EX0012

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS

MSc ECONOMICS

JUN 2024

ADVANCED ECONOMETRICS (MEC 502)

EXAMINATION   DURATION: 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Answer question 1 in Section A and any other three questions from Section B.

2. Question 1 carries 40 marks.

3. All the questions in Section B carry equal marks of 20 each.

4. Cell-phones are not allowed into the examination room.

SECTION A (COMPULSORY)

Question 1

a. i. Discuss the threats or disadvantages of Randomised Control Trials (RCTs) as impact evaluation methods. **(10 marks)**

ii. Formulate a hypothetical impact evaluation problem for which the Regression Discontinuity Design (RDD) method can be used. **(7 marks)**

iii. Explain one advantage of the propensity score matching program evaluation method over experimental design. **(3 marks)**

b. The following equation was estimated using 2010 data for Zimbabwe:

$$\widehat{bwght} = 3.25 + 0.007cigs - 0.12\log(fa\min c) + 0.052male - 0.031black$$
$$+ 0.025motheredu - 0.014motheredumale + 0.021\log(fa\min c)black$$

$$n = 1271, R^2 = 0.0093$$

where birth weight ($bwght$) takes 3 values (underweight=1, normal weight=2 and overweight=3), $cigs$ is average number of cigarettes the mother smoked per day during pregnancy, $fa\min c$ is household annual family income, $motheredu$ is years of schooling for the mother, $male$ is a dummy variable indicating that the child is born male and $black$ is a dummy variable indicating whether the child's race is classified as black.

Assuming your objective is to establish if mother smoking status influences the likelihood that the child is born underweight:

i. Does the above model help you to achieve your objective? Why or why not?
(4 marks)

ii. What is the best estimation method to achieve your objective? Justify.
(4 marks)

iii. Using the most appropriate estimation method of your choice, give an economic interpretation of the variable *cigs* basing on the objective specified above.
(4 marks)

iv. Interpret any one interaction term given above.
(4 marks)

v. Suggest any other two variables that can be included in this model.
(4 marks)
[40 marks]

SECTION B (ANSWER ANY THREE QUESTIONS)

Question 2

The boss of company ABC believes that gym exercise would make their staff more productive. You suggest that they should pilot the idea with a Randomised Controlled Trial among staff by giving free gym memberships to a randomly selected treatment group. One year later, regular gym exercise increased from 6% to 23% in the treatment group and stayed at 8% in the control group, and there was minimal non-response and turnover of staff. You have a measure of personal productivity for workers, Y, collected a year after the pilot.

a. How would you describe 'compliance' and 'attrition' in this trial? **(4 marks)**

b. Could the size of the company (number of employees) affect the success of the RCT? How? **(3 marks)**

c. Using the available information, would the following model be sufficient to estimate the effect of regular gym exercise on worker productivity? How would you sequence the estimation?

Exercise = a + b*Pass + u   [1]
Y = c + d*Exercise + v   [2]   **(3 marks)**

d. Identify the variable that needs an instrument and specify the instrument you would use. **(3 marks)**

e. Explain what you understand by the Local Average Treatment Effect (LATE), which parameter shows the causal effect of exercise on productivity? **(4 marks)**

f. There is no measurement of worker productivity before the pilot. Is it a problem that worker productivity is measured only after the pilot? Explain. **(3 marks)**
[20 marks]

Question 3

A study by Machin, Pelkonen and Salvanes (2012) estimates the effect of education on regional mobility and unemployment, by using a school reform as an instrumental variable for education. The school reform raised the minimum years of compulsory schooling from 7 to 9 years. They estimated a following two-equation system:

$$Outcome_i = \alpha + \beta Ed_i + \theta D_{Female} + \sum_c \lambda_c D_c + \phi_m + \varepsilon_i,$$

$$Ed_i = \eta + \delta Treated_i + \varphi D_{Female} + \sum_c \psi_c D_c + \Omega_m + v_i,$$

where Ed_i = years of education for individual i, $Treated_i$ = the individual is affected by the reform, D_{Female} = Dummy for women and D_c = Birth cohort dummies. Φ_m and Ω_m refer to municipality effects. Results for two outcome variables in equation (1), inter-county migration and unemployment, are presented in the following table, using both OLS and instrumental variable (IV) estimation. The values in parenthesis are the standard errors of the estimates.

A. Mobility and education

Dependent variable:	Years of education	No. of inter-county migrations	
Estimator:	First-stage OLS	OLS	IV
Affected by reform	.650 (.008)		
Years of education		-.022 (.005)	.032 (.013)
Female	.052 (.004)	-.039 (.005)	-.042 (.005)
Sample size	67,608	67,608	67,608
R-squared	.41	.01	

B. Employment and education

Dependent variable:	Years of education	Years not employed (out of 17)	
Estimator:	First-stage OLS	OLS	IV
Affected by reform	.650 (.008)		
Years of education		-.863 (.042)	-.300 (.112)
Female	.052 (.004)	2.705 (.042)	2.674 (.043)
Sample size	67,608	67,608	67,608
R-squared	.41	.06	

a) Which of the equations, (1) or (2), represents the so called '1st stage estimation' of the two-stage least squares instrumental variables estimation? **(3 marks)**

b) What are the two conditions that the school reform needs to satisfy to qualify as a valid instrumental variable? **(6 marks)**

c) Based on the results table, how much did the school reform increase the years of education for the average person in the sample? **(4 marks)**

d) Based on the results table, does education affect the number of inter-county migrations? Please explain. **(4 marks)**

e) The effect of Years of education on unemployment is -0.863 in OLS, but -0.300 in the IV. Provide a plausible intuitive explanation of why the OLS estimate is a larger negative value. **(3 marks)**

[20 marks]

Question 4
A researcher wants to estimate the effect of winter on happiness for the population of the Zimbabwe. To do this, the researcher asks 1,000 people from Gweru (one of the coldest places in the country) how happy they are on a scale of 0 to 100 (with 100 being the happiest). The researcher creates a dummy variable that equals one if a person was asked this question in the winter months and equal to zero otherwise. To estimate the effect of winter on happiness, the researcher regresses the happiness number on this dummy variable for winter.

Discuss the problems associated with trying to make causal inferences of winter on happiness in Zimbabwe using the above strategy. **(20 marks)**

[20 marks]

Question 5

Table IV from Lemieux, MacLeod, and Parent (*Quarterly Journal of Economics*, 2009; (see the last page) shows results from a regression of log wages on a dummy for whether a job has pay linked to performance (e.g. sales people paid on commission) and other variables. The data are panel data on workers. In addition to the reported coefficients, the regressions include industry, occupation, and year dummies; county unemployment; and marital status, race dummies, and union status. Standard errors are in parentheses.

The model also includes quadratic functions of experience (number of years in the workforce) and tenure (number of years at this specific job). The row labeled "Experience x performance-pay" is the effect of experience at 20 years interacted with performance pay. Similarly, the row labeled "Tenure x performance pay" is the effect of tenure (evaluated at ten years) interacted with performance pay.

    a. Based on column (3), is the return to education higher at performance pay jobs or non-performance pay jobs? What is the difference and is it statistically significant?

(5 marks)

    b. Again using column (3), what is the return to having a performance pay job for somebody with a college degree (16 years of education), 20 years of experience, and 10 years of tenure? **(5 marks)**

    c. Regression (4) includes worker-level fixed effects. The coefficient on years of education falls from .0637 in (3) to .0167 in (4). Is this a large change in economic terms? Explain. **(5 marks)**

    d. Explain a scenario for which the difference in the coefficients discussed in question 3 (0.0637 vs. 0.0167) may be a result of the omitted variable bias. **(5 marks)**

[20 marks]

TABLE IV

SKILLS-RELATED WAGE DIFFERENTIALS AND PERFORMANCE-PAY (PP) JOBS

	Sample					
	PP jobs	Non-PP jobs	All jobs			
	OLS	OLS	OLS	FE	OLS	FE
Estimation method	(1)	(2)	(3)	(4)	(5)	(6)
Performance-pay job dummy	—	—	-0.4526 (0.1019)	-0.2061 (0.0723)	-0.2406 (0.1251)	0.1414 (0.0998)
Years of education	0.0929 (0.0071)	0.0665 (0.0039)	0.0637 (0.0040)	0.0167 (0.0091)	0.0584 (0.0047)	0.0040 (0.0096)
Education × performance-pay job	—	—	0.0365 (0.0071)	0.0169 (0.00048)	0.0217 (0.0092)	-0.0079 (0.0071)
Education × 1990–1993	—	—	—	—	0.0161	0.0222 (0.0056)
Education × performance-pay job × 1990–1993	—	—	—	—	0.0190 (0.0137)	0.0280 (0.0089)
Potential experience (effect at 20 years)	0.4259 (0.0535)	0.2882 (0.0288)	0.3010 (0.0294)	0.4545 (0.1258)	0.3002 (0.0294)	0.4231 (0.1256)
Experience × performance-pay job	—	—	0.1162 (0.0584)	0.0149 (0.0501)	0.1018 (0.0581)	-0.0278 (0.0509)
Tenure (effect at ten years)	0.1670 (0.0268)	0.2197 (0.0154)	0.2262 (0.0154)	0.1158 (0.0129)	0.2271 (0.0154)	0.1191 (0.0129)
Tenure × performance-pay job	—	—	-0.0666 (0.0301)	0.0278 (0.0237)	-0.0677 (0.0303)	0.0196 (0.0239)
Number of observations	9,680	16,466	26,146	26,146	26,146	26,146

END OF PAPER