G604 Midterm, March 301, 2003 ANSWERS

Scores: 75, 74, 69, 68, 58, 57, 54, 43.

This is a close-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.

1. (10 points) Attached are two accounting tables. Find the current ratio, the debt-equity ratio, and the return on equity.

Answer. The tables give data for 2002 and for one past year, 2001, but all you needed was to tell me the latest available values for the company. This question turned out to be more difficult than I expected. Only one person received full credit.

The current ratio is the ratio of current assets, 47.871 billion, to current liabilities, 65.078 billion, which is 0.736. "Current assets" is a term of art, and does not mean the current value of total assets. Rather, it is assets that can be sold quickly at near their full value.

The debt-equity ratio is the ratio of total liabilities, 363.421 billion, to equity, which is 6.814+.834= 7.648 billion, a ratio equal to 7.46. The .834 billion is "minority interests", which refers to ownership by someone other than normal shareholders. In the case of GM, I think this might be Ross Perot's interest, but I don't know for sure. To get full credit, any allocation of the .834 million (or ignoring it) was acceptable.

The debt-equity ratio is *not* literally the ratio of what is called debt on the balance sheet to equity. A company could have no bank loans or bonds, but owe a lot to suppliers, and that would show up in "accounts payable", which is just as much a liability as a bond is.

The return on equity is the net income of 1.736 billion from the income statement divided by equity, 7.648 (or 6.814) as above, which comes to .23. It is different from the return on assets, which would be much much smaller for General Motors.

2. (5 points) Explain, using Viner's diagrammatic method, the empirical implication of a reduction in the fixed cost of operating a company on an industry's 4-firm concentration ratio.

Answer. Denote the minimum average cost by A. This is the point at the bottom of the U-shaped AC curve in a diagram. The average cost is AC= (FC +TVC)/Q, where FC is the fixed cost and TVC is the total variable cost (the integral of the marginal cost, with zero constant of integration). If the fixed cost decreases, then the AC curve shifts down with the fall in FC/Q, and the minimum AC decreases also, if the MC is upward sloping, so point A shifts to the left. In the short run, the fixed cost does not affect firm behavior, so the 4-firm concentration ratio would not change, but in the long run, since point A shifts to the left, so does the minimum efficient scale, and so firms shrink and the 4-firm concentration ratio falls.

The Excel spreadsheet costcurve.xls on the G604 website illustrates this for a particular functional form of quadratic costs. Try varying the entry for FC, which starts at 70.

3. (30 points) Suppose I wish to show the effect of concentration on profit by running the OLS regression

Return on Equity = a + b*(8-firm concentration ratio)

My t-tests show both a and b are significant.

Why does this not show that concentration is bad for economic welfare?

Answer. One's first thought might be that the significance of b (assuming it is a positive coefficient) shows that concentration increases profit by allowing more oligopolistic collusion, and hence higher prices, lower quantity, and a

reduction in consumer surplus bigger than the increase in producer surplus.

The positive effect of b might arise for various other reasons, however:

A. Demsetz noted that firms with lower costs would increase in size and come to dominate an industry, making it concentrated, and would also make high profits, thus giving rise to the correlation, even if the firms were price takers.

B. It might be that the way the accounting works, concentrated industries also tend to show higher returns on equity. This would be the case, for example, if growing industries have lower returns because of the depreciation subtracted to get earnings, and growing industries are also less concentrated.

C. Riskier firms can have higher expected profits without attracting entry, since their high returns' attractiveness is lower because of the risk. If more concentrated industries are riskier, this will give rise to the observed correlation.

D. Possible econometric problems include various forms of serial correlation. If the data is across time, it may be that the disturbances are correlated across time, and my OLS regression has ignored this, so though the coefficient estimates are unbiased, the standard errors are bigger than I thought. Or, it may be (and is likely true) that the disturbances of firms in the same industry are correlated, with the same result.

It may be better to use firm-level data than industry-level data, but it is not clear that that would reverse the result. More likely, with better data, the result would get stronger, if none of these other problems existed.

The student answers often failed to explain the problems that they mentioned. It is not enough to say "Because there might be a serial correlation problem" or "There might be accounting problems in measuring equity". Those are not explanations; they are just references to possible problems.

4. (10 points) What is the point of Coase's 1937 article? (R. H. Coase

(1937) "The Nature of the Firm," *Economica,* New Series, 4, 16: 386-405 (November 1937))

Answer. The point of the article is that the size of a firm is determined by the tradeoff between the marginal cost of managing a decision internally and the transaction cost of using the market to make the decision. Thus, a manager could order a subordinate to produce some input, or he could go to the market and find out what other firm could supply it at lowest cost. As the firm becomes bigger, it becomes harder to manage, and at some point the managerial marginal cost exceeds the cost of using the market instead. That limits the size the firm.

5. (20 points) Five risk-neutral bidders each receive a signal s_i independently drawn from the uniform distribution on $[v-m, v+m]$, where v is the true value of the object to each of them. They have diffuse priors on v. What should bidder i's strategy be in an open-exit ascending auction?

Answer. This is a common-value auction. Bidder i's strategy should be to keep bidding up to his signal of s_i, if nobody has yet dropped out; and if someone has dropped out at p_5, to bid up to a price of $\frac{s_i+p_5}{2}$.

First, suppose bidder i has the lowest signal. He will win only if all 4 other bidders also have the same low signal. In that case, the best estimate of v is s_i, so he should be willing to bid up to that amount.

Second, suppose someone has already dropped out. In a symmetric equilibrium, bidder i can deduce that that person's signal was $s_5 = p_5$ and is the lowest signal. Bidder i will win only if s_i is the highest signal. But if p_5 is the lowest signal and s_i is the highest, the expected value is $Ev = \frac{s_i+p_5}{2}$. So that is what he should bid up to.

For full credit, you had to provide not just the strategy, but an explanation. Some of you failed to provide any explanation, but did go on to calculate the expected payoff from the optimal strategy. That is interesting, but irrelevant to the question. Instead, you should have shown why that payoff was the biggest possible expected payoff (and, actually, to show that you

did not have to calculate the value itself–I did not have to in the paragraphs above).

Note that it is not a good answer to say that the optimal strategy is to choose the price at which to drop out to equal $v - \frac{m}{6}$. Bidder i does not know v, so he cannot base his strategy upon it.

6. (25 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 $f(e - c_0)$. Before it chooses e, the firm observes whether the observed average cost of electricity will be $c = c_0 + x - e$ or $c = c_0 - e$. The government believes the probability of a cost of $c = c_0 + x - e$ 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 $c+p(c)$ per unit of electricity. It wishes to choose the function $p(c)$ 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 $c = c_0 + x - e$ or $c = c_0 - e$, but it will learn this before it chooses e.

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

(b) Actually, $p(c)$ should not be a constant; p 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 $p(c)$ is a constant p, then there is no reason for the firm to choose

any effort higher than $e = 0$. Thus, the participation constraint is

$$(c + p - c)q - f(-c_0) \geq 0, \tag{1}$$

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

$$p = \frac{f(-c_0)}{q}. \tag{2}$$

(b) If p is constant, effort is zero. It would be better to have $p(c)$ 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

$$\theta[(c+p(c_0+x-e_1)-c)q-f(e_1-c_0)]+(1-\theta)[(c+p(c_0-e_2-c)q-f(e_2-c_0)] \geq 0, \tag{3}$$

which simplifies to

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

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

(d) The incentive compatibility constraints are

$$(c + p(c_0 + x - e_1))q - f(e_1 - c_0) \geq (c + p(c_0 + x - e_2))q - f(e_2 - c_0), \tag{5}$$

for the high-cost firm and

$$p(c_0 - e_2)q - f(e_2 - c_0) \geq p(c_0 - e_1)q - f(e_1 - c_0) \tag{6}$$

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 p.

The low-cost firm's participation 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 participation 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 $c_0 + x - e$. 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.

In your answers, if you define new notation (e.g. $\underline{c}$) please define what it means.