Written Preliminary PhD. Examination

Department of Applied Economics

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Policy Analysis

Instructions

• Identify yourself by your code letter, not your name, on each question.
• Start each question’s answer on the top of a new page.
• Answer 4 out of the following 6 questions.
• You have four hours to complete the examination.
**Question 1**

African American children perform less well than white children on a variety of measures of mathematics and reading tests, such as those included in the Early Childhood Longitudinal Study – Kindergarten (ECLS-K) data base used in Fryer and Levitt’s paper published in 2004 in the *Review of Economics and Statistics*. (The paper is provided to you as part of the exam.)

One hypothesis offered in the literature is that concentrations of poverty and/or individual poverty explain some or all of the racial gaps in test scores.

a) Write down the dummy variable model and the Blinder-Oaxaca version of the discrimination test that would reject the hypothesis that individual poverty or concentrations of poverty explain the racial gap in test scores.

b) According to the information provided in the attached Fryer-Levitt paper, what support is provided for the individual and/or concentration of poverty hypothesis? What support is provided for the discrimination hypothesis?

c) Detail how one might test for teacher discrimination using the information provided in the Fryer-Levitt paper, and explain why the test might fail in the face of unobserved teacher quality.

d) Suppose that teacher quality were measured by changes in student test scores. How would you retest for teacher discrimination while accounting for the inherent endogeneity of this measure of teacher quality? (Be sure to write out the equation you have in mind.)

e) Suppose you had available information on teacher grade point averages (GPA) in college and/or their performance on college entry examinations such as the Scholastic Aptitude Test (SAT). How would your results change if you controlled for teacher GPA and/or SAT scores in your measure of teacher quality?

f) Suppose that a member of the legislature, who believes that racial bias by teachers contributes to racial gaps in test scores, wants to require the Department of Education to administer a racial bias test (e.g. an Implicit Association Test) as a screening device. Assume that the covariance of the scores on the racial bias test and SAT scores is negative or zero. What impact will this have on your measurement of teacher discrimination in the dummy variable model? In the Blinder-Oaxaca model?
Question 2

a) Describe the difference between a market good and a “Samuelsonian” pure public good or service (such as national defense). Show graphically how the determination of the optimal level of private goods and public goods differs. If all consumers have homogeneous tastes, will all consumers demand the same quantity of the public good at any given price? Explain why or why not. Explain why the market result for providing pure public goods is likely to be sub-optimal. Is the market result likely to over-produce or under produce the pure public good?

b) In a democracy one way of determining how much of the pure public good should be produced is by vote of elected representatives. Carefully explain whose preferences for public goods will be met using a simplified model in which there are 3 elected representatives and each representative has 5 constituents including herself, all of whom have different preferences for the public good. What assumptions are necessary for your model? Will the allocation of resources to the pure public good be optimal? Is the representative democracy model likely to over-produce, under-produce, or optimally produce the pure public good?

c) Another way of determining how much of the pure public good should be produced is by popular vote or referenda. Assume a popularly elected executive defines the question to be decided as between service (and spending) levels A and B. Level A is the current level and is clearly less than optimal and level B is greater than level A. Assuming that the executive’s goal is to be re-elected and the executive has perfect information about the preferences of all constituents, whose preferences will level B reflect?

d) If the executive has less than perfect information about voter preferences and voters believe the vote is a one-time only opportunity to change the level of services provided, is it rational for the electorate to approve a service level B which exceeds the level of services determined in part b above? Explain your result carefully. If voters believe there will be another referendum in the near term would the electorate to approve a service level that exceeds the level of services determined in part b? Explain why or why not?
**Question 3**

a) How does Becker measure “tastes for discrimination?”

b) What does Becker assume about the mobility of capital in his two sector model of discrimination?

c) What assumptions are made in the Becker Model about uncertainty, bargaining and information about skills of workers?

d) Who gains and who loses from discrimination in the Becker Model?

e) In long run equilibrium in the Becker model of discrimination, what can be said about racial gaps in wages?

f) According to Heckman’s (1998) interpretation of the Becker Model:

“The impact of market discrimination is not determined by the most discriminatory participants in the market, or even by the average level of discrimination among firms, but rather by the level of discrimination at the firms where ethnic minorities or women actually end up buying, working and borrowing. It is at the margin that economic values are set.”

Explain. What are the implications of the Heckman proposition for the measurement and detection of discrimination?

g) Persico and Todd (2001) develop a test to detect discrimination in motor vehicle searches. The test compares the probabilities of being found guilty of carrying contraband, given a search, among different subgroups of the population. Absent discrimination, what can be said about intergroup differences in the probability of being found guilty of carrying drugs, given a search? What can be said about differences in the probability of search? Explain your results in light of the “marginal analysis” proposed by Heckman.

h) What are the implications of the Heckman proposition for optimal enforcement of anti-discrimination legislation?

i) Consider the following regression:

\[ \ln y = \sum \beta_j x_j + \delta Race \]  
(Eq. 1)
where \( y \) is earnings, and \( x \) is human capital measures, absent measures of intelligence. Race is equal to one if the worker is African American and equal to zero if the worker is white. Consider the revised regression equation that incorporates unmeasured intelligence through a proxy, AFQT.

\[
\ln y = \sum \beta'x_i + \delta' Race + \theta AFQT \quad \text{(Eq. 2)}
\]

According to the Darity-Mason critique of human capital models of discrimination, what can be said about the relationship between \( \delta \) and \( \delta' \)?

j) What are the implications of the Darity-Mason critique of human capital models of discrimination for the design of optimal anti-discrimination policies?
Question 4

Let \( E[Y_t] \) be the average of \( Y_{ti} \) for all individuals in the population when exposed to the treatment \( t \) and \( E[Y_c] \) be the average of \( Y_{ci} \) for all individuals when they are exposed to the control condition \( c \). Then the average treatment effect in the population is:

\[
(a) \quad \bar{\delta} = E[Y_t - Y_c] = E[Y_t] - E[Y_c].
\]

1. Explain why the Average Treatment Effect for the population cannot be calculated as defined above.

Instead of using the entire population, researchers frequently use a sample of size \( n \) taken from the population of interest. Unlike \( E[Y_t] \) and \( E[Y_c] \) as discussed above, the expected values \( E[Y_t| x=t] \) and \( E[Y_c| x=c] \) represent averages with respect to particular subgroups of the population for which \( Y_{ti} \) and \( Y_{ci} \) are observed (where \( x \) denotes the treatment assignment). From these expected values, the difference between the mean outcome for those in the treatment group and the mean outcome for those in the comparison group can be referred to as the standard estimator \( S^* \) of the treatment effect:

\[
(b) \quad S^* = \overline{Y_t} - \overline{Y_c}
\]

It is possible that the standard estimator in (b) consistently estimates the average treatment effect for the population described in (a). To understand when that occurs, it is useful to decompose the average treatment effect in the population from (a) into a weighted average of the average treatment effect for those in the treatment group and the average treatment effect for those in the control group:

\[
(c) \quad \bar{\delta} = \pi \quad \bar{\delta}_{i \in t} + (1 - \pi) \bar{\delta}_{i \in c}
\]
Winship and Sobel (2001) show that the expected value of the standard estimator $S^*$ is equal to:

\[(d) \quad E[S^*] = E[Y_t | x = t] - E[Y_c | x = c] = \bar{\delta} + (E[Y_c | x = t] - E[Y_c | x = c]) + (1 - \pi)(\bar{\delta}_t - \bar{\delta}_c)\]

The right-hand side of equation (d) consists of three parts. The first part is the average treatment effect in the population as described in (a). The second two parts help us understand the two possible sources of bias in the standard estimator.

2. Explain the two types of bias included in equation (d). Explain the two parts

\[(E[Y_c | x = t] - E[Y_c | x = c]) \quad \text{and} \quad (1 - \pi)(\bar{\delta}_t - \bar{\delta}_c) \] separately. Which part of this bias do researchers tend to focus on the most?

3. One method of estimating treatment effects is through the use of propensity score matching.

a. Briefly describe at least two specific types of matching procedures or algorithms that could be used to do PPM estimation.

b. Unlike ordinary regression analysis, propensity score matching estimation requires a common support region. What is meant by “common support?” Provide a short discussion of a hypothetical estimation issue in which the lack of common support could be problem.
Question 5

a) A corporation that is subject to the United States corporate income tax purchases a piece of equipment. Show how you would measure the present value of the tax savings the purchase generates for the corporation. Show the present value *per dollar* of the purchase price. Define the variables in your formula. Assume there is no investment tax credit. You may use either discrete or continuous time. Assume the corporation pays all profits as dividends to individual shareholders.

b) Define (in words) the user cost of capital from the Hall-Jorgenson model. According to Hall and Jorgenson, how does the user cost of capital affect a corporation’s investment decisions?

c) State and explain the formula for the user cost of capital for a U.S. corporation. Again, define the variables in your formula, assume there is no investment tax credit, use either discrete or continuous time, and assume the corporation pays all profits as dividends to individual shareholders. How does the formula change if there is an investment tax credit?

d) The 2003 U.S. tax bill included a provision that allowed businesses to expense (deduct immediately) 50% of the purchase cost of some capital assets. The remainder of the cost must be depreciated. Assuming the equipment purchased in (a) qualifies for this treatment, explain, using the formula in (c), how the cost of capital is affected by the tax law change.

e) How would you expect the law change in (d) to affect corporations’ investment in equipment? Explain your answer.

f) Periodically, proposals are made to “integrate” the U.S. individual and corporate income taxes to reduce distortions created by the corporate income tax. What distortions are created by the corporate income tax? How might individual-corporate tax integration reduce or eliminate those distortions?
Question 6

Fryer and Levitt’s paper published in 2004 in the *Review of Economics and Statistics* used the Early Childhood Longitudinal Study – Kindergarten cohort to estimate racial gaps in test scores in the early years of formal schooling. Some of the main results are reported in their Table 2. (The paper is provided to you as part of the exam.)

a. Interpret the evidence on the existence of the black-white test score gap as shown in Table 2. Does a statistically significant gap exist for each specification shown? How does the estimated gap vary as additional variables are added into the regression equation?

b. The ECLS-K data set contains thousands of variables that could potentially be used to explain differences in test scores among students of different races. What do you conclude about the importance of controlling for the approximately 100 additional covariates, as shown in regressions (5) and (10)?

c. What are the implications for the finding that most of the gap can be explained by a handful of variables?

d. Suppose that you are asked to design an analysis using the ECLS-K data to compare and contrast the likely effectiveness of the following policy interventions:
   - Reassignment of students to classes with teachers and students of the same race;
   - Vouchers for black children to attend private schools;
   - Earlier start dates for minority children in kindergarten.

   Detail how the Fryer-Levitt results support or reject the implementation of such policies. Describe how you might use the underlying ECLS-K data to perform an appropriate test of the effectiveness of these policy interventions.