

Econ 371
Practice Exam #3

Multiple Choice (5 points each): For each of the following, select the single most appropriate option to complete the statement.

- 1) The interpretation of the slope coefficient in the model $\ln(Y_i) = \beta_0 + \beta_1 \ln(X_i) + u_i$ is as follows:
- a) a 1% change in X is associated with a β_1 % change in Y.
 - b) a change in X by one unit is associated with a β_1 change in Y.
 - c) a change in X by one unit is associated with a $100\beta_1$ % change in Y.
 - d) a 1% change in X is associated with a change in Y of $0.01\beta_1$.

Answer: a

- 2) To test whether or not the population regression function is linear rather than a polynomial of order r,
- a) check whether the regression R^2 for the polynomial regression is higher than that of the linear regression.
 - b) compare the TSS from both regressions.
 - c) look at the pattern of the coefficients: if they change from positive to negative to positive, etc., then the polynomial regression should be used.
 - d) use the test of (r-1) restrictions using the F-statistic.

Answer: d

- 3) Simultaneous causality bias
- a) is also called sample selection bias.
 - b) happens in complicated systems of equations called block recursive systems.
 - c) results in biased estimators if there is heteroskedasticity in the error term.
 - d) arises in a regression of Y on X when, in addition to the causal link of interest from X to Y, there is a causal link from Y to X.

Answer: d

- 4) A survey of earnings contains an unusually high fraction of individuals who state their weekly earnings in 100s, such as 300, 400, 500, etc. This is an example of
- a) errors-in-variables bias.
 - b) sample selection bias.
 - c) simultaneous causality bias.
 - d) companies that typically bargain with workers in 100s of dollars.

Answer: a

- 5) $\text{cov}(u_{it}, u_{is} | X_{it}, X_{is}) = 0$ for $t \neq s$ means that
- there is no perfect multicollinearity in the errors.
 - division of errors by regressors in different time periods is always zero.
 - there is no correlation over time in the residuals.
 - conditional on the regressors, the errors are uncorrelated over time.

Answer: d

- 6) In the panel regression analysis of beer taxes on traffic deaths, the estimation period is 1982-1988 for the 48 contiguous U.S. states. To test for the significance of time fixed effects, you should calculate the F-statistic and compare it to the critical value from your $F_{q, \infty}$ distribution, where q equals
- 6.
 - 7.
 - 48.
 - 53.

Answer: a

- 7) In the linear probability model, the interpretation of the slope coefficient is
- the change in odds associated with a unit change in X, holding other regressors constant.
 - not all that meaningful since the dependent variable is either 0 or 1.
 - the change in probability that $Y=1$ associated with a unit change in X, holding others regressors constant.
 - the response in the dependent variable to a percentage change in the regressor.

Answer: c

- 8) In the probit model $\Pr(Y = 1 | X_1, X_2, \dots, X_k) = \Phi(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k)$,
- the β 's do not have a simple interpretation.
 - the slopes tell you the effect of a unit increase in X on the probability of Y.
 - β_0 cannot be negative since probabilities have to lie between 0 and 1.
 - β_0 is the probability of observing Y when all X's are 0.

Answer: a

Problems: Provide the requested information for each of the following questions. Be sure to show your work

1) Earnings functions attempt to find the determinants of earnings, using both continuous and binary variables. One of the central questions analyzed in this relationship is the returns to education.

a) Collecting data from 253 individuals, you estimate the following relationship

$$\widehat{\ln(Earn_i)} = 0.54 + 0.083 \times Educ, R^2 = 0.20, SER = 0.445$$

$$(0.14) \quad (0.011)$$

where *Earn* is average hourly earnings and *Educ* is years of education.

What is the effect of an additional year of schooling? If you had a strong belief that years of high school education were different from college education, how would you modify the equation? What if your theory suggested that there was a “diploma effect”?

Answer: One additional year of education carries an 8.3 percent increase, or a return, on earnings. You would need additional data to see if this coefficient was different for high school versus college education. Including both variables in the regression would then allow you to test for equality of the coefficients. A “diploma effect” could be studied by creating a binary variable for a high school diploma, a junior college diploma, a B.A. or B.Sc. diploma, and so forth.

b) You read in the literature that there should also be returns to on-the-job training. To approximate on-the-job training, researchers often use the so called Mincer or potential experience variable, which is defined as $Exper = Age - Educ - 6$. Explain the reasoning behind this approximation. Is it likely to resemble years of employment for various sub-groups of the labor force?

Answer: The idea is that everybody works except in the first six years of life and during the time spent in school/university for education. This approximation will work better for people with a strong attachment to the labor force. It will not work well for females and those who are frequently unemployed or out of the workforce.

c) You incorporate the experience variable into your original regression

$$\widehat{\ln(Earn_i)} = -0.01 + 0.101 \times Educ + 0.033 \times Exper - 0.0005 \times Exper^2,$$

(0.16) (0.012) (0.006) (0.0001)

$$R^2 = 0.34, SER = 0.405$$

What is the effect of an additional year of experience for a person who is 40 years old and had 12 years of education? What about for a person who is 60 years old with the same education background?

Answer: For the first person, the *Exper* variable increases from 22 to 23, and results in a 1.1 percent earnings increase. For the 60 year old, there is an expected decrease of 1 percent.

- d) Test for the significance of each of the coefficients of the added variables. Why has the coefficient on education changed so little?

Answer: Both coefficients are highly significant using conventional levels of significance. The fact that the coefficient on the education variable hardly changed suggests that education and experience are not highly correlated.

- 2) A study, published in 1993, used U.S. state panel data to investigate the relationship between minimum wages and employment of teenagers. The sample period was 1977 to 1989 for all 50 states. The author estimated a model of the following type:

$$\ln(E_{it}) = \beta_0 + \beta_1 \ln(M_{it}/W_{it}) + \gamma_2 D2_i + \dots + \gamma_n D50_i + \delta_2 B2_t + \dots + \delta_1 B13_t + u_{it},$$

where *E* is the employment to population ratio of teenagers, *M* is the nominal minimum wage, and *W* is average hourly earnings in manufacturing. In addition, other explanatory variables, such as the adult unemployment rate, the teenage population share, and the teenage enrollment rate in school, were included.

- a) Name some of the factors that might be picked up by time and state fixed effects.

Answer: Time effects will pick up the effect of omitted variables that are common to all

50 states at a given point in time. Federal fiscal and monetary variables, exchange rate and U.S. terms of trade movements, aggregate business cycle developments, etc., are candidates here. State fixed effects will include variables that are slowly changing over time within a specific state such as attitudes toward employment or labor force participation, state specific labor market policies, industrial and labor force composition, etc.

- b) The author decided to use eight regional dummy variables instead of the 49 state dummy variables. What is the implicit assumption made by the author? Could you test for its validity? How?

Answer: The implicit assumption by the author is that the coefficients on the state fixed effects are identical within a region but differ between regions. Since these coefficients imply linear restrictions, they can be tested using the F -test.

- c) The results, using time and region fixed effects only, were as follows:

$$\widehat{\ln E_{it}} = -0.182 \times \ln(M_{it}/W_{it}) + \dots; R^2 = 0.727$$

(0.036)

Interpret the result briefly.

Answer: Consider a ten percent increase in minimum wages, say from \$5 to \$5.50 with constant average hourly earnings. This corresponds to a ten percent increase in relative minimum wages. The resulting decrease in the teenage to population ratio is 1.8 or almost 2 percent. The regression explains roughly 73 percent of the employment to population ratio of teenagers during the period of 1977 to

- 3) Consider the following logit regression:

$$\Pr(Y = 1 | X) = \Lambda(15.3 - 0.24X)$$

Calculate the change in probability for X increasing by 10 for $X = 40$ and $X = 60$. Why is there such a large difference in the change in probabilities?

Answer: $\Pr(Y=1|X=40) = 0.997$; $\Pr(Y=1|X=50) = 0.964$; $\Pr(Y=1|X=60) = 0.711$;
 $\Pr(Y=1|X=70) = 0.182$. The change is large due to the nonlinear nature of the model and the values for which the change was calculated.