1. Market power and competitive pressure

Market power has been defined as the firm's ability to (profitably) raise the price above the competitive level. The degree of market power enjoyed by a firm can be measured by the Lerner index:

$$L = \frac{p-c}{p},$$

where *p* is the price a firm charges to maximize its profit and *c* its marginal cost of production.

In this Chapter we want to describe the market forces that limit market power. To do so we shall use three different, but equivalent, formalizations.

1.1 Market power and demand price elasticity

Consider a firm *i* that faces the residual demand function denoted by $Q_i(p_i)$. A residual demand curve represents the quantity that consumers buy from firm *i* when it charges the price p_i, keeping fixed the prices charged by *i*'s competitors and all the other market characteristics. Firm *i*'s profits are:

$$\pi_i = (p_i - c)Q_i(p_i),$$

where *c* denotes *i*'s marginal costs assumed constant. The price that maximizes *i*'s profits solves the following FOC[1]:

$$\frac{\partial \pi_i}{\partial p_i} = Q_i + (p_i - c)\frac{\partial Q_i}{\partial p_i} = 0$$

After some manipulation, the FOC yields the following condition:

$$\frac{p_i - c}{p_i} = \frac{\partial p_i}{\partial Q_i}\frac{Q_i}{p_i}$$

which can be written as:

$$L = \frac{1}{\varepsilon_i}$$

where ε_i is the price elasticity of firm *i*'s residual demand.

This result tells us that the market power of a firm is limited by the possibility that consumers reduce the volume of the product they buy from that firm when it increases its price. The stronger this consumers' reaction the lower the degree of market power that the firm holds. A firm lacks any market power if the price elasticity of firm *i*'s residual demand is infinite.

1.2 Market power and degree of rivalry

The relationship between market power and the demand price elasticity can be further explored by using a slightly different formalization. Let $Q(p)$ be the overall market demand where *p* is the vector of prices charged by all active firms, including firm *i*. As before, let us keep fixed all prices but p_i, and denote with $s_i(p_i)$ firm *i*'s market share, i.e. the percentage of the overall demand that is captured by *i* when it charges p_i. The firm's profit are now:

$$\pi_i = (p_i - c)s_i Q(p)$$

The FOC for profit maximization is:

[1] In a market game this condition must be satisfied for all firms.

$$\frac{\partial \pi_i}{\partial p_i} = s_i Q + (p_i - c)\left(\frac{\partial s_i}{\partial p_i} Q + \frac{\partial Q}{\partial p_i} s_i\right) = 0$$

that can be arranged as:

$$L = \frac{1}{\varepsilon_{si} + \varepsilon_{Qi}}$$

where:

ε_{si} is the price elasticity of firm *i*'s market share; and

ε_{Qi} is the price elasticity of the market demand when only firm *i* changes its price.

This formulation decomposes the consumer reaction to a price increase in two elements. The first element, the market share price elasticity, ε_{si}, represents the impact on *i*'s sales of the consumers' decision to buy the product from *i*'s rivals. The second element, ε_{Qi}, represents the impact of a variation of the price charged by *i* on the overall market demand. The two elements help us understand in more details what are the choices that consumers can make and how they can curb market power. Imagine a firm that sells pizza and that decides to increase its price. Consumers can react in two ways: they can buy pizza from another firm or stop buying pizza and use that money to buy something different (e.g. a burger) or save it. Both types of decision restraint the pizza maker's market power. However, the first factor, ε_{si}, may be crucial. Indeed, if ε_{si} is infinite the firm has no market power independently of the ability and willingness of consumers to reduce their overall demand. We can call this factor the "degree of rivalry".

Since the market share price elasticity measures the extent to which consumers' react to a price increase by reverting to the offer of *i*'s rivals, the first obvious factor we need to consider is whether a rival firm exists. If *i* is the only provider of the product in question, i.e. the only pizza shop in town, the market share price elasticity is bound to be zero. Indeed, either consumers buy the pizza from *i* or they have to eat something different. Indeed, a monopolist, by definition serves 100% of the market whatever is the price it charges and its market power can only be constrained by the willingness and ability of consumers to stop purchasing the monopolized product.

The number of rivals faced by firm *i* by itself is not crucial. Indeed, suppose that there is only one rival, and that *i* raises its price. If all consumers move away from *i* to buy the same product from that rival, the market share price elasticity is infinite: firm *i* is not in the position to exert any market power. Hence we need to understand what other factors affect the consumers' ability and willingness to divert their purchases from *i* to *i*'s rival(s). We will then reconsider whther the number of rivals is a factor that affects the value of the market share price elasticity and how.

The first of these factors is the extent to which the product offered by *i* is perceived as identical to the product of the rival firms. Is the pizza the same in all pizza shops? Or does firm *i* sell a pizza that consumers perceive as different from the other pizzas? In the first case we can say that the product is homogeneous across firms. Note that what really matters is the consumers' perception. Hence, two products are perfectly homogeneous if and only if consumers are able and willing to buy only the cheapest product, since all the other product's features do not affect their welfare by any means. This condition does not hold whenever consumers may decide to sacrifice a monetary saving in order to buy the product they prefer. This may be due to some inherent characteristics of the product that differ from those of other substitutes, so that the former is or is perceived as being of higher quality or being able to better meet consumers' tastes. Firms may also differ for their location, reputation etc. The development of brands and advertisement are typical instruments that firms use to convince consumers that their products differ from those offered by their competitors. In all these cases we say that products are differentiated. Product differentiation is a matter of degree: a useful

way to measure this degree of differentiation is exactly the extent to which consumers are willing to move from one product to another when their relative prices change.

A second factor that affects firm *i*'s market share price elasticity is whether rival firms have enough productive capacity to serve the demand stemming from those consumers that are willing to switch. If the rival pizza shops are already operating at full capacity and firm *i* increases its price, its share of the overall demand is not affected because consumers will keep buying pizza from it as they cannot be served by the other firms. Hence the market share price elasticity depends on the capacity constraints faced by rival firms.

A third factor is the existence of switching costs, i.e. the costs that consumers incur when they switch from firm *i* to its rivals. These may be monetary as well as psychological, effort- and time-based switching costs. Changing the pizza provider typically does not entail any particular cost. However, recurrent customers may experience some discomfort if they buy pizza from somebody that does not know his peculiar tastes. Some consumers may think that changing the hairdresser can be very costly. More typical and material switching costs exist for several products. For instance, changing the operating system or any other software implies substantial time and effort to become acquainted with the new routines, to which often one has to add some degree of personal stress. Moving a bank account from one firm to another may entail a closing fee. Mobile operators may charge cancellation fees to customer that switch to a different provider. Sometimes a switching cost stems from the loss of a possible reward: frequent flyer programs are an example of methods that firms use to create a switching cost that limit the customers' willingness to buy from competing carriers.

A fourth and final factor that affect the market share price elasticity is the existence of search costs. These are the costs that a consumer incurs to acquire the information she needs to make a decision. Again these may be monetary costs, as well as costs in terms of time and effort that need to be devoted to the activity of searching for suitable alternatives.

Let us now come back to the issue whether the number of rivals is a relevant factor. As already argued, in principle this element is not decisive. There may be cases in which the presence of only a limited number of rivals, or even just one, suffices to have such a high market share price elasticity to eliminate the risk of market power. In particular, this occurs when products are homogeneous, rivals have enough spare capacity to accommodate any new demand, and consumers do not face switching and search costs. However, when these factors create some obstacles to consumers' mobility, then the number of rivals to which they can turn to becomes relevant. In particular, the existence of a higher number of rivals is likely to relax the mobility constraints (with a positive impact on the market share price elasticity) that stems from the first two factors: product differentiation and the lack of spare productive capacity. As for the first element, the higher the number of firms active in a market the more likely is that a firm faces a competitor that offers a product that is a relatively close substitute. So, even if the overall degree of product differentiation may be positively related to the number of firms, it is likely that that the degree of differentiation that exists between one firm and its closest rivals is lower when there are many competitors. As for the second element, it is apparent that any limit that may stem from capacity constraints is likely less stringent when there is a higher number of suppliers.

The impact of the number of rivals on the other two factors, switching and search costs, is less clear cut. Indeed both types of costs may be unaffected by the number of firms that operate in the market. It is even possible to argue that search costs become higher if consumers have more opportunities and therefore need to collect more information to make a perfectly informed decision. Yet, what we are really interested in is to understand to what extent consumers will remain loyal to a firm when this increases its price. In this respect, having a large set of offers may render switching and search costs a less significant obstacle to the consumers' decision to leave the previous supplier. Switching costs prevent such a decision when they exceed the gain a consumer obtains from switching. If there are more offers available in the market it is more probable that one of them makes switching convenient even if the magnitude of switching costs is not altered. Similarly,

even if the presence of a larger number of suppliers increases the search costs that a consumer incurs to make a fully informed decision, it enhances the probability that a consumer finds a better offer with a limited search. Therefore the higher number of rivals is likely to relax the switching constraints that derive from switching and search costs.

To conclude, the magnitude of the market share price elasticity depends on:

- number of rivals;
- degree of product differentiation;
- capacity constraints;
- switching costs;
- search costs.

1.3 Market power and divertion ratios

We can use a third formalization to understand what determines the competitive pressure that limits firms' ability to exert market power. Consider a representative consumer that has to decide how to allocate her income to buy goods and services. Let us denote with *M* the consumer's income. Given the prices charged by all firms in the economy, and her preferences, she will spend her income as described by the following equation:

$$M = p_i Q_i + \sum_{j \neq i} p_j Q_j.$$

As in the previous sections, we want to understand what factors limit firm *i*'s market power. Hence, suppose that firm *i* increases its price, keeping fixed all the other prices. We can compute the following derivative:

$$\frac{\partial M}{\partial p_i} = Q_i + p_i \frac{\partial Q_i}{\partial p_i} + \sum_{j \neq i} p_j \frac{\partial Q_j}{\partial p_i}.$$

This derivative is bound to be zero. Indeed, the decision made by firm *i* to increase it price does not affect the consumer's income. Moreover the representative consumer will keep spending the entire income to buy goods and services.[2] Thus we can equate the derivative to zero and divide both sides of the equation by $p_i \frac{\partial Q_i}{\partial p_i}$. We obtain:

$$\frac{\partial p_i}{\partial Q_i}\frac{Q_i}{p_i} + 1 + \sum_{j \neq i} \frac{p_j}{p_i}\frac{\partial Q_j}{\partial p_i} \Big/ \frac{\partial Q_i}{\partial p_i} = 0.$$

Now, (remember that $\frac{\partial p_i}{\partial Q_i}$ is negative), the previous equation can be rearranged as:

$$\frac{1}{\varepsilon_i} = 1 - \sum_{j \neq i} \frac{p_j}{p_i} D_{i \to j}$$

where:

$D_{i \to j} = \frac{\partial Q_j}{\partial p_i} \Big/ \frac{\partial Q_i}{\partial p_i}$.

[2] This stems from the non-satiation assumption made in consumer choice theory. A more simple way to understand this point is to include among the various goods and services a product called "savings" and maintain that the consumer buys this product with the part of the income that is not used to buy other goods or services.

The term $D_{i\to j}$ is referred to as the "divertion ratio from *i* to *j*". It measures the share of volume sales lost by firm *i* (when it raises it price) that is captured by firm *j*, or "diverted" to firm *j*. For instance if pizza shop *i* sells 100 pizzas at a given price and 90 pizzas if it raises its price, it loses a volume of 10 pizzas. If the pizza shop *j* increases its volume sales by 5 pizzas when *i* raises the price, we can say that the divertion ration is 0.5, or 50%, as 50% of the sales lost by *i* are diverted to *j*.

Recall from section 1.1. that, in equilibrium, for profit maximizing firms, the Lerner index is equal to the inverse of the (residual) demand price elasticity. Therefore, we can rewrite the previous equation as:

$$L = 1 - \sum_{j \neq i} \frac{p_j}{p_i} D_{i\to j}.$$

According to this equation, firm's *i* market power depends on the sum of the divertion ratios from *i* to each other firms, where each of this divertion ratios is weighted by the relative price of *j* over *i*.

Divertion ratios are frequently used in the enforcement of competition law and especially in the application of the merger control regulation.

There is one element that we need to note. This further description of the determinants of market power shows that not all rivals are equally important. There are some rivals that matter more than others. In particular, rivals that exhibit a larger divertion ratio are those to which most customers revert when one firm tries to charge a higher price and therefore are those that play a much greater role in disciplining firms' pricing decisions. These rivals are referred to as "close competitors" and their products as "close substitutes". Close competitors and close substitutes are the main source of the competitive pressure that limits one firm's market power. Hence, it is important to make sure that the enforcement of competition rules is such to prevent conducts that aim at reducing the competitive pressure exerted by the closest competitors.