Written Exam for the M.Sc. in Economics 2013-II

Advanced Industrial Organization

Final Exam

31. May, 2013

(3hours closed book exam)
Short answers

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by "eksamen på dansk" in brackets, you must write your exam paper in Danish.

If you are in doubt about which title you registered for, please see the print of your exam registration from the students' self-service system.

ALL QUESTIONS BELOW SHOULD BE ANSWERED

Problem 1. Merger analysis in differentiated product markets

i) When Carl Shapiro served as US Deputy Assistant Attorney General for Economics in 1995, he wrote about merger analysis: *"Roughly speaking, a valuable index of the potential anticompetitive unilateral effects is obtained by multiplying the Diversion Ratio by the Gross Margin. Any danger of a unilateral price increase may be alleviated by product repositioning, entry, or efficiencies. Nonetheless, the Diversion Ratio and the Gross Margin are the key variables in the demand-side portion of the analysis".*

As you of course know (but just in case you forgot, you are now gently reminded): Shapiro refers to what has become known as the GUPPI (Gross Upward Price Pressure Index)

$$GUPPI = DM,$$

where D is the diversion ratio and M the gross margin also called the mark up

Explain the intuition behind the use of the GUPPI and Shapiro's statement.

The GUPPI measures the value of the diverted sales, when the firm increases its price. D is diverted to the other firm ,and the other firm's mark up is M, so GUPPI = DM is the value of diverted sales at the prevailing prices. The GUPPI is thus a measure the value to be internalized by the merged firm in a merger. This internalization gives a "pressure up" on prices if a merger occurs.

ii) Now, we consider a differentiated Bertrand market. There are two firms 1 and 2, producing differentiated products. The firms are in a symmetric situation, both have marginal cost c, and the demand for firm $i's$ product is

$$x_i = A - p_i + Dp_j$$

where $j \neq i$, $A > 0$ and $0 < D < 1$. D is the so called diversion ratio.

The firms set prices and seek to maximize profits in Bertrand competition.

Find the Bertrand equilibrium prices.

Firm $i's$ maximization problem is

$$\max_{p_i} \ (A - p_i + Dp_j)(p_i - c)$$

solving the first order condition gives the best reply

$$p_i = \frac{1}{2}(A + c + Dp_j)$$

Now use symmetry. The equilbrium prices solve

$$p = \frac{1}{2}(A + c + Dp)$$

so that

$$\bar{p} = \frac{A + c}{2 - D}$$

iii) For later use, find the mark up (also called the gross margin), $M = \frac{\bar{p}-c}{\bar{p}}$ in the Bertrand equilibrium.

$$M = \frac{\bar{p}-c}{\bar{p}} = \frac{\frac{A+c}{2-D}-c}{\frac{A+c}{2-D}} = \frac{1}{A+c}\left(A-c+cD\right)$$

Discuss the intuition behind how the mark up depends on the diversion ratio.

A high diversion ratio D implies that firm i gets a higher demand for a given p_j. It therefore responds with a higher price than if the diversion ratio was low, as can be seen from the best reply. In the symmetric equilibrium, this implies that a higher diversion ratio leads to a higher equilibrium price as can be seen from the expression for the symmetric equilibirum price. This means that the mark up is high.

iv) Now suppose the firms wish to merge. A competition authority wishes to predict the post merger price and asks its economist - you - to come up with a prediction. Please help them and find it.

The merged firms problem is

$$\max_{p_1,p_2}\ \left(A-p_1+Dp_2\right)\left(p_1-c\right)+\left(A-p_2+Dp_1\right)\left(p_2-c\right)$$

the first order conditions

$$\begin{aligned}\frac{\partial\left(\left(A-p_1+Dp_2\right)\left(p_1-c\right)+\left(A-p_2+Dp_1\right)\left(p_2-c\right)\right)}{\partial p_1} &= 0\\ \frac{\partial\left(\left(A-p_1+Dp_2\right)\left(p_1-c\right)+\left(A-p_2+Dp_1\right)\left(p_2-c\right)\right)}{\partial p_2} &= 0\end{aligned}$$

and we get that the first order conditions give:

$$\begin{aligned}p_1 &= \frac{1}{2}A+\frac{1}{2}c-\frac{1}{2}cD+Dp_2\\ p_2 &= \frac{1}{2}A+\frac{1}{2}c-\frac{1}{2}cD+Dp_1\end{aligned}$$

which implies

$$p_1^* = p_2^* = p^* = \frac{1}{2-2D}\left(A+c-cD\right) = \frac{A+\left(1-D\right)c}{2\left(1-D\right)}$$

It is ok to take the fast route and notice that obviously the solution is symmetric, hence the maximization problem can be written

$$\max_{p}\ \left(A-p+Dp\right)\left(p-c\right)+\left(A-p+Dp\right)\left(p-c\right)$$

which gives the same solution.

v) Carl Shapiro claims in his note on upward pricing pressure that in a market like the one we consider here, one can write the post merger percentage price increase as

$$\frac{p^* - \bar{p}}{\bar{p}} = \frac{DM}{2(1-D)}$$

Verify Shapiro's claim and explain the intuition behind the fact that the merger leads to a higher price.

We just insert from the expressions above and manipulate a bit

$$\begin{aligned}
\frac{p^* - \bar{p}}{\bar{p}} &= \frac{\frac{A+(1-D)c}{2(1-D)} - \frac{A+c}{2-D}}{\frac{A+c}{2-D}} \\
&= \frac{1}{2(1-D)} \frac{(A+(1-D)c) - \frac{2(1-D)(A+c)}{2-D}}{\frac{A+c}{2-D}} \\
&= \frac{1}{2(1-D)} \frac{\frac{(2-D)(A+(1-D)c)}{2-D} - \frac{2(1-D)(A+c)}{2-D}}{\frac{A+c}{2-D}} \\
&= \frac{1}{2(1-D)} \frac{\frac{(2-D)(A+(1-D)c) - 2(1-D)(A+c)}{2-D}}{\frac{A+c}{2-D}} \\
&= \frac{1}{2(1-D)} \frac{\frac{D(A-c+cD)}{2-D}}{\frac{A+c}{2-D}} \\
&= \frac{D}{2(1-D)} \frac{\frac{A+c-c-c+cD}{2-D}}{\frac{A+c}{2-D}} \\
&= \frac{D}{2(1-D)} \frac{\frac{A+c-c(2-D)}{2-D}}{\frac{A+c}{2-D}} \\
&= \frac{D}{2(1-D)} \frac{\frac{A+c}{2-D} - c}{\frac{A+c}{2-D}} \\
&= \frac{DM}{2(1-D)}
\end{aligned}$$

The intuition follows from the difference between the maximization problems in ii and iii. The before merger maximization problem of firm i, takes into account that when i increases its price it demand decreases with $\partial x_i/\partial p_i = -1$. Part of this demand goes to firm j (a fraction D (therefore the name diversion ratio). The merged firm internalizes this effect. When it maximizes profit the total demand effect of increasing p_i is a decrease in the demand for good i $\partial x_i/\partial p_i = -1$, (which is bad for profits) and an increase in the demand for good j equal to D, which is good for profits. The higher D, the more important is the second effect and the higher the price.

vi) In view of this result discuss the applicability of the GUPPI index for merger analysis and assesment of the unilateral effects. What is the reason for the difference between the GUPPI and the percentage price increase you find in question 4. Which is larger GUPPI or the percentage increase found. What

is the explanation for this difference.? Does it specifically pertain to the linear structure of the model or is it a general phenomon, and if so why?

The GUPPI measures the value of the diverted sales, when the firm increases its price. D is diverted to the other firm ,and the other firm's mark up is M, so GUPPI = DM is the value of diverted sales at the prevailing prices. The GUPPI is thus a measure the value to be internalized by the merged firm in a merger. The post merger percentage increase $\frac{p^* - \bar{p}}{\bar{p}}$ *takes into account the equilibrium effects, when both prices are adjusted as a result of the merger. As can be easily seen, there is no clearcut result of which measure is the largest:*

$$DM > \frac{DM}{2(1-D)}$$

iff

$$D < 1/2$$

Clearly this is true for non-linear demand as well.

vii) In a recent (fall 2012) Danish merger case, *ARCUS gruppen holding A/S' overtagelse af Pernod-Ricard Denmark A/S' (the Arcus group holding inc.'s aquisition of Pernod-Ricard Denmark inc.)* the firms were active in several markets, but the most important market was the market for aquavit in Denmark, which we now consider. The Danish Competition and Consumer Authority used consumer survey data to estimate the diversion ratio. When assessing the Diversion Ratio the DCCA used a questionaire where the respondents were asked what they would have done if the aquavit they bought last time was out of stock. Of the 135 respondents, who recently had bought an aquavit from Arcus, 79 answered that they would buy a different aquivavit. Of those 79, 42 responded that they would buy an aquavit from Perond Ricard.

The DCCA used this information to estimate the diversion ratio so that $D = 42/79 = 0,53$. They inserted this value in the formula, you derived above in question 4.

Discuss whether this is justified. Does the D so estimated correspond to the D in the model above? If not perfectly, could the DCCA have done better or is their method in fact sensible?

Discuss whether you think that the market for aquavit in Denmark can be reasonably described by a differentiated Bertrand model.

The D is not the same as in the model. In the model

$$D = \frac{\partial x_i}{\partial p_j}$$

i.e. the increase in i ' s demand when p_j *is lowered a bit. A question which perhaps better matches this would be: "How much more aquavit i would you buy if the price of aquavit j is increased with 5-10%". However, as we discussed in class, there are no particular reason to believe that respondents are able to resond meaningfully to such a question. And therefore the DCCA's question may*

be better. People probably have a better sense of which aquavit they find second best than how much their demand would respond. These are muddy waters as reality often is.

The aquavit market seems like a fine fit to the differentiated Bertand model. Aquavit is a well defined liquor and there are many different brands with different tastes etc.

viii) The DCCA found that $D = 0.53$, which we for ease of calculations will approximate by $D = 1/2$. The gross margin is considered a business secret and not disclosed, but the DCCA estimated the price increase as a result of the merger to be 4% if it was assumed that demand is linear and that the firms are in a symmetric situation. They used the fomula you derived. What is the DCCA's assesment of the gross margin in the aquavit business?

Just insert into the formula

$$\frac{\frac{1}{2}M}{2\left(1-1/2\right)} = 0.04$$

, Solution is: 0.08

ix) You suddenly hear a rumor that the aquavit market has been subject to tacit collusion. If the rumor is true what does it imply for the validity of the analysis above?

now you should think in terms of incentives to deviate, transparency of the market etc etc . The analysis above is not so interesting anymore.

Problem 3.

Here a sensible discussion is fine and there are many takes on this

A good discussion could include

- the market is diffferentiated
- there is not full transparency, consumers will have to search for prices
- the scheme automatically makes price comparisons for consumers, so that one would belive the price transparency to increase
- a suble thing is that consumers may want to search less since now they are informed automatically if the other shop has a lower price
- we know from Varian that the more transparent the market is on the consumer side, the lower is the expected price. This effect should make a competition authority happy
- on the other hand, we know from Green and Porter that the more transparent the market is for the firms the easier tacit collusion is to maintain. In order to invoke this scheme Tesco has to monitor the other firms' prices closely. If they did not do this beforehand the scheme chould be anti-competitive as it increases price-transparency on the producer side.

Problem 2: Technology often requires tacit knowledge to be transferred alongside the more formal and codified parts of technology. As the name suggests, tacit knowledge represents those components of technology that are not codified into blueprints, manuals, patents and the like. For instance, transfer of chemical process technology through a license will typically involve training the licensee in a variety of issues such as how to handle and store chemicals, how to control the production process, and how to return it to operation after unscheduled breakdowns caused by accidents.

To analyse this situation, consider the following model: A licensor owns a patented technology that a licensee needs to be able to market its product. The licensee is the only firm that is able to produce for this market, and it faces the demand curve $q = 4 - 2p$ where p is the price of the product and q is the quantity sold. If the licensor licenses the technology, but does not transfer the tacit knowledge needed to operate it efficiently, the licensee has constant marginal cost equal to c_H. If the technology is licensed, and the tacit knowledge is transferred, the licensee has constant marginal cost equal to c_L where $c_L < c_H$. Transferring the tacit knowledge involves a private cost T for the licensor.

A licensing contract specifies a royalty r per unit sold and a fixed fee F. The licensor has all the bargaining power and makes a take-it-or-leave-it offer to the licensee. If the licensee rejects the contract offered, both the (potential) licensor and the licensee earn zero profit.

Suppose first that licensing contracts are complete in the sense that it is possible to specify whether the tacit knowledge should be transferred or not (in addition to F and r).

(i) Assuming that licensing takes place, explain why the licensee sells a quantity $q^* = 2 - r - c_i$ and earns profit $\frac{(2-r-c_i)^2}{2} - F$ where c_i is the marginal cost, $c_i \in \{c_L, c_H\}$.

(ii) Find the optimal contract that (a) maximizes the licensor's profit, and (b) is accepted by the licensee. In addition to specifying F and r, consider whether the tacit knowledge should be transferred or not and how this depends on T.

Assume from now on that it is not possible to verify in court whether the tacit knowledge is transferred or not. Therefore, the licensing contract specifies F and r but not whether the tacit knowledge is transferred.

(iii) Explain why a royalty $r > 0$ increases the licensor's incentive to transfer the tacit knowledge. Derive the optimal contract that (a) maximizes the licensor's profit, (b) induces the licensor to transfer the tacit knowledge to the licensee, and (c) is accepted by the licensee.

Suppose now that transferring the tacit knowledge makes the licensee able to imitate the technology at a cost I, thereby avoiding all royalty payments (but not the fixed fee).

(iv) Write down the constraint that the contract must fulfill in order to prevent the licensee from imitating.

(v) Suppose that licensor has some complementary input that the licensee needs and that is easy to monitor. Do think that this helps the licensor to sell its technology in a more efficient way?