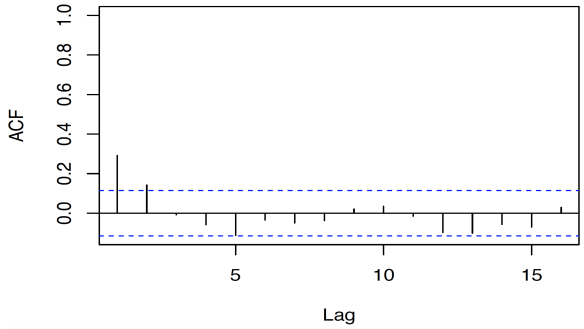
Question A (22 credits)

Consider the following time series of U.S. real GDP (given in logs) and its fitted linear trend:



1. (**5P**) Assume U.S. real GDP is difference stationary. Describe what will probably happen to the time series after the huge negative shock in 2020Q2.

2. The OLS regression $y_t = \rho y_{t-1} + u_t$, where y_t denotes U.S. real GDP (in logs), yielded the following autocorrelogram (ACF) of OLS residuals $\hat{u}_t$:



   (i) (**5P**) Explain why is a Dickey-Fuller unit root test not appropriate here. Describe which alternatives can be used instead.

   (iii) (**5P**) Which pair of ADF hypotheses (with/out intercept and trend) are more appropriate for the U.S. real GDP data? Briefly explain your answer.

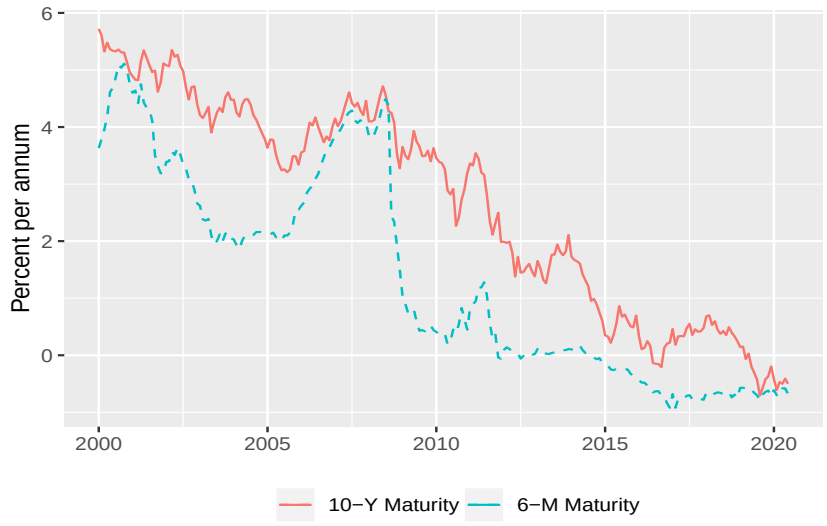
3. (**7P**) Perform an ADF test based on the following ADF regression:

$$\Delta y_t = \underset{(0.0687)}{0.0084} - \underset{(0.00007)}{0.00001}\, t - \underset{(0.00892)}{0.00022}\, y_{t-1} - \underset{(0.0698)}{0.3788}\, \Delta y_{t-1} + \underset{(0.0703)}{0.0720}\, \Delta y_{t-2},$$

   where $\Delta y_t = \hat{y}_t - y_{t-1}$, standard errors are given in parenthesis and sample size $T = 293$. Carefully state the null and alternative hypotheses, perform the test and interpret your results at the 5% level.

Question B (16 credits)

Consider the following plot which displays time series of 6-month (short-term) and 10-year maturity (long-term) interest rates of german bonds:



1. (**5P**) Explain why the plot suggests a cointegration relationship between long-term (Y_t) and short-term german interest rates (X_t).

   The OLS regression of Y_t on X_t delivers the following results:

OLS: using observations 2000:1 - 2020:6 (T = 246)				
	Coefficient	Std. Error	t-ratio	p-value
intercept	1.4193	0.0629	22.55	0.000
X_t	0.9187	0.0276	33.20	0.000

Residual std. error	0.7946	Log-likelihood	-291.4861
R^2	0.8187	Adjusted R^2	0.818
F-statistic(1,244)	1102	P-value (F)	$< 2.2e-16$
Akaike criterion	588.9721	Schwarz criterion	599.4881
$\hat{\rho}$	0.9559	Durbin-Watson	0.0712

2. (**4P**) Which potential problem might emerge from the OLS regression of Y_t on X_t? How would you identify it?

3. (**5P**) Based on the regression output, can you trust the point estimate? Explain.

4. (**2P**) Assume Y_t and X_t are cointegrated. How would you interpret the point estimate?

Question C (22 credits)

Consider a logit model $\mathrm{E}(y_i|x_i) = \Lambda(\mathbf{x}_i\boldsymbol{\theta})$ with $\Lambda(z) = \exp(z)/(1+\exp(z))$.

1. (**5P**) Derive the partial effect a continuous regressor $\mathbf{x}_{ik}$ has on y_i and interpret the expression.

2. (**4P**) Describe the difference between partial effect of the average (PEA) and average partial effect (APE).

   Consider the logit model to assess main risk factors for predicting mortality in patients with COVID-19. The regression output is as follows:

Logit Regression: 119 observations				
Dependent Variable: death (=1 if deceased, =0 if recovered)				
	Coefficient	Std. Error	z	p-value
const	-54.2380	17.6300	-3.08	0.002
gender	-0.2722	.4599	-0.59	0.554
age	1.4067	.4627	3.04	0.002
cough	0.2339	.4781	0.49	0.625
dyspnoea	2.1889	.7374	2.97	0.003
fever	-1.0926	.6011	-1.82	0.069
lethargy	0.1021	.6696	0.15	0.879
chest_pain	1.3060	.9705	1.35	0.178
$R^2 = 0.28$			Log-likelihood =	-60.1444

Partial Effect of the Average, PEA				
	dy/dx	Std. Error	z	p-value
dyspnoea	0.4437	.1169	3.79	0.000

3. (**5P**) Discuss the statistical significance of the 0-1 dummy variables *dyspnoea* (1 = patient suffers from shortness of breath, 0 = otherwise), *cough* (1 = patient suffers from cough, 0 = otherwise) and *chest pain* (1 = patient suffers from chest pain, 0 = otherwise). What can be said about their clinical relevance?

4. (**3P**) Interpret PEA results for *dyspnoea*.

5. (**5P**) Consider the restricted model without the regressors $fever$ and *cough*, which delivers a log-likelihood value of -61.8944. Perform a likelihood ratio test to find out whether $fever$ and *cough* are jointly risk factors for COVID-19 mortality. Interpret your test results!
   ($Hint$: use the critical value $\chi^2_{2,0.05} = 5.99$).