Exercises 1

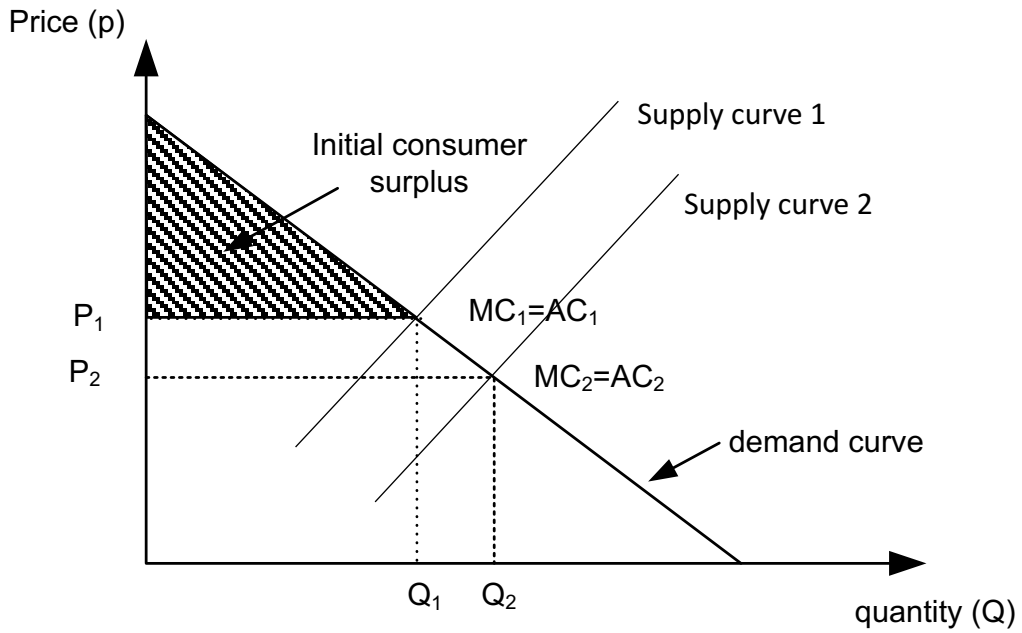
Economics of innovation

Exercise 1- the introduction of new process

Suppose that innovations in textile industry lower the cost of producing T-shirt by 10%. This cost reduction effectively shifts the inverse supply curve downward by 10% at every quantity.

Assume that the price of T-shirtis is determined by the forces of demand and supply. Graph the market for T-shirtis initially, and then illustrate the effects of the technological innovation.

Solution exercise 1



Exercise 2 - The introduction of a new product

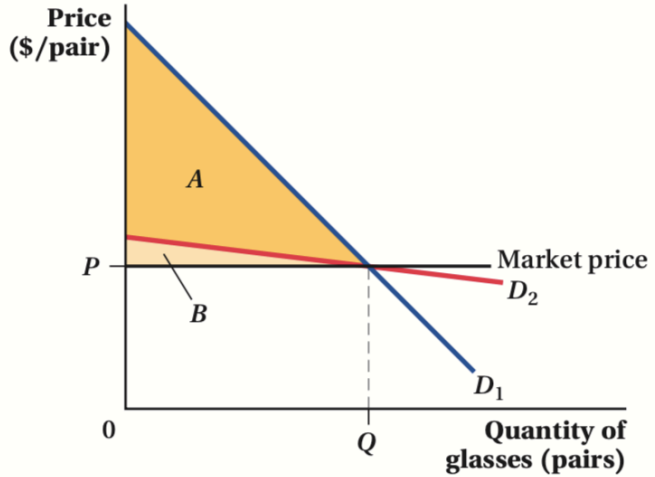
Let’s look at eyeglasses market. Glasses were first invented in 1280.

What appened when were first commercially available contact lenses on the market in the latter half of the twentieth century?

When are available substitute goods are likely to make demand more elastic.

This is true of glasses, too: When contact lenses became available, the demand for glasses became more price elastic. How would this change in elasticity affect the consumer surplus people get from the existence of eyeglasses?

Solution exercise 2



Because many people in 1280 need glasses, the demand curve was very steep — there was a set of individuals with a very high willingness to pay for glasses. This would also imply that demand wasn't particularly sensitive to prices. This steepness of the demand curve probably remained stable for the next 700 years, until the first commercially available contact lenses came on the market in the latter half of the twentieth century.

Consumer surplus in 1950 is large because the demand for glasses *D*1 is inelastic — if you want to see better, glasses are the only game in town. The consumer surplus is the area above the price and below *D*1, or area *A* + *B*. Many people would be willing to buy glasses even if the price were much higher than *P*. (That's what having an inelastic demand means.)

When contact lenses become available, the demand for glasses becomes much more elastic, as shown by curve *D*2. Even if just as many people buy glasses at the equilibrium price as before, a sharp rise in the price of glasses would cause many people to stop buying them because now they have an alternative.

The figure shows that the consumer surplus from glasses declines after contacts come on the market. The area below the new, flatter demand curve and above the price is only area *B*. When contact lenses become available, the demand for glasses becomes much more elastic, as shown by curve *D*2. Even if just as many people buy glasses at the equilibrium price as before, a sharp rise in the price of glasses would cause many people to stop buying them because now they have an alternative. The figure shows that the consumer surplus from glasses declines after contacts come on the market. The area below the new, flatter demand curve and above the price is only area *B*.

Solution exercise 2 - discussion

After contacts are available, glasses are not worth as much to consumers because there are now other ways in which they can improve their eyesight. If glasses are the only way to fix your eyesight, you might be willing to pay thousands of dollars for them. Once you can buy contacts for €300, however, there is a limit to how much you would pay for glasses. You might still buy the glasses for $200, but you would certainly not be willing to pay $1,000 for them, and the change in consumer surplus reflects that change. Glasses are a miracle invention if they are the only way to correct one's vision (so they yield a higher consumer surplus). Remember that consumer surplus depends on the *most* that people would be willing to pay for the product. That maximum price goes down if alternatives are available. When alternative methods of vision correction are available, however, glasses are just another option rather than a virtual necessity, and the consumer surplus associated with them falls.

Exercise 3 - Firms' Costs of Reducing negative externalities

- Suppose there are only two firms in the electricity industry, Acme and Best.
- The amount of pollutants that each would emit in the absence of any externality remedy is 40 tons, or 80 tons total for the industry.
- We presume the efficient level of pollution for the industry is 50 tons.
- Achieving efficiency therefore requires reducing emissions by a total of 30 tons. Any scheme of emissions reduction across the two firms that adds to 30 tons will work. But, if the two firms differ in their costs of cutting emissions, all these schemes are not made equal. Let's see why.
- Suppose Best uses a newer, more flexible technology than Acme.
- This allows it to switch to less-polluting inputs at lower cost, which means that Best faces a lower marginal abatement cost, the additional cost of reducing an additional unit of emissions.
- Let's assume that the marginal abatement cost for Acme is $MAC_A = 2e_A$, where e_A measures the number of tons of emissions cut by Acme. Best, which has the more flexible technology, has marginal abatement cost $MACB = e_B$ per ton, where e_B measures the number of tons of emissions reduced by Best.
- For both firms, we assume that the more the firm cuts emissions, the more expensive it is to cut an additional ton. This seems reasonable. Firms can often reduce emissions fairly easily at first by making small changes to their production process. Larger cuts, however, involve more complicated and costly adjustments.

Solution exercise 3

The lowest-cost way for society to achieve the 30-ton emissions cut is to split the cut across the two firms in a way that equalizes the two firms' marginal abatement costs. Because if these marginal abatement costs are not equalized, Acme could save more by increasing emissions than it would cost Best to decrease them by the same amount.

This change in emissions levels would keep total emissions constant at 50 tons but save money. Therefore, the cheapest way to achieve the 30-ton drop in emissions is to make sure $MAC_A = MAC_B$, or $2e_A = e_B$. Because total emissions reduced must be equal to 30 or $eA + eB = 30$, we can solve for eA and eB:

$2e_A = e_B$ considering that $e_A + e_B = 30$ and that $e_B = 30 - e_A$ so

$2e_A = 30 - e_B$ and that $2e_A + e_A = 30$ so

$3e_A = 30$

$e_A = 10$

$e_B = 2e_A = 20$

Acme should cut 10 tons of emissions and Best should cut 20 tons. At these levels, the marginal abatement cost for each firm of reducing one more ton of emissions is the same and equal to $20.

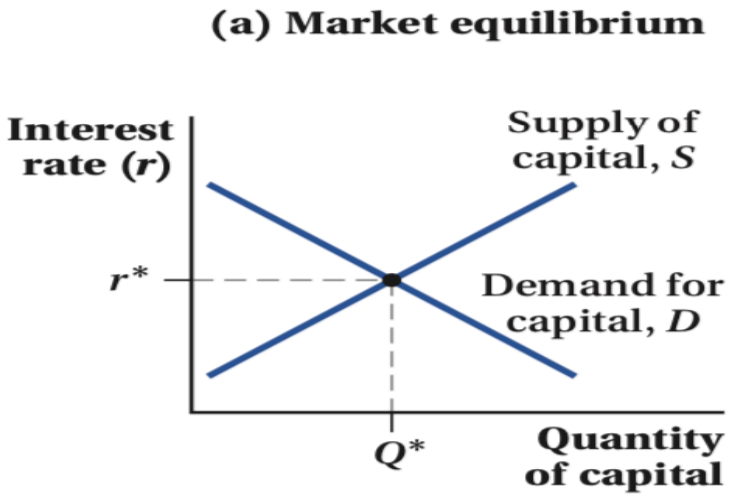
It's not surprising that cost minimization implies that Best, which faces lower marginal abatement costs, cuts emissions more.

Exercise 4 - The market of capital

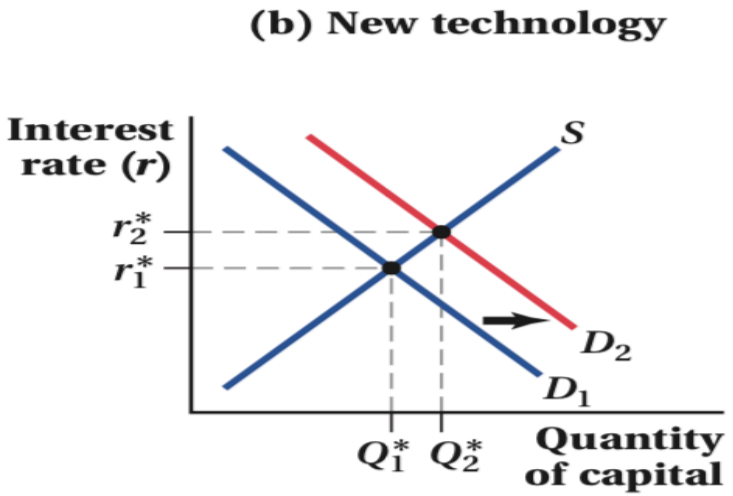
What happens to the market of capital when new technology is introduced?

- Graph the market for capital initially, and then illustrate the effects of the technological innovation.

Solution exercise 4



(a) As with all other economic markets, the capital market determines the equilibrium price and quantity of capital. Here, the equilibrium interest rate *r** and quantity of capital *Q** are at the intersection of supply *S* and demand *D* of capital.



(b) When a new technology is introduced that raises firms' expected future payoffs from an investment, the demand for capital shifts out from *D*1 to *D*2. As a result, the equilibrium interest rate rises from *r**1 to *r**2, and quantity increases from *Q*1* to *Q*2*.