UNIVERSIDAD CARLOS III DE MADRID
ECONOMETRÍA I
Curso 2004/05 (Grupo bilingüe)
EXAMEN FINAL (Convocatoria ordinaria)

7 de Febrero de 2005

TIEMPO: 2 HORAS 30 MINUTOS
TIME: 2 HOURS 30 MINUTES

Instrucciones:

- ANTES DE EMPEZAR A RESPONDER EL EXAMEN:
  BEFORE YOU START TO ANSWER THE EXAM:
  - Rellene sus datos personales en el **impreso de lectura óptica**, que será el único documento válido de respuesta. Recuerde que tiene que completar sus datos identificativos (Nombre y apellidos y DNI) tanto en letra como en las casillas correspondientes de lectura óptica.
    (Siga las instrucciones de la hoja adjunta).
    Fill in your personal data in the optical reading form, which will be the only valid answering document. Remember that you must complete all your identifiying data (name and surname(s), and DNI or Passport) both in letters and in the corresponding optical reading boxes.
  - Rellene, tanto en letra como en las correspondientes casillas de lectura óptica, el código de la asignatura y su grupo, de acuerdo con la siguiente tabla:
    Fill in, both in letters and in the corresponding optical reading boxes, the course code and your group, according with the following table:

TITULACION	**GRUPOS**					**CODIGO DE ASIGNATURA**
Economía	61	62	63	64	65*	10188
ADE	71	72	73	74	75*	10188
ADE (Colmenarejo)	71					10188
Sim. Eco-Dcho.	69					42020
Sim. ADE-Dcho.	77	78				43020
Sim. ADE-Dcho (Colmenarejo)	17					43020

*Grupos bilingües

- Compruebe que este cuadernillo tiene 5 problemas y que el cuestionario de preguntas tiene 40 preguntas numeradas correlativamente.
  Chcek that this document contains 5 Problems and that the questionnaire contains 40 questions sequentially numbered.

- **Compruebe que el número de tipo de examen que aparece en el cuestionario de preguntas coincide con el señalado en el impreso de lectura óptica.**
  Check that the number of exam type that appears in the questionnaire matches the number indicated in the optical reading form.

- Lea las preguntas detenidamente.
  Cuando una pregunta se refiera a uno de los problemas enunciados en el cuadernillo adjunto, el encabezado de la pregunta incluirá entre paréntesis el número de problema al que se refiere.
  Se recomienda leer atentamente el enunciado de cada problema **antes** de contestar las preguntas relacionadas.
  Read the questions carefully.
  Whenever a question is referred to any of the 5 Problems included in the enclosed document, the question will refer to the problem number within parentheses at the beginning of the question.
  It is advised to read carefully the text of each problem before answering its corresponding questions.

- Para la fila correspondiente al número de cada una de las preguntas, rellene la casilla correspondiente a la respuesta escogida en el impreso de lectura óptica (A, B, C ó D).
  For each row regarding the number of each question, fill the box which corresponds with your chosen option in the optical reading form (A, B, C or D).

- **Cada pregunta tiene una única respuesta correcta**.
  Cualquier pregunta en la que se seleccione más de una opción será considerada nula y su puntuación será cero.
  Each question only has one correct answer.
  Any question in which more than one answer is selected will be considered incorrect and its score will be zero.

- Todas las preguntas respondidas correctamente tienen idéntica puntuación. Las respuestas incorrectas tendrán una puntuación de cero. Para aprobar el examen hay que responder correctamente un mínimo de 24 preguntas.
  All the questions correctly answered has the same score. Any incorrect answer will score as zero. To pass the exam, you must correctly answer a minimum of 24 questions.

- Si lo desea, puede utilizar la plantilla de respuestas que aparece a continuación como borrador, si bien dicha plantilla carece por completo de validez oficial.
  If you want, you may use the answer table as a draft, although such table does not have any official validity.

- Puede utilizar el reverso de las hojas como borrador (no se facilitará más papel).
  You can use the back side of the sheets as a draft (no additional sheets will be handed out).

- Al final de este documento, se adjuntan tablas estadísticas.
  Statistical tables are enclosed at the end of the document.

- **Cualquier alumno que sea sorprendido hablando o intercambiando cualquier tipo de material en el examen será expulsado en el acto y su calificación será de cero, sin perjuicio de otras medidas que se puedan adoptar.**
  Any student who were found talking or sharing any sort of material during the exam will be expelled out inmediately and his/her overall score will be zero, independently of any other measure that could be undertaken.

- **Fechas de publicación de calificaciones:** Viernes 11 de febrero.
  Date of publication of scores: Friday, February, 11th.

- **Fecha de revisión:**
  Date of exam revision:

  - Martes, 15 de febrero a las 15 h en las AULAS 15.1.03 y 15.1.05
    Tuesday, February, 15th, at 15 h in classrooms 15.1.03 and 15.1.05.

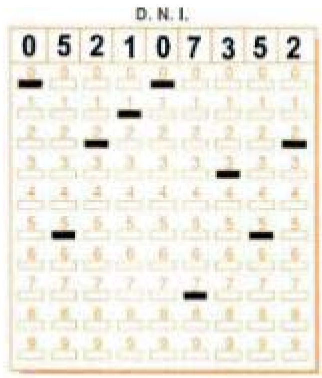
- **Normas para la revisión:**
  Rules for exam revision:

  - La revisión sólo tendrá por objeto comprobar el número de respuestas correctas del examen.
    Its only purpose will be to check that the number of correct answers is right.
  - Para tener derecho a revisión, el alumno deberá:
    To be entitled for revision, the student should:
    * **Solicitarlo por escrito**, apuntándose en la lista situada en el Tablón de Información del departamento de Economía (junto al despacho 15.2.22), indicando titulación y grupo.
      Apply in writing, enrolling in a list located in the Tablón de Información of the Department of Economics (close to room 15.2.22), establishing your grade and group.
    * **Acudir a la revisión con una copia impresa de las soluciones** del examen, que estarán disponibles en Aula Global a partir del miércoles 9 de febrero.
      Bring a printed copy of the exam solutions, which will be available in Aula Global from Wednesday, February, 9th.

CONFECCIÓN DEL EXAMEN

- **No** se debe **marcar** en las zonas ocupadas por **marcas negras** en la hoja de examen.
- **No arrugar** ni doblar las hojas de examen.
- El campo D.N.I. debe estar marcado en su totalidad, **incluyendo ceros** a la izquierda si el D.N.I. tiene un tamaño inferior al del campo. Es **muy importante incluir tantos ceros a la izquierda como sea necesario** para la correcta corrección de los exámenes.

  Por ejemplo, un alumno cuyo D.N.I.sea 52.107.352, debería rellenar el campo así:



  En cambio no será válido si lo rellena de alguna de estas formas:

  El campo D.N.I. se utiliza para comprobar la existencia del alumno en los grupos de clase.

- Se pueden tener hasta **10 tipos distintos de examen.** Para indicarlo se utiliza la **primera línea** de las dos existentes sobre el bloque de las respuestas en la hoja de exámenes. Todos los tipos de exámenes deberán tener el **mismo número de preguntas.**

- El **número máximo de preguntas** en el examen es de **100.** Cada pregunta puede tener **cuatro posibles respuestas y ninguna puede aparecer en blanco.**
- **No existe la posibilidad de corregir una contestación** con una marca especial,es necesario borrarla y marcar otra. Si el borrado no es bueno puede originar dobles marcas en la pregunta al leerla (se recomienda en caso de tener que corregir alguna marca, usar una hoja nueva).

Borrador de RESPUESTAS									
PREGUNTA	**(a)**	**(b)**	**(c)**	**(d)**	**PREGUNTA**	**(a)**	**(b)**	**(c)**	**(d)**
1.					**21.**				
2.					**22.**				
3.					**23.**				
4.					**24.**				
5.					**25.**				
6.					**26.**				
7.					**27.**				
8.					**28.**				
9.					**29.**				
10.					**30.**				
11.					**31.**				
12.					**32.**				
13.					**33.**				
14.					**34.**				
15.					**35.**				
16.					**36.**				
17.					**37.**				
18.					**38.**				
19.					**39.**				
20.					**40.**				

PROBLEMA 1: EFECTO DE LA EDUCACIÓN (EFFECT OF EDUCATION)

The usual wage equation that characterizes the return to education has the form

$$LW = \beta_0 + \beta_1 EDUC + \beta_2 EXP + \beta_3 ANT + \beta_4 CAP + \varepsilon, \qquad \text{(S.1)}$$

$$\begin{aligned} E\left(\varepsilon \mid EDUC, EXP, ANT, CAP\right) &= 0 \\ V\left(\varepsilon \mid EDUC, EXP, ANT, CAP\right) &= \sigma^2 \end{aligned}$$

wher:

LW = logarithm of the monthly wage (in thousand dollars);
$EDUC$ = completed years of education;
EXP = labour experience (in years);
ANT = tenure in last job (in years);
CAP = ability or capacity.

The expected effects of these four variables are positive.

Furthermore, we know that education and ability are positively correlated,

$$C(EDUC, CAP) > 0.$$

and that both experience (EXP) and tenure (ANT) **are not correlated with** education ($EDUC$) and ability (CAP).

However, ability is unobservable, so that the model that can actually be estimated is

$$LW = \delta_0 + \delta_1 EDUC + \delta_2 EXP + \delta_3 ANT + u \qquad \text{(S.2)}.$$

Nevertheless, there remains the possibility of using an imperfect measure of ability. An available measure in our sample is the individual's intelligence quofficient (IQ), which even though is positively correlated with ability, differs from ability accordingly with the following expression:

$$IQ = CAP + \xi,$$

where ξ denotes the measurement error associated with the use of IQ instead of CAP. (IQ is an index number with 100 denoting the "normal" intelligence level, so that IQ can be above or below 100).

Besides the variables mentioned above, the following variables (uncorrelated with ξ and ε) are also available:

$EDUCMAD$ = mother's years of education;

KWW = score attained by the individual in a global knowledge test;
$EDAD$ = age (in years).

Using 758 observations, we have obtained the following estimates:

SALIDA 1				
Dependent Variable: *LW*				
Method: Least Squares				
Sample: 1 758				
Included observations: 758				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.5135	0.1205	45.76	0.000
$EDUC$	0.0705	0.0070	10.75	0.000
EXP	0.0202	0.0038	5.26	0.000
ANT	0.0073	0.0029	2.56	0.011
R-squared		0.1485		
Adjusted R-squared		0.1451		
S.E. of regression		0.3790		
Sum squared resid		108.32		

SALIDA 2				
Dependent Variable: *LW*				
Method: Least Squares				
Sample: 1 758				
Included observations: 758				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.2686	0.1391	37.87	0.000
IQ	0.0040	0.0012	3.45	0.001
$EDUC$	0.0624	0.0078	7.95	0.000
EXP	0.0204	0.0038	5.35	0.000
ANT	0.0069	0.0028	2.44	0.015
R-squared		0.1617		
Adjusted R-squared		0.1572		
S.E. of regression		0.3763		
Sum squared resid		106.64		

SALIDA 3				
Dependent Variable: IQ				
Method: Least Squares				
Sample: 1 758				
Included observations: 758				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	74.7950	5.2558	14.23	0.000
$EDUCMAD$	0.3393	0.1602	2.12	0.034
KWW	0.4702	0.0688	6.84	0.000
$EDAD$	−0.9243	0.1755	−5.27	0.000
$EDUC$	2.6301	0.2387	11.02	0.000
EXP	0.1607	0.1321	1.22	0.224
ANT	0.1075	0.0863	1.25	0.213
R-squared		0.3233		
Adjusted R-squared		0.3179		
S.E. of regression		11.248		
Sum squared resid		95010.45		
	W^0	64.04		

(**NOTE**: W^0 is the test of joint significance of $EDUCMAD$, KWW, $EDAD$)

SALIDA 4				
Dependent Variable: LW				
Method: Two-Stage Least Squares				
Sample: 1 758				
Included observations: 758				
Instrument list: $EDUCMAD$ KWW $EDAD$				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.6350	0.2945	15.74	0.000
IQ	0.0145	0.0044	3.30	0.001
$EDUC$	0.0296	0.0139	2.13	0.033
EXP	0.0208	0.0040	5.19	0.000
ANT	0.0059	0.0030	1.96	0.050
R-squared		0.0731		
Adjusted R-squared		0.0682		
S.E. of regression		0.3957		
Sum squared resid		117.91		

(**NOTA**: The endogenous explanatory variable in Salida 4 is IQ).

SALIDA 5				
Dependent Variable: *LW*				
Method: Least Squares				
Sample: 1 758				
Included observations: 758				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.6350	0.2790	16.61	0.000
IQ	0.0145	0.0042	3.48	0.001
$EDUC$	0.0296	0.0148	2.00	0.045
EXP	0.0208	0.0038	5.47	0.000
ANT	0.0059	0.0029	2.07	0.039
$RES3$	−0.0113	0.0043	−2.62	0.009
R-squared		0.1693		
Adjusted R-squared		0.1637		
S.E. of regression		0.3749		
Sum squared resid		105.67		

(**NOTE**: $RES3$ are the residuals from Salida 3)

PROBLEMA 2: DIFERENCIAS SALARIALES POR SEXO Y ORIGEN ÉTNICO (WAGE DIFFERENTIALS BY SEX AND ETHNIC ORIGIN)

Consider the linear regression model:

$$\begin{aligned} E(\ln SAL \mid EDUC, EXP, NEG, HISP, MUJER) &= \beta_0 + \beta_1 EDUC + \beta_2 EXP \\ &+\beta_3 NEG + \beta_4 HISP \\ &+\beta_5 MUJER \\ &+\beta_6 (EXP * MUJER) \end{aligned}$$

where the assumptions of the classical linear regression model hold.

Furthermore, the variables are defined as

SAL = individual's hourly wage (in euros);
$EDUC$ = individual's (completed) years of education;
EXP = individual's years of labour experience;
NEG = binary variable which equals 1 if individual is black and 0 otherwise;
$HISP$ = binary variable which equals 1 if individual is hispanic and 0 otherwise;
$MUJER$ = binary variable which equals 1 if individual is female and 0 otherwise.

There are only three possible ethnic groups: black, hispanic and white. Using data on 528 individuals, we have obtained the OLS estimates that appear in SALIDAS 1 and 2.

SALIDA 1

Dependent Variable: ln(SAL)
Method: Least Squares
Sample: 1 528
Included observations: 528

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.6101	0.1264	4.83	0.000
$EDUC$	0.0993	0.0082	12.15	0.000
EXP	0.0167	0.0023	7.23	0.000
NEG	−0.0844	0.0580	−1.45	0.146
$HISP$	−0.1109	0.0910	−1.22	0.224
$MUJER$	−0.1140	0.0684	−1.67	0.096
$EXP * MUJER$	−0.0082	0.0032	−2.59	0.010
R-squared		0.2977		
Adjusted R-squared		0.2896		
S.E. of regression		0.4393		
Sum squared resid		100.55		

SALIDA 2				
Dependent Variable: SAL				
Method: Least Squares				
Sample: 1 528				
Included observations: 528				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.4025	1.2457	-4.34	0.000
$EDUC$	0.9770	0.0813	11.98	0.000
EXP	0.1575	0.0230	6.84	0.000
$MUJER$	-0.7200	0.6836	-1.05	0.293
$EXP * MUJER$	-0.0899	0.0317	-2.83	0.005
R-squared		0.2702		
Adjusted R-squared		0.2646		
S.E. of regression		4.4137		
Sum squared resid		10177.66		

PROBLEMA 3: USO MENSUAL DE LA TARJETA DE CRÉDITO (MONTHLY PAYMENT WITH CREDIT CARD)

Consider the following linear model about monthly expenditure with credit card,

$$TC = \beta_0 + \beta_1 EDAD + \beta_2 RENTA + \beta_3 RENTA^2 + \beta_4 PROP + \varepsilon$$

where:
TC = monthly expenditure (in euros) with credit card;
$EDAD$ = age (in years);
$RENTA$ = income in euros, divided by 10000;
$PROP$ = binary variable which equals 1 if individual is owner of his/her home and 0 otherwise (that is, if renter of his/her home).

Using a sample with 72 observations we have obtained the following estimates:

SALIDA 1

Dependent Variable: TC
Method: Least Squares
Sample: 1 72
Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	−237.1465	199.3517	−1.19	0.238
$EDAD$	−3.0818	5.5147	−0.56	0.578
$RENTA$	234.3470	80.3659	2.92	0.005
$RENTA^2$	−14.9968	7.4693	−2.01	0.049
$PROP$	27.9409	82.9223	0.34	0.737

R-squared	0.2435	Mean dependent var	262.5321
Adjusted R-squared	0.1984	S.D. dependent var	318.0468
S.E. of regression	284.75	Akaike info criterion	14.20802
Sum squared resid	5432562	Schwarz criterion	14.36612

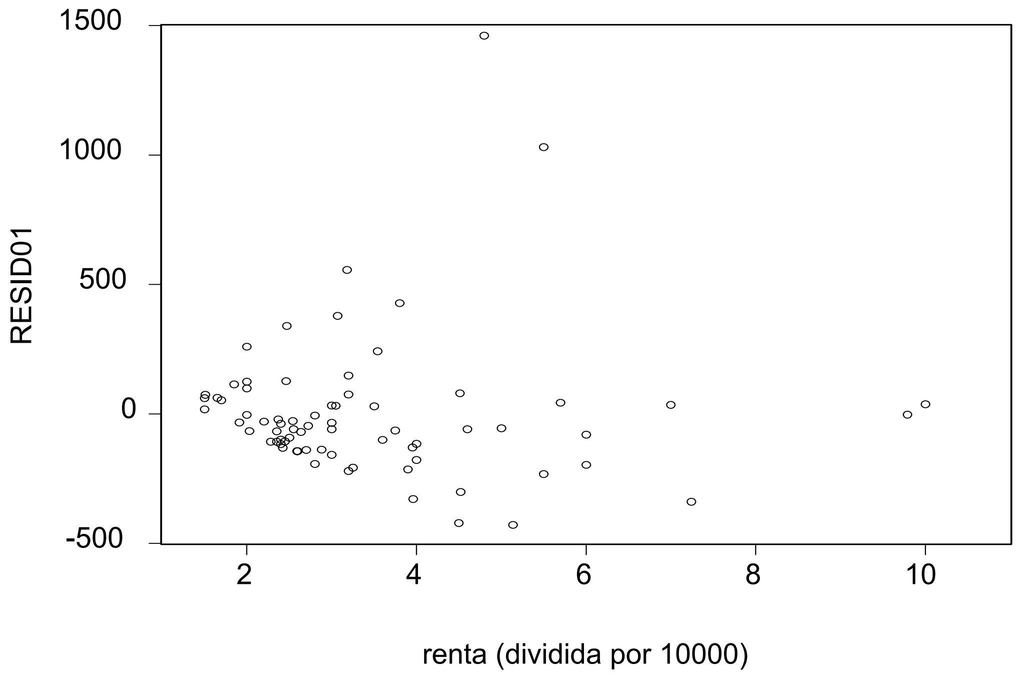


Gráfico H: Residuals versus Income (renta)

SALIDA 2

Dependent Variable: TC
Method: Least Squares
Sample: 1 72
Included observations: 72
White Heteroskedasticity-Consistent Standard Errors Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	−237.1465	220.7950	−1.07	0.287
$EDAD$	−3.0818	3.4226	−0.90	0.371
$RENTA$	234.3470	92.1226	2.54	0.013
$RENTA^2$	−14.9968	7.1990	−2.08	0.041
$PROP$	27.9409	95.5657	0.29	0.771

R-squared	0.2436	Mean dependent var	262.5321
Adjusted R-squared	0.1984	S.D. dependent var	318.0468
S.E. of regression	284.75	Akaike info criterion	14.20802
Sum squared resid	5432562	Schwarz criterion	14.36612

PROBLEMA 4: ESTIMACIÓN DE TECNOLOGÍAS DE PRODUCCIÓN (ESTIMATION OF PRODUCTION TECHNOLOGIES)

One of the mostly used production functions is the CES function (Constant Elasticity substitution), due to the fact that it includes other production functions, such as Cobb-Douglas or Leontieff, as particular cases. The CES function has the following expression:

$$Y = \gamma\left(\delta K^{\rho} + (1-\delta)L^{\rho}\right)^{v/\rho}$$

where Y, K and L denote output or production and capital and labour factors, γ is the efficiency parameter, δ is the factor share within the production function, ρ is the parameter whuch defines the elasticity of substitution, and v is the returns-to-scale parameter, so that $v = 1$, $v > 1$, and $v < 1$ refer, respectively, constant returns, increasing returns and decreasing returns.

A researcher has specified an econometric model in order to estimate the technology with data on 25 manufacturing companies, using a first-order linear approximation to the logarithm of the CES function:

$$\begin{aligned}\ln Y &= \ln\gamma + \delta v \ln K + (1-\delta)v\ln L - 1/2\rho\delta\,(1-\delta)\,v\left[\ln(K/L)\right]^2 + \varepsilon \\ &= \beta_0 + \beta_1 \ln K + \beta_2 \ln L + \beta_3\left[\ln(K/L)\right]^2 + \varepsilon\end{aligned}$$

The estimates are shown as follows.

SALIDA 1				
Dependent Variable: $\ln Y$				
Method: Least Squares				
Sample: 1 25				
Included observations: 25				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.9602	2.2051	-0.89	0.384
$\ln K$	0.6501	0.0303	21.47	0.000
$\ln L$	0.5592	0.2075	2.69	0.013
$[\ln(K/L)]^2$	0.0879	0.0654	1.36	0.188
R-squared		0.9912		
Adjusted R-squared		0.9900		
S.E. of regression		0.0266		
Sum squared resid		0.0148		

SALIDA 2

Dependent Variable: $\ln(Y/L)$
Method: Least Squares
Sample: 1 25
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0155	0.0084	1.84	0.079
$\ln(K/L)$	0.6262	0.0144	43.51	0.000
$[\ln(K/L)]^2$	0.0379	0.0323	1.17	0.253
R-squared		0.9921		
Adjusted R-squared		0.9914		
S.E. of regression		0.0264		
Sum squared resid		0.0154		

SALIDA 3

Dependent Variable: $\ln Y$
Method: Least Squares
Sample: 1 25
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.6394	1.1255	0.56	0.576
$\ln K$	0.6130	0.0135	45.44	0.000
$\ln L$	0.3214	0.1142	2.81	0.010
R-squared		0.9905		
Adjusted R-squared		0.9896		
S.E. of regression		0.0271		
Sum squared resid		0.0161		

In addition, we assume that the error term satisfies:

$$\begin{aligned} E(\varepsilon|K, L) &= 0 \\ V(\varepsilon|K, L) &= \sigma^2 \end{aligned}$$

PROBLEMA 5: PRECIO DE LAS ACCIONES (STOCK PRICES)

Some authors argue that quoted prices of firms listed in the stock market depend on the dividend policy decided by the managers of each firm. The economic model used to explain the quoted price in the stock market is:

$$P = \alpha VC^{\beta_2} DPA^{\beta_3},$$

where P is the firm's quoted price (in euros) in the stock marker, VC is the accounting value (in euros) of a firm's share, and DPA is the dividend (in euros) per share.

In order to estimate such model, a sample of 22 firms listed in the stock market has been used. The model that is estimated by OLS is

$$\ln P = \beta_1 + \beta_2 \ln(VC) + \beta_3 \ln(DPA) + \varepsilon.$$

The estimation results are shown in Salida 1.

Salida 2 reports the variance-covariance matrix of the estimated parameters of the model.

SALIDA 1

Dependent Variable: $\ln P$
Method: Least Squares
Sample: 1 22
Included observations: 22

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.0913	0.4251	2.57	0.0190
$\ln(VC)$	0.7781	0.0935	8.32	0.000
$\ln(DPA)$	0.1814	0.0820	2.21	0.039
R-squared		0.8669		
Adjusted R-squared		0.8529		
S.E. of regression		0.4069		
Sum squared resid		3.1460		

SALIDA 2 (Matriz de cov. de los estimadores)

	C	$\ln(VC)$	$\ln(DPA)$
C	0.1807		
$\ln(VC)$	−0.0376	0.0087	
$\ln(DPA)$	0.0291	−0.0074	0.0067

Tabla A.1. *Función de distribución acumulada de la normal estándar.*

	0,00	0,01	0,02	0,03	0,04	0,05	0,06	0,07	0,08	0,09
0,00	0,500	0,504	0,508	0,512	0,516	0,520	0,524	0,528	0,532	0,536
0,10	0,540	0,544	0,548	0,552	0,556	0,560	0,564	0,567	0,571	0,575
0,20	0,579	0,583	0,587	0,591	0,595	0,599	0,603	0,606	0,610	0,614
0,30	0,618	0,622	0,626	0,629	0,633	0,637	0,641	0,644	0,648	0,652
0,40	0,655	0,659	0,663	0,666	0,670	0,674	0,677	0,681	0,684	0,688
0,50	0,691	0,695	0,698	0,702	0,705	0,709	0,712	0,716	0,719	0,722
0,60	0,726	0,729	0,732	0,736	0,739	0,742	0,745	0,749	0,752	0,755
0,70	0,758	0,761	0,764	0,767	0,770	0,773	0,776	0,779	0,782	0,785
0,80	0,788	0,791	0,794	0,797	0,800	0,802	0,805	0,808	0,811	0,813
0,90	0,816	0,819	0,821	0,824	0,826	0,829	0,831	0,834	0,836	0,839
1,00	0,841	0,844	0,846	0,848	0,851	0,853	0,855	0,858	0,860	0,862
1,10	0,864	0,867	0,869	0,871	0,873	0,875	0,877	0,879	0,881	0,883
1,20	0,885	0,887	0,889	0,891	0,893	0,894	0,896	0,898	0,900	0,901
1,30	0,903	0,905	0,907	0,908	0,910	0,911	0,913	0,915	0,916	0,918
1,40	0,919	0,921	0,922	0,924	0,925	0,926	0,928	0,929	0,931	0,932
1,50	0,933	0,934	0,936	0,937	0,938	0,939	0,941	0,942	0,943	0,944
1,60	0,945	0,946	0,947	0,948	0,949	0,951	0,952	0,953	0,954	0,954
1,70	0,955	0,956	0,957	0,958	0,959	0,960	0,961	0,962	0,962	0,963
1,80	0,964	0,965	0,966	0,966	0,967	0,968	0,969	0,969	0,970	0,971
1,90	0,971	0,972	0,973	0,973	0,974	0,974	0,975	0,976	0,976	0,977
2,00	0,977	0,978	0,978	0,979	0,979	0,980	0,980	0,981	0,981	0,982
2,10	0,982	0,983	0,983	0,983	0,984	0,984	0,985	0,985	0,985	0,986
2,20	0,986	0,986	0,987	0,987	0,987	0,988	0,988	0,988	0,989	0,989
2,30	0,989	0,990	0,990	0,990	0,990	0,991	0,991	0,991	0,991	0,992
2,40	0,992	0,992	0,992	0,992	0,993	0,993	0,993	0,993	0,993	0,994
2,50	0,994	0,994	0,994	0,994	0,994	0,995	0,995	0,995	0,995	0,995
2,60	0,995	0,995	0,996	0,996	0,996	0,996	0,996	0,996	0,996	0,996
2,70	0,997	0,997	0,997	0,997	0,997	0,997	0,997	0,997	0,997	0,997
2,80	0,997	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,998
2,90	0,998	0,998	0,998	0,998	0,998	0,998	0,998	0,999	0,999	0,999
3,00	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999	0,999

Ejemplo: Si $Z \sim \mathcal{N}(0, 1)$, entonces $\Pr(Z < 1{,}15) = F(1{,}15) = 0{,}875$.

Tabla A.2. *Función de distribución acumulada de la chi-cuadrado.*

	$G_k(\cdot)$										
k	0,60	0,65	0,70	0,75	0,80	0,85	0,90	0,95	0,975	0,990	0,995
1	0,71	0,87	1,07	1,32	1,64	2,07	2,71	3,84	5,02	6,63	7,88
2	1,83	2,10	2,41	2,77	3,22	3,79	4,61	5,99	7,38	9,21	10,60
3	2,95	3,28	3,66	4,11	4,64	5,32	6,25	7,81	9,35	11,34	12,84
4	4,04	4,44	4,88	5,39	5,99	6,74	7,78	9,49	11,14	13,28	14,86
5	5,13	5,57	6,06	6,63	7,29	8,12	9,24	11,07	12,83	15,09	16,75
6	6,21	6,69	7,23	7,84	8,56	9,45	10,64	12,59	14,45	16,81	18,55
7	7,28	7,81	8,38	9,04	9,80	10,75	12,02	14,07	16,01	18,48	20,28
8	8,35	8,91	9,52	10,22	11,03	12,03	13,36	15,51	17,53	20,09	21,95
9	9,41	10,01	10,66	11,39	12,24	13,29	14,68	16,92	19,02	21,67	23,59
10	10,47	11,10	11,78	12,55	13,44	14,53	15,99	18,31	20,48	23,21	25,19
11	11,53	12,18	12,90	13,70	14,63	15,77	17,28	19,68	21,92	24,72	26,76
12	12,58	13,27	14,01	14,85	15,81	16,99	18,55	21,03	23,34	26,22	28,30
13	13,64	14,35	15,12	15,98	16,98	18,20	19,81	22,36	24,74	27,69	29,82
14	14,69	15,42	16,22	17,12	18,15	19,41	21,06	23,68	26,12	29,14	31,32
15	15,73	16,49	17,32	18,25	19,31	20,60	22,31	25,00	27,49	30,58	32,80
16	16,78	17,56	18,42	19,37	20,47	21,79	23,54	26,30	28,85	32,00	34,27
17	17,82	18,63	19,51	20,49	21,61	22,98	24,77	27,59	30,19	33,41	35,72
18	18,87	19,70	20,60	21,60	22,76	24,16	25,99	28,87	31,53	34,81	37,16
19	19,91	20,76	21,69	22,72	23,90	25,33	27,20	30,14	32,85	36,19	38,58
20	20,95	21,83	22,77	23,83	25,04	26,50	28,41	31,41	34,17	37,57	40,00

UNIVERSIDAD CARLOS III DE MADRID
ECONOMETRÍA I
Curso 2004/05
EXAM QUESTIONNAIRE

7 de Febrero de 2005

Tipo de Examen: 5

1. Consider the simple linear regression model without constant term

$$y_i = \beta x_i + \varepsilon_i, \quad (i = 1, \ldots, n)$$

where $E(\varepsilon_i|x_i) = 0$, $E(\varepsilon_i^2|x_i) = \sigma^2$, $E(x_i) \neq 0$. Consider the following estimator of the β parameter:

$$b = \frac{\sum_{i=1}^n y_i}{\sum_{i=1}^n x_i}.$$

In general,

(a) Such estimator is exactly equal to the OLS estimator.

(b) Such estimator is consistent.

(c) Such estimator is the most efficient among all the linear and unbiased estimators.

(d) Such estimator is not consistent because there is not any instrumental variable.

2. The price of a flat in euros (*precio*) is related with the current local pollution, measured by the CO_2 level ($CO2$) and with the number of rooms (*habit*), in accordance with the linear regression model

$$log(precio) = \beta_0 + \beta_1 log(CO2) + \beta_2 habit + \varepsilon,$$

where $\beta_1 < 0$, $\beta_2 > 0$, and both regressors are negatively correlated.
Let a_1 be the OLS estimator of α_1 in the simple linear regression

$$log(precio) = \alpha_0 + \alpha_1 log(CO2) + u.$$

What would you expect about a_1 as the sample size tends to infinity?

(a) That it converges to a value below β_1.

(b) That it converges to a value above β_1.

(c) That it converges to zero.

(d) That it converges to β_1.

3. Given a sample of 1000 Spanish companies of the iron production industry, it has been proposed the model $Y = \beta_0 + \beta_1 X^* + \varepsilon$, where X^* denotes the value of sales and Y is the number of employees; ε es the error term such that $E(\varepsilon | X^*) = 0$. However, it is suspected that companies fake the value of their sales, so that we observe instead $X = X^* + v$. Let b_1 be the OLS estimator of the slope of Y over X. Then:

   (a) b_1 is an inconsistent estimator of β_1.

   (b) Using b_1, we can properly test the hypothesis $H_0 : \beta_1 = 1$.

   (c) b_1 is a consistent estimator of β_1, despite the measurement error of the value of sales.

   (d) b_1 is a consistent estimator of β_1, although its variance is high, and therefore there occurs a loss of precision.

4. Given the tax declarations and the consumption by types of goods of 500 taxpayers, we want to analyze the relationship between luxury goods consumption and personal income. For such purpose, we propose the model:

$$C = \beta_0 + \beta_1 R^* + \varepsilon$$

   where C is luxury goods consumption, R^* is income and ε is the error term. However, we are sure that some taxpayers do not have declared some "hidden income", so that we actually observe the declared income $R = R^* - v$, where v denote hidden income (which is unobservable). Moreover, we also observe the declared wealth, P.
   In this context, given that declared income is the regressor used in the estimation, let b_1 be the OLS estimator of the slope of the simple regression of C over R.
   Point out which of the following sentences is FALSE:

   (a) b_1 is a consistent estimator of β_1.

   (b) The declared income R is an exogenous variable, that is, uncorrelated with the error term of the model to be estimated.

   (c) The declared income R is an endogenous variable, and therefore the OLS estimator of β_1 is inconsistent.

   (d) Assuming that the declared wealth P is uncorrelated with hidden income, we could consistently estimate β_1 by means of an instrumental variable estimator, using P as instrument for R.

5. Consider a linear regression model under heteroskedasticity, but in which all the usual assumptions hold. Point out which of the following sentences is FALSE:

   (a) The OLS estimator is consistent.

   (b) The standard way to compute the variance of the OLS estimator is incorrect.

(c) The properties of the OLS estimator and the appropriate formula of its variance do not depend on whether the homoskedasticity assumption is satisfied or is not.

(d) Correct inference about the model parameters requires the use of Eicker-White robust standard errors.

6. If there is heteroskedasticity, but it is completely ignored, so that we use the command to obtain the usual OLS estimator (without special options), then:

   (a) We will get inconsistent estimates of the parameters.

   (b) We will get inconsistent estimates of the variance of the estimator.

   (c) We will get upward biased estimates of the variance of the estimator.

   (d) None of the other answers is correct.

7. Consider the multiple linear regression model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

   with the standard assumptions. Point out which of the following sentences is FALSE:

   (a) A necessary condition for the conditional expectation of Y given X_1, X_2 to be linear (so that it will be exactly equal to the best linear predictor) is that $E(\varepsilon | X_1, X_2) = 0$.

   (b) A necessary condition for the conditional expectation of Y given X_1, X_2 to be linear (so that it will be exactly equal to the best linear predictor) is that both $E(\varepsilon | X_1, X_2) = 0$ and $V(\varepsilon | X_1, X_2) = \sigma^2$.

   (c) The violation of the assumption $V(\varepsilon | X_1, X_2) = \sigma^2$ does not affect the linearity of the conditional expectation function of Y given X_1, X_2.

   (d) The fact that the conditional expectation function of Y given X_1, X_2 is linear does not imply that the conditional expectation function of Y given X_1 is also linear.

8. Consider the model

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon,$$

   where ε is the error term of the model, which satisfies that $E(\varepsilon) = 0$, $C(X_1, \varepsilon) = 0$, and $C(X_2, \varepsilon) \neq 0$. Furthermore, $C(X_1, X_2) \neq 0$. Assume that we have a random sample available, for which we observe Y, X_1, and X_2. Let b_1, b_2 be the OLS estimators of the slopes of X_1, X_2, respectively. Then, in general,

   (a) Although b_1 will be a consistent estimator of β_1, b_2 will be an inconsistent estimator of β_2.

   (b) Both b_1 and b_2 are consistent estimators of β_1, β_2, respectively, since X_1 and X_2 are exogenous.

(c) Although X_2 is an endogenous variable, both b_1 and b_2 are inconsistent estimators of β_1, β_2, respectively.

(d) It is possible to perform valid tests of hypotheses about the parameters β_1 and β_2 using b_1 and b_2.

9. (**Problema 2**) From the results in Salida 1:

   (a) The estimation of $V(\ln SAL)$ is equal to $(0.4393)^2$.

   (b) The estimation of $V(\ln SAL \mid EDUC, EXP, NEG, HISP, MUJER)$ is equal to 0.2916.

   (c) The estimation of $V(\ln SAL \mid EDUC, EXP, NEG, HISP, MUJER)$ is equal to $(0.4393)^2$.

   (d) None of the other answers is correct.

10. (**Problema 2**) The estimated percentage difference between the wage of a black man and a white woman who have the same education and labour experience is:

    (a) $[-0.0844 - (-0.1140)] \times 100 = 2.96\%$.

    (b) $[-0.0844 - (-0.1140) - (-0.0082) \times 10] \times 100 = 11.16\%$, if both individuals have 10 years of labour experience.

    (c) $[-0.0844 - (-0.0082)] \times 100 = -7.62\%$.

    (d) $[-0.0844 - (-0.0082)] \times 100 = -7.62\%$, only if both individuals have 1 year of labour experience.

11. (**Problema 2**) Suppose that we want to test the null hypothesis that the wage equation is independent of gender. Considering the non restricted model shown in the problem:

    (a) The null hypothesis would be $H_0 : \beta_5 = \beta_6 = 0$.

    (b) The null hypothesis would be $H_0 : \beta_5 = \beta_6$.

    (c) The null hypothesis would be $H_0 : \beta_2 = \beta_6 = 0$.

    (d) The null hypothesis would be $H_0 : \beta_5 = 0$.

12. (**Problema 2**) Suppose that we want to test the null hypothesis that the wage equation is independent of the ethnic origin. Considering the non restricted model shown in the problem:

    (a) The null hypothesis would be $H_0 : \beta_4 = \beta_6 = 0$.

    (b) The null hypothesis would be $H_0 : \beta_3 = \beta_4 = 0$.

    (c) The null hypothesis would be $H_0 : \beta_0 = \beta_3 = \beta_4$.

    (d) The null hypothesis would be $H_0 : \beta_3 = \beta_4$.

13. (**Problema 2**) Suppose that we want to test the null hypothesis that the wage equation is independent of the ethnic origin.

(a) The test statistic is (comparing the R^2s of the restricted –Salida 2– and unrestricted –Salida 1– models) is

$$W^0 = \frac{(0.2702 - 0.2977)}{(1 - 0.2977)} \times (528 - 7 - 1) = -20.39,$$

which is approximately distributed as a χ^2_2 distribution, so that we do not reject the null hypothesis at any significance level.

(b) The test statistic is (comparing the R^2s of the restricted –Salida 2– and unrestricted –Salida 1– models) is

$$W^0 = \frac{(0.2977 - 0.2702)}{(1 - 0.2977)} \times (528 - 7 - 1) = 20.39,$$

which is approximately distributed as a χ^2_2 distribution, so that we reject the null hypothesis at the 1% significance level.

(c) The test statistic is (comparing the R^2s of the restricted –Salida 2– and unrestricted –Salida 1– models) is

$$W^0 = \frac{(0.2977 - 0.2702)}{(1 - 0.2977)} \times (528 - 7 - 1) = 20.39,$$

which is approximately distributed as a χ^2_1 distribution, so that we reject the null hypothesis at the 1% significance level.

(d) None of the other answers is correct.

14. **(Problema 1)** Although we are interested in the coefficients of equation (S.1), given that ability in unobservable, suppose that we consider the OLS estimation of the linear projection of the logarithm of the wage over education, experience and tenure (equation (S.2)). Point out which of the following sentences is FALSE:

(a) The OLS estimation of equation (S.2) does not yield consistent estimators of β_1.

(b) We would expect that the OLS estimator of equation (S.2) will overestimate the effect of education on wages.

(c) We would expect that the OLS estimator of equation (S.2) will underestimate the effect of education on wages.

(d) The omission of ability in the equation of interest will cause the explanatory variables included in the model (particularly, education) to be correlated with the error term of the equation to be estimated, so that $E(\varepsilon \mid EDUC, EXP, ANT) \neq 0$.

15. **(Problema 1)** Assume that $IQ = CAP$, so that the intelligence quofficient IQ is exactly equal to ability. For a given experience, tenure and ability, an additional year of education entails on average an estimated wage increase of:

   (a) 62.4 dollars per month.

   (b) 70.5 dollars per month.

   (c) 6.24%.

   (d) 7.05%.

16. **(Problema 1)** Assume that $IQ = CAP + \xi$, where $V(\xi) \neq 0$.

   (a) The education coefficient in Salida 1 is an appropriate estimator of β_1.

   (b) The education coefficient in Salida 2 is an appropriate estimator of β_1.

   (c) The education coefficient in Salida 2 is inconsistent, due to the fact that the intelligence quofficient measures ability with error.

   (d) In order to obtain a consistent estimator of education in the equation including IQ, $EDUC$, EXP and ANT as explanatory variables, it would suffice to apply two-stage least squares, using a valid instrument for education ($EDUC$), and treating the remaining explanatory variables (IQ, EXP y ANT) as exogenous.

17. **(Problema 1)** Assume that $IQ = CAP + \xi$, where $V(\xi) \neq 0$. We are concerned with obtaining consistent estimators of the coefficients of equation (S.1).

   (a) The estimators of Salida 2 are consistent.

   (b) The estimators of Salida 4 are not consistent, because we would need that at least any of the instruments ($EDUCMAD$, KWW, $EDAD$) were correlated with the endogenous variable IQ, what does not appear to be the case given Salida 3.

   (c) The estimators of Salida 4 are consistent, because the instruments ($EDUCMAD$, KWW, $EDAD$) fullfill the two required conditions to be valid: being uncorrelated with the measurement error of ability ξ (as it is stated in the text) and being correlated with the endogenous variable IQ (as it can be seen in the reduced form reported in Salida 3).

   (d) The reduced form for IQ in Salida 3 is incorrect, since it should not include the remaining variables included in the model ($EDUC$, EXP and ANT): It should include only the instruments.

18. **(Problema 1)** If we want to evaluate whether the variable IQ, as a measure of ability, entails a measurement error problem:

   (a) We will test whether IQ is endogenous in the wage equation by means of a t-test for the coefficient of IQ.

(b) We cannot test that hypothesis.

(c) We will test whether IQ is endogenous in the wage equation by means of a Hausman test.

(d) We will test the joint significance of all the regressors in Salida 3 (test of joint significance, or regression test).

19. **(Problema 1)** Given the results:

    (a) Since RES is statistically significant in the OLS estimation of the augmented wage equation (Salida 5), we do NOT reject that IQ is exogenous, and therefore we conclude that the measurement error in IQ is irrelevant.

    (b) Since RES is statistically significant in the OLS estimation of the augmented wage equation (Salida 5), we reject that IQ is exogenous, and therefore we conclude that there is a measurement error problem in IQ as a measure of ability.

    (c) The reported test for endogeneity is incorrect, since the reduced form in which the residuals are based does incorrectly include the exogenous variables of the wage equation ($EDUC$, EXP and ANT).

    (d) None of the other answers is correct.

20. **(Problema 1)** Using the appropriate estimates, we can conclude that for a given experience, tenure, and ability, an additional year of education will represent on average an estimated wage increase of:

    (a) 29.6 dollars per month.

    (b) 6.24%.

    (c) 7.05%.

    (d) 2.96%.

21. **(Problema 1)** Using the appropriate estimates, we can conclude that for a given experience, tenure, and education, 10 additional points of ability will represent on average an estimated wage increase of:

    (a) 4 dollars per month.

    (b) 14.5%.

    (c) 4%.

    (d) 14.5 dollars per month.

22. **(Problema 1)** Using the appropriate estimates, we can conclude that for a given ability, experience, and education, an additional year of tenure will represent on average an estimated wage increase of:

    (a) 5.9 dollars per month.

(b) 0.59%.

(c) 0.69%.

(d) 6.9 dollars per month.

23. **(Problema 1)** Using the appropriate estimates, if we compare two individuals with the same ability and education, but who differ in which the first one has a labour experience of 30 years and a tenure in his current job of 20 years, while the second one has a labour experience of 35 years and a tenure in his current job of 5 years, we estimate that the first one will earn on average:

(a) 1.55% less than the second.

(b) 0.75% more than the second.

(c) 1.55% more than the second.

(d) 15.5 dollars per month less than the second.

24. (**Problema 3**) Given the estimates:

(a) The parameter estimates of the linear model in Salida 1 are not consistent because Gráfico H provides evidence against the homoskedasticity assumption.

(b) We cannot know whether the conditional variance of the errors is independent of the explanatory variables, since the residual variance cannot be consistently estimated under heteroskedasticity.

(c) Gráfico H points out an endogeneity problem of the variable $RENTA$, what implies that ε is not mean-independent of all the explanatory variables.

(d) In Gráfico H we can observe that residuals show a higher dispersion the larger the income, so that there is evidence in favour of heteroskedasticity and therefore we must use robust standard errors.

25. (**Problema 3**) If we want to test the individual significance of each variable, given the reported estimates:

(a) The test statistic that we must use to test the null hypothesis $H_0 : \beta_2 = 0$ is:

$$t = \frac{234.3470}{80.3659} \simeq 2.92,$$

which under the classical assumptions is approximately distributed as a standard normal, so that it has a p-value of 0.005, and therefore we reject the null hypothesis at the 5% level.

(b) We cannot perform the test from any of the reported estimates since Gráfico H shows evidence of heteroskedastic errors, and in such a case the OLS estimates of the parameters cannot be used to test any hypothesis.

(c) The test statistic that we must use to test the null hypothesis $H_0 : \beta_2 = 0$ is:

$$t = \frac{234.3470}{92.1226} = 2.543860,$$

which is approximately distributed as a standard normal, so that it has a p-value of 0.0133, and therefore we reject the null hypothesis at the 5% level (but not at the 1%).

(d) Both answers 25a and 25c are correct.

26. (**Problema 3**) Given the estimates, we can conclude that:

(a) The estimated mean effect, ceteris paribus, of income on monthly credit card expenditure, is not constant, that is, it depends on the income level, and it is approximately: $234.3470 - 2 \times 14.9968 \times RENTA$.

(b) For an individual with an income of 30000 euros, the estimated mean effect, ceteris paribus, of an additional euro of income on monthly credit card expenditure is approximately equal to $234.3470 - 2 \times 14.9968 \times 30000 = -899576.053$.

(c) The estimated mean effect, ceteris paribus, of income on monthly credit card expenditure is always negative and decreasing with the income level.

(d) Both answers 26a and 26b are correct.

27. (**Problema 3**) Given the estimates, and denoting renters as the individuals who are not owners of their home, we can conclude that:

(a) The renters have, on average, a larger monthly credit card expenditure that owners (keeping all the other characteristics constant), although the difference is not significant.

(b) Keeping income constant, for an individual aged 30 years, the estimated average difference in monthly credit card expenditure between an owner and a renter is constant and equal to $-3.0818 + 27.9409 = 24.8591$ euros.

(c) If we want to test whether there is any difference in the expected monthly credit card expenditure between an owner and a renter, we will have to test the null hypothesis that $H_0 : \beta_0 = \beta_4 = 0$, using the heteroskedasticity-robust standard errors to construct the test.

(d) None of the other answers is correct.

28. (**Problema 3**) Given the estimates, for an individual with an income of 40000 euros, the estimated mean increase in monthly credit card expenditure , ceteris paribus, after an increase of yearly income of 1000 euros is:

(a) $(234.3470 - 2 \times 14.9968 \times 4) = 114.3726$ euros.

(b) $(234.3470 - 2 \times 14.9968 \times 4)/10 = 11.43726$ euros.

(c) $(234.3470 - 2 \times 14.9968 \times 4)/10000 = 0.01143726$ euros.

(d) None of the other answers is correct.

29. (**Problema 4**) Regarding the test of constant returns to scale in the CES technology, point out which of the following sentences is FALSE:

(a) The null hypothesis to be tested is $H_0 : \nu = 1$, or equivalently, $H_0 : \beta_1 + \beta_2 = 1$, where β_1 and β_2 are the parameters associated with $\ln K$ y $\ln L$ in the model which consists on the first order approximation to the CES technology that is estimated in Salida 1.

(b) In order to test the existence of constant returns to scale in the CES technology, we could consider the models estimated in Salidas 1 and 2, as unrestricted and restricted model, respectively, and use the test statistic:

$$\frac{SRR - SRS}{SRS}(n-4)$$

with approximate distribution χ^2_1, where SRR and SRS denote the residual sum of squares of the restricted and unrestricted models, respectively.

(c) In order to test the existence of constant returns to scale in the CES technology, we could consider the models estimated in Salidas 1 and 2, as unrestricted and restricted model, respectively, and use the test statistic:

$$\frac{R^2_S - R^2_R}{1 - R^2_S}(n-4)$$

with approximate distribution χ^2_1, where R^2_R and R^2_S denote the R^2s of the restricted and unrestricted models, respectively.

(d) Given that the coefficient of the variable $[\ln(K/L)]^2$ is statistically equal to zero, we could test constant returns to scale in the model that imposes the constraint $\beta_3 = 0$, and the hypothesis to be tested would then be $H_0 : \beta_1 + \beta_2 = 1$.

30. (**Problema 4**) According to Salidas 1 and 3, omission of the variable $[\ln(K/L)]^2$ in Salida 3 implies that:

(a) The estimated variance is smaller than the variance of the OLS estimate in the unrestricted model and the corresponding OLS estimate remains consistent.

(b) The estimated variance is smaller than the variance of the OLS estimate in the unrestricted model but the corresponding OLS estimate is no longer consistent.

(c) The estimated variance is larger than the variance of the OLS estimate in the unrestricted model and the corresponding OLS estimate is consistent.

(d) The estimated variance is larger than the variance of the OLS estimate in the unrestricted model and the corresponding OLS estimate is not consistent.

31. (**Problema 4**) Consider the results obtained in Salidas 1 y 3. Assuming that the p-value associated with the OLS estimate of the parameter corresponding to the variable $[\ln(K/L)]^2$ in Salida was equal to 0.0001 instead of 0.188, other things held constant, omission of the variable $[\ln(K/L)]^2$ in Salida 3 implies that:

    (a) The estimated variance is smaller than the variance of the OLS estimate in the unrestricted model and the corresponding OLS estimate remains consistent.

    (b) The estimated variance is smaller than the variance of the OLS estimate in the unrestricted model but the corresponding OLS estimate is no longer consistent.

    (c) The estimated variance is larger than the variance of the OLS estimate in the unrestricted model and the corresponding OLS estimate is consistent.

    (d) The estimated variance is larger than the variance of the OLS estimate in the unrestricted model and the corresponding OLS estimate is not consistent.

32. (**Problema 4**) Assume now that the true model in order to estimate the production technology is given by

$$\ln(Y/L) = \gamma_0 + \gamma_1 \ln(K/L) + \gamma_2 [\ln(K/L)]^2 + \eta,$$

where the error term satisfies that $E(\eta|K,L) = 0, Var(\eta|K,L) = \sigma^2$, with $\gamma_1 > 0$ and $C\left(\ln(K/L), [\ln(K/L)]^2\right) > 0$.
If the variable $[\ln(K/L)]^2$ is omitted, then the omitted-variable bias (alternatively, asymptotic bias) of the OLS estimate of γ_1 in the simple regression of $\ln(Y/L)$ on $\ln(K/L)$ will have:

    (a) A constant zero value.

    (b) The same sign of γ_2. Moreover, the extent of the bias is inversely related with $V(\ln(K/L))$.

    (c) The opposite sign of γ_2. Moreover, the extent of the bias is directly related with $V(\ln(K/L))$.

    (d) The same sign of γ_2. Moreover, the extent of the bias is directly related with $V(\ln(K/L))$.

33. (**Problema 5**) In view of the estimations, it turns out that:

    (a) Each additional euro in the accounting value increases the firm's quoted price, on average, in 0.78 euros.

(b) Each 1% increase in the dividend per share, increases the firm's quoted price, on average, in 0.18 euros.

(c) Each 1% increase in the accounting value corresponds, on average, to a 0.78% increase in the firm's quoted price.

(d) Each additional euro in the dividend per share corresponds, on average, to a 0.18% increase in the firm's quoted price.

30. (**Problema 5**) According to the results contained in Salida 1, it can be concluded that the average elasticity of the firm's quoted price with respect to the dividend per share:

    (a) It is not statistically different than 1 at the 1% level.

    (b) It is statistically different than 0 at the 2% level.

    (c) It is statistically different than 0 at the 1% level.

    (d) It is statistically different than 1 at the 1% level.

31. (**Problema 5**) The approximated 95% confidence interval for the elasticity of the firm's quoted price with respect to its accounting value is

    (a) (0.0206 ; 0.3422).

    (b) (0.5948 ; 0.9614).

    (c) (0.6243 ; 0.9319).

    (d) (0.0465 ; 0.3164).

32. (**Problema 5**) If we are interested on studying whether the sum of the elasticities of the firm's quoted price with respect to its accounting value and with respect to the dividend per share is equal to one:

    (a) The right statistic is

$$t = \frac{(0.7781 + 0.1814) - 1}{0.0935 + 0.0820} = -2.61,$$

    asymptotically distributed as a $N(0, 1)$ under the null hypothesis that the sum of elasticities is equal to one.

    (b) The right statistic is

$$t = \frac{(0.7781 + 0.1814) - 1}{\sqrt{0.0935^2 + 0.0820^2 - 2 \times 0.0074}} = -1.56,$$

    asymptotically distributed as a $N(0, 1)$ under the null hypothesis that the sum of elasticities is equal to one.

(c) The right statistic is

$$t = \frac{(0.7781 + 0.1814)}{\sqrt{0.0935^2 + 0.0820^2 - 2 \times 0.0074}} = 37.17,$$

asymptotically distributed as a $N(0,1)$ under the null hypothesis that the sum of elasticities is equal to one.

(d) It is not possible to test the null hypothesis with the available information. We would need to have the restricted model, the one where it has been imposed that the sum of the elasticities is equal to one.

33. (**Problema 5**) If we are interested on testing whether the sum of the elasticities of the firm's quoted price with respect to its accounting value and with respect to the dividend per share is equal to one:

(a) H_0 cannot be rejected at the 5% significance level.

(b) H_0 is rejected at the 1% significance level.

(c) H_0 is rejected at the 5% significance level.

(d) It is not possible to test the null hypothesis with the available information. We would need to have the restricted model, the one where it has been imposed that the sum of the elasticities is equal to one.

34. Consider the following model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon,$$

where ε satisfies $E(\varepsilon) = 0$, $C(X_1, \varepsilon) = 0$, $C(X_2, \varepsilon) \neq 0$ and $C(X_3, \varepsilon) \neq 0$. Assume that we have a random sample of Y, X_1, X_2, X_3, Z_1 y Z_2, Z_1 and Z_2 being independent of ε. In this situation:

(a) If $C(X_2, Z_1) \neq 0$ and $C(X_3, Z_2) \neq 0$, then we know for sure that Z_1 and Z_2 are valid instruments and we will use them to obtain the Two-Stage Least Squares estimator of β_0, β_1, β_2 and β_3.

(b) If $C(X_2, Z_1) \neq 0$ and $C(X_2, Z_2) \neq 0$, then we know for sure that we cannot use the Two-Stage Least Squares estimator, because the two instruments are correlated with the same endogenous variable.

(c) The OLS estimator of the model is not consistent, and we will try to use the Two-Stage Least Squares estimator, testing in the first stage whether the instruments that we have are valid.

(d) All of the other answers are correct.

35. Consider the following model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 \ln(X_2) + \varepsilon$$

where $E(\varepsilon | X_1, X_2) = 0$, $\beta_1 \neq 0$, $\beta_2 \neq 0$.

(a) It is satisifed that $E(Y|X_1, X_2) = PLO(Y|X_1, X_2)$.

(b) It is satisifed that $E(Y|X_1, X_2) = PLO(Y|X_1, \ln(X_2))$.

(c) The conditional expectation function of Y given X_1 and X_2 is linear in both variables.

(d) It is satisifed that $\beta_1 = C(X_1, Y)/V(X_1)$.

36. Consider the following model:

$$\ln(Y) = \beta_0 + \beta_1 \ln(X) + \varepsilon$$

where $E(\varepsilon|X) = 0$, $\beta_1 \neq 0$.

(a) It is satisifed that $E(Y|X) = PLO(Y|X)$

(b) It is satisifed that $E(Y|X) = PLO(Y|\ln(X))$

(c) The conditional expectation function of Y given X is linear in X.

(d) None of the other answers is correct.