

Problem Set 3

A. A worker of ability  $z$  faces the decision of how much education,  $e$ , to obtain. The wage schedule as a function of ability and education is

$$w(e, z) = \alpha_0 + \alpha_1 e z + \alpha_2 z$$

Education costs  $c(e)$ , where  $c'(e) > 0$  and  $c''(e) > 0$  for all  $e$ .

1. Characterize the education decision for a given worker.
2. What is the “structural” return to education? (That is, what is the benefit of an additional unit  $e$  of schooling for a given worker?)
3. Derive the equilibrium observed return to schooling. Show that it can be decomposed into a “structural” component and a “selection” component.

B. Analyze a student loan crisis in the context of a Becker/Card model where the only cost of schooling is forgone wages.

1. Write down the maximization problem that students solve, and derive the first-order condition that characterizes the optimal level of schooling.
2. What does a student loan crisis do in the context of this model? Specifically, use the model to discuss the likely consequences of the student loan crisis for
  - i. Rates of college attendance and the demographics of college attendance
  - ii. The average return to college attendance and how this varies across demographic groups
  - iii. Long-run vs short run effects on both of the above
3. In addition to subsidized loans, many students finance their education through grants that are effectively discounts on the “sticker price” of a college education. With colleges cutting back on financial aid as their endowments shrunk, the sticker price may also go up.

Analyze the effect of tuition increases on schooling choices using a model similar to the one used in part 1, above, but add tuition costs in the amount  $T$  per year. Use this model to show that if everyone pays the same tuition, then raising tuition from zero to an amount equal to one-quarter of the earnings of a college graduate is roughly equivalent to increasing the student loan interest rate by 25 percent.

4. Discuss a specific channel (or channels) through which a capital market crisis might boost college enrollment.

C. Suppose that productivity  $y_i$  for workers of group  $g \in \{b, w\}$  is distributed  $N(\mu_g, \sigma_y^2)$ . Employers know the distribution of productivity and can observe a worker’s group, but they cannot observe productivity for individual workers. Employers also observe a noisy signal of productivity for each worker  $s_i \sim N(y_i, \sigma_g^2)$ . (Note that the precision of the signal varies across

groups.)

1. Show that the expected productivity of a worker given the noisy signal is a weighted average of the signal and the group mean. (Hint: The CEF for joint normal random variables is the population regression function.) Explain why this generates “statistical discrimination” between workers who appear to be of the same measured ability (i.e., have the same signal).
2. Assume that  $\mu_b = \mu_w$  and  $\sigma_b^2 > \sigma_w^2$ . Suppose that workers are paid their expected productivities. Compare the relationships between  $s_i$  and wages for workers of each group. Give a prediction of this model that could easily be tested with data on wages, group status, and  $s$ .
3. Use data from the NLSY (any version you like) to test your prediction in a reasonable way.

D. This question asks you to produce estimates of the effects of the job training program evaluated in Dehejia and Wahba (1999). The data for this exercise is available in the MHE data archive.

1. The data set `nswre74.dta` includes data from a randomized evaluation of the job training program. The data include a treatment variable and post-treatment earnings from 1978, as well as demographics and pre-treatment earnings from two years (1974 and 1975). Produce separate estimates of the effect of the training program using no control variables, demographic controls, and controls for demographics and pre-treatment earnings. How do your estimates of the effect of the program change as you control for additional variables? Give a theoretical justification for your answer.
2. In many cases researchers do not have access to experimental data. The data set `cps1re74.dta` includes data on a larger sample of people for whom treatment was not randomly assigned. Produce estimates of the effect of the treatment program using the same specifications from part (1). How do your estimates depend on the set of controls now? How well do the experimental and non-experimental estimates match?

E. This question asks you to analyze contracting between unions and employers.

1. Provide a mathematical characterization of the contract curve for an efficient bargain between union and employer. Hint: Specify a profit function for the firm and a utility function for the union. Does this analysis determine exactly what the employment/wage combination will be in an efficient labor-management bargain?
2. Let the competitive wage be  $w^*$ . Show that if the union maximizes the excess wage bill,  $(w-w^*)L$ , where  $L$  is labor employed, then efficient bargains set employment equal to the competitive level. Such bargains are said to be “strongly efficient.” Why might we like to believe that labor-management bargains are indeed strongly efficient?

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