

## Economics 380: Solutions 3

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1. A firm does not deviate

$$\pi^M \leq \frac{1}{1-\delta} \frac{\pi^M}{N}$$

Now rearrange.

2. The first order conditions are given by  $MR(q_1 + q_2) = MC_1(q_1) = MC_2(q_2)$ .

3. (a) Under Bertrand,  $p = c_2$ . Profits are  $\pi_1 = c_2 - c_1$  and  $\pi_2 = 0$ .

(b) Under monopoly pricing,  $p^M = v$  and  $\pi^M = v - c_1$ .

(c) To stop firm 2 deviating we require

$$(v - c_2) \leq \frac{1}{1-\delta} t$$

To stop firm 1 deviating we require

$$(v - c_1) + \frac{\delta}{1-\delta}(c_2 - c_1) \leq \frac{1}{1-\delta}(v - c_1 - t)$$

Putting these together,

$$(1 - \delta)(v - c_2) \leq t \leq \delta(v - c_2)$$

Hence we require  $\delta \geq 1/2$ .

(d) To stop firm 1 deviating we require

$$(v - c_1) + \frac{\delta}{1-\delta}(c_2 - c_1) \leq \frac{1}{1-\delta} q_1^*(v - c_1) \tag{1}$$

To stop firm 2 deviating we require

$$(v - c_2) \leq \frac{1}{1-\delta} q_2^*(v - c_2)$$

If firm 2 is indifferent between deviating and not,  $q_2^* = 1 - \delta$ , and  $q_1^* = \delta$ . Substituting, into (1) and rearranging, cooperation requires

$$\delta \geq \frac{v - c_1}{2v - c_1 - c_2} > \frac{1}{2}$$

Intuitively, efficiency is higher in part (c), and so there is more to gain from cooperating.

4. Observe the question you to calculate whether the firms can sustain a price *below* the monopoly price. The answer, however, is the same as before. That is we need  $\delta \leq 1/2$  to sustain cooperation.

5. Holdup problem:

- (a) First best is  $I = 1$ . The surplus is  $1/2$ .
- (b) With holdup, the price will be  $p = 0$ . Investment will be  $I = 0$ .
- (c) If the buyer stick to agreement they get  $1/2$  each period. If they defect they get 1 this period and 0 thereafter. Hence they will not defect if  $\delta \geq 1/2$ . The seller is (weakly) better off by sticking to the agreement.

6. A good answer would hit the following points.

- (a) Explain double marginalisation.
- (b) Explain what contractual devices can sidestep double marginalisation. For example, two-part tariffs.
- (c) Say what's wrong with these contractual solutions. With two-part tariffs, we require a lot of information and need to stop arbitrage. Two-part tariffs are also unwieldy: can you imagine going to a two-part tariff style supermarket?
- (d) Practically there is evidence that it's a problem. There are many real world examples, such as the Porsche case.

7. Double markup:

- (a) The firms exert negative externalities on each other by increasing their price.
- (b) The price will equal the vertically integrated price.
- (c) Exclusive territories may increase prices and reduce the profits of the upstream firm. Of course, they may be not such a bad thing if two-part tariffs are possible.

8. The scheme is like a selective wage increase for people who study.

- (a) In the short term, this wage increase will decrease profits. People may put in more effort if wage increases. You may also get lower turnover. Any answer along these lines is acceptable.
- (b) In the long-term, there will be a selection effect. Attract more diligent employees. Could increase profits.

9. Here are two explanations:

- (a) Volvos are safe, so people drive more recklessly.
- (b) Careless people know they are careless and buy Volvos.

10. Optimal bundles:

- (a) Bundle at a price of \$14.
- (b) Sell separately at price of \$10 each.
- (c) Bundle at a price of \$14.

11.(a) Invest more. This is a strategic effect: investing more means lower costs which means lower prices if entry occurs.

(b) Probably invest more. There is a direct effect: holding price fixed, more R&D means the entrant gets fewer sales. There is also a strategic effect: more investment means the quality is higher and price will be higher. For example, it may be that without investment the firms are undifferentiated and make Bertrand profits, while with investment, the firms are vertically differentiated so even the lower quality firm (the entrant) make profits. In this case the incumbent should invest less.