

The Economics of Competition (Law)

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INTRODUCTION

This introduction is designed to provide you an overview on the topics covered in this reader and the accompanying lecture. Moreover, you will find reasons why it is worthwhile to study the subject of industrial organization and learn more about competition policy.

What is industrial organization?

The subject of industrial organization (IO) is a branch in economics that is concerned with analyzing firm behavior and market outcomes. This is particularly interesting in markets which are not characterized by perfect competition, such as monopolies or oligopolies. Especially the latter are subject to the following examples of strategic interaction among firms:

- What price should a firm optimally set and what quantity supply, given that its competitors make a similar reasoning? What determines the extent of **competition**? What determines the dimensions upon which firms compete? What is the effect of the number of firms on price-cost margins?
- Can firms increase their profits by **coordinating** their market behavior? Should they trust their co-conspirators? How can firms *attain* supracompetitive profits? Is it allowed to attain such a position? If yes, how can firms maintain such increased profits?
- What determines **market structure**? What determines the ease of entry and the response of incumbents to the appearance of entrants? What determines asymmetries among firms?
- What is meant by **market power** or dominance? What determines the creation and sustainability of dominance? Is there increasing or decreasing dominance? Is it good or bad for welfare that an industry is dominated by a few firms?

These questions illustrate that economics (including industrial organization) is not about finding equilibria or the intersection of two curves. Economics is about trying to understand certain phenomena and is defined by the set of questions, not a set of methods. Methods can change but the questions do not.

“One of the first steps in studying industrial organization is to have an idea of what types of industry structure there may be” (Cabral 2000: p. 69). In section A , we start with defining the most extreme and best-known cases with many firms (perfect competition) and a single firm (monopoly). In section B , we proceed to the somewhat more advanced case of industries with few firms (oligopoly). We find that firms' competitive conduct as well as the market outcome depend on the production technology, for example the existence of capacity constraints. Competition is supposed to be intense when every firm in a market would be able to serve the entire demand (Bertrand-competition). However, competition is less intense when capacity-constrained firms can serve

demand only if several firms operate in this market.

We show that these different market structures (monopoly, oligopoly, and perfect competition) differ in their levels of allocative efficiency and welfare. Section C extends this analysis to productive and dynamic efficiency. We find that the characteristics of the production technology used affect the structure of a market. For example, an industry will be characterized by fewer firms if a high proportion of fixed costs of production implies a large minimum efficient scale of production. Moreover, the competitive conditions in an industry affect firms' incentive to innovate, i.e. to create better products or reduce the costs of production.

What is competition policy?

In practice, industrial organization has had an ongoing effect on competition policy. A passionate statement why competition and, thus, **competition policy is important** for everyone was provided by the European competition commissioner Joaquín Almunia in a speech in February 2011¹:

“Ladies and Gentlemen:

Competition is an instrument, not an end in itself. But it is indeed a vital instrument in very many respects. Without fair, robust, and effective competition policy and enforcement, I don't see how we Europeans can overcome the crisis rapidly and shape up to compete with the other, dynamic players that are increasingly present on the world scene. Of course, competition is not the only tool we should use to pursue this goal. But we need a vibrant and competitive environment in the single market if we are serious about leading in the information age.

We need competition to be equal partners with the US, China, and the other leading global players; we need competition to grow; we need competition to preserve our social model for the benefit of our citizens and of the future generations. Considering our demographic trends and the imperative task of building sustainable and green economic and social models, Europe needs all its resources and resourcefulness.

The EU competition system is one of the best, if not the best in the world. My commitment is to use it to the full extent of the law, because I am convinced that this is what I must do within my area of responsibility to contribute to a better future for Europe.

Thank you.”

¹ <http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/11/96&format=HTML&aged=0&language=EN&guiLanguage=en>

In this lecture, you will learn why competition is so important for our well-being, why dominant firms can reduce welfare, and what harm is caused by collusive agreements. In short, you will learn the details underlying Mr. Almunia's above conclusions. Moreover, you will learn how measures of competition policy are used to raise welfare. We present an introduction to competition policy in the European Union supplemented by remarks on competition policy in Germany and USA (chapter D). We follow a dual approach, i.e. presenting (European) competition laws with an emphasis being laid on their economic justification and consequences.

In sections A and B we propose that prices charged and quantities sold in a market depend on the structure of an industry and the competitive conduct of the firms. In section E, we elaborate on the relationship between market structure and firms' conduct with regard to the existence of market power. Competition policy defines market power as “the ability to profitably maintain prices above competitive levels for a period of time or to profitably maintain output in terms of product quantities, product quality and variety or innovation below competitive levels for a period of time” (EC 2011: para. 39). A related definition considers market power to be a firm's ability to profitably charge prices above marginal costs. Therefore, we present measures for assessing both the structure of an industry and the existence of market power. Additionally, we present answers to the question: “How can market power persist in an industry?” With respect to firm-behavior we identify the actual or potential entry of competitors into a market as one factor that erodes market power. With respect to consumer-behavior we propose that buyer power can countervail firms' market power. Moreover, we identify switching costs and network effects as elements which allow firms to exercise market power on their customers.

Many of the concepts for measuring market power or industry structure (e.g. market shares, the HHI, or the analysis of substitution patterns) crucially depend on the delineation of the relevant market. Chapter F presents some common concepts for defining the relevant market before we proceed to the four key concerns in competition policy.

Chapter G is concerned with the economics of merger control in the EU. In this context, we deal with the assessment of the pro- and anti-competitive effects of both horizontal and non-horizontal mergers. The earlier refer to a merger of competitors while the latter can be vertical mergers (for example, a manufacturer and a retailer merger) or conglomerate mergers (the merging firms appear to be unrelated with regard to the production and distribution of their goods). Chapter H adds to the discussion of agreements between undertakings by focusing on the assessment of horizontal co-operation agreements and a detailed analysis of vertical restraints. Section H is also concerned with the competitive conduct of firms who consider the impact of their current decisions on market performance in the future. These dynamic aspects are relevant in the analysis of

horizontal agreements among firms. Such agreements typically aim at an increase in prices which raises firms' profits and reduces consumer surplus. Interestingly, such agreements need not necessarily be explicit and, thus, illegal. They may also consist of an implicit understanding among firms to raise prices (so-called tacit collusion). Tacit collusion can arise in an industry when firms may effectively prevent freeriding behavior of any of the participating firms and when the potential deviators pay sufficient attention to this punishment.

In chapter J we present economic principles to be applied in abuse of dominance cases. In all these areas of competition policy two-sided markets have attracted increasing attention recently. Therefore, chapter I describes some economic principles for the assessment of market power when a firm provides services to two types of agents who benefit from the network effects created by the platform. Fourth, chapter K concludes with a brief outlook on the assessment of state aid.

Why should you study industrial organization and competition policy?

Put plainly, the analysis of strategic decision making – as is done in industrial organization – and a profound knowledge of the economics of management are important for anyone who wants to become a successful business manager. In addition to this target group, the demand for economists in the consulting business has increased over the last years. Some important consulting firms are ESMT², Frontier Economics³, NERA⁴, Oxera⁵, and RBB⁶. Additionally, industrial economists have increasingly been employed by competition authorities such as the Bundeskartellamt⁷ and the Directorate General Competition at the European Commission.⁸ The service supplied by economists is sometimes called *forensic economics* (Connor 2008: p. 31). For example, economists serve as expert witnesses in competition cases and advise either the judges, a competition authority, the claimant, or the defendant. Moreover, they assist in designing competition laws against welfare-detrimental mergers, cartels, the abuse of a dominant position, or state aid. The scope of their work goes beyond purely theoretical analyses and – to a considerable extent – includes empirical work.

2 <http://www.esmt.org/eng/consulting/esmt-competition-analysis/>

3 <http://www.frontier-economics.com/>

4 <http://www.nera.com/>

5 <http://www.oxera.com/>

6 <http://www.rbbecon.com/>

7 <http://www.bundeskartellamt.de/>

8 http://ec.europa.eu/competition/index_en.html

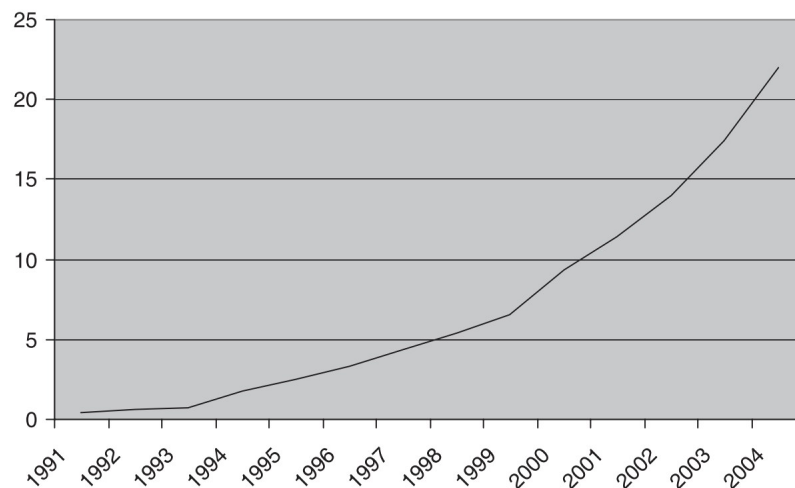


Figure 1: Turnover of economic consultancy firms (in £ million, base year: 2004)

Source: Neven (2006: p. 748)

Neven (2006: p. 748) shows (see Figure 1) that the turnover of economic consultancy firms has drastically increased between 1992 and 2004. Since 2004 competition cases have gained further importance. In Europe, fines imposed on cartels rose from a total of 3.2bn EUR in 2000-2004 to 8.9bn EUR in 2005-2009. The number of cartel cases decided rose from 11 in 1990-1994 to 33 in 2005-2009.⁹ For these reasons, one may expect a stable or even increasing demand for competition economists over the following years. In 2010, the Antitrust Division of the US-American Department of Justice filed 60 criminal cases and obtained \$555m in fines (Shapiro 2010: p. 1). The evolution of these numbers from 2006-2010 is shown in Table 1.

	2006	2007	2008	2009	2010
Total cases filed	34	40	54	72	60
Defendants charged	61	57	84	87	84
Fines obtained	USD 473m	USD 630m	USD 701m	USD 1,007m	USD 555m
Total jail days obtained	5,383	31,391	14,331	25,396	26,046

Table 1: US Department of Justice - Antitrust Division Criminal Enforcement Data

Source: Shapiro (2010: p. 2)

⁹ DG Comp cartel-statistics as of 9 November 2010: <http://ec.europa.eu/competition/cartels/statistics/statistics.pdf>

To illustrate the ongoing **demand for forensic economists**, consider that the first known cartel case was reported in Athens 326 BC (Connor 2008: p. 32). Due to military disturbances the import-price of grain had been extremely volatile. Therefore, grain dealers formed a collusive agreement in form of a bidding ring. They would not have overbid each other in purchasing grain which harmed the sellers of grain. Moreover, the grain dealers restricted sales of grain to the Athenian people in periods of scarcity. This caused an increase in sales prices and harmed the buyers of grain. As a consequence, the dealers' profits increased by 500 percent. The court judgment in this case reflects two aspects that are still important today. First, the grain dealers should not only be punished for the infringement of competition laws. Second, others should also be deterred from breaking those laws in the future.

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A COMPETITION IN STATIC INDUSTRIES: PERFECT COMPETITION AND MONOPOLY

The welfare that is generated by a market depends on the structure of the market. In particular, the number of firms in a market is an important determinant for the existence of market power and, thus, welfare. Subsection A.1 is concerned with defining welfare and allocative efficiency. Moreover, we see that allocative efficiency is achieved when a market can be described by a model of perfect competition (see subsection A.2).

Models are simplified descriptions of reality, i.e. they provide a means for understanding a particular situation or event. We can use models to predict how the market outcome (e.g. welfare) changes in response to changes in, for example, market structure or firms' behavior. Comparing a situation after a change in these variables to the situation prior to this change is called **comparative statics**. The word *statics* implies that we are not predicting the dynamic path that takes us from one equilibrium to the other. In order to see how welfare responds to changes in market-structure we start with analyzing a model for many firms (perfect competition). The subsequent sections are concerned with analyzing welfare when a market is characterized by only one firm (monopoly – see subsection A.3) or a few firms (oligopoly – see section B).

A.1 Welfare and Allocative Efficiency

Consumer surplus is the difference between the maximum amount a consumer is willing to pay for a unit of a good and the amount actually paid for that unit p_0 . Let the demand function of a good be given by equation (1).

$$q_D = D(p) = q(p) \quad (1)$$

Consumers' willingness to pay $p(q)$ for some quantity q of the good is defined by the inverse demand function (2).

$$p_D = D^{-1}(q) = p(q) \quad (2)$$

The consumer surplus CS is defined as the area between the demand curve and the ordinate in Figure 2, evaluated in the interval between the price paid p_0 and the maximum willingness to pay \bar{p} of the consumers.

$$CS(p_0, \bar{p}) = \int_{p_0}^{\bar{p}} q(x) dx \quad (3)$$

Alternatively, the consumer surplus may be calculated as the area between the demand curve and the abscissa in Figure 2 in the interval $[0; q(p_0)]$ minus the amount paid for the quantity bought $q(p_0)$ at price p_0 .

$$CS(p_0, \bar{p}) = \left(\int_0^{q(p_0)} p(x) dx \right) - p_0 q(p_0) \quad (4)$$

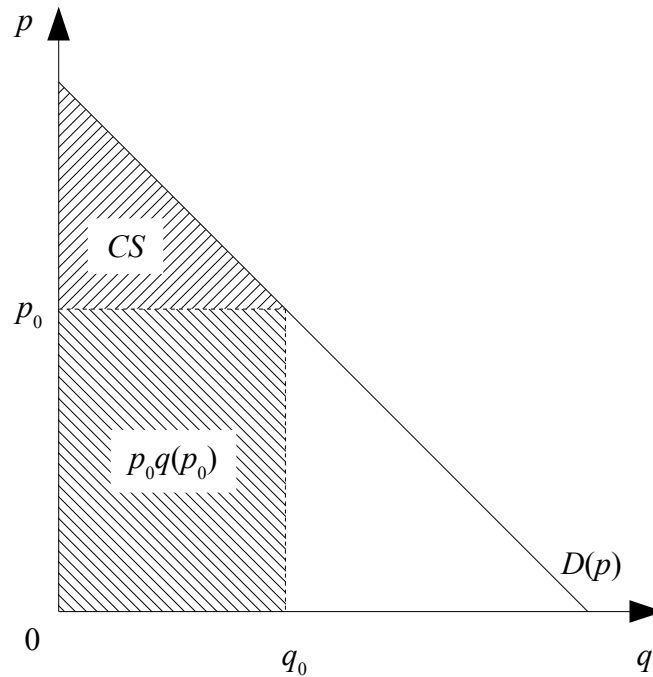


Figure 2: Consumer Surplus

Producer surplus is the difference between the amount a producer receives from the sale of a unit, i.e. its revenues $p_0 q(p_0)$, and the amount that unit costs $c(q_0)$ to produce the sold quantity q_0 . The variable costs of a firm are defined as the area between the supply curve and the abscissa in the interval $[0; q_0]$. The supply function is defined as

$$q_s = S(p) \quad (5)$$

The supply curve is defined by the inverse of the supply function and equals the marginal costs c of the most efficient firm in the production of output quantity q .

$$c(q) = S^{-1}(q) \quad (6)$$

Hence, the producer surplus PS can be expressed as in equation (7).

$$PS(p_0) = p_0 q(p_0) - \int_0^{q(p_0)} c(x) dx \quad (7)$$

Economic **welfare** $W(p_0)$ (or total surplus) as shown in Figure 3 is defined as the sum of consumer surplus and producer surplus.

$$\begin{aligned}
 W(p_0) &= CS(p_0) + PS(p_0) \\
 &= \int_0^{q(p_0)} p(x) - c(x) dx
 \end{aligned} \tag{8}$$

Choosing q to maximize this expression leads to the first order condition

$$p(q) = c(q) \quad , \tag{9}$$

which occurs precisely at the perfectly competitive equilibrium quantity when demand is downward sloping and marginal costs rise (Jehle and Reny 2000: ch. 4.3.3).

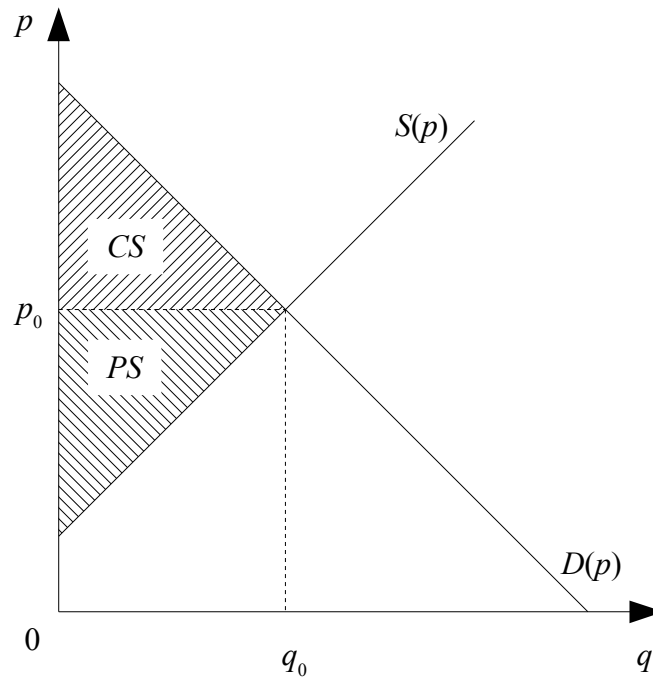


Figure 3: Total Surplus

This situation is (Pareto-) **efficient**. A market outcome is said to be efficient when it is impossible to determine some change in the allocation of capital, labor, goods, or services that would improve the well-being of one individual in the market without hurting any others (Pepall et al. 2008: p. 35). To see this, suppose the quantity sold was q_1 with $q_1 < q_0$ and, thus, $c(q_1) < p(q_1)$. It can be seen from equation (8) that welfare can be raised by increasing the quantity, which is equivalent to lowering the price. This would raise both consumer surplus and producer surplus. This situation is allocatively efficient because resources were allocated to their most efficient use. Hence, total surplus is a measure of allocative efficiency (Cabral 2000: ch. 2.4). The allocatively efficient equilibrium in perfect competition is shown in greater detail in section A.2 .

A.2 Pricing in Perfect Competition

In this section, we present the basic model of perfect competition besides some further relevant issues such as the economic definition of costs. This requires a **definition of competition** (Vickers 1995: p. 4).

Competition can be described as a form of rivalry that arises whenever two or more parties strive for something that all together cannot obtain.

This definition emphasizes the behavioral aspects of competition. However, in economic models such as the model of perfect competition, competition is often treated as a state or a situation. When we say that a market becomes more competitive, this can be the result of

- (i) a greater behavioral freedom of rivals (e.g. the freedom to enter an industry – section E.2),
- (ii) an increase in the number of rivals (section B.3), and/or
- (iii) a move away from collusion towards independent behavior between rivals (section H.2).

Brandenburger and Nalebuff (1996: 18) do not define competition in terms of market structure or performance, i.e. the state of the market, or in terms of firms' conduct. They focus on the products that are supplied by competitors and emphasize that competitors supply substitutable products such as Coca-Cola or Pepsi-Cola. Most chapters of this Reader are concerned with the case where the firms supply homogeneous goods, i.e. perfect substitutes. Differentiated products, i.e. imperfect substitutes, are analyzed in section G .

The Basic Model of Perfect Competition

The model of **perfect competition** is based on five central assumptions (Cabral 2000: ch. 6.1).

1. **Atomicity**: There are many suppliers in the market. Each supplier is so small that its actions (on input and output markets) have no significant impact on other suppliers.
2. **Product homogeneity**: The products of all suppliers are perfectly the same.
3. **Perfect information**: All economic agents know the characteristics of the good and can observe the prices set by all firms.
4. **Equal access to production technologies**: All firms have access to all production technologies.
5. **Free entry**: Any firm may enter or exit the market as it wishes.

A firm in perfect competition acts as a **price taker** on both input and output markets. The price p is not something that the perfectly competitive firm chooses. Instead, that price is determined by the interaction of all the firms and consumers in the market for this good. This implies that the

assumption of atomicity does not require infinitely many firms to be in the market. It rather requires the number of firms to be large enough for firms to *think* that their actions will not affect the market price. “An example of a “small” firm would be a wheat farmer in Kansas or, alternatively, a broker on the New York Stock Exchange trading IBM stock” (Pepall et al. 2008: p. 22). As a single firm in perfect competition cannot influence the market price it faces a horizontal residual demand curve. The industry demand curve can, nonetheless, be downward sloping as shown in Figure 2.

The profit $\pi_i(q_i)$ of a perfectly competitive firm i when supplying quantity q_i is defined as the difference between its revenue $R_i(q_i)$ and its total costs $C_i(q_i)$, that can be decomposed into marginal costs $c_i(q_i)$ and fixed costs F_i .

$$\begin{aligned}\pi_i(q_i) &= R_i(q_i) - C_i(q_i) \\ &= p \cdot q_i - \int_0^{q_i} c_i(x) dx - F_i\end{aligned}\quad (10)$$

Firm i must decide what optimal quantity $q_{i,opt}$ to supply in order to maximize its profits. The condition for profit maximization

$$\max_{q_i} \pi_i(q_i) \quad (11)$$

implies first-order condition (12).

$$\begin{aligned}\frac{d \pi_i(q_i)}{dq_i} &= \frac{d R_i(q_i)}{dq_i} - \frac{d C_i(q_i)}{dq_i} \stackrel{!}{=} 0 \\ &= p = c_i(q_{i,opt})\end{aligned}\quad (12)$$

In perfect competition, the marginal revenue $dR_i(q_i)/dq_i$ equals the market price p , which in optimum must equal marginal costs c_i .

In the following, we show that perfect competition is a good situation for two reasons. First, each firm sets the efficient output level, i.e. the output level such that prices equal marginal cost. Second, the set of firms active in the long run is efficient. Because of free entry, firms produce a long-run output such that price equals the minimum average cost. Please note that this refers to static efficiency, i.e. efficiency at the current point in time. The model is silent about the implications of competition for technological progress (Cabral 2000: ch. 6.1).

Note that the aggregate supply q_s of the n firms in a market is the horizontal sum of each firm's output q_i at price p . This yields the short-run industry supply curve.

$$q_s = S(p, n) = \sum_{i=1}^n q_i(p) \quad (13)$$

The **short run** is defined as the period where no entry or exit of firms in this industry occurs. Figure 4 presents the horizontal summation of individual supply curves for an industry with $n = 3$ firms.

For any market to be in equilibrium, first order condition (12) must be satisfied for every firm i . Hence, in equilibrium all firms produce at the same marginal costs equaling the equilibrium price p_0 .

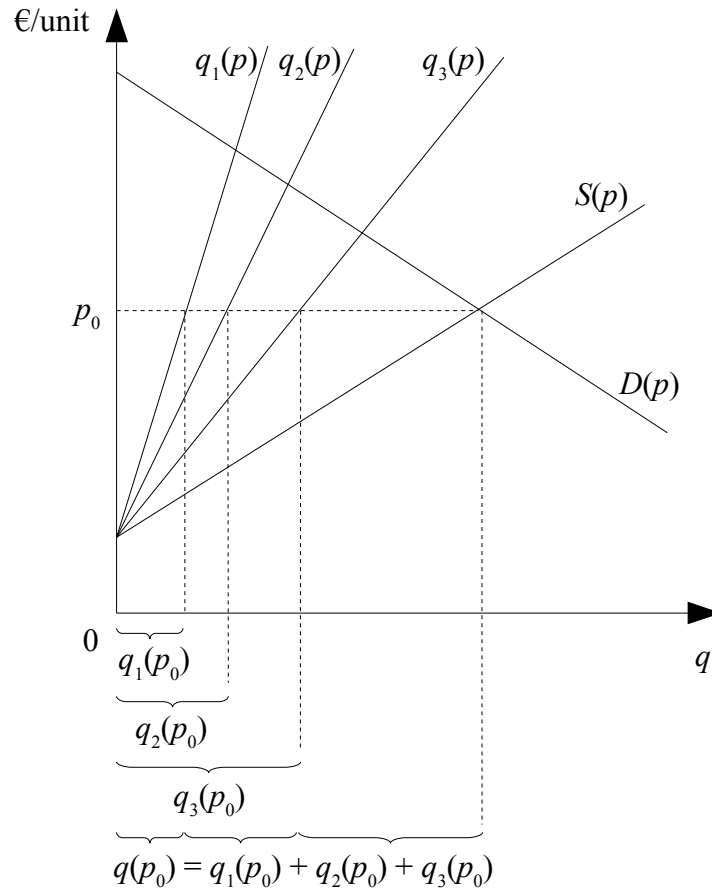


Figure 4: Horizontal Aggregation of Supply-Curves

In the **long run** firms can enter or exit the industry. The above assumption of free entry ensures that in the long run each firm make zero economic profits. If any firm makes positive economic profits, other firms will enter the industry until economic profits of all firms equal zero.

$$\begin{aligned} \pi_i(q_i) &= R_i(q_i) - C_i(q_i) = 0 \\ p &= \frac{C_i(q_i)}{q_i} \end{aligned} \quad (14)$$

Condition (14) denotes the **free-entry equilibrium** because (i) no active firm wishes to leave the market, and (ii) no inactive firm wishes to enter the market. In this case, prices equal average costs. Because the marginal cost curve intersects the curve of average costs at its minimum (see Figure 5), condition (12) for the short run equilibrium is found to apply when condition (14) for the long run equilibrium applies. The minimum of the average cost curve defines the output that can be produced

by firm i at the lowest unit-costs. This output is also called the Minimum Efficient Scale.

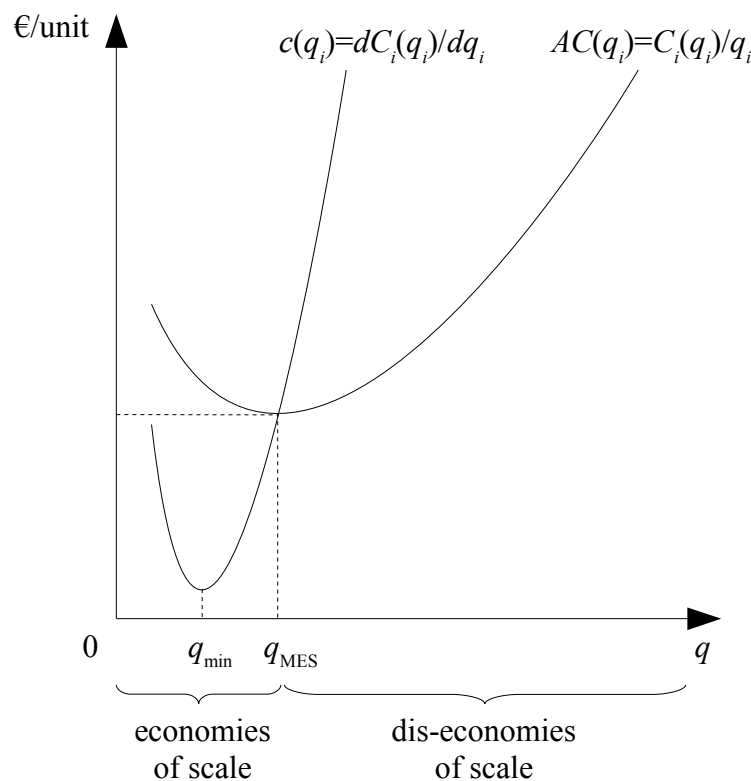


Figure 5: Minimum Efficient Scale

Economic Profits and Costs

The economic profit as defined in equation (10) is not equivalent to the accounting profit as it appears, e.g., in profit and loss accounts. In particular, economic costs do not equal accounting costs because the earlier are defined as opportunity costs. Thus, economic costs include the amount necessary to pay the owners of the firm's capital a risk-adequate, competitive return (**cost of equity**). The opportunity cost for the firm's capital is measured as the rate of return that the capital could earn if invested elsewhere.

“The reason why this is important is because it makes clear that when a firm earns no economic profit it does not mean that its stockholders go away empty-handed. It simply means that those stockholders do not earn more than a normal return on their investment” (Pepall et al. 2008: p. 22). Likewise, when a firm makes a positive economic profit, its stockholders receive a rate of return on their investment that exceeds the normal rate of return that can be earned from investing their money into a firm or project with a comparable risk structure. An excessive rate of return can result from a firm possessing market power (see section E).

Perloff et al. (2007: 15) name eight problems in calculating economic rates of return

correctly from internal or external accounting measures. Such difficulties can well drive a wedge between accounting profits and economic profits (see, e.g., Paha (2012) for an overview).

1. Capital is usually not valued appropriately because accounting definitions are used instead of the economic definitions. For example, **assets** are frequently valued at historic costs instead of their market value (or: fair value).
2. **Depreciation** is usually measured improperly. For example, a linear depreciation schedule rarely is a good representation of the true, economic (or Hotelling (1925)) depreciation of an asset. The economic depreciation is basically the change in the market value of an asset between period $t-1$ and period t . This corresponds to the valuation of an asset at its *fair value* (IAS 16).
3. Valuing problems arise for advertising and research and development (R&D) because, as with capital, they have lasting impacts. The money a firm spends on R&D this year may generate benefits next year, just as a plant built this year provides a benefit next year. Therefore, it is difficult to decide whether expenses for research and development constitute an **intangible asset**, which must be recognized in the balance sheet and amortized later on.
4. Rates of return may not be properly adjusted for risk. The issue of **risk adjustment** is important because the rate of return of a firm shall be compared to the normal rate of return of an equally risky alternative investment. This gives an indication whether the firm enjoys market power or not. If the risk structure of the alternative investment does not match that of the firm, the market power assessment is likely to be biased.
5. The risk associated with an investment also depends on the **ratio of debt to equity**. If a firm is financed by a high share of debt a greater portion of the business risk must be borne by the equity holders as in a firm with a lower debt-equity ratio. Hence, the normal rate of return will be higher for the equity holders of the earlier, highly leveraged firm in order to account for the higher risk. This is the case even if the two firms are exposed to the same risks in the product market.
6. Proper adjustments must be made for **inflation**. The earned rate of return can be calculated as either a real rate of return (adjusted for the effects of inflation) or as a nominal rate of return (excluding the effects of inflation).
7. Sometimes, *goodwill* or *intangible assets* (IAS 38 48-53) are recognized as assets whose value implicitly contains a market power effect, i.e. the firm earns higher profits with these assets because of its **market power** and **values** the assets accordingly. This higher book value of assets incorrectly lowers the rate of return on assets that is reported for this firm.

8. Firms usually base make decisions based on their after-**tax** return. Therefore, rates of return should be calculated as after-tax values.

A.3 Pricing in Pure Monopoly

Monopolies in Theory

The model of **monopoly** rests on several assumptions.

1. There is a well-defined market with **one single supplier**.
2. The seller faces a **negatively sloped demand** $D(p)$ (see equation (1)).
3. There is **no potential entry** by other firms into this market.
4. Here, we assume that the monopolist charges the same price to all customers, i.e. **no price discrimination** occurs. This assumption can be relaxed in more elaborate models of monopoly.

The profit-function of the monopolist is the same than that of a firm in perfect competition (see equation (10)).

$$\begin{aligned}\pi(q) &= R(q) - C(q) \\ &= p(q) \cdot q - \int_0^q c(x) dx - F\end{aligned}\tag{15}$$

The only difference between the profit-function of a firm in perfect competition and a monopolist is that the monopolist does not take the price p as given. Instead, the price depends on the quantity produced (i.e. $p(q)$). The assumption of negatively sloped demand implies that the sustainable price is the lower the higher a quantity the monopolist chooses.

Hence, by increasing its output from q_0 to q_1 in Figure 6 the monopolist lowers the market-price from p_0 to p_1 . As a result, it loses area L in its revenue but gains the areas G and g . This marginal revenue $dR(q)/dq$ is also shown in Figure 6. The firm's profit¹⁰ rises from $\pi_0=A+L$ to $\pi_1=A+G$. The area g shows the additional costs that are incurred by increasing output.

¹⁰ We assume that fixed costs F are zero and marginal costs $c(q)$ are constant in output.

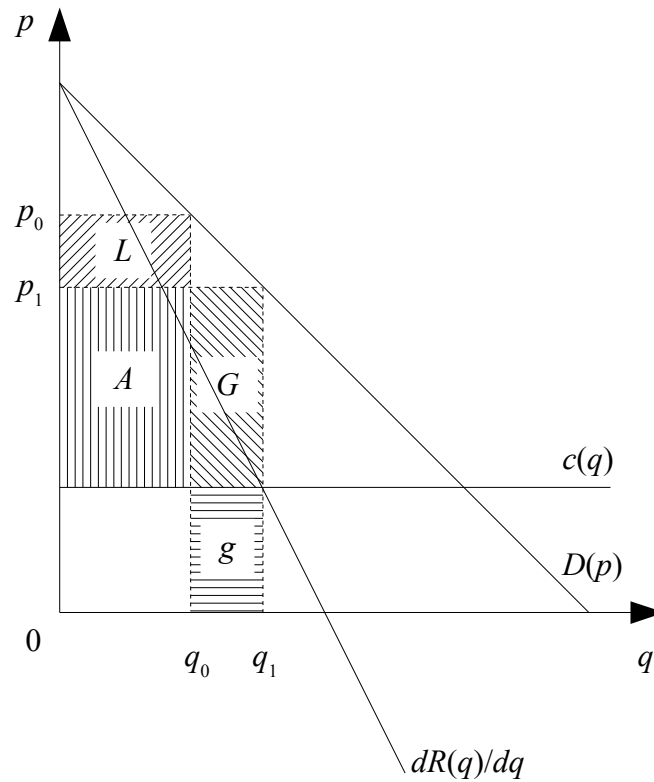


Figure 6: Pure Monopoly

Determining the profit-maximizing quantity q_{opt} implies first order condition (16). Notice that, because price and output are related by the demand function, it is the same thing to choose the optimal output or to choose the optimal price. In the following, we assume the monopolist to set an optimal quantity.

$$\begin{aligned}
 \max_q \pi(q) &\rightarrow \left(\frac{dp(q)}{dq} \cdot q + p(q) \right) - c(q) \stackrel{!}{=} 0 \\
 \frac{dR(q)}{dq} - \frac{dC(q)}{dq} &= 0 \\
 \frac{dR(q)}{dq} &= c(q)
 \end{aligned} \tag{16}$$

We find that in optimum the marginal revenue $dR(q)/dq$ of a monopolist equals its marginal costs. In Figure 6 this is the case when the monopolist chooses quantity q_1 . Since $dp(q)/dq < 0$, the marginal revenue of selling one additional unit of output is lower than the current price $p(q)$, i.e. the additional output can only be sold if the price declines. Given the above assumption that no other firm may enter the market, condition (16) is the condition for the short-run *and* the long-run equilibrium.

Re-arranging (16) shows that in its profit-maximum a monopolist chooses a price-cost margin, which equals the inverse of the price elasticity of demand η . This is the well-known

Amoroso-Robinson relation.

$$\begin{aligned}\frac{p(q)-c(q)}{p(q)} &= -\frac{dp(q)}{dq} \cdot \frac{q}{p(q)} \\ &= \frac{1}{\eta}\end{aligned}\tag{17}$$

The left-hand side of equation (17) is also known as **Lerner-index** (see section E.1). We find that a monopolist may charge a higher optimal markup on marginal costs when consumers are relatively insensitive to changes in price, i.e. when their price-elasticity of demand is low. Similarly, if demand was perfectly elastic (horizontal demand curve) with a willingness to pay at the level of marginal costs, the monopolist would have to charge a price equaling marginal costs.

Welfare Effects of a Monopoly

Now, we use Figure 7 to examine the welfare-effects of a monopoly in comparison to the base case of perfect competition (Motta 2004: ch. 2.2.2). In the perfectly competitive short-run equilibrium, firms would equalize the price to marginal costs (see condition (12)) and set p_c . This is a long-run equilibrium, too, because firms make zero economic profits. Welfare W_c equals consumer surplus CS_c and encompasses the areas A , B , and C . As we have seen above, a monopolist would optimally sell quantity q_1 at price p_1 . Welfare W_1 would equal the sum of consumer surplus CS_1 (= area A) and producer surplus PS_1 (= area B). Hence, in comparison to perfect competition the monopoly causes a redistribution of rents (= area B) from consumers to producers because of higher prices. Moreover, the increase in price comes along with a reduction of the quantity sold. This causes a **deadweight loss** in welfare (= area C). A welfare loss occurs not just for the monopoly price but for any price above marginal costs. One may see from Figure 7 that the deadweight loss caused by market power is the larger the higher the market price p .

Please note that total welfare in the monopoly-case is smaller than welfare in perfect competition. However, producer surplus in monopoly is higher than that in perfect competition. The monopoly-situation is inefficient, because by lowering the price one could increase the quantity sold and make consumers better off. This is not a **Pareto improvement** (i.e., not everybody is better off), since the producer surplus shrinks with respect to the monopoly case. However, it would be possible to redistribute rents such that the profit of the monopolist is not reduced (Pepall et al. 2008: p. 39).

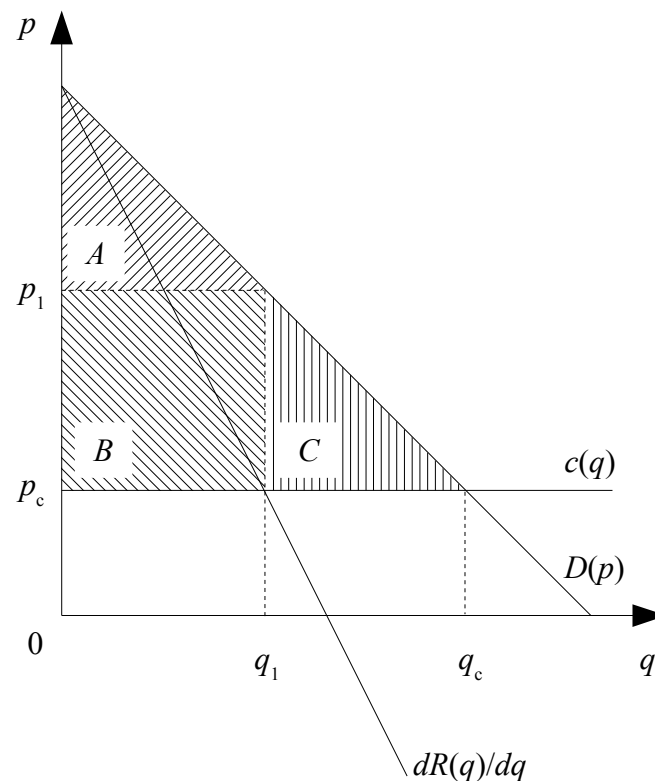


Figure 7: Welfare in Monopoly

In addition to the above deadweight loss, monopolies may create an additional welfare loss because of **rent-seeking activities** (Motta 2004: ch. 2.2.3). To see this, recall that a monopolist makes producer surplus B in Figure 7 as compared to a producer surplus of zero in perfect competition. Therefore, it would be individually profitable for a firm to invest an amount up to B in, e.g., lobbying activities or the creation of entry barriers in order to acquire or maintain monopoly power. This investment does not necessarily have any social value and, thus, constitutes an additional welfare loss.

Monopolies in Reality

Reasons for the existence of monopolies can be lower costs, higher quality (or better reputation for quality), or network effects (network industries (see section E.2), natural monopolies (see section C)). **Examples of pure monopolies** are rare. One rather finds industries where one firm commands a high market share while its competitors are rather insignificant. Examples of such industries are the mainframe computer industry in the 1960/70s with IBM as a dominant firm, or the industry for photographic films with Kodak as a dominant firm in the late 20th century (Cabral 2000: p. 71). Pepall et al. (2008: 29) provide the following example of a monopoly:

“It is not always easy to find examples of the classic monopoly behavior described in economics textbooks. However, Tyco International's control of the plastic hanger

market in the late 1990s may have come pretty close. Retail firms such as J. C. Penny and K-Mart use only plastic hangers to display their clothing goods. Starting in about 1994, Tyco used mergers and acquisitions of rival firms to gain control of 70 to 80 percent of the market for plastic hangers. In a number of geographic regions, Tyco became the only plastic hanger firm available. In 1996, Tyco acquired a Michigan-based hanger firm, Batts, that was one of the largest suppliers to the Midwest region. Immediately thereafter, Tyco raised prices by 10 percent to all its customers. Some clients grumbled but most accepted the higher prices. Others though, such as K-Mart and VF (makers of Lee and Wrangler jeans) informed Tyco that they had an alternative hanger supplier, namely a company called WAF. For a brief moment, Tyco appears to have backed off raising the price. Yet the firm's underlying strategy soon became clear. In the fall of 1999, Tyco bought the WAF Corporation. Within a few months, it not only raised prices to all its customers again but, this time, it also added in a new delivery charge. Tyco also pursued an aggressive repurchase program so as to corner the market on used hangers. If it did not control the supply of this alternative to new hangers, Tyco would have faced increasing difficulty in charging a high price.”

This example highlights a few points, that are not obvious from the above theoretic model of a monopolized industry. First, real industries are frequently characterized by the existence of a (small) number of firms rather than a single firm. This requires modeling the interaction among firms as is shown in sections B.2 and B.3. Second, the relevant market must be well-defined (see assumption 1 above). This requires identifying the relevant substitutes of a product, such as for example used hangers. Moreover, one has to identify the geographic scope of the relevant market. These issues are addressed in greater detail in section F. Third, only after the relevant market has been defined one can engage in attempts to forecast the likely price-increase of a merger like that between Tyco and Batts. This is illustrated more closely in section G.

Lessons Learned

After reading this section you should be able to answer the following questions.

1. What is the difference between the demand function and the inverse demand function?
2. Define the following economic concepts: producer surplus, consumer surplus, and welfare.
3. Show that the market outcome in perfect competition is allocatively efficient.
4. Determine the industry-supply curve when the marginal cost of each firm in an industry is $c_i(q_i)=4q_i+8$. Assume the number of firms in this industry to be $n = 80$ (Pepall et al. 2008: 23).
5. Explain why the amount of economic profits is below the amount of accounting profits.
6. Show that allocative efficiency in a monopoly is lower than in perfect competition.

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