

Problem Set 4

Economics of Education
11.126/11.249/14.48

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Spring 2007

Due in Section Friday, May 11, 2007

1. (35 points) Consider the following model of the labor market for teachers: In each location (e.g., a state or a school district), schools require a fixed number of teachers. That is, we're going to ignore any benefits from reduced class sizes. However, voters have preferences over teacher wages (which affect taxation levels) and average teacher quality (which affects student test scores), and this yields a demand function for teacher quality $Q_D(w, Z_D)$, where w is teachers' wage and Z_D is anything else that increases demand for quality. Similarly, college graduates decide whether to enter teaching or an alternative field, and the average quality of people in the teaching profession can be expressed in a quality supply function $Q_S(w, Z_S)$, where Z_S is anything other than the teacher wage that makes "high quality" workers want to become teachers.
 - (a) (6 points) Draw a graph that shows how average teacher quality and teachers' wages are determined in the long run. Do you expect the supply function Q_S to be more elastic or less elastic in the short run? Explain why.
 - (b) (7 points) When studies (like Loeb & Page) try to estimate the relationship between teacher quality and wages, are they trying to estimate Q_D , Q_S , or some combination of the two? In the context of this bare-bones model, do they want to use changes in Z_D or changes in Z_S to estimate this function?
 - (c) (12 points) Loeb & Page take several different approaches to the data, but their preferred approach (in Tables 4 and 5) is to regress a state's 10-year change in student outcome on the state's 10-year change in teacher wages, controlling for changes in the wages of female college graduates in the state. To what extent do you think they are picking up changes in Z_D ? To what extent do you think they are picking up changes in Z_S ? Insofar as they are picking up the "wrong" kind of variation (i.e., not what you specified in part (b)), in which direction will their estimates be biased? Explain your answers.
 - (d) (8 points) Loeb & Page do not measure teacher quality directly; instead they measure student outcomes (which are presumably affected by teacher quality but are also affected by other factors). Suppose they were able to use the ideal, pure source of variation you identified in part (b). Would you still have concerns that the estimates in Tables 4 and 5 might be biased? Explain why or why not.

2. (30 points) Write short (one or two paragraph) essays on each of the following:
- (a) (15 points) Computerized scoring software like Criterion can be used in two different ways: it can be used pedagogically to give students feedback on their writing (when the teacher might have insufficient time to read every essay), or it can be used evaluatively to assign grades on students' coursework. What problems might arise when software is used evaluatively that would not be as severe when it is used pedagogically? Illustrate with examples from Criterion.
 - (b) (15 points) The paper by Rouse, Krueger & Markman on evaluating computerized instruction suggests disappointing results. What are some drawbacks of computerized instruction methods relative to more traditional approaches? Do you think that these drawbacks will fade as computer technology becomes more advanced?
3. (35 points) The article by Gordon Winston talks about peer effects (among other things); this is the idea that how much you learn depends in part on who your fellow students are. Consider the following model: There are two types of students, with ability $a = 1$ and $a = 0$ respectively; each type is $\frac{1}{2}$ of the cohort of entering freshmen. There are two colleges, each with an equal number of spots available. When a person with ability a goes to a college where the average ability is \bar{a} , they leave with human capital

$$H = \alpha + \beta a + \gamma \bar{a} + \delta a \bar{a}$$

and this is also their lifetime productivity once they finish college.

- (a) (10 points) Suppose you are the education czar of the United States, and you get to command each college to admit a certain proportion of high ability students. Your goal is to maximize GDP. How do you want to divide the high ability students between the two colleges? (Hint: The answer will depend on some of the parameters $\alpha, \beta, \gamma, \delta$. The two colleges are equivalent, so you can just say that college 1 will be the "better" college with average ability $\bar{a}_1 \geq \frac{1}{2}$. Then college 2 must have average ability $\bar{a}_2 = 1 - \bar{a}_1$ because the total number of high ability students is fixed. Write down an expression for this cohort's average productivity, and maximize it with respect to \bar{a}_1 . If you don't need to do the math in order to come up with the answer, that's fine, but be sure to explain why your answer is correct well.)
- (b) (10 points) You should have found two cases in part (a) depending on the values of the parameters. Try to come up with at least one reason why each of the cases might be true in practice. Which of the cases do you think is more likely to hold for college education? Would

your answer change if we were talking about primary or secondary schooling instead?

- (c) (10 points) Suppose that the labor market is perfectly competitive, so workers earn their productivity. Think about the maximum tuition each student would be willing to pay to get into a given college. How would this maximum willingness to pay vary with \bar{a} for a low ability student? How would it vary with \bar{a} for a high ability student?

Now imagine that we had a free and perfectly competitive market in education and that colleges just tried to maximize "profits" (which they can spend on architectural curiosities or elite sports teams). Each college can charge one price to high ability students and a different (higher) price to low ability students. Do you think a perfect free market will maximize GDP? (Hint: This turns on the observations about willingness to pay above.)

- (d) (5 points) Suggest one reason why the sorting of high and low ability students across colleges might be different in a real world higher education system than in the idealized market of part (c). Explain your answer.