May 27, 2003

G604 Final, Spring 2003 ANSWERS

Scores: 91, 83, 77, 74, 71,70, 62, 57.

This is a closed-book test, except that you may use one double-sided page of notes. Answer each question as best you can. If you get lost in solving equations, write down in words what you are trying to do and what you think would come out of the mathematical analysis.

Answers to some questions are below.

1. (20 points) You have price and quantity data from 20 countries for 50 brands of chocolate, for a total of 1000 data points. You also have data on 3 characteristics of each brand–sweetness, hardness, and darkness– and demographic data on 4 characteristics of the consumers in each country. You would like to figure out whether brand 1 has market power.

(a) One approach is to regress the quantity sold of brand 1 on the prices of all 50 brands. How would this approach use the regression coefficients to test whether brand 1 has market power? What is wrong with this approach?

Answer. Using the coefficients from either a linear or a logarithmic regression specification of a demand curve like this, each brand's elasticity of demand and cross-elasticities can be calculated. If a brand has market power, its demand curve is downward sloping; it has less than perfectly elastic demand.

The biggest problem with this approach is that prices are endogenous—they depend on quantity, because of the supply equation. Thus, the coefficient estimates are biased, and they may even come out positive.

Not putting the characteristics as explanatory variables is another, but

smaller, defect of this approach. It is equivalent to assuming that consumers do not care about the differences in characteristics.

(b) Discuss other approaches to figuring out whether brand 1 has market power, including the BLP random-coefficient logit approach, and, if you remember it, the nested logit approach. If you can't remember how either of these works, invent your own approach.

Answer. For the BLP approach, see my class notes. Different countries correspond to different years in those notes. For nested logit, you start by grouping the chocolate bars into categories, and then estimate a specification that has a category disturbance and an individual brand disturbance.

2. (10 points) Before the courts struck down the law, the state of Rhode Island prohibited price advertising by liquor stores.

(a) What did George Stigler's theory of pricing and search predict would happen to prices once the advertising ban ended?

Answer. They would fall, and price dispersion would fall, because consumers would be better informed about which stores had low prices.

(b) George Stigler's theory of regulation suggests a reason why the legislature of Rhode Island passed the ban. What is that reason?

Answer. Liquor stores wanted to keep prices high so as to keep their profits high, so they lobbied the legislature to pass the law. Consumers were not so aware of the situation, and did not lobby against it.

3. (10 points) Table 4 of Jin and Leslie's paper on Los Angeles restaurants shows the effect of different inspection regimes (I, II, and III) and disclosure regimes (voluntary nonverifiable, voluntary, and mandatory) on the hygiene scores reported by the inspectors.

What do we learn from these regression results?

Answer. 1. Voluntary and mandatory disclosure raised hygiene scores. 2.

They raised the scores by about the same amount, so unravelling seems to have occurred. 3. The second two inspection regimes also raised the scores.

4. (10 points) Sellers Apex and Brydox are located at $x_a = 0.7$ and $x_b = 0.9$. Demand is uniformly distributed on the interval [0,1] with a density equal to one (think of each consumer as buying one unit). Production costs are zero. Each consumer always buys, so his problem is to minimize the sum of the price plus the linear transport cost, which is $\theta = 0.5$ per unit distance travelled. Thus,

$$\pi_{buyer\ at\ x} = -Min\{\theta|x_a - x| + p_a,\ \theta|x_b - x| + p_b\}. \tag{1}$$

Show that there is no pure-strategy equilibrium in this game.

Answer. For there to be a pure-strategy equilibrium, either one firm sells to all consumers, or there is some consumer x^* who is indifferent between the two firms.

First, it cannot be an equilibrium for one firm to sell to all consumers. If Apex captures the market, then p_b must be sufficiently higher than p_a, and Brydox will earn zero profit. But Brydox could deviate by charging a price equal to Apex then, and earn positive profit by splitting the market, so the prices cannot form an equilibrium.

Second, there is an indifferent consumer at x^* then that consumer's payoff is equal from going to each firm, so

$$.5(x^* - .7) + p_a = 5(9. - x^*) + p_b,$$

which solves out to

$$x^* = .8 - p_a + p_b.$$

Apex's quantity demanded is then $.8 - p_a + p_b$ and Brydox's is $(1 - x^* = .2 + p_a - p_b$. Apex's profit maximization problem is to maximize $p_a(.8 - p_a + p_b)$, which has first order condition $.8 - 2p_a + p_b = 0$, so

$$p_a = p_b/2 + .4.$$

Brydox's profit maximization problem is to maximize $p_b(.2 + p_a - p_b)$, which has first order condition $.2 - 2p_b + p_a = 0$, so

$$p_b = p_a/2 + .1.$$

Substituting for p_b into the p_a equation,

$$p_a = [p_a/2 + .1]/2 + .4 = .45 + p_a/4,$$

which solves out to $p_a = .6$. Then, $p_b = .6/2 + .1 = .4$. As a result, $x^* = .8 - .6 + .4 = .6$, but this does not lie between $x_a = .7$ and $x_b = .9$, so it cannot be part of an equilibrium.

5. (30 points) "Characteristics, Contracts, and Actions: Evidence From Venture Capitalist Analyses," Steven Kaplan and Per Stromberg, January 2002. http://gsbwww.uchicago.edu/fac/steven.kaplan/research/ksrisk.pdf

Summarize this article in a couple of paragraphs. Then critique it. Note any flaws; suggest ways to improve the writing style; note anything you especially like; suggest further tests or data if you think it appropriate. Also: If you were told to shorten this article by 5 pages, which 5 pages would you cut out?

6. (20 points) The government is trying to set up a system by which to set the price of electricity. The electric company will choose its effort level, e, which reduces its payoff by $p(e - c_0)$, where $p' > 0, p'' > 0$. Before it chooses e, the firm observes whether the observed average cost of electricity will be $c = c_0 + y - e$ or $c = c_0 - e$. The government believes the probability of a cost of $c = c_0 + y - e$ is θ and the probability of a cost of $c = c_0 - e$ is $(1 - \theta)$. The government will observe c, but not e.

The system the government has chosen is that it will set a price of $c + f(c)$ per unit of electricity. It wishes to choose the function $f(c)$ to minimize the expected price of electricity subject to providing the company with enough profit to agree to accept the system in the first place. The company does not

know in advance whether $c = c_0 + y - e$ or $c = c_0 - e$, but it will learn this before it chooses e.

(a) If $f(c)$ is a constant, not varying with c, what should it equal?

(b) Actually, $f(c)$ should not be a constant; f should decrease with c. Explain why, in words.

(c) What is the participation constraint for this mechanism design problem?

(d) What are the incentive compatibility constraints?

(e) In equilibrium which constraints will be binding?

Answer.

(a)If $f(c)$ is a constant f, then there is no reason for the firm to choose any effort higher than $e = 0$. Thus, the participation constraint is

$$(c + f - c)q - p(-c_0) \geq 0, \tag{2}$$

where q is the output (which it is ok, for grading, if you normalized to equal one). Since we want the firm to participate, this yields

$$f = \frac{p(-c_0)}{q}. \tag{3}$$

(b) If f is constant, effort is zero. It would be better to have $f(c)$ decline in c, because then the firm would have an incentive to choose higher effort e and reduce c, reducing the amount the government must reimburse. This would be true whether there were two types of firms, as here, or just one, as in a simple moral hazard problem.

(c) The participation constraint for this mechanism design problem is that

$$\theta[(c+f(c_0+y-e_1)-c)q-p(e_1-c_0)]+(1-\theta)[(c+f(c_0-e_2-c)q-p(e_2-c_0)] \geq 0, \tag{4}$$

which simplifies to

$$\theta[f(c_0 + y - e_1)q - p(e_1 - c_0)] + (1 - \theta)[f(c_0 - e_2)q - p(e_2 - c_0)] \geq 0, \quad (5)$$

where e_1 and e_2 are the efforts chosen when costs are high and low.

(d) The incentive compatibility constraints are

$$(c + f(c_0 + y - e_1))q - p(e_1 - c_0) \geq (c + f(c_0 + y - e_2))q - p(e_2 - c_0), \quad (6)$$

for the high-cost firm and

$$f(c_0 - e_2)q - p(e_2 - c_0) \geq g(c_0 - e_1)q - p(e_1 - c_0) \quad (7)$$

for the low-cost firm.

(e) The participation constraint will be binding, because if it were not, the government could reduces its expense by subtracting a constant off of f.

The low-cost firm's incentive compatibility constraint will be binding, because the government needs to give it a rent as incentive to choose high effort and low cost, and the government wants to keep that rent to a minimum. Thus, the low-cost firm will be barely indifferent between e_2 and e_1.

The high-cost firm's incentive compatibility constraint will not be binding. To get the high value of p appropriate to the low-cost firm, it would have to exert very high effort, since the cost generated by its high-cost technology is $c_0 + y - e$. Thus, to get cost low enough it would have to exert more effort than the low-cost firm, and if the low-cost firm is indifferent, the high-cost firm will strictly prefer e_1.