Stockholm University

Department of Economics

Course name:	**Econometrics 1**
Course code:	**EC7410**
Examiner:	**Björn Tyrefors Hinnerich**
Number of credits:	**7,5 credits**
Date of exam:	**Thursday 7 January 2016**
Examination time:	**3 hours [09:00-12:00]**

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 45 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 28 January at the latest.

Good luck!

Question 1.

(a) Describe in words and mathematically the probability distribution for a discrete RV (random variable).

(b) Describe in words and mathematically the cumulative probability distribution or cumulative distribution function for a discrete RV.

(c) What would be the 2 equivalent distributions as in (a) and (b) for a continues RV? Describe in words and mathematically.

(d) Describe in words and mathematically how these two distributions are related for a continues RV

Question 2

(a) Chebychev's inequality states that for a random variable V and a positive constant δ, then $\Pr(|V - \mu_V| \geq \delta) \leq \frac{Var(V)}{\delta^2}$. Prove Chebychev's inequality.

(b) State the central limit theorem and prove that a standard t-statistic used to test a null hypothesis of the form H_0: $E(Y) = \mu_{Y,0}$ is approximately normally distributed.

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: $\boldsymbol{X'X}$, $(\boldsymbol{X'X})^{-1}$ and $\boldsymbol{X'Y}$

(b) Explain what is meant by the matrix $\boldsymbol{X}$ 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. How do you specify define the dynamic multipliers and cumulative dynamic multipliers in a regression model?

(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.