18 We will now plot the average cost curve on another graph with the number of bears produced along the horizontal axis and cost ($) on the vertical axis. You will need your cost axis to go up to at least $12. When you have done this write down what you notice about the slope of the curve; that is, what happens to the average costs of production as more and more bears are produced? Can you suggest reasons for this? (Hint: Even if no bears or 1,000 bears are produced, what costs does Sue have to pay?)

Well done! By completing the activity about Bear Necessities you have learnt all about costs and revenues associated with production in a firm, how to calculate them and what they mean for profit. The rest of this unit will now help you to understand these important business and economic concepts fully, and to apply your knowledge to other examples.

Just like the Bear Necessities toy-making firm in Activity 3.25, most private sector firms aim to make as much profit as possible. Profit is calculated as the difference between what it costs a firm to produce its goods or services and the revenue it earns from their sale. That is:

profit = total revenue – total cost

To maximize profit a firm will aim to raise as much revenue as it can, for example by using advertising to boost demand and pricing strategies to attract consumers from rival firms, and it will also aim to minimize costs. Controlling costs is also very important in non-profit making organizations such as charities. However, to control costs a firm must be able to identify and measure the costs of all the factors of production it employs and uses up in production. These are the cost of wages for labour, payments for capital goods, components and materials, and the costs of many other goods and services supplied by other producers, including banking and insurance services, telecommunications, energy, legal services, transportation and much more.

Fixed costs

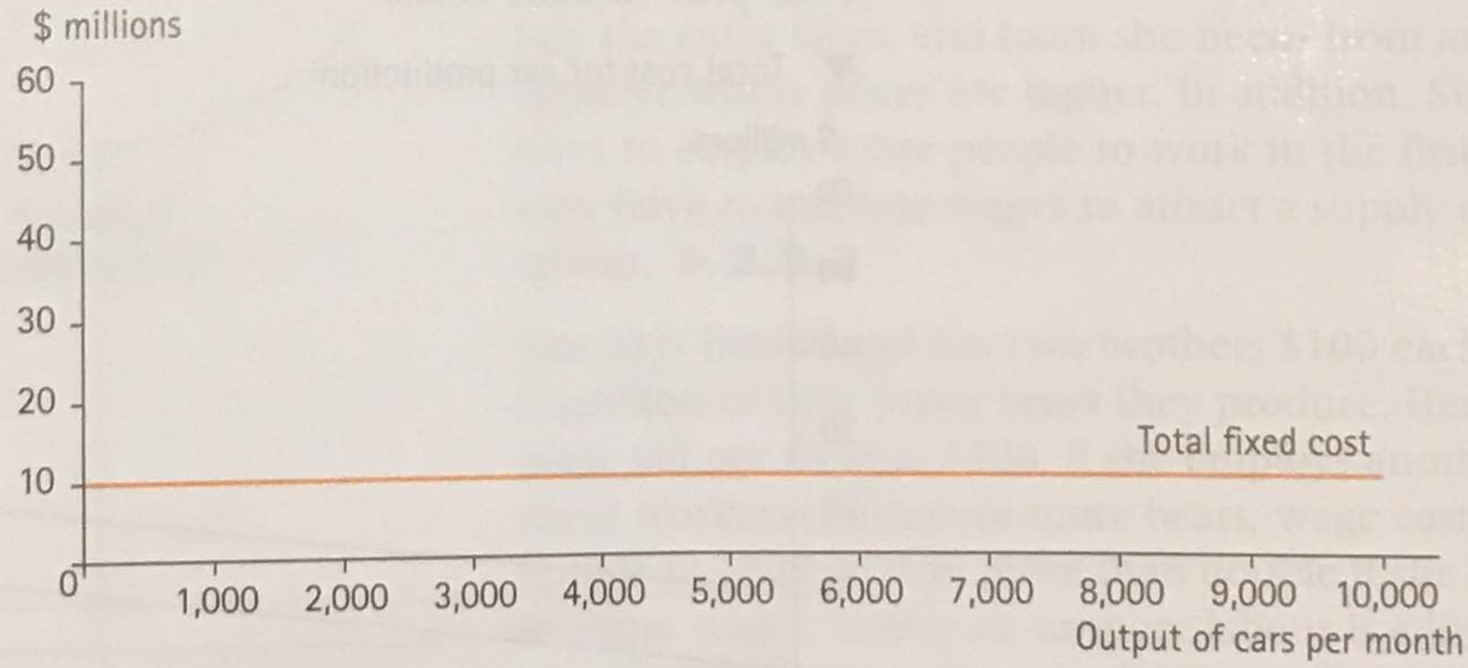
Before a firm can begin production and make goods and services for sale it will need to buy or hire many items. It may need premises, vehicles, computers and other equipment, stationery and it may need to undertake market research. These are start-up costs. Starting a business or developing a new product can be expensive and there will be no revenue to cover these start-up costs until production begins and products are sold.

Fixed costs, such as mortgage payments or rents for premises, interest charges on bank loans, leasing charges for machinery, telephone bills, cleaning costs and insurance premiums, will continue to be paid once production has started, no matter how much a firm produces and sells. That is, fixed costs do not vary with the level of output.

We can plot the total of fixed costs for a firm on a graph just like the one you drew for Bear Necessities in Activity 3.25. You will have noticed from your graph that the total fixed cost curve is flat because fixed costs do not vary with the level of output. However, this is only true up to the point at which a firm is operating at full capacity. This is because when a firm has no more space or equipment to raise output further it will need to hire or buy more equipment and possibly invest in larger premises to expand its scale of production.

The graph below plots total fixed costs for an imaginary firm producing motor vehicles. It is a large manufacturing organization that can produce up to 10,000 cars each month and has fixed costs of $10 million each month whether it produces 10,000 cars or not. If it wants to increase its scale of production up to, say, 20,000 cars each month it will need to hire or buy a new, bigger factory and more equipment.

▼ Total fixed costs for car production

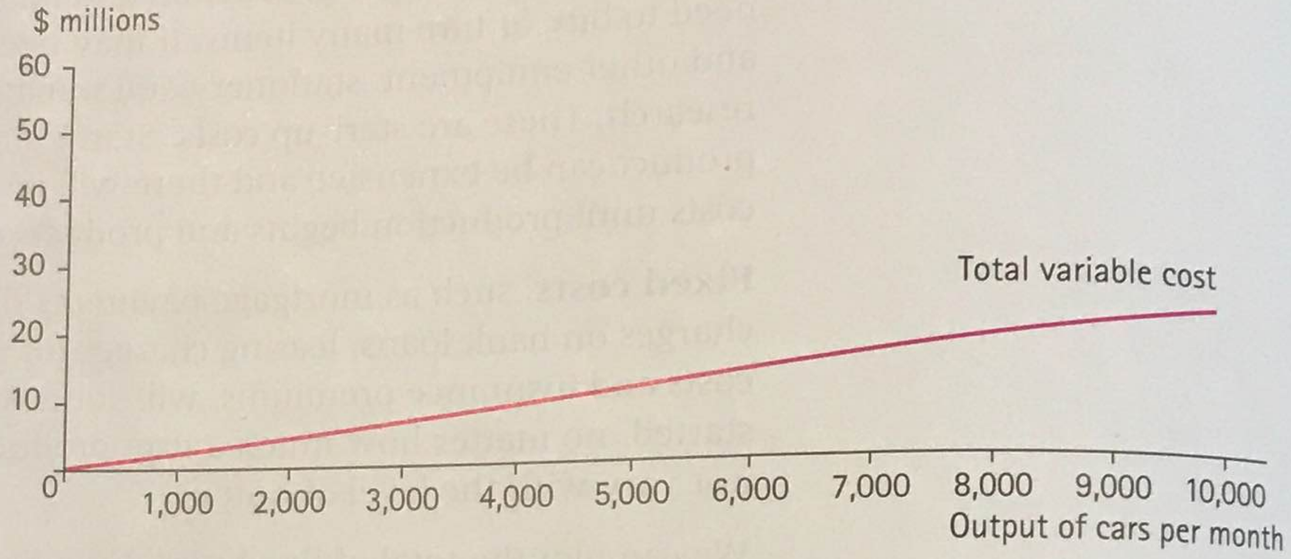


Variable costs

To increase output a firm will need more materials or component parts. Similarly, more electricity may be needed to power machines and computers, and to heat and light premises, over longer periods of time. The firm may also need to employ more workers or pay its existing workers overtime to work more hours.

If we plot the total variable costs for a firm on a graph the variable cost curve will slope upwards. This is because **variable costs** vary directly with the level of output. For example, our car manufacturing firm can produce up to 10,000 cars per month with its existing factory and equipment. The total cost of materials and other variable items per car is $2,000. So, if the variable cost of producing one car is $2,000, then the total variable cost of producing 10,000 cars will be $20 million.

▼ Total variable costs for car production



In general, therefore, the total variable cost of a given level of output is calculated as follows.

Total variable cost = variable cost per unit × quantity produced

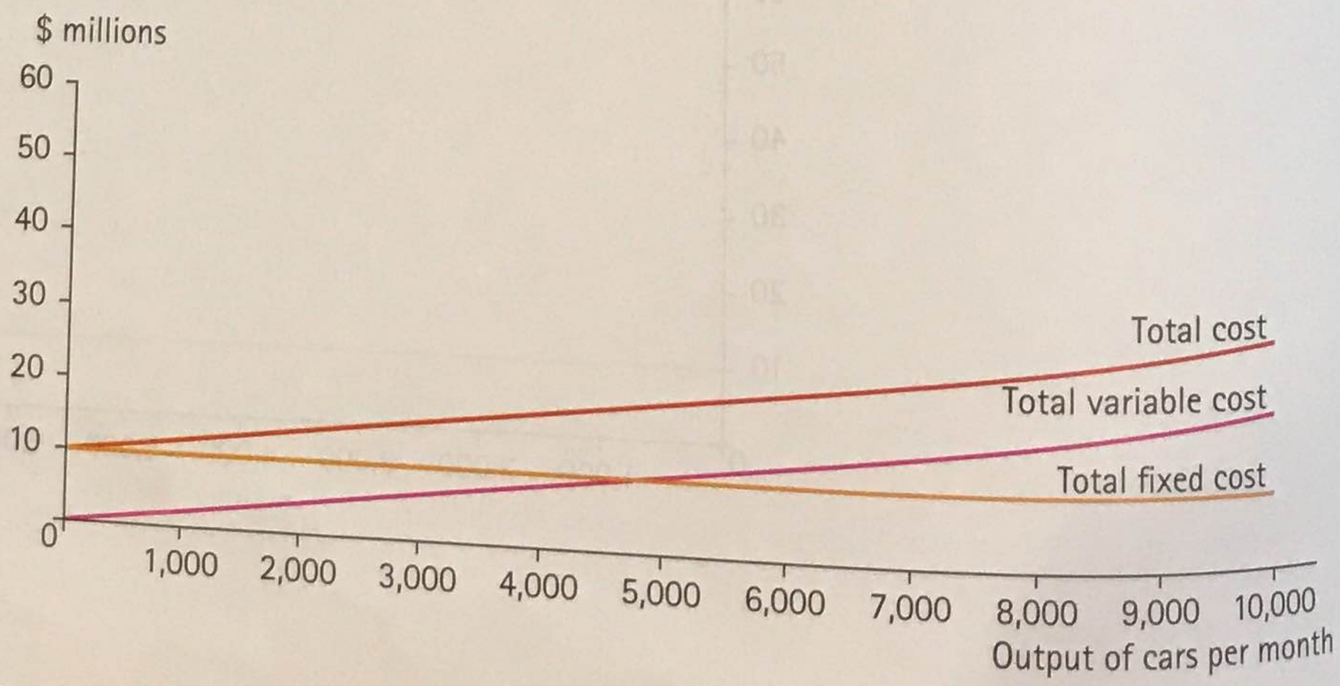
If we add together all the fixed and variable costs of production of a firm we can calculate the total cost of producing each level of output.

Total cost = total fixed cost + total variable cost

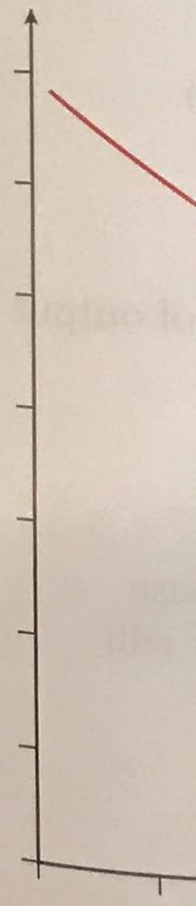
If a firm produces no goods or services its total costs will be equal to its total fixed costs. Adding total variable costs to fixed costs means total costs will also increase as output rises, so the total cost curve will be upward sloping.

In our car firm the total cost of producing no cars will therefore be the fixed costs it will have to continue paying for at $10 million per month, while the total cost of producing 10,000 cars each month will be $30 million of fixed costs plus variable costs.

▼ Total cost for car production



▼ Average co



Average costs

If the total cost of producing 10,000 cars each month is $30 million, then the **average cost** of producing each car, or cost per unit of output, is $3,000. We can calculate the average cost per unit of output using the following equation:

$$\textbf{Average cost per unit} = \frac{\textbf{total cost}}{\textbf{total output}}$$

To make a profit the car company must therefore sell each car for more than $3,000 to make enough revenue to cover its costs and leave a surplus. But the car company must be careful not to charge too high a price for each car, otherwise consumers may not buy them, especially if demand for cars is highly price elastic. ➤ 2.7.2

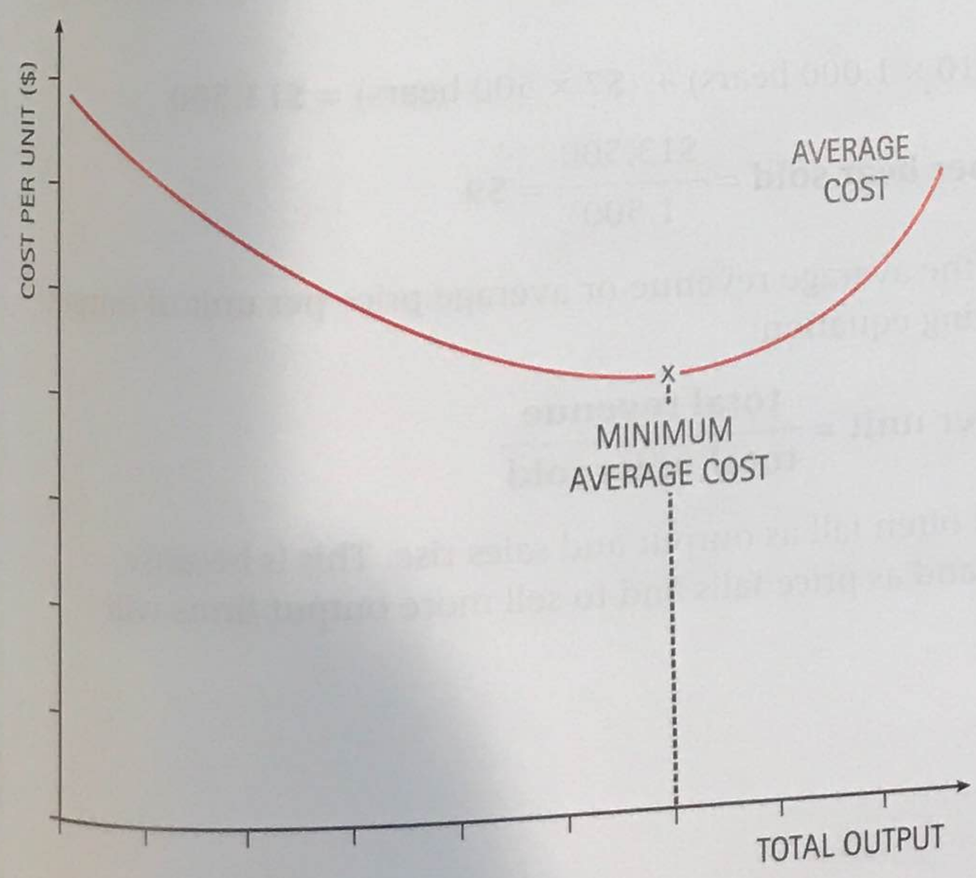
A firm can calculate the average cost per unit of providing a service in exactly the same way. For example, the average cost of one hour of labour from a car mechanic, the average cost of one mile of journey on a train, or the average cost of treating one patient at a hospital. All a firm needs to know are the fixed and variable costs of providing its service. So, if it costs a passenger rail company a total of $20,000 each day to run a train service over 1,000 kilometres then the average cost per kilometre travelled is $20.

From Activity 3.25 you will have discovered how the average cost of producing a toy bear fell as the number of bears produced by Bear Necessities increased.

At a production rate of 400 bears per week each bear cost $8.50 to produce. The unit cost per bear fell to $8.20 as output was raised to 1,000 bears each week. Similarly, if our car firm produces only 500 cars each month the average cost would be a massive $22,000 per car, which is unlikely to be a profitable level of production.

In general, therefore, the average cost of each unit of a good or service will tend to fall with the volume produced, simply because fixed costs remain the same but their burden is spread over a much larger output. However, after a point, average costs may start to rise again because it can become more difficult and expensive to increase output further.

▼ Average cost curve



For example, imagine the Bear Necessities business in Activity 3.25 attempts to increase output to 1,100 bears each week. However, the producer supplying synthetic fur fabric and foam to Bear Necessities is unable to increase the amount it supplies. The owner of Bear Necessities, Sue Brennan, may then have to buy the extra fabric and foam she needs from another supplier where prices are higher. In addition, Sue may have to employ more people to work in the firm and may have to increase wages to attract a supply of labour. ➤ 3.3.2

Sue pays herself and her two brothers $100 each week regardless of how many bears they produce. Her total wage bill per week is $300. If she employs another three workers to produce more bears, wage costs will double to $600 or may more than double if she has to increase wages. However, as more labour is added, output will rise but may only do so at a diminishing

rate as the average productivity of labour falls. So, while wage costs double, th output of bears may not double. Therefore, the average cost of producing each bear will begin to increase.

If we plot the average cost of production on a graph it will appear as a U-shaped curve for many firms, showing that as output rises, average costs fall up to a point and may then begin to increase slowly as output is raised yet further.

Similarly, our car manufacturer may find that there is a shortage of the skilled manufacturing workers it needs to increase output from, say, 8,000 cars per month up to full capacity of 10,000 cars per month. It may have to hire unskilled workers and spend more money training them, or it will have to increase wages to attract skilled workers away from other manufacturing firms. It too will find, therefore, that its average cost curve is U-shaped, with the average cost of producing each car falling at first but then rising after output increases beyond 8,000 cars per month.

SECTION 3.7.3–4

Definition and calculation of revenue

What is revenue?

Firms earn revenue from the sale of their goods and services to consumers. **Total revenue** is therefore the total amount sold multiplied by the price per unit sold.

Total revenue = price per unit × quantity sold

Revenue from sales is also known as **turnover**.

What happens if a firm sells its goods or services to different consumers at different prices? For example, in Activity 3.25 Bear Necessities charged a price of $10 per bear. Now imagine that the firm wants to expand into overseas markets, but to do so the bears will have to be sold at a lower price than $10 each in order to attract overseas consumers to buy them. For example, if the firm sells 1,000 bears at $10 each and another 500 overseas at $7 each then total revenue will be $13,500, and the average revenue per bear sold will be $9 as follows:

Total revenue = ($10 × 1,000 bears) + ($7 × 500 bears) = $13,500

$$\textbf{Average revenue per bear sold} = \frac{\$13{,}500}{1{,}500} = \$9$$

A firm can calculate the average revenue or average price per unit of output sold using the following equation:

$$\textbf{Average revenue per unit} = \frac{\textbf{total revenue}}{\textbf{total units sold}}$$

Average revenue will often fall as output and sales rise. This is because demand tends to expand as price falls and to sell more output firms will

therefore need to lower their prices. We also know that as the market supply of a product increases so market price will tend to fall. ➤ **2.6.1**

A firm entering a new market may also price low to attract demand. This pricing strategy is known as penetration pricing. ➤ **4.4**

Profit and loss

Every firm will monitor its costs of production and revenues over time so that it is possible to calculate whether it is making a profit or a loss. Profit or loss is calculated as the difference between total revenue and total cost at each level of output. That is:

Profit (or loss) = total revenue – total cost

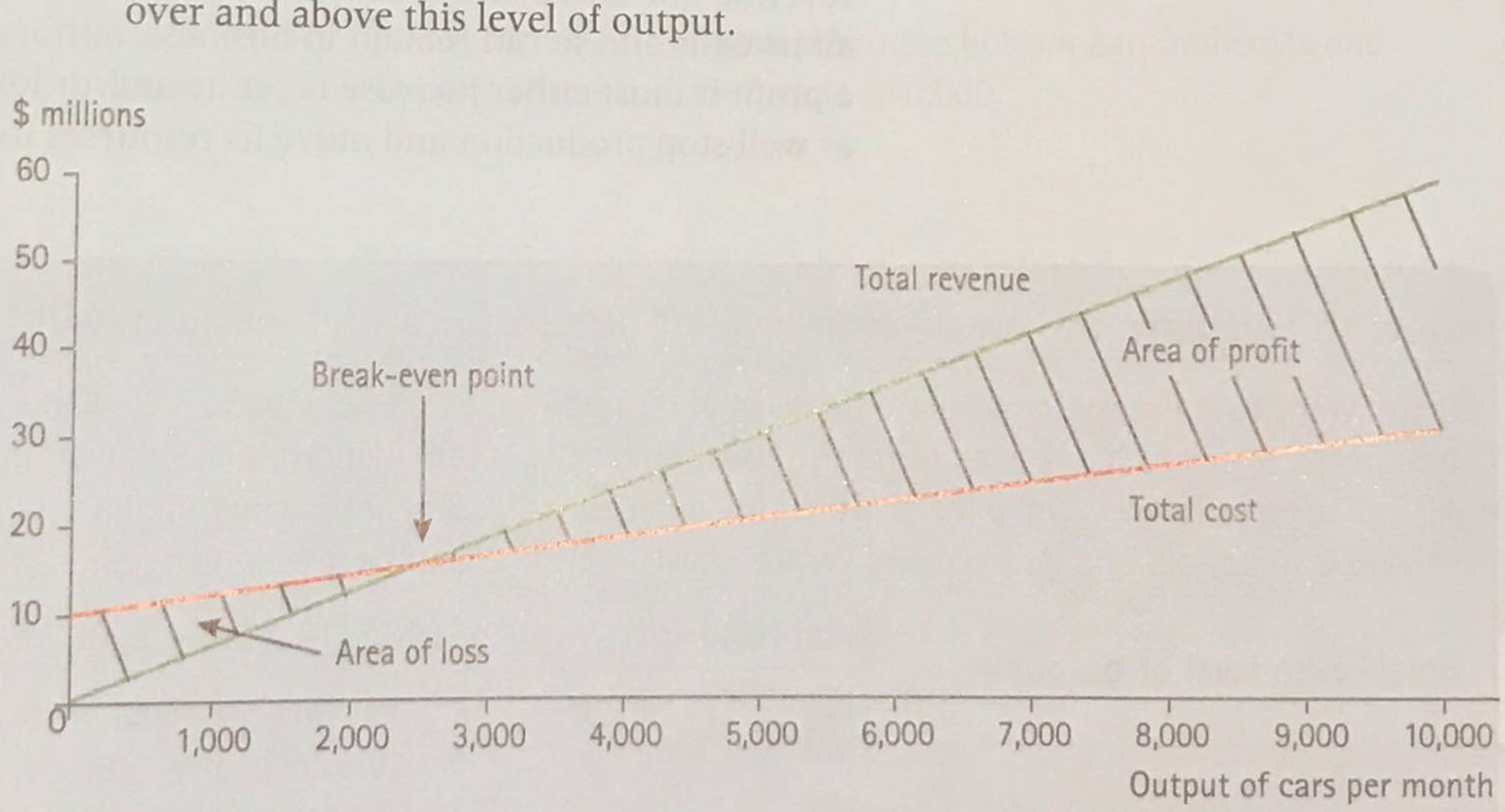
If total revenue exceeds total cost a firm will make a profit. Profit is therefore maximized when the difference between total revenue and total cost is at its greatest.

However, if total revenue does not cover total costs, a firm will make a loss. If this continues the firm will go out of business and its resources will be moved to more profitable uses.

We can identify profit and loss in a firm from a graph of its total revenues and total costs at different levels of output.

Returning to the example of the car manufacturer, let us assume each car sells for $6,000. Total revenue therefore appears as an upward sloping curve, from zero when no cars are sold to $60 million when 10,000 are sold. The car firm makes a loss on all sales up to 2,500 cars per month, and a profit on all sales over and above this level of output.

▶ Total revenue, total cost, profit and loss for car production



It is also useful to know how much profit or loss is made from every unit of output sold by calculating the difference between average revenue and average cost.

Profit (or loss) per unit = average revenue – average cost

This is particularly informative for a firm planning to expand production. We already know that average cost per unit may start to rise after a certain level of output is reached because extra wages may have to be paid to attract more workers or there may be supply problems with component parts and other materials. We also know that average revenue may start to fall after a certain level of sales is reached, as prices may need to be cut to attract additional demand or when entering new markets. It follows, therefore, that a firm may find it unprofitable to expand output too much if its average revenue falls below its average cost.

Breaking-even

The **break-even level of output** is that level of output, which if sold, will generate a total revenue that will exactly equal total cost. At the break-even level of output a firm will neither make a profit or a loss. That is, break-even occurs where:

total revenue = total cost

or where:

total revenue – total cost = 0

For example, Bear Necessities broke even when output and sales reached 100 bears per month. Sales below this level of output made a loss, while sales above it earned a profit. Similarly, the car manufacturer has a break-even level of output of 2,500 cars per month.

The break-even level of output can be found graphically where the total revenue line crosses the total cost curve. At break-even a firm is able to cover all its costs and so can remain in business, although clearly if it wants to make a profit it must either increase revenue and/or lower costs otherwise it might as well stop production and move its resources to more profitable uses.

How to calculate the break-even level of output for a firm without using a graph

If you want to it is easy to calculate the level of output a firm needs to sell to break even using the equation below. All you need to know is the price at which the good or service is to be sold and its fixed and variable costs:

$$\text{Break-even level of output} = \frac{\text{total fixed cost}}{\text{price per unit} - \text{variable cost per unit}}$$

Let's quickly calculate break-even this way for Bear Necessities and our car firm example.

From Activity 3.25 we know the fixed costs of bear production were $200 per month, variable costs were $8 per bear and the final price per bear sold was $10. So, the break-even point is:

$200/($10 – $8) = $200 / $2 = 100 bears per month.

Our car firm has fixed costs of $10 million per month, variable costs of $2,000 per car, and sells its cars for $6,000 each. So, the level of output and sales needed to break even is:

$10,000,000/($6,000 – $2,000) = $10,000,000/$4,000 = 2,500 cars per month.