



Topic 6:

Objectives of Firms; Cost and Revenue

Theme 2.2: Firms and Decisions

How to use this set of lecture notes?

1) BEFORE LECTURES – UNDERSTANDING CONTENT

- Reference your notes against your H2 syllabus. Mark out the key concepts so that you know what you **MUST** know
- Read your notes ahead so that you can focus on listening and capturing additional notes during lectures

2) During lectures – APPLYING CONTENT

- Bring your hard copy notes along, and use your PLDs to refer to the lecture slides concurrently
- Capture additional notes, especially the real-world examples where you can note down how concepts are applied and how economic analysis are developed in varying contexts
- You should make use of a notetaking/consolidation tool to take notes during lessons and to consolidate your learning at timely junctures. Examples are Miro, Notion, Goodnotes, Notability, Microsoft OneNote, KAMI, etc. The choice is yours!

3) After Lectures – TUTORIAL PREPARATION to use content flexibly to show application, analysis and evaluation skills

- Revise concepts relevant for the case study and essay questions
- Refer to the notes and use it flexibly to prepare your answers to meet question requirements. Pure memorisation will not work as it does not involve deep understanding.
- Do share your notes with your friends to multiply learning!

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[**NOTE** these 3 cost concepts: Total Cost (TC), Average Cost (AC) and Marginal Cost (MC)]

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[**NOTE** these 3 revenue concepts: Total Revenue (TR), Average Revenue (AR) and Marginal Revenue (MR)]

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- 1. What decisions do firms make?
- 2. How do firms make decisions?
- 3. What are the impacts of firm's decisions?

Introduction to Objectives of Firms; Cost and Revenue

From the **market** forces of demand and supply, the remaining Microeconomic topics examine the producer behaviour in greater depth from a **firm's** perspective. We will deepen our understanding of how a firm makes rational decisions to achieve its objective(s).

This topic will reveal the various objectives of the firm and how a firm's cost of production and revenue is affected when its production increases. You might be surprised to find out that production costs of a firm can be affected when a group of firms producing similar or related goods and services (also known as an industry) expands its scale of production. While the understanding of production costs is critical to a firm based on its traditional objective of profit-maximisation, it is important to also appreciate other firm objectives to understand their decision-making process in the real world!

A firm is an organisation or enterprise formed by an **entrepreneur** (or a group of entrepreneurs) who brings together various factors of production (**land, labour and capital**) to produce goods or services for sale. The process in which various factors of production (also known as factor input) are utilised to produce goods and services (also known as output) is the **production** itself.

As a firm increases production to a higher level of output, it will have to increase the quantity of factor inputs. This will in turn affect its costs of production.

Through Theme 2.2, we will uncover the objectives and contexts that firms operate in to better understand how they make decisions anchored on benefits and costs, in consideration of data and information, perspectives and constraints. In so doing, we will also appreciate how well they are able to achieve intended outcomes as well as how unintended outcomes could result.

1. Objectives of Firms

1.1 Profit-maximisation (Traditional)

The traditional objective of a rational firm is to maximise profit. Decisions made on the use of scarce resources would in turn affect the revenue received and the costs incurred. Recall that firms (as economic agents) make decisions at the margin, in line with the Marginalist Principle (which we will revisit later). As such, the firm then will have to weigh the change in revenue (Marginal Revenue) against the costs (Marginal Cost) incurred, when deciding whether to produce an additional unit of its good/service.

To maximise profits, the firm will produce up till the quantity where **Marginal Revenue (MR) = Marginal Cost (MC)** (to be explained later).

1.2 Alternative Objectives (Non-traditional)

While it is assumed that firms act in accordance with the profit-maximising objective, they may not always do so due to the following:

- a. Firms may not be able to accurately estimate their MR and MC due to unavailable or imperfect information.

To obtain information about MR:

Firms will need to know how responsive consumers will be to any price changes – or the PED. They could estimate PED using past data or market research, but neither will be fully accurate.

To obtain information about MC:

Firms should consider both explicit and implicit costs. However, firms may only consider explicit costs, for example, labour costs, because it is easier to compute, and they may lack information on implicit costs.

The issue of obtaining accurate information may be compounded by **dynamic market conditions**. This means that even if the correct points of MR and MC could be identified, the rapid changes in market conditions could make the identified point obsolete quickly and become inaccurate. Thus, firms would have to constantly adjust prices or output as market conditions change if they wish to maximise profits.



Connect, Extend, Challenge

How do firms make use of technology to obtain more information about MR and MC?

- b. Firms may not profit-maximise in the short run and choose to pursue alternative objectives. This non-profit maximising behaviour is dependent on their operating context such as stage of maturity and extent of competition. **Nonetheless, these alternative objectives may be short-term in nature while retaining their longer-term objective of profit-maximisation.**

The alternative firm objectives are:

a. Profit satisficing

Profit-satisficing behaviour arises due to the separation of ownership and management. The principal-agent problem provides insight into this. As information is imperfect, firm's owners (the principal) may not know what the maximum level of profits could be. Hence managers (the agent) may aim for a minimum level of profit that is just enough to satisfy the owners (and shareholders) rather than maximise profits.

b. Revenue maximisation

Some firms may also simply aim for revenue maximisation instead. This could also be explained through the principal-agent problem. In competing with one another, a manager (the agent) may aim to maximise revenue rather than profits as his job performance may be measured by the former. They may deploy strategies so that they garner top sales awards, high commissions and

favourable promotion prospects. However, it may not be in the interests of the firm's owners (the principal) whose objective is to maximise profits ($TR - TC$). While it is good to maximise revenue and sell as much as possible, higher costs will also need to be taken into consideration. If the rise in costs outweighs the rise in revenue, this would mean that the firm owner will suffer a fall in profit. This behaviour to maximise revenue regardless of higher costs will then conflict with what the firm owners had in mind for profit-maximisation to maximise revenue yet minimise costs.

c. Market share dominance

A firm could choose to focus on preserving as well as to enlarge its market share at the expense of its profit through pricing strategy (e.g., lower prices) and non-pricing strategies (e.g., aggressive advertising and marketing) to make the demand for their products **more price inelastic**. Market dominance brings certain advantages:

- A dominant firm could find it easier to develop strategic partnerships with other firms especially those producing related goods.
- The best talent would prefer to work for a dominant firm due to its perceived prestige.
- Rivals would hesitate in engaging in competitive strategies since a dominant firm has a large captive consumer base and strong consumer loyalty and could retaliate with more aggressive competition.
- A dominant firm could obtain bank loans at a more favourable interest rate, helping it to expand more easily.

In the long run, this enables the firm to set higher prices to earn higher revenue and profits.

d. Social and Environmental

Aside from fulfilling the firm's self-interests, there exists firms that engage in production to promote the well-being of society. Some are altruistic in nature in providing a range of goods and services at highly competitive prices. For example, NTUC FairPrice Cooperative is a social enterprise run by the National Trade Union Congress (NTUC). It produces in-house brands for necessities like cooking oil and rice. In fact, NTUC FairPrice maintains a basket of 500 essential items that are competitively priced with at least 90 per cent of their *Everyday Low Price* items among the lowest available in the market.

Government-owned and government-linked firms may also exist to provide goods and services for the general public. Government-owned firms/industries are also known as nationalised or state-owned enterprises. They can be fully or partially owned by the government. In comparison, government-linked firms are enterprises that the government has a stake in i.e., the government is a shareholder.

Regardless of whether the firms are government-owned or government-linked, most tend to be in strategic industries such as natural resources, public transport, communications, utilities, energy and defence, as it is in the interest of society and national security for the government to own them and/or manage its production. Hence many of the oil companies in the Organisation of Petroleum Exporting Countries (OPEC) are government-owned, for example, Saudi Arabian Oil Company (Saudi Aramco) and Abu Dhabi National Oil Company.

In Singapore, government-linked corporations (GLC) play a substantial role. These GLCs are partially or fully owned by a government-owned investment company, Temasek Holdings. Notable GLCs are Keppel Corporation, Singapore Airlines, SMRT, Singtel and Singapore Technologies Engineering.

Firms may also consider the impact of their goods and production processes on society and the environment and hence use less harmful inputs or production methods. For example, food manufacturers may use healthier ingredients like unsaturated oils to cook their products or bio-degradable packaging like paper rather than non-biodegradable ones made from plastics to pack and store their products. While critics may consider such actions to be merely responses that cater to the demand of increasingly health and environmentally conscious consumers, it is possible that the managers or owners of some of these firms could be undertaking such decisions at the expense of profits as they have altruistic intentions.

In the news

Discount on about 100 essential items at NTUC FairPrice supermarkets every Friday from Mar 4

SINGAPORE – From Mar 4, shoppers at all NTUC FairPrice supermarkets and hypermarkets will enjoy a 5 per cent discount every Friday on about 100 “key essential items”, FairPrice said on Monday (Feb 14).

The key essential items comprise daily household staples such as rice, oil, eggs, milk, vegetables, meat, laundry and paper products. The discounts will run until the end of the year.

The move is part of FairPrice's "Stretch Your Dollar" programme to help consumers "cope with the rising cost of living that has been exacerbated by the protracted COVID-19 situation", FairPrice Group said in a media release.

Source: Channel NewsAsia



Connect, Extend, Challenge

What do you think is the aim of NTUC FairPrice?

2. Economic Profit and Production Costs

Traditionally, all firms are assumed to be profit-maximisers. In this section, we shall examine the 3 types of economic profits that firms can make.

2.1 Types of Economic Profit

The formula for the computation of economic profit takes into account both production costs and revenue:

$$\begin{aligned}\text{Economic Profit} &= \text{Total Revenue (TR)} - \text{Total Costs (TC)} \\ &= (\text{Price} \times \text{Quantity}) - (\text{Average Cost} \times \text{Quantity})\end{aligned}$$

In Economics, the term 'profit' typically refers to economic profit. The types of profit are:

Type of Profit	Value
Supernormal profits (Required to attract new firms into the industry)	Positive Economic Profit ($TR - TC > 0$) ($TR > TC$)
Normal profits (Required to keep existing firms in the industry)	Zero Economic Profit ($TR - TC = 0$) ($TR = TC$)
Subnormal profits (Incentivise existing firms to exit the industry)	Negative Economic Profit ($TR - TC < 0$) ($TR < TC$)

Note: Illustrations of these profit levels on a price setting firm in Topic 7 under Monopoly.

Profit-maximisation follows the **Marginalist Principle** when firms make rational decisions on the optimal output level. Previously, we learnt that the Marginalist Principle involves the weighing of Marginal Benefit and Marginal Cost by the economic players. For firms, Marginal Benefit refers to the additional revenue (**Marginal Revenue**) earned from an additional unit of good/service, while **Marginal Cost** refers to its additional cost of production.

Short-run Production and Costs

3. Short-run Production and Costs

This segment will enlighten us on a firm's cost of production in both short and long run, which is crucial to understanding a firm's traditional objective of profit-maximisation.

It is firstly important to take note that the concept of **short-run** and **long-run production** is not defined as a specific period of time such as a month or a year. Instead, it depends on whether there are any fixed factor inputs (short run) or are all factor inputs variable (long run).

Short-run production is when there is at least 1 fixed factor input.

In contrast, **long-run production** is when all factor inputs can be varied

3.1 Short-run Costs

In the short-run, fixed factors are inputs that cannot be changed in quantity within the time period. The cost incurred from the use of these fixed factor inputs are known as **fixed costs**. Total fixed costs (TFC) remain the same when output varies and are incurred even when output is zero.

Some examples of fixed factors and its corresponding fixed costs are:

Firm	Fixed Factors	Fixed Costs
Google	Land (office)	Rental
Gong Cha	Land (outlet)	Rental
	Capital (cup sealing equipment, fridge)	Machinery cost

In the short-run, firms have to increase variable factors to increase output.

Variable factors are inputs that can be changed within the time period. The cost incurred from the use of these variable factor inputs are known as **variable costs**. Variable costs increase as output increases and are not incurred when output is zero.

Some examples of variable factors and its corresponding variable costs are:

Firm	Short-run	Variable Factors	Variable Costs
Google	Possibly up to 10 years	Labour	Wages
		Capital (computers)	Machinery cost
Gong Cha	Possibly up to 1 month	Labour	Wages

So, in the short-run, a firm incurs both fixed and variable costs. Hence total cost is the sum of total fixed and total variable costs:

Total Cost (TC) = Total Fixed Cost (TFC) + Total Variable Cost (TVC)

Firms will also be able to derive its average costs from its total costs.

Average Total Cost (ATC)
= Average Fixed Cost (AFC) + Average Variable Cost (AVC)

Average Total Cost (ATC) = Total Cost (TC) ÷ Total Output (Q)

Average Fixed Cost (AFC) = Total Fixed Cost (TFC) ÷ Total Output (Q)

Average Variable Cost (AVC) = Total Variable Cost (TVC) ÷ Total Output (Q)

For more information on the derivation of the AFC, AVC and ATC, please refer to Annex.

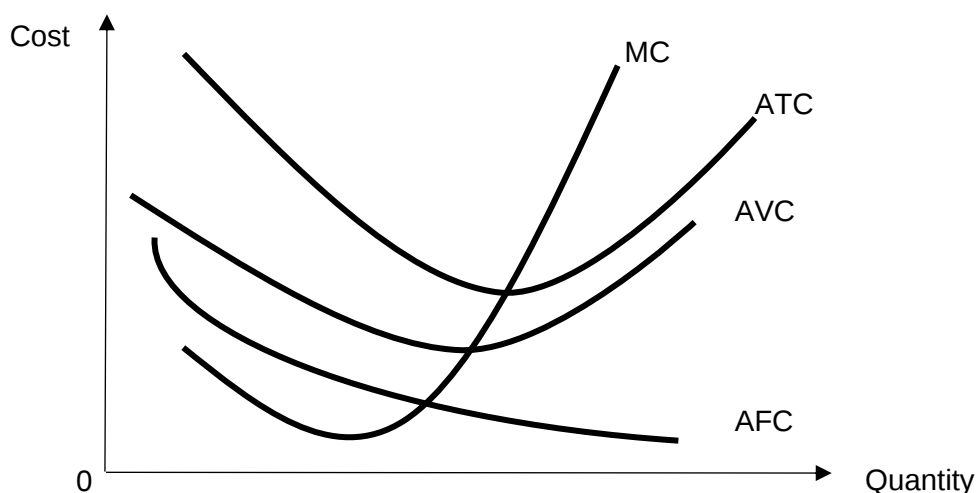
3.2 Marginal Cost (MC)

Marginal Cost (MC) is the additional total cost incurred with the production of one more unit of output.

$\text{Marginal Cost (MC)} = \frac{\text{Change in Total Cost } (\Delta \text{TC})}{\text{Change in Total Output } (\Delta Q)} = \frac{\text{Change in Total Variable Cost } (\Delta \text{TVC})}{\text{Change in Total Output } (\Delta Q)}$

From Annex, total fixed cost (TFC) does not vary with the output level, **MC is not affected by changes in TFC**. However, **MC is affected by changes in total variable cost (TVC)**. Hence MC also falls and then rises i.e., a U-shaped curve.

Figure 1a: Cost Curves

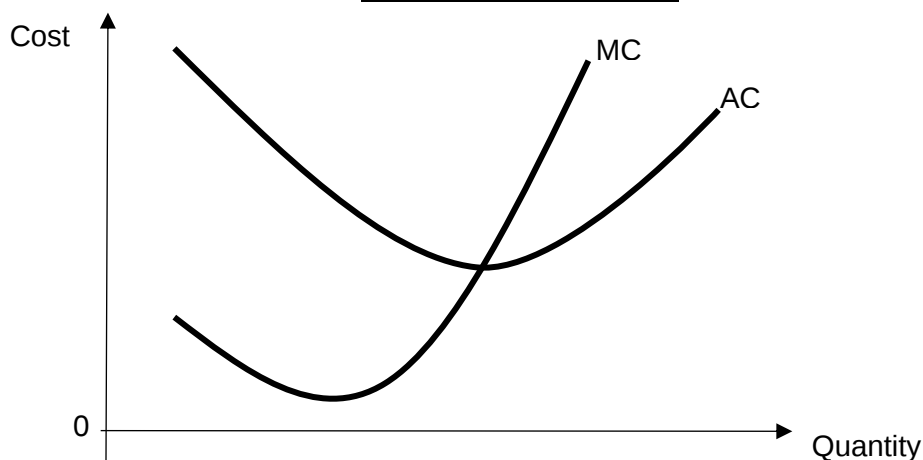


From Figure 1a, some observations can be made on the relationships between ATC and AVC.

- When MC is below ATC, ATC falls.
- When MC is below AVC, AVC falls
- When MC is above ATC, ATC rises.
- When MC is above AVC, AVC rises
- So, **MC cuts both ATC and AVC at their respective minimum points.**
- MC reaches its minimum first, followed by AVC and then ATC.

In your syllabus, you are required to know this simplified Figure 1b:

Figure 1b: Cost curves



- When MC is below AC, AC falls.
- When MC is above AC, AC rises.
- So, **MC cuts AC at its minimum point.**
- MC reaches its minimum first, followed by AC.

4. Long-run Production and Costs

In the long-run, firms are no longer constrained by the fixed factors as they are free to change all factor inputs. To increase output, the firm can now set up more branches or buy more machinery. Since there are no fixed factors, TFC is 0.

Long-run production is when all factor inputs can be varied.

Total Cost (TC) = Total Variable Cost (TVC)

Average Variable Cost (AVC) = Total Variable Cost (TVC) ÷ Total Output (Q)

When firms can change all their factor inputs, we are interested to know what happens to output and cost.

4.1 Returns to Scale

a. Increasing Returns to Scale

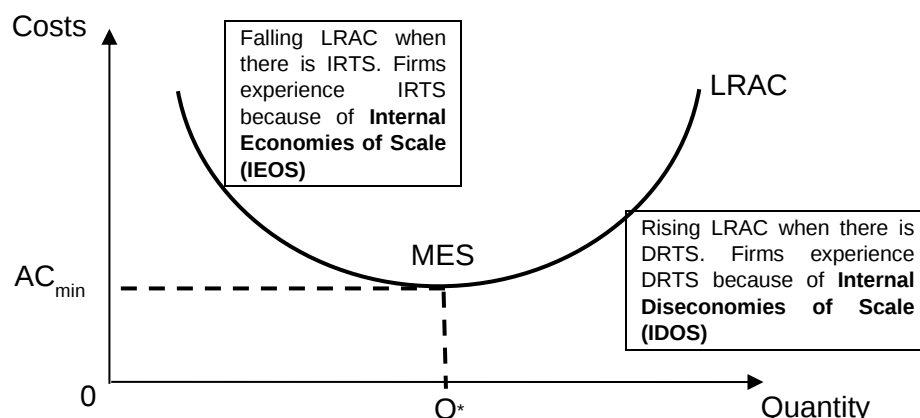
- Output increases by **more than proportionately** to an increase in factor input.
- For example, when factor input doubles, output is more than doubled.
- Hence **long-run average cost (LRAC) falls** as output increases.
- Firms enjoy **Internal Economics of Scale (IEOS)** i.e., lower unit cost enjoyed by firms when they expand their scale of production.

b. Decreasing Returns to Scale

- Output increases **less than proportionately** to an increase in factor input
- For example, when factor input doubles, output is less than doubled.
- Hence **LRAC rises** as output increases.
- Firms experience **Internal Diseconomies of Scale (IDOS)** i.e., higher unit cost incurred by firms when they over-expand their scale of production.

Hence the LRAC curve is typically U-shaped i.e., LRAC falls, then rises.

Figure 2: LRAC Curve

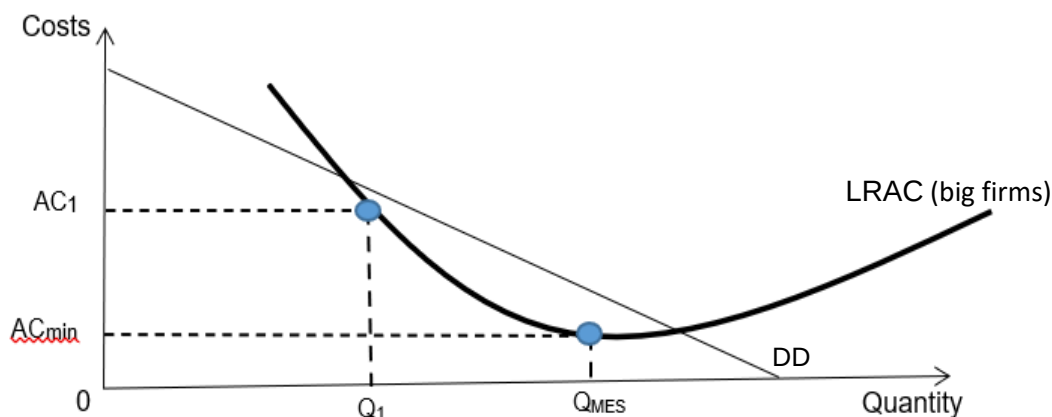


The LRAC reflects:

- The least-cost combination of the factor inputs for each unit of output. This means that each point on the curve is the lowest possible unit cost for each level of output.
- **The Minimum Efficient Scale (MES) is at Q^* .** This means that Q^* is the minimum scale of production that firms must expand towards so as to fully reap all IEOS and to achieve lowest LRAC.
- As firms expand beyond Q^* , firms experience internal diseconomies of scale and average cost rises as output increases (rising portion of the LRAC).

4.2 Long-run Average Cost (LRAC) for substantial IEOS

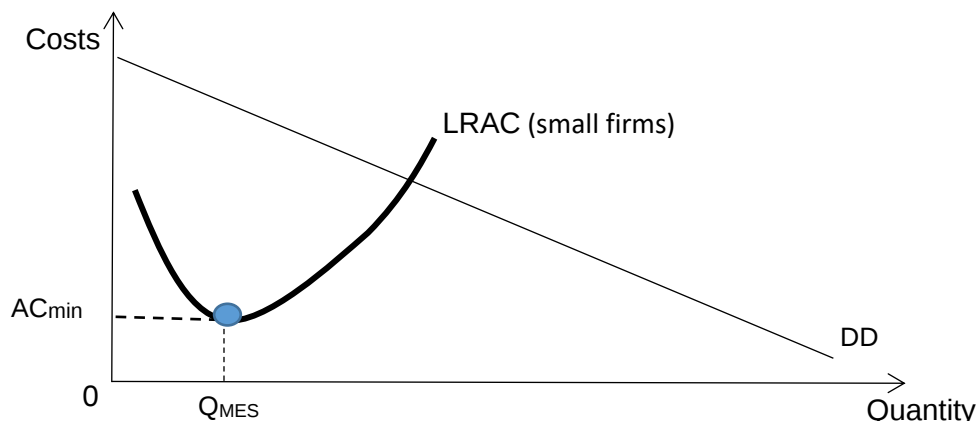
Figure 3: LRAC for substantial IEOS



Industries that have high barriers to entry (such as telecommunications) due to reasons such as high start-up cost tend to consist of a few big firms each with a large market share. There is thus significant IEOS to be reaped by firms in such industry, and thus the MES is large relative to industry demand. As firm increases its output (say from Q_1 to Q_{MES}), there is significant cost savings (AC_1 to AC_{min}), i.e., total cost can be spread over a larger output. Hence the LRAC falls over a large range of output.

4.3 Long-run Average Cost (LRAC) for limited IEOS

Figure 4: LRAC for limited IEOS



Comparatively, for industries that have low barriers to entry (such as neighbourhood hair salon) due to reasons such as low start-up cost, tend to consist of a many small firms and each firm only has a small market share. There is thus limited IEOS to be reaped by firms in such industry, and thus the MES is small relative to industry demand. Hence the LRAC falls over only a small range of output as firms increases its production.



Connect, Extend, Challenge

Comparing the operations of a canteen stall operator and a fast-food restaurant operator, how are there differing extents of internal economies of scale enjoyed?

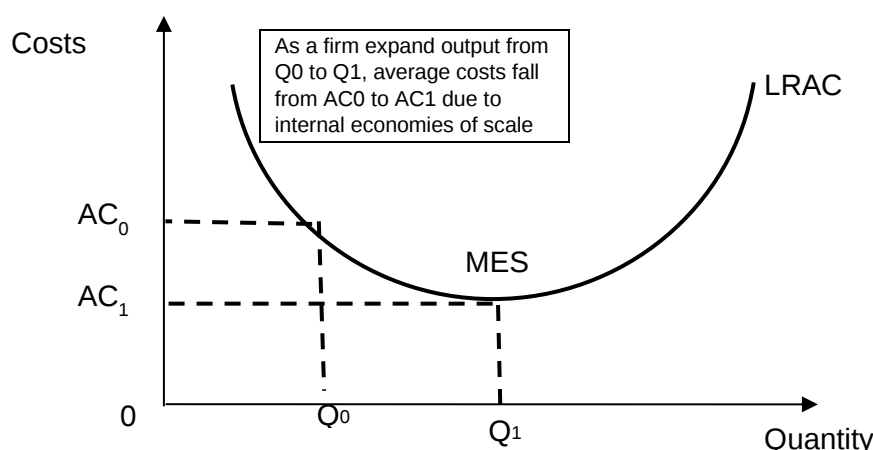
4.4 Internal Economies and Diseconomies of Scale

4.4.1 Internal Economies of Scale

When firms initially expand their scale of production, they first experience IRTS and falling LRAC because of **Internal Economies of Scale (IEOS)**.

Internal Economies of Scale (IEOS) refers to **unit** cost reductions that accrue to a firm as a result of expanding the firm's scale of production.

Figure 5: Internal Economies of Scale (IEOS)



IEOS arise from the spreading-out of fixed costs, productivity improvements and greater buying power over inputs, when a firm expands its production.

The different sources of EOS are attached for your understanding of how a firm's AC can fall when output rises. These include:

a. Technical Economies

i. Specialisation and division of labour

As the firm expands, there is greater scope for labour to be deployed to different scopes of work across the production process. Workers can now specialise on a specific area of work and become more proficient in doing so over time. This increases their productivity as they can produce more units of output per man hour. Assuming wages remain constant, unit cost of production will be lowered. Diagrammatically, it is a movement down along the LRAC.

ii. Factor indivisibility

Certain machinery caters to a specific and large size and are not available in smaller units to cater to a smaller production scale. For example, a commercial freezer warehouse is designed for keeping a sizeable amount of frozen meat product. Storing small amounts of meat products would not allow the producer to utilise much of the freezer warehouse and hence unit cost of production will be high. The spreading-out of fixed costs over a larger output would thus result in lowered unit cost of production.

b. Managerial Economies

As the firm expands, managers can be assigned to look after specific processes/areas. Similar to how workers become more specialised and proficient in their areas of work, managers are also more skilled as they specialise in managing certain production processes as well as human resources. Each manager becomes a specialist with deep knowledge of the management processes and become more productive. This increases labour productivity as more units of output can be produced per man hour. Assuming wages remain constant, unit cost of production will be lowered.

c. Marketing Economies

Due to the large scale of production, larger firms often buy their raw materials and components in bulk. As a significant buyer, the firm is able to not only dictate their requirements in relation to specifications and quality, the firm will also be able to enjoy cost advantages relating to bulk purchase. Consider how a large hotel like Swissotel will be able to enjoy bulk discounts for toiletries compared to a small boutique inn. Hence unit cost lowers.

d. Financial Economies

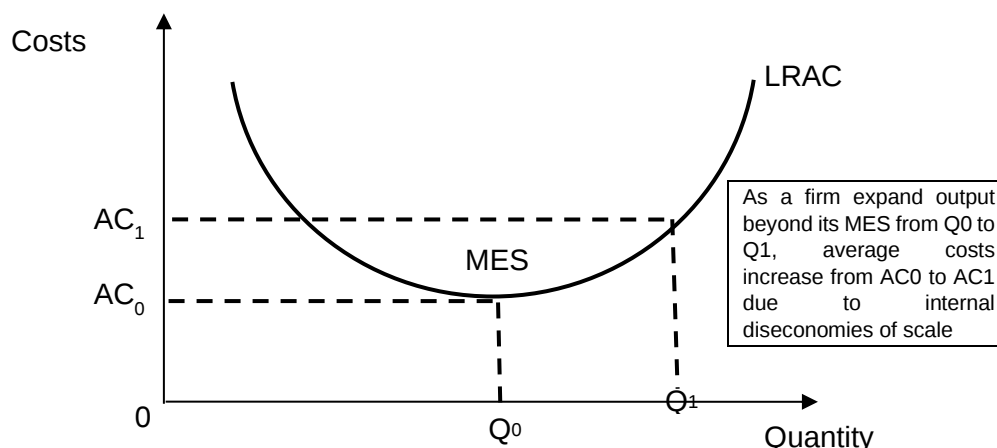
Large firms are often associated with greater credibility and hence perceived to be at a lower less risk of loan defaults. Large firms also have more avenues to raise funds (e.g., sale of bonds or shares). Banks are more confident of the prospects of large firms and hence may offer loans at a lower rate of interest, in consideration of its better credit ratings and collateral available for pledging. Hence unit interest cost lowers.

4.4.2 Internal Diseconomies of Scale

When firms continue to expand their scale of production, they then experience diseconomies of scale and increasing unit cost (upward rising portion of the LRAC) because of **Internal Diseconomies of Scale (IDOS)**.

Internal Diseconomies of Scale (IDOS) refers to unit cost increments that accrue to a firm as a result of the firm's over-expanding its scale of production.

Figure 6: Internal Diseconomies of Scale



IDOS arise from the fall in productivity due to greater complexity and lower labour motivation, as well as the employment of more resources to manage such problems, when a firm expands its production.

The different sources of IDOS are attached for your understanding of how a firm's AC can rise when output rises. These include:

a. Overspecialisation

As the firm expands its output with increased specialisation, workers may become disengaged due to the monotony of repetitive work. This becomes problematic when the management do not involve the workers in the firm's decisions and do not actively seek to engage them, making them feel undervalued. This decreases their productivity, and they produce fewer units of output per

man hour. Assuming wages remain constant, unit cost of production will be higher.

b. Managerial Diseconomies

As managers become more specialised and deep-rooted in their area of work, communication channels may become more challenging. Employees may have uneven understanding of company direction and find it difficult to perform their roles as intended. This results in higher monitoring costs and reduces productivity. Assuming wages remain constant, unit cost of production will be higher.

4.5 External Economies and Diseconomies of Scale

While firms experience IEOS and IDOS when they expand their scale of production, they also experience External Economies and Diseconomies of Scale when their industry (a group of firms engaged in similar or related activities) expands.

External Economies of Scale (EEOS) are unit cost reductions which accrue to the firm because of the industry expanding.

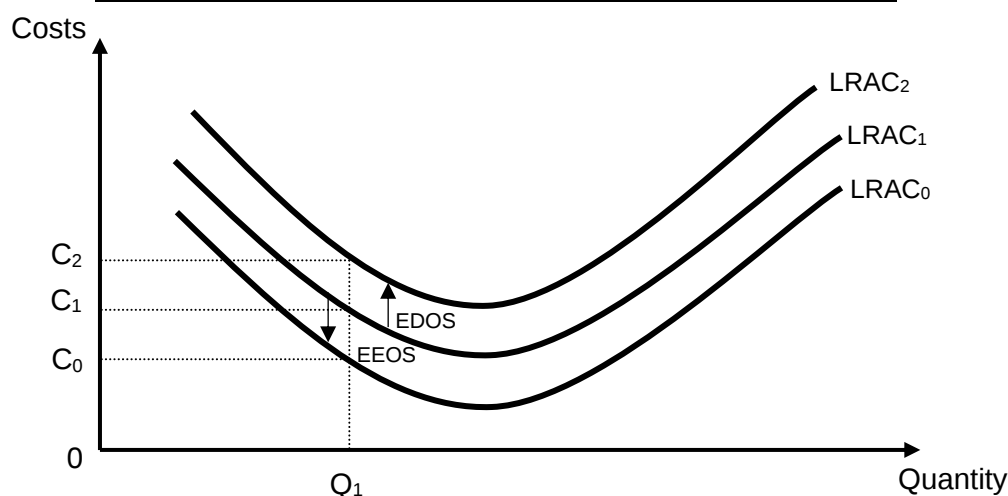
External Diseconomies of Scale (EDOS) are unit cost increments which accrue to the firm because of the industry over-expanding.

EEOS arise from the sharing of common resources between firms and the outsourcing of production processes to supporting firms, due to industry expansion. EDOS arise from infrastructural bottlenecks and increased competition for common inputs, due to industry expansion.

Recall that when firms experience IEOS and IDOS, it was reflected by a **movement along** the U-shaped LRAC because it was a result of the firm's expansion.

Now when firms experience EEOS and EDOS, it is reflected by a **shift of the entire LRAC** curve because it is a result of the industry's expansion, irrespective of the firm's scale of production.

Figure 7: External Economies and Diseconomies of Scale



When external economies are experienced, the LRAC will shift down. The firm enjoys a lower cost at every level of output.

EEOS is represented by a downward shift from $LRAC_1$ to $LRAC_0$. For a firm producing at Q_1 , the firm's AC falls from C_1 to C_0 as the industry expands.

When external diseconomies are experienced, the LRAC will shift up. The firm enjoys a higher cost at every level of output.

In contrast, EDOS is represented by an upward shift from $LRAC_1$ to $LRAC_2$. For a firm producing at Q_1 , the firm's AC rises from C_1 to C_2 .

In fact, all firms within the industry enjoy the rise or fall in AC regardless of their output across the whole range of output.

4.5.1 External Economies of Scale

Some sources of **External Economies of Scale** (EEOS) are:

a. Economies of Concentration

This can be derived when many related firms concentrate themselves in a specific geographical region. As they form a cluster and develop a reputation for selling specific goods, each firm will now attract more customers than they would have as an individual firm. An example would be Smart City Kitchens @ Bishan, where ghost commercial kitchens operate exclusively for food delivery riders. Because there are no eat-in facilities, restaurants operating at Smart City Kitchens can therefore cut down on operating costs (such as doing away with a service crew to serve walk-in customers). Every firm can therefore cut down on marketing/advertising costs.

Firms that are related through linked processes will enjoy reduced transport costs when they situate near one another. For example, a car repair firm will enjoy lower transport costs when it is located near a firm selling tyres or metal components.

Transport and communications costs for all firms may also be reduced if the concentration of firms in an area increases its importance to the economy and also the likelihood of government support in terms of transport and communications infrastructure.

With the aggregation of firms in the same industry, the pool of skilled and unskilled labour within the area grows. This makes it easier for firms to have access to a ready pool of labour and for labour to transit from one firm to another. Hence, recruitment costs are reduced for all firms in the region.

b. Economies of Information

As the industry grows and where the market becomes saturated, they may see the opportunity to collaborate to reap breakthrough innovation. Instead of competition, firms are moving into 'coopetition', a strategic behaviour where competitors cooperate.

As they share, they learn useful lessons from one another's previous experiences including best practices, knowledge, ideas, information and insights gleaned from past failures. This will minimise unnecessary wastage in terms of resources (capital, entrepreneurship, land and labour) that can now be channelled to more productive uses.

It may also reduce research, development and innovation costs for all involved firms. Economies of Information can be seen in the car industry (between

Toyota, Peugeot, and Citroen) as well as in the technology-related industry (between Apple and Microsoft).

c. Economies of Disintegration

With the expansion of an industry, firms may find it more worthwhile to divide its production processes and outsource out certain production process, especially for those where other firms could produce at a lower average cost. In so doing, the firm can concentrate on its core business and lower its average cost of production at the same time. Common examples include sales, customer support, servicing and maintenance.

4.5.2 External Diseconomies of Scale

Similar to a firm, an industry will experience **External Diseconomies of Scale** (EDOS) when it over-expands. Some sources of EDOS are:

a. Strain on Infrastructure

Firms within a geographical area will likely lead to constraints on infrastructure. With more traffic within the area, the roads become more congested, leading to more time spent transporting goods and workers from one point to another. This will push up the transportation costs and hence all firms incur higher average costs.

b. Strain on Resources

With the expansion of the industry, the demand for the same pool of resources is likely to increase. To satisfy increased demand and hence higher output delivery, firms are pressured to hire more resources such as skilled or unskilled labour. As a result, firms will bid amongst themselves to offer higher wages to attract workers to join them. Overall, while a higher wage is good for the workers, all firms will now incur higher labour costs.

5. Firms' Revenue Curves

Building on our understanding of cost curves, we will now examine the revenue curves for a firm before we can determine the profit-maximising level of output in the next section.

When a firm is too small to affect market price, the firm is said to be a price taker¹. However, if a firm has some extent of market power, this happens in an imperfect market¹, the firm is said to be a price-setter. Take note that the revenue curves will look different for these different types of firms.

Let's first look at the revenue curves of a price-taking firm.

¹ To be covered in Section 2.1 of Topic 7.

5.1 Revenue Curves for Price-taking Firms

Figure 8: Market curves of a perfectly competitive industry

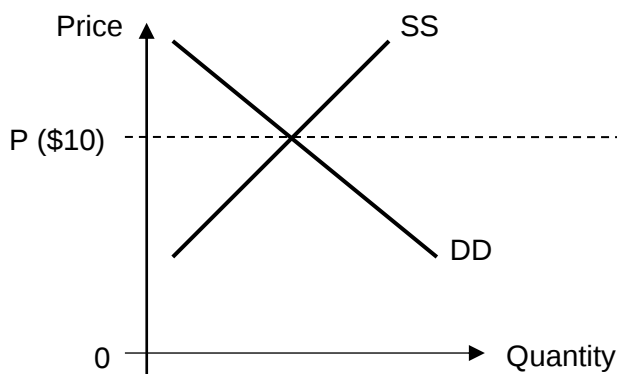
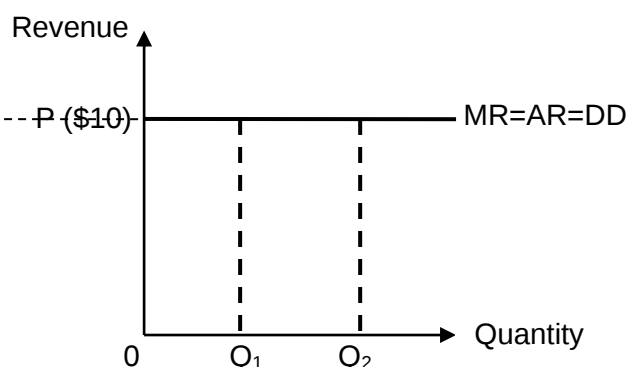


Figure 9: Demand curve of a perfectly competitive firm



Calculating revenues for a price-taking firm

Price	Quantity	TR (= P X Q)	AR (= TR ÷ Q)	MR = $\Delta TR \div \Delta Q$
10	1	10	10	-
10	2	20	10	10
10	3	30	10	10
10	4	40	10	10

a. Total Revenue (TR = P x Q)

Total revenue is the total amount received by the seller from the sale of a good. For a price taker, price remains constant regardless of the quantity the firm wants to sell. Therefore, TR should rise at constant rate as more units are being sold.

b. Average Revenue (AR)

Average revenue is the amount of revenue per unit sold, which is simply the price of the good.

$$AR = TR \div Q = (P \times Q) \div Q = P$$

The AR curve of the perfectly competitive firm is also the demand curve of the product of the firm. It shows the price of the firm's product at each level of output. Since the price remains the same regardless of the number of units the firm sells, the AR curve, is a horizontal straight line.

c. Marginal Revenue (MR)

Marginal Revenue is the change in TR due to the sale of an additional unit of output.

$$MR = \Delta TR \div \Delta Q \text{ Or } MR_{nth} = TR_n - TR_{n-1}$$

Since the price remains the same for each price-taking firm, the addition to TR from selling an additional unit of output is the price, i.e., $MR = P$. So, when the market price is \$10 per unit, the firm will get \$10 for the first unit and \$10 for the second unit and \$10 for each subsequent unit. Therefore, the marginal revenue would be the same as the market price.

Thus, for a price-taking firm, $P=DD=AR=MR$, and all are represented by the horizontal demand curve in Figure 9.

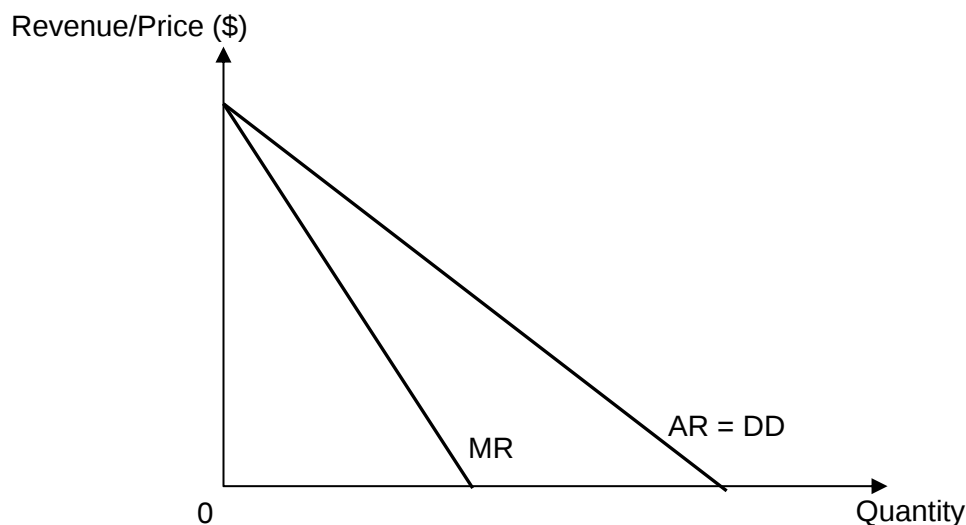
5.2 Revenue Curves for Price-setting Firms

Recall that the Law of Demand states that an inverse relationship between price and quantity demanded. This means that to sell more units of a good, the firm has to decrease the price of the good, vice versa. Hence, following the Law of Demand, a firm's average revenue (AR) curve is downward sloping.

For these price-setting firms, price must fall as output is increased. As the new lower price applies to all units sold, the marginal revenue (MR) of the firm is always less than the price. As the price is lowered further, MR will fall even more. Hence, the MR curve also downward sloping and lies below the AR curve. Let's take the numerical example:

Qty (kg)	Price \$/kg	Total Revenue (\$)	Average Revenue (\$)	Marginal Revenue (\$)
3	2.00	6.00	2.00	1.60
4	1.80	7.20	1.80	1.20
5	1.60	8.00	1.60	0.80
6	1.40	8.40	1.40	0.40

Figure 10: Revenue curves for a price-setting firm



6. Profit-Maximisation Condition ($MC = MR$), Price, Output, Level of Profits

Profit-maximising condition:

All firms will profit-maximise by producing an output corresponding to $MC=MR$.

This is in line with the Marginalist Principle.

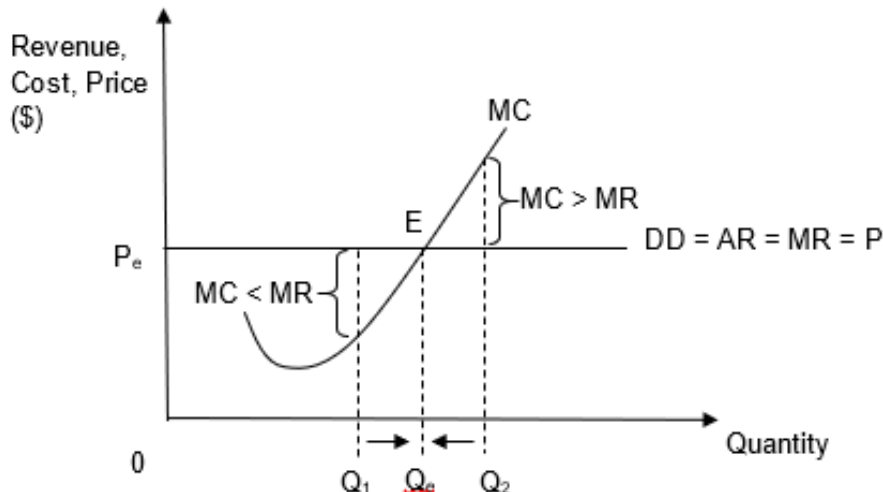
In this section, we will need to put the revenue and cost curves together to determine the profit-maximising price, output and level of profits.

6.1 Price-taking Firms

6.1.1 Determining the Profit-Maximising Price and Output

Profits are maximised when $MC = MR$ and MC is rising, i.e., at Q_e . At this output level, there is no tendency for the firm to alter its output since it has maximised its profits.

Figure 11: Profit-maximising price and output of a price-taking firm



aFor $MR > MC$, consider an output level Q_1 :

If the firm were to produce Q_1 units, the MR (the extra revenue from selling *one more* unit) is greater than the MC (the extra cost of producing *that* additional unit). Producing this additional unit will benefit the firm as the extra unit will add to its total profits.

For $MC > MR$, consider an output level Q_2 :

By producing an output greater than Q_e output level (e.g., Q_2), the MC (the extra cost of producing *one more* unit) is greater than the MR (the extra revenue from selling *that* additional unit). Hence, doing so will not benefit the firm and in fact will lead to lower profits.

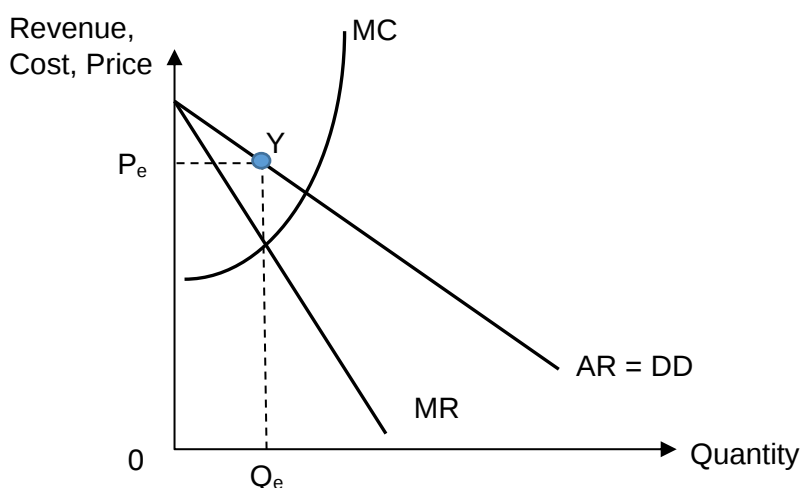
Hence, the profit-maximising level of output should be where **$MC = MR$** and MC is rising.

6.2 Price-setting Firms

6.2.1 Determining the Profit-Maximising Price and Output

Similarly, the firm will produce at the level of output where $MC = MR$, the firm determines price by looking at the AR (or demand) curve. (Note: Price is always higher than the marginal cost for the monopoly.) The profit-maximising output will be at Q_e where $MC = MR$ where MC is rising and charging a price P_e that is along the corresponding point of the AR (or demand) curve.

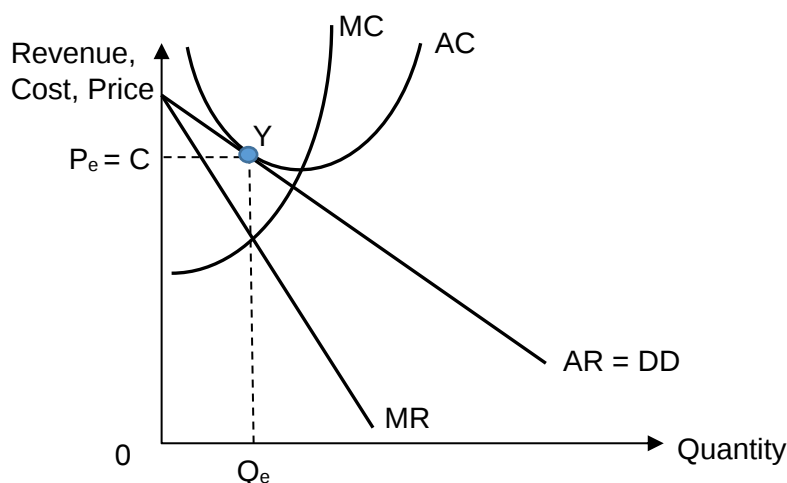
Figure 12: Profit-maximising outcome for a price-setting firm



6.2.2 Normal Profit for a Price-setting Firm

In the short run, a firm can make normal profits. In this case $AR = AC$ and the AC curve will be tangential to the AR curve at point Y as shown in Figure 13 below. At the profit-maximising output $0Q_e$, and price $0P_e$, total revenue (determined by $P \times Q$) is $0P_eYQ_e$. For output level $0Q_e$, total cost is $0CYQ_e$. As total revenue equals to total cost, the firm makes normal profits (zero economic profit).

Figure 13: Price-setting firm earning normal profits



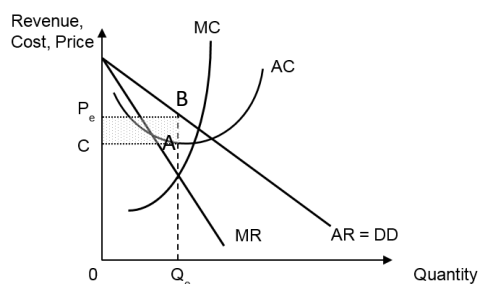
6.2.3 Supernormal and Subnormal Profit for a Price-setting Firm

Besides normal profits, in the short run, the price-setting firms can also make supernormal or subnormal profits.

(a) Supernormal Profit for a Price-setting Firm

In the short run, the price-setting firm may also enjoy supernormal profits. This happens when the average cost curve is lower than the price at $0Q_e$.

Figure 14: Supernormal profit for a price-setting firm



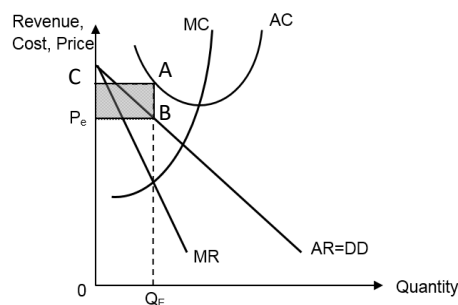
The firm maximises profits by producing $0Q_e$ output at $MC = MR$.

At output $0Q_e$,
 $TR = \text{Area } 0P_eBQ_e$,
 $TC = \text{Area } 0CAQ_e$
 Supernormal profit = Area P_eCAB .

(b) Subnormal Profit for a Price-setting Firm

In the short run, the monopolist may also incur subnormal profits i.e., economic losses. This happens when the average cost curve is higher than the price at $0Q_e$.

Figure 15: Subnormal profit for a price-setting firm



The firm maximises profits by producing $0Q_e$ output at $MC = MR$.

At output $0Q_e$,
 $TR = \text{Area } 0P_eBQ_e$,
 $TC = \text{Area } 0CAQ_e$
 Subnormal profit = Area CP_eBA .

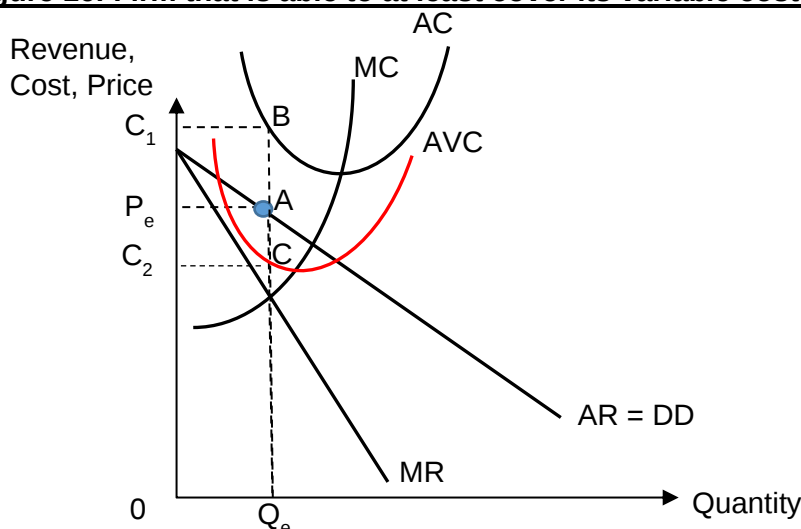
7. Shut-down Conditions

7.1 Short Run Shut-down Condition

7.1.1 A firm is able to cover at least its variable costs ($AR \geq AVC$)

A firm making losses in the short run **will not need to shut down if can cover at least its variable costs**. In continuing production, it could still cover part of the fixed costs (which it will still need to bear in full anyway if it stops production).

Figure 16: Firm that is able to at least cover its variable costs



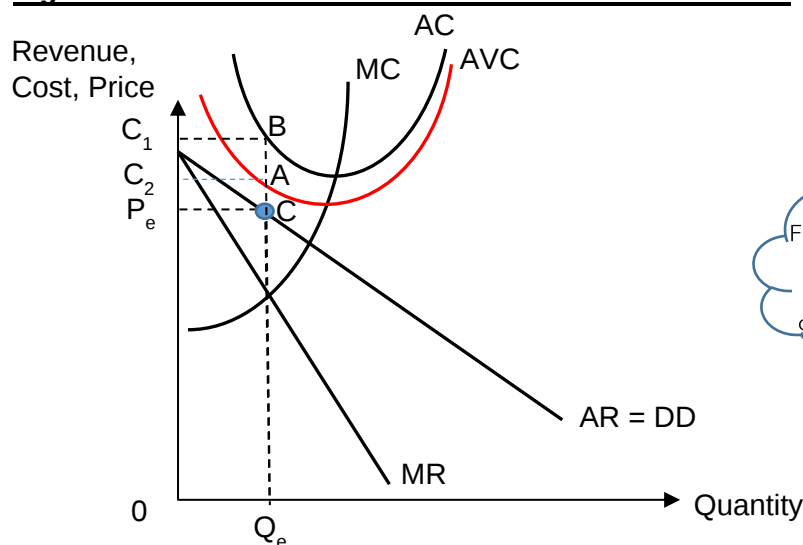
In the short run, when it produces Q_e output, the firm will incur subnormal profits of C_1P_eAB . If the firm shuts down, it will incur subnormal profits C_1C_2CB (which is the total fixed cost).

Since $C_1C_2CB > C_1P_eAB$, the firm should continue to produce. Thus, when **$AR \geq AVC$** , it **minimises losses** by continuing to produce at the output where $MR = MC$.

7.1.2 A firm is not able to cover at least its variable costs ($AR < AVC$)

Let us now consider the case where a **firm is not able to cover its variable costs**. A firm making losses in the short run **will shut down if it is unable to cover at least its variable costs**.

Figure 17: Firm that is unable to cover its variable costs



Note:
 Figures 16 and 17 serve to aid your understanding and there is **no need** to draw these in the exams.

In the **short run**, when it produces Q_e output, the firm will incur subnormal profits of C_1P_eCB . If the firm shuts down, it will incur subnormal profits C_1C_2AB (which is the total fixed cost)

Since $C_1P_eCB > C_1C_2AB$, the firm should shut down.

Thus, when **$AR < AVC$** , it **minimises losses** by shutting down.

If a firm is making subnormal profits but $AR \geq AVC$, it should continue production.

A firm should shut down only when **$AR < AVC$** (shut-down condition in the short-run).

In the **long run**, all costs are variable. Thus, total cost is equal to variable cost.

If a firm is making at least normal profits i.e., $AR \geq AC$, it should continue production.

A firm should shut down only when **$AR < AC$** (shut-down condition in the long-run).

A firm should **shut down** if it is unable to charge a price at least equal to average total cost i.e., it makes **subnormal profits**.

In closing, let's consolidate our **Enduring Understandings**:

1. A firm's traditional objective is to profit-maximise. In the short run however, a firm could pursue other alternative objectives such as profit-satisficing, revenue maximisation, market dominance, and social objectives. **These alternative objectives may be short-term in nature while retaining their longer-term objective of profit-maximisation.**
2. A profit-maximising firm needs to understand its cost and revenue patterns which in turn determines its strategies (i.e., expand, merge, diversify, market, shut down or remain status quo).

Annex

Law of Diminishing Marginal Returns and how it impacts Variable Costs and Average Costs

1. Law of Diminishing Marginal Returns (LDMR)

We can illustrate short-run cost curves by using a numerical example with the Gong Cha context. With reference to the table below, In the short-run, the fixed factor for Gong Cha is machinery while the variable factor is labour. To increase output, Gong Cha has to hire more labour.

Table 1: Short-run Production and Costs (Hypothetical)

Fixed Factor (Machinery, \$20 per unit)	Variable Factor (Labour, \$25 per unit)	Total Fixed Cost (TFC)	Total Variable Cost (TVC)	Total Cost (TC)	Output (Q)	Average Fixed Cost (AFC)	Average Variable Cost (AVC)	Average Total Cost (ATC)	Marginal Cost (MC)
1	0	20	0	20	0	-	-	-	-
1	1	20	25	45	4	5	6.3	11.3	6.3
1	2	20	50	70	10	2	5.0	7.0	4.2
1	3	20	75	95	14	1.4	5.4	6.8	6.3
1	4	20	100	120	17	1.2	5.9	7.1	8.3
1	5	20	125	145	19	1.1	6.6	7.6	12.5
1	6	20	150	170	20	1.0	7.5	8.5	25

As the firm hires:

- the 1st unit of labour, output increases by 4 units.
- the 2nd unit of labour, output increases by 6 units.

Hence at the initial stages of production, the additional output produced by each additional unit of labour is increasing.

However, as the firm hires:

- the 3rd unit of labour, output only increases by 4 units.
- the 4th unit of labour, additional output is 3 units.
- the 5th unit of labour, additional output falls further to 2 units.

Why is that so? This can be explained by the **Law of Diminishing Marginal Returns (LDMR)**.

The **Law of Diminishing Marginal Returns (LDMR)** states that when more quantities of a variable factor are used in combination with a given quantity of fixed factor, there comes a point when an additional unit of the variable factor will produce less additional output.

In this example, LDMR sets in at the 3rd unit of variable factor (labour). This is because of the overutilisation of the fixed factor (machinery) when the firm hires too many of the variable factor (labour). The constraint of 1 machinery results in overcrowding and inefficiency and hence falling additional output when one more unit of variable factor (labour) is hired.

2. Total Fixed Costs (TFC) and Total Variable Costs (TVC)

For the above example, the fixed factor is 1 unit of machinery, and its unit cost is \$20 (so total fixed cost for the firm is \$20). From the table above, it is thus reflected that:

Total Fixed Cost (TFC) remains the same as output increases, and it is incurred even when output is zero.

In contrast, the variable factor for the firm is labour. Each additional unit of labour costs \$25. Hence total variable cost increases by \$25 for each additional unit of labour. To increase output, the firm must hire more labour. From Table 1 above, it is thus reflected that:

Total Variable Cost (TVC) increases as output increases, and it is not incurred when output is zero.

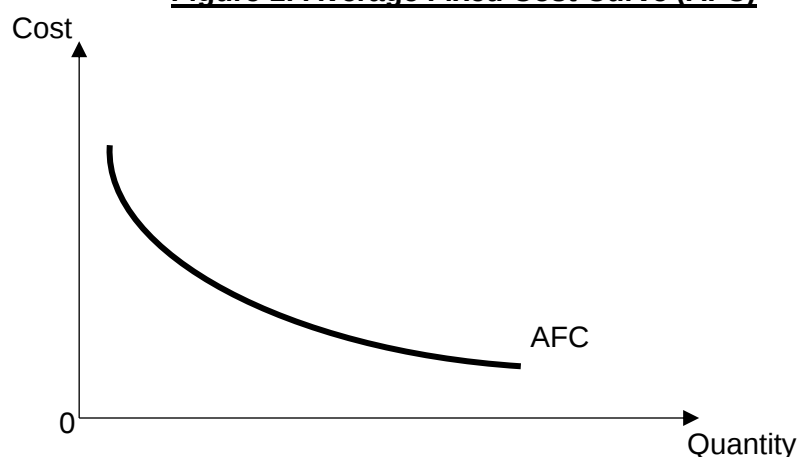
3. Average Fixed Cost (AFC)

AFC is computed as total fixed cost per unit output ($AFC = TFC \div Q$).

From the table above, note that as output increases, AFC falls. This is because the total fixed cost of \$20 is spread over a larger quantity of output. Hence AFC falls as output increases i.e., when output increases from 4 to 20, AFC falls from \$5 to \$1.

Graphically, AFC will thus be a downward sloping curve. Do note that the downward-sloping shape is especially pronounced for a high TFC amount that spreads over a large amount of output.

Figure 1: Average Fixed Cost Curve (AFC)



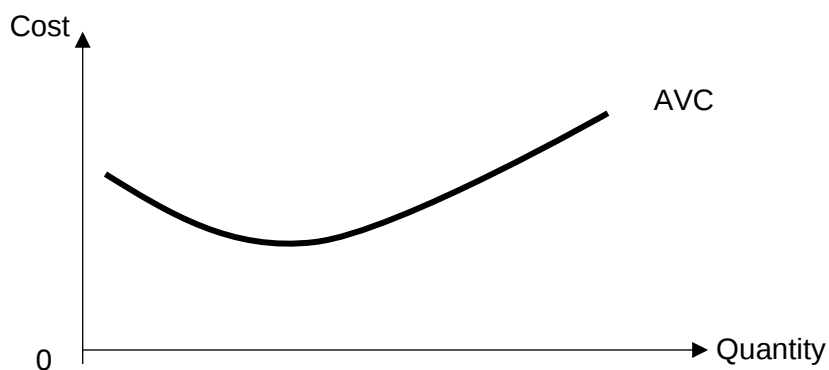
4. Average Variable Cost (AVC)

AVC is computed as total variable cost per unit output ($AVC = TVC \div Q$).

Again, referring to Table 1, note that as output increases, AVC falls and then rises too. This is because LDMR only sets in from the 3rd unit of variable factor (labour) onwards. Each additional unit of variable factor (labour) produces fewer additional output due to overutilisation of the fixed factor (machinery). Hence the variable cost incurred for per unit of output increases.

Graphically, AVC will thus be a U-shaped curve as AVC rises after LDMR sets in.

Figure 2: Average Variable Cost Curve (AVC)



5. Average Total Cost (ATC)

ATC is computed as total cost per unit output ($ATC = TC \div Q$). It can also be derived by $ATC = AFC + AVC$.

From Table 1, note that as output increases, ATC falls and then rises too. This is because:

- From output 0 to 10, as AFC and AVC are both falling, ATC falls too.
- From output 10 to 14, AFC continues to fall while AVC rises. ATC continues to fall as the falling AFC outweighs the rising AVC.
- From output 14 onwards, ATC rises as the rising AVC outweighs the falling AFC.

Graphically, AVC will thus be a U-shaped curve as well. Note that:

- The vertical distance between ATC and AVC is AFC.
- As AFC falls as output increases, the vertical distance between ATC and AVC also narrows.

Figure 3: Average Total Cost Curve (ATC)

