UNIVERSIDAD CARLOS III DE MADRID
ECONOMETRICS
Academic year 2009/10
FINAL EXAM

May, 17, 2010

Very important: Take into account that:

1. Each question, unless otherwise stated, requires a complete analysis of all the outputs shown in the corresponding problem.
   For example, to answer those questions referring to "appropriate estimates", or "given the estimates" or "given the problem conditions", the results based on the consistent and more efficient among outputs, must be used.
2. Each output includes all the explanatory variables used in the corresponding estimation.
3. Some results in the output shown may have been omitted.
4. The dependent variable can vary among outputs within the same problem.
5. For the sake of brevity, we will say that a model is well specified if it is linear in the conditioning variables (as they appear in the model) and its error term is mean-independent of such variables.
6. OLS, and 2SLS or TSLS, are the corresponding abreviations of ordinary least squares and two stage least squares, respectively.
7. Statistical tables are included at the end of this document.

Problem: Determinants of fertility.

We would like to study the determinants of the total number of children a woman has ($KIDS$) at specific moment in time. We are interested in knowing if fertility rates (meaning the average number of children per woman) have changed over time. We have a sample of 476 women from the *General Social Survey* of the National Opinion Research Center (NORC) in the USA for the years 1972, 1978 and 1984.

The characteristics of the woman we are interested in are $EDUC$ (Years of education), AGE (Age, in years), AGE^2 (Age squared), $BLACK$ (Binary variable that takes the value of 1 if the woman is black and 0 otherwise).

Moreover, in order to consider the possibility that fertility rates change over time, we have the variables $YEAR$ (The year corresponding to the observation; this variable takes three possible values: 72, 78 or 84); $Y72$ (Binary variable that takes the value of 1 if the observation corresponds to the year 1972 and 0 otherwise); $Y78$ (Binary variable that takes the value of 1 if the observation corresponds to the year 1978 and 0 otherwise); $Y84$ (Binary variable that takes the value of 1 if the observation corresponds to the year 1984 and 0 otherwise).

Also, we take into account the possibility that there are interactions between $Y78$ and $Y84$ with education, $Y78 \times EDUC$ and $Y84 \times EDUC$, respectively.

The following models are considered to analyze the determinants of the number of children:

$$KIDS = \beta_0 + \beta_1 AGE + \beta_2 AGE^2 + \beta_3 BLACK + \beta_4 EDUC + \beta_5 YEAR + \varepsilon_1 \quad \text{(I)}$$

$$KIDS = \delta_0 + \delta_1 AGE + \delta_2 AGE^2 + \delta_3 BLACK + \delta_4 EDUC + \delta_5 Y78 + \delta_6 Y84 + \varepsilon_2 \quad \text{(II)}$$

$$KIDS = \delta_0 + \delta_1 AGE + \delta_2 AGE^2 + \delta_3 BLACK + \delta_4 EDUC + \delta_5 Y78 + \delta_6 Y84 + \delta_7 Y78 \times EDUC + \delta_8 Y84 \times EDUC + \varepsilon_3 \quad \text{(III)}$$

We also have two additional variables about the years of education of the father ($FEDUC$) and the mother ($MEDUC$), respectively. Moreover, we know that these variables are not correlated with the errors of the three models considered.

The results of the various estimations are presented below:

Output 1: OLS, using observations 1–476
Dependent variable: $KIDS$

	Coefficient	Std. Error	t-ratio	p-value
const	−2.1966	5.0370	−0.4361	0.6630
AGE	0.4788	0.2178	2.1982	0.0284
AGE^2	−0.0054	0.0025	−2.1862	0.0293
$BLACK$	0.3640	0.2929	1.2429	0.2145
$EDUC$	−0.1381	0.0298	−4.6403	0.0000
$YEAR$	−0.0489	0.0152	−3.2135	0.0014

Mean dependent var	2.67	S.D. dependent var	1.67
Sum squared resid	1197.9	S.E. of regression	1.60
R^2	0.0993	Adjusted R^2	0.0897
$F(5, 470)$	10.36	P-value(F)	1.93e–09

Output 2: OLS, using observations 1–476
Dependent variable: $KIDS$

	Coefficient	Std. Error	t-ratio	p-value
const	−6.0500	4.8054	−1.2590	0.2087
AGE	0.4908	0.2179	2.2518	0.0248
AGE^2	−0.0055	0.0025	−2.2398	0.0256
$BLACK$	0.3814	0.2931	1.3014	0.1938
$EDUC$	−0.1374	0.0298	−4.6184	0.0000
$Y78$	−0.1001	0.1871	−0.5351	0.5929
$Y84$	−0.5794	0.1827	−3.1706	0.0016

Mean dependent var	2.67	S.D. dependent var	1.67
Sum squared resid	1194.3	S.E. of regression	1.60
R^2	0.1020	Adjusted R^2	0.0905
$F(6, 469)$	8.87	P-value(F)	3.48e–09

Coefficient covariance matrix (Output 2)

AGE	AGE^2	$BLACK$	$EDUC$	$Y78$	$Y84$	
0.048	−0.0005	0.0013	0.0007	0.0034	0.0036	AGE
	6×10^{-6}	-1.4×10^{-5}	-7.4×10^{-6}	-3.6×10^{-5}	-3.6×10^{-5}	AGE^2
		0.0859	0	0.0030	0.0012	$BLACK$
			0.0009	−0.0003	−0.0008	$EDUC$
				0.0350	0.0177	$Y78$
					0.0334	$Y84$

Output 3: OLS, using observations 1–476
Dependent variable: $KIDS$

	Coefficient	Std. Error	t-ratio	p-value
const	−6.6862	4.8266	−1.3853	0.1666
AGE	0.4597	0.2182	2.1070	0.0357
AGE^2	−0.0052	0.0025	−2.0936	0.0368
$BLACK$	0.4199	0.2926	1.4349	0.1520
$EDUC$	−0.0308	0.0548	−0.5609	0.5751
$Y78$	1.4262	0.9752	1.4625	0.1443
$Y84$	1.5355	0.9166	1.6752	0.0946
$Y78 \times EDUC$	−0.1249	0.0770	−1.6209	0.1057
$Y84 \times EDUC$	−0.1684	0.0713	−2.3624	0.0186

Mean dependent var	2.67	S.D. dependent var	1.67
Sum squared resid	1179.8	S.E. of regression	1.59
R^2	0.1129	Adjusted R^2	0.0977
$F(8, 467)$	7.43	P-value(F)	2.48e–09

Coefficient covariance matrix (Output 3)

AGE	AGE^2	$BLACK$	$EDUC$	$Y78$	$Y84$	$Y78\times EDUC$	$Y84\times EDUC$	
−1.04	0.0117	−0.0546	−0.0449	0.008	−0.011	−0.0003	0.0011	AGE
0.05	−0.0005	0.0013	0.0003	-8×10^{-5}	1.3×10^{-4}	3.2×10^{-6}	-1.3×10^{-5}	AGE^2
	6×10^{-6}	-1.3×10^{-5}	-3×10^{-5}	0.022	0.0134	−0.0015	−0.0010	$BLACK$
		0.085626	0.0013	0.037	0.0364	−0.0030	−0.0030	$EDUC$
			0.0030	0.951	0.4595	−0.0737	−0.0362	$Y78$
					0.8402	−0.0364	−0.0640	$Y84$
						0.0059	0.0030	$Y78\times EDUC$
							0.0051	$Y84\times EDUC$

Output 4: TSLS, using observations 1–476
Dependent variable: $KIDS$
Instrumented: $EDUC$
Instruments: const AGE AGE^2 $BLACK$ $Y78$ $Y84$ $MEDUC$ $FEDUC$

	Coefficient	Std. Error	z-stat	p-value
const	−6.1390	5.0506	−1.2155	0.2242
AGE	0.4931	0.2216	2.2247	0.0261
AGE^2	−0.0056	0.0025	−2.2157	0.0267
$BLACK$	0.3831	0.2946	1.3006	0.1934
$EDUC$	−0.1344	0.0600	−2.2385	0.0252
$Y78$	−0.1012	0.1880	−0.5381	0.5905
$Y84$	−0.5822	0.1891	−3.0791	0.0021

Mean dependent var	2.67	S.D. dependent var	1.67
Sum squared resid	1194.3	S.E. of regression	1.60
R^2	0.1019	Adjusted R^2	0.0905
$F(6, 469)$	6.15	P-value(F)	3.16e–06

Coefficient covariance matrix (Output 4)

AGE	AGE^2	$BLACK$	$EDUC$	$Y78$	$Y84$	
0.049	−0.0006	0.0025	0.0028	0.0027	0.0017	AGE
	6.3×10^{-6}	-2.6×10^{-5}	-3.0×10^{-5}	-2.8×10^{-5}	-1.4×10^{-5}	AGE^2
		0.0868	0.002	0.0024	−0.0002	$BLACK$
			0.0036	−0.0013	−0.0033	$EDUC$
				0.0353	0.0186	$Y78$
					0.0357	$Y84$

Output 5: OLS, using observations 1–476
Dependent variable: $EDUC$

	Coefficient	Std. Error	t-ratio	p-value
const	20.9667	6.4290	3.2613	0.0012
AGE	−0.5603	0.2936	−1.9083	0.0570
AGE^2	0.0063	0.0033	1.8922	0.0591
$BLACK$	0.2407	0.4003	0.6012	0.5480
$Y78$	0.1169	0.2529	0.4621	0.6442
$Y84$	0.3342	0.2485	1.3447	0.1794
$MEDUC$	0.1524	0.0333	4.5704	0.0000
$FEDUC$	0.2436	0.0371	6.5672	0.0000

Mean dependent var	12.71	S.D. dependent var	2.53
Sum squared resid	2170.8	S.E. of regression	2.15
R^2	0.2857	Adjusted R^2	0.2750
$F(7, 468)$	26.74	P-value(F)	7.37e–31

Output 5B: OLS, using observations 1–476
Dependent variable: $EDUC$

	Coefficient	Std. Error	t-ratio	p-value
const	29.7970	7.3227	4.0691	0.0001
AGE	−0.7726	0.3360	−2.2994	0.0219
AGE^2	0.0084	0.0038	2.1926	0.0288
$BLACK$	−0.5606	0.4537	−1.2356	0.2172
$Y78$	0.3604	0.2896	1.2445	0.2139
$Y84$	0.9302	0.2801	3.3214	0.0010

Mean dependent var	12.71	S.D. dependent var	2.53
Sum squared resid	2877.1	S.E. of regression	2.47
R^2	0.0533	Adjusted R^2	0.0433
$F(5, 470)$	5.30	P-value(F)	0.000096

Output 6: OLS, using observations 1–476
Dependent variable: $KIDS$

	Coefficient	Std. Error	t-ratio	p-value
const	−6.1390	5.0559	−1.2142	0.2253
AGE	0.4931	0.2219	2.2223	0.0267
AGE^2	−0.0056	0.0025	−2.2134	0.0274
$BLACK$	0.3831	0.2949	1.2993	0.1945
$EDUC$	−0.1344	0.0601	−2.2361	0.0258
$Y78$	−0.1012	0.1882	−0.5375	0.5912
$Y84$	−0.5822	0.1893	−3.0759	0.0022
$RES5$	−0.0040	0.0692	−0.0572	0.9544

NOTE: $RES5$ are the residuals of Output 5

Mean dependent var	2.67	S.D. dependent var	1.67
Sum squared resid	1194.3	S.E. of regression	1.60
R^2	0.1020	Adjusted R^2	0.0885
$F(7, 468)$	7.59	P-value(F)	1.10e–08

Universidad Carlos III de Madrid
<u>ECONOMETRICS</u>
Academic year 2009/10
FINAL EXAM
MAY, 17, 2010

Exam Type: 1

DURATION: 2 HOURS

Directions:

- BEFORE YOU START TO ANSWER THE EXAM:
  - 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 **NIU**, which has 9 digit and always begins by 1000) both in letters and in the corresponding optical reading boxes.
  - Fill in, both in letters and in the corresponding optical reading boxes, the course code and your group.
- **Check that this document contains 46 questions sequentially numbered.**
- Check that the number of exam type that appears in the questionnaire matches the number indicated in the optical reading form.
- Read the problem text and the questions carefully.
- 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, or C).
- **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.
- All the questions correctly answered have the same score. Any incorrect answer will be graded as zero. To obtain a pass (at least 5 over 10) you must correctly answer **27** questions.
- If you wish, you may use the answer table as a draft, although such table does not have any official validity.
- You can use the back side of the problem text as a draft (no additional sheets will be handed out).
- **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.**
- **Dates of grades publication:** Friday, May, 21.
- **Date of exam revision:** It will be published in Aula Global.
- **Rules for exam revision:**
  - Its only purpose will be that each student:

  * check the number of correct answers;
  * handout in writing, if (s)he wants, the possible claims about the problem text and the questions, that will be attended by writing in the next 10 days since the revision date.
- To be entitled for revision, the student *should bring a printed copy of the exam solutions*, which will be available in Aula Global from the date of grade publication.

Answer DRAFT															
	(a)	**(b)**	**(c)**		**(a)**	**(b)**	**(c)**		**(a)**	**(b)**	**(c)**		**(a)**	**(b)**	**(c)**
1.				**13.**				**25.**				**37.**			
2.				**14.**				**26.**				**38.**			
3.				**15.**				**27.**				**39.**			
4.				**16.**				**28.**				**40.**			
5.				**17.**				**29.**				**41.**			
6.				**18.**				**30.**				**42.**			
7.				**19.**				**31.**				**43.**			
8.				**20.**				**32.**				**44.**			
9.				**21.**				**33.**				**45.**			
10.				**22.**				**34.**				**46.**			
11.				**23.**				**35.**							
12.				**24.**				**36.**							

1. Assume that model (III) verifies the assumptions of the classical regression model. Given the results in Output 3:

   (a) The effect of education is not statistically different from zero.

   (b) The effect of education does not vary over time.

   (c) The effect of education is more negative in 1984 than in 1972.

2. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that the year does not affect the number of children:

   (a) The null hypothesis is $H_0 : \delta_5 = \delta_6 = \delta_7 = \delta_8$.

   (b) The null hypothesis is $H_0 : \delta_5 = \delta_6 = 0$.

   (c) The null hypothesis is $H_0 : \delta_5 = \delta_6 = \delta_7 = \delta_8 = 0$.

3. Comparing the models (I) and (II):

   (a) None of the other statements are correct.

   (b) Model (I) is more restrictive, because it imposes that in year 1972 education does not have an impact on the number of children.

   (c) Model (II) is less restrictive, because it allows for a given race, age and education, that fertility rates change differently over time.

4. Assume that model (I) verifies the assumptions of the classical regression model. An appropriate estimation of the variance of the dependent variable (rounding to two decimals), conditional on the explanatory variables is:

   (a) 1.60.

   (b) 2.79.

   (c) 2.56.

5. The 2SLS estimated coefficients in Output 4 could have been obtained in an equivalent way:

   (a) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the prediction of education based on the estimations in Output 5

   (b) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the prediction of education based on the estimations in Output 5B.

   (c) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the instruments $MEDUC$ and $FEDUC$.

6. If education was an endogenous variable, in order to test whether two instruments, father's and mother's education, are valid instruments, we would have to:

   (a) In a regression of $EDUC$ on the exogenous variables of the model and on both instruments, test that these two instruments are individually significant.

   (b) In a regression of $EDUC$ on the exogenous variables of the model and on both instruments, test that these last two variables are jointly significant.

   (c) Test the hypothesis that the residual of the reduced form (the linear projection of $EDUC$ on the exogenous variables and both instruments) has a significant effect on education.

7. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test whether the effect of education for a women observed in 1978 is the same than the one observed in 1984, the null hypothesis would be:

   (a) $\delta_4 = \delta_7 = \delta_8$.

   (b) $\delta_7 = \delta_8 = 0$.

   (c) $\delta_7 = \delta_8$.

8. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients (and rounding to two decimals), for a 20 year old white woman with 10 years of education:

   (a) The mean number of children is approximately 6.24.

   (b) The mean number of children was approximately 0.19 in 1972.

   (c) There is not enough information to predict the mean number of children in 1972.

9. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that the effect of education on the number of children does not depend on the year, the null hypothesis is:

   (a) The null hypothesis is $H_0 : \delta_7 = \delta_8 = 0$.

   (b) The null hypothesis is $H_0 : \delta_7 = \delta_8$.

   (c) The null hypothesis is $H_0 : \delta_4 = \delta_7 + \delta_8$.

10. Suppose that we are interested in model (II). Consider the following statement: "In 1972, the fertility rate of a 30 year old black woman is equal to the fertility rate of a white woman of the same age but with 8 years less of education". Given the results (rounding to one decimal):

   (a) The test statistic is approximately $t = 3.9$.

   (b) The test statistic is approximately $t = -1.2$.

   (c) The test statistic is approximately $t = -1.9$.

11. Assume that model (I) verifies the assumptions of the classical regression model. An appropriate estimation of the unconditional variance of the dependent variable is:

   (a) 1.60.

   (b) 2.79.

   (c) 2.56.

12. Assume that model (I) verifies the assumptions of the classical regression model. If the variable $KIDS$ was measured with error, estimates in the Output 1 will be in general:

   (a) None of the other statements are correct.

   (b) Consistent.

   (c) Less efficient that the ones obtained if the variable $KIDS$ was not measured with error.

13. Comparing the models (II) and (III), indicate which of the following statements is FALSE:
    (a) When estimating model (III) by OLS, we see that education does not longer have a significant effect on fertility.
    (b) Model (II) is more restrictive, because it imposes that the effect of education does not depend on time (the year).
    (c) At the 5% significance level we would choose Model (II).
14. The 2SLS estimated coefficients in Output 4 could have been obtained in an equivalent way:
    (a) None of the other statements are correct.
    (b) Estimating by 2SLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the education, using a prediction based on the estimations in Output 5B as an instrument for education.
    (c) Estimating by 2SLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the education, using a prediction based on the estimations in Output 5 as an instrument for education.
15. If you only had information about the number of children, the best prediction you can give about the value of this variable (rounding up to two decimals) is:
    (a) 2.20.
    (b) 2.67.
    (c) 1.67.
16. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, the mean difference in the number of children between two women with the same characteristics but one in 1972 and the other in 1978 is:
    (a) The question cannot be answered with the information provided in Output 2.
    (b) Significantly different from zero.
    (c) Statistically equal to zero.
17. Assume that model (I) verifies the assumptions of the classical regression model. Under the evidence of Output 1, the effect of age on the number of children is:
    (a) Positive, but marginally decreasing in age for women who are younger than 40.
    (b) Constant.
    (c) Negative for women older than 35 years old.
18. Assume that model (III) verifies the assumptions of the classical regression model. Given the results in Output 3, and taking into account only women younger than 40 years old, indicate which of the following statements is FALSE:
    (a) The casual effect of education is the same for all women considered.
    (b) In general, women with lower educational level have on average more children.
    (c) Older women have on average more children.

19. If we are certain that all the explanatory variables of model (II), except $EDUC$, are exogenous, and we would have estimated model (II) by 2SLS but using only $MEDUC$ as an instrument for $EDUC$, the estimates obtained for the parameters of model (II):

(a) We cannot obtain consistent 2SLS estimates if we only have one instrument.

(b) Would be inconsistent.

(c) Would be less efficient than the 2SLS estimates in Output 4.

20. Assume that model (II) verifies the assumptions of the classical regression model. If the education variable ($EDUC$) was measured with error, the inconsistency bias of the estimates of the affected coefficients would be larger:

(a) The larger the expected value of education.

(b) The larger the variance of the measurement error with respect to the education variance.

(c) The larger the education variance with respect to the variance of the measurement error.

21. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test whether the effect of education on women observed in 1978 is the same as on women observed in 1984, the test statistic (rounding to one decimal) would be:

(a) 0.6.

(b) -1.6.

(c) -2.4.

22. Let's focus on model (II):

(a) None of the other statements are correct.

(b) The model is misspecified, as it omits the variable $Y72$.

(c) Model (I) is a particular case of model (II).

23. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that education does not affect fertility:

(a) The null hypothesis would be $H_0 : \delta_4 - \delta_7 - \delta_8 = 0$.

(b) The null hypothesis would be $H_0 : \delta_4 = 0$.

(c) The null hypothesis would be $H_0 : \delta_4 = \delta_7 = \delta_8 = 0$.

24. Assume that model (I) verifies the assumptions of the classical regression model. Given the results in Output 1, we can say that fertility rates:

(a) We do not have enough information to conclude anything.

(b) Have remained constant over time.

(c) Have decreased over time.

25. If education was an endogenous variable, given the available information, we can say that

(a) It would be possible to obtain consistent estimates of the parameters by using only the father's education as instrument.

(b) Only the father's education ($FEDUC$) is a valid instrument for $EDUC$.

(c) Only the mother's education ($MEDUC$) is a valid instrument for $EDUC$.

26. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, for a 20 year old black woman with 5 years of education, between 1978 and 1984, the mean number of children has decreased (rounding to two decimals) by:

   (a) 0.68.

   (b) 0.48.

   (c) 0.58.

27. The information provided in Output 6 allow us to know whether:

   (a) None of the other statements are correct.

   (b) We can reject the null hypothesis that education is exogenous.

   (c) We can reject the null hypothesis that the instruments are valid.

28. Comparing the models (I) and (II), model (II) can be expressed as model (I) with the following restriction:

   (a) $\delta_6 = 6\delta_5$.

   (b) $\delta_5 = \delta_6$.

   (c) $\delta_6 = 2\delta_5$.

29. If we want to test whether both father's and mother's education are valid instruments, the value of the test statistic would be

   (a) 154.9.

   (b) 190.4.

   (c) 26.8.

30. Using $KIDS$ as dependent variable, consider the models that include a constant, AGE, AGE^2, $BLACK$ and $EDUC$. Indicate which of the following statements is FALSE:

   (a) If we would also include $YEAR$ and $Y78$ as explanatory variables , the model would be more general than model (I), but it would not be comparable to model (II), because the models impose different restrictions.

   (b) If we would also include $YEAR$ and $Y78$ as explanatory variables and we would estimate by OLS, the R^2 would coincide with the one of Output 2.

   (c) If we would also include $YEAR$ and $Y78$ as explanatory variables and we would estimate by OLS, the estimated coefficients of AGE, AGE^2, $BLACK$ and $EDUC$ would coincide with those of Output 2.

31. Assume that model (I) verifies the assumptions of the classical regression model. If the variable $KIDS$ was measured with some error, and that error was correlated with some of the explanatory variables, estimations in Output 1 would be:

   (a) None of the other statements are correct.

   (b) Inconsistent.

   (c) As efficient as the ones obtained if the variable $KIDS$ was not measured with error.

32. Given the results in Output 6:

    (a) We do not reject that the correlation of the instruments with the error of model (II) is zero.

    (b) We do not reject that $EDUC$ is exogenous.

    (c) We do not reject that the correlation between the instruments and $EDUC$ is zero.

33. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients and for a given race, age and education:

    (a) A woman in 1984 has 58% less children than a woman in 1972.

    (b) For every 100 women, there are around 58 less children in 1984 than in 1972.

    (c) A woman in 1978 has 10% more children than a woman in 1972.

34. Assuming that models (I) and (II) verify the assumptions of the classical regression model, assume that the variable years of education ($EDUC$) is measured with error. Then

    (a) Output 1 and Output 2 will provide consistent estimates for the parameters of models (I) and (II), respectively.

    (b) Output 1 will provide consistent estimates for the parameters of model (I).

    (c) Output 2 will provide inconsistent estimates for the parameters of model (II).

35. Suppose that we are interested in model (II). Consider the following statement: "In 1972, the fertility rate of a 30 year old black woman is equal to the fertility rate of a white woman of the same age but with 8 years less of education". Given the results obtained:

    (a) We cannot reject the above statement at the 10% significance level.

    (b) At the 1% significance level, we can reject the above statement.

    (c) We can reject the above statement at the 10% significance level, but we cannot at the 5% significance level.

36. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test the null hypothesis that the effect of education on women observed in 1978 is the same as on women observed in 1984, we can conclude that:

    (a) We do not reject the null hypothesis at the 10% significance level.

    (b) We reject the null hypothesis at the 5% significance level.

    (c) We reject the null hypothesis at the 10%, but we do not reject it at the 5% significance level.

37. Assume the error in the model (II) verifies $E\left(\varepsilon_2 | \, AGE, BLACK, EDUC, Y78, Y84\right) = 0$ for any combinations of the values of the explanatory variables, but the homoskedasticity assumption does not hold. Then:

    (a) The Gauss-Markov Theorem is verified.

    (b) The estimated OLS coefficients are inconsistent.

    (c) The estimated OLS coefficients are unbiased.

38. Comparing the models (I) and (II):

(a) Model (I) imposes the restriction that the coefficient of $Y84$ is exactly the double of the coefficient of $Y78$.

(b) The models (I) and (II) are different models because none of them is a particular case of the other.

(c) Model (I) imposes the restriction that the coefficients of $Y78$ and $Y84$ are both equal to zero.

39. Suppose that we are interested in model (II). Consider the following conjecture: "For a given race and educational level, the decrease in the fertility rate is constant over time". Indicate which of the following statements is false:

(a) We do not have enough information to evaluate the above conjecture.

(b) If the conjecture is true, model (II) could be represented as model (I).

(c) At the 5% significance level, we cannot reject the above conjecture.

40. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test the hypothesis that the year does not affect the number of children:

(a) The question cannot be answered with the provided information.

(b) It is not rejected, as the p-value of the corresponding statistic is equal to zero.

(c) It is rejected given the value of the corresponding statistic obtained when comparing the unrestricted model and the model that imposes the restriction.

41. In model (II), if you wanted to test that the effect of age on the number of children is constant, the null hypothesis would be

(a) $H_0 : \delta_1 + \delta_2 = 0$.

(b) $H_0 : \delta_1 = \delta_2 = 0$.

(c) $H_0 : \delta_2 = 0$.

42. In model (II), if you wanted to test whether the mean number of children for a black woman in 1972 with 10 years of education is the same than a white woman in 1972 with the same age but with 12 years of education:

(a) The null hypothesis would be $H_0 : 2\delta_4 + \delta_3 = 0$.

(b) The null hypothesis would be $H_0 : 2\delta_4 - \delta_3 = 0$.

(c) The null hypothesis would be $H_0 : 12\delta_4 - \delta_3 = 0$.

43. Assume that model (I) verifies the assumptions of the classical regression model. Consider two women interviewed in the same year, both of them are white and have the same level of education, but one is 40 years old and the other one is 30 years old. The first one will have on average (rounding to the closest integer number):

(a) 1 child more than the second woman.

(b) 5 children more than the second woman.

(c) The same number of children as the second woman.

44. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, in the year 1972, the mean difference in the number of children between a black woman and a white woman with the same age but with 5 years less of education than the first one is (rounding to one decimal):

    (a) 1.1 more children.

    (b) 0.4 more children.

    (c) 0.3 less children.

45. If education was an endogenous variable, then:

    (a) None of the other statements are correct.

    (b) The estimated coefficients in Output 1 would be inconsistent for model (I), but those of Output 2 would not be inconsistent for model (II).

    (c) The estimated coefficients in Output 2 would be inconsistent for model (II), but those of Output 3 would not be inconsistent for model (III).

46. Assume that model (I) verifies the assumptions of the classical regression model. Given the results in Output 1 and keeping all the other factors constant, which of the following statements is FALSE:

    (a) A woman in 1978 had on average 0.29 more children than a woman in 1984.

    (b) A woman in 1978 had on average 0.29 less children than a woman in 1972.

    (c) A woman in 1978 had on average 0.05 less children than a woman in 1972.

Universidad Carlos III de Madrid
ECONOMETRICS
Academic year 2009/10
FINAL EXAM
MAY, 17, 2010

Exam Type: 2

DURATION: 2 HOURS

Directions:

- BEFORE YOU START TO ANSWER THE EXAM:
  - 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 **NIU**, which has 9 digit and always begins by 1000) both in letters and in the corresponding optical reading boxes.
  - Fill in, both in letters and in the corresponding optical reading boxes, the course code and your group.
- **Check that this document contains 46 questions sequentially numbered.**
- Check that the number of exam type that appears in the questionnaire matches the number indicated in the optical reading form.
- Read the problem text and the questions carefully.
- 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, or C).
- **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.
- All the questions correctly answered have the same score. Any incorrect answer will be graded as zero. To obtain a pass (at least 5 over 10) you must correctly answer **27** questions.
- If you wish, you may use the answer table as a draft, although such table does not have any official validity.
- You can use the back side of the problem text as a draft (no additional sheets will be handed out).
- **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.**
- **Dates of grades publication:** Friday, May, 21.
- **Date of exam revision:** It will be published in Aula Global.
- **Rules for exam revision:**
  - Its only purpose will be that each student:

* check the number of correct answers;
* handout in writing, if (s)he wants, the possible claims about the problem text and the questions, that will be attended by writing in the next 10 days since the revision date.

– To be entitled for revision, the student *should bring a printed copy of the exam solutions*, which will be available in Aula Global from the date of grade publication.

Answer DRAFT															
	(a)	**(b)**	**(c)**		**(a)**	**(b)**	**(c)**		**(a)**	**(b)**	**(c)**		**(a)**	**(b)**	**(c)**
1.				**13.**				**25.**				**37.**			
2.				**14.**				**26.**				**38.**			
3.				**15.**				**27.**				**39.**			
4.				**16.**				**28.**				**40.**			
5.				**17.**				**29.**				**41.**			
6.				**18.**				**30.**				**42.**			
7.				**19.**				**31.**				**43.**			
8.				**20.**				**32.**				**44.**			
9.				**21.**				**33.**				**45.**			
10.				**22.**				**34.**				**46.**			
11.				**23.**				**35.**							
12.				**24.**				**36.**							

1. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test whether the effect of education on women observed in 1978 is the same as on women observed in 1984, the test statistic (rounding to one decimal) would be:

   (a) -2.4.
   (b) -1.6.
   (c) 0.6.

2. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test the null hypothesis that the effect of education on women observed in 1978 is the same as on women observed in 1984, we can conclude that:

   (a) We reject the null hypothesis at the 10%, but we do not reject it at the 5% significance level.
   (b) We reject the null hypothesis at the 5% significance level.
   (c) We do not reject the null hypothesis at the 10% significance level.

3. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that education does not affect fertility:

   (a) The null hypothesis would be $H_0 : \delta_4 = \delta_7 = \delta_8 = 0$.
   (b) The null hypothesis would be $H_0 : \delta_4 = 0$.
   (c) The null hypothesis would be $H_0 : \delta_4 - \delta_7 - \delta_8 = 0$.

4. Assume that model (I) verifies the assumptions of the classical regression model. An appropriate estimation of the unconditional variance of the dependent variable is:

   (a) 2.56.
   (b) 2.79.
   (c) 1.60.

5. Comparing the models (II) and (III), indicate which of the following statements is FALSE:

   (a) At the 5% significance level we would choose Model (II).
   (b) Model (II) is more restrictive, because it imposes that the effect of education does not depend on time (the year).
   (c) When estimating model (III) by OLS, we see that education does not longer have a significant effect on fertility.

6. Assume that model (I) verifies the assumptions of the classical regression model. Under the evidence of Output 1, the effect of age on the number of children is:

   (a) Negative for women older than 35 years old.
   (b) Constant.
   (c) Positive, but marginally decreasing in age for women who are younger than 40.

7. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test whether the effect of education for a women observed in 1978 is the same than the one observed in 1984, the null hypothesis would be:

   (a) $\delta_7 = \delta_8$.
   (b) $\delta_7 = \delta_8 = 0$.
   (c) $\delta_4 = \delta_7 = \delta_8$.

8. If education was an endogenous variable, given the available information, we can say that
   (a) Only the mother's education ($MEDUC$) is a valid instrument for $EDUC$.
   (b) Only the father's education ($FEDUC$) is a valid instrument for $EDUC$.
   (c) It would be possible to obtain consistent estimates of the parameters by using only the father's education as instrument.

9. Assume that model (I) verifies the assumptions of the classical regression model. Consider two women interviewed in the same year, both of them are white and have the same level of education, but one is 40 years old and the other one is 30 years old. The first one will have on average (rounding to the closest integer number):
   (a) The same number of children as the second woman.
   (b) 5 children more than the second woman.
   (c) 1 child more than the second woman.

10. In model (II), if you wanted to test whether the mean number of children for a black woman in 1972 with 10 years of education is the same than a white woman in 1972 with the same age but with 12 years of education:
   (a) The null hypothesis would be $H_0 : 12\delta_4 - \delta_3 = 0$.
   (b) The null hypothesis would be $H_0 : 2\delta_4 - \delta_3 = 0$.
   (c) The null hypothesis would be $H_0 : 2\delta_4 + \delta_3 = 0$.

11. Comparing the models (I) and (II):
   (a) Model (II) is less restrictive, because it allows for a given race, age and education, that fertility rates change differently over time.
   (b) Model (I) is more restrictive, because it imposes that in year 1972 education does not have an impact on the number of children.
   (c) None of the other statements are correct.

12. In model (II), if you wanted to test that the effect of age on the number of children is constant, the null hypothesis would be
   (a) $H_0 : \delta_2 = 0$.
   (b) $H_0 : \delta_1 = \delta_2 = 0$.
   (c) $H_0 : \delta_1 + \delta_2 = 0$.

13. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, for a 20 year old black woman with 5 years of education, between 1978 and 1984, the mean number of children has decreased (rounding to two decimals) by:
   (a) 0.58.
   (b) 0.48.
   (c) 0.68.

14. The information provided in Output 6 allow us to know whether:
   (a) We can reject the null hypothesis that the instruments are valid.
   (b) We can reject the null hypothesis that education is exogenous.
   (c) None of the other statements are correct.

15. If you only had information about the number of children, the best prediction you can give about the value of this variable (rounding up to two decimals) is:

    (a) 1.67.

    (b) 2.67.

    (c) 2.20.

16. Assume that model (I) verifies the assumptions of the classical regression model. Given the results in Output 1 and keeping all the other factors constant, which of the following statements is FALSE:

    (a) A woman in 1978 had on average 0.05 less children than a woman in 1972.

    (b) A woman in 1978 had on average 0.29 less children than a woman in 1972.

    (c) A woman in 1978 had on average 0.29 more children than a woman in 1984.

17. Let's focus on model (II):

    (a) Model (I) is a particular case of model (II).

    (b) The model is misspecified, as it omits the variable $Y72$.

    (c) None of the other statements are correct.

18. Suppose that we are interested in model (II). Consider the following statement: "In 1972, the fertility rate of a 30 year old black woman is equal to the fertility rate of a white woman of the same age but with 8 years less of education". Given the results (rounding to one decimal):

    (a) The test statistic is approximately $t = -1.9$.

    (b) The test statistic is approximately $t = -1.2$.

    (c) The test statistic is approximately $t = 3.9$.

19. Assume that model (I) verifies the assumptions of the classical regression model. An appropriate estimation of the variance of the dependent variable (rounding to two decimals), conditional on the explanatory variables is:

    (a) 2.56.

    (b) 2.79.

    (c) 1.60.

20. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, in the year 1972, the mean difference in the number of children between a black woman and a white woman with the same age but with 5 years less of education than the first one is (rounding to one decimal):

    (a) 0.3 less children.

    (b) 0.4 more children.

    (c) 1.1 more children.

21. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that the year does not affect the number of children:

    (a) The null hypothesis is $H_0 : \delta_5 = \delta_6 = \delta_7 = \delta_8 = 0$.

    (b) The null hypothesis is $H_0 : \delta_5 = \delta_6 = 0$.

    (c) The null hypothesis is $H_0 : \delta_5 = \delta_6 = \delta_7 = \delta_8$.

22. Comparing the models (I) and (II), model (II) can be expressed as model (I) with the following restriction:

(a) $\delta_6 = 2\delta_5$.

(b) $\delta_5 = \delta_6$.

(c) $\delta_6 = 6\delta_5$.

23. If we are certain that all the explanatory variables of model (II), except $EDUC$, are exogenous, and we would have estimated model (II) by 2SLS but using only $MEDUC$ as an instrument for $EDUC$, the estimates obtained for the parameters of model (II):

(a) Would be less efficient than the 2SLS estimates in Output 4.

(b) Would be inconsistent.

(c) We cannot obtain consistent 2SLS estimates if we only have one instrument.

24. The 2SLS estimated coefficients in Output 4 could have been obtained in an equivalent way:

(a) Estimating by 2SLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the education, using a prediction based on the estimations in Output 5 as an instrument for education.

(b) Estimating by 2SLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the education, using a prediction based on the estimations in Output 5B as an instrument for education.

(c) None of the other statements are correct.

25. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test the hypothesis that the year does not affect the number of children:

(a) It is rejected given the value of the corresponding statistic obtained when comparing the unrestricted model and the model that imposes the restriction.

(b) It is not rejected, as the p-value of the corresponding statistic is equal to zero.

(c) The question cannot be answered with the provided information.

26. Using $KIDS$ as dependent variable, consider the models that include a constant, AGE, AGE^2, $BLACK$ and $EDUC$. Indicate which of the following statements is FALSE:

(a) If we would also include $YEAR$ and $Y78$ as explanatory variables and we would estimate by OLS, the estimated coefficients of AGE, AGE^2, $BLACK$ and $EDUC$ would coincide with those of Output 2.

(b) If we would also include $YEAR$ and $Y78$ as explanatory variables and we would estimate by OLS, the R^2 would coincide with the one of Output 2.

(c) If we would also include $YEAR$ and $Y78$ as explanatory variables , the model would be more general than model (I), but it would not be comparable to model (II), because the models impose different restrictions.

27. Assume that model (I) verifies the assumptions of the classical regression model. Given the results in Output 1, we can say that fertility rates:

(a) Have decreased over time.

(b) Have remained constant over time.

(c) We do not have enough information to conclude anything.

28. Suppose that we are interested in model (II). Consider the following conjecture: "For a given race and educational level, the decrease in the fertility rate is constant over time". Indicate which of the following statements is false:

   (a) At the 5% significance level, we cannot reject the above conjecture.

   (b) If the conjecture is true, model (II) could be represented as model (I).

   (c) We do not have enough information to evaluate the above conjecture.

29. Assume that model (III) verifies the assumptions of the classical regression model. Given the results in Output 3:

   (a) The effect of education is more negative in 1984 than in 1972.

   (b) The effect of education does not vary over time.

   (c) The effect of education is not statistically different from zero.

30. Assuming that models (I) and (II) verify the assumptions of the classical regression model, assume that the variable years of education ($EDUC$) is measured with error. Then

   (a) Output 2 will provide inconsistent estimates for the parameters of model (II).

   (b) Output 1 will provide consistent estimates for the parameters of model (I).

   (c) Output 1 and Output 2 will provide consistent estimates for the parameters of models (I) and (II), respectively.

31. Suppose that we are interested in model (II). Consider the following statement: "In 1972, the fertility rate of a 30 year old black woman is equal to the fertility rate of a white woman of the same age but with 8 years less of education". Given the results obtained:

   (a) We can reject the above statement at the 10% significance level, but we cannot at the 5% significance level.

   (b) At the 1% significance level, we can reject the above statement.

   (c) We cannot reject the above statement at the 10% significance level.

32. Assume the error in the model (II) verifies $E(\varepsilon_2 | AGE, BLACK, EDUC, Y78, Y84) = 0$ for any combinations of the values of the explanatory variables, but the homoskedasticity assumption does not hold. Then:

   (a) The estimated OLS coefficients are unbiased.

   (b) The estimated OLS coefficients are inconsistent.

   (c) The Gauss-Markov Theorem is verified.

33. If education was an endogenous variable, in order to test whether two instruments, father's and mother's education, are valid instruments, we would have to:

   (a) Test the hypothesis that the residual of the reduced form (the linear projection of $EDUC$ on the exogenous variables and both instruments) has a significant effect on education.

   (b) In a regression of $EDUC$ on the exogenous variables of the model and on both instruments, test that these last two variables are jointly significant.

   (c) In a regression of $EDUC$ on the exogenous variables of the model and on both instruments, test that these two instruments are individually significant.

34. The 2SLS estimated coefficients in Output 4 could have been obtained in an equivalent way:

    (a) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the instruments $MEDUC$ and $FEDUC$.

    (b) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the prediction of education based on the estimations in Output 5B.

    (c) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the prediction of education based on the estimations in Output 5

35. Given the results in Output 6:

    (a) We do not reject that the correlation between the instruments and $EDUC$ is zero.

    (b) We do not reject that $EDUC$ is exogenous.

    (c) We do not reject that the correlation of the instruments with the error of model (II) is zero.

36. Comparing the models (I) and (II):

    (a) Model (I) imposes the restriction that the coefficients of $Y78$ and $Y84$ are both equal to zero.

    (b) The models (I) and (II) are different models because none of them is a particular case of the other.

    (c) Model (I) imposes the restriction that the coefficient of $Y84$ is exactly the double of the coefficient of $Y78$.

37. If we want to test whether both father's and mother's education are valid instruments, the value of the test statistic would be

    (a) 26.8.

    (b) 190.4.

    (c) 154.9.

38. Assume that model (I) verifies the assumptions of the classical regression model. If the variable $KIDS$ was measured with some error, and that error was correlated with some of the explanatory variables, estimations in Output 1 would be:

    (a) As efficient as the ones obtained if the variable $KIDS$ was not measured with error.

    (b) Inconsistent.

    (c) None of the other statements are correct.

39. Assume that model (II) verifies the assumptions of the classical regression model. If the education variable ($EDUC$) was measured with error, the inconsistency bias of the estimates of the affected coefficients would be larger:

    (a) The larger the education variance with respect to the variance of the measurement error.

    (b) The larger the variance of the measurement error with respect to the education variance.

    (c) The larger the expected value of education.

40. If education was an endogenous variable, then:

   (a) The estimated coefficients in Output 2 would be inconsistent for model (II), but those of Output 3 would not be inconsistent for model (III).
   (b) The estimated coefficients in Output 1 would be inconsistent for model (I), but those of Output 2 would not be inconsistent for model (II).
   (c) None of the other statements are correct.

41. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients and for a given race, age and education:

   (a) A woman in 1978 has 10% more children than a woman in 1972.
   (b) For every 100 women, there are around 58 less children in 1984 than in 1972.
   (c) A woman in 1984 has 58% less children than a woman in 1972.

42. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that the effect of education on the number of children does not depend on the year, the null hypothesis is:

   (a) The null hypothesis is $H_0 : \delta_4 = \delta_7 + \delta_8$.
   (b) The null hypothesis is $H_0 : \delta_7 = \delta_8$.
   (c) The null hypothesis is $H_0 : \delta_7 = \delta_8 = 0$.

43. Assume that model (I) verifies the assumptions of the classical regression model. If the variable $KIDS$ was measured with error, estimates in the Output 1 will be in general:

   (a) Less efficient that the ones obtained if the variable $KIDS$ was not measured with error.
   (b) Consistent.
   (c) None of the other statements are correct.

44. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, the mean difference in the number of children between two women with the same characteristics but one in 1972 and the other in 1978 is:

   (a) Statistically equal to zero.
   (b) Significantly different from zero.
   (c) The question cannot be answered with the information provided in Output 2.

45. Assume that model (III) verifies the assumptions of the classical regression model. Given the results in Output 3, and taking into account only women younger than 40 years old, indicate which of the following statements is FALSE:

   (a) Older women have on average more children.
   (b) In general, women with lower educational level have on average more children.
   (c) The casual effect of education is the same for all women considered.

46. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients (and rounding to two decimals), for a 20 year old white woman with 10 years of education:

(a) There is not enough information to predict the mean number of children in 1972.

(b) The mean number of children was approximately 0.19 in 1972.

(c) The mean number of children is approximately 6.24.

Universidad Carlos III de Madrid
<u>ECONOMETRICS</u>
Academic year 2009/10
FINAL EXAM
MAY, 17, 2010

Exam Type: 3

DURATION: 2 HOURS

Directions:

- BEFORE YOU START TO ANSWER THE EXAM:
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– To be entitled for revision, the student *should bring a printed copy of the exam solutions*, which will be available in Aula Global from the date of grade publication.

Answer DRAFT															
	(a)	**(b)**	**(c)**		**(a)**	**(b)**	**(c)**		**(a)**	**(b)**	**(c)**		**(a)**	**(b)**	**(c)**
1.				**13.**				**25.**				**37.**			
2.				**14.**				**26.**				**38.**			
3.				**15.**				**27.**				**39.**			
4.				**16.**				**28.**				**40.**			
5.				**17.**				**29.**				**41.**			
6.				**18.**				**30.**				**42.**			
7.				**19.**				**31.**				**43.**			
8.				**20.**				**32.**				**44.**			
9.				**21.**				**33.**				**45.**			
10.				**22.**				**34.**				**46.**			
11.				**23.**				**35.**							
12.				**24.**				**36.**							

1. Assume that model (II) verifies the assumptions of the classical regression model. If the education variable ($EDUC$) was measured with error, the inconsistency bias of the estimates of the affected coefficients would be larger:

   (a) The larger the variance of the measurement error with respect to the education variance.

   (b) The larger the expected value of education.

   (c) The larger the education variance with respect to the variance of the measurement error.

2. Assume that model (I) verifies the assumptions of the classical regression model. An appropriate estimation of the variance of the dependent variable (rounding to two decimals), conditional on the explanatory variables is:

   (a) 2.79.

   (b) 1.60.

   (c) 2.56.

3. If education was an endogenous variable, then:

   (a) The estimated coefficients in Output 1 would be inconsistent for model (I), but those of Output 2 would not be inconsistent for model (II).

   (b) None of the other statements are correct.

   (c) The estimated coefficients in Output 2 would be inconsistent for model (II), but those of Output 3 would not be inconsistent for model (III).

4. In model (II), if you wanted to test that the effect of age on the number of children is constant, the null hypothesis would be

   (a) $H_0 : \delta_1 = \delta_2 = 0$.

   (b) $H_0 : \delta_1 + \delta_2 = 0$.

   (c) $H_0 : \delta_2 = 0$.

5. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, in the year 1972, the mean difference in the number of children between a black woman and a white woman with the same age but with 5 years less of education than the first one is (rounding to one decimal):

   (a) 0.4 more children.

   (b) 1.1 more children.

   (c) 0.3 less children.

6. Using $KIDS$ as dependent variable, consider the models that include a constant, AGE, AGE^2, $BLACK$ and $EDUC$. Indicate which of the following statements is FALSE:

   (a) If we would also include $YEAR$ and $Y78$ as explanatory variables and we would estimate by OLS, the R^2 would coincide with the one of Output 2.

   (b) If we would also include $YEAR$ and $Y78$ as explanatory variables , the model would be more general than model (I), but it would not be comparable to model (II), because the models impose different restrictions.

   (c) If we would also include $YEAR$ and $Y78$ as explanatory variables and we would estimate by OLS, the estimated coefficients of AGE, AGE^2, $BLACK$ and $EDUC$ would coincide with those of Output 2.

7. Comparing the models (I) and (II), model (II) can be expressed as model (I) with the following restriction:

   (a) $\delta_5 = \delta_6$.
   (b) $\delta_6 = 6\delta_5$.
   (c) $\delta_6 = 2\delta_5$.

8. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, for a 20 year old black woman with 5 years of education, between 1978 and 1984, the mean number of children has decreased (rounding to two decimals) by:

   (a) 0.48.
   (b) 0.68.
   (c) 0.58.

9. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test whether the effect of education for a women observed in 1978 is the same than the one observed in 1984, the null hypothesis would be:

   (a) $\delta_7 = \delta_8 = 0$.
   (b) $\delta_4 = \delta_7 = \delta_8$.
   (c) $\delta_7 = \delta_8$.

10. Assume that model (I) verifies the assumptions of the classical regression model. Under the evidence of Output 1, the effect of age on the number of children is:

    (a) Constant.
    (b) Positive, but marginally decreasing in age for women who are younger than 40.
    (c) Negative for women older than 35 years old.

11. Assume that model (III) verifies the assumptions of the classical regression model. Given the results in Output 3:

    (a) The effect of education does not vary over time.
    (b) The effect of education is not statistically different from zero.
    (c) The effect of education is more negative in 1984 than in 1972.

12. Assume that model (I) verifies the assumptions of the classical regression model. If the variable $KIDS$ was measured with some error, and that error was correlated with some of the explanatory variables, estimations in Output 1 would be:

    (a) Inconsistent.
    (b) None of the other statements are correct.
    (c) As efficient as the ones obtained if the variable $KIDS$ was not measured with error.

13. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test the null hypothesis that the effect of education on women observed in 1978 is the same as on women observed in 1984, we can conclude that:

    (a) We reject the null hypothesis at the 5% significance level.
    (b) We do not reject the null hypothesis at the 10% significance level.
    (c) We reject the null hypothesis at the 10%, but we do not reject it at the 5% significance level.

14. Assume that model (I) verifies the assumptions of the classical regression model. Given the results in Output 1, we can say that fertility rates:

    (a) Have remained constant over time.

    (b) We do not have enough information to conclude anything.

    (c) Have decreased over time.

15. The 2SLS estimated coefficients in Output 4 could have been obtained in an equivalent way:

    (a) Estimating by 2SLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the education, using a prediction based on the estimations in Output 5B as an instrument for education.

    (b) None of the other statements are correct.

    (c) Estimating by 2SLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the education, using a prediction based on the estimations in Output 5 as an instrument for education.

16. Assume that model (III) verifies the assumptions of the classical regression model. Given the results in Output 3, and taking into account only women younger than 40 years old, indicate which of the following statements is FALSE:

    (a) In general, women with lower educational level have on average more children.

    (b) The casual effect of education is the same for all women considered.

    (c) Older women have on average more children.

17. Given the results in Output 6:

    (a) We do not reject that $EDUC$ is exogenous.

    (b) We do not reject that the correlation of the instruments with the error of model (II) is zero.

    (c) We do not reject that the correlation between the instruments and $EDUC$ is zero.

18. Suppose that we are interested in model (II). Consider the following conjecture: "For a given race and educational level, the decrease in the fertility rate is constant over time". Indicate which of the following statements is false:

    (a) If the conjecture is true, model (II) could be represented as model (I).

    (b) We do not have enough information to evaluate the above conjecture.

    (c) At the 5% significance level, we cannot reject the above conjecture.

19. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that the effect of education on the number of children does not depend on the year, the null hypothesis is:

    (a) The null hypothesis is $H_0 : \delta_7 = \delta_8$.

    (b) The null hypothesis is $H_0 : \delta_7 = \delta_8 = 0$.

    (c) The null hypothesis is $H_0 : \delta_4 = \delta_7 + \delta_8$.

20. Assuming that models (I) and (II) verify the assumptions of the classical regression model, assume that the variable years of education ($EDUC$) is measured with error. Then

    (a) Output 1 will provide consistent estimates for the parameters of model (I).

    (b) Output 1 and Output 2 will provide consistent estimates for the parameters of models (I) and (II), respectively.

    (c) Output 2 will provide inconsistent estimates for the parameters of model (II).

21. If we want to test whether both father's and mother's education are valid instruments, the value of the test statistic would be

    (a) 190.4.

    (b) 154.9.

    (c) 26.8.

22. Comparing the models (II) and (III), indicate which of the following statements is FALSE:

    (a) Model (II) is more restrictive, because it imposes that the effect of education does not depend on time (the year).

    (b) When estimating model (III) by OLS, we see that education does not longer have a significant effect on fertility.

    (c) At the 5% significance level we would choose Model (II).

23. In model (II), if you wanted to test whether the mean number of children for a black woman in 1972 with 10 years of education is the same than a white woman in 1972 with the same age but with 12 years of education:

    (a) The null hypothesis would be $H_0 : 2\delta_4 - \delta_3 = 0$.

    (b) The null hypothesis would be $H_0 : 2\delta_4 + \delta_3 = 0$.

    (c) The null hypothesis would be $H_0 : 12\delta_4 - \delta_3 = 0$.

24. If education was an endogenous variable, in order to test whether two instruments, father's and mother's education, are valid instruments, we would have to:

    (a) In a regression of $EDUC$ on the exogenous variables of the model and on both instruments, test that these last two variables are jointly significant.

    (b) In a regression of $EDUC$ on the exogenous variables of the model and on both instruments, test that these two instruments are individually significant.

    (c) Test the hypothesis that the residual of the reduced form (the linear projection of $EDUC$ on the exogenous variables and both instruments) has a significant effect on education.

25. Assume that model (I) verifies the assumptions of the classical regression model. An appropriate estimation of the unconditional variance of the dependent variable is:

    (a) 2.79.

    (b) 1.60.

    (c) 2.56.

26. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that education does not affect fertility:

 (a) The null hypothesis would be $H_0 : \delta_4 = 0$.

 (b) The null hypothesis would be $H_0 : \delta_4 - \delta_7 - \delta_8 = 0$.

 (c) The null hypothesis would be $H_0 : \delta_4 = \delta_7 = \delta_8 = 0$.

27. If you only had information about the number of children, the best prediction you can give about the value of this variable (rounding up to two decimals) is:

 (a) 2.67.

 (b) 2.20.

 (c) 1.67.

28. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test whether the effect of education on women observed in 1978 is the same as on women observed in 1984, the test statistic (rounding to one decimal) would be:

 (a) -1.6.

 (b) 0.6.

 (c) -2.4.

29. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that the year does not affect the number of children:

 (a) The null hypothesis is $H_0 : \delta_5 = \delta_6 = 0$.

 (b) The null hypothesis is $H_0 : \delta_5 = \delta_6 = \delta_7 = \delta_8$.

 (c) The null hypothesis is $H_0 : \delta_5 = \delta_6 = \delta_7 = \delta_8 = 0$.

30. If education was an endogenous variable, given the available information, we can say that

 (a) Only the father's education ($FEDUC$) is a valid instrument for $EDUC$.

 (b) It would be possible to obtain consistent estimates of the parameters by using only the father's education as instrument.

 (c) Only the mother's education ($MEDUC$) is a valid instrument for $EDUC$.

31. Comparing the models (I) and (II):

 (a) The models (I) and (II) are different models because none of them is a particular case of the other.

 (b) Model (I) imposes the restriction that the coefficient of $Y84$ is exactly the double of the coefficient of $Y78$.

 (c) Model (I) imposes the restriction that the coefficients of $Y78$ and $Y84$ are both equal to zero.

32. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients (and rounding to two decimals), for a 20 year old white woman with 10 years of education:

 (a) The mean number of children was approximately 0.19 in 1972.

 (b) The mean number of children is approximately 6.24.

 (c) There is not enough information to predict the mean number of children in 1972.

33. Assume that model (I) verifies the assumptions of the classical regression model. Given the results in Output 1 and keeping all the other factors constant, which of the following statements is FALSE:

   (a) A woman in 1978 had on average 0.29 less children than a woman in 1972.

   (b) A woman in 1978 had on average 0.29 more children than a woman in 1984.

   (c) A woman in 1978 had on average 0.05 less children than a woman in 1972.

34. The information provided in Output 6 allow us to know whether:

   (a) We can reject the null hypothesis that education is exogenous.

   (b) None of the other statements are correct.

   (c) We can reject the null hypothesis that the instruments are valid.

35. Suppose that we are interested in model (II). Consider the following statement: "In 1972, the fertility rate of a 30 year old black woman is equal to the fertility rate of a white woman of the same age but with 8 years less of education". Given the results (rounding to one decimal):

   (a) The test statistic is approximately $t = -1.2$.

   (b) The test statistic is approximately $t = 3.9$.

   (c) The test statistic is approximately $t = -1.9$.

36. Assume that model (I) verifies the assumptions of the classical regression model. If the variable $KIDS$ was measured with error, estimates in the Output 1 will be in general:

   (a) Consistent.

   (b) None of the other statements are correct.

   (c) Less efficient that the ones obtained if the variable $KIDS$ was not measured with error.

37. Assume the error in the model (II) verifies $E\left(\varepsilon_2 | AGE, BLACK, EDUC, Y78, Y84\right) = 0$ for any combinations of the values of the explanatory variables, but the homoskedasticity assumption does not hold. Then:

   (a) The estimated OLS coefficients are inconsistent.

   (b) The Gauss-Markov Theorem is verified.

   (c) The estimated OLS coefficients are unbiased.

38. Comparing the models (I) and (II):

   (a) Model (I) is more restrictive, because it imposes that in year 1972 education does not have an impact on the number of children.

   (b) None of the other statements are correct.

   (c) Model (II) is less restrictive, because it allows for a given race, age and education, that fertility rates change differently over time.

39. The 2SLS estimated coefficients in Output 4 could have been obtained in an equivalent way:

    (a) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the prediction of education based on the estimations in Output 5B.

    (b) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the prediction of education based on the estimations in Output 5

    (c) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the instruments $MEDUC$ and $FEDUC$.

40. If we are certain that all the explanatory variables of model (II), except $EDUC$, are exogenous, and we would have estimated model (II) by 2SLS but using only $MEDUC$ as an instrument for $EDUC$, the estimates obtained for the parameters of model (II):

    (a) Would be inconsistent.

    (b) We cannot obtain consistent 2SLS estimates if we only have one instrument.

    (c) Would be less efficient than the 2SLS estimates in Output 4.

41. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test the hypothesis that the year does not affect the number of children:

    (a) It is not rejected, as the p-value of the corresponding statistic is equal to zero.

    (b) The question cannot be answered with the provided information.

    (c) It is rejected given the value of the corresponding statistic obtained when comparing the unrestricted model and the model that imposes the restriction.

42. Suppose that we are interested in model (II). Consider the following statement: "In 1972, the fertility rate of a 30 year old black woman is equal to the fertility rate of a white woman of the same age but with 8 years less of education". Given the results obtained:

    (a) At the 1% significance level, we can reject the above statement.

    (b) We cannot reject the above statement at the 10% significance level.

    (c) We can reject the above statement at the 10% significance level, but we cannot at the 5% significance level.

43. Assume that model (I) verifies the assumptions of the classical regression model. Consider two women interviewed in the same year, both of them are white and have the same level of education, but one is 40 years old and the other one is 30 years old. The first one will have on average (rounding to the closest integer number):

    (a) 5 children more than the second woman.

    (b) 1 child more than the second woman.

    (c) The same number of children as the second woman.

44. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients and for a given race, age and education:

    (a) For every 100 women, there are around 58 less children in 1984 than in 1972.

    (b) A woman in 1984 has 58% less children than a woman in 1972.

    (c) A woman in 1978 has 10% more children than a woman in 1972.

45. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, the mean difference in the number of children between two women with the same characteristics but one in 1972 and the other in 1978 is:

   (a) Significantly different from zero.

   (b) The question cannot be answered with the information provided in Output 2.

   (c) Statistically equal to zero.

46. Let's focus on model (II):

   (a) The model is misspecified, as it omits the variable $Y72$.

   (b) None of the other statements are correct.

   (c) Model (I) is a particular case of model (II).

Universidad Carlos III de Madrid
<u>ECONOMETRICS</u>
Academic year 2009/10
FINAL EXAM
MAY, 17, 2010

Exam Type: 4

DURATION: 2 HOURS

Directions:

- BEFORE YOU START TO ANSWER THE EXAM:
  - 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 **NIU**, which has 9 digit and always begins by 1000) both in letters and in the corresponding optical reading boxes.
  - Fill in, both in letters and in the corresponding optical reading boxes, the course code and your group.
- **Check that this document contains 46 questions sequentially numbered.**
- Check that the number of exam type that appears in the questionnaire matches the number indicated in the optical reading form.
- Read the problem text and the questions carefully.
- 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, or C).
- **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.
- All the questions correctly answered have the same score. Any incorrect answer will be graded as zero. To obtain a pass (at least 5 over 10) you must correctly answer **27** questions.
- If you wish, you may use the answer table as a draft, although such table does not have any official validity.
- You can use the back side of the problem text as a draft (no additional sheets will be handed out).
- **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.**
- **Dates of grades publication:** Friday, May, 21.
- **Date of exam revision:** It will be published in Aula Global.
- **Rules for exam revision:**
  - Its only purpose will be that each student:

* check the number of correct answers;
* handout in writing, if (s)he wants, the possible claims about the problem text and the questions, that will be attended by writing in the next 10 days since the revision date.

– To be entitled for revision, the student *should bring a printed copy of the exam solutions*, which will be available in Aula Global from the date of grade publication.

Answer DRAFT															
	(a)	(b)	(c)		(a)	(b)	(c)		(a)	(b)	(c)		(a)	(b)	(c)
1.				**13.**				**25.**				**37.**			
2.				**14.**				**26.**				**38.**			
3.				**15.**				**27.**				**39.**			
4.				**16.**				**28.**				**40.**			
5.				**17.**				**29.**				**41.**			
6.				**18.**				**30.**				**42.**			
7.				**19.**				**31.**				**43.**			
8.				**20.**				**32.**				**44.**			
9.				**21.**				**33.**				**45.**			
10.				**22.**				**34.**				**46.**			
11.				**23.**				**35.**							
12.				**24.**				**36.**							

1. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients and for a given race, age and education:

   (a) A woman in 1978 has 10% more children than a woman in 1972.

   (b) A woman in 1984 has 58% less children than a woman in 1972.

   (c) For every 100 women, there are around 58 less children in 1984 than in 1972.

2. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that education does not affect fertility:

   (a) The null hypothesis would be $H_0 : \delta_4 = \delta_7 = \delta_8 = 0$.

   (b) The null hypothesis would be $H_0 : \delta_4 - \delta_7 - \delta_8 = 0$.

   (c) The null hypothesis would be $H_0 : \delta_4 = 0$.

3. Comparing the models (I) and (II), model (II) can be expressed as model (I) with the following restriction:

   (a) $\delta_6 = 2\delta_5$.

   (b) $\delta_6 = 6\delta_5$.

   (c) $\delta_5 = \delta_6$.

4. Let's focus on model (II):

   (a) Model (I) is a particular case of model (II).

   (b) None of the other statements are correct.

   (c) The model is misspecified, as it omits the variable $Y72$.

5. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that the effect of education on the number of children does not depend on the year, the null hypothesis is:

   (a) The null hypothesis is $H_0 : \delta_4 = \delta_7 + \delta_8$.

   (b) The null hypothesis is $H_0 : \delta_7 = \delta_8 = 0$.

   (c) The null hypothesis is $H_0 : \delta_7 = \delta_8$.

6. Using $KIDS$ as dependent variable, consider the models that include a constant, AGE, AGE^2, $BLACK$ and $EDUC$. Indicate which of the following statements is FALSE:

   (a) If we would also include $YEAR$ and $Y78$ as explanatory variables and we would estimate by OLS, the estimated coefficients of AGE, AGE^2, $BLACK$ and $EDUC$ would coincide with those of Output 2.

   (b) If we would also include $YEAR$ and $Y78$ as explanatory variables , the model would be more general than model (I), but it would not be comparable to model (II), because the models impose different restrictions.

   (c) If we would also include $YEAR$ and $Y78$ as explanatory variables and we would estimate by OLS, the R^2 would coincide with the one of Output 2.

7. If you only had information about the number of children, the best prediction you can give about the value of this variable (rounding up to two decimals) is:

   (a) 1.67.

   (b) 2.20.

   (c) 2.67.

8. Assume that model (I) verifies the assumptions of the classical regression model. If the variable $KIDS$ was measured with some error, and that error was correlated with some of the explanatory variables, estimations in Output 1 would be:

   (a) As efficient as the ones obtained if the variable $KIDS$ was not measured with error.

   (b) None of the other statements are correct.

   (c) Inconsistent.

9. In model (II), if you wanted to test whether the mean number of children for a black woman in 1972 with 10 years of education is the same than a white woman in 1972 with the same age but with 12 years of education:

   (a) The null hypothesis would be $H_0 : 12\delta_4 - \delta_3 = 0$.

   (b) The null hypothesis would be $H_0 : 2\delta_4 + \delta_3 = 0$.

   (c) The null hypothesis would be $H_0 : 2\delta_4 - \delta_3 = 0$.

10. Comparing the models (II) and (III), indicate which of the following statements is FALSE:

   (a) At the 5% significance level we would choose Model (II).

   (b) When estimating model (III) by OLS, we see that education does not longer have a significant effect on fertility.

   (c) Model (II) is more restrictive, because it imposes that the effect of education does not depend on time (the year).

11. Assume that model (I) verifies the assumptions of the classical regression model. Consider two women interviewed in the same year, both of them are white and have the same level of education, but one is 40 years old and the other one is 30 years old. The first one will have on average (rounding to the closest integer number):

   (a) The same number of children as the second woman.

   (b) 1 child more than the second woman.

   (c) 5 children more than the second woman.

12. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, in the year 1972, the mean difference in the number of children between a black woman and a white woman with the same age but with 5 years less of education than the first one is (rounding to one decimal):

   (a) 0.3 less children.

   (b) 1.1 more children.

   (c) 0.4 more children.

13. Assume that model (I) verifies the assumptions of the classical regression model. Under the evidence of Output 1, the effect of age on the number of children is:

   (a) Negative for women older than 35 years old.

   (b) Positive, but marginally decreasing in age for women who are younger than 40.

   (c) Constant.

14. Assume that model (III) verifies the assumptions of the classical regression model. Given the results in Output 3, and taking into account only women younger than 40 years old, indicate which of the following statements is FALSE:

    (a) Older women have on average more children.

    (b) The casual effect of education is the same for all women considered.

    (c) In general, women with lower educational level have on average more children.

15. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients (and rounding to two decimals), for a 20 year old white woman with 10 years of education:

    (a) There is not enough information to predict the mean number of children in 1972.

    (b) The mean number of children is approximately 6.24.

    (c) The mean number of children was approximately 0.19 in 1972.

16. In model (II), if you wanted to test that the effect of age on the number of children is constant, the null hypothesis would be

    (a) $H_0 : \delta_2 = 0$.

    (b) $H_0 : \delta_1 + \delta_2 = 0$.

    (c) $H_0 : \delta_1 = \delta_2 = 0$.

17. Assume that model (I) verifies the assumptions of the classical regression model. Given the results in Output 1 and keeping all the other factors constant, which of the following statements is FALSE:

    (a) A woman in 1978 had on average 0.05 less children than a woman in 1972.

    (b) A woman in 1978 had on average 0.29 more children than a woman in 1984.

    (c) A woman in 1978 had on average 0.29 less children than a woman in 1972.

18. Comparing the models (I) and (II):

    (a) Model (I) imposes the restriction that the coefficients of $Y78$ and $Y84$ are both equal to zero.

    (b) Model (I) imposes the restriction that the coefficient of $Y84$ is exactly the double of the coefficient of $Y78$.

    (c) The models (I) and (II) are different models because none of them is a particular case of the other.

19. Comparing the models (I) and (II):

    (a) Model (II) is less restrictive, because it allows for a given race, age and education, that fertility rates change differently over time.

    (b) None of the other statements are correct.

    (c) Model (I) is more restrictive, because it imposes that in year 1972 education does not have an impact on the number of children.

20. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test the null hypothesis that the effect of education on women observed in 1978 is the same as on women observed in 1984, we can conclude that:

   (a) We reject the null hypothesis at the 10%, but we do not reject it at the 5% significance level.

   (b) We do not reject the null hypothesis at the 10% significance level.

   (c) We reject the null hypothesis at the 5% significance level.

21. If education was an endogenous variable, in order to test whether two instruments, father's and mother's education, are valid instruments, we would have to:

   (a) Test the hypothesis that the residual of the reduced form (the linear projection of $EDUC$ on the exogenous variables and both instruments) has a significant effect on education.

   (b) In a regression of $EDUC$ on the exogenous variables of the model and on both instruments, test that these two instruments are individually significant.

   (c) In a regression of $EDUC$ on the exogenous variables of the model and on both instruments, test that these last two variables are jointly significant.

22. Suppose that we are interested in model (II). Consider the following conjecture: "For a given race and educational level, the decrease in the fertility rate is constant over time". Indicate which of the following statements is false:

   (a) At the 5% significance level, we cannot reject the above conjecture.

   (b) We do not have enough information to evaluate the above conjecture.

   (c) If the conjecture is true, model (II) could be represented as model (I).

23. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test whether the effect of education for a women observed in 1978 is the same than the one observed in 1984, the null hypothesis would be:

   (a) $\delta_7 = \delta_8$.

   (b) $\delta_4 = \delta_7 = \delta_8$.

   (c) $\delta_7 = \delta_8 = 0$.

24. Assume that model (II) verifies the assumptions of the classical regression model. If the education variable ($EDUC$) was measured with error, the inconsistency bias of the estimates of the affected coefficients would be larger:

   (a) The larger the education variance with respect to the variance of the measurement error.

   (b) The larger the expected value of education.

   (c) The larger the variance of the measurement error with respect to the education variance.

25. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test the hypothesis that the year does not affect the number of children:

   (a) It is rejected given the value of the corresponding statistic obtained when comparing the unrestricted model and the model that imposes the restriction.

   (b) The question cannot be answered with the provided information.

   (c) It is not rejected, as the p-value of the corresponding statistic is equal to zero.

26. If we want to test whether both father's and mother's education are valid instruments, the value of the test statistic would be

(a) 26.8.

(b) 154.9.

(c) 190.4.

27. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, for a 20 year old black woman with 5 years of education, between 1978 and 1984, the mean number of children has decreased (rounding to two decimals) by:

(a) 0.58.

(b) 0.68.

(c) 0.48.

28. Assume that model (II) verifies the assumptions of the classical regression model. Given the estimated coefficients, the mean difference in the number of children between two women with the same characteristics but one in 1972 and the other in 1978 is:

(a) Statistically equal to zero.

(b) The question cannot be answered with the information provided in Output 2.

(c) Significantly different from zero.

29. Assume that model (I) verifies the assumptions of the classical regression model. An appropriate estimation of the unconditional variance of the dependent variable is:

(a) 2.56.

(b) 1.60.

(c) 2.79.

30. Assume that model (III) verifies the assumptions of the classical regression model. Given the results in Output 3:

(a) The effect of education is more negative in 1984 than in 1972.

(b) The effect of education is not statistically different from zero.

(c) The effect of education does not vary over time.

31. If we are certain that all the explanatory variables of model (II), except $EDUC$, are exogenous, and we would have estimated model (II) by 2SLS but using only $MEDUC$ as an instrument for $EDUC$, the estimates obtained for the parameters of model (II):

(a) Would be less efficient than the 2SLS estimates in Output 4.

(b) We cannot obtain consistent 2SLS estimates if we only have one instrument.

(c) Would be inconsistent.

32. If education was an endogenous variable, then:

(a) The estimated coefficients in Output 2 would be inconsistent for model (II), but those of Output 3 would not be inconsistent for model (III).

(b) None of the other statements are correct.

(c) The estimated coefficients in Output 1 would be inconsistent for model (I), but those of Output 2 would not be inconsistent for model (II).

33. The 2SLS estimated coefficients in Output 4 could have been obtained in an equivalent way:

(a) Estimating by 2SLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the education, using a prediction based on the estimations in Output 5 as an instrument for education.

(b) None of the other statements are correct.

(c) Estimating by 2SLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the education, using a prediction based on the estimations in Output 5B as an instrument for education.

34. Assume that model (I) verifies the assumptions of the classical regression model. An appropriate estimation of the variance of the dependent variable (rounding to two decimals), conditional on the explanatory variables is:

(a) 2.56.

(b) 1.60.

(c) 2.79.

35. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test that the year does not affect the number of children:

(a) The null hypothesis is $H_0 : \delta_5 = \delta_6 = \delta_7 = \delta_8 = 0$.

(b) The null hypothesis is $H_0 : \delta_5 = \delta_6 = \delta_7 = \delta_8$.

(c) The null hypothesis is $H_0 : \delta_5 = \delta_6 = 0$.

36. Assuming that models (I) and (II) verify the assumptions of the classical regression model, assume that the variable years of education ($EDUC$) is measured with error. Then

(a) Output 2 will provide inconsistent estimates for the parameters of model (II).

(b) Output 1 and Output 2 will provide consistent estimates for the parameters of models (I) and (II), respectively.

(c) Output 1 will provide consistent estimates for the parameters of model (I).

37. Given the results in Output 6:

(a) We do not reject that the correlation between the instruments and $EDUC$ is zero.

(b) We do not reject that the correlation of the instruments with the error of model (II) is zero.

(c) We do not reject that $EDUC$ is exogenous.

38. The 2SLS estimated coefficients in Output 4 could have been obtained in an equivalent way:

(a) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the instruments $MEDUC$ and $FEDUC$.

(b) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the prediction of education based on the estimations in Output 5

(c) Estimating by OLS a model with $KIDS$ as the dependent variable and including as regressors all the exogenous explanatory variables and the prediction of education based on the estimations in Output 5B.

39. The information provided in Output 6 allow us to know whether:

    (a) We can reject the null hypothesis that the instruments are valid.
    (b) None of the other statements are correct.
    (c) We can reject the null hypothesis that education is exogenous.

40. If education was an endogenous variable, given the available information, we can say that

    (a) Only the mother's education ($MEDUC$) is a valid instrument for $EDUC$.
    (b) It would be possible to obtain consistent estimates of the parameters by using only the father's education as instrument.
    (c) Only the father's education ($FEDUC$) is a valid instrument for $EDUC$.

41. Suppose that we are interested in model (II). Consider the following statement: "In 1972, the fertility rate of a 30 year old black woman is equal to the fertility rate of a white woman of the same age but with 8 years less of education". Given the results (rounding to one decimal):

    (a) The test statistic is approximately $t = -1.9$.
    (b) The test statistic is approximately $t = 3.9$.
    (c) The test statistic is approximately $t = -1.2$.

42. Suppose that we are interested in model (II). Consider the following statement: "In 1972, the fertility rate of a 30 year old black woman is equal to the fertility rate of a white woman of the same age but with 8 years less of education". Given the results obtained:

    (a) We can reject the above statement at the 10% significance level, but we cannot at the 5% significance level.
    (b) We cannot reject the above statement at the 10% significance level.
    (c) At the 1% significance level, we can reject the above statement.

43. Assume the error in the model (II) verifies $E(\varepsilon_2 | AGE, BLACK, EDUC, Y78, Y84) = 0$ for any combinations of the values of the explanatory variables, but the homoskedasticity assumption does not hold. Then:

    (a) The estimated OLS coefficients are unbiased.
    (b) The Gauss-Markov Theorem is verified.
    (c) The estimated OLS coefficients are inconsistent.

44. Assume that model (III) verifies the assumptions of the classical regression model. If we wanted to test whether the effect of education on women observed in 1978 is the same as on women observed in 1984, the test statistic (rounding to one decimal) would be:

    (a) -2.4.
    (b) 0.6.
    (c) -1.6.

45. Assume that model (I) verifies the assumptions of the classical regression model. Given the results in Output 1, we can say that fertility rates:

    (a) Have decreased over time.
    (b) We do not have enough information to conclude anything.
    (c) Have remained constant over time.

46. Assume that model (I) verifies the assumptions of the classical regression model. If the variable $KIDS$ was measured with error, estimates in the Output 1 will be in general:

(a) Less efficient that the ones obtained if the variable $KIDS$ was not measured with error.

(b) None of the other statements are correct.

(c) Consistent.