



Department of Economics

Course name: Econometrics 1
Course code: EC7410

Examiner: Björn Tyrefors Hinnerich
Number of credits: 7,5 credits
Date of exam: 2016-02-14
Examination time: 3 hours 13:00-16:00

Write your identification number on each paper and cover sheet (the number stated in the upper right hand corner on your exam cover).

Use one cover sheet per question. Explain notions/concepts and symbols. If you think that a question is vaguely formulated, specify the conditions used for solving it. Only legible exams will be marked. **No aids are allowed.**

The exam consists of 5 questions. Each question is worth 20 points, 100 points in total. For the grade E 40 points are required, for D 50 points, C 60 points, B 75 points and A 90 points.

Your results will be made available on your "My Studies" account (www.mitt.su.se) on 2016-03-04 at the latest.

Good luck!

Question 1.

- (a) Describe in words and mathematically the Conditional Distribution of a R.V (random variable) Y .
- (b) Describe in words and mathematically the concept of independence between two random variables
- (c) Prove the Law of iterated expectations

Question 2

Show that the sample mean is

- (a) unbiased
- (b) consistent (you do not need to prove Chebychev's inequality)
- (c) the "least squares estimator of the true mean"

Moreover derive the

- (d) variance of the sample mean and discuss efficiency.

Question 3.

Say that we are interested in the effect of X_{i1} on Y_i . We specify the following equation:

$$Y_i = \beta_0 + \beta_1 X_{i1} + u_i$$

- (a) Derive the omitted variable bias (X_{i2} omitted). Give two cases when there is no bias?

Next, we control for X_{i2} , i.e., specifying the equation in the following way

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \varepsilon_i$$

- (b) Is there a weaker assumption than conditional mean zero assumption in which we can consistently estimate β_1 ? If yes, state this assumption and give an intuition of this assumption.

Question 4.

We are interested in estimating the gender wage gap and specify the following equation:

$$Wage_i = \beta_0 + \beta_1 Female_i + u_i$$

where $Wage$ is the hourly wage rate expressed in SEK and $Female$ is a dummy variable taking the value 1 if the individual is a female and 0 otherwise.

We base our estimation on a sample of 40 observations where 20 are females. The sum of all wages is equal to 4,000 and the sum of all female wages equal to 1,500.

- (a) Calculate the following matrices: $X'X$, $(X'X)^{-1}$ and $X'Y$
- (b) Explain what is meant by the matrix X having full column rank
- (c) Also get the estimated coefficient vector. What is the average male wage? How large is the gender wage gap?
- (d) The estimated regressions error, i.e., $s^2 = 250$. Calculate the t-statistics for the test whether the regression coefficient of the female dummy is zero.

Question 5.

- (a) Describe the assumptions required for estimating a dynamic causal effect with exogenous regressors using OLS.
- (b) Discuss the two major causes of non-stationarity and relevant tests in order to detect these threats in a standard AR(1) forecasting model.