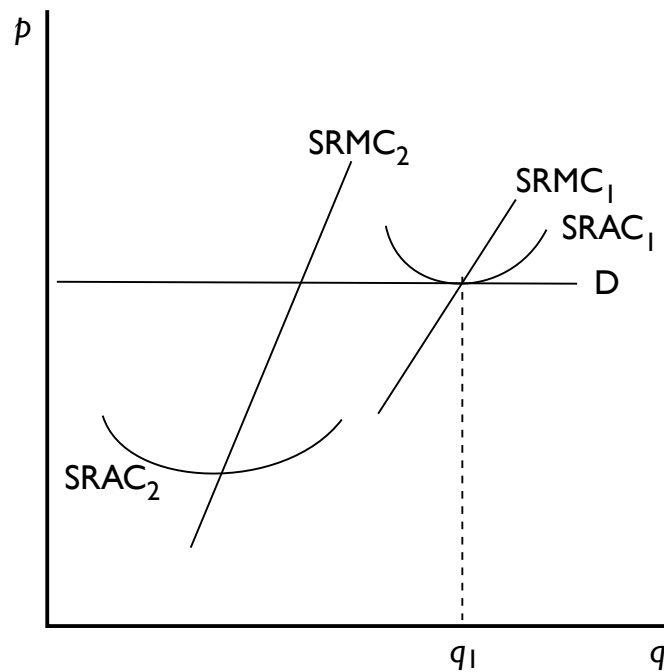


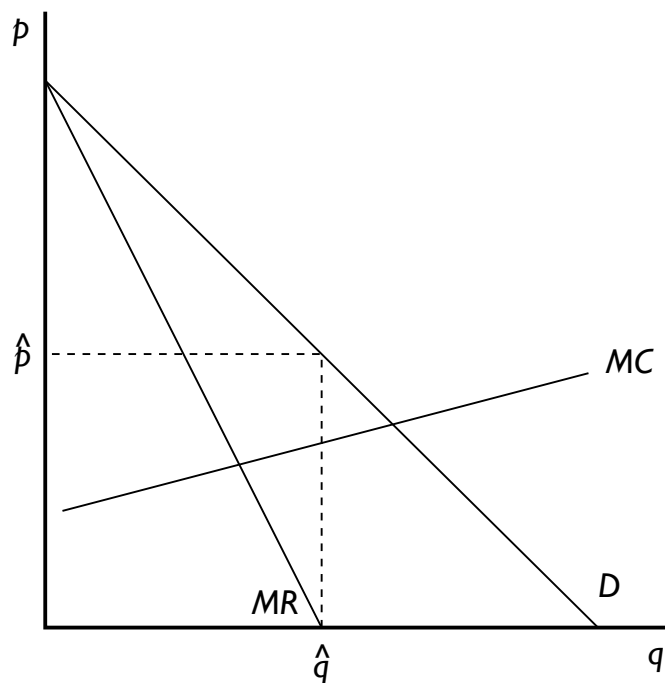
Problem Set 1

1. *OilWells*. Suppose a small county in West Texas has 28 oil wells with cost curves subtscripted “1” in the graph below and 4 oil wells with cost curves subtscripted “2.” The price of oil is determined outside this market, and is shown by the horizontal demand curve.

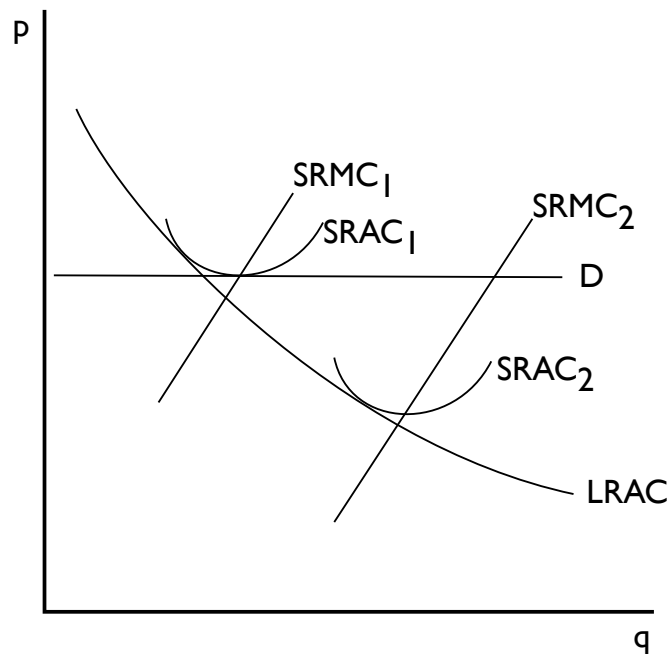


- (a) Show in the graph what quantity a type-2 well produces. How much profit does it make?
- (b) If the type-2 wells are earning Ricardian rents, what does this imply for the long-run number of each type of well and the price?
- (c) If the type-2 wells have recently adopted a new technology which is available to all oil wells worldwide, what does this imply for the long-run number of each type of oil well and the price?

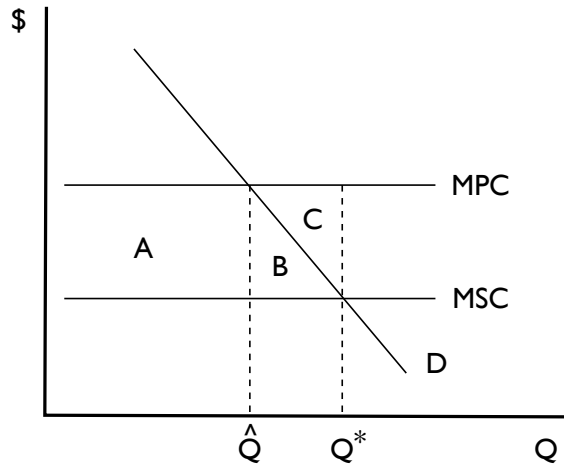
2. *ProfitMax.* A monopoly firm produces quantity \hat{q} at price \hat{p} as shown in this diagram:



- (a) Does this firm maximize profit? Explain.
 - (b) Is there any deadweight loss? How much?
 - (c) If this firm is under threat of government regulation, does that help explain the firm's decision to produce \hat{q} ?
 - (d) Harder. Without drawing any additional curves on the diagram, show how much operating profit this firm makes.
3. *LongRun.* Currently, the industry shown in the following diagram is in a long-run, perfectly competitive equilibrium with many firms all using technology 1.

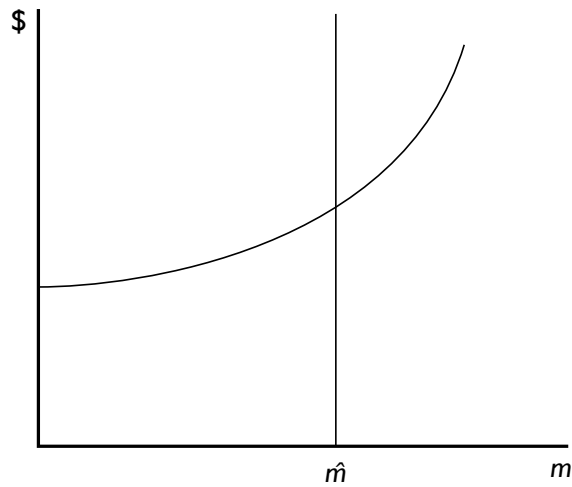


- (a) What quantity does a type-1 firm produce? How much profit does it make?
- (b) Suppose technology 2 becomes available. Nevertheless, there are some firms that would like to stay with technology 1 because they believe that the type of work involved in technology 1 is more creative and personally fulfilling. Can these firms stay with technology 1 in the long run?
4. *IMOpen*. Underlying Instant Messaging (IM) is a database called the Names and Presence Directory (NPD) which shows who is available and whether or not they are online (present). Several leading IM services, including AOL, Yahoo!, Microsoft, and Skype, use proprietary NPDs that are not open to other systems. There may be positive externalities in production of IM because the NPD, if open, could be used to produce other value-added products based on whether or not people are online.
- Here is a diagram of the situation for AOL Instant Messenger (AIM)



- (a) Without any intervention in the market, AIM would produce quantity \hat{Q} . Which area (A, B, or C) would be deadweight loss? Explain in words who would suffer this loss?
- (b) If the government employed a Pigouvian subsidy to get AOL to produce Q^* , the cost of the subsidy would be what?

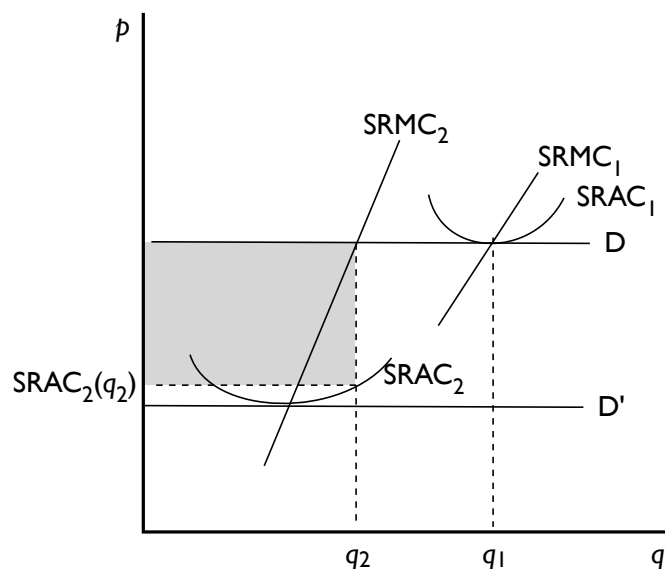
5. *NWDelta*. Northwest Airlines and Delta Air Lines have been cooperating with their frequent flier programs and some scheduling arrangements for a long time. Let m be Delta's marketing efforts that are directed toward Northwest.



- (a) Northwest has determined that m^* is the optimal level to ask for from Delta. If they can contract on it and verify the result, how much do they have to pay Delta? Explain.
 - (b) It turns out that only Delta's marketing *budget* is verifiable, not the *direction* of the effort toward Northwest. If we redefine m as the underlying, unverifiable direction of Delta's marketing effort, what would you expect Delta to do? Why?
 - (c) Suppose that Delta's marketing direction is correlated with Northwest's measurable success after the fact. Show how Northwest could offer a higher-powered contract to Delta. Why wouldn't Delta do less m than m^* under such a contract?
6. Are the services of Middletown's snow plows rival or nonrival? Excludable or nonexcludable?
7. You should know how to do Chapter 2, problems 1, 2, 3, 6, 7, 8, and 9.
8. You should know how to do Chapter 3, problems 3, 4, 6, and 8.

Answers:

1. *OilWells_a*.



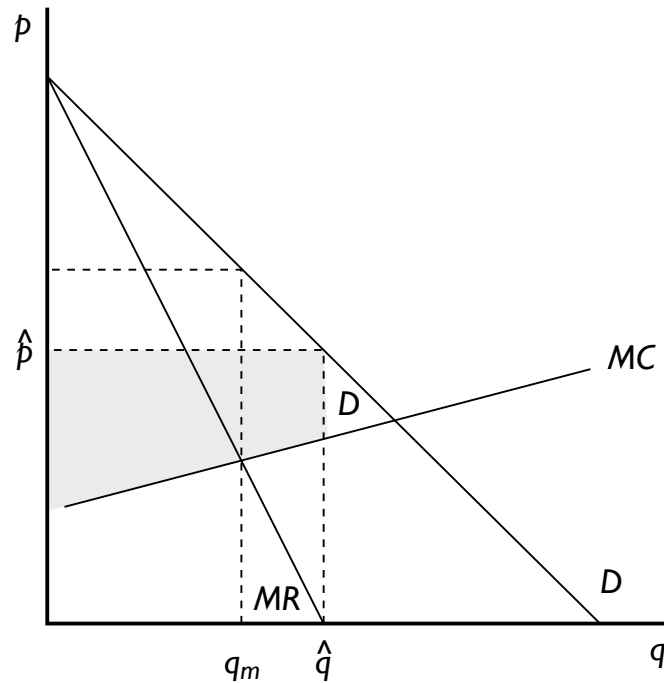
- (a) A type-2 firm produces quantity q_2 , determined from setting its marginal cost equal to its price. Its profits are

$$(p - SRAC_2(q_2))q_2$$

which is shaded on the graph.

- (b) Since the rents are Ricardian, they cannot be reproduced. No other oil wells can become type-2 wells. Therefore, the type-2 wells will continue to earn these rents in the long run, and the type 1 rents will remain in business and continue to earn zero economic profit.
- (c) Since there are large rents to using the type-2 technology, the type 1 wells and/or new entrant wells will want to adopt it. As they do adopt it, this will push the industry supply curve to the right, lowering the price. Eventually, the price will fall to D' , at which point there will be many more type-2 wells, all earning zero economic profit. No type-1 wells will be able to remain in business.

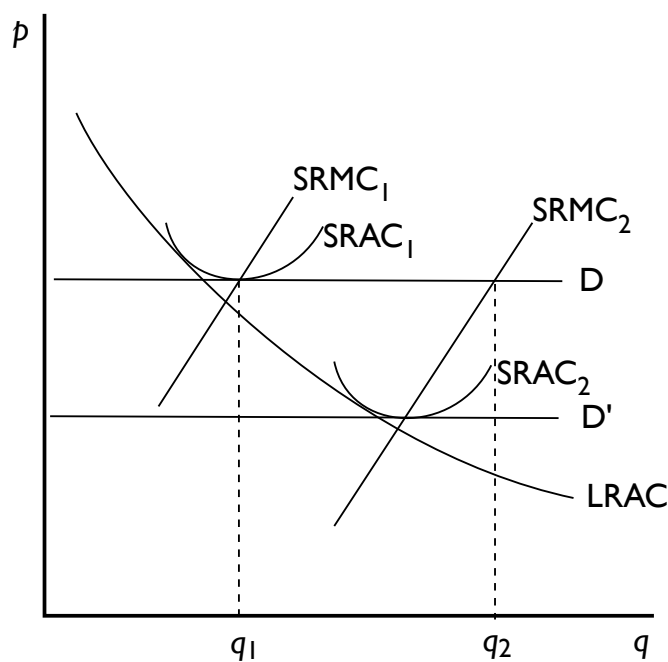
2. ProfitMax_a.



- (a) No, this firm does not maximize profits because the marginal cost of \hat{q} is greater than the marginal revenue. Profits would therefore rise if the firm cut output. The profit-maximizing output is where $MR = MC$, labeled q_m on the diagram.
- (b) Yes, there is a deadweight loss, labeled D in the diagram. It is obviously larger than the zero deadweight loss that would occur if the firm behaved like a perfect competitor, but it is smaller than the deadweight loss of a profit-maximizing monopoly.
- (c) Yes, if there is some chance the government will regulate the firm, it might want to avoid the image of being an inefficient monopoly. Increasing output, and thereby decreasing price and deadweight loss, is a way of making the firm less costly to society. Of course, this comes at the expense of reduced profits, but those profits might still be higher than what would be earned under regulation.

(d) The operating profit is the revenue minus the variable cost. In this case, total revenue is equal to the area $\hat{p}\hat{q}$. Total variable cost is the area under the marginal cost curve between $q = 0$ and $q = \hat{q}$. The difference between these is operating profit, the shaded trapezoid in the figure.

3. *LongRun_a*. Currently, the industry shown in the following diagram is in a long-run, perfectly competitive equilibrium with many firms all using technology 1.



- (a) Each type 1 firm maximizes its profit by setting marginal cost equal to price, producing output q_1 . Since the firms are in long-run equilibrium, price also equals average cost at that point. As a result, the firms do not make any economic profit.
- (b) Initially, a small number of type 2 firms could enter the industry and produce output q_2 . They would earn large profits since price is well

above $SRAC_2$, while the type-1 firms would continue to earn zero profit.

However, the large profits available to type-2 firms would attract entry into the industry. Even if none of the type-1 firms changed technology, capital would move into the industry from other sectors of the economy. Eventually, the entry of type-2 firms would increase market supply and thus decrease equilibrium price. The new demand curve facing a single firm would shift to D' in the diagram. At this price, type-2 firms would make zero economic profit, but type-1 firms would incur a heavy loss. Eventually, all type-1 firms would have to leave the industry.

Note that all of this is based on the homogeneous-good demand curve which is given in the problem. If, somehow, the type-1 firms could differentiate their product, they could command a higher price, and perhaps then they could stay in business.

4. *IMOpen_a.*

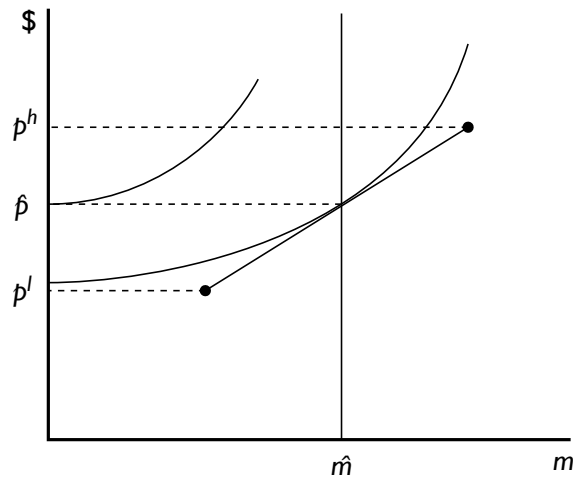
- (a) The deadweight loss is B . This is the area that has a lower social cost than it does social benefit. It is suffered by those who demand the NPD service, in this case both end-consumers and the hypothetical producers of the add-on products.
- (b) A Pigouvian subsidy would push AOL to lower its price to the level given by the MSC curve. The problem for AOL is that it would be lowering the price on every unit, not just the units between \hat{Q} and Q^* . Thus, it would incur a loss equal to the vertical distance between MSC and MPC on every unit. The subsidy would therefore cost $A+B+C$.

This shows how difficult Pigouvian subsidies can be. In order to produce benefit B , the government needs to spend a great deal more on subsidy. The subsidy is just a transfer within society, from the taxpayers to AOL, so it does not reduce social welfare, but it is not very

plausible that Congress would approve such a large redistribution of resources for such a small social gain. In the real life case of the AOL / Time-Warner merger, a condition of merger approval was to open the NPD, which in this case is a simpler strategy, especially since the marginal cost in this example is close to zero.

5. *NWDelta_a.*

- (a) The isoprofit curve shows how much Delta can get by doing $m = 0$, i.e. its *outside option*. Thus, to get delta to do \hat{m} , Northwest has to pay them \hat{p} just to make them equally well off. The payment covers Delta's additional costs from doing the work.



- (b) Since Northwest cannot observe Delta's m , and since m is costly to Delta, Delta can just shirk by setting $m = 0$ but collect the \hat{p} anyway. This will give Delta an even higher payoff, shown by the higher isoprofit curve in the diagram.
- (c) Suppose Northwest pays Delta p^h if Northwest does well and p^l if Northwest does poorly. Further, suppose that Northwest's outcomes can be measured on the same axis as Delta's m and are correlated with Delta's m as shows in the diagram. Then on average, Delta expects to receive \hat{p} and this is enough to justify effort level \hat{m} . If Delta

shirked by doing $m < \hat{m}$, then it would increase the probability of receiving p^l , moving down along the tangent line, and thus moving *below* the isoprofit curve. Thus, this is not in Delta's interest.

Note that since Delta's initial isoprofit curve is risk free, while the high-powered incentive is risky, the diagram above is only correct if Delta is risk-neutral. Assuming Delta is risk averse, it would need somewhat higher payments p^l and p^b to compensate for the added risk.

6. Plowed streets are both nonrival and nonexcludable. They are nonrival because one car driving on a plowed street does not somehow "unplow" the street. And they are nonexcludable because there is no way to prevent cars from using the plowed streets.

On the other hand plowed driveways are rival and excludable. They are rival because if one driveway is plowed, then the time and energy taken to plow it was not used on another driveway. And they are excludable because normal property laws prevent drivers from using driveways without permission (note that the fact that most driveways are dead-end is important to enforcing these laws – *through* driveways are more difficult to exclude and are often used as illegal shortcuts).

If you define snowplow services somewhere in between these two extremes, such as comparing plowed and unplowed sections of town, then the services are partially rival and excludable.