14.272 Problem Set 1
Merger Analysis

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Question 1

The point of this question is to go through Farrell and Shapiro (1990) style logic to gain intuition for when mergers are**PROFITABLE** in a Cournot model (remember, strategic substitutes). Not may results are available generally, so I give an intuitive answer and then present simple examples.

(a) With N=2 firms the merger would certainly be profitable because there would be no competitive effect. With N¿2 firms there is competitive effect - non-merging firms increase output - which tends to make the merger less profitable. In fact for quite general demand systems mergers to N-1 from N in Cournot are not privately profitable if N$\geq$ 4.[1] For linear demand this is also true for N=3.

Example: inverse demand is $P = 1 - Q$. N firms. Marginal cost c. No fixed costs.

Each firm solves

$$\max q_i(1 - (N - 1)q_{-i} - q_i) - cq_i$$

Find the FOC and set $q_{-i} = q_i$ to get

$$q_i = \frac{1 - c}{N + 1}$$

(i.e., just solve the standard Cournot game as you have done many times before)

$$\pi_i = \frac{1 - c}{N + 1}\left[1 - \frac{N}{N + 1}.(1 - c) - c\right]$$

$$= \frac{(1 - c)^2}{(N + 1)^2}$$

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[1]Economic Letters is the home of most of these results.

Merger is privately profitable iff (remember following merger there are N-1 firms active)

$$\frac{(1-c)^2}{(N)^2} > 2\frac{(1-c)^2}{(N+1)^2}$$
$$N^2 - 2N - 1 < 0$$
$$N < 2.4 (approx)$$

(b) It should be clear that for there will be some fixed cost such that a merger would be profitable (for F high enough there would only be two firms in the industry anyway). More generally from the above where N firms are active before the merger, the merger is profitable if:

$$\frac{(1-c)^2}{(N)^2} - F > 2\frac{(1-c)^2}{(N+1)^2} - 2F$$

(c) Assume that following the merger the new firm just has the technology of the low cost party to the merger.

Pre-merger the FOC for a firm i is:

$$1 - 2q_i - \sum_{j\neq i} q_j - c_i = 0$$

and profits are:

$$\pi_i(N) = \left[1 - c_i - \frac{1}{N+1} \sum_{j\neq i} (1 - c_j) \right]^2$$

Then when firms 1 and 2 merge ($c_1 < c_2$), the merger is profitable iff

$$\left[1 - c_1 - \frac{1}{N} \sum_{j=3}^{N} (1-c_j) \right]^2 > \left[1 - c_1 - \frac{1}{N+1} \sum_{j=2}^{N} (1-c_j) \right]^2 + \left[1 - c_2 - \frac{1}{N+1} \sum_{j\neq 2} (1-c_j) \right]^2$$

To see that asymmetries can make a merger profitable imagine that $c_1 = c_3 = 0, c_2 > 0$ and 1 and 2 merge. The merger is profitable iff

$$\left[1 - \frac{1}{3} \right]^2 > \left[1 - \frac{1}{4}(2 - c_2) \right]^2 + \left[1 - c_2 - \frac{1}{2} \right]^2$$

which should give profitability if $c_2 > \frac{1}{15}$. Hence you can get profitable mergers with linear demand which you could not in (a).

(d) Capacity constraints will make mergers more profitable insofar as they make it more expensive for rivals to expand output (there is a different marginal

cost for output reductions than for expansions). Of course, if they are not binding capacity constraints do not matter. As a practical matter capacity constraints may also slow the ability of rivals to expand output in response to a price increase (for example, a new power plant takes 2 years to build).

Question 2

This question is straightforward.

(a) Strategic complements. Why? Assume costs are zero.

$$\begin{aligned} \pi_1 &= p_1.(12 + p_2 - 2p_1) \\ \frac{\partial \pi_1}{\partial p_1} &= 12 + p_2 - 4p_1 \\ \frac{\partial \pi_1}{\partial p_1 \partial p_2} &= 1 > 0 \end{aligned}$$

and same switching the subscripts as the problem is symmetric.

Reaction function. Set $\frac{\partial \pi_1}{\partial p_1} = 0$ to get

$$p_1^* = 3 + \frac{1}{4}p_2$$

and symmetry for p_2.

(b) Equilibrium prices are 4 for each firm. Profits (maintaining our zero cost assumption) are 32 (quantities are 8).

Question 3

As one would expect with a "true/false" question, the conclusions contain a grain of truth but are too strong. Remember the market definition rule is based on whether a hypothetical monopolist could profitably engage in a small but significant amount for a non-transitory period. An important point (which people sometimes ignore) is that it is possible for areas A and B to be in the same market from the point of view of assessing a merger in B, but not from the point of view of assessing a merger in A. It all depends on the demand and supply elasticities in A and B and the level of costs. Note also that one should think about the vertical level at which trade takes place : for example even though goods may be manufactured on an international basis, the market for distribution or retailing could be far more local.

(a) Consistent with same geographic market, but also consistent with highly correlated costs (e.g. gas station prices in different parts of the US are highly correlated, but this is because the underlying input price of crude oil is the key

cause of price movements). Also, what does highly correlated mean? Typically how price correlation is done is to compare the correlation of two areas that we definitely believe are in the same market with that between areas that may or may not be in the same market, and to see whether the correlation for the latter is significantly less than the former.

(b) Consistent with either seperate or same market. The key question is whether the current price in area A constrains the price in area B. It is quite possible that if the price in B increased, goods would start to be supplied by people in A. Imagine for example that the current difference equals the transport cost between area A (low price) and area B (high price): further price increases in B would lead to more supply from A as long as there is some elasticity of supply in A.

(c) Again consistent with both. Assume that the merger is happening in the importing area, B. If prices went up would supply from A be able to increase enough to make a price increase unprofitable? In the Spanish electricity case this was impossible because of capacity constraints on transmission. However for a merger between two North Sea crude oil producers there may be enough supply from Saudi Arabia etc. to constrain price increases. Assume that the merger is happening in the exporting area, A where costs are lower than in B. In this case a monopolist in A might well be able to profitably increase prices in A, particularly if it is possible to price discriminate between A and B.

(d) Again ... . It depends on the supply elasticity. Imagine that supply is perfectly elastic then demand shocks will not lead to price increases. Of course, if you have a prior that supply is not elastic then response to demand shocks could provide interesting evidence.

Question 4
(a) Event study where the events are antitrust events that were not completely expected at the time by the market. Ideally one would want to look not only at the effect on Microsoft's price but also of those of its competitors (SUN etc.) and its biggest consumers (although this is harder for MS than for steel producers at the turn of the century). This is because Microsoft's price may also be effected simply by the likely costs of continued litigation etc..

The data: CRSP stock market prices for MS, competitors and biggest customers.

The specification: standard IO event study specification. In practice the risk free rate was fairly constant over this period (note in the 70s this was not true due to rampant inflation) so not adjusting for this would not cause a big bias.

$$R_{it} = \alpha + \beta . R_{mt} + \delta D_t + \varepsilon_{it}$$

where the D vector contains dummies for the events. The equation is estimated using pre-, during and post-event data. Depending on what you want to believe you may impose restrictions on δ assuming similar effects on different companies etc.. As Nancyh explained one might also want to control for debt-equity mix.

The interpretation: the key point is that events affect market values relative to what was expected prior (i.e., a restriction may be bad to Microsoft but less bad than a restriction which was expected). To estimate financial effects one really must know the probabilities which the market attached to different possible events which will be hard to glean from newspaper reports. Example interpretations: MS +, rivals -, customers - : ruling allows MS to exercise dominance and exclude rivals; MS -, rivals +, customers - : ruling stops MS from competing effectively, allows competitors to raise prices/reduce service which harms consumers.

For the rest of this question see the Word handout at the back prepared by my predecessor, Mark Rainey.

Question 5

(a) Have to assume that the retail margin remains fixed (or that you can make an assumption about how it changes). Nevo does the former so that it forms part of his estimate of marginal cost which remains fixed when he estimates prices post-merger. Of course, this may not be the case : a cereals merger between Kelloggs and Post would undoubtedly affect how they bargain with supermarkets for shelf space, retailer mark-up etc..

(b) The danger is that you overestimate the own price elasticity. Imagine that Star do an offer on Cheerios then demand for Cheerios will spike and then fall when the price goes back-up. If there had not been a price decrease demand would be higher at the normal price which is not an effect that the static model can deal with. Of course, if non-Cheerios customers don't switch to Cheerios during the offer it is not obvious how the cross-price elasticity estimates will be affected, at least in a Hausman style demand approach. (In a BLP/Nevo approach where price is a characteristic I think that you will also overestimate the cross price elasticity).

To deal with the problem you could either:

- use data of different frequencies (daily, weekly, monthly) to see how sensitive your results are to this. If stocking up is limited (i.e. you only buy a couple of weeks supply at most) then monthly estimates will less affected than weekly estimates; or

- write down an explicit model of stocking up. This has been done for a few cases (e.g. soft drinks) where there is data on individual purchases. Using aggregate (store level) data you would have to assume more and estimate less.