10 THE FIRM'S PRODUCTION DECISIONS

LEARNING OBJECTIVES:

By the end of this chapter, students should:

➢ Revisit the meaning of competition and a competitive market

➢ Look at the conditions under which a competitive firm will shut down temporarily

➢ Examine the conditions under which a firm will choose to exit a market

➢ See why sunk costs can be ignored in production decisions

➢ Cover the difference between normal and abnormal profit and how making normal or zero profit still means it is worth continuing in production

➢ See how the supply curve for a competitive firm is derived in the short run and the long run

➢ Cover the difference in the equilibrium position of a competitive firm in the short run and the long run.

After reading this chapter students should be able to:

➢ State the assumptions of the model of a highly competitive firm

➢ Calculate and draw cost and revenue curves and show the profit-maximizing output

➢ Show, using diagrams and basic maths, the conditions under which a firm will shut down temporarily and exit the market in the long run

➢ Explain the difference between normal and abnormal profit

➢ Explain why a firm will continue in production even if it makes zero profit

➢ Use diagrams to explain the short- and long-run equilibrium position for a firm in a highly competitive market.

CONTEXT AND PURPOSE:

Chapter 10 is the third of six chapters in part four of the textbook looks microeconomics and the

economics of firms in markets.

Chapter 10 looks in particular at business production decisions especially for competitive firms over the short-run and long-run period. It demonstrates the theory of how competitive firms respond to changes in market conditions such as a shift in the demand curve.

The purpose of Chapter 10 is to examine the behaviour of competitive firms—firms that do not have market power. The cost curves developed in the previous chapter shed light on the decisions that lie behind the supply curve in a competitive market.

KEY POINTS:

0. Because a competitive firm is a price taker, its revenue is proportional to the amount of output it produces. The price of the good equals both the firm's average revenue and its marginal revenue.

1. To maximize profit, a firm chooses a quantity of output such that marginal revenue equals marginal cost. Because marginal revenue for a competitive firm equals the market price, the firm chooses quantity so that price equals marginal cost. Thus, the firm's marginal cost curve is its supply curve.

2. In the short run when a firm cannot recover its fixed costs, the firm will choose to shut down temporarily if the price of the good is less than average variable cost. In the long run when the firm can recover both fixed and variable costs, it will choose to exit if the price is less than average total cost.

3. In a market with free entry and exit, profits are driven to zero in the long run. In this long-run equilibrium, all firms produce at the efficient scale, price equals minimum average total cost, and the number of firms adjusts to satisfy the quantity demanded at this price.

4. Changes in demand have different effects over different time horizons. In the short run, an increase in demand raises prices and leads to profits, and a decrease in demand lowers prices and leads to losses. But if firms can freely enter and exit the market, then in the long run the number of firms adjusts to drive the market back to the zero-profit equilibrium.

CHAPTER OUTLINE:

I.   Introduction

        A.   Competitive Markets – A Refresher

> Pitfall... Remember that students may have difficulty understanding what a competitive market is. The use of the word "competition" in economics is very different to that in sports. This will lead students to often forget that these firms are generally unconcerned with the actions of their rivals.

                1.   We can summarize the meaning of competition in the following way:

      a. Where more than one firm offers the same or a similar product there is competition.

      b. Competition can also manifest itself where substitutes exist: for example, gas and electricity are separate markets but there is the opportunity for consumers to substitute gas cookers for electric ones and so some element of competition exists.

      c. The closer the degree of substitutability the greater will be the competition that exists.

      d. Firms may influence the level of competition through the way they build relationships with consumers, encourage purchasing habits, provide levels of customer service and after sales service and so on.

2. There are three characteristics of a competitive market (sometimes called a perfectly competitive market).

      a. There are many buyers and sellers.

      b. The goods offered by the sellers are largely the same.

      c. Firms can freely enter or exit the market.

      d. There is a high degree of information available to buyers and sellers in the market.

Tip... To help students understand price-taking behaviour, use the example of company shares. Have your students assume that they inherited 1,000 shares in a company well known in your area. Point out that these 1,000 shares may seem like a lot, but it is a very small proportion of the total number of shares outstanding. If the student wanted to know the value of a share, it could be obtained from a stockbroker. At this market-determined price, the student could sell as few or as many shares as he wishes. At a price above this, no one would be willing to buy any. There is also no reason to charge a price below the current market price, because the student can sell any number of shares that he wishes at the current price.

Pitfall... The graphs in this chapter often confuse students because they contain many different curves at the same time. Thus, the first time you draw the profit-maximizing decision of the firm, use only the marginal cost curve and the marginal revenue line. Then, after students feel comfortable with this, add average total cost (to teach students how to measure profit or loss). Last, add average variable cost to teach students about the short-run shutdown decision of a firm earning an economic loss.

B. The Marginal-Cost Curve and the Firm's Supply Decision

1. Cost curves have special features that are important for our analysis.

| Refer to Figure 10.1 |

0. Recap on profit maximization occurs where MC=MR and in a competitive market the firm is a price taker so P is horizontal and therefore also = AR and MR.

1. The marginal cost curve is upward sloping.

2. The average total cost curve is U-shaped.

3. The marginal cost curve crosses the average total cost curve at the minimum of average total cost.

2. To find the profit-maximizing level of output, we can follow the same rules that we discussed above.

a. If marginal revenue is greater than the marginal cost, the firm can increase its profit by increasing output.

b. If marginal cost is greater than marginal revenue, the firm can increase its profit by decreasing output.

c. At the profit-maximizing level of output, marginal revenue is equal to marginal cost.

Activity 1 — A Profitable Opportunity?

Type:	In-class assignment
Topics:	Profit maximization
Materials needed:	None
Time:	15 minutes
Class limitations:	Works in any size class

Purpose
This exercise reinforces the importance of marginal cost in decision-making. It shows average costs can be misleading.

Instructions
Tell the class, "As a recent graduate of this university you have landed a job in production management for Universal Clones, Inc. You are responsible for the entire company on weekends."

"Your costs are shown below."

Quantity	Average Total Cost
500	€200
501	€201

Your current level of production is 500 units. All 500 units have been ordered by your regular customers.

"The phone rings. It's a new customer who wants to buy 1 unit of your product. This means you would have to increase production to 501 units. Your new customer offers you €450 to produce the extra unit."

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a. Should you accept this offer?
b. What is the net change in the firm's profit?

Common Answers and Points for Discussion
Most students will answer "yes." Selling something for €450 when the average cost of production is €201 seems like good business. They are wrong.

The relevant comparison is marginal cost to marginal revenue. Marginal cost can be easily calculated as the change in total costs.

Quantity	Average Total Cost	Total Cost = $Q \times ATC$
500	200	100,000
501	201	100,701

€100,701 − €100,000 = €701

Marginal cost in this example is €701. This is much higher than the marginal revenue of €450. The offer should not be accepted. It would result in a €251 loss.

Refer to Figure 10.2

3. If the price in the market were to change to P_2, the firm would set its new level of output by equating marginal revenue and marginal cost.

4. Because the firm's marginal cost curve determines how much the firm is willing to supply at any price, it is the competitive firm's supply curve.

5. A similar, but reversed, situation would occur if the price fell for some reason.

Refer to Figure 10.3

C. The Firm's Short-Run Decision to Shut Down

1. In some circumstances, a firm will decide to shut down and produce zero output.

2. There is a difference between a temporary shutdown of a firm and an exit from the market.

a. A shutdown refers to the short-run decision not to produce anything during a specified period of time because of current market conditions.

  b. Exit refers to a long-run decision to leave the market.

  c. One important difference is that, when a firm shuts down temporarily, it still must pay fixed costs.

3. If a firm shuts down, it will earn no revenue and will have only fixed costs (no variable costs).

4. Therefore, a firm will shut down if the revenue that it would get from producing is less than its variable costs of production:

Shut down if $TR < VC$.

5. Since $TR = P \times Q$ and $VC = AVC \times Q$, we can rewrite this condition as:

Shut down if $P < AVC$.

6. We now can tell exactly what the firm will do to maximize profit (or minimize loss).

  a. If the price is less than average variable cost, the firm will produce no output.

  b. If the price is above average variable cost, the firm will produce the level of output where marginal revenue (price) is equal to marginal cost.

If:	The Firm Will:
$P \geq AVC$	Produce output level where $MR = MC$
$P < AVC$	Shut down and produce zero output

? What if... the price the firm received was equal to AVC in the long run – would the firm still be able to continue in production indefinitely?

5. Therefore, the competitive firm's short-run supply curve is the portion of its marginal revenue curve that lies above average variable cost.

Refer to Figure 10.4

6. Spilt Milk and Sunk Costs

  a. Definition of **sunk cost: a cost that has been committed and cannot be recovered**.

  b. Once a cost is sunk, it is no longer an opportunity cost.

  c. Because nothing can be done about sunk costs, you should ignore them when making decisions.

D. The Firm's Long-Run Decision to Exit or Enter a Market

1. If a firm exits the market, it will earn no revenue, but it will have no costs as well.

2. Therefore, a firm will exit if the revenue that it would earn from producing is less than its total costs:

Exit if $TR < TC$.

3. Since $TR = P \times Q$ and $TC = ATC \times Q$, we can rewrite this condition as:

Exit if $P < ATC$.

4. A firm will enter an industry when there is profit potential, so this must mean that a firm will enter if revenues will exceed costs:

Enter if $P > ATC$.

> **Refer to Figure 10.5**

5. Because, in the long run, a firm will remain in a market only if $P \geq ATC$, the firm's long-run supply curve will be its marginal cost curve above ATC.

If:	The Firm Will:
$P > ATC$	Enter because economic profits are earned
$P = ATC$	Not enter or exit because economic profits are zero
$P < ATC$	Exit because economic losses are incurred

E. *Case Study: Production Shutdowns*

1. By shutting down temporarily, Potash Corp will not have to pay the variable costs of operating machinery and mining potash given that sluggish demand for potash means prices may be lower than the variable costs of production.

F. Measuring Profit in Our Graph for the Competitive Firm

1. Recall that Profit = $TR - TC$.

2. Because $TR = P \times Q$ and $TC = ATC \times Q$, we can rewrite this equation:

Profit = $(P - ATC) \times Q$.

3. Using this equation, we can measure the amount of profit (or loss) at the firm's profit-maximizing level of output (or loss-minimizing level of output).

Pitfall... Students frequently want to use the point of minimum average total cost when finding profit on the graph. Remind them to always find the average total cost of the profit-maximizing level of output.

> **Tip...** Keep reminding students that economic profits and losses are different from accounting profits and losses. Point out that economic cost includes the cost of all resources including a "normal return or profit" to compensate the firm's owner for the risks and other efforts put into the business.

II.   The Supply Curve in a Competitive Market

    A.   The Short Run: Market Supply with a Fixed Number of Firms

        1.   Example: a market with 1,000 identical firms.

        2.   Each firm's short-run supply curve is its marginal cost curve above average variable cost.

        3.   To get the market supply curve, we add the quantity supplied by each firm in the market at every given price.

    B.   The Long Run: Market Supply with Entry and Exit

        1.   If firms in an industry are earning profit, this will attract new firms.

            a.   The supply of the product will increase (the supply curve will shift to the right).

            b.   The price of the product will fall and profit will decline.

> **Pitfall Prevention...** When talking about zero economic profit, it is important to remember the distinction between economic profit and accounting profit introduced in Chapter 9. When an economist talks of zero profit they are referring to economic profit.

        2.   If firms in an industry are incurring losses, firms will exit.

            a.   The supply of the product will decrease (the supply curve will shift to the left).

            b.   The price of the product will rise and losses will decline.

        3.   At the end of this process of entry or exit, firms that remain in the market must be making zero economic profit.

4.   Because Profit = *TR* – *TC*, profit will only be zero when:

$$TR = TC.$$

5.   Because *TR* = *P* x *Q* and *TC* = *ATC* x *Q*, we can rewrite this as:

$$P = ATC.$$

6.   Therefore, the process of entry or exit ends only when price and average total cost become equal.

7.   This implies that the long-run equilibrium of a competitive market must have firms operating at their efficient scale.

C.   Why Do Competitive Firms Stay in Business If They Make Zero Profit?

1.   Profit is equal to total revenue minus total cost.

2.   To an economist, total cost includes all of the opportunity costs of the firm.

3.   When a firm is earning zero profit, this must mean that the firm's revenues are compensating the firm's owners for the time and money that they have expended to keep their businesses going.

4.   Definition of **normal profit: the minimum amount required to keep factors of production in their current use.**

5.   Definition of **abnormal profit: the profit over and above normal profit.**

? What if... a firm earned profit which was only 1 per cent less than zero profit? Would it still be worthwhile continuing in production?

D.   A Shift in Demand in the Short Run and Long Run

1.   Assume that the market begins in long-run equilibrium. This means that firms are earning zero profit and price equals the minimum of average total cost.

2.   If the demand for the product increases, this will lead to an increase in the price of the good.

3.   Firms will respond to the increase in price by producing more in the short run.

4.   Because price is now greater than average total cost, firms are earning profit.

> *Refer to Figure 10.9*

5.   The profit will attract new firms into the industry, shifting the supply curve to the right.

6.   This will lower price until it falls back to the minimum of average total cost and firms are once again earning zero economic profit.

JEOPARDY PROBLEM... When the Channel Tunnel was built between the United Kingdom and France, the cost of production rose dramatically but not surprisingly given the technical challenges of such an engineering project. Once opened it soon became clear that the firm which operated the tunnel, Eurotunnel, would never break even. Why might this situation have arisen and why is the tunnel still operational despite being loss making?

E.   Why the Long-Run Supply Curve Might Slope Upward

1.   Because we assumed that all potential entrants faced the same costs as existing firms, average total cost of each firm was unaffected by the entry of new firms into the industry.

2.   In this situation, the long-run supply of the industry will be a horizontal line at minimum average total cost.

3.   However, there are two possible reasons why this may not be the case.

    a.   If a resource is limited in quantity, entry of firms will increase the price of this resource, raising the average total cost of production.

    b.   If firms have different costs, then it is likely that those with the lowest costs will enter the industry first. If the demand for the product then increases, the firms that would enter will likely have higher costs than those firms already in the market.

4.   In this situation, the long-run supply curve of the industry will be upward sloping.

Tip...No matter what the shape of the long-run supply curve, an increase in demand will always lead to a rise in the price in the short run and a decrease in demand will always lead to a drop in price in the short run. Long-run supply curves will always be more elastic than short-run supply curves.

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5.   In either case, the long-run supply curve of an industry is generally more elastic than the short-run supply curve of the industry (due to the fact that firms can enter or exit in the long run).

SOLUTIONS TO TEXT PROBLEMS:

Quick Quizzes

1. The price faced by a profit-maximizing firm is equal to its marginal cost because if price were above marginal cost, the firm could increase profits by increasing output, while if price were below marginal cost, the firm could increase profits by decreasing output.

    A profit-maximizing firm decides to shut down in the short run when price is less than average variable cost. In the long run, a firm will exit a market when price is less than average total cost.

2. In the long run, with free entry and exit, the price in the market is equal to both a firm's marginal cost and its average total cost, as Figure 1 shows. The firm chooses its quantity so that marginal cost equals price; doing so ensures that the firm is maximizing its profit. In the long run, entry into and exit from the industry drive the price of the good to the minimum point on the average total cost curve.
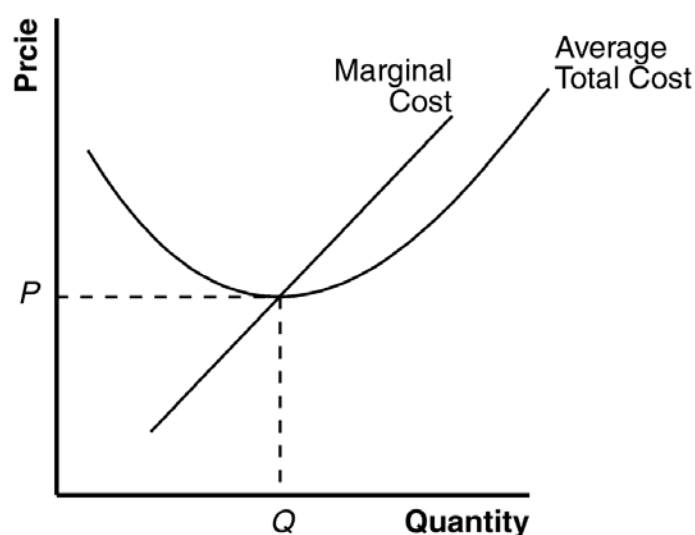

Figure 1

Questions for Review

1. A competitive firm is a firm in a market in which: (1) there are many buyers and many sellers in the market; (2) the goods offered by the various sellers are largely the same; and (3) firms can freely enter or exit the market.

2. Figure 2 shows the cost curves for a typical firm. For a given price (such as P^*), the level of output that maximizes profit is the output where marginal cost equals price (Q^*), as long as price is greater than average variable cost at that point (in the short run), or greater than average total cost (in the long run).
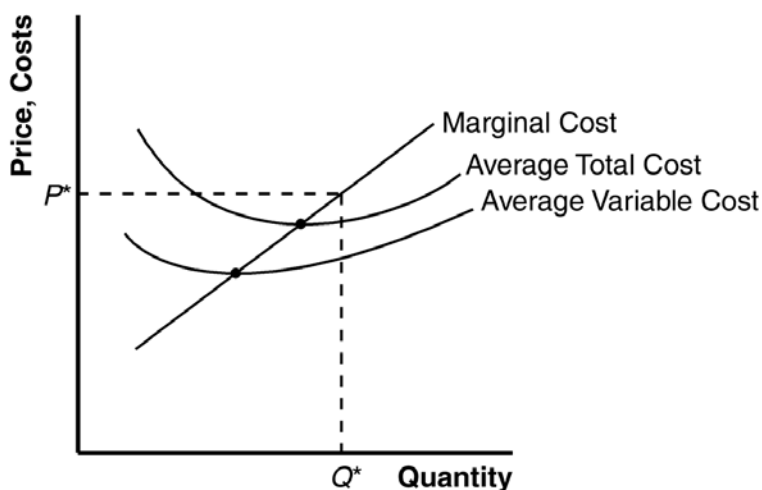
Figure 2

3.   A firm will shut down temporarily if the revenue it would get from producing is less than the variable costs of production. This occurs if price is less than average variable cost.

4.   A firm will exit a market if the revenue it would get if it stayed in business is less than its total cost. This occurs if price is less than average total cost.

5.   A firm will enter a market if existing firms in the market are earning abnormal profits. The entry of new firms will increase supply which will drive down prices. Firms

6.   A competitive firm's price equals marginal cost in both the short run and the long run. In both the short run and the long run, price equals marginal revenue. The firm should increase output as long as marginal revenue exceeds marginal cost, and reduce output if marginal revenue is less than marginal cost. Profits are maximized when marginal revenue equals marginal cost.

7.   The firm's price equals the minimum of average total cost only in the long run. In the short run, price may be greater than average total cost, in which case the firm is making profits, or price may be less than average total cost, in which case the firm is making losses. But the situation is different in the long run. If firms are making profits, other firms will enter the industry, which will lower the price of the good. If firms are making losses, they will exit the industry, which will raise the price of the good. Entry or exit continues until firms are making neither profits nor losses. At that point, price equals average total cost.

8.   A firm will continue production even if it makes zero profit (often referred to as normal profit). Zero profit includes an implicit amount for the opportunity costs which would be made up of the alternative interest that could be earned plus another job the entrepreneur had given up to set up the firm.

9.   In a highly competitive market, there are no real barriers to entry. In the long-run, potential competitors will notice the abnormal profits being made and enter the market. A shift in the supply curve outwards means a reduction in prices and since all firms are price takers, the abnormal profit diminishes until normal profits are earned again.

10.   Market supply curves are typically more elastic in the long run than in the short run. In a competitive market, since entry or exit occurs until price equals the minimum of average total

cost, the supply curve is perfectly elastic in the long run.

Problems and Applications

1.   A competitive market is one in which: (1) there are many buyers and many sellers in the market; (2) the goods offered by the various sellers are largely the same; and (3) usually firms can freely enter or exit the market. Of these goods, bottled water is probably the closest to a competitive market. Tap water is a natural monopoly because there's only one seller. Cola and beer are not perfectly competitive because every brand is slightly different.

2.   Since a new customer is offering to pay €300 for one dose, marginal revenue between 200 and 201 doses is €300. So we must find out if marginal cost is greater than or less than €300. To do this, calculate total cost for 200 doses and 201 doses, and calculate the increase in total cost. Multiplying quantity by average total cost, we find that total cost rises from €40,000 to €40,401, so marginal cost is €401. So your flatmate should not make the additional dose.

3.   Once you have ordered the dinner, its cost is sunk, so it does not represent an opportunity cost. As a result, the cost of the dinner should not influence your decision about finishing the dinner.

4.   a)

Quantity	Total fixed costs (€)	Total variable costs (€)	AFC	AVC	ATC	MC
0	100	0				0
1	100	50	100	50	150	50
2	100	70	50	35	85	20
3	100	90	33	30	63	20
4	100	140	25	35	60	50
5	100	200	20	40	60	60
6	100	360	17	60	77	160

b) At a price of €50 the business would make a loss at each level of output. The lowest loss of €40 would be made at an output of 3 or 4. However the firm cannot recover its fixed costs in the short-run if it temporarily shut down, so the firm can ignore these costs in the short-run. It would only be worth shutting down in the short-term only if the price it received was less than the variable cost. Therefore it would not pay to shutdown as long as output remained below 6.

c) This is not a good decision. The MR and MC is both at €50 at an output of 1 and 4 units. If only one unit was produced and sold the loss would be €50, but if 4 units were sold the loss would drop to €20 simply because the MC was lower between these outputs.

5.   Figure 3 shows that although high prices cause an industry to expand, entry into the industry eventually returns prices to the point of minimum average total cost. In the figure, the industry is originally in long-run equilibrium. The industry produces output Q_1, where supply curve S_1 intersects demand curve D_1, and the price is P_1. At this point the typical firm produces output q_1. Since price equals average total cost at that point, the firm makes zero economic profit.

Now suppose an increase in demand occurs, with the demand curve shifting to D_2. This causes "high prices" in the industry, as the price rises to P_2. It also causes the industry to increase

output to Q_2. With the higher price, the typical firm increases its output from q_1 to q_2, and now makes positive profits, since price exceeds average total cost.

However, the positive profits that firms earn encourage other firms to enter the industry. Their entry, "an expansion in an industry," leads the supply curve to shift to S_3. The new equilibrium reduces the price back to P_1, "bringing an end to high prices and manufacturers' prosperity," since now firms produce q_1 and earn zero profit again. The only long-lasting effect is that industry output is Q_3, a higher level than originally.
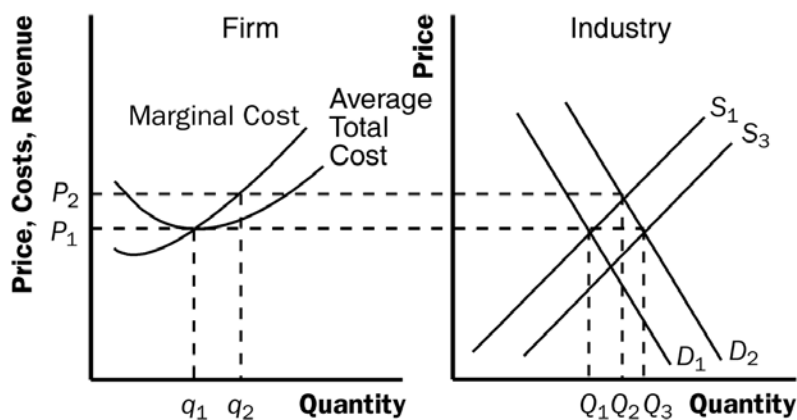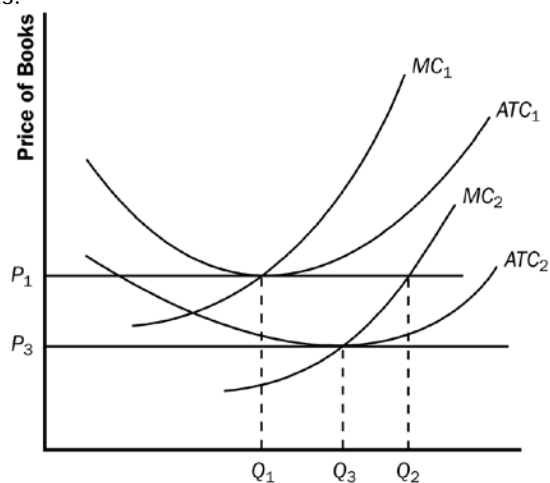

Figure 3

6. a. Figure 4 shows the typical firm in the industry, with average total cost ATC_1, marginal cost MC_1, and price P_1.

   b. The new process reduces Hi-Tech's marginal cost to MC_2 and its average total cost to ATC_2, but the price remains at P_1 since other firms cannot use the new process. Thus Hi-Tech earns positive profits.

   c. When the patent expires and other firms are free to use the technology, all firms' average-total-cost curves decline to ATC_2, so the market price falls to P_3 and firms earn no profits.

Figure 4

7. The rise in the price of oil increases production costs for individual firms and thus shifts the industry supply curve up, as shown in Figure 5. The typical firm's initial marginal cost curve is MC_1 and its average total cost curve is ATC_1. In the initial equilibrium, the industry supply curve, S_1, intersects the demand curve at price P_1, which is equal to the minimum average total cost of the typical firm. Thus the typical firm earns no economic profit.

The increase in the price of oil shifts the typical firm's cost curves up to MC_2 and ATC_2, and shifts the industry supply curve up to S_2. The equilibrium price rises from P_1 to P_2, but the price does not increase by as much as the increase in marginal cost for the firm. As a result, price is less than average total cost for the firm, so profits are negative.

In the long run, the negative profits lead some firms to exit the industry. As they do so, the industry-supply curve shifts to the left. This continues until the price rises to equal the minimum point on the firm's average-total-cost curve. The long-run equilibrium occurs with supply curve S_3, equilibrium price P_3, industry output Q_3, and firm's output q_3. Thus, in the long run, profits are zero again and there are fewer firms in the industry.
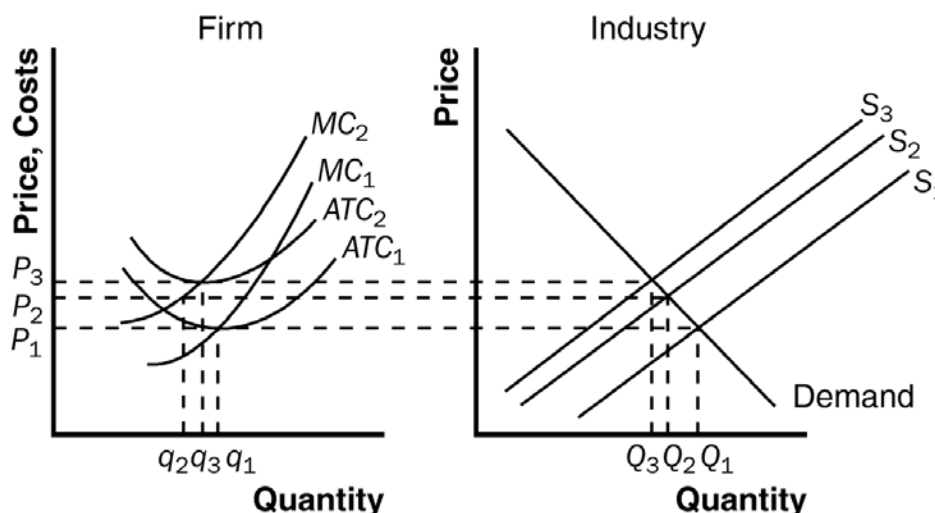

Figure 5

8. a. Figure 6 illustrates the situation in the EU textile industry. With no international trade, the market is in long-run equilibrium. Supply intersects demand at quantity Q_1 and price €30, with a typical firm producing output q_1.
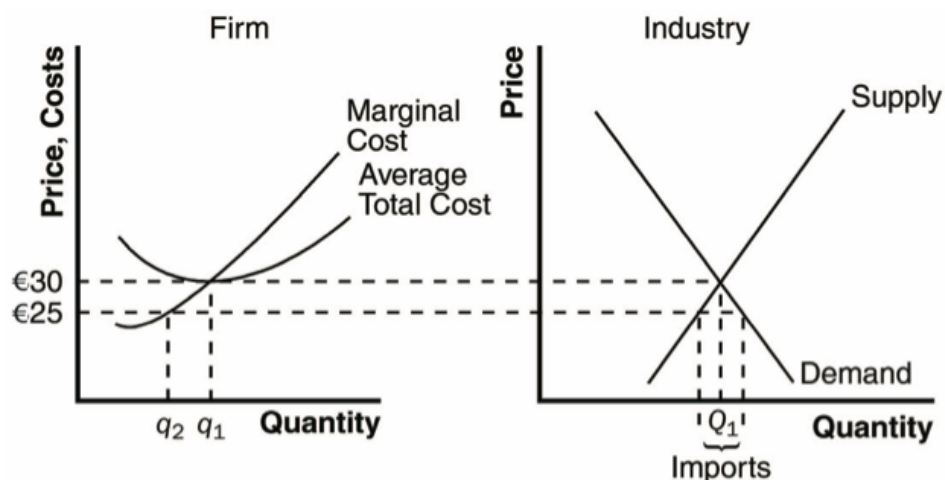
Figure 6

b. The effect of imports at €25 is that the market supply curve follows the old supply curve up to a price of €25, then becomes horizontal at that price. As a result, demand exceeds domestic supply, so the country imports textiles from other countries. The typical domestic firm now reduces its output from q_1 to q_2, incurring losses, since the large fixed costs imply that average total cost will be much higher than the price.

c. In the long run, domestic firms will be unable to compete with foreign firms because their costs are too high. All the domestic firms will exit the industry and other countries will supply enough to satisfy the entire domestic demand.

9. a. Figure 7 illustrates the gold market (industry) and a representative gold mine (firm). The demand curve, D_1, intersects the supply curve at industry quantity Q_1 and price P_1. Since the industry is in long-run equilibrium, the price equals the minimum point on the representative firm's average total cost curve, so the firm produces output q_1 and makes zero profit.

b. The increase in jewellery demand leads to an increase in the demand for gold, shifting the demand curve to D_2. In the short run, the price rises to P_2, industry output rises to Q_2, and the representative firm's output rises to q_2. Since price now exceeds average total cost, the representative firm now earns positive profits.

c. Since gold mines are earning positive economic profits, over time other firms will enter the industry. This will shift the supply curve to the right, reducing the price below P_2. But it's unlikely that the price will fall all the way back to P_1, since gold is in short supply. Costs for new firms are likely to be higher than for older firms, since they'll have to discover new gold sources. So it's likely that the long-run supply curve in the gold industry is upward sloping. That means the long-run equilibrium price will be higher than it was initially.
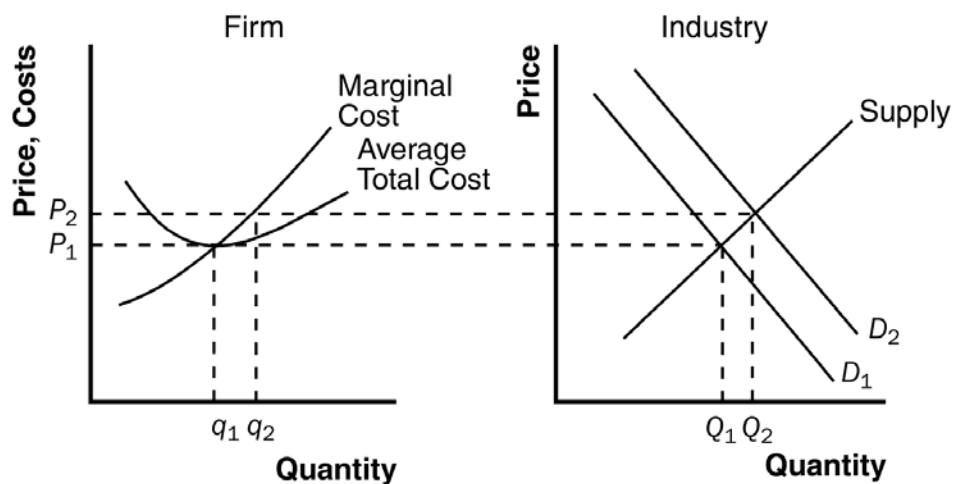
Figure 7

10.   a.   Remembering that, in a competitive market, price equals marginal cost when firms are maximizing profit, we know the marginal cost must be €0.30, since that is the price.

         b.   The industry is not in long-run equilibrium since price exceeds average total cost.