G604 Final Examination, 10 May 2006

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. Each of the 19 questions is worth 4 points, a total of 76 points. Scores: 20s: 1. 40s: 4. 50's: 4, 60's: 3.

1. One bidder in an auction has a private value of 4, and the other has a private value of 10, an interdependent private value auction. Assume that if the bids are tied, the bidder with a value of 10 gets the prize.

(a) What is the unique equilibrium of the open cry auction?

Answer: The players bid up to 4 and to 10, and the high-valuer wins at a price of 4.

The answer is not that each player will bid 4. That is the outcome, but not the equilibrium strategies.

(b) What is the unique pure-strategy equilibrium of the first-price auction?

Answer: Both players bid 4. This is an equilibrium because if the weak player bids less, he will still lose, while if he bids more, he will win and have a negative payoff; if the strong player bids less he will lose and have a zero payoff, while if he bids more he will win, but with a reduced payoff.

(c) Prove that there exist no other pure-strategy equilibria for the first- price auction.

Answer: This question asks you to prove something false, so I will give everyone credit for it. I didn't notice that it is also an equilibrium for both players to bid x, for $x \in [4, 10]$, since the tie-breaking rule makes the strong player always win.

(d) What are two pure-strategy equilibria of the second-price auction?

Answer: (1) Each player bids his value. (2) The low-valuer bids 0 and the high-valuer bids 10.

(e) Find the seller's optimal mechanism.

Answer: Sell at a price of 10.

Since this is not an independent private value auction, but interdependent, the Revenue Equivalence Theorem does not apply.

A good way to think about a question like this is to put yourself in the place of the principal (the seller).

2. Two firms, Apex and Brydox, product complementary current products that yield each of them 2 in profit. Apex knows whether the value $v > 0$ of a new product is greater than or less than 2. Before talking to Apex, Brydox believes the probability the new product's value is high is 30%. In discussion with Brydox, Apex will say about the new product either "No" or "Yes", and then the two firms will simultaneously choose *Current* or *New*.

Table 1: Subgame Payoffs

		Brydox	
		Current	*New*
Apex:	*Current*	$2, 2$	$0, 0$
	New	$0, 0$	v, v

Payoffs to: (Apex, Brydox).

(a) (4 points) Describe a perfect bayesian equilibrium in which Apex sometimes strictly prefers to say No and sometimes strictly prefers Yes. What happens in that equilibrium if Apex means to say No but says Yes by mistake?

Answer. Apex: $No|Low, Yes|High, Current|No, New|Yes$
Brydox: $Current|No, New|Yes$

No out-of-equilibrium beliefs are needed.

If Apex says Yes by mistake, Apex chooses New.

(b) (4 points) Describe a pareto-dominated perfect bayesian equilibrium in which Apex always says Yes, but is indifferent about its statement.

Answer. Apex: $No|Low, No|High, Current|No, Current|Yes$
Brydox: $Current|No, Current|Yes$

Out-of-equilibrium belief of Brydox: $Prob(High|No) = x$, where x can be anything from 0 to 1 (the out-of-equilibrium belief must be specified, but doesn't affect the actions).

3. Answer these questions:

(a) (4 points) What is a Harberger Triangle, and what did Harberger show?

Answer. The Harberger Triangle is the deadweight loss triangle from underproduction due to market power. Harberger showed that it is small compared to total sales.

(b) (4 points) How do Schumpeter and Coase differ in what they emphasize about the role of company presidents?

Answer. Schumpeter emphasized the role of the president as either "mere manager" or as entrepreneur—doing things in new ways. Coase emphasize the role as of exerting authority within the firm, telling people what to do.

4. Below is Table 3 from John Asker's "Diagnosing Foreclosure Due to Exclusive Dealing," October 14, 2004. The dependent variable is the market share of a particular brand of beer sold at a particular time in a particular place.

Table 3: Logit and Random Coefficient (BLP) Demand Models

Specification:	A		B		C		D	
Instruments:	None		Lagged and Lead Mean Prices		Lagged and Lead Mean Prices		Lagged and Lead Mean Prices	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Interacted with (1/Income)*2500								
Constant	-	-	-	-	0.029	0.129	-	-
Price (per 12oz)	-	-	-	-	0.293	0.283	-	-
Interacted with draws from N(0,1)								
Constant	-	-	-	-	-	-	-0.177	3.134
Price (per 12oz)	-	-	-	-	-	-	0.063	3.093
Not interacted								
Price (per 12oz)	-4.648	0.106	-6.509	0.112	-6.590	1.341	-5.966	0.744
Promo	0.260	0.013	0.059	0.013	0.104	0.081	0.118	0.062
Serving Size[1] (div by 10)	-0.052	0.002	-0.071	0.002	-0.066	0.010	-0.064	0.009
Serving Size^2 (div by 10000)	0.097	0.005	0.119	0.005	0.011	0.001	0.011	0.001
Holiday[2]	0.364	0.006	0.360	0.006	0.364	0.009	0.361	0.016
Temperature (°C, div by 10)	0.084	0.002	0.083	0.002	0.085	0.003	0.085	0.008
Distributor-Brand Dummies	+	+	+	+	+	+	+	+
r^2	0.436		0.431		0.438		0.433	
SSR	98527		99501		105800		99031	
SER	0.846		0.850		0.877		0.848	
N	138213		138213		138213		138213	

Notes: Note that in specifications B, C and D the r-squared statistics are merely indicative of goodness of fit due to the presence of instrumental variables

[1] Serving size is always in oz.

[2] The Holiday variable is a dummy for weeks in the fortnight leading up to Superbowl Sunday, the 4th of July, Labor Day and Christmas

(a) (4 points) Will collinearity of any of the explanatory variables cause bias in the estimates in regression A?

Answer. No– it never causes bias.

(b) (4 points) Why are instruments used in regressions B, C, and D? Discuss whether the mean of the lagged prices across brands and locations is a good instrument.

Answer. The price is endogenous. Besides saying this, or that the price is correlated with unobserved variables in the equation, you need to justify your assertion. That is easy here. The market share will depend on the price, but the price will also depend on the market share– the quantity– because a higher quantity demanded will push up the price. Anything that makes demand stronger for a firm will tend to make the firm increase its price.

A good instrument should be correlated with the current brand price, but not with the strength of current demand. Lagged means might do that.

(c) (4 points) Why is the serving size divided by ten, and the square of the serving size divided by ten thousand?

Answer. There are two reasons for this, either of which was enough for full credit. First, adjusting the units this way makes the coefficients come out without a lot of zeroes. Second, in BLP and similar computation-intensive methods, scaling of the variables matters to whether the computer can do the computations correctly, as Ian Lee emphasized. Big numbers cause problems.

(d) What can be concluded from regression A? ("Promo" is a variable indicating whether the beer had special advertising or other promotion for that observation.)

Answer. Sales drop with price and rise with promotions, holidays, and heat. They fall with serving size, but convexly–which is what the quadratic term tells us.

(e) What is the point of doing regressions C and D as well as regression B?

Answer. Regressions C and D check for heterogeneous coefficients across consumers, and relax the strong constraints on elasticities of the simple logit model.

5. Suppose the demand for trailer-homes increases unexpectedly as the result of federal subsidies to the poor, and that currently 40 companies produce trailers.

(a) Explain what happens to the number and average size of trailer companies in the short run.

Answer. The number is constant in the short run, by definition of the short run. The size rises, because when the price is higher increased production is profitable. (Note: this is true whether competition is perfect or not.)

(b) Explain what happens to the number and average size of trailer companies in the long run.

Answer. In the long run, if the market is competitive there will be entry and profits will return to zero, at the same size firm as there was initially (unless input prices are driven upwards, in which case it depends on which inputs go up).

6. Someone is using data from 800 firms, subscripted i, and three years, subscripted t, to estimate the following equation:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \omega_{it} + \epsilon_{it}, \tag{1}$$

where y is the log of output, k is log of capital, l is log of labor, ϵ is i i d error unobserved by either the firm or the econometrician, and ω is a variable unobserved by the econometrician but observed by the firm.

The econometrician wants to know whether $\beta_k + \beta_l < 1$, which would indicate decreasing returns to scale.

(a) If a firm knows that it has a particularly high marginal product of capital, how would that show up in the values of each of the variables in the equation?

Answer. y, k, l, and ω would be high. Note that the parameter β_k is not subscripted i– it does not vary between firms. Marginal products vary only because of the variable values. It must be that ω_{it} is high for our firm (not $epsilon_{it}$, because the firm knows it has a high marginal product). This will also make the marginal product of labor high– in this model, the two move together. So the firm will hire more capital and more labor, and have more output.

I think nobody got this completely correct– nobody even mentioned y_{it}, for example.

(b) The econometrician is thinking of simply regressing y on k and l. Under what conditions will that produce an unbiased estimate?

Answer. If ω and k and l are independent, there will be no bias.

(c) What would the equation look like in terms of not the log of output, y, but output itself, Y? What would happen to output if ω_{it} were to double?

Answer. The equation becomes

$$Y_{it} = e^{\beta_0} K_{it}^{\beta_k} + L_{it}^{\beta_l} e^{\omega_{it}} e^{\epsilon_{it}}, \tag{2}$$

or

$$Y_{it} = \gamma K_{it}^{\beta_k} L_{it}^{\beta_l} \Omega_{it} E_{it}, \tag{3}$$

I gave credit either for Y_{it} doubling or increasing by how much $e^{\omega_{it}}$ increased.