ECO410H: Practice Questions 4 – SOLUTIONS

1. (a) 1967: CR4 = 0.95, HHI = 0.650
   1977: CR4 = 0.90, HHI = 0.225
   1987: CR4 = 0.95, HHI = 0.275

   (b) The HHI, unlike the CR4, adjusts to reflect the equalization of market shares over time.

   (c) High market shares are often thought to be necessary, but not sufficient for the existence of market power. In this case, the expansion by small firms, and entry and growth of a sixth firm suggest that market shares are not indicative of market power.

2. (a)

$$q_1 = 80 - 6p_1 + 3p_2 + 1p_3 = 80 - 6 * 26 + 3 * 31 + 1 * 31 = 48$$

$$q_2 = 107 + 3p_1 - 6p_2 + 1p_3 = 107 + 3 * 26 - 6 * 31 + 1 * 31 = 30$$

$$q_3 = 291 + 1p_1 + 1p_2 - 6p_3 = 291 + 1 * 26 + 1 * 31 - 6 * 31 = 162$$

If use revenue-based market shares:

$$s_1 = \frac{48 * 26}{7200} = 0.1733$$

$$s_2 = \frac{30 * 31}{7200} = 0.1292$$

$$s_3 = \frac{162 * 31}{7200} = 0.6975$$

$$HHI = 17.33^2 + 12.92^2 + 69.75^2 = 5332$$

$$\Delta HHI = (17.33 + 12.92)^2 + 69.75^2 - 5332 = 835$$

No, this is not in a safe harbor according to the U.S. Horizontal Merger Guidelines (2010), which would categorize this as a "highly concentrated market" because the HHI is above 2500. "Mergers resulting in highly concentrated markets that involve an increase in the HHI of more than 200 points will be presumed to be likely to enhance market power" HMG (2010) p. 19. However, this merger would be in a safe harbor according to the Canadian Merger Enforcement Guidelines (2011). While the Canadian guidelines explicitly state that the HHI is not used to mark safe harbors it does state on page 19 that "The Commissioner generally will not challenge a merger on the basis of a concern related to the unilateral exercise of market power when the post-merger market share of the merged firm would be less than 35 percent."

If use quantity-based market shares:

$$s_1 = \frac{48}{240} = 0.2$$

$$s_2 = \frac{30}{240} = 0.125$$

$$s_3 = \frac{162}{240} = 0.675$$

$$HHI = 20^2 + 12.5^2 + 67.5^2 = 5112.5$$

$$\Delta HHI = (20 + 12.5)^2 + 67.5^2 - 5112.5 = 500$$

The conclusions regarding whether or not this merger falls into a safe harbor under the U.S. and Canadian merger guidelines is the same as with revenue-based market shares.

(b)

$$\pi_1 = (p_1 - c_1)(80 - 6p_1 + 3p_2 + p_3)$$

$$\frac{\partial \pi_1}{\partial p_1} = 80 - 6p_1 + 3p_2 + p_3 - 6p_1 + 6c_1 \stackrel{set}{=} 0$$

$$80 - 6 * 26 + 3 * 31 + 31 - 6 * 26 + 6c_1 = 0$$

$$c_1 = 18$$

$$\pi_2 = (p_2 - c_2)(107 + 3p_1 - 6p_2 + p_3)$$

$$\frac{\partial \pi_2}{\partial p_2} = 107 + 3p_1 - 6p_2 + p_3 - 6p_2 + 6c_2 \stackrel{set}{=} 0$$

$$107 + 3 * 26 - 6 * 31 + 31 - 6 * 31 + 6c_2 = 0$$

$$c_2 = 26$$

$$\pi_3 = (p_3 - c_3)(291 + p_1 + p_2 - 6p_3)$$

$$\frac{\partial \pi_3}{\partial p_3} = 291 + p_1 + p_2 - 6p_3 - 6p_3 + 6c_3 \stackrel{set}{=} 0$$

$$291 + 26 + 31 - 6 * 31 - 6 * 31 + 6c_3 = 0$$

$$c_3 = 4$$

(c) The system of demand equations shows that the merging parties – producers of goods 1 and 2 – are each other's closest competitor. A change in the price of good 1 causes a bigger change in sales of good 2 than good 3 (non-merging firm) and a change in the price of good 2 causes a bigger change in sales of good 1 than good 3: notice the coefficients of 3 versus 1 on the demand parameters that determine the closeness of substitution. Hence the fact that firm 3 has by far the biggest market share masks the important competition between firms 1 and 2. The next part quantifies the magnitude of the harm from the merger (i.e. the unilateral effects), which is considerable given that a lot of competition is lost when two close competitors are allowed to merge.

(d)

$$\pi_{1,2} = (p_1 - c_1)(80 - 6p_1 + 3p_2 + p_3) + (p_2 - c_2)(107 + 3p_1 - 6p_2 + p_3)$$

$$\frac{\partial \pi_{1,2}}{\partial p_1} = 80 - 6p_1 + 3p_2 + p_3 - 6p_1 + 6c_1 + 3p_2 - 3c_2 \stackrel{set}{=} 0$$

$$80 - 12p_1 + 6p_2 + p_3 = -30$$

$$\frac{\partial \pi_{1,2}}{\partial p_2} = 3p_1 - 3c_1 + 107 + 3p_1 - 6p_2 + p_3 - 6p_2 + 6c_2 \stackrel{set}{=} 0$$

$$107 + 6p_1 - 12p_2 + p_3 = -102$$

Use fact you were given $p_3 = 31.56$ at the post-merger NE to solve two equations for two unknowns yielding $p_2 = 34.59$ and $p_1 = 29.09$. Prices have shot up: for Product 1 from \$26.00 to \$29.09, for Product 2 from \$31.00 to \$34.59 and for Product 3 from \$31.00 to \$31.56. The very large increases in prices of Products 1 & 2 caused by the merger would mean a very substantial lessening of competition, at least according to a price standard.

3. Are these market shares for an antitrust market? (If so, this is within the Canadian safe harbor although not a U.S. one.) What is the geographic market(s)? Differentiated or homogenous goods? If differentiated, how close of substitutes are Goods 3 and 4? If homogenous, are these market shares good indicators of future competitive significance? How are these market shares calculated? Entry: timely, likely, and sufficient? Are their industry characteristics that would facilitate collusion? Any history of coordination amongst firms? What are the merger-specific efficiencies? As you can see, markets shares by themselves are very limited information.

4. Find the pre-merger equilibrium:

$$\pi_1 = (a - bq_1 - bq_2 - bq_3 - c)q_1$$

$$\frac{\partial \pi_1}{\partial q_1} = a - 2bq_1 - bq_2 - bq_3 - c \stackrel{set}{=} 0$$

Using symmetry obtain:

$$a - 2bq - bq - bq - c = 0$$

$$q = \frac{a - c}{4b}$$

Pre-merger market output and price are: $Q = \frac{3(a-c)}{4b}$ and $P = a - b\frac{3(a-c)}{4b} = \frac{a+3c}{4}$.
Find the post-merger equilibrium:

$$\pi_1 = (a - bq_1 - bq_M - c)q_1$$

$$\frac{\partial \pi_1}{\partial q_1} = a - 2bq_1 - bq_M - c \stackrel{set}{=} 0$$

$$q_1 = \frac{a - c - bq_M}{2b}$$

$$\pi_M = (a - bq_1 - bq_M - c_M)q_M$$

$$\frac{\partial \pi_M}{q_M} = a - 2bq_M - bq_1 - c_M \stackrel{set}{=} 0$$

$$q_M = \frac{a - c_M - bq_1}{2b}$$

Cannot use symmetry to solve because the firms are not symmetric: merged firm has different

marginal costs. Can solve two equations with two unknowns to obtain:

$$q_1 = \frac{a - 2c + c_M}{3b}$$
$$q_M = \frac{a - 2c_M + c}{3b}$$

Post-merger market output and price are:

$$Q = q_1 + q_2 = \frac{2a - c - c_M}{3b}$$
$$P = \frac{a + c + c_M}{3}$$

Under a price standard it must be that the price does not increase with the merger:

$$P^{Post} = \frac{a + c + c_M}{3} \leq \frac{a + 3c}{4} = P^{Pre}$$
$$c_M \leq \frac{5c - a}{4}$$

5. FALSE. There many problems with this statement: (1) this is likely not a "merger to monopoly", (2) it ignores the efficiency defense, and (3) it says nothing about the closeness of substitution between these two hospitals. Just because the merged hospital would be the only one in the small town does not mean that it will be a monopoly. This depends on how far away other hospitals are and patients' willingness to travel for medical care. Second, given that this is likely not a merger to monopoly it would be important to consider whether there would be substantial efficiencies (cost savings) associated with the merger. Third, maybe one hospital is a pediatric hospital and the other is general hospital (i.e. not very close substitutes). It is of course possible that the merger should be blocked (maybe small efficiencies and strong competition between the hospitals rather than with other further away hospitals), but it is certainly not "definite."

6. UNCERTAIN. If the merger implies little or no cost efficiencies (namely at the level of marginal cost), the combined output of the merging firms declines in simple Cournot models like that explored in the Cournot merger simulation spreadsheet (linear demand, constant marginal costs, no capacity constraints, etc.). If however the merger reduces the marginal cost of the combined firm significantly, then it is possible that the combined output increases as a result of the merger.