MANAGERIAL ECONOMICS

Corrado Pasquali

Oligopoly: non-collusive models

Introduction

Oligopoly theory rests on recognition of the importance of the number of firms in the industry, and the nature of the product.

In all oligopolistic markets, a few sellers account for a substantial proportion of total sales. The fewness of the firms is the chief identifying characteristic of an oligopoly.

Introduction

As a result of the fewness of firms within a clearly defined industry, produc- ing a similar product or service, the central problem of oligopoly focuses on the recognition of the firms' mutual dependence or interdependence.

Interdependence means a firm is aware that its own actions affect the actions of its rivals and vice versa. Profit maximization and survival in an oligopoly depend on how effec- tively each firm operates in this situation of interdependence.

The road ahead

We begin with a general discussion of the key issues of interdependence, conjectural variation, independent action and collusion in oligopoly.

We will then turn to examining Cournot's original model of output determination in a duopoly, based on a simple assumption that two firms take their output decisions sequentially, each in the expectation that its rival will not subsequently react.

The road ahead

We will then turn to examining Chamberlin's model of joint profit maximization, in which mutual dependence is recognised.

Then, we will study Stackelberg's leader–follower model. This is biolt on the assumption that one firm learns to anticipate its rivals' reactions to its own decisions, and exploits this foresight to increase its own profit at its rivals' expense.

The road ahead

The Cournot, Chamberlin and Stackelberg models focus mainly on the firms' **output decisions** in duopoly or oligopoly.

However, as eager to learn as we are, we will conclude with the study of models developed by Bertrand and Edgeworth, which focus on **price decisions**.

The Bertrand model provides a theoretical justification for the idea that intense price competition might occur in markets with few firms producing a similar or identical product.

The Edgeworth model focuses on the possibility that oligopolistic markets might be permanently unstable, with no long-run equilibrium price or output level ever being achieved.

Interdependence, conjectural variation, independent action and collusion

At the beginning of the twentieth century, classical microeconomic analysis focused on the models of perfect competition and pure monopoly in its attempt to describe the behavior of firms.

It soon became apparent, however, that these two models were unable to explain many aspects of business conduct in the real world.

An additional theory was required to deal with the vast area of industry structure that lies between the two polar cases of perfect competition and monopoly.

This middle ground, known as imperfect competition, can be subdivided into two:

- monopolistic competition
- oligopoly

Interdependence

Interdependence provides the main challenge for the analysis of oligopoly. Each firm's behavior depends on its assumptions about its rivals' likely reactions.

'I' (an oligopolist) cannot define my best policies unless I know what 'You' (my rival) are going to do; by the same token, however, you cannot define your best move unless you know what I will do. (Asch, 1969)

Conjectural variation

Faced with this situation of interdependence, the firms must make some guesses or conjectures as to the likely actions of rivals. Each firm must determine its price or output, while making assumptions about its rivals' likely reactions to its own actions.

The term conjectural variation refers to the assumptions a firm makes about the reactions it expects from its rivals in response to its own actions.

Independent action VS collusion

It is sometimes suggested that the solution to the oligopoly problem is one of two extremes: either pure independent action or pure collusion.

Under pure independent action, each firm reaches a unilateral decision on a course of action, without any prior contact with its rivals. Under collusion, two or more rival firms recognize their interdependence, creating the potential for bargaining to take place with a view to formulating some plan of joint action.

In reality, both independent action and collusion are usually a matter of degree. While examples may be found that conform to these two polar cases, most cases fall somewhere between the two extremes.

Models of output determination in duopoly: Cournot

We are now ready to study Cournot's duopoly model: a model of output determination in duopoly.

Cournot's duopoly model

Cournot's (1838) model of output determination in oligopoly was the first successful attempt to describe an oligopoly equilibrium.

The type of solution that Cournot proposed almost two centuries ago still plays a central role in many present-day models of oligopoly.

Cournot's duopoly model

Cournot's original formulation assumes a two-firm oligopoly, known as a duopoly, operating at zero marginal cost.

Cournot analysed a market comprising two proprietors or firms, A and B, both selling mineral spring water.

To ensure both firms operate at zero marginal cost, it is assumed the two firms are located side by side next to the spring and customers arrive at the spring with their own bottles.

Cournot's duopoly model

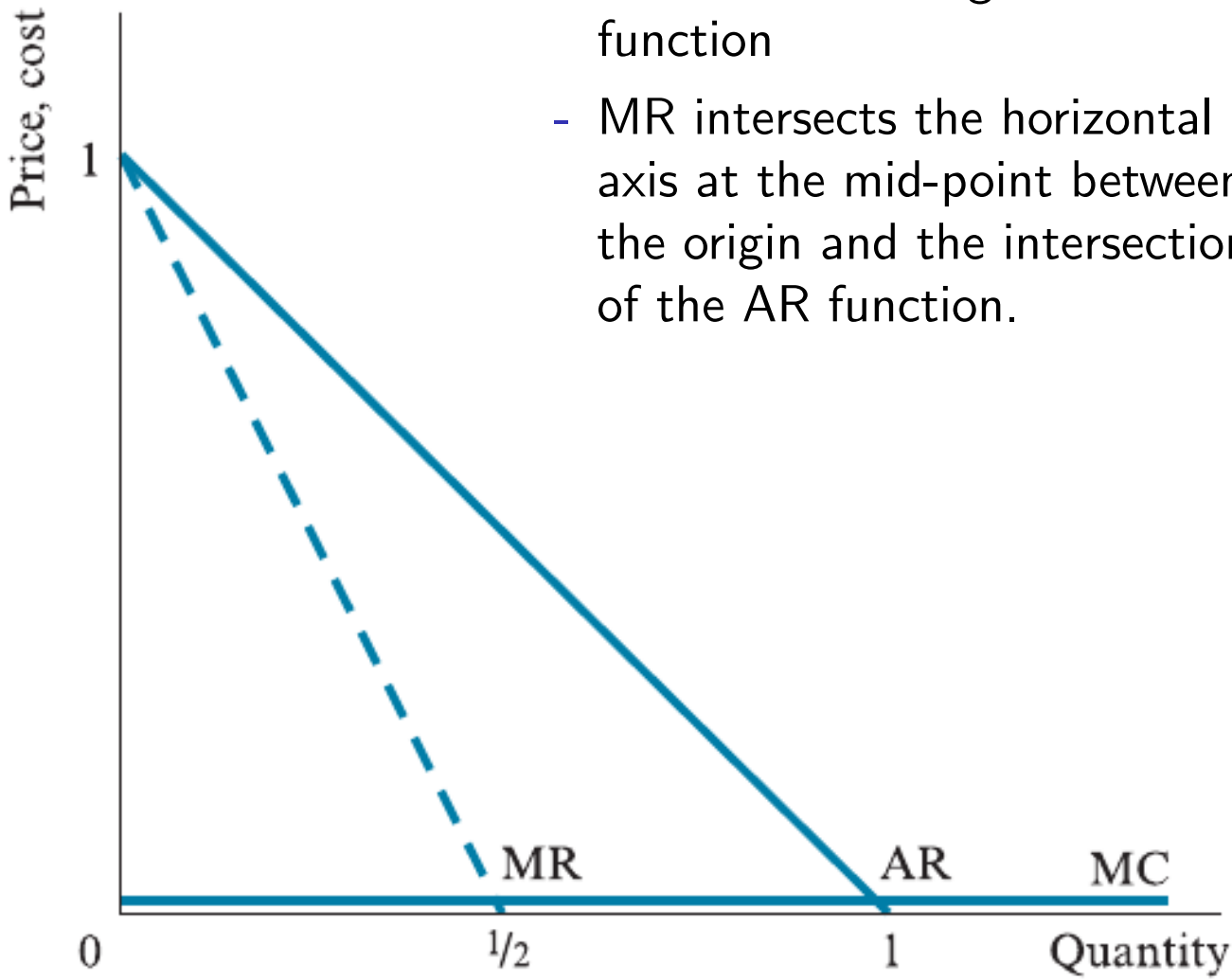
The firms are assumed to make their trading plans in turn or sequentially.

It is also assumed, when making its own trading plans, that each firm expects the other firm to maintain its output at its current level. In other words, each firm assumes the other firm's reaction (in terms of adjustment to output) is always zero.

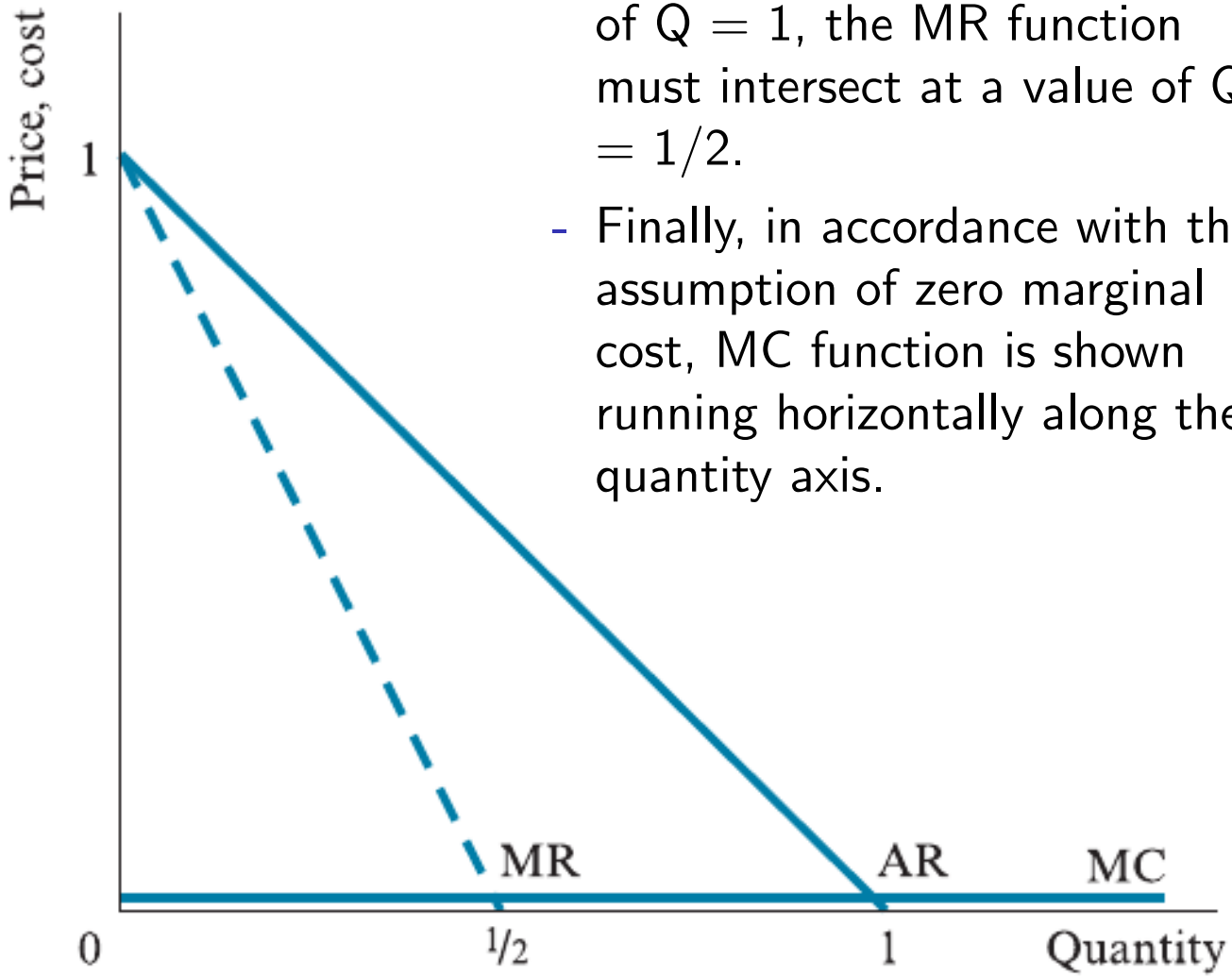
So: zero conjectural variation.

Cournot's duopoly model

- AR = linear demand function
- MR = linear marginal revenue function
- MR intersects the horizontal axis at the mid-point between the origin and the intersection of the AR function.



Cournot's duopoly model

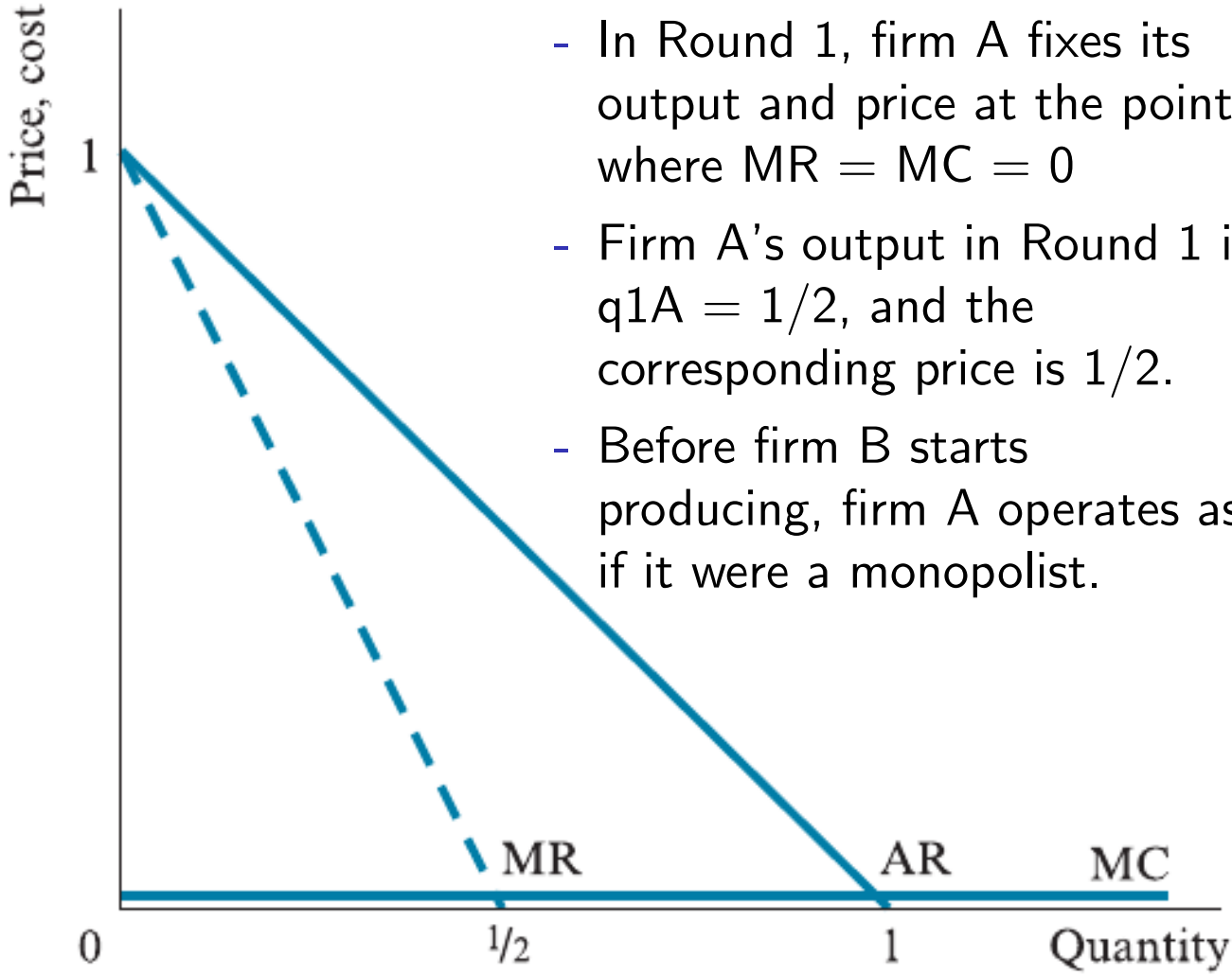


- if the AR function intersects the horizontal axis at a value of Q = 1, the MR function must intersect at a value of Q = 1/2.
- Finally, in accordance with the assumption of zero marginal cost, MC function is shown running horizontally along the quantity axis.

Cournot's duopoly model

In the Cournot model, the market equilibrium is reached through a sequence of actions and reactions on the part of the two firms.

Cournot's duopoly model



- Assume firm A is the first to open for business.
- In Round 1, firm A fixes its output and price at the point where MR = MC = 0
- Firm A's output in Round 1 is q1A = 1/2, and the corresponding price is 1/2.
- Before firm B starts producing, firm A operates as if it were a monopolist.

Cournot's duopoly model

Why is p = 1/2?

Why is p = 1/2?

We are implicitly using:

$$P = 1 - Q$$

$$MC = 0$$

Where $Q = q_A + q_B$

In round 1, B does not produce anything so: $Q = q_A$

Cournot's duopoly model

Why is p = 1/2?

Let us now turn to total revenue:

$$TR_A = P \cdot q_A = (1 - q_A)q_A$$

$$TR_A = q_A - q_A^2$$

and to marginal revenue:

$$MR_A = \frac{dTR_A}{dq_A} = 1 - 2q_A$$

and finally to marginal cost:

$$MC = 0$$

Cournot's duopoly model

Why is p = 1/2?

Now, profit is maximized whenever:

$$MR = MC$$

that is:

$$1 - 2q_A = 0$$

so that:

$$q_A = \frac{1}{2}$$

Cournot's duopoly model

Why is p = 1/2?

As to corresponding price:

$$P = 1 - Q = 1 - q_A$$

substitute $q_A = \frac{1}{2}$ and we get:

$$P = 1 - \frac{1}{2}$$

...which serves you right. :-)

Cournot's duopoly model

Now firm B enters the market.

B sees A is supplying $q_A = \frac{1}{2}$.

According to the zero conjectural variation assumption, B assumes that whatever B does, A will continue to produce $q_A = \frac{1}{2}$

Therefore B's effective or residual demand function is the segment of the market demand function that is not currently serviced by A.

This is the segment of the market demand function that lies to the right of $q_A = \frac{1}{2}$

However, If B charges a price of 1/2, B sells zero output.

Want to know why?

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model

Cournot's duopoly model