Market Structure and Competition Policy

Game-Theoretic Approaches

Edited by
GEORGE NORMAN
and
JACQUES-FRANÇOIS THISSE

CAMBRIDGE
UNIVERSITY PRESS

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE
The Pitt Building, Trumpington Street, Cambridge CB2 1RP, United Kingdom

CAMBRIDGE UNIVERSITY PRESS
The Edinburgh Building, Cambridge CB2 2RU, UK http://www.cup.cam.ac.uk
40 West 20th Street, New York, NY 10011-4211, USA http://www.cup.org
10 Stamford Road, Oakleigh, Melbourne 3166, Australia
Ruiz do Alarcón 13, 28014 Madrid, Spain

© First published 2000

Printed in the United Kingdom at the University Press, Cambridge

Typeface Times 10/12 pt. *System* 3b2 [ADVENT]

A catalogue record for this book is available from the British Library

Library of Congress Cataloguing-in-Publication Data

Market structure and competition policy: game theoretic approaches/edited by George Norman and Jacques-François Thisse.
p. cm.
A collection of 12 papers by European and North American scholars which develops some of the theroretical and policy concerns associated with the pioneering work of Louis Phlips.
ISBN 0-521-78333-X
1. Competition–Government policy–Mathematical models. 2. Industrial policy–Mathematical models. 3. Game theory. 4. Phlips, Louis. I. Norman, George, 1946– II. Thisse, Jacques-François. III. Phlips, Louis.
HB238.M37 2000
338.6′048–dc21 00-028960

ISBN 0521 78333 X Hardback

Contents

Figures

Tables

1 Competition policy and game-theory: reflections based on the cement industry case

Claude d'Aspremont, David Encaoua and Jean-Pierre Ponssard

1 Introduction

Is the main objective of competition policy the *maintenance of competition per se* or the *promotion of economic efficiency*? These two goals do not necessarily have the same basis or the same implications.[1] The goal of maintaining competition *per se* can be justified morally, politically and legally by the wish to protect individual freedom and rights, and by limiting the power of agents. This faith in the democratic virtues of interacting competitive forces is grounded in a political philosophy which sees regulatory mechanisms resulting from *impersonal* market forces as a guarantee against the arbitrariness of authority, whether public or private. In this sense, competition is a right which warrants protection. Economically, competition is not considered as an end in itself but rather as a mechanism for allocating resources which in many, if not all cases, promotes economic efficiency. The question the economist has then to answer is whether or not, depending on the circumstances, competition promotes the reduction of costs, the selection of the most efficient businesses, the welfare of consumers, the creation of new products, the entry of new enterprises, the development of technological progress and innovation and so on.

To what extent do these two goals of competition policy overlap? Before setting out our framework to formulate an answer to this question, let us introduce the basic issues.

Clearly, if competition policy adopted an exclusively normative approach, consisting of the decentralised inducement of an efficient

An initial version of this chapter was presented at the conference 'Economic Analysis and Antitrust Issues in Concentrated Sectors: The Case of the Cement Industry', Paris, Carré des Sciences (15 January 1996). We wish to thank Louis Phlips, Hervé Tanguy, Jacques-François Thisse and the other participants at the conference for their comments and suggestions.

[1] See, for example, Jenny (1993); Encaoua (1997).

allocation of resources, based on the perfectly competitive behaviour of firms, the convergence between the above two goals would be total, according to the First Welfare Theorem. Such an approach means, however, that each business would be obliged to comply with the rule of maximising profits by taking the environment in which it operates as fixed – an outrageous requirement. We know that that is not how competition policy functions. Rather than decreeing rules *a priori*, free competition limits itself to prohibiting certain types of behaviour judged to be reprehensible in so far as they hinder the free play of market forces. However, the interpretation of this notion is tricky since no precise system of reference exists for judging deviant behaviour.

Thus, in many oligopolistic sectors the reference to 'perfect competition' is totally unrealistic. Market forces are not impersonal and the limited number of actors naturally leads firms to adopt strategic behaviour in which they anticipate their competitors' reactions. We have thus to ascertain which rules would need to prevail on these markets in order to ensure that the discrepancy was not too great between the principle of maintaining rivalry, implicit in the free play of market forces, on the one hand, and the concern to enhance economic efficiency and the social optimum, on the other.

The independent behaviour of the different actors is one of the guiding principles of all competition policies; they defend this rule by opposing anything which may indirectly facilitate collusion between firms (agreements or information exchange concerning prices, quantities produced or capacities, etc.). However, this type of approach is soon limited without an appropriate conceptual model to analyse imperfect competition as such. It results, for example, in only explicit agreements being condemned while tacit collusion becomes acceptable, the latter being seen as an expression of rational behaviour between independent agents with a common perception of their environment.[2]

With the formalisation of imperfect competition by means of game-theory, another step forward can be taken. The ambiguous notion of parallel behaviour is replaced by the more precise one of non-cooperative equilibrium. It then becomes possible to reflect on the interaction between

[2] Wood pulp is a case in point. The alignment of prices among about 50 wood pulp producers was judged by the European Commission to be an expression of a concerted practice. The European Court of Justice (ECJ), however, regarded wood pulp to be an homogeneous product for which the market is perfectly transparent. It considered that the firms may have reacted identically to modifications in their environment without any formal agreement. For the European Commission decision (19 December 1984), see the *Official Journal of the European Communities*, *L*851, and for the ECJ judgement in the appeal case (31 March 1993), see *Recueil de la Jurisprudence de la Cour de Justice et du Tribunal de Première Instance*, I, 1993, 3. For a case study, see Phlips (1995, pp. 131–6).

certain rules of the game and the degree of economic inefficiency of the non-cooperative equilibrium which may result from it. Some rules may then appear to be less effective than others and be condemned as such, whereas others will be encouraged. This approach thus provides a more powerful frame for examining competition policy.

The present chapter develops this type of analysis in relation to the cement industry. It considers several rules concerning price policy, the exchange of information and external growth operations (mergers and acquisitions), with particular reference to models derived from game-theory.

The cement industry is a typical example of an oligopolistic sector. Cement is an homogeneous good for which the price elasticity of demand is weak, production requires heavy investments and distribution involves high transport costs. Consequently, there are often few local competitors. They are, however, subject to competitive pressure from the outside, from distant firms which try to sell at marginal costs.

The sector has a rich history of anti-trust cases in the United States, Europe and Japan, which have provided subject-matter for an extensive literature on the various standpoints taken. In the present chapter we draw essentially on the cases referenced in the historical analysis by Dumez and Jeunemaître (2000). In some of these cases there is clear proof of agreement while in many others the questions concern practices with far less obvious effects – e.g. the choice of price regulation (the use of points of parity, for instance), the role of information exchange between competitors and the choice of the relevant market for analysing concentration.

We shall consider these questions of principle in the light of several theoretical developments which are particularly relevant to a study of the cement industry.

First, what is the impact of a *pricing system*, in relation to its degree of discrimination, in a context of horizontal differentiation? Numerous studies have focused on this question since the first articles by Spence (1976) and Salop (1979). Most reached the classical conclusion that more competitive pricing had a positive impact on welfare (Phlips, 1983). Norman and Thisse (1996) examined the same question by considering the role of the irreversibility of investments. They show that highly competitive pricing may lead to greater market concentration and ultimately to a loss of welfare for the economy as a whole.

The second question concerns *information exchange* – or, more generally, trade practices which shape competition. How are they justified and what is their impact? Information exchange usually concerns commitments to align prices on advance notification. But there are other facilitating

practices. Holt and Scheffman (1987) showed that such practices could influence the intensity of competition – for example, by causing it to change from Bertrand to Cournot competition. This conclusion is used by d'Aspremont and Motta (2000) in a context of horizontal differentiation. They show that more intense competition may lead to greater concentration.

These theories, in terms of both pricing and facilitating practices, provide arguments in favour of the maintenance of rules tending to moderate competition in the short term and thereby limit concentration in the sector. Of course, in these models it is always assumed that firms' behaviour remains non-cooperative. The question of whether a particular rule promotes agreements between firms remains relevant. However, empirical studies by Sutton (1991) reinforce the general assumption that the intensity of competitive pricing can have a retroactive effect on concentration. The value of theoretical analyses is then to specify the mechanisms which may favour this retroaction to a greater or lesser degree.

Lastly, we examine a point which has received relatively little attention in the literature but is directly relevant to the empirical analysis of the cement industry. When we study this sector over periods of about 10 years, we are struck by the considerable importance of the buying and selling of assets – production units, here – for purposes of restructuring (Tanguy, 1987). The indivisibility of investments, the stagnation of demand in most developed countries and the increase in the minimal economic size of production investments are all factors which make competition in the cement business resemble a *game of Go*. In this game, some positions which are still profitable do not seem viable in the long term; the company then tries to sell them at a profit to a rival in a better position who has anticipated the situation more accurately. This process of restructuring the industry, favoured by a degree of financial concentration, seems to play a major part in the strategy of cement firms (Collomb and Ponssard, 1984). From a theoretical point of view, we are then led to question the relationship between short-term competition rules and firms' capacities to engage in this process of long-term efficiency.

A natural starting point for the study of this question is the modelling of competition in a dynamic context with free entry. Now, it has already been shown that in this type of context strong potential competition which facilitates entry does not necessarily lead to greater economic efficiency but may, on the contrary, lead to a waste of capital (Eaton and Lipsey, 1980; Maskin and Tirole, 1988). This results from the fact that incumbent firms may be induced to create entry barriers artificially

by means of defensive measures involving heavy costs (advertising, vertical integration, renewal of assets before this is due, etc.) rather than lowering their prices. This analysis, developed in the absence of competitive advantages between firms, has been completed so as to take into account possibilities of asymmetry (Gromb, Ponssard and Sevy, 1997). The authors show that an effective process of selection will be initiated, in which a more efficient entrant will replace a less efficient incumbent. However, this selection depends on a mechanism of rational expectations which presumes that firms are able to assess their respective structural positions.

The rest of this chapter is organised as follows. In section 2 the characteristics of the cement industry are analysed in detail. Section 3 develops theoretical considerations and explains the results mentioned above. In the conclusion (section 4) we summarise the lessons drawn from the proposed approach and suggest some general ideas in terms of competition policy for an oligopolistic sector such as the cement industry.

2 Characteristics of the cement industry

In this section we present the basic economic characteristics of the cement industry by following the classical approach which consists of successively examining demand, supply and market structure. On the basis of these characteristics we are then able to define the main economic stakes in the sector. Our presentation concerns the industrialised countries and, more specifically, Europe. We have drawn upon the French case for many of our examples.

Demand

Demand in the cement industry is typically that of an activity which is mature, cyclical and with low price elasticity. It is also characterised by a high degree of horizontal differentiation in terms of location and a low degree of vertical differentiation in terms of quality.

Let us look at each of these points. Cement is an homogeneous product. Most of its sales concern about half a dozen commercial varieties, of which Portland cement is by far the leader. No brand name exists, so that one supplier's products can easily be substituted for another. Cement is, however, an experience good; its quality is guaranteed by standards with which the supplier has to comply. These standards are often national but in most cases the products of one country can easily be approved in neighbouring countries. Standards therefore do not constitute trade barriers as such, even if they may hinder trade.

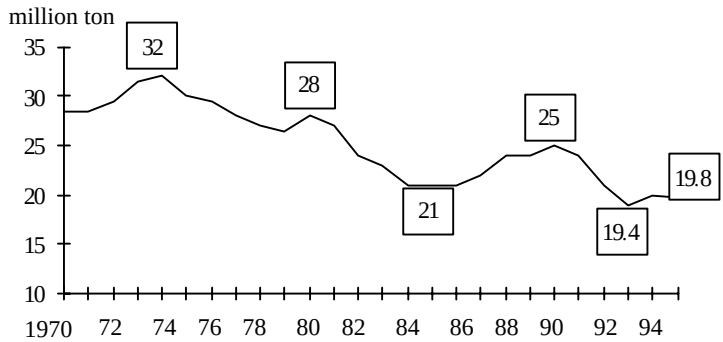

Figure 1.1 Cement consumption, 1970–1994, million tons

Although cement is one of the main ingredients used in the construction industry, it accounts for only 2 per cent of the costs. The price of cement therefore has little impact on final demand which is essentially the result of macroeconomic conditions (economic growth rate, interest rates, policy of infrastructure development, etc.). By contrast, intermediaries such as producers of precast concrete or prefabricated material are strongly affected by prices, with the result that pressure is constantly exerted on suppliers to lower prices. This pressure will be particularly strong when the sector is concentrated downstream.

Figure 1.1 represents the consumption of cement in France over the period 1970–95 (trade syndicate data). This demand, typical of industrialised countries, appears to be cyclical with a downward trend after peaking in 1974 (this peak occurred a little earlier in the United Kingdom and Germany and more recently in Spain and Italy). This demand curve does not encourage the entry of new competitors.

Let us now consider horizontal differentiation in this sector. The demand for cement is geographically widely dispersed and corresponds roughly to population density. Although cement is an upstream industry, it differs from other basic industries such as aluminium, steel or glass, for which demand is concentrated both geographically and in terms of the number of customers. In the cement industry demand is, by contrast, dispersed in multiple zones of consumption, each of which comprises numerous customers. Geographical factors thus determine the structure of the market. For example, in areas with high levels of consumption, accessible by waterway (such as London, Marseilles or Barcelona) the market stakes differ from those of more isolated areas (such as Berne, Grenoble or Madrid).

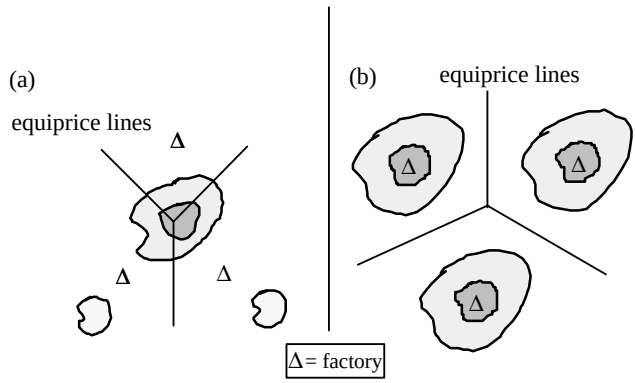

Figure 1.2 Maritime and land models of market structure. (a) Maritime model (b) Land model

Figure 1.2, adapted from Tanguy (1987), illustrates this phenomenon. On the left, producers compete on a major market; on the right, each producer is relatively isolated on its natural market. These two extreme cases – called the *maritime* and the *land* model, respectively, by Dumez and Jeunemaître (2000), as well as all the possible intermediate forms, constitute the *playing field* of the cement industry. The traditional playing field is the land model, but the maritime model takes over when communication over vast distances becomes possible (the Great Lakes and Mississippi networks in the United States, the North Sea network, the Euro–Mediterranean network, and so on).

Supply

Two economic considerations are important *a priori* in structuring supply in a market characterised by strong horizontal differentiation:

- The trade-off between fixed costs and transport costs which, depending on the economic size of the factories, gives an initial idea of the density of the network of production units covering the territory, in relation to the density of demand
- The level of investment costs and the life-span of facilities which determine the rigidity and the duration of the network.

We shall begin our discussion of supply by giving a rough idea of the main expense items and the profitability factors of a production unit, and by simplifying the transport question.

Factory costs and key factors of profitability

The following data (table 1.1), drawn from interviews with professionals in the sector in France, give a breakdown of expenses for a production unit which has a capacity of 1 million tons per year and costs 1 billion francs in investments. This size is representative both of current technical capacities and of the economic stakes in most industrialised countries. For high-growth urban markets or for *on-shore* plants intended for an essentially maritime environment, larger dimensions would be more appropriate.

The main items in table 1.1 may be grouped together as *variable* expenses, which change in proportion to production, and as *fixed* expenses which are reduced to the ton but remain constant, irrespective of production. (By contrast, fixed costs may vary in relation to capacity; we shall return to this point below.) With regard to variable expenses, the item 'market access' represents transport costs for an average geographical dispersion. For a production of 1 million ton/year, variable expenses are 150 Fr/ton and fixed expenses are 180 Fr/ton, a total cost (excluding economic depreciation) of 330 Fr/ton.

In 1995 in France the average customer price including transport was roughly 450 Fr/ton. This type of factory therefore has a profit before tax of $450 - 330 = 120$, or 80 Fr/ton after tax (for a tax rate of 33.3 per cent).

To evaluate the operating profit after depreciation and taxes, one has to subtract the capital charges for investment (taken here to be equal to

Table 1.1 *Cost/profit structure for a production unit with a capacity of 1 million tons per year, running at full capacity*

Capacity: 1 million ton/year	Fr/ton (F/T)	Total	
Material	30		
Energy	70		
Market access	50	150	Variable costs
Factory fixed costs	100		
Maintenance	40		
Overhead (commercial, administrative)	40	180	Fixed costs
Selling price	450		
Earnings before tax	120		
Taxes	40		
Econ. depreciation	76		
Econ. rent	4		

8 per cent), taking into account the delayed deductibility of this expense owing to tax depreciation. By considering a life-span of about 20 years while tax depreciation is over a shorter time period, one can obtain a rough estimate in proceeding as follows. First compute the tax shield associated with depreciation (given local fiscal rules, in our example this amount would be 250 Fr/ton); secondly, after subtracting this amount from the investment cost (to obtain $1000 - 250 = 750$ Fr/ton), compute the economic depreciation associated with this capital investment of 750 Fr/ton on 20 years. With a unit capital cost of 8 per cent per year that gives approximately 76 Fr/ton in our case. The economic rent generated by this production unit would then be 4 Fr/ton. This cost structure implies that the economic rent is quite sensitive to price variation and to utilisation rate. This sensitivity is typical of a capital-intensive process industry in which the fixed costs (after tax) together account for over 65 per cent of the total cost.

It is generally considered that fixed factory costs and investments are largely determined by capacity. When the latter increases from 800 k ton/year to 1,500 k ton/year, they may be reduced by a factor of about 35 per cent. This calculation makes it possible to determine the part of fixed costs which is *truly fixed*. The corresponding economy explains why it may be advantageous to build large plants, provided that transport costs to the market are not too high.

The preponderance of transport costs

Transport costs depend on several factors: the means of transport used, the quantity transported and the distance covered. The three main means of transport are: road for short distances (less than 200 km), rail for longer distances (200–600 km) and finally water, essentially maritime. In the latter case, the cost is generally not considered to depend on the distance.

Each means of transport is economical not only for certain distances but also in relation to a minimum quantity which ranges from 25 ton for a lorry to 1,300 ton for a train and about 10,000 ton for a boat or ship. This is explained primarily by the loading and unloading costs involved. Boats are usually loaded directly from an on-shore plant whereas unloading costs require expensive facilities.

It is therefore possible to draw up a comparative table of transport costs (see table 1.2). All the corresponding data are drawn from interviews with professionals in the industry.

In an analysis of competition transport costs, which may easily amount to 100–150 Fr/ton, rapidly account for a significant fraction of the factory cost. Greater efficiency in production costs is thus soon lost in relation to

Table 1.2 *Estimation of transport costs*

Transportation mode	Road (0–200 km)	Railway (200–600 km)	Sea ex: Greece–USA
Loading	18 Fr/ton	15 Fr/ton	—
Per km	0.35 Fr/ton × km	0.25 Fr/ton × km	70 Fr/ton
Unloading	—	20 Fr/ton	80 Fr/ton
Total/ton	18–88 Fr/ton	85–185 Fr/ton	150 Fr/ton
Standard quantity	25 ton	1300 ton	10000 ton

a competitor who may be better placed on the market. On the other hand, the discrepancy between the price and the variable cost clearly constitutes a strong incentive to marginal-cost selling. Given the destabilising nature of this type of selling, it is likely to develop over large distances to avoid possible retaliation. In such cases harbour areas will be structurally more vulnerable to imports than inland areas.

If we wanted to use managerial stylisation, we could say that favourable transport conditions will tend to multiply the areas of contact between a large number of competitors, since the market will resemble a commodity market. By contrast, the exclusive use of road transport in areas of moderate consumption will bring together only a small number of competitors since the market will resemble a juxtaposition of specialised activities. This is another way of distinguishing between a maritime and a land model.

The network and its rigidity

By taking the geographical distribution of demand, fixed factory costs and transport costs, it is possible to determine an effective networking of a given territory. Applied to the territory of France, and excluding all imports and exports of cement, we find about a dozen production units with capacities of between 800 k ton/year and several million ton/year. (We note, however, that a capacity of several million ton/year is not realistic because of competitive vulnerability.)

Although theoretical, this calculation helps us to locate the real network. In 1995 France had about 20 production sites, whereas there had been about 50 in the early 1980s for a market which, admittedly, was 50 per cent bigger. Thus, the size of the plants has increased, which has enabled them to benefit from economies of scale in a shrinking market.

This type of calculation is, however, too static and overlooks some important dimensions. The historical analysis in the French context illustrates the extremely rigid nature of cement production. For example, no new plant was built between 1980 and 1995. Three factors explain this phenomenon: first, the life-span of factories is very long – about 20–30 years; secondly, it is relatively more economical to renovate old factories than to build new ones; and, lastly, environmental constraints (notably for the opening of quarries) make the creation of new units more and more difficult. In a context of stagnating demand peculiar to industrialised countries, these three factors generate a very stable industrial structure.

These elements enable us to complete the description of the spatial playing field by introducing a time dimension, and then examine the strategies used by competitors on this time–space playing field.

Market structure and the implications of restructuring

The time–space playing field has to be analysed in light of the fact that the vast majority of firms in the sector have several plants. Many of them are part of major multinationals active in several countries. Surprisingly, in view of its regional character, the cement sector is highly internationalised.

In France, for example, there were about 30 factories in 1995 but only four rival firms (Holderbank, Lafarge, Ciments Français and Heidelberg). These firms were, moreover, well established in other European countries, North America and, in some cases, Latin America and Asia. Similarly, in the United Kingdom there are three dominant cement groups, and this type of concentration is also apparent in Spain and Germany, even if in those countries many independent single-plant firms remain operational. This highly concentrated multiplant structure results far more from a process of acquisitions than from one of internal development. The rigidity of supply explains why.

Concentration has two main objectives. The first is the wish to stabilise competition in a context of a tit-for-tat-type strategy. Numerous acquisitions in Europe thus followed the setting up of the Single Market and the rapid increase in *uncontrolled* exports. Several large companies acquired positions in Greece or Italy, for example, in an attempt to exert pressure on national manufacturers.

The second factor seems equally important. Financial concentration makes it possible to benefit from industrial rationalisation campaigns through the renovation and/or closure of several plants in the same area. On the one hand financial concentration enables firms to raise

funds, which is essential in such a capital-intensive industry and, on the other, the existence of several plants close together makes it possible to reorganise flows without becoming involved in trade wars.

Let us consider two examples of this type of process concerning the border area between France and Belgium. In the early 1990s the company Ciments Français bought out the Belgian firm CCB. Following this acquisition, it closed down two of its own plants in the region. Conversely, Holderbank bought out the company Cedest and closed one of the newly acquired plants. Thus, within a few years a financial and industrial restructuring had taken place in an area which for a long time had had an overcapacity. This occurred without any price war for the selection of the best plants. The questions are: on what was the selection process based, and how effective was it?

We suggest the following interpretation. In the process of acquisition and restructuring, it was as if the firms practised a form of *indirect competition* on the physical assets market (either to acquire existing factories or to sell them) rather than on the product market. Consider a given playing field. Some production units seem to be doomed (e.g. problems of quarries being too small to warrant heavy but essential investments), although still able temporarily to defend a natural market. Moreover, for various reasons other more modern factories in the vicinity have an overcapacity. There thus exist opportunities for value creation derived from industrial restructuring. The firms will prepare this type of set up by means of purely financial acquisitions and/or overinvestments in existing sites to discourage investment in other sites. This amounts to a sort of *game of Go* in which the status of a production unit may switch from one side to another without this being immediately foreseeable. The fact that there are now four cement firms in France while in the 1960s there were close to 40 accounts for the size of the phenomenon of financial concentration and industrial restructuring.

The cost structure is at the origin of this process. It explains why a plant, even an old one which is less efficient as regards variable costs and fixed factory costs, yet no longer has depreciation charges, remains marginally profitable unless the selling price drops by at least 40 per cent. However, this type of price decrease would by nature be extremely costly for all the actors involved. In the cement industry, the selection process by price war is hardly credible and easily backfires on those who initiate it. A production unit is consequently a long-term strategic asset. It allows a firm either to acquire plants close by in order to improve the efficiency of the area, or to realise a capital gain on sales by trying to recover a significant part of the value derived by the acquirer from this enhanced efficiency.

3 Theoretical analysis of some relevant competition rules for the cement sector

In this section we examine the theoretical implications of the above characteristics of the competition process, as regards both the price regime and information exchange (or others facilitating practices).

When transport costs account for a significant proportion of all costs, competition must be analysed on two levels. The first is the establishment of the way in which transport costs are incorporated into prices. Multiple *pricing systems* are possible. At this level coordination between firms may already appear, in so far as they may agree on a particular pricing system for transport costs. The second is that of the establishment of *price levels* as such, incorporating transport costs in relation to the pricing system adopted at the first level. At this second level (which is the only one to consider when transport costs are not very high) coordination, or mutual understanding on the basis of information exchange between firms, plays an essential part in the establishment of a mode of competition.

The role of the pricing system

In a context of geographical differentiation, competition is extremely intense locally (although limited to a small number of neighbouring competitors). By nature it is scarcely affected by changes in distant areas. In these conditions, the direct threat regulating prices is the entry of a competitor. This may either be a direct entry through the construction of a new production unit or, more probably, in the cement sector, an entry linked to the construction of a terminal allowing for mass deliveries from an existing but distant plant. Entry on the market is thus a major strategic decision in which the reaction of local competitors cannot be overlooked.

One of the first articles to study this question was that of Eaton and Wooders (1985). The authors showed, in particular, that spatial competition is 'fierce' but 'local'. The same point is examined by MacLeod, Norman and Thisse (1988).

To study this question, two systems of pricing are usually chosen: the system of uniform *FOB pricing* (or *mill pricing*), and the system of non-uniform *discriminatory delivered pricing* (discriminatory pricing with absorption of transport costs). It is these two systems which are of interest to us here, although we cannot entirely overlook other pricing systems which have been used and analysed. For example, a system at the origin of many discussions is that of *points of parity*, where the delivered price is equal to a *base price* associated with a point in space (the point of parity,

agreed in advance) to which are added (shadow) transport costs calculated from this point and not from the point where the seller is located (unless this corresponds to the point of parity). Phlips (1983) presents this pricing system in detail. It was prohibited in the United States, particularly in the case of cement (see Areeda and Kaplow, 1948). In Europe, in the case of steel, it was adopted by article 60 of the ECCS treaty. It was even considered during discussions (between 1981 and 1994) between the German, Belgian and Dutch cement industries and the European Commission. This system is generally considered to favour price collusion (all the producers agree on a single rate for transport) and to be globally inefficient in terms of location. Since transport costs paid by buyers do not correspond to real costs, cross-hauling will generally occur. Another price system, also used in the past by the cement industry in the Benelux countries, is that of *uniform delivered prices per zone*. This system poses similar problems when there is wide geographical dispersion; it is generally applied in areas with a strong concentration of buyers (in cities).

Let us revert to a theoretical comparison between the two most common price systems – *mill pricing* and *discriminatory pricing*.

For a long time most economists considered that non-uniform discriminatory pricing was preferable because it provided an incentive for more vigorous short-term competition for established firms. Moreover, under some symmetry assumptions, this regime results in collectively optimal locations. If buyers' *reservation prices* are high enough for demand to be covered completely, we then have an efficient solution. Yet this result also depends on an implicit assumption of relocation without costs, following an entry. When this assumption is not verified, as is the case in a sector such as the cement industry, it is possible to show that the absence of discrimination becomes socially preferable. The reason for this result derives from the fact that an entry penalises incumbent firms far more in a system of *mill pricing* and that they have therefore to protect themselves by a less concentrated market structure (more firms) and, finally, lower prices (Norman and Thisse, 1996).

The impact of information exchange on prices

In so far as it may lead to collusion, or to agreements between firms likely to limit competition, or to the abuse of a dominant position, the exchange of information on prices is one of the main targets of anti-trust authorities. The Sherman Act (1890) in the United States served above all to prohibit price collusion, as did the application, in Europe, of articles 85 and 86 of the Rome Treaty (1957). We note, however, that information

of this nature is not always exchanged in the same way. It may be direct or indirect, organised through announcements or contracts. For example, it may be agreed that a competitor may make public advance announcements on price changes (which are not binding), which the other competitors may or may not follow.[3] Similarly, sales contracts may include particular clauses such as *the most-favoured customer*, which excludes discrimination between consumers, or *meet-or-release*, which guarantees the customer the best price compared to other competitors. It has been shown that such practices generate more coordination between firms, resulting in less competition. This reduction in competition depends to a large degree on the specific practices adopted. Thus, if all the practices just cited are adopted, and if adjustments as compared to announced prices are possible at the time of the sale (by granting discounts), then the solution observed should be a Cournot-type solution. The role of discounts is to enable firms to defend their territory (Holt and Scheffman, 1987).

Yet reduced competition and welfare losses, resulting from certain types of coordination, may be a short-term effect only. The long-term effect, if we take structural adjustment in the industry into account, may be positive for the collective welfare by allowing a less concentrated structure to be maintained.

The following example (inspired by the Hotelling model), described in figure 1.3, illustrates this possibility (d'Aspremont and Motta, 2000).

We presume that the consumers are uniformly distributed in a straight line. Each of them buys a unit of the good if, and only if, the price is less than a given price (the *reservation price*, presumed to be the same for everyone). There are three possible (equidistant) locations and a fixed set-up cost for three potential producers. In the first stage, the producers decide whether or not to set up. The transport pricing scheme is presumed to be that of FOB prices where the customer must pay the factory price plus the transport cost, with the latter taken to be proportional to the distance. In the second stage no producer may increase its profits by unilaterally changing its price. If competition is of the Cournot type (more coordinated), this change is envisaged by considering that the competitors will adjust their factory prices to retain their customers. If competition is of the Bertrand type (less coordinated), competitors are supposed to maintain their factory price at a fixed level. *Ex ante*, a producer sets up only if it anticipates a positive profit after set-up costs.

[3] This is standard practice in the cement industry. In the United States the industry was sued on this point by the anti-trust authorities but won its cases (cf. Dumez and Jeunemaître, 2000).

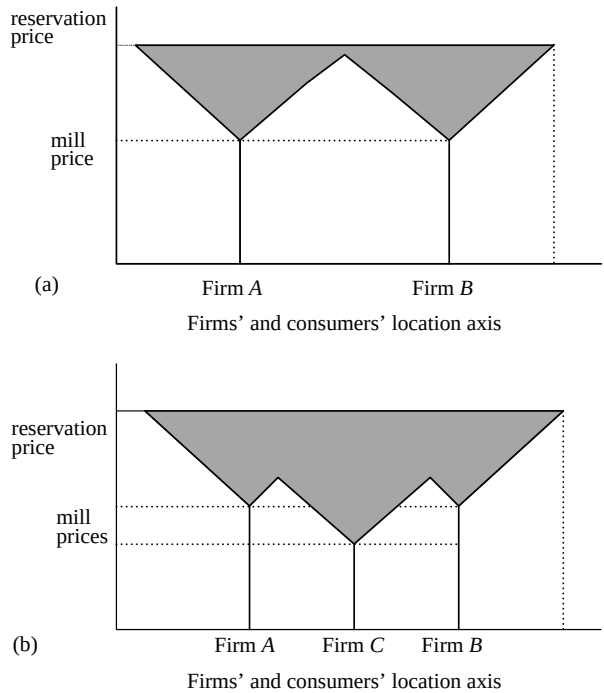

Figure 1.3 The effect of competition on pricing: Cournot and Bertrand examples. (a) Bertrand (b) Cournot

In the example (figure 1.3), two producers will set up if competition is of the Bertrand type (figure 1.3a) and three will set up if it is of the Cournot type (figure 1.3b). Moreover, the consumer surplus, measured by the difference between the purchase price and the reservation price (the shaded area on both figures), is greater in the Cournot than in the Bertrand case (owing to the presence of an additional competitor). The same relationship is verified for the total surplus (consumer surplus plus sum of profits).

More short-term competition but greater concentration in the long run

The general ideal conveyed by the above results is that it may be preferable to have a less concentrated structure (more firms) with less intense price competition, rather than more intense price competition resulting in a more concentrated structure (with fewer firms). The trade-off between the level of short-term competition and the level of concentration may then become an issue. Now, it is accepted that a high level of

concentration often goes hand in hand with the exercise of increased monopoly. This idea is corroborated by the empirical studies of Sutton (1991) in the agri-food sector.

As far as the cement industry is concerned, we can certainly interpret the construction of the European Union as a period of intensified competition in the short term, challenging national oligopolies. The extent of mergers and acquisitions in Europe can then be considered as the natural consequence of this intensification of competition.

The basic question is whether this increase in concentration will not eventually result in less intense competition. We may also wonder whether a policy limiting competition in the short term by allowing anti-dumping within the Union, for example, would not have had the effect of limiting purely defensive acquisitions, without hindering the restructuring process.

In order to consider the terms of this question in more depth, we need a frame of analysis enabling us to understand the possible forms of the acquisition–restructuring process, and to investigate corresponding gains and the impact of the competition dynamics in the materialisation of such gains.

Dynamic efficiency and selection process in the long run

Let us assume that potential competitors are constantly trying to enter a market on which only a limited number of firms can make a sustainable profit. Let us consider two questions. Does the entry/exit process select the most efficient firms? Does potential competition generate efficiency in the incumbent firms? The first question concerns productive efficiency while the second concerns allocative efficiency.

Intuitively it may seem that the less rigid the market, the closer to perfect competition the competitive process, the more the answers to the above questions are likely to be affirmative. This idea is more particularly linked to the notion of contestable markets (Baumol, Panzar and Willig, 1982). It is then advisable to encourage everything which may promote market flexibility by eliminating all forms of rigidity. However, this type of reasoning is particularly misleading, for two reasons.

First, this reasoning is theoretically inaccurate because strong potential competition can lead to high levels of *waste*. This point was initially demonstrated by Eaton and Lipsey (1980), who were also the first to propose a formalisation of dynamic competition with free entry. In their model, firms use their capital investments as entry barriers. Once paid for, a facility has a definite life-span known to all, and its use involves zero marginal costs. It is therefore in an incumbent firm's interests to renew

its capital well before the facility reaches the end of its life, so that a price war in the event of a competitor's entry will be credible. Even if the incumbent's profits are whittled away by competitive pressure, the consumer does not benefit from this pressure which is merely a waste of capital. Maskin and Tirole (1988) considered this question by looking at the role of capacity as a barrier to entry. They show that potential competition not only disciplines the incumbent firm but also induces it to act efficiently. Steinmetz (1998) shows that when firms can choose between anticipated renewal resulting in wasted capital on the one hand and reduced prices on the other, it is in their interests to choose wastage. These different approaches show that any judgement of productive efficiency will strongly depend on the form of competition.

Let us illustrate this type of wastage in the cement industry. If we compare the market zones in which a given factory delivers, we notice that these areas vary considerably from one country to the next – for example, they are geographically limited in France but spread out in the United States. As an explanation we may imagine that efforts towards extreme flexibility, required by strong short-term competition in the United States, may lead to overinvestment in logistics, including in numerous terminals. Steinmetz' results suggest that this form of capital waste in the United States is favoured by firms, to the detriment of price reductions, whereas in France weaker short-term competition results in greater logistic efficiency.

Let us now consider the second reason for which a policy aimed at maximal contestability may be illusory. The underlying reasoning may be ill-suited to reality, for the concrete nature of rigidity may be partly structural and its elimination is not always possible. In these conditions, it is certainly preferable to develop a theory of imperfect competition which takes into account the existence of *mobility barriers* limiting entries and exits on a market. By simplifying, we could then imagine that the strategy of incumbent firms consists of acting on these barriers in order to choose between immediate profits, of whatever size, on the one hand and risks of entry, of whatever degree, on the other. As for potential competitors, one may imagine that their strategies consist of seeking a competitive advantage (innovation, enhanced efficiency, etc.) enabling them to enter at a lower cost and with greater chances of success.[4] It is then worthwhile to explore those factors which favour the substitution of more efficient firms for less efficient ones and, finally, promote technical progress.

[4] Scherer (1992) and Geroski (1995) provide a large number of empirical studies to justify this formulation of the problem.

In order to understand the theoretical conditions in which this selection process may be initiated, we can start with the following. Consider the case of two firms: an entrant and an incumbent. In this context the level of the entry barrier resulting from the incumbent's strategy must be greater than or equal to the rent expected by the potential competitor in the event of it replacing the incumbent. Suppose that the least efficient firm is able to retain its position on the market for a fairly long period. We are going to show that a contradiction will result as the end of the game becomes more distant. This is because the rent of the least efficient firm is certainly lower than that of the most efficient one. This difference between rents will increase as the horizon becomes more distant (assuming that the discount rate is not too high). Consequently, to remain on an horizon that is more and more distant, the least efficient firm must raise the level of its entry barrier (and thus decrease its current profit). This reasoning leads to an *avalanche effect* which widens the gap between the rents. As soon as the horizon goes beyond a certain stage the least effective firm will have a negative total rent owing to its efforts to bar the entry of a more efficient competitor. It is then in its interests not to bar the entry and rather to adopt a strategy of exiting in the most profitable way possible.

This intuition may be formalised (Gromb, Ponssard and Sevy, 1997; Ponssard, 2000) but the reasoning behind it is admittedly based on rational expectations. This property of positive selection may, for example, be contrasted with other well established results on the *effect of reputation*. In the models integrating this effect, a little uncertainty always enables an incumbent monopoly, even an inefficient one, to protect itself in the long run against efficient entrants by *acting strong* (Kreps and Wilson, 1982).

The mechanism through which inefficient firms are replaced by more efficient ones naturally makes one think of the merger/acquisition and restructuring process as analysed earlier for the cement industry. The theoretical analysis then suggests that a degree of transparency of information will certainly be necessary if the corresponding expectations are to be developed. By highlighting the non-necessity of price wars in a successful process of selection, this analysis also invites us to grant a significant role to gains derived from mergers, even if these also increase the monopoly power resulting inherently from the spatial differentiation of the sector.

In the Schumpeterian view, characterising the present competitive dynamic, these monopoly powers would be challenged by sources of innovation. In other words, it is the very existence of monopoly power which encourages firms to strive for greater efficiency and to want to

take advantage of it elsewhere. Even if we need to be careful in this interpretation, we may consider that such a mechanism is not totally unrelated to the fact that the biggest cement firms are European corporations, whereas American firms remain, on the whole, regional (before being bought out by European firms). It is noteworthy that American firms were hardly able to enjoy the efficiency gains which attend mergers and acquisitions, primarily because the anti-trust authorities have an extremely limited view of the notion of a relevant market.

4 Conclusion

This chapter has attempted to illustrate some of the contributions of game-theory to competition policy, by analysing the case of the cement industry.

These contributions have been focused on elements of doctrine such as questions of pricing systems, information exchange and other facilitating practices; questions which were debated at length in the anti-trust cases in which the cement industry was involved. On these subjects, the analysis suggests that a reinforcement of short-term competition must logically be accompanied by greater financial concentration in the industry. This hypothesis is confirmed in the European cement industry by a large number of mergers and acquisitions throughout the Union. It naturally leads to questions on the anti-trust regulations which need to be established.

To answer such questions, it is necessary to have a thorough understanding of the part played by financial concentration in industrial restructuring typical of a capital-intensive sector. The theoretical analysis of the selection process in an industry characterised by rigidity provides several benchmarks on the subject. Because of this rigidity, price wars in processes of selection are relatively ineffective; some other form of selection must then be encouraged. Systematic efforts towards greater fluidity, contrary to widespread belief, does not necessarily constitute a favourable context for this selection. This approach (which relies on a simplistic interpretation of the notion of contestability) may have the unintended effect of wasting resources in an attempt to preserve established positions at all costs[5] without this resulting in an effective selection and without the consumer necessarily benefiting (in terms of price and quality of service). By contrast, a certain transparency of information may contribute to this process of selection by 'revealing' winning and losing positions in

[5] In the cement industry, this corresponds to inefficient choices in relation to production capacity, multiplication of terminals, high transport costs, etc.

the long term. By highlighting the structural conditions of the sector, this transparency[6] may also facilitate the analysis of a competition authority by enabling it to distinguish between efficient and inefficient areas, independently of the stability or instability of short-term competition in those areas.

Finally, when considering a highly oligopolistic sector, this theoretical analysis allows one to diverge fairly systematically from an approach which merely applies the principles of perfect competition (maximising short-term competition, absence of information exchange, as much fluidity as possible, total independence in the behaviour of firms, etc.). It is not, however, a question of looking for general rules in game-theory, in so far as this theory is merely an instrument of analysis. The approach which we believe to be the most fruitful consists of starting by analysing the economic characteristics of the sector concerned, and then applying game-theory to clarify the impact of a particular mode of organising competition in the sector. This chapter also indicates how this type of approach may indirectly contribute to new theoretical developments.

Bibliography

Areeda, P. and L. Kaplow (1948) *Antitrust Analysis*, Boston: Little Brown & Co.

d'Aspremont, C. and M. Motta (2000) Tougher price competition or lower concentration: a tradeoff for anti-trust authorities?, chapter 6 in this volume

Baumol, W.J., J. Panzar and R.D. Willig (1982) *Contestable Markets and the Theory of Natural Monopoly*, New York: Harcourt Brace Foranorich

Collomb, B. and J.-P. Ponssard (1984) Creative management in mature capital intensive industries: the case of cement, in A. Charnes and W.W. Cooper (eds.), *Creative and Innovative Management*, Cambridge, Mass.: Ballinger

Dumez, H. and A. Jeunemaître (2000) *Understanding and Regulating the Market at a Time of Globalization*: *The Case of the Cement Industry*, London: Macmillan

Eaton, B.C. and R. Lipsey (1980) Exit barriers are entry barriers: the durability of capital as a barrier to entry, *Bell Journal of Economics*, 10, pp. 721–9

Eaton, B.C. and M.H. Wooders (1985) Sophisticated entry in a model of spatial competition, *Rand Journal of Economics*, 16, pp. 282–7

Encaoua, D. (1997) Les politiques communautaires de la concurrence, in H. Brochier *et al*., *L'Economie Normative*, Paris: Economica

FTC *v*. Cement Institute, 333 US 683, pp. 355–60

Geroski, P.A. (1995) What do we know about entry?, *International Journal of Industrial Organization*, 13, pp. 421–40

[6] In the cement industry this consists of knowing the utilisation rate of capacities, the age and technical characteristics of the facilities, the level of prices, etc. in a given geographical area.

Gromb, D., J.-P. Ponssard and D. Sevy (1997) Selection in dynamic entry games, *Games and Economic Behavior*, 21, pp. 62–84

Holt, C.A. and D.T. Scheffman (1987) Facilitating practices: the effects of advanced notice and best-price policies, *Rand Journal of Economics*, 18(2), pp. 187–97

Jenny, F. (1993) Competition and efficiency, chapter 10 in B. Hawk (ed.), *1993 Fordham Corporate Law Institute*: Transnational Juris Publications

Kreps, D. and R. Wilson (1982) Reputation and incomplete information, *Journal of Economic Theory*, 27, pp. 253–79

MacLeod, W.B., G. Norman and J.-F. Thisse (1988) Price discrimination and equilibrium in monopolistic competition, *International Journal of Industrial Organization*, 6, pp. 429–46

Maskin, E. and J. Tirole (1988) A theory of dynamic oligopoly, part I: overview and quantity competition with large fixed costs, *Econometrica*, 56(3), pp. 549–69

Norman, G. and J.-F. Thisse (1996) Product variety and welfare under tough and soft pricing regimes, *Economic Journal*, 106, pp. 76–91

Phlips, L. (1983) *The Economics of Price Discrimination*, Cambridge: Cambridge University Press

(1995) *Competition Policy*: *A Game Theoretic Perspective*, Cambridge: Cambridge University Press

Ponssard, J.-P. (2000) Modelling the entry and exit process in dynamic competition: an introduction to repeated-commitment models (Chapter 10 in this volume)

Salop, S.C. (1979) Monopolistic competition with outside goods, *Bell Journal of Economics*, 10, pp. 141–56

Scherer, F.M. (1992) *International High-Technology Competition*, Cambridge, Mass.: Harvard University Press

Spence, M. (1976) Product selection, fixed costs, and monopolistic competition, *Review of Economic Studies*, 43, pp. 217–35

Steinmetz, S. (1998) Spatial preemptions with finitely lived equipments, *International Journal of Industrial Organization*, 16, pp. 253–70

Sutton, J. (1991) *Sunk Costs and Market Structure: Price Competition*, *Advertising and the Evolution of Concentration*, Cambridge, Mass.: MIT Press

Tanguy, H. (1987) L'instrumentation des choix stratégiques, chapter 2, thèse de doctorat, Paris: Ecole Polytechnique