Exercises 2

Economics of innovation

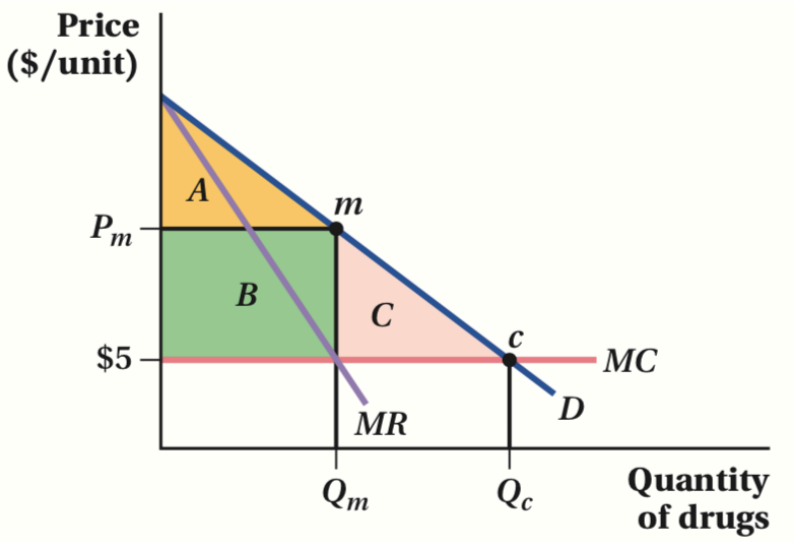
Exercise 1 - Patents

The government encourages innovation by giving companies monopolies on products. *D* represents the demand curve for the cure for the common cold. In a perfectly competitive market, the drug would be sold at a price equal to its marginal cost, $5.

1. Draw a graph in which it is shown the consumer surplus
2. At this price, the firm would be able or unable to recover the fixed cost of developing the drug? and would choose to invest or not to invest in the cure for the common cold?
3. What appens if the government give the firm a patent? Determine the price the quantity and the new consumer surplus

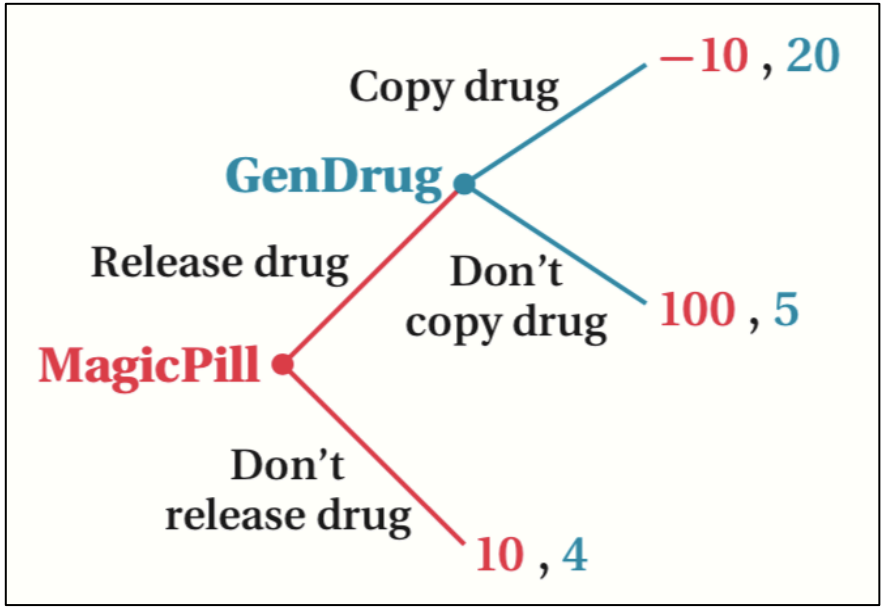
Solution exercise 1

1) The consumer surplus would be *A* + *B* + *C*
2) At this price, the firm would unable to recover the fixed cost of developing the drug and would choose not to invest in the cure for the common cold.
3) By giving the firm a patent, the government allows it to recover the costs of innovation, and the firm produces at the monopoly price *Pm* and quantity *Qm*. The consumer surplus is now the triangle *A*



Exercise 2 - Patents

MagicPill Inc. has developed a new wonder drug for curing obesity that has been approved by the Food and Drug Administration. If the drug is released for sale, a competitor, GenDrug, will attempt to copy the formula and steal all of MagicPill's customers by offering the wonder drug at a lower price. (Assume there are no patent laws at this time.) The extensive form of the game is shown below (payoffs represent profits in millions of dollars):



a. Should MagicPill release this new wonder drug for sale? Explain.
b. Would your answer to (a) change if GenDrug promised not to copy the new drug? Explain.
c. Would your answer to (a) change if GenDrug signed a contract with MagicPill promising to pay $10 million if it copies the drug? Explain.
d. How would your answer to (a) change if patent laws protect MagicPill's exclusive right to produce its new wonder drug?

Solution exercise 2

a. No, MagicPill will not release the drug. Using backward induction, we can see that if the drug is released, GenDrug will choose to copy it (because it can earn $20 million profit rather than $5 million). Knowing this, MagicPill is better off not releasing the drug (because it can earn $10 million rather than losing $10 million).

b. No. GenDrug's promise would not be credible. The incentive ($15 million additional profit) is large enough that MagicPill cannot believe the promise by GenDrug.

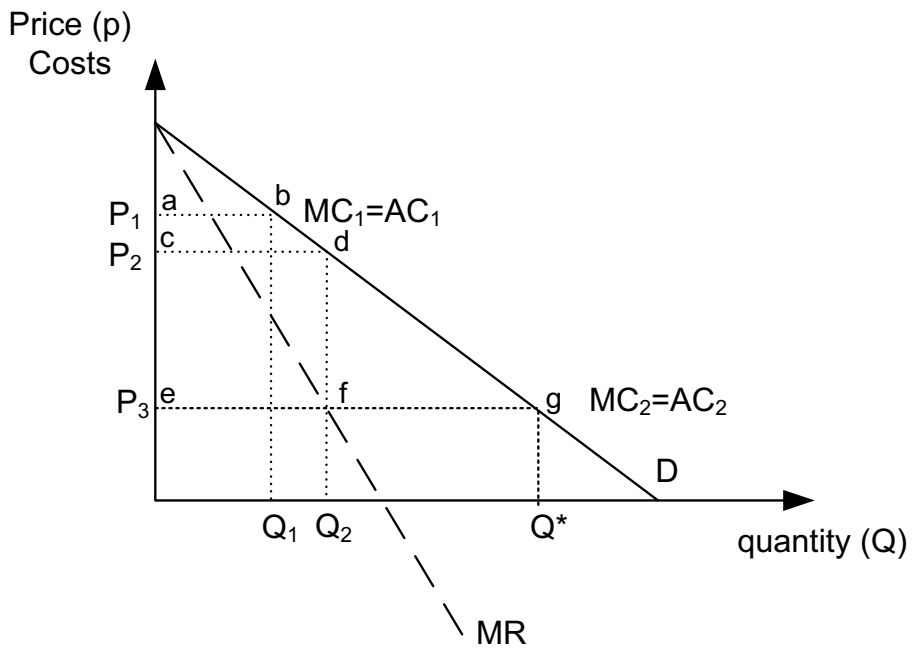
c. No. The payment of $10 million by GenDrug will not change GenDrug's incentive for copying the drug ($20 million **–** $10 million > $5 million). Furthermore, the payment of $10 million would not be enough to induce MagicPill to release the drug (**–** $10 million + $10 million < $10 million).

d. Yes. If the patent prohibited GenDrug from copying the wonder drug, we can ignore the "Copy Drug" option in the game. In this case, Magic Pill will want to release the drug because $100 million > 10 millions

Exercise 3

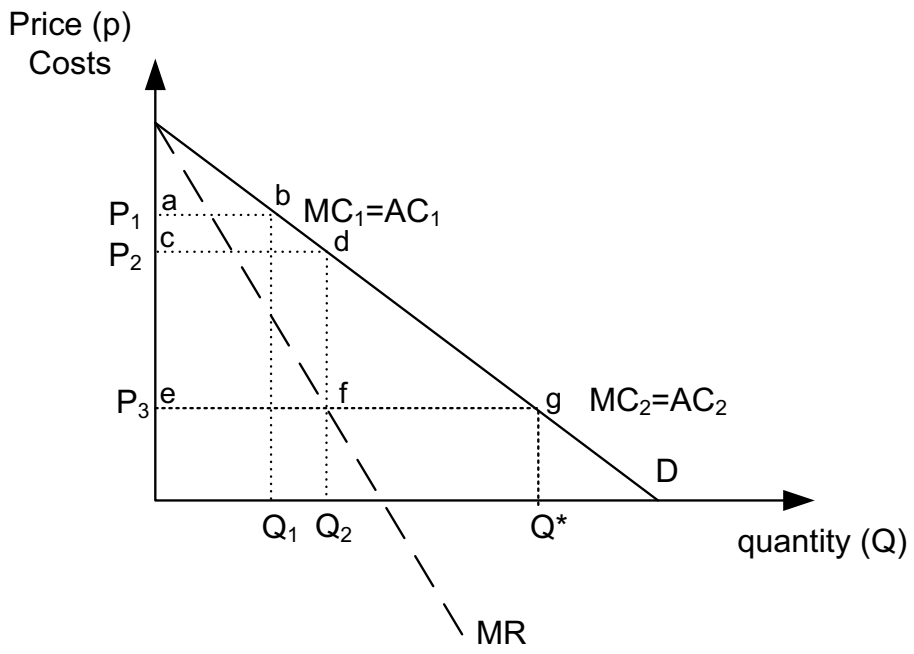
- Draw a graph of a perfectly competitive market, in which the process of production of fabrics with some protection characteristics is standard and the good would be sold at a price equal to its marginal cost, MC_1.
- On the same graph now draw the situation of one firm that acquires a patent for the innovative technique that allows production of a line of high-tech fabrics with protection characteristics. The new marginal MC_2 cost will be higher or lower?

Solution exercise 3



Before the cost-reducing process innovation many firms produce and sell at price *P*1 = MC1 = AC1 (i.e., the market is perfectly competitive). After the innovation, one firm acquires a patent for the innovative technique that allows production at cost MC2. With the new cost at MC2, the profit- maximizing price is *P*2 (profit maximization occurs where MR = MC2, hence quantity *Q*2 is produced and sold at *P*2). The patent holder can either supply all of the market at price *P*2 or issue licenses to others for the use of the patented technology, charging them *P*2 −MC2. When the patent expires the product price falls to *P*3 = MC2.

Solution exercise 3 - Discussion



Economists are particularly interested in the *welfare* implications of such cases and we now look at these in detail. The total *social welfare* gain from the innovation in the long run is given by the area ABGE, all of which accrues to consumers by increasing their *consumer surplus* (which measures the difference between the amount they actually pay and the maximum amount they would be willing to pay for this quantity of the product). During the patent period the innovator produces less than *Q** and receives profits of CDFE. These profits provide the incentive for innovation and are generated by the fact that *P*2 > MC2. However, this incentive to innovate is lower than the long-run welfare gain by the welfare loss of monopoly, triangle DGF, plus the short-run gains from price reduction accruing to customers of area ABDC.

Exercise 4

- The inverse demand function for a good is given by $p(Q)= A - Q$, where Q is industry output. Suppose that there are two firms in the industry but firm 1 has a patent on the production technology that allows to produce good X with constant per unit cost c , where $c < A$. Firm 1 charges firm 2 a license fee of t per unit of output produced by firm 2.
- (a) Suppose that for given value of t the two firms compete the two firms compete by choosing outputs simultaneously. Find Nash equilibrium, assuming that t is small enough so that both produce positive output levels.
- (b) Now consider a dynamic game. Firm 1 starts the game by choosing the license fee t , then firm 2 observes the value of the license fee and both firms simultaneously chose their output levels. Find perfect Nash equilibrium.
- (c) Compare profit of the first firm in case (b) with the profit in the case where firm one is the pure monopolist. Could this result be generalized for any downward sloping demand curve?

Solution exercise 4

- $q_1 = \frac{A-c+t}{3}$ and $q_2 = \frac{A-c+2t}{3}$
- $t = \frac{A-c}{2}$, $q_1 = \frac{A-c+t}{3} = \frac{A-c}{2}$ and $q_2=0$

- $\boldsymbol{\pi}_1^{(b)} = \boldsymbol{\pi}$ *monopoly*

- This result could be generalized.