Economies of scale and international trade

- In the models discussed so far, differences in prices across countries (the source of gains from trade) were attributed to differences in resources/technology. Countries specialize in the things they do relatively well (produce inexpensively).
- All these models were characterized by constant returns to scale technologies and perfectly competitive markets.
- Not all commodity markets exhibit purely competitive behavior. Moreover, the phenomenon of intra-industry trade cannot be explained with models based on perfect competition.
- We will therefore look at imperfect market structures, particularly at a model with *monopolistic competition* where there are scale effects in production that provide an explanation for international trade patterns going beyond the relevance of asymmetries in technologies or factor endowments.

Two types of economies of scale

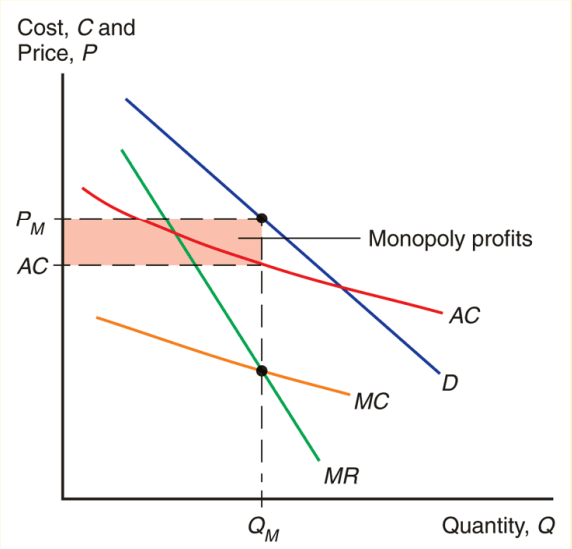
- By *economies of scale (EOS)*we refer to the fact that the unit costs decrease with the scale of production. This implies the following regarding production and pattern of trade: It pays of to specialize in relatively few goods in order to achieve large scale of production.
- *Internal economies of scale:* the size of the individual firm matters, i.e. larger firms have a cost advantage over smaller firms.
- *External economies of scale:* the size of the industry matters. A firm trying to expand will face increasing costs, but as the industry as a whole expands, the costs of the individual firms are lowered.
- These two types of EOS have different implications for market structure:
  - An industry with purely external EOS typically consists of many small firms that perfectly compete with each other.
  - Internal EOS, however, because large firms have cost advantages over small firms, are characterized by an imperfectly competitive market structure.

Review of the pure monopoly

Figure 6-1

Monopolistic Pricing and Production Decisions

A monopolistic firm chooses an output at which marginal revenue, the increase in revenue from selling an additional unit, equals marginal cost, the cost of producing an additional unit. This profit-maximizing output is shown as Q_M; the price at which this output is demanded is P_M. The marginal revenue curve *MR* lies below the demand curve *D*, because, for a monopoly, marginal revenue is always less than the price. The monopoly's profits are equal to the area of the shaded rectangle, the difference between price and average cost times Q_M.



Monopolistic competition

- A firm making high profits normally attracts competitors. That is why case of pure monopoly are rather rare in practice. *Oligopoly* is the market structure that is more common to industries characterized by internal EOS.

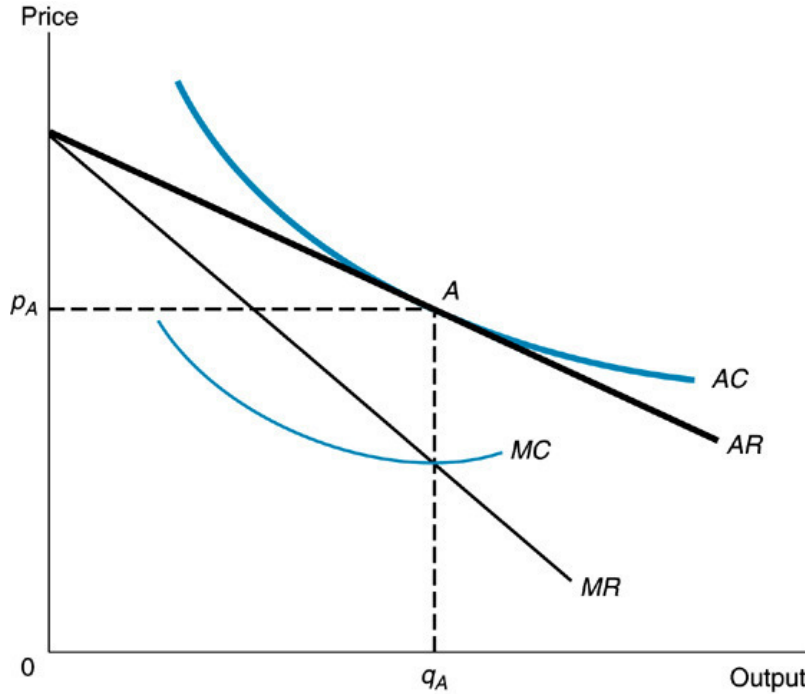
- Analysis of oligopolistic behavior is complex however because the pricing policies of the firms are interdependent. We will therefore analyze a special case of oligopoly, i.e. *monopolistic competition*.

- In models of monopolistic competition, two key assumptions are made in order to get around the problem of interdependencies:

  1. Firms can differentiate their products from that of their rivals. That is, they are not perfect substitutes but only to some degree. This assumption assures that firms have some degree of monopolistic power and are somewhat insulated from competition.

  2. Each firm takes the prices charged by its rivals as given, i.e. it ignores the impact of its own price on the prices of other firms: even though each firm faces competition it behaves as if it were a monopolist.

Free entry and a downward sloping demand curve



Formalizing

- A firm in a monopolistically competitive industry is expected:
  - to sell more the larger the total sales of the industry and the higher the prices charged by its rivals.
  - to sell less the larger the number of firms in the industry and the higher its own price.
- To incorporate these properties, we assume that a typical monopolistically competitive firm faces a downward-sloping demand curve of the form:

$$Q = S \times \left[1/n - b\left(P - \bar{P}\right)\right]$$

The terms in the demand equations

$$Q = S \times \left[1/n - b\left(P - \bar{P}\right)\right]$$

- Q is an individual firm's sales
- S is the total sales of the industry
- n is the number of firms in the industry
- b is a constant term representing the responsiveness of a firm's sales to its price
- P is the price charged by the firm itself
- $\bar{P}$ is the average price charged by its competitors

Finding the market equilibrium

- In order to simplify things, we assume that all firms face identical demand and cost functions.
- In a symmetric equilibrium, the state of the industry can be described without going into details of each firm; all that has to be known is the number of firms in the industry and what price a typical firm would charge.
- Once n and $\bar{P}$ are known, we can ask how they are affected by international trade.
- We follow a three step approach:
  1. Derive the relationship between average costs and the number of firms in a market.
  2. Determine the relationship between the number of firms and the price charged.
  3. Find the equilibrium number of firms where no entry or exit occurs.

The number of firms and average costs

- The cost function of a firm is given by

$$C = F + cQ$$

where F are fixed costs and c are constant marginal costs.

- Individual output is then given by $Q = S/n$. The firms' average costs are defined as the cost per unit, and are given by

$$AC = \frac{C}{Q} = \frac{F}{Q} + c = \frac{F}{S}n + c \tag{1}$$

- We can see that
  1. The larger the number of firms n in the industry, the higher the average cost for each firm because the less each firm produces.
  2. The larger the total sales S of the industry, the lower the average cost for each firm because the more that each firm produces.

Price and marginal revenue

- In order to determine the relationship between the number of firms and the price, it is useful to look at the relation between price and marginal revenue of a monopolistic competitor first.

- Assume that each firm faces a linear demand function described by

$$Q = A - B \cdot P \quad \Longleftrightarrow \quad P = \frac{A}{B} - \frac{Q}{B}$$

- Total revenue TR of such a firm is given by the price times quantity sold:

$$TR = PQ = \frac{A}{B}Q - \frac{Q^2}{B}$$

- The marginal revenue is the extra revenue a firm gains from selling one additional unit. It is given in this case by

$$MR = \frac{\partial TR}{\partial Q} = \frac{A}{B} - \frac{2Q}{B} = P - \frac{Q}{B}$$

The number of firms and the price (1)

- When rearranging we see that the gap between price and marginal revenue depends on the initial sales Q of the firm and the slope of the demand curve B:

$$P - MR = \frac{Q}{B}$$

- When taking the average price charged by the competitors as given, we can write our demand function as

$$Q = \underbrace{S(1/n + b\bar{P})}_{=A} - \underbrace{Sb}_{=B} \cdot P$$

- The relationship between marginal revenue and price in this case is therefore

$$MR = P - \frac{Q}{Sb}$$

- A profit-maximizing firm sets marginal revenue equal to marginal cost: $MR = MC$.

The number of firms and the price (2)

- By setting $MR = MC$ we get

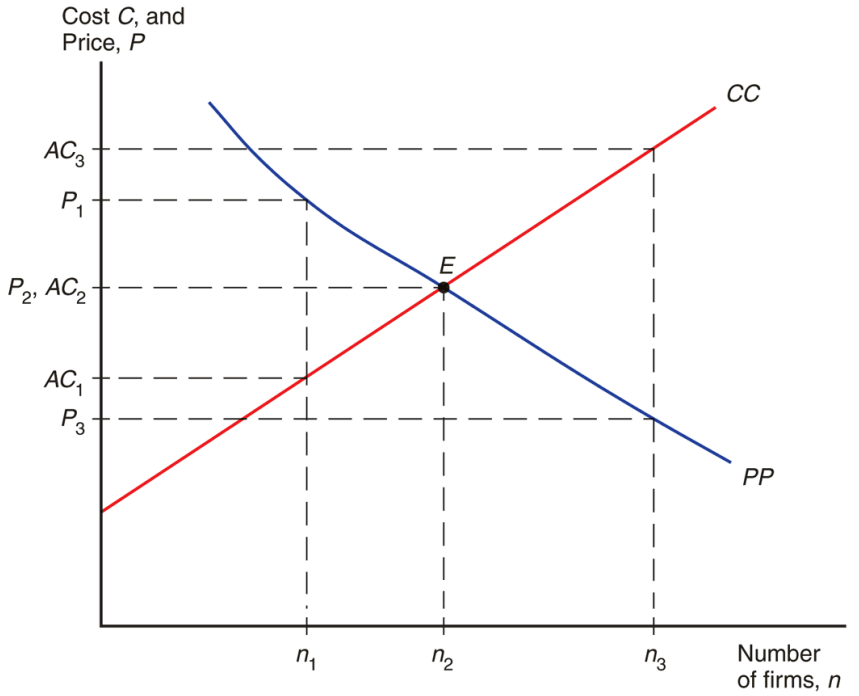
$$P - \frac{Q}{Sb} = c$$

- We have already noted that we look at an equilibrium in which all firms behave identically, i.e. all charge the same price. This implied that each firm's output is $Q = S/n$. When using this information, we find that the price is given by

$$P = c + \frac{1}{b \cdot n}$$

- This result is quite intuitive: the more firms n there are in the market, the more intense the competition among them will be. Therefore, price and number of firms are inversely related.

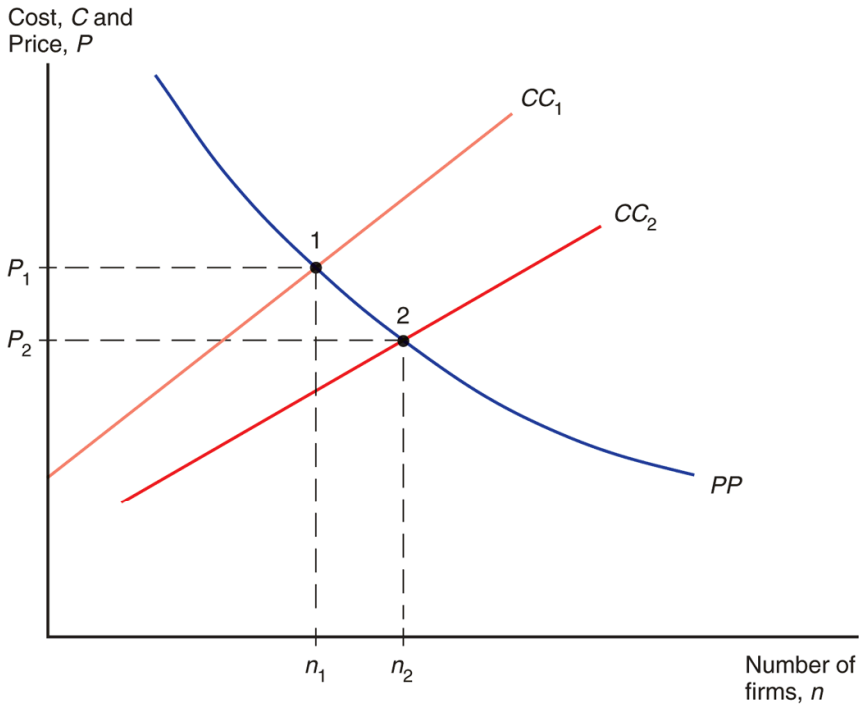
The equilibrium number of firms



Monopolistic competition and trade

- Trade increases market size which is the variable that constrains the variety that can be produced and the scale of production.
- With free trade, each country's firms can concentrate production on a smaller range of varieties and import the rest. Thereby, the total amount of varieties available to consumers is increased while cost advantages associated to EOS can be exploited.
- "...trade improves the trade-off between scale and variety that individual nations face." (Krugman/Obstfeld, p.121).

Effects of a larger market



Gains from an integrated market: a numerical example

- Imagine that automobiles are produced by a monopolistically competitive industry. The demand that each producer faces is of the above specified form with a slope term of $b = 1/30'000$.
- Assume further that there is a fixed cost $F = 750'000'000$ and constant marginal costs given by $c = 5'000$.
- Let there be two countries, Home and Foreign. The annual car sales are $S = 900'000$ in Home and $S^* = 1'600'000$ in Foreign.
- Find the equilibrium number of firms and the price charged in each country before trade. What happens if the two countries start trading with each other?

Calculations

Gains from an integrated market: results

	Home market, before trade	Foreign market, before trade	Integrated market, after trade
Total sales	900'000	1'600'000	2'500'000
Number of firms	6	8	10
Sales per firm	150'000	200'000	250'000
Average cost	10'000	8'750	8'000
Price	10'000	8'750	8'000

Gross vs. net trade flows

- When talking about net trade flows, one is referring to homogeneous product categories (e.g. Automobiles).
- Considering gross trade flows takes into account that product categories may be heterogeneous (e.g. BMW, Mercedes, Fiat, etc.).
- Although the net trade flow of Autos in a country is close to zero, there could be significant gross trade flows because imports and exports of different varieties take place.
- Inter industry trade reflects comparative advantage
- Intra industry trade is independent of comparative advantage

Example and conclusion

- H-O model, 2 goods (X is K-intensive, Y is L-intensive), Home is K abundant, Foreign L abundant. With IRS and preferences for variety, both countries will export and import both goods. However, Home will be a net exporter X and Foreign of Y. (Even with the same K/L ratio in both countries there will be international trade $\rightarrow$ intra-industry trade!)
- The less similar the two countries (in terms of K/L), the larger the component of inter-industrial trade.
- The more similar the two countries (in terms of K/L), the larger the component of intra-industrial trade.
- Implication for income distribution: the effects of intra-industry trade are smaller than those of inter-industry trade.

External economies of scale

- Examples: Financial sector in NYC , 42nd street, Silicon Valley, Hollywood
- An initial advantage (head start) may persist. A country may produce and export something even if it would not have a cost advantage without the head start.
- In terms of welfare (gains from trade) this means that a country may end up worse off as a result of international trade.
- Consider e.g. the watch industry (graph below).

External EOS and trade