UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Exam: ECON3150/4150 – Introductory Econometrics

Date of exam: Tuesday, May 13, 2014 **Grades will be given: June 4, 2014**

Time for exam: 09.00 a.m. – 12.00 noon

The problem set covers 5 pages (incl. cover sheet)

Resources allowed:

- Open book exam, where all written and printed resources, as well as calculator, are allowed

The grades given: A-F, with A as the best and E as the weakest passing grade. F is fail.

Exam ECON4150: Introductory Econometrics.
May 13; 09:00h-12.00h.

This is an open book examination where all printed and written resources, in addition to a calculator, are allowed. If you are asked to derive something, give all intermediate steps. Do not answer questions with a "yes" or "no" only, but carefully motivate your answer. In the grading, questions 1 and 2 will together count for 2/3 and questions 3 and 4 will together count for 1/3.

Question 1

The government of a developing country wants to implement a program where poor families receive food stamps that can be used to purchase prepackaged foods with high nutritional value. The government decides to set up an experiment where 500 families (each with 1 child) are randomly assigned to a treatment group (eligible for food stamps, $T_i = 1$) and to a control group (ineligible for food stamps, $T_i = 0$). The government has hired a researcher to investigate the effect of food stamps on the probability that a child has poor health.

After the experiment the researcher performs a regression of H_i (a binary variable that equals 1 if a child has poor health) on F_i (a binary variable that equals 1 if a family received food stamps). She obtains the following OLS estimation results.

```
. regress H F, robust

Linear regression                               Number of obs =         500
                                                F(  1,   498) =       20.08
                                                Prob > F      =      0.0000
                                                R-squared     =      0.0375
                                                Root MSE      =      .49141
```

H	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
F	-.2090787	.0466629	-4.48	0.000	-.3007592	-.1173983
_cons	.6538462	.0381663	17.13	0.000	.5788593	.728833

a) Interpret the two estimated coefficients.

b) The researcher finds out that some of the families in the control group received food stamps. Explain whether we can interpret the estimated OLS coefficient on F as the causal effect of food stamps on child health?

The researcher decides to estimate the effect of food stamps using an instrumental variable approach. She uses assignment to the treatment group as instrument for the actual receipt of food stamps. She obtains the following first stage estimation results.

```
. regress F T, robust noheader
```

F	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
T	**.624**	**.0306963**	**20.33**	**0.000**	**.5636897**	**.6843103**
_cons	**.376**	**.0306963**	**12.25**	**0.000**	**.3156897**	**.4363103**

c) Do you think that the instrument relevance condition holds? Is T a weak instrument?

d) Do you think that the instrument exogeneity condition holds?

e) The following table shows the averages of H_i and F_i for those assigned to treatment group ($T_i = 1$) and for those assigned to the control group ($T_i = 1$). Use the results in the table below to obtain the instrumental variable estimate of the effect of food stamps on the probability that a child has poor health.

	$T_i = 1$	$T_i = 0$
$\widehat{E}\left[H_i \middle\| T_i = x\right]$	0.476	0.544
$\widehat{E}\left[F_i \middle\| T_i = x\right]$	1	0.376

Question 2

The Norwegian government wants to know whether restricting the opening hours of liquor stores reduces alcohol consumption. Holger, an employee of Statistics Norway, is asked to investigate this research question. He uses panel data for $n = 60$ municipalities observed in $T = 10$ time periods. The data set contains information on per capita alcohol consumption (in liters per year) in municipality i in year t ($alcohol_{it}$) and on the number of hours that liquor stores were open during year t in municipality i ($hours_{it}$). Holger estimates

$$alcohol_{it} = \beta_0 + \beta_1 ln(hours_{it}) + u_{it}$$

by OLS and obtains the following estimation results.

```
. regress alcohol lnhours, robust

Linear regression                               Number of obs =        600
                                                [redacted]
                                                R-squared     =     0.0745
                                                Root MSE      =     .9568
```

alcohol	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
lnhours	**5.288235**	**.7486464**	[redacted]	[redacted]	[redacted]	[redacted]
_cons	**2.768777**	**5.686286**	**0.49**	**0.626**	**-8.398742**	**13.9363**

a) Test the null hypothesis that $\beta_1 = 0$ at a 1% significance level.

b) Use the above estimation results to predict the change in alcohol consumption if the opening hours of liquor stores are reduced by 20 percent.

c) Marit, Holger's colleague, suggests to augment the model with municipality fixed effects (α_i)

$$alcohol_{it} = \beta_0 + \beta_1 ln(hours_{it}) + \alpha_i + u_{it} \quad (1)$$

Explain how you could estimate model (1).

d) Holger decides to estimate a model that includes both municipality and year fixed effects. Both Holger and Marit are confident that by including municipality and year fixed effects the estimated coefficient on $ln(hours_{it})$ cannot suffer from omitted variable bias problems. Do you agree with Holger and Marit?

Question 3

Discuss whether each of the following statements is correct or not.

a) A high R^2 implies no omitted variables bias.

b) A high p-value indicates that we cannot reject the null hypothesis.

c) In a regression model with no explanatory variables the R^2 is equal to 0.

d) If a variable follows a random walk with drift, the best forecast of the variable tomorrow is the value of the variable today.

Question 4

Consider a labour market with a labour supply function $L_i^s = \beta_0 + \beta_1 W_i + \varepsilon_i^s$ and a labour demand fuction $L_i^d = \gamma_0 + \varepsilon_i^d$ and a market equilibrium condition $L_i^s = L_i^d$. In addition $E[\varepsilon_i^s] = E[\varepsilon_i^d] = 0$ and $Cov(\varepsilon_i^s, \varepsilon_i^d) = 0$.

a) Show that $Cov(W_i, \varepsilon_i^s) \neq 0$.

b) Show that the OLS estimator of β_1 is inconsistent.