

UC Berkeley  
Econ 121  
Prof Joseph Farrell  
GSI: Jenny Shanefelter

**Review Session:** Monday May 15, 1-3p, Evans 3

Problem Set #4 – Suggested solutions.

1. a) Here, we have the basic ICE set-up of a vertical relationship between a monopolist and a competitive complementary industry. As we discussed in class, in this situation, the monopolist prefers for the end-users to see the monopoly price and quantity. So, regardless of whether the software companies are organized perfectly competitively or they are vertically integrated with the monopolist, the price paid by the users will not change.

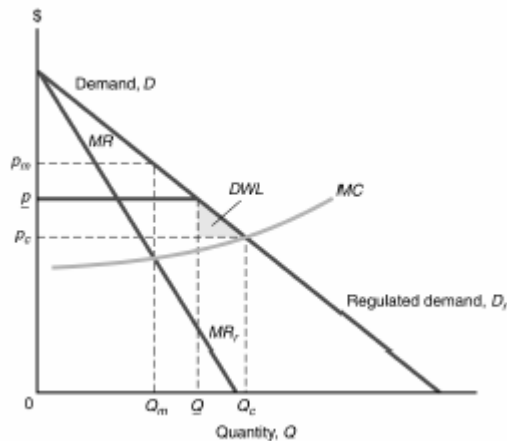
Why? The theory of ICE (Internalization of Complementary Efficiencies) gives us a framework for understanding this. Recall the definition of complementary goods: if Good 1 is a complement of Good 2, then demand for Good 1 is increasing as the price of Good 2 decreases. So, if the sales of SGI are increasing as the price of software goes down, SGI wants the price of software to be as low as possible – which is equivalent to saying that SGI wants to set the monopoly price and quantity and wants the added cost of the software to be as non-distorting as possible. If the price paid by the user is above the monopoly price (e.g., the software manufacturer adds a margin to the cost), then the monopolist will be selling less than the monopoly quantity, which is not optimal. The greater the difference between the monopoly's optimal price and the price to the user, the more the quantity consumed will be distorted. Regardless of the organization of the software market (vertically integrated or perfectly competitive), the monopolist prefers a monopoly price on the hardware and as low a price as possible for the software ( $p=mc$ ).

b) Now, the software industry is no longer competitive. Thus, if acting on their own, the software manufacturers will add a margin to their product, leading to double marginalization. This does not jointly maximize profits for the two groups. If the monopoly bought the software companies, it could eliminate the double marginalization and end-use consumers would see a lower price. They would be charged the monopoly price for the package. This is a lower total price (and therefore a higher total quantity sold) than if the monopoly marks up the hardware and the duopoly marks up the software.

This is analogous to the cable example discussed in class. If Fox and DirecTV had merged, the total cost for their package would be lower than the total cost for Fox plus cable service. The integrated firm has a cost advantage over the unintegrated firm.

2) Figure 20.1 shows the effect of efficient price regulation, in which the regulated price is set equal to the competitive price (the point at which MC crosses demand). Figure 20.2

shows the effect of price regulation that holds the price well below the competitive level, resulting in a shortage. In this problem, you are asked to consider a price that is below the monopoly level and above the competitive level. Your graph should show that quantity falls below the competitive level and above the monopoly level. There is deadweight loss, but is smaller than the deadweight loss that results from pricing at the monopoly level. There is no shortage that occurs, in contrast to Figure 20.2.



3. a) The value of licensing the patent is the probability of the patent being valid times the value of the patent. Since the value of the patent to the user is  $V$  and there is a 50% chance that the patent is valid, the maximum the potential user would be willing to pay would be  $V/2$ .

b) i. In this situation, the value of licensing the patent increases to  $D/2$ . This is because if the patent is found valid and there is no license, the firm must pay  $D$ . Thus, if the firm chooses not to license, that will cost  $D/2$  in expectation.

That is, if the firm decides to license at royalty,  $r$ , the benefit is  $(V-r)$ . If the firm decides not to license, the benefit of using the technology is  $.5(V-D)+.5(V)$ . That is, there is a 50% chance of losing money if the firm uses the technology without licensing it.

To ensure licensing, the royalty should be set such that the benefit of licensing exceeds the benefit of not licensing.  $(V-r) \geq .5(V-D)+.5(V) \rightarrow r \leq D/2$ . Note that the firm will never pay more than the value of the technology, so for this to hold,  $D/2 < V$ .

ii) If there are several users who compete with one another downstream, everyone will use the technology. This is the best response, whether competitors are using the technology or not. They are willing to pay up to the full value of the patent,  $V$ , to use the technology. In a competitive industry, when everyone pays the same amount to access the patent, there is weak incentive to challenge it. Successfully challenging the patent would simply lower costs for everyone. It is therefore likely that everyone will license the patent.