Examen de Introducción a la Econometría (Grupo Bilingüe)

Universidad Carlos III de Madrid

1^a Convocatoria

Curso 2005/2006

Conteste las preguntas siguientes en caudernillos separados en 2 horas y media

1. **[2 points]** Let U, X and Y be three discrete variables such that $Y = X + U$. The following table shows the joint probability function for X and U:

	$U=-7$	$U=3$
$X=5$	0.2	0.3
$X=15$	0.1	0.4

a. **[0.75 points]** Obtain the following population moments: $E(X)$, $E(U)$, $Cov(X,U)$, $Var(X)$, $Var(U)$, $E(Y)$, $Var(Y)$ and $Cov(X,Y)$.

b. **[0.75 points]** Compute the Best Linear Predictor of Y given X. That is to say, compute the value for a and b in $OLP(Y|X) = a + bX$ and get the predicted value for Y as a function of X according to the expression. Show that in this case the best predictor is linear, $E(Y|X) = OLP(Y|X)$.

c. **[0.5 points]** Obtain $E(X|Y)$.

2. **[3 points]** Consider the linear model

$$\log(price) = \delta_0 + \delta_1 age + u$$

where *price* is house prices in a borough and *age* is the age of the house (in years). OLS estimates are obtained using a sample of 321 dwellings.

a. **[1 points]** If the confidence interval at the 95% confidence level for δ_1 is $(-0,0067524, -0,0040476)$, what is the OLS estimate for δ_1? How should you interpret the coefficient estimate? Is the variable *age* significant at the 5% level? and at the 1%?

b. **[0.5 points]** If the sample standard deviation for *age* is equal to 32.51507343, what is the sample covariance for $log(price)$ and *age*?

c. **[1 point]** The R^2 of the OLS estimation is 0.161051 Economy theory suggests that the variable *rooms* (number of rooms per dwelling) should also be incorporated as an explanatory variable in the equation. If a new equation both with *age* and with *rooms* is run, its R^2 is 0.385150.Can we reject the null hypothesis that *rooms* is not significantly different from zero?

d. **[0.5 points]** If we fit the variable *rooms* with *age* we get:

Dependent Variable: ROOMS
Method: Least Squares
Sample: 1 321
Included observations: 321

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGE	-0.001417			
C	6.611182			

F-statistic	0.838128
Prob(F-statistic)	0.360624

Can we reject the null that the slope for *age* is the same in the "short" and the "long" models?

3. [3 points] Firms can obtain financial resources by issuing shares (own funds) or by issuing bonds (debt). A certain economic theory states that the debt to own funds ratio, 100∗Debt/(Own Funds) , will depend on the tax rates that the firm faces. In particular, *ceteris paribus*,

- the higher profit taxes are, the higher the debt to own funds ratio will be.
- the higher taxes on capital earnings are, the higher the debt to own funds ratio will be.
- the higher taxes on income are, the lower the debt to own funds ratio will be.

You have data from 51 US states with information on tax rates on profits, $tprof$, on taxes on capital earnings, $tcap$, and on taxes on income, $tinc$; in addition, you know the average at state level of the debt to own funds ratio, $debrat$. All variables are measured in percentage points. OLS estimations with the sample give the following results:

$$\widehat{debrat}_i = \underset{(9,8700)}{69,3662} + \underset{(1,0607)}{1,6223}\ tprof_i - \underset{(0,7028)}{1,1214}\ tinc_i + \underset{(1,3427)}{1,0777}\ tcap_i \quad (1)$$
$$n = 51 \quad R^2 = 0,350553 \quad SSR = 7328,5176$$

$$\widehat{(debrat_i - tcap_i)} = \underset{(4,8050)}{81,7726} + \underset{(0,9749)}{0,9886}\ (tprof_i - tcap_i) - \underset{(0,4201)}{0,3085}\ (tinc_i - tcap_i) \quad (2)$$
$$n = 51 \quad R^2 = 0,063316 \quad SSR = 7649,2574$$

$$\widehat{debrat}_i = \underset{(9,6765)}{69,4269} + \underset{(0,3989)}{1,5778}\ tprof_i - \underset{(0,6680)}{1,1302}\ (tinc_i - tcap_i) \quad (3)$$
$$n = 51 \quad R^2 = 0,350524 \quad SSR = 7328,8376$$

$$\widehat{debrat}_i = \underset{(9,8700)}{69,3662} + \underset{(1,0607)}{1,6223}\ tprof_i - \underset{(0,7028)}{1,1214}\ (tinc_i - tcap_i) - \underset{(0,9651)}{0,0437}\ tcap_i \quad (4)$$
$$n = 51 \quad R^2 = 0,350553 \quad SSR = 7328,5176$$

a. [1 point] Looking at the results for Model (1), would firms have more debt than own funds in the absence of taxes? What would happen for the firms in a state where the tax on capital earnings is fixed at 15%, the income tax is 20%, and the profit tax is set at 30%?

b. [0.75 points] Test at the 1% significance level that, jointly, taxes matter in the financial decisions of the firms. Would you have a different result if you had performed individual tests at the same significance level? Why?

c. [0.75 points] Test at the 1% significance level that a 1 percentage point increase in all taxes will result in a 1 percentage point increase of the debt to own funds ratio, *ceteris paribus*. Use both the F and the t statistic for the test.

d. [0.5 points] For the results of Model (1), the variance-covariance matrix for the slope coefficients is

$$Var\begin{pmatrix} \widehat{\beta}_{tprof} \\ \widehat{\beta}_{tinc} \\ \widehat{\beta}_{tcap} \end{pmatrix} = \begin{pmatrix} 1,1251014 & -0,0399419 & -0,9069212 \\ -0,0399419 & 0,4939748 & -0,6826735 \\ -0,9069212 & -0,6826735 & 1,802722 \end{pmatrix}$$

A government announces a fiscal reform based on a reduction of the income tax of 5 percentage points and an increase of the capital earnings tax of 10 percentage points keeping the profits tax constant. Compute the confidence interval at the 90% for the expected change, on average, of the debt to own funds ratio. Do you think it likely, with a 90% confidence level, that this reform will result in a decrease of the ratio of 10 percentage points?

4. [2 points] Every year, the Office for Labor Statistics in the US carries out a survey to study the US labor market. Within the variables that can be defined using the information available in the survey we find the logarithm of the hourly nominal wage ($lwage$), the effective years in college education (in excess of 16.5 years) ($educa$), and a dummy variable that takes value 1 if worker is female ($female$). You have data for the year 2000 for workers with job experience of less than a year and university studies (that is to say, at least 16.5 years of education). In the sample, variable $educa$ only takes three values: 0, 1.5 and 3.5. In addition, a new variable is obtained interacting $educa$ and $female$, $edufem = educa * female$.
With the available data, the following regressions are run (standard errors in parenthesis):

Regression 1:

$$\widehat{lwage} = \underset{(.041913)}{2.676852} + \underset{(.0206192)}{0.1310272} educa$$
$$n = 501; \quad RSS = 97.342215946$$

Regression 2:

$$\widehat{lwage} = \underset{(.0287494)}{2.73752} + \underset{(.0590482)}{0.1874562} educa - \underset{(.080746)}{0.1217951} female - \underset{(.0828375)}{0.1090569} edufem$$
$$n = 501; \quad RSS = 94.649281968$$

a. [0.75 points] Interpret the value obtained for the coefficient associated to $educa$ in regression 1. Compute the exact wage differential, in percentage terms, between workers with 20 years of education (postgraduate studies) and workers with 16.5 years of education (3 year college degree).

b. [0.75 points] Interpret the value of the coefficient associated to $edufem$ in regression 2. Are differences by gender in the returns to higher education significant? Explain your answer.

c. [0.5 points] Show in detail how you would test that the returns to higher education for female workers are not linear.

VALORES CRÍTICOS:

$N(0,1)$
$\Pr(N(0,1) > 2,576) = 0,005$
$\Pr(N(0,1) > 2,326) = 0,01$
$\Pr(N(0,1) > 1,960) = 0,025$
$\Pr(N(0,1) > 1,645) = 0,05$
$\Pr(N(0,1) > 1,282) = 0,10$

$\chi^2_{(1)}$	$\chi^2_{(2)}$	$\chi^2_{(3)}$
$\Pr\left(\chi^2_{(1)} > 6,63\right) = 0,01$	$\Pr\left(\chi^2_{(2)} > 9,21\right) = 0,01$	$\Pr\left(\chi^2_{(3)} > 11,34\right) = 0,01$
$\Pr\left(\chi^2_{(1)} > 3,84\right) = 0,05$	$\Pr\left(\chi^2_{(2)} > 5,99\right) = 0,05$	$\Pr\left(\chi^2_{(3)} > 7,81\right) = 0,05$
$\Pr\left(\chi^2_{(1)} > 2,71\right) = 0,10$	$\Pr\left(\chi^2_{(2)} > 4,61\right) = 0,10$	$\Pr\left(\chi^2_{(3)} > 6,25\right) = 0,10$