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The Economics of the European Union

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Lecture 6: Economies of Scale, Imperfect Competition and Market Integration

Market Integration in Imperfectly Competitive Markets

- The assumptions of the absence of economies of scale and the existence of perfect competition are rather extreme assumptions, as many markets are characterized by scale economies and imperfect competition.
- In fact, from its very inception in the 1950s, an important premise behind the drive for European economic integration was the belief that unification of European economies would make European firms more efficient and competitive, by allowing them to achieve a bigger scale and reduce their average costs. Also the belief that market integration would lead to reduced profit margins that would benefit consumers.
- The idea was that market integration, through initially the common market and, later on the single market, would give European firms access to a bigger markets, and lead to firms of a bigger scale and at the same time lead to more competitive product markets.

Market Fragmentation in Europe

- Europe's national markets were, and in some cases still are, separated by a whole host of barriers.
- These included EEC tariffs and import quotas, until the Common Market was completed in 1968, and tariffs between the EEC and EFTA until the EEC-EFTA free trade agreements were signed in 1974.
- In addition, many technical, cultural, administrative, physical and fiscal barriers existed and exist besides tariffs, making it easier for a firm to sell in its own national market than in other EU markets.
- As a result, many European firms dominate in their home market but are marginal players in other national markets.
- Programs that reduce market fragmentation, such as the single market program, make European markets more competitive, in that price cost margins fall, inefficient firms close down, and the average size of remaining firms increases.

Econometric Evidence

- Bellone et al (2008) found that the implementation of the single market program and economic and monetary union reduced price cost margins in French manufacturing by 4-5 percentage points.
- Allen et al (1998, 1999), examining a more general data set had also found a 4% average drop in price cost margins in European industry as a result of the Single Market Programme.
- Badinger (2007), using data from ten member states over 1981-1999, for manufacturing, construction and services, found markup reductions in manufacturing and construction, but not services.
- Chen et al (2009), using disaggregated data, find the existence of a pro competitive effect from economic integration. Prices and markups fell and productivity rose.

Scale Economies

- There are economies of scale when production is becoming more efficient as the scale of production increases.
- With economies of scale, doubling the quantities of inputs leads to more than a doubling of the volume of output.
- Alternatively, the average cost of production decreases as the scale of production increases.

Internal versus External Scale Economies

- *External Economies of Scale* occur when the average cost of production depends negatively on the size of the industry, and not the size of particular firms.
- *Internal Economies of Scale* occur when the average cost of production depends negatively on the size of firms and not the size of the industry.
- External Economies of Scale are compatible with competitive sectors.
- Internal Economies of scale are not compatible with perfectly competitive sectors, and necessarily lead to imperfect competition (monopolies or oligopolies).

A Simple Characterization of Internal Economies of Scale

Assume a firm that produces output q

Its total cost of production consist of two elements: A fixed cost F, which is independent of its scale of production, and a variable cost, which depends linearly on its scale of production. So the more it produces, the higher its total cost, as the variable cost increases at the same rate as the increase in its volume of production.

This total cost function can be written as,

$$C=F+cq$$

We can define the marginal cost of production by taking the first derivative of the total cost function with respect to q. This gives us a marginal cost of production which is constant at c

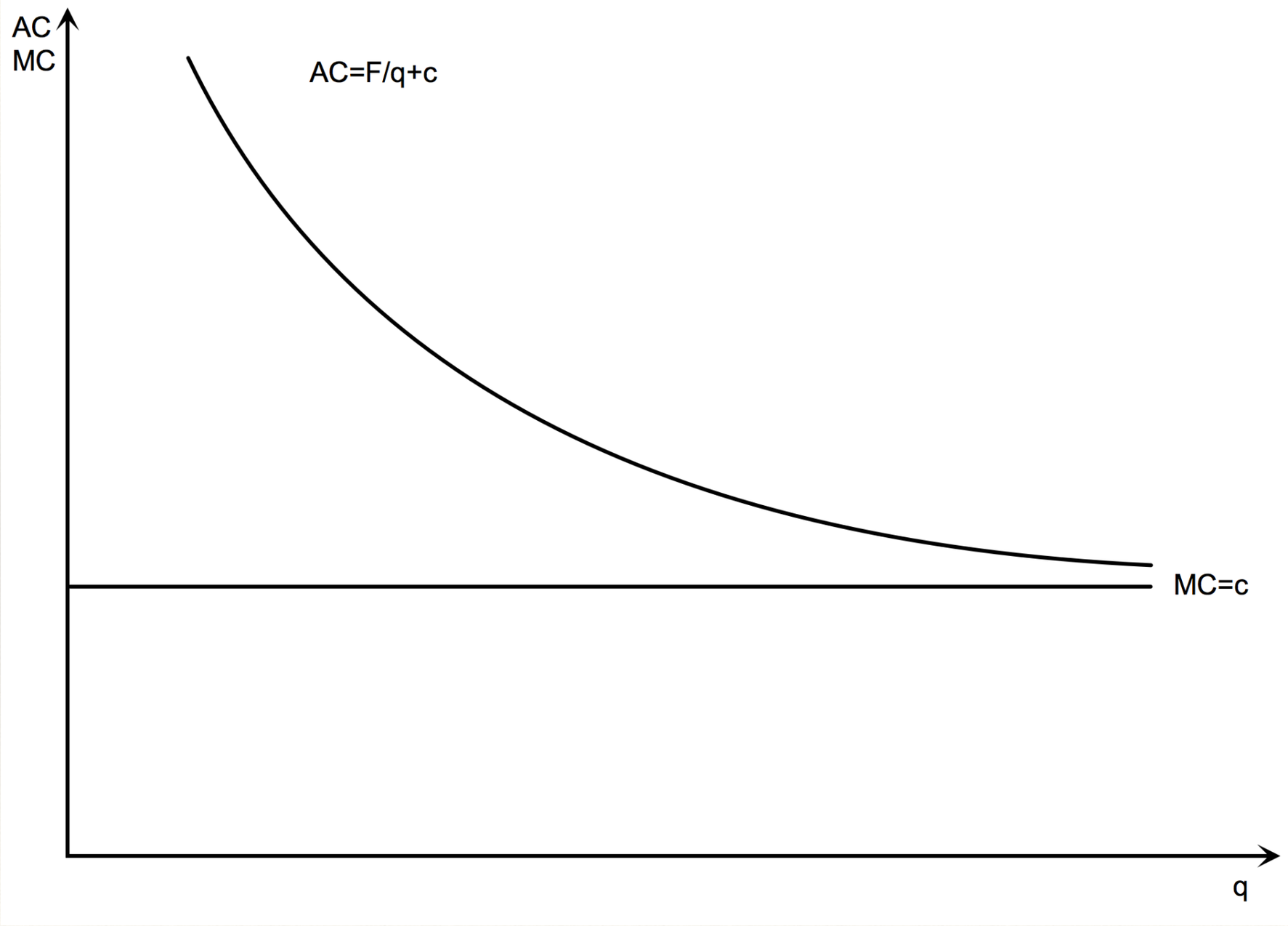
$$MC=c$$

The average cost of production is defined by,

$$AC=F/q+c$$

One can see that the average cost of production is declining as the scale of production increases.

The Shape of the Average Cost and the Marginal Cost Curve



Why Perfect Competition Cannot Prevail with Internal Scale Economies

- In perfectly competitive markets, all firms sufficiently small, so that their production decisions have no effect on the market price. Essentially they have no market power, and they take the price of the good that they produce as given.
- Profit maximization requires that price is equal to marginal cost.
- If a sector which is characterized by internal scale economies was competitive, the equilibrium price would have been equal to the marginal cost.
- However, as we can see from the previous diagram, this would imply that all firms would be making losses at the equilibrium price, as the equilibrium price would be below their average costs.
- Thus, in a competitive equilibrium all firms would be making losses, and they would be forced to close down. This would reduce the number of firms until the point where the sector stops being perfectly competitive and becomes imperfectly competitive.

The Economics of Imperfect Competition

- In markets with a limited number of firms, firms have market power, in the sense that their own production decisions affect the market price, and they cannot act as price takers. They essentially affect (set) prices in the market.
- Thus, in imperfectly competitive markets, profit maximization does not result in prices being equal to marginal cost, as each individual firm does not face a perfectly elastic (horizontal) demand curve for its product, but a downward sloping demand curve.
- In imperfectly competitive markets, profit maximization implies that firms set marginal costs to be equal to their marginal revenue, which is lower than the market price.
- The reason is that for any firm with market power to be able to sell additional goods and services, the market price must fall in order to induce consumers to buy the additional goods and services. But if the market price falls, the extra revenue that the firm gets from an additional unit it sells is lower than the price, because the firm loses revenue on all the units it sold on the previously higher price. So the extra revenue from an additional unit of production (marginal revenue) is lower than the price.

A Simple Characterization of the Demand Conditions in an Imperfectly Competitive Market

Assume that the total demand Q for a product produced in an imperfectly competitive market is determined by the following linear demand curve, where P is the price of the product.

$$Q=A-bP$$

The price as a function of the level of production is given by,

$$P=(A-Q)/b$$

A rise in the level of industry production by one unit, reduces the price by $1/b$ units.

Total revenue is given by,

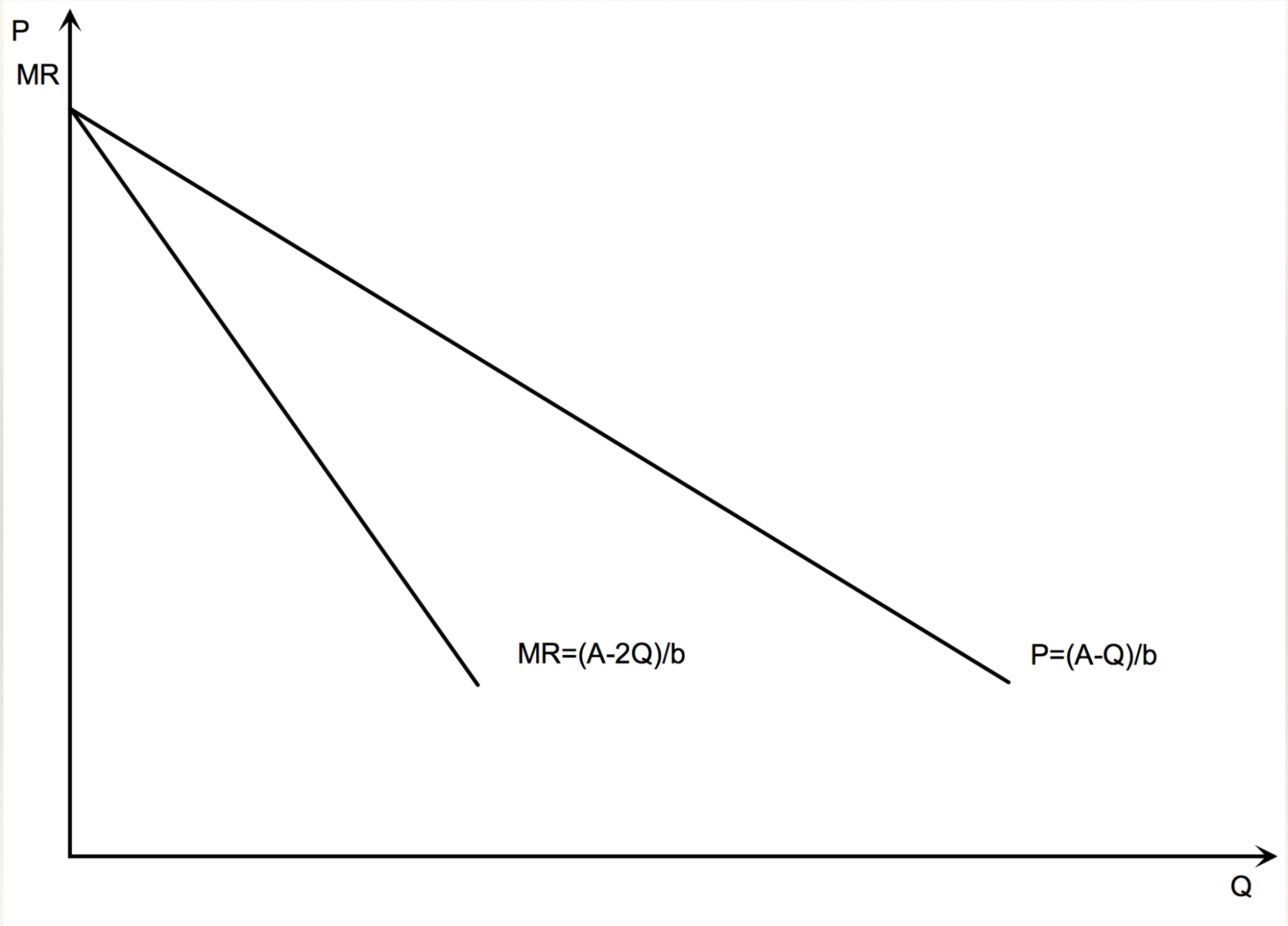
$$TR=PQ=((A-Q)/b))Q=(A-Q)Q/b$$

The extra revenue from a rise in production by one unit (marginal revenue) is given by,

$$MR=(A-Q)/b-Q/b=(A-2Q)/b$$

Thus, the marginal revenue of each particular firm is lower than the price.

The Shape of the Demand Curve and the Marginal Revenue Curve



The Economics of Monopoly

The case of a single firm (monopoly) is the simplest case of imperfectly competitive markets that can be analyzed.

In a monopolistic market there are no other firms, and therefore no strategic interactions between firms.

The firm is assume to maximize its profits, subject to the market demand curve and its total cost curve.

The profits of a monopolist are defined as,

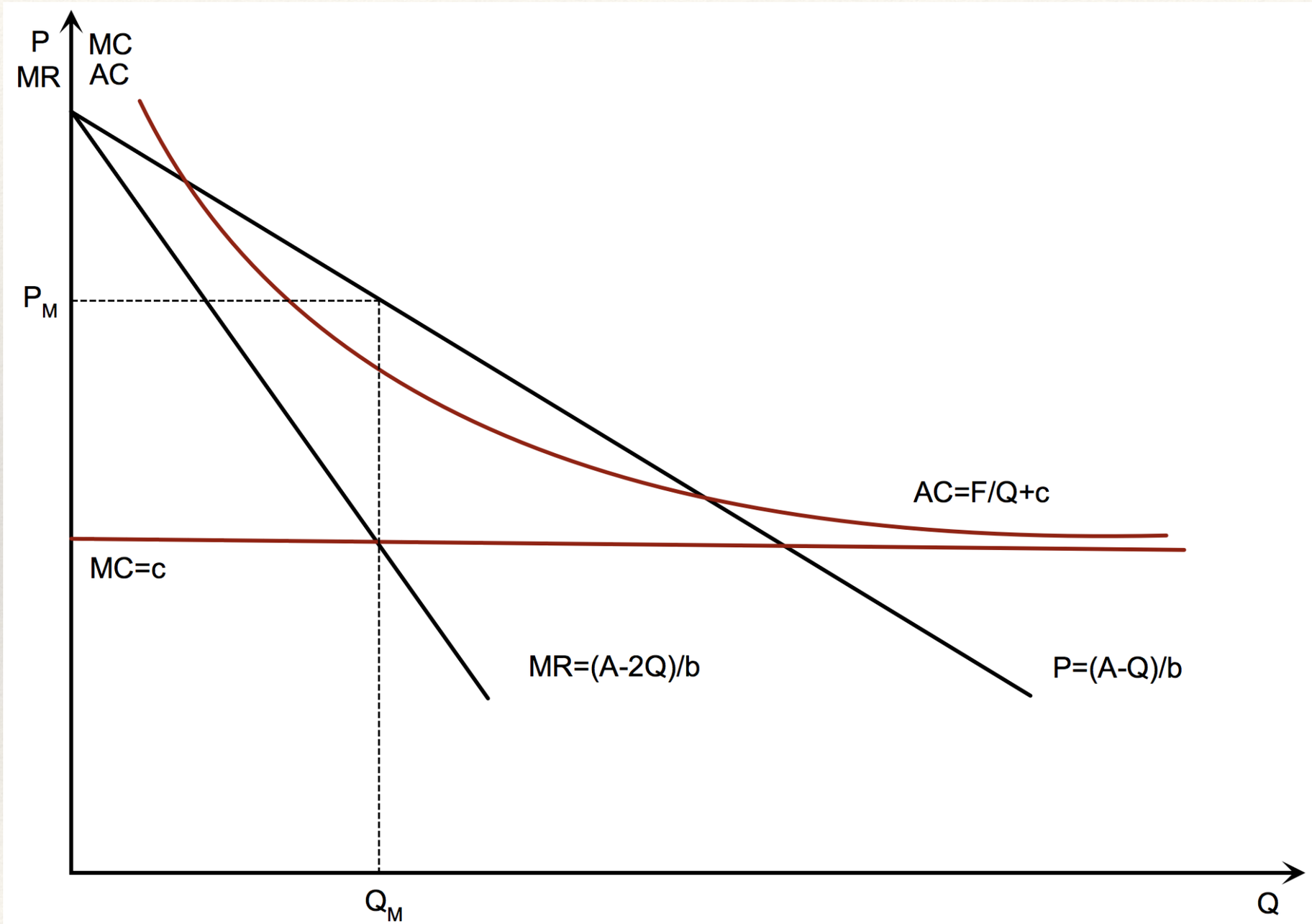
$$TR-TC=PQ-F-cQ=(A-Q)Q/b-F-cQ$$

From the first order conditions for profit maximization,

$$(A-2Q)/b=c$$

Thus, in order to maximize profits the monopolist equates marginal revenue to marginal cost. The monopolist alone is the one who decides how much output will be produced and sold in the market.

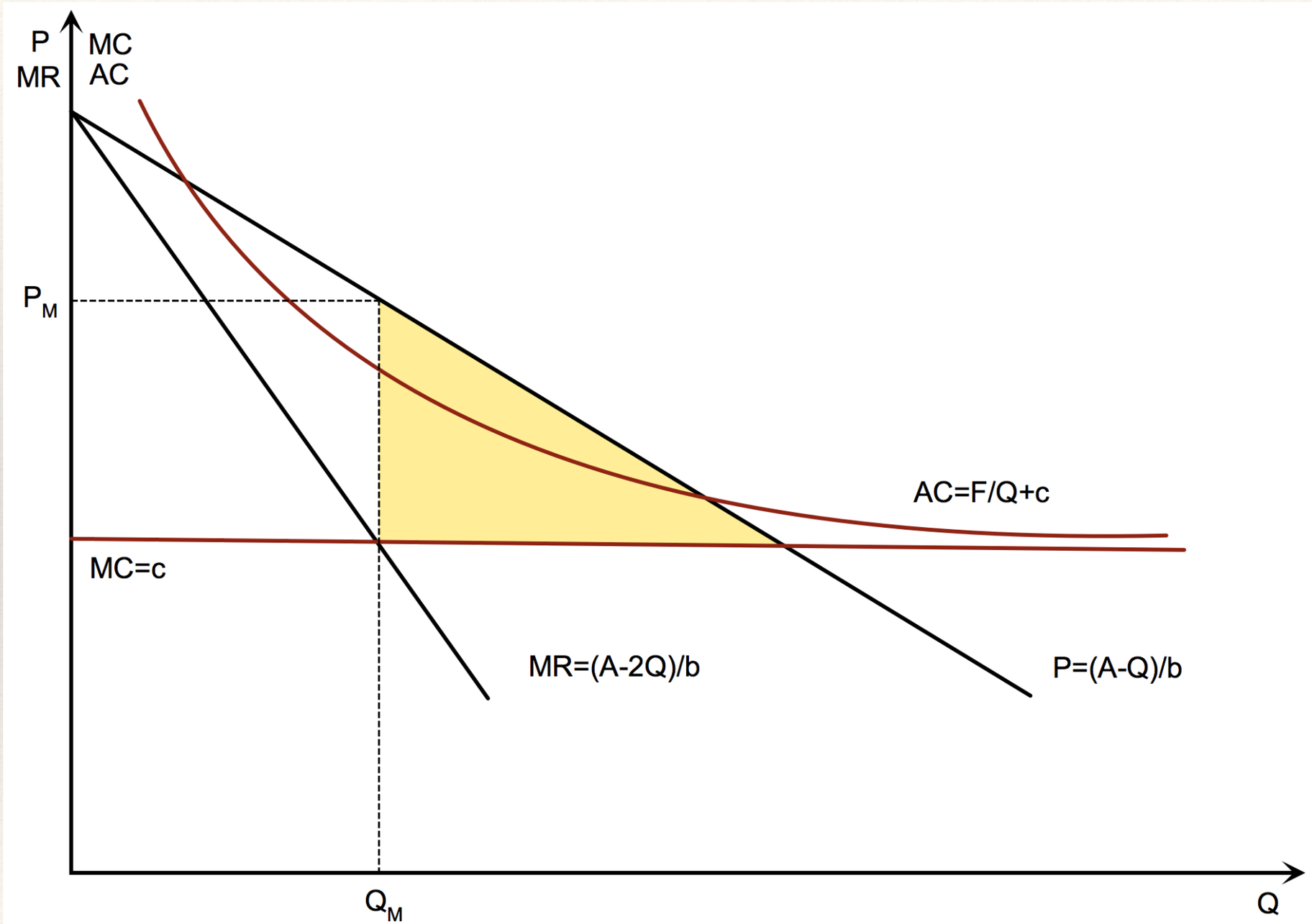
A Diagrammatic Exposition of the Economics of Monopoly



Monopoly versus Perfect Competition

- A monopoly results in lower production and sales than a competitive market. In our case production and sales are equal to $(A\text{-}bc)/2$. This is half than what a competitive market would produce.
- A monopoly results higher prices than a competitive market. The competitive market price would have been c. The monopoly price $P_M=c+(A\text{-}bc)/2b$
- The monopoly implies a welfare cost for consumers relative to perfect competition, which is equal to the loss of consumer surplus. This is equal to $(A\text{-}bc)^2/4b$

The Welfare Cost of Monopoly



Beyond Monopoly

- Monopolies are relatively rare forms of industrial organization. Most industries are characterized by a limited number of firms, i.e they are oligopolies
- In analyzing oligopolies, one has to take account of the strategic interactions between firms.
- For example, the effects of one firm's production decisions on the market price, depend on the reaction of other firms in the industry, regarding their own production
- These strategic interactions can be understood by first studying a duopoly, i.e an industry in which there are two firms rather than one

A Duopoly

Assume now a duopoly. There are two firms, 1 and 2. The production of firm 1 is Q_1 and the production of firm 2 is Q_2. The firms face the market demand curve and they each have a cost curve with increasing returns.

$$Q=Q_1+Q_2$$

$$P=(A-Q_1-Q_2)/b$$

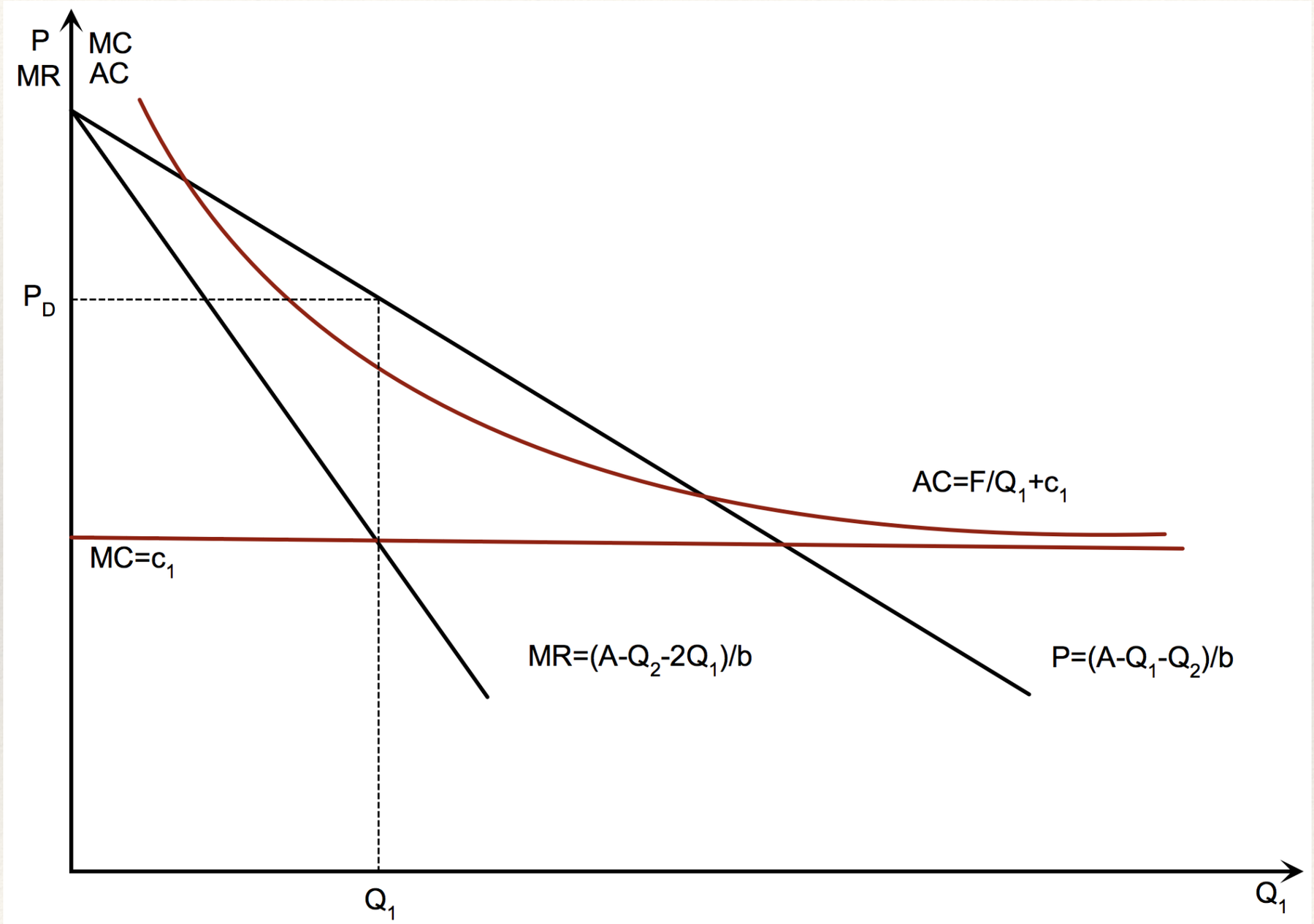
Each firm maximizes profits, *taking the output of the other as given*. From *MR=MC*,

$$Q_1=(A-Q_2-bc_1)/2$$

$$Q_2=(A-Q_1-bc_2)/2$$

These are called *reaction functions*. They determine the optimal response of one firm's production to the production decision of the other.

Profit Maximization in a Duopoly



Equilibrium in a Duopoly

A duopolistic market will be in equilibrium if the conjecture of each firm about the production level of its competitor is correct. This will only happen if the reaction functions of both firms are simultaneously satisfied. In equilibrium, the production of each firm is the best response to the production of the other. This is the definition of a *Nash equilibrium,* but was first analyzed in this context by Cournot.

Solving the reaction functions for Q_1 and Q_2 we see that,

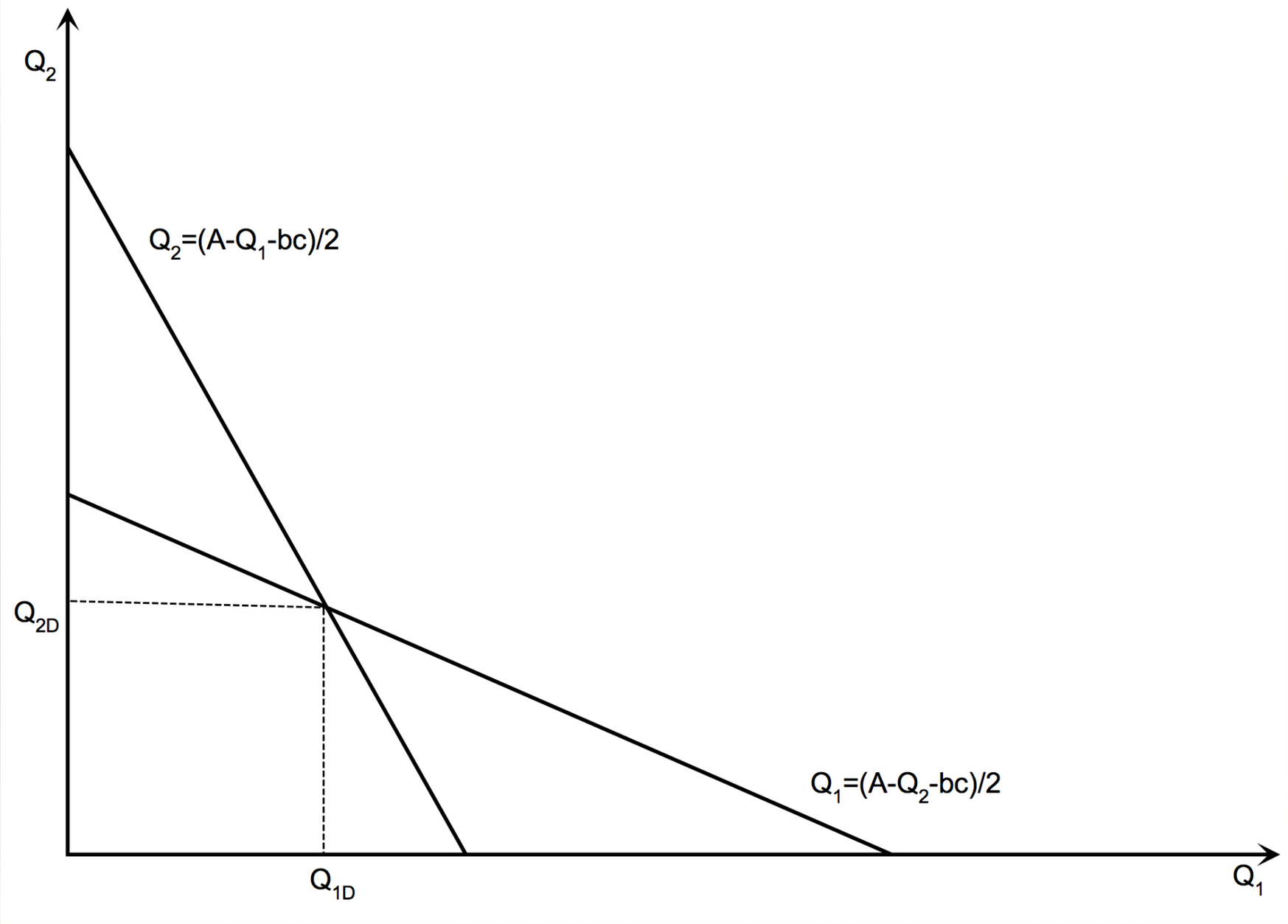
$$Q_1=(A-b(2c_1-c_2))/3 \text{ and } Q_2=(A-b(2c_2-c_1))/3$$

In equilibrium, the firm with the higher marginal cost ends up producing less than its competitor.

In a symmetric equilibrium, with $c_1=c_2=c$, both firms produce the same.

$$Q_1=Q_2=(A-bc)/3$$

A Diagrammatic Exposition of Equilibrium in a Symmetric Duopoly



Production and Prices in a Duopolistic Market

$$Q_D=2(A-bc)/3$$

$$P_D=c+(A-bc)/3b$$

where, $c=(c_1+c_2)/2$

It is obvious that,

$$Q_D>Q_M$$

$$P_D<P_M$$

A Comparison of a Duopoly with a Monopoly

- Production is higher in a duopoly than in a monopoly and prices and price cost markups are lower.
- Thus, total firm profits in a duopoly a lower than in a monopoly.
- In addition, the loss of consumer surplus in lower in a duopoly than in a monopoly.

Antoine Augustin Cournot (1801-1877)

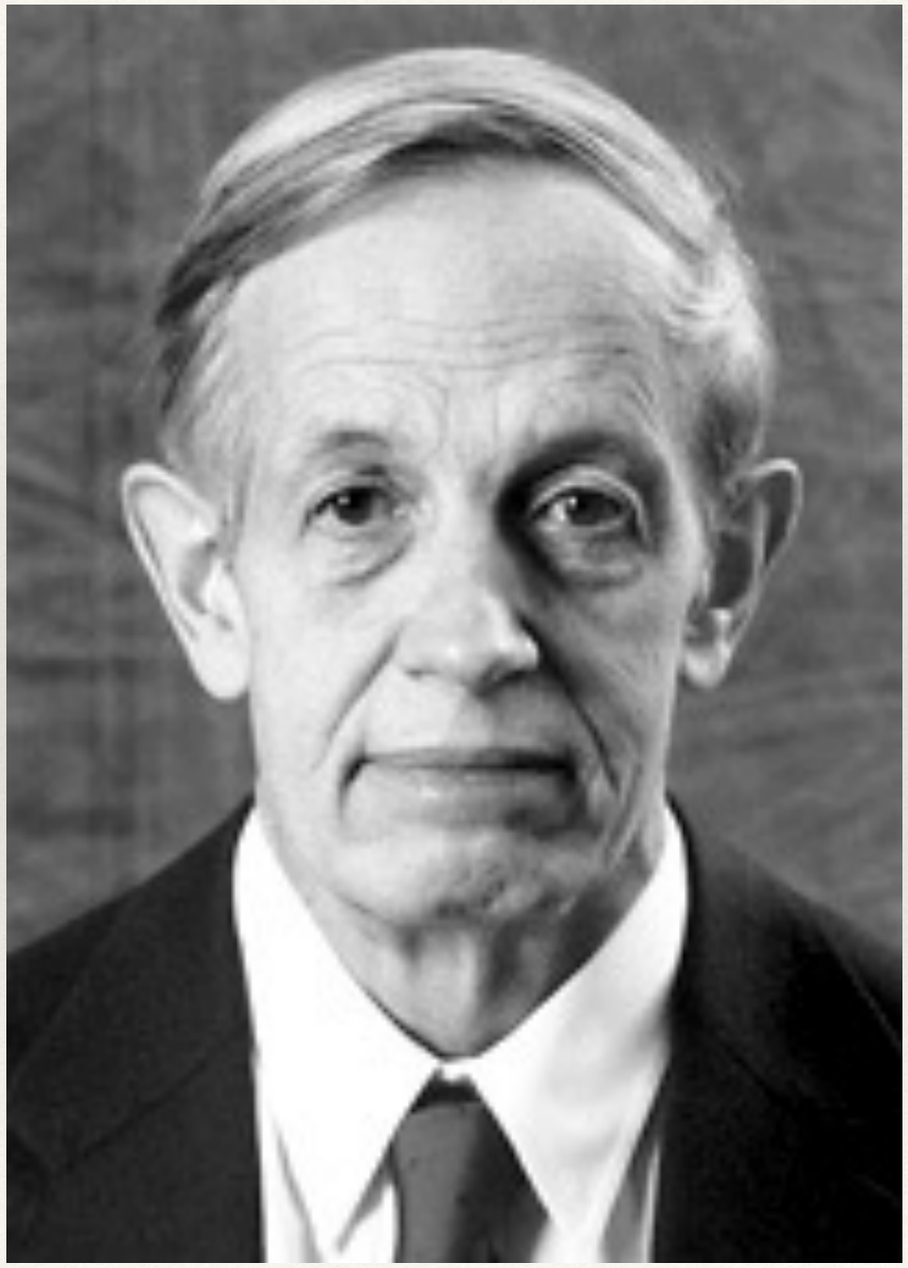
Antoine Augustin Cournot (28 August 1801 – 31 March 1877) was a French philosopher and mathematician who also made important contributions to economic theory.

In 1838 he published the book *Researches on the Mathematical Principles of the Theory of Wealth* in which introduced the ideas of functions and probability into economic analysis. He derived the first formula for the rule of supply and demand as a function of price and in fact was the first to draw supply and demand curves on a graph, anticipating the work of Alfred Marshall by roughly thirty years. The Cournot duopoly model developed in his book also introduced the concept of a (pure strategy) Nash equilibrium, the reaction function and best-response dynamics, anticipating Nash by more that a century.

John Forbes Nash Jr. (1928-2015)

John Forbes Nash Jr. (1928-2015), was an American mathematician who made fundamental contributions to, among other fields, game theory, where he introduced the Nash equilibrium concept.

Informally, a set of strategies is a Nash equilibrium if no player can do better by unilaterally changing their strategy. In a Nash equilibrium, the strategy of each player is a best response to the strategies of all other players. The contribution of Nash in his 1951 article *Non-Cooperative Games* was to define a mixed-strategy Nash equilibrium for any game with a finite set of actions and prove that at least one (mixed-strategy) Nash equilibrium must exist in such a game.



Symmetric Oligopoly

Let now assume that a market consists of N firms, with the same cost functions. The N firms produce a similar product

Cost function of firm n

$$C_n=F+cq_n$$

Demand function of firm n

$$P=(A-q_n-(N-1)q)/b$$

where q is the conjecture of firm n about the average production level of its competitors.

Profit maximization, taking the production decisions of all other firms as given,

$$q_n=(A-(N-1)q-bc)/2$$

Equilibrium in a Symmetric Oligopoly

In equilibrium, since all firms are the same, all firms will produce the same output.
Equilibrium production of the average oligopolistic firm

$$q=(A-bc)/(N+1)$$

Total equilibrium production

$$Q=(N/(N+1))(A-bc)$$

Equilibrium Price

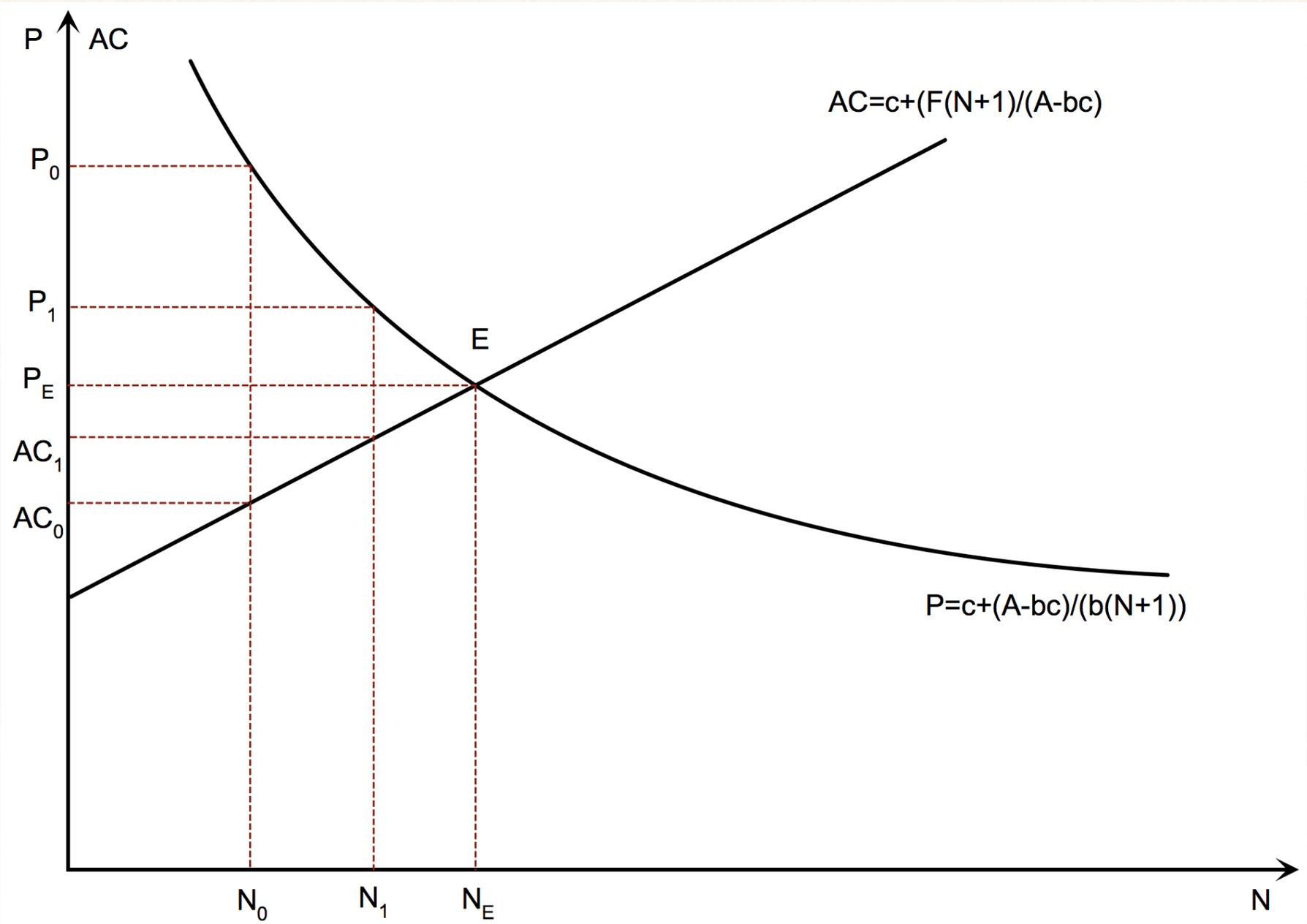
$$P=c+(A-bc)/(b(N+1))$$

Equilibrium Average Cost

$$AC=c+F/q=c+F(N+1)/(A-bc)$$

An increase in the number of firms in an oligopolistic market results in higher output and consumption, lower prices and higher average costs.

Price Cost Margins and the Number of Firms in an Oligopolistic Market



The Number of Firms, Prices and Price Cost Margins

- As the number of firms increases in an oligopolistic market, prices and price cost margins decline, and production and sales increase.
- Thus, the distortions associated with imperfect competition are reduced, and consumers benefit.
- By reducing barriers to entry in EU markets, the Single Market program has increased the number of firms in oligopolistic markets, leading to lower prices for consumers and lower price cost margins.
- Entry is not completely free in all markets yet, and one of the main objectives of the EU single market and competition policy is to reduce remaining barriers to entry and lead to further declines in prices and price cost margins.
- Up to which point can a free entry policy succeed.

A Symmetric Oligopoly with Free Entry

If there is free entry of new firms in a market, this will continue until profits are reduced to zero. Thus, entry will stop only when the price is equal to the average cost of production.

The condition that will determine the number of firms with free entry is thus that $P=AC$. With the assumptions that we have made, this implies,

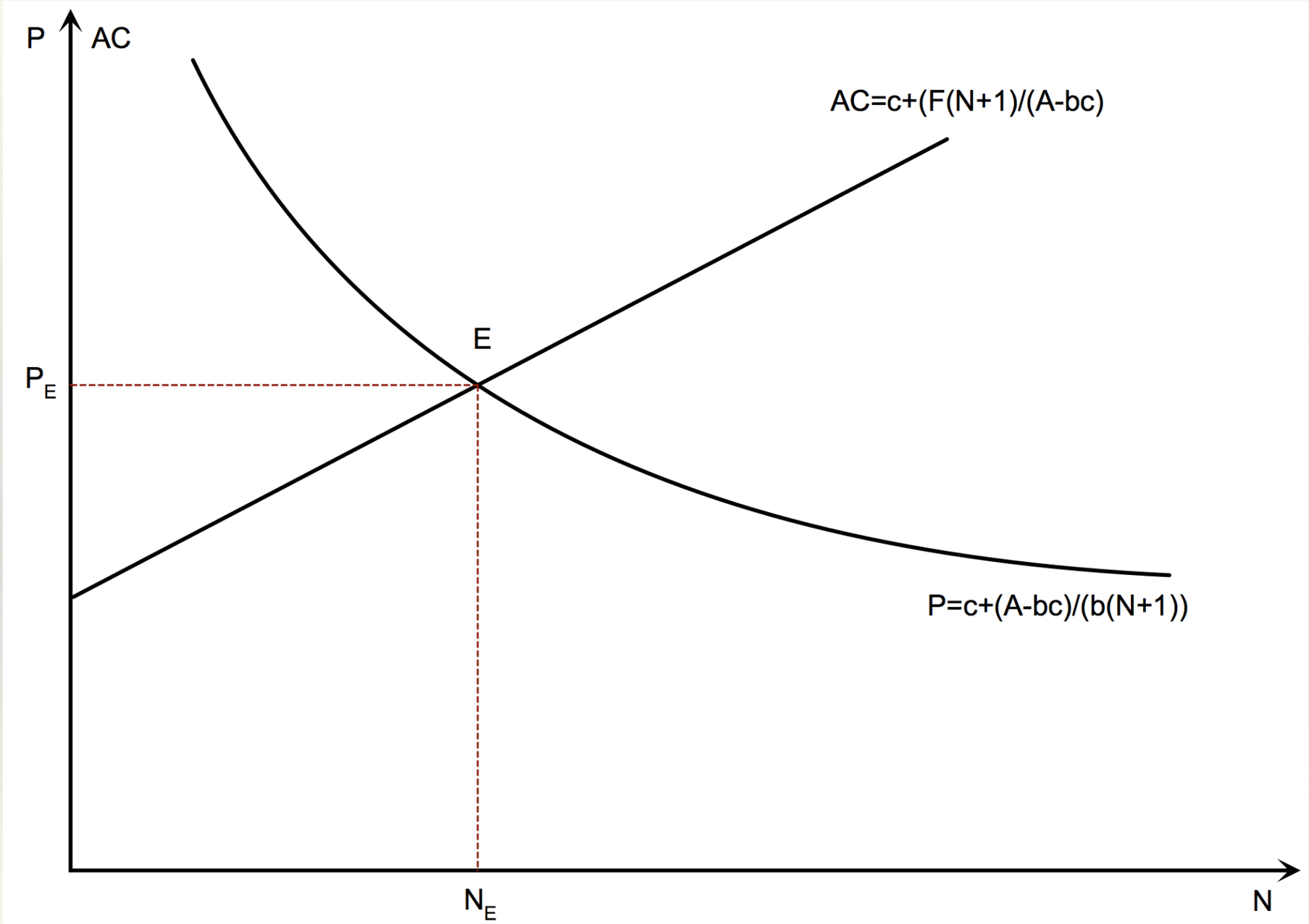
$$P=c+(A-bc)/(b(N+1)) = AC=c+F(N+1)/(A-bc)$$

Solving for $N+1$,

$$N+1=(A-bc)/(bF)^{1/2}$$

The larger the size of the market, the higher the number of firms. On the other hand, marginal costs, the price sensitivity of demand and fixed costs have a negative effect on the number of firms.

The Determination of the Number of Firms in a Symmetric Oligopoly with Free Entry



Monopolistic Competition

Oligopolistic markets are not the only form of market organization in the presence of internal scale economies.

Another widespread form of market organization is monopolistic competition.

In monopolistic competition, firms have internal economies of scale, but each firm produces a unique product, which differs, or is perceived to differ, from competing products from its competitors.

Many markets for consumer goods are characterized by monopolistic competition.

A Simple Model of Monopolistic Competition

- *N* firms, where *N* is large, each producing a diversified product
- Firms maximize profits by taking the prices of their competitors as given.
- All firms face a similar demand function and have the same cost function.
- Demand Function for the Product of Firm *n*

$$q_n = A[1/N - b(P_n - P)]$$

- Cost Function of Firm *n*

$$TC_n = F + cq_n$$

Profit Maximization in Monopolistic Competition

- The marginal revenue of each firm is given by,

$$MR=P_n\text{-}q_n/Ab$$

- Each firm will produce at the point where marginal revenue is equal to marginal cost. Thus, if follows that,

$$P_n\text{-}q_n/Ab=c \;\; \acute{\eta} \;\; P_n=c+q_n/Ab$$

- In a symmetric equilibrium in which all firms have the same cost function and face the same demand conditions, they will produce the same quantity and will charge the same price.

Prices, Market Shares and Average Costs in Monopolistic Competition

- In a symmetric equilibrium,

$$P_n = P = c + 1/bN$$

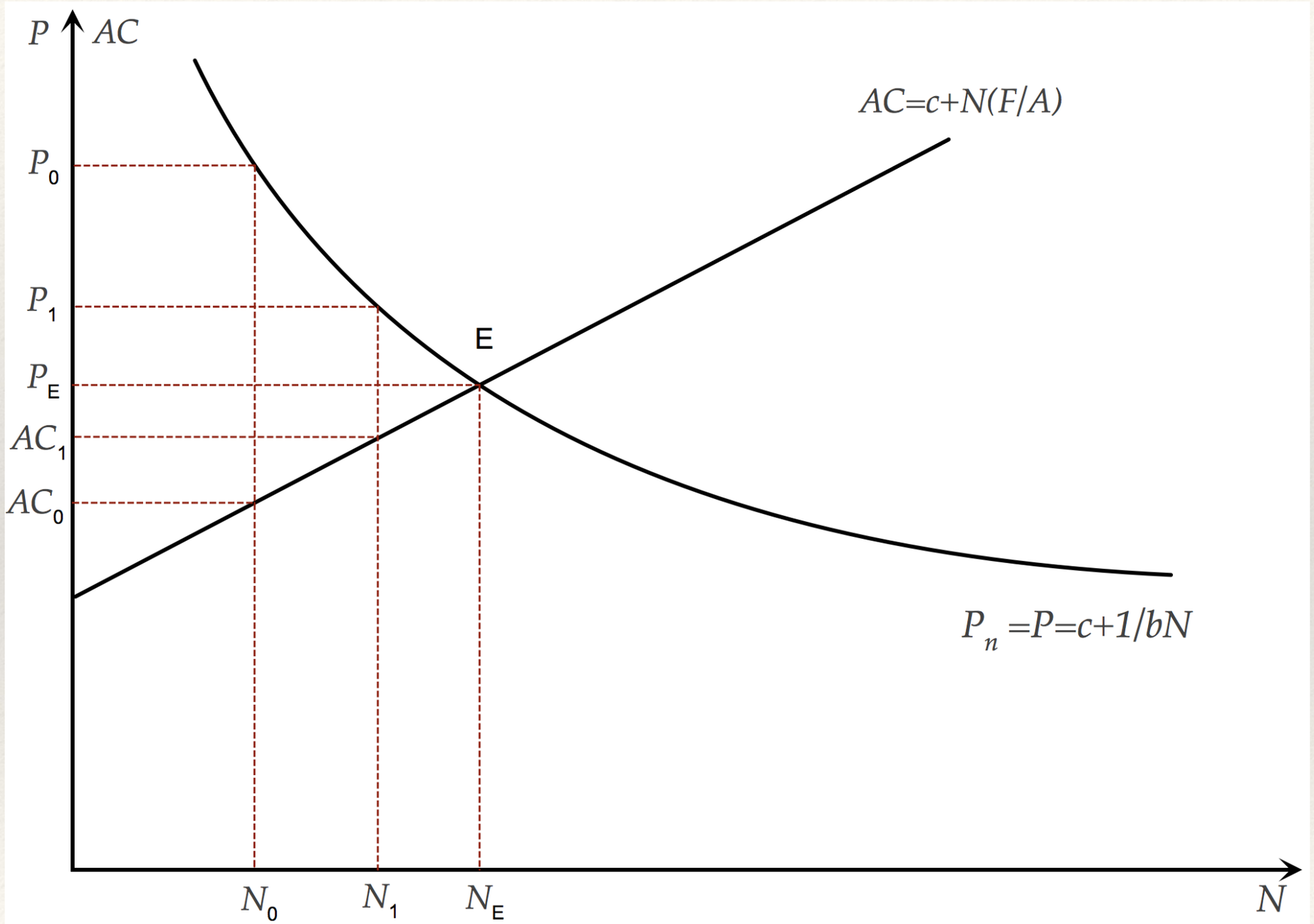
$$q_n = q = A/N$$

- Each firm has a market share of $1/N$ and the equilibrium price is a negative function of the number of firms N.
- The average cost of each firm is given by,

$$AC = c + F/q = c + N(F/A)$$

- The average cost of each firm is a positive function of the number of firms N.

Price Cost Margins and the Number of Firms in a Monopolistically Competitive Market



Monopolistic Competition with Free Entry

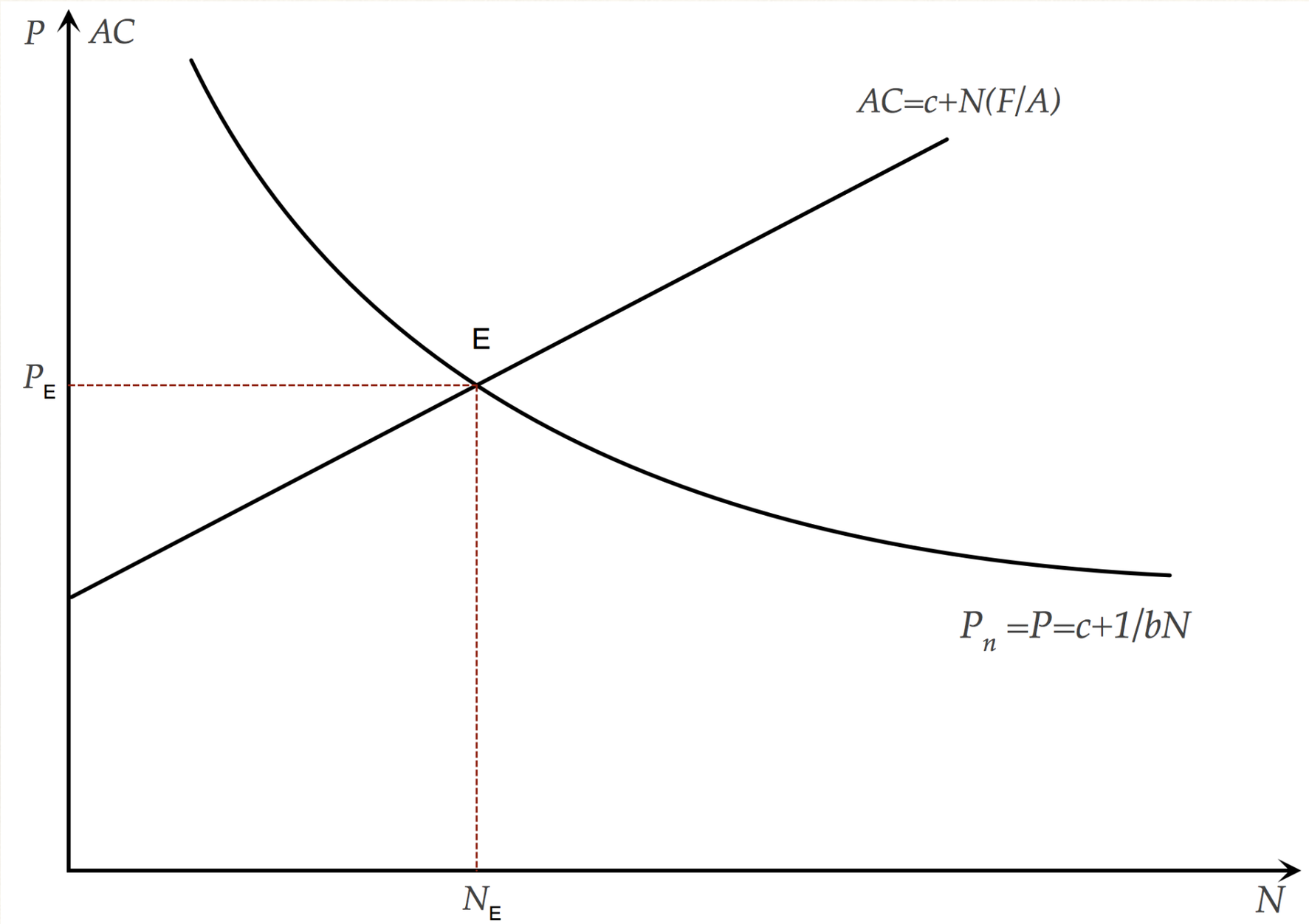
- If there are no barriers to entry, the entry of new firms in a monopolistically competitive market will continue as long as prices exceed the average cost of production and firms make "excessive" profits.
- Entry will stop when prices become equal to average costs.
- The equilibrium condition $P=AC$ implies that,

$$c+1/bN=c+N(F/A)$$

- Solving for the equilibrium number of firms with free entry,

$$N=(A/bF)^{1/2}$$

The Number of Monopolistically Competitive Firms with Free Entry



Edward Chamberlin (1899-1967)

Edward Hastings Chamberlin was an American economist. He was born in La Conner, Washington, and died in Cambridge, Massachusetts.

For most of his career Edward Chamberlin taught economics at Harvard (1937–1967). He coined the term "product differentiation" to describe how a supplier may be able to charge a greater amount for a product than perfect competition would allow. His most significant contribution was the Chamberlinian monopolistic competition theory. Chamberlin published his book *The Theory of Monopolistic Competition* in 1933, the same year that Joan Robinson published her book on the same topic: *The Economics of Imperfect Competition*.

Trade Liberalization in Monopolistic Sectors

Assume two European countries, in each of which there is a sector (e.g telecoms, electricity, water, etc) in which only one national monopoly operates. Demand and cost functions in each country are given by,

$$Q=A-bP,\ Q^*=A-bP^*$$

$$TC=F+cQ,\ TC^*=F+cQ^*$$

Trade Liberalization will Result in at Least a Duopoly

If international trade is not allowed in this sector, then sales and prices in each of the countries are given by,

$$Q=Q^*=(A-bc)/2,\ P=P^*=c+(A-bc)/2b$$

If trade is liberalized in the sector, then the sector will become a duopoly in the single market. Sales and prices will be given by,

$$Q=Q^*=2(A-bc)/3,\ P=P^*=c+(A-bc)/3b$$

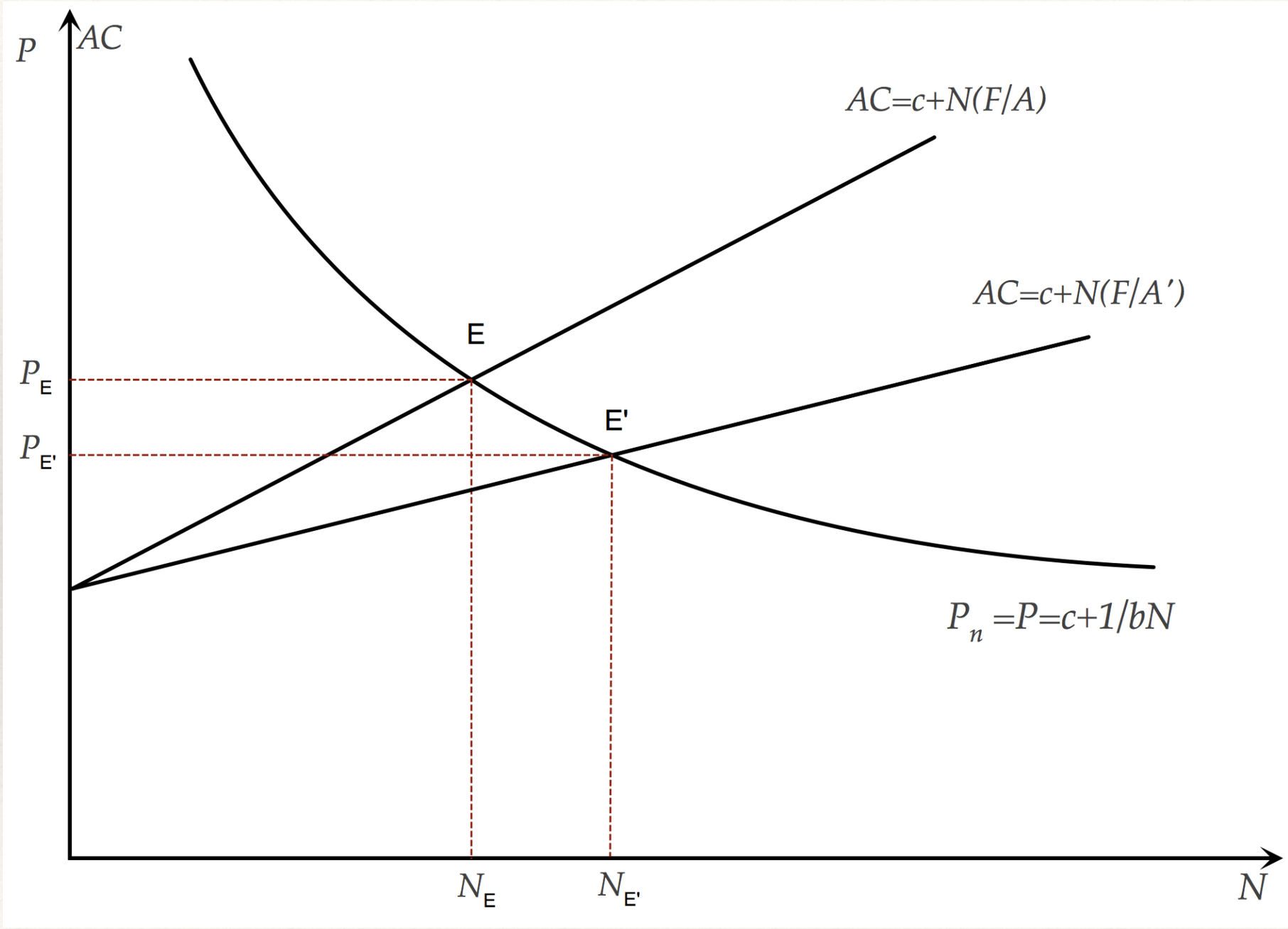
Effects on the Single Market in Sectors that Operated as National Monopolies

- European production rises and prices fall.
- The reason is that liberalization converts national monopolies in European oligopolies (a duopoly in our example).
- The change in market structure results in smaller price cost margins for firms in the sector and benefits consumers.
- Similar effects take place in oligopolistic industries, as the number of firms increases in all national markets.

Oligopolies and the Single Market

- The expansion of the market caused by the single market program led to an increase of the number of firms producing for each national market and a reduction in the average price, as every firm now operates at a bigger scale.
- This model also explains the intra-industry trade, something that competitive models cannot explain.
- Intra-industry trade is an important part of European trade in industrial products between the developed economies.

Monopolistic Competition and the Single Market



The Effects of the Single Market on Monopolistically Competitive Sectors

- The expansion of the market caused by the single market program, led to an increase in product variety (and the number of firms) in each national market, and a reduction in the average price, as every firm now services a greater market (national and in other European countries) .
- Monopolistic competition also explains intra-industry trade, something that competitive models can not explain.
- Intra-industry trade is an important part of intra-European trade.

Conclusions on the Effect of the Single Market Program on Competition, Price Cost Margins and Average Costs

- In all the imperfectly competitive models that we analyzed trade is intra-industry, and does not depend on traditional comparative advantage.
- In sectors where there are excessive profits (eg monopolies or oligopolies without free entry), the positive effects of the creation of the single market on sales and prices are due to a change in market structure. Markets become more competitive as more firms operate in then, leading to a reduction in firms' profit margins and prices, and an increase in total sales and output.
- In industries with free entry, in which excessive profits do not exist, the sources of the expansion of sales and output, and the reduction of prices, are related to increasing returns to scale, which reduce the average cost of production after the expansion of the overall size of firms which now operate in larger markets.