The Firm & The Industry

We go from the individual firm to the industry. The supply side differs from the demand side: firms appear and disappear in response to profitability. The number of firms determines the nature of the market and so the equilibrium price and quantity.

1. From a single price-taking firm, industry supply curve can be obtained by the horizontal summation of individual firm’s supply curves, in the short run. (H&H Ch. 7.1)

2. In the long run, two complications: (1) the factor-price effect, and (2) the entry and exit of firms from the industry. (H&H Ch. 7.1)

3. The price elasticity of supply measures the percentage change in quantity following a 1%-change in output price. (H&H Ch. 7.1)

4. The conditions for perfect competition, and for pure competition (no barriers to entry or exit).

5. A single seller: pure monopoly. (H&H Ch. 8.1)

6. Monopolistic competition: several firms selling goods which are close, but not perfect, substitutes. Long-run profits are zero. (H&H Ch. 9.2)

7. Price discrimination and the segmentation of markets. The mark-up with market power. Consumer’s surplus, and how to capture it. (H&H Ch. 7.3, 8.4)

8. Producer’s surplus and economic rent. (H&H Ch. 7.3) (Revision)

The single price-taking firm interacts with the rest of the world through markets, taking prices $P$ and $w_i$ as given:

- the market for output $y^D(P)$
- the markets for inputs $z^S_i(w_i)$

that is, the firm decides how much output $y^*$ to produce and sell, and how much of each input $z^*_i$ to buy in order to maximize profit, given —

- the demand for output $y^D(P)$
- the supply curves for inputs $z^S_i(w_i)$

(For a price-taking firm these are horizontal.)

Two directions in possible analysis:

1. The firm has market power and can influence the price $P$ it receives for output by altering its level of production & sales, in which case the firm’s demand curve is not horizontal.

By altering the amount $y^S$ it offers for sale, the firm can affect the price it sells at, so long as it faces a downwards-sloping demand curve,
and $\frac{\partial P}{\partial y_P} < 0$ is evidence of market power. (downwards sloping firm’s demand curve)

When this happens, we say there is imperfect competition, and speak of these (definitions)
- **monopoly** one seller,
- **monopsony** one buyer,
- **oligopoly** a few sellers.

(strategic behaviour) (→ game theory!)

We consider this below (next lectures).

2. We can aggregate across a large number of small (price-taking) firms to obtain the
   - **industry supply of output**, and
   - **industry demand for inputs** (e.g. labour).

(We assume that each firm produces identical output goods.)

We shall answer these questions:
Q: at marketing-clearing equilibrium ($S=D$):
   - what is the price of output? $P$
   - what are the prices of inputs? $w_i$
   - what are the quantities of outputs & inputs traded? $y, z_i$

and are these equilibria stable? That is, will prices and quantities adjust to a market-clearing equilibrium, where supply = demand?

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1. **Supply and Short-Run Response**
   (H&H Ch. 7.1)

1. When $P < P_V$ (where $P_V \equiv \min(AVC)$), then $y^* = 0$ because $TR < VC$, and profit < 0.

   When $P > P_V$,
   then $TR > VC$ and short-run $\pi > 0$ and $\pi$ maximum with $y^*$: $MC(y^*) = P$.
   (so long as increasing $MC$)

2. The price-taking firm’s supply curve is its $MC$ curve above breakeven ($\pi = 0$). The industry supply curve or market supply is obtained by horizontally adding all supply curves of individual firms:

   $P = \sum_{i} S_i$

   at any price of output ($P_1$) —
   how much will firm 1 supply? how much will firm 2 supply?

   The summation is similar to the summation of individual consumer demand curves to obtain the market demand curves (see above)

   but not exactly: there are complications:
2. **Two complications** in deriving the market supply curve from the individual firms’ supply curves:

**Long-run Responses:**

1. *the number of firms is not fixed in the long run*, but will adjust in response to profitability,
   \[ \therefore \text{ the number is responsive to output price } P \text{ and profits} \]
   
   - if a firm sees an opportunity for increased profit in a new market, it may enter,
   
   - if a firm is suffering low or negative profits in a market, it must eventually leave the market.

\[ \therefore \text{ As price } P \text{ rises, firms enter, } \text{ cet. par.} \]
\[ \text{ as price } P \text{ falls, firms leave, } \text{ cet. par.} \]

The effect of an increase in supply (due to more firms) is to bid down the price, and reduce the profit of the marginal firm to zero, i.e. no more incentive for entry or exit.

The **marginal firm** is the one with the highest average costs of production but positive profit still.
2. (Second complication) **The Factor-Price Effect.**

As the *price of output P rises* (say, cars) this may well have an effect on other markets (for example, labour or other markets in which *cars are an input* to production)

An increase in price of output P may thus

- result in *increased costs of production* for the firms,
- & result in a shift upwards in their supply curves.

\[ \therefore \text{ the effective industry supply curve} \]

be steeper (less elastic) than the aggregate of firms’ supply curves.

In conclusion:

- the short-run supply curve of a competitive (or price-taking) firm is identical to its *MC* curve (above min *AVC*),
- the short-run supply curve of a competitive industry is the horizontal sum of firms’ supply curves, adjusted for the factor-price effect,
- in the long run, the number of firms will change as marginal firms (in cost terms, *LRAC = P, \therefore \pi = 0*) enter or leave in response to positive or negative profit opportunities.
3. Price Elasticity of Supply:

Let \( \kappa \) denote the price elasticity of supply:

\[
\text{industry } \kappa = \frac{\Delta Q^S / Q^S}{\Delta P / P} \quad \text{(arc)} \\
= \frac{\partial Q^S}{\partial P} \frac{P}{Q} \quad \text{(point)}
\]

for a firm,

\[
\kappa_i = \frac{\partial Q^S_i}{\partial P} \frac{P}{Q_i} \quad \text{(point)}
\]

\( \kappa_i \) is +ve

**Defn.** The price elasticity of supply is the % change in output offered in response to a 1% increase in price of output.

But for the industry, \( \kappa \leq \sum_{i=1}^{n} s_i \kappa_i \), (note the inequality)

where \( s_i = \frac{Q^S_i}{\Sigma Q^S_i} \) is the market share

and \( \kappa_i \) is the price elasticity of supply of firm \( i \).

(The inequality is because of a time period for adjustment, and entry or exit of firms, and the factor-price effect.)

4. Pure Competition

A perfectly competitive market satisfies the following three conditions:

1. numerous buyers \( \Rightarrow \) price takers
   
   \( \therefore \) there is no market power for an individual buyer or seller to affect the market price.

2. A homogenous good & identical buyers (or arm’s length deals) \( \Rightarrow \) no price discrimination.

3. Perfect information of all offers to buy & sell \( \therefore \) there is one equilibrium price: \( S(P) = D(P) \).

+ 4. An additional condition \( \Rightarrow \) pure competition:

   there are no barriers to entry or exit
   
   \( \therefore \) zero long-run profit at the margin.

1, 2, 3 \( \Rightarrow \)

- individual consumers face horizontal supply curves
- individual firms face horizontal supply curves (inputs)
- individual firms face horizontal demand curves (outputs)

where \( \text{price: market supply = market demand} \)

\( \therefore \) price = marginal cost to producers
= marginal value for consumers

\begin{align*}
P & \quad S = \Sigma MC_i \\
D & \quad D = \Sigma D_j
\end{align*}
Short run:

\[ P > SRAC \] \therefore \text{profit is positive}

Long-run equilibrium when:

\[ P = LRMC = \min LRAC \]

and profit is zero.

In the diagrams (Smith 8-5, 8-6):

- quantity \( A_2 \) is less than \( A_1 \)
- competitive price \( P_{A_2} \) is less than \( P_{A_1} \).

For the price-taking firm:

- \( MR \equiv P = MC \),
- rising marginal costs \( MC \), and
- non-negative profits \( \pi \).
- For the *marginal* firm, profits are zero (\( \pi = 0 \)).

Although the industry demand curve is downwards sloping, the firm sees only a horizontal demand curve.
5. Pure Monopoly

The single seller (monopoly) faces a downward-sloping demand curve—it possesses market power, and can choose any combination \((P, Q)\) on the demand curve to maximize its profit \(\pi\). But choose \(Q\) to maximise profit \(\pi\).

\[
\pi = TR(Q) - TC(Q)
\]

\[
\max_Q \pi \Rightarrow \frac{d\pi}{dQ} = 0 = \frac{dTR}{dQ} - \frac{dTC}{dQ}
\]

\[
\therefore MR(Q^*) = MC(Q^*) \text{ for } \pi \text{ max.}
\]

\[
\rightarrow Q^* \rightarrow P^*
\]

Marginal Revenue \(MR\) = \(\frac{d(P\times Q)}{dQ}\)

\[
= P\times(1 + \frac{1}{\eta^P})
\]

\[
\leq P, \text{ (i.e., market power)}.
\]

because the price elasticity of demand \(\eta^P\) is negative.

\[
\therefore P \geq MC \text{ with market power}
\]
Demand = $AR = P$

$MC = AC = 30¢$

$TR = P \times Q, \quad P = P(Q)$

$\Delta TR = P \times \Delta Q + \\Delta P \times Q$

$MR = \frac{\partial TR}{\partial Q} = \frac{\partial P(Q)}{\partial Q} Q + P$

Q: At what quantity is Revenue maximised?

In the long run · · ·

( · · · we’re all dead – J.M. Keynes)

Competitive market:

$AR = P = MC = AC$

& $\pi = 0$

because

$AR = AC$

so: for the marginal firm, profit is zero, having been competed away by new entrants.

Long-run equilibrium when:

$P = LRMC = \min LRAC$

and economic profit is zero.

The positive profits attract new entrants, whose output in aggregate reduces the price at which supply equals demand, until profits disappear (at least at the margin).

To attain a competitive advantage, firms want to secure a market position that protects from imitation and entry.
6. Monopolistic Competition:

For a firm (a monopoly ?) with market power (i.e. facing a downwards-sloping demand curve) with other firms selling close substitutes, there is competition as firms change the prices of the close substitutes, which results in a shift to the left in the demand curve that our firm faces.

\[ \rightarrow \text{Monopolistic Competition} \]

Conditions for Monopolistic Competition:

1. firms compete by selling differentiated (such as branded) products; substitutes but not perfect substitutes; so they have some market power;
2. free entry and exit; no barriers;
3. firms do not behave strategically, they assume their competitors’ actions fixed;
4. buyers are price takers; no bargaining.

Summary:

1. Prices of substitutes affect the demand curve, downwards-sloping. (imperfect substitutes)
2. Assume that each firm takes others’ actions constant & then sets sales \( Q_{SR}^* \) so that
\[
MR(Q_{SR}^*) = MC(Q_{SR}^*) \quad (SR \Rightarrow \text{Short Run})
\]
to maximize its profit \( Q_{SR}^* \rightarrow P^* \).
3. In general, \( P^* > AC(Q^*) \) for each firm, so that profit \( \pi \) is positive in the short run.
\[ \Rightarrow \text{attractive for new firms to produce close substitutes in the long run.} \]
4. In the medium-to-long run, new entrants invest, and the original firms’ demand curves move to the left, as their market share falls.
5. In the long run \( LR \), all profits will be bidded away for the marginal firm, with
\[
AR = D \equiv P = AC \quad \therefore \pi = 0
\]
and maximum profit point on demand curve
\[
(i.e. \text{output } Q_{LR}^*: \quad MR(Q_{LR}^*) = MC(Q_{LR}^*))
\]
\[ \therefore \text{the demand curve must be tangent to the } AC \text{ curve at the price } \& \text{ output chosen. } (LR: \text{long run}) \]

(See the T-shirt case.)
Monopolistic Competition

Long-run equilibrium at the margin.

(Remember: average profit = average revenue – average cost.)

There will be excess capacity: firms will not operate at minimum AC, and so they could reduce AC by increasing output. Why don’t they?

Competitive Pricing and Monopoly Pricing
### Assume: Many Buyers

<table>
<thead>
<tr>
<th>Number of Sellers</th>
<th>One</th>
<th>A Few</th>
<th>Many</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homogenous Product</td>
<td>Pure Monopoly</td>
<td>Homogeneous Oligopoly</td>
<td>Pure Competition</td>
</tr>
<tr>
<td>Differentiated Product</td>
<td>Pure Monopoly</td>
<td>Differentiated Oligopoly</td>
<td>Monopolistic Competition</td>
</tr>
</tbody>
</table>

#### Market Structure

(One buyer, many sellers: *monopsony.)*

“I think it’s wrong only one company makes the game Monopoly”

— US humorist, Steve Wright

### HOMOGENEOUS or DIFFERENTIATED?

Degree of Substitutability?

- Physical Attributes
- Ancillary Services
- Geographical Location
- Subjective Image
7. Price Discrimination

When a company which possesses some market power charges its consumers different prices for essentially the same product.

With market-power, the profit-maximization output $y^*$ is given by:

$$MR(y^*) = MC(y^*)$$

but since (with uniform pricing):

$$P = D = AR > MR$$

it is not the case that $P = MC$.

Instead,

$$P > MC$$

$$P = \frac{MC}{1 - \frac{1}{|\eta_P|}}$$  \(\text{see above}\)

$$\therefore \frac{P}{MC} = \frac{1}{1 - \frac{1}{|\eta_P|}} > 100\%$$

when elastic: $|\eta_P| > 1$

= the mark-up (or $P/MC - 1$).

The monopolist would like to segment the market according to the price elasticity of demand $\eta_P$ and charge higher prices for those consumers with lower elasticities of demand.

Similarly: Taxes: on items with lower $\eta$? Which?
Price Discrimination can take three broad forms:

1. **First-Degree Price Discrimination**
   To capture all the consumers’ surplus, the firm with market power would like to charge each of its customers the maximum price that customer is willing to pay for each unit sold. *Perfect price discrimination.*

2. **Second-Degree Price Discrimination**
   In some markets (water, electricity, etc.) each consumer buys many units of the good over any given period, and the consumer’s demand falls with the number of units bought.
   In this situation, a firm can discriminate according to quantity bought. *Multi-part pricing* or *declining block pricing*, where the price for later blocks bought is lower than the price for the earlier blocks.

3. **Third-Degree Price Discrimination**
   The firm *segments the market* into two or more groups with separate demand curves for each group, and charges the members of each group the same price, but members of different groups different prices.
   This is the most common version of price discrimination (haircuts, airfares, generic brands, student and pensioner discounts).
   For the groups, total output must be divided between groups to equalise their marginal revenues (otherwise firms are not maximising profits).

   Total output must be such that marginal cost equals marginal revenue across all groups (otherwise the firms are not maximising profits). Total output is determined by horizontally summing the marginal revenues of all groups and equating this sum with the marginal cost of total production.

   Remember that the mark-up formula gives:
   \[
   MR = P (1 + \frac{1}{\eta}), \quad \eta < 0
   \]
   and \( MR_1 = MR_2 \) implies that the ratio of prices in two segments is
   \[
   \frac{P_1}{P_2} = \frac{(1 + 1/\eta_2)}{(1 + 1/\eta_1)}
   \]
   so the higher price is charged to the consumers with the lower demand elasticity, as expected.

4. **The Two-Part Tariff**
   Another way of extracting consumer surplus:
   • charge an up-front fee \( T \) (for membership or entrance or connection or a “monthly service fee”) and then
   • charge a further per-unit price \( P \) for usage (for use or rides or phone calls or water litres).

   How to set the connect/entry fee \( T \) and the usage fee \( P \)? For a single consumer: let \( P = MC \) and \( T \) equal the entire consumer surplus.
8. Consumers’ Surplus

Remember: each point on the demand curve gives the *highest uniform price* at which consumers are willing to buy the corresponding quantity of output.

At price $P_1$ there exist some consumers (represented by the demand curve to the left) whose *net willingness to pay* is still positive.

At price $P_1$ they gain *consumers’ surplus*, which (if their expenditure is a small fraction of their total expenditure, so that there are no income effects with the price change) equals the area above the price and below the demand curve.

So consumers’ surplus is a willingness to pay over and above the uniform price (at uniform pricing or general pricing).

A monopolist might like to segment the market and *price discriminate* to increase his or her producers’ surplus at the expense of consumers’ surplus.

8.1 Producers’ Surplus and Economic Rent

Each point on the supply curve (the $MC$ curve for price-taking firms) gives the *lowest uniform price* which suppliers are willing to sell the corresponding quantity of output.

The firm’s view: $P.S. = TR - VC$

$\therefore \pi = P.S. - FC$

At price $P_1$ there exist some producers (represented by the supply curve to the left) who would sell at prices below $P_1$: their *net willingness to sell* at $P_1$ is still positive.

At price $P_1$ they gain *producers’ surplus*, or *economic rent*: a return to producers over and above the minimum necessary to induce them to supply $Q_1$ in aggregate. $P.S.$ equals the area below the (uniform) price and above the supply ($MC$) curve.
In the long run, monopolistic-competition equilibrium there will be excess capacity,

i.e. firms will not operate at the minimum efficient scale ($y'$, which results in the minimum $AC$), and so they could reduce $AC$ by increasing output.

\[ MC = AC \Rightarrow \text{constant cost firm} \]
9. Summary

In this section, we have considered:

1. How industry supply curves are derived from those of individual firms, and the complications of achieving this, in the short run and the long.

2. The differences between pure and perfect competition, at one extreme, and

3. The use of market power by a profit-maximising monopolist, at the other extreme.

4. What the long-run equilibrium condition of zero profits for the marginal firm means when firms face horizontal demand curves (no market power) or downwards-sloping demand curves (with market power) in the case of monopolistic competition.

5. How and why firms with market power might segment the market and price discriminate in order to capture more of consumers’ surplus and so increase their profits.


7. The meaning of economic rent, and the relationship between producers’ surplus and profit.