Written Preliminary Ph.D. Examination

Department of Applied Economics
January 2009

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
- You must answer the first question
- Then you will choose 3 out of the following 5 questions
- You have four hours to complete the examination
Required question. All students are expected to answer this question.

1. Some recent federal proposals in the U.S. involve large government infrastructure expenditures for roads, bridges, etc.

   a. Describe the economic rationale for government involvement in the provision of infrastructure.

   b. President Obama’s advisors predict that large increases in public infrastructure spending will benefit the economy by increasing employment. However, critics argue that the estimation of the benefits from infrastructure investment is inconsistent with the conventional way of conducting cost-benefit analysis (CBA).

      How is the employment associated with infrastructure projects evaluated in CBA and does this differ from the current discussion of the employment benefits of infrastructure projects?

   c. One suggestion from the new behavioral economics literature is that discount rates used in CBA should fall over time, especially for projects with benefits or costs lasting longer than 50 years. How would declining discount rates affect the evaluation of the benefit-cost ratio for long-lived projects such as buildings or policies affecting climate change?

   d. How is uncertainty about the level of benefits treated in conventional CBA? Describe how Dixit and Pindyk propose that uncertainty over the level of future benefits should be incorporated into the analysis. What does this do to the benefit cost ratio calculated under the traditional method? How large an impact would the Dixit-Pindyk adjustment make in the evaluation of the economic efficiency of the infrastructure section of the current stimulus package?
Students will choose 3 out of the following 5 questions.

2. Taxation

a. Consider an individual’s budget constraint \( x = wl - (wl - b)t \), where \( x \) is consumption (with price = 1), \( t \) is the tax rate, \( b \) is positive constant, \( w \) is the wage, and \( l \) is hours worked (labor).
   1) Provide an interpretation of \( b \).
   2) Show the average effective tax rate. How does the average effective tax rate change with income? Is this an example of a progressive, regressive, or flat tax?
   3) Let utility be \( U = x - l^2 \). How does the number of hours worked change with increases in \( b \) and \( t \)? Explain these effects.

b. Generally, in an economy with a progressive individual income tax, what would you expect to be the effect on labor supply of an increase in the income tax rate? Use both economic theory and empirical evidence to support your answer.

c. Assume there are two time periods, 0 and 1, and two individuals, A and B. Individuals may work and earn income only in the first period, and they earn interest on any first-period savings at a rate \( r \). The individuals are identical, except that A tends to save more than B.
   1) Show A’s and B’s lifetime tax burdens under a comprehensive income tax. Compare the tax burdens of the two individuals.
   2) Show A’s and B’s lifetime tax burdens under a comprehensive consumption tax. Compare the tax burdens of the two individuals.
   3) Explain the differences, if any, between the lifetime tax burdens in 1) and 2).

d. Evaluate this statement: “Uniform commodity taxation (taxing all commodities at the same rate) is optimal.”
3. Consider this equation for an individual:

\[ Y = a + bX + dD + e \]

where D denotes a dummy variable coded 0 or 1 if this person participated in a government program.

a. Assuming the estimation of the effects of the program is to be undertaken using nonexperimental or observational data, under what circumstances would the estimate of \( d \) provide an unbiased effect of the government program on some outcome \( Y \)?

b. In many instances, researchers may have reason to be concerned that the estimate of \( d \) from the equation above is not an unbiased estimate of the treatment effect. Describe the method of instrumental variables applied to this problem above.

c. In many cases, a suitable instrument is not available. Depending on data availability, some researchers might use panel data while some other researchers might use propensity score matching estimation. Which method(s) allows for the possibility that some unobservable individual characteristic exists that is correlated with the outcome and the treatment? Explain. Make sure to discuss the differences between the two approaches in your answer.

d. Explain why random assignment of the program D can generate unbiased estimates of the treatment effect without the need to run any of the regression based methods described above.
4. On March 31 a federal "car czar" will examine plans prepared by GM and Chrysler to demonstrate their long-term viability. At that point, the government may decide to recall the more than $17 billion in loans authorized and allow the automakers to fail if they have not made sufficient plans to restructure.

Discuss the economic principles the "car czar" should follow in preparing his recommendations. You are not expected to be familiar with the details of the current loans or the auto industry. Just focus on the economic principles involved. Structure your answer as follows:

a. Begin by discussing the difference between the decision rule that a private bank would use to evaluate whether to make the initial loan and that which should be used by the government to evaluate whether the loan should be made. This discussion should include a discussion of the differences in potential costs or losses as well as the differences in benefits that enter into the decision rule.

b. Given that a decision has already been made to grant the loan, under what conditions a private bank recall the loan? Under what conditions should the public sector recall the loan? Assume that the short to mid-range economic outlook is weaker than at the time the loan was granted. What will the impact be on the private bank's decision? What will the impact be on the public sector decision? Under what conditions would the bank increase the loan? Under what conditions would the public sector increase the loan? Under what conditions would the public sector change the loan to a grant?

c. An alternative to the loan would be a package of tax subsidies. What should be the decision rule for replacing the loan with a similarly sized package of tax subsidies? What are the advantages and disadvantages of using the tax system rather than direct expenditures in subsidizing the auto industry?

d. A possible alternative to continuing the federal program would be to replace it with a program in which the states provide the needed funding for loans to the auto industry based on the share of auto manufacturing activity in their state (i.e. 1/17 of auto manufacturing is in state A so state A would decide whether to provide $1 billion of the $17 billion in loans.) Evaluate this alternative. Explain how the fact that most states are facing a deficit and have constitutional restrictions against deficit funding should affect the calculations used to make the decision.
5. Program evaluation.

a. Consider the evaluation of the effects of participation in a compensatory education or training program targeted towards highly disadvantaged individuals. In an observational or nonexperimental study design, what are the difficulties in obtaining a comparison group when the program or treatment is assigned to individuals that are the most disadvantaged among the population? What concern would you have over the direction of the bias when estimating the effects of these types of program with nonexperimental data?

b. Janet Currie and Duncan Thomas published a paper in the 1995 *American Economic Review* titled "Does Head Start Make a Difference?" using data from the National Longitudinal Survey of Youth (NLSY). Recall that the federal program Head Start offers children from low-income families a free preschool program intended to improve school readiness. Currie and Thomas used several estimation methods in order to control for selection on observables and unobservables.

What is meant by selection on observables and selection on unobservables?

c. In the attached table, Currie and Thomas present estimates of the effects of Head Start on test scores (the PPVT) and absence of grade repetition. The results come from three different estimation methods. Focus your attention on the estimated coefficient associated with the Head Start variable in the PPVT regressions. To help with your interpretation of this table, note that in the first set of estimates participation in Head Start is associated with a -5.6 point lower test score for white children. Focusing your attention on the estimates for white children, explain the difference between the three estimation methods used (OLS-unadjusted, OLS- adjusted, and mother fixed effects) and explain the difference in the implied effects of Head Start for whites. (You can ignore the grade repetition results).

d. Explain in greater detail how each of the three estimation methods attempts (or fails to attempt) to control for selection on observables and unobservables.

e. Finally, what do these results suggest about the effects of Head Start participation on the PPVT test score for African Americans?
### Table 4—Effect of Participation in Head Start and Preschool on PPVT Score and Absence of Grade Repetition

<table>
<thead>
<tr>
<th>Variable</th>
<th>OLS-unadjusted</th>
<th>OLS-adjusted</th>
<th>Mother fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head Start&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-5.621</td>
<td>1.037</td>
<td>-6.658</td>
</tr>
<tr>
<td>(1.570)</td>
<td>(1.223)</td>
<td>(1.990)</td>
<td></td>
</tr>
<tr>
<td>Other preschool&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.077</td>
<td>2.007</td>
<td>7.070</td>
</tr>
<tr>
<td>(1.275)</td>
<td>(1.481)</td>
<td>(1.955)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>31.512</td>
<td>13.762</td>
<td>17.749</td>
</tr>
<tr>
<td>(0.783)</td>
<td>(0.823)</td>
<td>(1.136)</td>
<td></td>
</tr>
<tr>
<td>F (Head Start - preschool)</td>
<td>75.38</td>
<td>0.40</td>
<td>36.22</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.53)</td>
<td>(0.000)</td>
<td></td>
</tr>
<tr>
<td>F (all covariates)</td>
<td>43.62</td>
<td>0.99</td>
<td>133.49</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.37)</td>
<td>(0.000)</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.03</td>
<td>0.01</td>
<td>0.14</td>
</tr>
<tr>
<td>Sample size</td>
<td>2,519</td>
<td>1,158</td>
<td>3,477</td>
</tr>
</tbody>
</table>

#### B. Dependent Variable: Probability Never Repeated Grade

<table>
<thead>
<tr>
<th>Variable</th>
<th>OLS-unadjusted</th>
<th>OLS-adjusted</th>
<th>Mother fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head Start&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.035</td>
<td>-0.010</td>
<td>-0.025</td>
</tr>
<tr>
<td>(0.058)</td>
<td>(0.061)</td>
<td>(0.084)</td>
<td></td>
</tr>
<tr>
<td>Other preschool&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.029</td>
<td>-0.069</td>
<td>0.098</td>
</tr>
<tr>
<td>(0.062)</td>
<td>(0.058)</td>
<td>(0.104)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.654</td>
<td>0.537</td>
<td>0.118</td>
</tr>
<tr>
<td>(0.031)</td>
<td>(0.043)</td>
<td>(0.052)</td>
<td></td>
</tr>
<tr>
<td>F (Head Start - preschool)</td>
<td>0.76</td>
<td>0.47</td>
<td>1.20</td>
</tr>
<tr>
<td>(0.38)</td>
<td>(0.49)</td>
<td>(0.27)</td>
<td></td>
</tr>
<tr>
<td>F (all covariates)</td>
<td>0.39</td>
<td>0.34</td>
<td>2.82</td>
</tr>
<tr>
<td>(0.68)</td>
<td>(0.72)</td>
<td>(0.02)</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Sample size</td>
<td>414</td>
<td>314</td>
<td>728</td>
</tr>
</tbody>
</table>

Notes: Standard errors are reported in parentheses below the coefficients; p values are given in brackets below the F statistics. Variance-covariance matrices were estimated by the method of infinitesimal jackknife for PPVT scores. OLS-adjusted regressions include controls for child age, gender, and whether first born, (log) household permanent income, mother's education, mother's AFQT score, mother's height, number of siblings when the mother was age 14, and grandmother's education. Fixed-effect models include controls for child age, gender, whether first born, and household income at age 3.

<sup>a</sup>Dummy variable = 1 if participated in Head Start.
<sup>b</sup>Dummy variable = 1 if participated in other preschool.

education, her AFQT score, her height, the number of siblings in the mother's household when she was age 14, and the education of the maternal grandmother. The fixed-effects models include child age, gender, and whether the child is the first born, as well as household income at the time the child was age 3.²¹

²¹It turns out that while these controls do affect the outcomes, their inclusion has only a small (depressing) impact on the estimated effects of Head Start and preschool. Inferences are not changed in any cases, and so only the controlled fixed-effects estimates are reported in the tables. We have also experimented with OLS models that include such potentially endogenous variables as number of children under age 18 in the household, mother's age at first birth, employment, and marital status (when the child was 3). The latter two covariates have also been included in fixed-effects models. In all cases, the results are qualitatively similar to those discussed below. All regressions also include controls to identify cases in which covariates are missing. Since not all children are eligible for all questions and some were not tested, sample sizes vary across the outcomes. They are reported at the bottom of each panel.
6. Evaluating the effectiveness of anti-discrimination programs:

Federal transit rules require that state and local agencies that receive funding for certain transportation projects maintain goals to include disadvantaged business enterprises (DBEs) in their overall expenditure plans. The DBE goals are intended to rectify past or continuing disparities that have occurred in public procurement and contracting between white male-owned firms and women or minority-owned business enterprises. Some critics of DBE programs argue that DBE goals amount to discrimination against non-DBEs (NBEs). Many jurisdictions around the nation have sought to address this criticism and have implemented "Emerging Small Business Enterprise" (ESBE) programs as race-neutral alternatives to typical DBE programs.

DBEs are certified if they do not exceed certain size, tenure, and net worth ceilings and if the majority owners are women, members of racial minority groups, or persons who can establish social disadvantage. The DBE program establishes an overall goal of a percentage of contract dollars that will be allocated to DBEs out of all contract and procurement dollars expended by the state or local agency or authority that is receiving the federal transit funds.

An ESBE is understood to be a firm that meets the same size, tenure, and net worth standards established for the certification of DBEs, but it need not be a firm whose majority owners are women, minorities, or persons who are socially disadvantaged. The ESBE program sets aside contracts on which only ESBES are permitted to bid.

For a given jurisdiction (and recipient of federal funding), analysts estimated the following model for prime contractors for a period before and after the implementation of the ESBE program.

**Equation 1**

\[ \ln Y = \sum \beta_i x_i + \gamma \cdot DBE + \mu \]

where DBE is a dummy variable that indicates whether the prime contractor was a DBE or non-DBE; Y is contract amounts awarded to prime contractors; x is a vector of characteristics of the contract and the contractor. Coefficients to be estimated are \( \beta \) and \( \gamma \); error term is \( \mu \). The model was estimated for all firms and also for DBEs and non-DBEs (NBEs) separately:

**Equation 2**

\[ \ln Y^{DBE} = \sum \beta_i^{DBE} x_i^{DBE} + \mu \]

**Equation 3**

\[ \ln Y^{NBE} = \sum \beta_i^{NBE} x_i^{NBE} + \mu \]
The model was also estimated separately before and after the implementation of the ESBE program, where \( t \) denotes before and \( t+1 \) denotes after implementation of the ESBE program:

**Equation 4**
\[
\ln Y_t = \sum \beta_{it} x_{it} + \gamma_t \cdot DBE_i + \mu_t
\]

**Equation 5**
\[
\ln Y_{t+1} = \sum \beta_{i, t+1} x_{i, t+1} + \gamma_{t+1} \cdot DBE_{t+1} + \mu_{t+1}
\]

**Equation 6**
\[
\ln Y_{t, DBE} = \sum \beta_{it}^{DBE} x_{it}^{DBE} + \mu_t
\]

**Equation 7**
\[
\ln Y_{t, NBE} = \sum \beta_{it}^{NBE} x_{it}^{NBE} + \mu_t
\]

**Equation 8**
\[
\ln Y_{t+1, DBE} = \sum \beta_{i, t+1}^{DBE} x_{i, t+1}^{DBE} + \mu_{t+1}
\]

**Equation 9**
\[
\ln Y_{t+1, NBE} = \sum \beta_{i, t+1}^{NBE} x_{i, t+1}^{NBE} + \mu_{t+1}
\]

Using information obtained from the estimated coefficients in equations 1 through 9, discuss the process of how one would answer the following questions:

1. Across all of the years measured, is there evidence that non-DBEs experienced discrimination? (20%)

2. Was there discrimination against non-DBEs prior to the implementation of the ESBE program? If so, did the program eliminate (or reduce) this discrimination? (20%)

3. Was there discrimination against DBEs prior to the implementation of the ESBE program? If so, did the program eliminate (or reduce) this discrimination? (20%)

Analysts also estimated the following models that measure the impacts of an ESBE goal on DBE contract dollars awarded and measure the impacts of an ESBE goal on total contract dollars awarded during the period after the implementation of the ESBE program.
\textbf{Equation 10}
\[
\ln Y^{DBE} = \sum \alpha_i^{DBE} z_i + \theta^{DBE} \cdot ESBE + \nu
\]

\textbf{Equation 11}
\[
\ln Y = \sum \alpha_i z_i + \theta \cdot ESBE + \nu
\]

$Z$ denotes a vector of the firm's and the contract's characteristics; $ESBE$ is the percentage goal on a given contract and ranges from 0 to 100%. $Y$ is contract dollars awarded and $\alpha$ and $\theta$ are coefficients to be estimated; error term is $\nu$.

An ESBE goal of greater than zero means that a share of dollars (equal to the goal) has been set aside for which only ESBE-eligible firms may bid.

4. From the information obtained from the coefficient estimates in equations 10 and 11, how would one determine whether ESBE goals benefit DBEs relative to other firms? (20%)

5. Discuss how one might evaluate the effectiveness of the ESBE program. (20%)