Question 1.

In 1990, the Norwegian parliament decided to introduce a package of policies, implemented from 1991 ("Tiltakspakken") to improve conditions of living and to increase the number of people in the work force and their competence in municipalities in Finnmark and Nord-Troms, hereafter denoted "Tiltakssonen". One of the elements was to introduce more favorable conditions for repayment of student loans for individuals living in "Tiltakssonen". According to the rules, up to ten percent of a person's study loan could be written off, up to a maximum of NOK 25,000, every year for a person who have lived and worked in municipalities in Finnmark or selected municipalities in Nord-Troms for one year. The Ministry of Local Governments wants to evaluate the effects of this debt reduction policy and hires you to conduct the evaluation. The ministry makes two samples available for the evaluation, one for 1987 and one for 1993 for inhabitants 25-66 years old. The samples contain register information on number of hours worked for the individuals. The geographical location is represented by a dummy ***Tiltakssonen*** equal to 1 if the individual lives in a municipality in "Tiltakssonen" and 0 otherwise. ***d1993*** is a dummy variable equal to 1 if the observation is from the 1993 sample, and 0 if it is from the 1987 sample. In an introductory meeting, the ministry gives you the following information:

Table 1. Deskriptive statistics.

	Individuals in "Tiltakssonen" ***Tiltakssonen* = 1**	Individuals not in "Tiltakssonen" ***Tiltakssonen* = 0**
Average hours worked per individual 1987, ***d1993=0***	800	1100
Average hours worked per individual 1993, ***d1993=1***	890	1130

a) Use the information in Table 1 to estimate the effect of the debt reduction policy implemented in "Tiltakssonen" from 1991 on.

b) The Ministry wants you to obtain confidence intervals around the estimated policy effect. Formulate an econometric model containing the variables above and explain how the policy effect in a) can be estimated in this model and explain how you can construct confidence intervals asked for by the ministry.

c) The Ministry suggests that your result may reflect that those living in "Tiltakssonen" differs systematically from the rest of the country in terms of age and basic education. The data set contains individual age as represented by the variable ***Age*** while basic education is represented by a dummy variable ***Complete*** equal to 1 if the person has completed upper secondary school, 0 otherwise. Explain how you would extend your empirical approach to account for the suggestions from the Ministry.

d) The Ministry also suggests that you take into account that the debt reduction policy in "Tiltakssonen" only affected individuals with higher education. You have information whether the individuals have higher education or not with a dummy variable ***High*** equal to 1 if the individual has higher education, and 0 if not. Explain how you can reformulate the model in b) to take this information into account when evaluating the policy effect.

Question 2.

We consider a cross section sample of married couples where both wives and husbands work. The dependent variable is the natural logarithm of annual family income, ***lfaminc***, defined as the logarithm of the total income of husband and wife. We are interested in the impact of level of education, both the husband's education, ***hedu***, and the wife's education, ***wedu***, both measured in number of years of completed education. Table 2 shows the correlation matrix for these variables.

Table 2. Correlation matrix for variables.

	lfaminc	***hedu***	***wedu***
lfaminc	1.000		
hedu	0.386	1.000	
wedu	0.349	0.594	1.000

Table 3 presents the estimation results from different version of the family income equation estimated by OLS.

a) What does the estimated coefficients in column (1) tell you about the quantitative relationship between family income and husband and wife's education? Explain.
b) Why does the estimated impact of husband's education differ between column (1) and (2)? Explain.
c) In column (3), the variable ***wedu*** is replaced by the variable ***edutot*** which is the sum of ***wedu*** and ***hedu***. Interpret and explain the estimated coefficients in column (3).
d) A commentator wants you to test the hypothesis that husband and wife's education has the same impact on family income. Perform a test of the hypothesis. What is your conclusion? Explain.
e) In column (4) the number of kids in the family less than 6 years old, ***kl6***, is added to the model. What is the quantitative effect of ***kl6*** on family income? What happens to the impact of husband and wife's education on family income when this variable is included?
f) Table 4 reports results from a regression between ***lfaminc***, ***hedu***, ***wedu***, and the squared and cubes of predicted dependent variable, $\boldsymbol{\widehat{lfaminc}^2}$ and $\boldsymbol{\widehat{lfaminc}^3}$ based on column (1) in Table 3. Explain how you can use these results to test whether the model estimated in column (1) in Table 3 is a correct specification. Conduct the test and report and interpret the results.
g) A student makes the following statement: "Exploiting data for the same families (couples) for more than one period would reduce omitted variable problems when estimating the impact of husband and wife's education on family income". Discuss this statement.

Table 3. Estimation results. Standard errors in parentheses

VARIABLES	(1) lfaminc	(2) lfaminc	(3) lfaminc	(4) lfaminc
hedu	0.0439	0.0613	0.0048	0.0448
	(0.0087)	(0.0071)	(0.0182)	(0.0086)
wedu	0.0390			0.0421
	(0.0116)			(0.0115)
edutot			0.0390	
			(0.0116)	
kl6				-0.1733
				(0.0542)
Constant	10.2647	10.5385	10.2647	10.2378
	(0.1220)	(0.0921)	(0.1220)	(0.1210)
Observations	428	428	428	428
R-squared	0.171	0.149	0.171	0.191

Table 4. Regression results. Standard errors in parentheses.

VARIABLES	lfaminc
hedu	-46.4957
	(27.1151)
wedu	-41.3778
	(24.1288)
$\widehat{lfaminc}^2$	93.8980
	(54.9372)
$\widehat{lfaminc}^3$	-2.7688
	(1.6268)
Constant	-6,885.9499
	(4,027.6345)
Observations	428
R-squared	0.179