

Appendix A. Markets and Industries.

To what extent should we regulate Industry?

Industry is regulated because markets fail, or are, at least, perceived to fail. There are two sorts of industry regulation relevant for our purposes; specific and general. Industry-specific regulation is characterised by the existence of a regulatory agency. It arises partly because of information asymmetry in between buyer and seller, which cannot be contained by self-regulation within the industry alone. Examples of this include regulation of the financial services sector and the advertising industry. It also arises in industries that were once thought of as natural monopolies and have been privatised. General regulation of industry occurs partly because of the possibility of collusive activity or the abuse of a dominant position. Hence we have competition policy. General regulation also occurs because governments want to control technological developments or to ensure that the social problems of sectoral decline are minimised.

We concentrate in these lectures on competition issues and privatisation. As you will see there are very different approaches as to how governments should intervene in these matters.

To get going we are going to examine what we mean by industrial economics and what we interpret as an industry. This latter point is important for Competition authorities that need to know what the relevant market is from the outset of any investigation. Having identified the market some measure of dominance has to be established and this we do by considering market share and concentration ratios. Finally, judgements have to be made about the nature of regulation and this will differ depending on the theoretical beliefs of the investigator. I provide a brief insight as to differing perspectives in industrial economics.

Aims

- ❑ To show that there are complexities in our understanding of the relevant market for competition purposes and
- ❑ That there are a number of competing perspectives in industrial economic which make public policy decisions problematic.

Learning Outcomes

After following this paper you will be able to

- ❑ define industrial economics
- ❑ demonstrate what a concentration ratio is
- ❑ assess the definition of an industry
- ❑ compare and contrast various perspectives in industrial economics

A Definition of Industrial Economics

Industrial economics is the application of microeconomic theory to the analysis of firms, markets and industries (Stigler, 1968)

However, industrial economics concentrates its efforts on the study of

strategic behaviour by monopolies (particularly since privatisation) and oligopolies and

the public policy implications of such behaviour

Moreover, it recognises that industries change over time, i.e. there are "industrial dynamics".

The concept of an industry

It is essential that we recognise that the size of the market is important in our understanding of an industry. The local shop in a rural area may be a monopoly supplier of household items to the local community but they are only one element of an industry.

The term 'industry' refers to the aggregation of firm numbers at some politically determined level: the region, the nation, the EU. However, some academics and politicians have even talked of 'global industries' but official statistics on this are rare.

This aggregation could be based on

demand side (market based) criteria, i.e. by grouping together those firms who produce a product whose cross price elasticity reaches a particular threshold e.g. greater than 2.

The advantage of this approach is that we would understand how consumers distinguish between particular products although the technologies involved may be similar, e.g. Minis and Rolls Royce's. The disadvantage is calculating cross price elasticities

supply side (technology based) criteria, i.e. grouping together those producers that have similar technological expertise in the supply of certain products.

The advantage of this approach is that it recognises the ability of firms to switch to the creation of new (differentiated) products (brands) like those supplied by firms with similar technologies, e.g. manufacturers of Rolls Royce producing a smaller car that would compete with the Mini.

Governments have adapted the latter method of classifying firms to industries.

(See Table 1 which shows UK Standard Industrial Classification for a few products using the 1992 revisions)

Why is the concept of an industry important?

Koutsoyiannis (1979) argues that the concept of an industry

reduces complex inter-relationships of all firms in an economy to manageable dimensions

makes it possible to derive a set of general rules from which we can predict the behaviour of competing groups that constitute an industry.

provides a framework for the analysis of entry on the behaviour of firms and on equilibrium, price and output.

Market structures

As every firm produces a unique (differentiated) product they could be categorised as a monopolist. However, in microeconomics we group firms together on the basis of certain characteristics to identify the type of market structure they belong to (e.g. product substitutability, interdependence of sellers, ease of entry)

Thus, we can identify perfect competition, monopolistic competition, monopoly and oligopoly. The most important of these is oligopoly. Oligopolies are usually heterogeneous. Some may have a dominant firm(s) with a competitive fringe; many have been identified as having strategic groupings (Porter, 1980)

(See table 2 showing relationship between market structure and these characteristics)

TABLE 1

SIC92 **Standard Industrial Classification - 1992 Revision**

92sect	92div	92group	92class	92subcl	description
4					D: Manufacturing
	15				<i>Manufacture of food products and beverages</i>
		151			Production, processing and preserving of meat and meat products
			1511		Production and preserving of meat
				15111	Slaughtering of animals other than poultry and rabbits
				15112	Animal by-product processing
				15113	Fellmongery
			1512		Production and preserving of poultry meat
			1513		Production of meat and poultry meat products
				15131	Bacon and ham production
				15132	Other meat and poultry meat processing
		152	1520		Processing and preserving of fish and fish products

TABLE 2

Classification of Markets

Type of Market	Product Substitutability criterion	Interdependence of Sellers criterion	Ease of Entry criterion
	(cross-price elasticity)	(cross-quantity elasticity)	$E = (P_m - P_{pc}) / P_{pc}$
Pure Competition	YES	NO	YES
Monopolistic Competition	SOME	NO	YES
Pure Oligopoly	YES	DEFINITELY	MAYBE
Heterogeneous Oligopoly	SOME	DEFINITELY	MAYBE
Monopoly	NO ?	NO	BLOCKADED

Market Share and Competition

Market share measures are usually the main way of assessing whether a dominant position exists within a market. Market shares of individual firms are, of themselves, useful in providing a glance at the nature of an industry. However, to capture the relationship between firm numbers and market shares within an industry, economists have developed a number index called a **Concentration Ratio**. There are many such measures but two of the most important are

1. **The n firm concentration** ratio where n refers to the top number of firms measured (usually) by output. So

$$C5i = Y5i / Y_i$$

is the 5 firm concentration ratio in industry I where Y refers to output minus exports

Shepherd (1992) makes the distinction between 'tight' oligopolies and 'loose' oligopolies to provide a flavour of the nature of competition in particular industries. The distinction is somewhat arbitrary but a tight oligopoly might be an industry with a ratio of 60% or greater - This would certainly fit in with the current EC view of dominant positions.

This ratio can be adjusted to take account of trade to capture what is sold in the domestic market.

This point is taken up recently by Cowling *et al* (2000) as they examine the declining concentration in manufacture of vehicles within the UK over the period 1965 to 1994. One of the problems of existing studies is that they treat all imports as competitive. Thus, the 5 firm adjusted concentration ratio is

$$C5i = Y5i / (Y_i + M_i) \text{ where } M \text{ refers to imports.}$$

However, if we recognise that a high proportion of imports are tied to multinational production then the appropriate adjustment is

$$C5i = (Y5i - M5i) / (Y_i + M_i)$$

The problem is getting data on these non-competitive imports. Cowling *et al* use data on the number of units sold and imported in the car, van, bus and truck industries to demonstrate the importance of distinguishing between each measure. The conventional C5 ratio shows a steady de-concentration in each of these industries over the period 1965 to 1994. The appropriately adjusted C5 ratio, on the other hand, show that the rapid fall in concentration to the mid-1970s has not been sustained into the 1990s in three of the four industries – cars, trucks and buses – despite dramatic increases in imports. The reasons are largely due to quite complex restructuring processes in each industry in which overseas transnationals (including some that have a long

tradition of UK production) became industry leaders relying on high levels of intra-firm trade.

Table 3

Accounting for imports in Concentration Ratios – The UK Car industry

Year	$(Y5i - M5i) / (Yi + Mi)$	$Y5i / (Yi + Mi)$
1965	91.35	91.40
1975	74.20	66.60
1985	72.40	41.80
1994	69.76	40.99

Source: adapted from Cowling *et al* (2000) Table 1 p.49.

2. **The Hirschman-Herfindahl index** is a measure of the sum of the squared market shares in an industry *i*.

$$HHI_i = (\text{market share } 1)^2 + (\text{market share } 2)^2 + \dots + (\text{market share } n)^2$$

Some differences between the two measures show how HHI might be superior (see Table 4).

Table 4: Comparing the n firm and HHI concentration Indices

Firms	Market Shares	4 Firm Concentration	HHI
Ten firms	10%	40	1,000
Six firms	16%	64	1,660
Five firms	20%	80	2,000
Four firms	25%	100	2,500
Three firms	33%	100	3,300

HHI clearly shows that the index rises rapidly as the number of firms is reduced. Thus, a monopoly supplier would have an HHI number of 10,000.

We can calculate a numbers equivalent HHI using the following formula

$$\text{Numbers equivalent} = \frac{10,000}{HHI}$$

If HHI =2,000 this is equivalent to saying that 5 firms could each supply 20% of the market.

We could also note the importance of dominant firms using a HHI. For example, if a firm has 60% of the market and another 4 firms shared the rest

of the market equally the HHI would be 4000, whilst the HHI for 5 firms sharing equally is 2000.

Its appeal is that it captures the market shares of all the firms in the industry. This measure of concentration is directly calculable from oligopoly models and so has a theoretical base.

Competing Views of the Competitive Process

1. Structure - Conduct - Performance

Viewing industries in this way suggests that public policy may be applicable.

Basic Conditions

- What demand and supply side factors influence the industry?
- What is the regulatory framework within which organisations have to operate?

What is structure?

- Describes the characteristics and composition of markets and industries in the economy.
- Refers to the number and size distribution of firms in the market.

What is conduct?

Refers to the behaviour (actions) of firms in a market; the decisions they make and also the way in which these decisions are taken.

What is meant by performance?

Do the firms enhance economic welfare?

- Are they being productively efficient, avoiding wasteful use of available factors?
- Are they being allocatively efficient in producing the right goods in the right quantities?
- How effective are they in enhancing employment and economic growth?

Which view of industries should we believe?

Depends on whether we adopt a laissez-faire or interventionist view (or somewhere in between).

- Traditional, uni-directional view

This view suggests that monopolies are inherently bad because they emanate from a particular market structure.

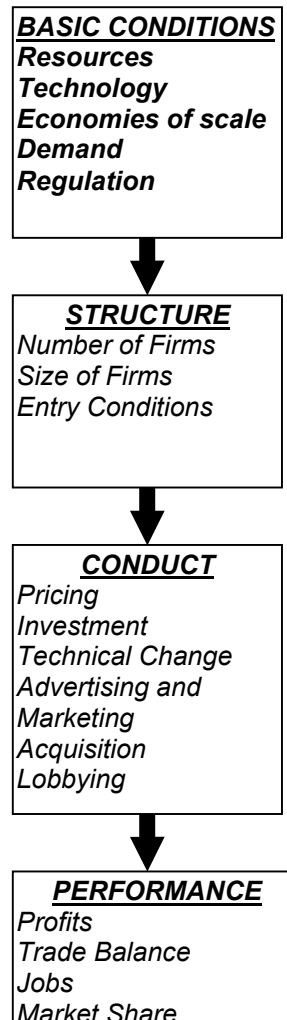


Figure 1
The S-C-P Paradigm.
A linear view

2. Behaviourists

These stress that conduct has a more important role to play in determining structure and performance. This suggests that we need control over mergers and cartels.

See Figure 2, which shows a more complex set of relationships between S – C – P.

3. New Industrial Economics

Adopts a game theoretic approach to explaining interdependencies in monopoly and oligopolistic market structures. Thus, it too makes conduct explicit because it explores the role of strategy.

4. *UCLA-Chicago school*

This is the traditional neo-classical view of industry S-C-P. Indeed, this view proposes that large oligopolistic firms have achieved success via efficiency. Thus, rather than market structure being a determinant of performance, performance determines the number of firms (and their size) within a particular market structure. In such a scenario regulation of monopolies and mergers is not required. Further, control of cartels should be minimal as they are susceptible to cheating. The implication is that government should regulate industry with a 'light hand'.

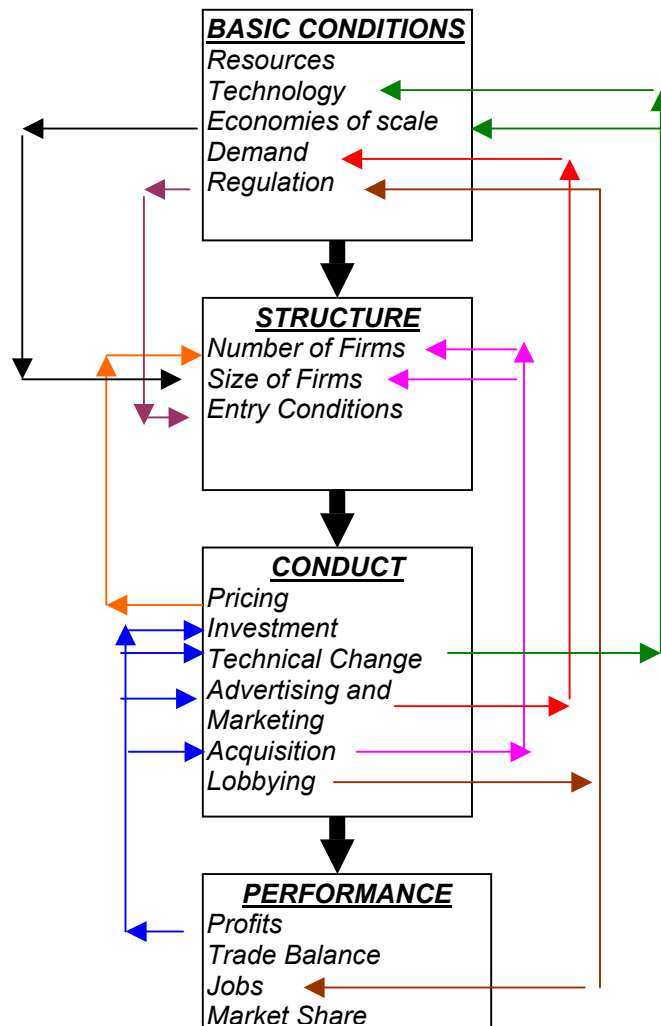
5. *Contestable Markets*

This perspective suggests that potential competition is an important force in bringing about competitive outcomes particularly where the exit costs of entering an industry are zero. This approach has had an important bearing on the privatisation debate.

6. *Austrian view*

This approach suggests that intervention should be minimal. Monopolistic profits are the reward for entrepreneurial endeavour in introducing technical and technological change. Over time entry will occur to erode such profit but by that time other developments may have arisen.

Figure 2
The S-C-P Paradigm. A more complex view



Reading

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Martin S (1994) *Industrial Economics. Economic Analysis and Public Policy*, 2nd edition, Macmillan, London.

And Finally....

Have you covered the learning outcomes?

Consider the following (without reference to the paper)

1. What is meant by the term industrial economics?
2. What is the Herfindahl-Hirschmann Index of concentration and how does it compare with the n-firm concentration ratio?
3. What factors should we take into account when defining an industry?
4. Briefly (less than 100 words) consider whether a particular structure leads to a certain performance or is more complex than that?



Market Definition

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1 Introduction

- 1.1 This guideline provides advice and information on how the Director General of Fair Trading defines markets when investigating cases under the Competition Act 1998. The techniques described in this guideline are not new. They reflect current practice by the Director General of Fair Trading, and by competition authorities throughout Europe, North America and elsewhere.
- 1.2 The Director General has a duty under section 60 to handle cases in such a way as to ensure consistency with Community law. This is described further in the Competition Act guideline [The Major Provisions](#).
- 1.3 In general, this guideline follows the same approach as the European Commission's Notice on market definition¹.
- 1.4 Market definition and the measurement of market shares form only one part of an investigation. An investigation will normally look at the potential for new entry, other evidence on market power, and the individual behaviour of undertakings. Assessment of these issues are discussed in other Competition Act guidelines [Assessment of Market Power](#) and [Assessment of Individual Agreements and Conduct](#).
- 1.5 The approach described in this guideline is not mechanical, it is a conceptual framework within which evidence can be organised. The Director General will not follow every step described below in every case. Instead, he will look at the areas of evidence which are relevant to the case in question - and will often be constrained by the extent to which evidence is available. Market definition is not an end in itself, but rather a step which helps in the process of determining whether undertakings possess, or will possess, market power.
- 1.6 In particular, in some cases it may be clear that on any sensible market definition the undertakings under investigation will not possess any market power. In that case it will not normally be necessary to establish which of the potential market definitions is correct.

¹ European Commission, Commission Notice on the definition of the relevant market for the purposes of Community competition law, 1997. The same approach is also used in the US Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines, revised 1992 and in OFT Research Paper 1 (OFT049): National Economic Research Associates, Market Definition in UK Competition Policy, 1992.

2 Market definition

The purpose of market definition

- 2.1 The prohibitions in the Act are designed primarily to prevent undertakings from exploiting market power. Market power exists where undertakings can consistently charge higher prices, or supply goods and services of a lower quality, than they would if they faced effective competition². Market power can exist when an undertaking has a high market share or when undertakings which together have high market shares do not actively compete with each other.

² Competition problems often involve other forms of conduct, such as vertical restraints or predation, rather than high profits, but it is the ability to raise prices above competitive levels which demonstrates that undertakings possess market power.

- 2.2 Some agreements between undertakings, such as price-fixing agreements, might be prohibited even if the undertakings involved did not possess market power (see the Competition Act guideline [The Chapter I prohibition](#)). Apart from those cases, an investigation under the Act normally begins by considering whether particular undertakings possess market power. High market shares, combined with other evidence, may indicate that undertakings possess market power. Where an undertaking has a high market share there may be a lack of strong competitors, in which case it may be able to raise prices above competitive levels without fear of losing sales. It may also be easier for undertakings to collude. High market shares do not always convey market power - for example, there may be a strong threat of competition from new entrants. If, however, the relevant market has been defined appropriately, undertakings with very low market shares will almost certainly not possess market power, and an investigation can normally be dropped at an early stage.
- 2.3 Market definition is important because, first, market shares can be calculated only after the boundaries of a market have been defined. Secondly, it is important in the rest of the Director General's analysis under the Competition Act, because it sets the stage on which competition takes place. For example, when considering the potential for new entry it is necessary to identify the market being entered.
- 2.4 Thirdly, market definition is important for establishing whether or not particular undertakings fall within the scope of the prohibitions:
- the Chapter I prohibition applies only to agreements which have an 'appreciable' effect on competition. The appreciability test requires definition of a relevant market and demonstration that the agreement would have an appreciable effect on competition within that market (see the Competition Act guideline [The Chapter I prohibition](#));
 - under Chapter II, undertakings with very low market shares are unlikely to be dominant so their behaviour will not be caught by the prohibition (see the Competition Act guideline [The Chapter II prohibition](#)).
- 2.5 High market shares are not themselves prohibited, and do not necessarily indicate a competition problem. The main purpose in measuring market shares is to establish at an early stage those cases where it is clear that no market power is present and that no further action by the Director General is necessary.

The main concept

- 2.6 The idea of a market is familiar. Annual reports, business plans and other documents often refer to the market in which the undertaking operates. This will normally include other undertakings which the undertaking views as its competitors. The Director General starts from the same position, trying to identify products which are substitutes for each other, so that competing undertakings can be identified.
- 2.7 The boundaries of a market are not always obvious, however. Does a manufacturer of colas compete in the market for cola-flavoured drinks, the market for carbonated or 'fizzy' drinks, the market for soft drinks, the market for non-alcoholic beverages, or some other collection



3 The term monopolist here merely means that the undertaking is the only supplier of these products or services, not that it necessarily possesses any market power.

4 It is also assumed that the Government does not regulate the undertaking's prices, and that the undertaking does not reduce prices to avoid future regulation. This does not mean that the test cannot be applied to products supplied by regulated undertakings. The test poses a hypothetical question and is not meant to represent reality. However, the existence of Government regulations, or a statutory monopoly, may affect the scope for supply-side substitution (see paras 3.13 to 3.22 below). Any assessment of a regulated undertaking's conduct will take account of the fact that its behaviour is regulated.

5 The test can be thought of as looking at a group of hypothetical oligopolists rather than a single monopolist. According to the 'hypothetical monopolist' test, if the narrowest possible market is identified and the undertakings do not collude, then, by definition, only an undertaking with 100 per cent of that market would possess market power. A group of

of products? Clearly its market share could vary significantly depending on which definition was used. Market shares cannot be measured until that question has been resolved: that involves identifying the products which are the closest substitutes for the products at the centre of the investigation. If an undertaking supplying the products set prices above competitive levels would its consumers still buy its products, or would they switch to substitutes? In particular, would so many switch to substitutes that it would be unprofitable to raise prices above competitive levels?

- 2.8 One way to look at this problem is to consider an undertaking that was the only supplier of the products (or group of products) at the centre of the investigation and use the conceptual framework of whether a hypothetical monopolist of these products would maximise its profits by consistently charging higher prices than it would if it faced competition³. The assumption is that this hypothetical undertaking would not be constrained by the threat of new entry, which would be considered in any overall assessment of an undertaking's market power - see the Competition Act guideline [Assessment of Market Power](#). (Defining the market therefore cannot demonstrate on its own that an undertaking possesses market power⁴.)
- 2.9 If the undertaking would be prevented from setting prices above competitive levels by substitution to certain products, those substitutes can then be added to the potential market and the test applied again. This involves asking whether an undertaking which was the only supplier of this larger group of products would maximise profits by charging prices above competitive levels. By repeating the process a definition can eventually be reached where, under the assumptions above, a 'hypothetical monopolist' could maintain prices above competitive levels. This will usually be the market definition used. If the market were to be expanded further, the same condition should be met: a 'hypothetical monopolist' could set higher prices than an undertaking facing competition. The Director General would usually use the narrowest potential market definition⁵. This will not always be the case, however; the relevant market may be wider in the case of a horizontal agreement, for example.
- 2.10 A market definition should normally contain two dimensions: a product and a geographic area⁶. Taking a recent example, when looking at a complaint regarding ice cream cabinets in Ireland the European Commission defined the relevant market as impulse ice cream in Ireland. The product market was impulse ice cream (ice creams bought from convenience outlets on the spur of the moment rather than from a supermarket) and the geographic market was Ireland (rather than, say, Western Europe). The market definition analysis has to be applied separately to determine both the product and the geographic area. In the case of the geographic market the question is whether an increase in price would cause customers to switch to suppliers in neighbouring areas. The geographic market could be wider than the United Kingdom or it could be any part of the United Kingdom.
- 2.11 The issue in market definition is usually to determine products to which consumers might switch. However, substitution can also take place by suppliers. If prices rise, undertakings which do not currently supply the product might be able to start supplying it at short notice. This will prevent undertakings charging monopoly prices, so any supply-side substitutes should also be included in the market.

3 The product market

The demand-side

- 3.1 The process starts by looking at a relatively narrow potential definition. This would normally be the products which two parties to an agreement both produce or the products which are the subject of a complaint. Common sense will normally indicate the narrowest potential market definition. The Director General then considers how customers would react if prices were raised a small but significant amount above competitive levels.
- 3.2 Common practice in both Europe and the US is to consider a price 5-10 per cent above competitive levels. This will normally be the Director General's approach, although, in practice, it is often difficult to quantify a potential price rise. The 5-10 per cent test is a rough guide rather than a rule⁷.
- 3.3 If significant numbers of customers would switch to substitutes (known as demand-side substitution), the market definition should be widened to include the substitutes. It is not necessary for all customers, or even the majority, to switch. The important factor is whether the number of customers likely to switch is large enough to prevent a 'hypothetical monopolist' exercising market power.
- 3.4 Substitutes do not have to be identical products to be included in the same market. For example, in its report on Matches and Disposable Lighters⁸, the Monopolies and Mergers Commission included matches and disposable lighters in the same market because consumers viewed them as close substitutes. The products' prices do not have to be identical. For example, if two products perform the same purpose, but one is of a higher quality, they might be included in the same market. This depends on whether the price of one constrains the price of the other. Although one is of a lower quality, customers might still switch to this product if the price of the more expensive product rose and if they no longer felt that the higher quality justified the price differential.
- 3.5 The important issue is whether the undertaking could maintain prices above competitive levels. The products will still be included in the same market if the delay before substitution takes place is so short it would never be worthwhile to raise prices in the first place. As a rough rule of thumb, if substitution took longer than one year the products would not be included in the same market. However, the answer will vary from case to case. Substitution that was possible within one year might not be included if customers would have to incur significant switching costs, for example.
- 3.6 The Director General considers evidence on substitution from a number of different sources. The information used will vary from case to case, but the following areas are likely to be important:
- customers and competitors will often be interviewed. In particular, customers can be asked directly how they would react to a hypothetical price rise, but because of the hypothetical nature of the question, answers may need to be treated with a degree of caution;

undertakings acting together could, however, behave as if they were a hypothetical monopolist, and thus one of the undertakings would hold market power without having 100 per cent of the narrowest conceivable market. In practice, the narrowest theoretical market might be one for which no disaggregated data existed, so that the market may be defined to be larger than the narrowest theoretically possible market. Part 5 of this guideline describes how the relevant market may sometimes be wider than the narrowest conceivable market.

6 Throughout these guidelines, the term product includes services and property rights.

7 Arguably, the test should be applied to the value added by the undertaking, not its selling price. In practice, selling prices are more easily seen and are usually the price which will be considered. This is one reason why some flexibility in the size of price differential considered must be retained.

8 Cm 1854, 1992



- a significant factor determining whether substitution takes place is whether customers would incur costs in substituting products. High switching costs relative to the value of the product will make substitution less likely;
- patterns in price changes can provide strong evidence, when combined with other evidence. For example, two products showing the same pattern of price changes, for reasons not connected to costs, could be strong evidence that they were close substitutes. The Director General may also look at the effects of any past price changes to see how customers reacted. Price divergence over time, without significant levels of substitution, provides evidence that the two products may be in separate markets. However, if the absence of substitution could be explained by a divergence in both price and quality, the products could still be in the same market (see paragraph 3.4 above);
- evidence on price elasticities may also be examined. These measure the rate at which demand for a product changes when its price (or the price of substitutes) goes up or down. OFT Research Paper 1⁹ provides information on how price elasticities can be used to define markets.

⁹ see footnote 1 above

Captive customers and price discrimination

- 3.7 In many cases some customers will be able to switch between product A and product B while others cannot, and are therefore captive. As noted at paragraph 3.3, the market might still be wider than product A if there are a significant number of customers who could substitute to product B. The important question is whether substitution by the non-captive customers will prevent a monopolist charging prices above competitive levels.
- 3.8 Even if the proportion of captive customers is small, the monopolist may be able to set monopolistic prices if it can discriminate between different customers, charging high prices to those who are captive, and lower (competitive) prices to those who are not. For example, on a particular hypothetical route, commuters travelling by train might be keen to minimise the time they spend travelling, in which case they might not view coaches as close substitutes. They might also need to travel before 9.00am. Leisure travellers might be willing to travel later in the day and may view coaches as a close substitute. If this were the case, commuters might be captive while leisure travellers were not, and a train operating company could price discriminate against the (captive) commuters by charging higher fares before 9.00am. After 9.00am fares might be constrained by competition from coaches while before 9.00am they could be set at a monopoly level.

Chains of substitution

- 3.9 Two products do not have to be direct substitutes to be included in the same market. There may be a chain of substitution between them. A large luxury car is unlikely to be a direct substitute for a small hatchback, for example. If the price of one manufacturer's small hatchback rose, customers would be more likely to switch to a different small hatchback rather than to a large luxury model. The hatchback and the luxury car are not likely to be direct substitutes for most customers.

- 3.10 If the price of all small hatchbacks rose, however, customers might hypothetically switch to slightly larger cars (a medium-sized hatchback, for example), since the price differential would narrow. These cars might then be included in the same market. Similarly, if the price of medium-sized hatchbacks rose customers might either switch to small hatchbacks or to slightly larger cars. If this were the case, there might then be a chain of substitution linking together cars of different sizes.
- 3.11 The Director General will sometimes look at chains of substitution when defining markets. However, he will look carefully to ensure that there are no breaks in the chain which would suggest that separate markets exist. In the hypothetical example above, the Director General might find that a monopolist in large luxury cars would not be constrained by substitution to smaller models, because there is a gap in the chain of substitution. It might then hypothetically decide that a chain of substitution existed between small and medium-sized cars, but that large cars formed a separate market.
- 3.12 A chain of substitution is a useful concept, but it does not necessarily define the boundaries of a market. The Director General often needs to identify the narrowest potential market, so part of the chain might still be treated as a separate market. For example, if there was a chain linking products A to Z, and the issue was in which market a supplier of product F operated, it might be found that F alone would not be a relevant market due to substitution to E and G. If, however, there was a sole supplier of E, F and G, customers buying F would only substitute to products E or G, where the same undertaking would be the only supplier. So it might be worthwhile for the undertaking to raise the prices of E, F and G above competitive levels together. In that case the group of products E to G might be defined as a separate market from others in the chain. The main issue then is whether substitution to D and H would prevent the undertaking from raising the prices of the intervening products.

The supply-side

- 3.13 Substitution can also take place by suppliers (known as supply-side substitution). If prices rise, undertakings which do not currently supply a product might be able to supply it at short notice. This will prevent undertakings charging monopoly prices, so any supply-side substitutes should also be included in the market.
- 3.14 An example is the supply of paper for use in publishing¹⁰. Paper is produced in various different grades dependent on the coating used. From a customer's point of view, the different types of paper are not viewed as substitutes, but because they are produced using the same plant and raw materials, it is relatively easy for manufacturers to switch production between different grades. If a 'hypothetical monopolist' in one grade of paper tried to set prices above competitive levels, manufacturers currently producing other grades could easily start supplying that grade – the ability to exploit market power is thus constrained by substitution by suppliers.
- 3.15 Analysing supply-side substitution raises similar issues to the analysis of barriers to entry (discussed further in the Competition Act guideline [Assessment of Market Power](#)). In both cases the question is whether undertakings would start supplying a particular product if prices rose. The distinction is timing: supply-side substitution occurs when undertakings start supplying the market in the short run (for example, within one year), whereas new entry into the market occurs over a longer time scale.

¹⁰ Where the Commission defined the market based on supply-side substitution in *Torras/Sarrio*, Case IV/M166 OJ (1992) C58/20, [1992] 4 CMLR 341.



- 3.16 As with the demand-side, substitution should be relatively quick. If substitution took longer than one year these undertakings would not normally be included in the market. Since the issue is identifying opportunities for short-run substitution, undertakings would not normally be included if they had to make a significant investment in new production capacity or other fixed assets.
- 3.17 Even if substitution were technically possible, there may be other barriers. It may be necessary to advertise products or incur other marketing costs. For example, if two consumer products are produced using similar technology, and substitution is technically feasible, an undertaking switching between them might still need to spend time establishing a brand in a new product area, in which case substitution could not occur in the short run. There might also be other barriers to distribution, for example if supply chains were foreclosed to new suppliers.
- 3.18 Some competition authorities prefer to define markets solely on the demand-side, leaving supply-side issues to the analysis of new entry. In practice both approaches should produce the same conclusions on the question of market power, provided that supply-side issues are examined at some point. However, the Director General will define markets on the supply-side in some circumstances. In the paper example above there would be little value in analysing competition in each grade of paper if it was clear that supply-side substitution would undermine any potential market power in a particular grade. Defining markets on the supply-side can allow early determination that an undertaking has no market power, thus avoiding the need for further analysis.
- 3.19 Supply-side substitutes will therefore be included within the market definition when it is clear that substitution would take place quickly and easily. If there is any serious doubt on this point, they will not be included but will be considered when analysing potential entry.
- 3.20 The Director General might look at evidence from some or all of the following sources:
- potential suppliers might be asked whether substitution was technically possible, and about the costs of switching production between products, and the time it would take to switch production. The key question is whether it would be economic to switch production given a small (ie 5–10 per cent) price increase;
 - undertakings might be asked whether they had spare capacity or were free to switch production. Undertakings may be prevented from switching production because all their existing capacity was tied up – they may be committed to long-term contracts. There might also be difficulties obtaining necessary inputs or finding distribution outlets;
 - although new undertakings may be able to supply the market, there may be reasons why customers would not use their products, so the views of customers might be sought.
- 3.21 Supply-side substitutes are included in market shares by identifying a set of products whose suppliers would switch to selling the relevant product if prices rose. It is the products rather than the undertakings which are added to the market definition. Market shares should then be calculated by adding up supplies of all the products which are included within the market, although this can prove difficult. Part 4 of the Competition Act guideline [Assessment of Market Power](#) explains more fully how market shares are calculated. If there are practical

difficulties in estimating market shares when supply-side substitutes are included, the suppliers of the substitutes may be treated as potential entrants that will constrain market power, rather than as existing competitors.

- 3.22 Where supply-side substitutes are included there may still be constraints on the capacity that an undertaking might switch into supplying the relevant product. In that case the market shares might be adjusted to reflect this, or substitutable capacity could be used as a measure of market shares.

4 The geographic market

- 4.1 The geographic market is the area over which substitution takes place. Geographic markets are defined using the same process as that used to define the product market. This part outlines some issues which are particularly relevant to geographic market definition:

- demand-side issues;
- supply-side issues; and
- imports.

- 4.2 The approach often depends on whether the product is retailing, wholesaling or manufacturing. Retailing markets are more likely to be defined on the demand-side, while wholesaling and manufacturing markets are more likely to be defined on the supply-side.

The demand-side

- 4.3 As with the product market, the objective is to identify substitutes which are so close that they would prevent a 'hypothetical monopolist' in one area from charging monopolistic prices. The process starts by looking at a relatively narrow area, which would normally be the area supplied by the parties to an agreement or the subject of a complaint. Examination is then broadened to consider whether consumers would switch to suppliers in neighbouring areas in response to a small increase in price. If substitution is potentially so significant that it would prevent an undertaking from raising prices, the area is added to the market definition.
- 4.4 Chains of substitution can be an important factor in geographic markets, particularly retail markets. Consumers in any one location might not be willing to travel more than, say, two or three miles to purchase a particular product, but there may be a chain of substitution creating a much larger geographic market. In principle, this could create a market covering the whole of the United Kingdom but it would depend on whether there were areas where the chain broke. Chains of substitution often break down in rural areas - that between Northern England and Central Scotland, for example - or in the peripheries of the British Isles. Even if most of the United Kingdom formed a single market, areas such as the Highlands of Scotland might form separate markets; the answer will vary from case to case.
- 4.5 If an undertaking with a monopoly in several neighbouring areas could raise prices across those areas, the total area might form a separate market (see paragraph 3.12 above on chains of substitution in product markets).



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- 4.6 The evidence used to define geographic markets on the demand-side will usually be similar to the information used to define the product market (see paragraph 3.6), but the value of a product is often an important factor in defining geographic markets. The higher the value, the more likely customers are to travel further in search of cheaper supplies. The mobility of customers may be a relevant factor: whether most customers have access to cars, for example.

The supply-side

- 4.7 This entails looking at the potential for undertakings to supply customers in neighbouring territories. As with product-market definition, substitution should be possible in the short run (for example, within one year). Supply-side substitution may not be possible within one year if undertakings need to spend significant sums on advertising or marketing, or if distribution channels are foreclosed.
- 4.8 Again the main evidence will usually mirror the information gathered on product market definition, but the level of transport costs relative to the price of a product is also an important issue. Higher relative transport costs normally mean a narrower geographic market. This has often led to regional market definitions for building products, for example, although the regions may be linked together by a chain of substitution (which led the European Commission to widen the geographic market in Pilkington Techint/SIV¹¹).

Imports

- 4.9 Significant imports of a particular product may indicate that the market is international, although it is not always the case. Imports may come only from subsidiaries of domestic suppliers, for example, or there may be quotas which limit the volume of imports.
- 4.10 Conversely a lack of imports does not necessarily mean that the market cannot be international. The potential for imports may still be an important source of substitution should prices rise: when the European Commission looked at a merger between bus manufacturers in Germany it found that although imports were low at the time, there were no significant barriers to imports from the rest of the Community should prices in Germany rise¹².

11 Case IV/M358, 1993, CMLR 4 [1994] 405, CCH 2 [1994] 2 031.

12 Mercedes-Benz/Kassbohrer, Case IV/M477, 1995, OJ [1995] L211/1, CMLR 4 [1995] 573.

5 Other issues

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Temporal markets

- 5.1 A third dimension to market definition is time. Examples of temporal markets include:
- peak and off-peak services. This can be a factor in transport services or utilities such as electricity supply;
 - seasonal variations, such as summer versus winter months; and
 - inter-generational products. Customers may defer expenditure on present products because they believe innovation will soon produce better substitutes.
- 5.2 Markets can be defined by time when:
- It is not possible for customers to substitute between time periods. Customers might not view peak and off-peak train tickets as substitutes, for example, or they might not be able to store fruit from one season to another; and
 - suppliers' capacity varies between time periods. Fresh fruit supplies may vary depending on the season of the year.
- 5.3 To some extent, temporal markets are simply an extension of the product dimension: the product can be defined as the supply of train services at a certain time of day.

Complements and secondary products

- 5.4 Market definition normally involves identifying groups of substitutes, but markets can be defined to include groups of complements. Complements are products which are consumed together (coffee and milk) or produced together (petrol and diesel oil). Complements are included in the same market when competition to supply one product constrains the prices charged for the other. The most common area when they arise is for secondary markets – sometimes called after markets.
- 5.5 Secondary products are those purchased only if the customer has already purchased a primary product. The main examples are spare parts and servicing: car tyres (a secondary product) are not bought unless the buyer already owns a car (the primary product). Manufacturers of primary products sometimes have a monopoly or high market share in the supply of secondary products or services. They might be accused of exploiting this dominant position. However, the secondary product is not always a relevant market, because any exploitation of a manufacturer's monopoly in the secondary product can affect its position in the market for the primary product. An aircraft engine manufacturer, for example, might have a monopoly supplying spare parts for its engines, but an increase in the price of the spare parts might be taken into account by airlines when purchasing engines in the future.



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- 5.6 Where secondary products exist there are three possible market definitions:
- a single market – including both the primary and secondary products (cars plus their spare parts);
 - multiple markets – where there is one market for the primary product but separate markets for secondary products for each brand of primary product (Ford spare parts, Fiat spare parts, Volkswagen spare parts etc); or
 - dual markets – one for the primary product and one for all brands of secondary product (a market for new cars and a separate market for spare parts for all types of car).
- 5.7 The main issue is whether customers take account of the whole-life cost of a product before purchasing. This occurs if customers look at both the cost of the primary product and the costs of expected secondary product purchases when deciding which product to buy. A significant number of car buyers looking at spare part costs when choosing which car to buy might prevent a manufacturer from exploiting any monopoly in spare parts. Not all consumers need to do so, however, as long as the manufacturer cannot discriminate between those who do and those who do not.
- 5.8 The following factors may indicate whether customers will whole-life cost:
- customers are more likely to whole-life cost if the secondary product is a higher proportion of the primary product's price;
 - large companies may be better able to whole-life cost than smaller companies or final consumers;
 - if customers lack information on the costs of spare parts and servicing, and the reliability of products, whole-life costing will be more difficult. The availability of specialist publications may be a factor here; and
 - if there is uncertainty about how often spare parts or servicing will be required it will be difficult to whole-life cost.
- 5.9 In 1995, the European Commission rejected a complaint that Kyocera, a manufacturer of computer printers, was abusing its dominant position in the supply of secondary products for its printers. One reason for rejection was that Kyocera was not dominant. The Commission concluded that Kyocera was constrained by competition in the primary market for computer printers, because customers were well informed about the costs of secondary products which were significant relative to the printer's price¹³.
- 5.10 A further factor is how often the primary product is replaced, and whether there are switching costs from changing suppliers. If replacement is very infrequent or switching costs are high there may be a significant number of secondary product customers who are captive. Depending on the relative size of the primary market, even if new customers whole-life cost, the supplier may find it profitable to exploit these captive customers, implying that the secondary products will be a separate market.

13 Pelikan/Kyocera
European Commission,
XXVth Report on
Competition Policy: 1995
p.140.

- 5.11 Suppliers of the primary product may reduce prices below cost in order to increase profits from future sales of secondary products. It has been argued that in this situation the market should be defined to include both products. However, this behaviour might itself be considered undesirable (for example, it may lead to over-supply of the primary product, and under-supply of the secondary product). In this situation it may be more appropriate to treat the primary and secondary products as separate markets and consider separately whether or not the undertaking's behaviour in either market might be an abuse under the Chapter II prohibition.

Identifying the competitive price

- 5.12 A remaining difficulty is how to identify the competitive price. When assessing a new agreement the Director General might assume that the current price was competitive: even if it was not at the competitive level in practice, it might be appropriate to use it as the benchmark price. The agreement could have an appreciable effect on competition if it would allow the undertakings to raise prices further above competitive levels than they could at present.
- 5.13 When assessing an undertaking's position under the Chapter II prohibition, consideration has to be given to whether the current price was above competitive levels – a dominant undertaking could already have raised prices above competitive levels to its profit-maximising level. In that situation, it will be constrained from raising prices further by substitution from its closest substitutes – even a monopolist would find it unprofitable to raise prices further at some level. If the question was whether or not the undertaking could raise prices above current levels, the answer would be that it could not due to substitution from other products. If prices already exceeded the competitive level, however, it would clearly be wrong to include those products in the relevant market and argue that they prevented the undertaking from exercising market power. This problem is sometimes known as the cellophane fallacy after a US case involving cellophane products¹⁴. The Director General must make some judgement on whether or not the current price is likely to be significantly above competitive levels already.
- 5.14 This is a difficult question to answer. Evidence that prices are above competitive levels might include excess profits or past price movements (see part 2 of the Competition Act guideline [Assessment of Individual Agreements or Conduct](#)). In these cases, the process of defining the market will not be carried out in isolation but would be considered alongside other evidence on market power and the undertaking's conduct, reflecting the fact that market definition is a tool for assessing whether undertakings possess market power, not an end in itself.

¹⁴ US v El Du Pont de Nemours & Co, [1956] 351 US 377.

Previous cases

- 5.15 In many cases a market may have already been investigated and defined by the Director General or by another competition authority. Sometimes, earlier definitions can provide a useful short cut. Although previous cases can provide useful information, the market definition used may not always be the correct one to use in future cases. Most obviously,



competitive conditions may change over time. In particular, innovation may make substitution between products easier, or more difficult, and therefore change the market definition. Secondly, a previous product market definition may relate to a particular area, such as another part of the European Union, where substitution is more, or less, likely. A product market definition may therefore be different in different locations. In assessing cases in markets which have already been considered by the European Commission and the European Court, the Director General will ensure that the question of market definition is dealt with in a manner which is consistent with its treatment in Community law.

Market definitions are not unique

- 5.16 A third reason why precedents may be of limited value is that many markets contain differentiated products where there is no clear cut-off point delineating the boundary of the market. This means that, in practice, even within the same area at the same time, the market definition is not unique and can vary depending on the competition problem under investigation. The two following hypothetical examples illustrate how market definition can be affected by the nature of the competition issue.

Definition varies depending on the parties

- 5.17 If, hypothetically, there were three versions of the same product, A, B and C, and each was produced using different technology and were therefore not supply-side substitutes, and each version varied slightly in performance so that A was the best, B the second best and C the worst, some consumers would view A and B as substitutes, some would view B and C as substitutes, but A and C would not be direct substitutes. It might be concluded that a monopolist that supplied only one version would not be able to set prices above competitive levels because of substitution by consumers. None of A, B or C forms a separate market, because to some extent they are linked by a chain of substitution. However, a monopolist that supplied both A and B could set prices above competitive levels, as could a monopolist which supplied both B and C. The market definition is not unique: it could be A plus B or B plus C. The definition used in any particular case will depend on the parties being investigated. If an agreement existed between undertakings which manufactured products A and B, the relevant market would be A plus B. If the agreement was between manufacturers of B and C, the relevant market would be B plus C. If the market had been defined as A plus B in one case, undertakings should not assume that B and C could never be included in the same market in future cases. This example shows that the market definition can vary depending on where the test starts (with product A or product C).

Definition varies depending on the type of alleged infringement

- 5.18 Again hypothetically, if Airways operated an air service between two cities and Trainco operated a train service between the same two cities, an allegation might be received that Airways had used predatory pricing tactics or some other form of anti-competitive conduct to remove a rival airline. Airways' conduct would be found to contravene the Chapter II prohibition only if a number of tests were met. One aspect would be whether it possessed a dominant position, depending in part on whether air services were a separate market from

train services. The Director General might conclude that air services were a separate market - perhaps because train services were slower and did not constrain Airway's prices. The relevant market might change, however, if Airways and Trainco entered into an agreement to coordinate timetables so that their services did not directly compete¹⁵.

- 5.19 Looking at a hypothetical monopoly supplier of air and train services, a supplier might be able to set prices of both services above existing levels because trains and aeroplanes are substitutes at the margin. Although air fares might already be above competitive levels, they might still be constrained to some extent by competition from trains. In the future, if that competition were to be removed, fares could increase. So because the competition problem is different the relevant market definition would then be different.
- 5.20 This hypothetical example also shows that the relevant market will not necessarily be the narrowest economic market. This is particularly so in cases involving horizontal agreements where there might be a perceived loss of competition between two undertakings where their products were the closest substitutes at the margin; this would apply even if they could be defined as separate markets using the narrowest potential market definition.

15 The agreement might qualify for an individual exemption, but the Director General would still have to define the relevant market to assess whether there was an appreciable effect on competition and the agreement was caught by the Chapter I prohibition in the first place.

The role of market definition

- 5.21 This guideline explains how the Director General delineates the boundaries of a market by identifying existing competitors and thus the calculation of market shares. However, the question is only part of a full competition analysis. In particular, an undertaking with a high share within a properly defined market might still face other constraints which will prevent it from exercising market power. This is explained further in the Competition Act guideline [Assessment of Market Power](#).
- 5.22 Market definition is most useful as a way of identifying relatively quickly those cases where undertakings clearly will not possess market power because they face significant competition from existing competitors. This is likely to be the case where undertakings possess low market shares within a properly defined market. The Competition Act guidelines [The Chapter I prohibition](#) and [The Chapter II prohibition](#) indicate market shares where, depending on the issue involved, the Director General does not generally expect undertakings to be affected by the prohibitions in the Act.



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Directorate General

Competition

COMMISSION NOTICE on the definition of the relevant market for the purposes of Community competition law.

(Only the published text is authentic. Published in the Official Journal: OJ C 372 on 9/12/1997)

I INTRODUCTION

The purpose of this notice is to provide guidance as to how the Commission applies the concept of relevant product and geographic market in its ongoing enforcement of Community competition law, in particular the application of Regulations 17/62 and 4064/89, their equivalents in other sectoral applications such as transport, coal and steel, and agriculture, and the relevant provisions of the EEA agreement. [\(1\)](#) Throughout this notice, references to Articles 85 and 86 of the Treaty and to merger control are to be understood as referring to the equivalent provisions in the EEA agreement and the ECSC Treaty.

Market definition is a tool to identify and define the boundaries of competition between firms. It allows to establish the framework within which competition policy is applied by the Commission. The main purpose of market definition is to identify in a systematic way the competitive constraints that the undertakings involved [\(2\)](#) face. The objective of defining a market in both its product and geographic dimension is to identify those actual competitors of the undertakings involved that are capable of constraining their behaviour and of preventing them from behaving independently of an effective competitive pressure. It is from this perspective, that the market definition makes it possible, inter alia, to calculate market shares that would convey meaningful information regarding market power for the purposes of assessing dominance or for the purposes of applying Article 85.

It follows from the above, that the concept of relevant market is different from other concepts of market often used in other contexts. For instance, companies often use the term market to refer to the area where it sells its products or to refer broadly to the industry or sector where it belongs

The definition of the relevant market in both its product and geographic dimensions often has a decisive influence on the assessment of a competition case. By rendering public the procedures the Commission follows when considering market definition and by indicating the criteria and evidence on which it relies to reach a decision, the Commission expects to increase the transparency of its policy and decision making in the area of competition policy.

Increased transparency will also result in companies and their advisors being able to better anticipate the possibility that the Commission would raise competition concerns in an individual case. Companies could, therefore, take such a possibility into account in their own internal decision making when contemplating for instance, acquisitions, the creation of joint ventures or the establishment of certain agreements. It is also intended that companies are in a better position to understand what sort of information the Commission considers relevant for the purposes of market definition.

The Commission's interpretation of the notion of relevant market is without prejudice to the interpretation which may be given by the Court of Justice or the Court of First Instance of the European Communities.

II DEFINITION OF RELEVANT MARKET

Definition of relevant product and relevant geographic market.

The regulations based on Articles 85 and 86 of the Treaty, in particular in section 6 of Form A/B with respect to Regulation 17, as well as in section 6 of Form CO with respect to regulation 4064/89 on the control of concentrations of a Community dimension have laid down the following definitions. Relevant product markets are defined as follows:

"A relevant product market comprises all those products and/or services which are regarded as interchangeable or substitutable by the consumer, by reason of the products' characteristics, their prices and their intended use."

Relevant geographic markets are defined as follows:

"The relevant geographic market comprises the area in which the undertakings concerned are involved in the supply and demand of products or services, in which the conditions of competition are sufficiently homogeneous and which can be distinguished from neighbouring areas because the conditions of competition are appreciably different in those areas".

The relevant market within which to assess a given competition issue is therefore established by the combination of the product and geographic markets. The Commission interprets the definitions at paragraphs 7 and 8 (which reflect the jurisprudence of the Court of Justice and the Court of First Instance as well as its own decisional practice) according to the orientations defined in this Notice.

Concept of relevant market and objectives of Community competition policy.

The concept of relevant market is closely related to the objectives pursued under Community competition policy. For example under the Community's merger control, the objective in controlling structural changes in the supply of a product/service is to prevent the creation or reinforcement of a dominant position as a result of which effective competition would be significantly impeded in a substantial part of the common market. Under the Community's competition policy, a dominant position is such that a firm or group of firms would be in a position to behave to an appreciable extent independently of its competitors, customers and ultimately of its consumers (3). Such a position would usually arise when a firm or group of firms would account for a large share of the supply in any given market, provided that other factors analysed in the assessment (such as entry barriers, capacity of reaction of customers, etc.) point in the same direction.

The same approach is followed by the Commission in its application of Article 86 of the Treaty to firms that enjoy a single or collective dominant position. Under Regulation 17 the Commission has the power to investigate and bring to an end abuses of such a dominant position, which must also be defined by reference to the relevant market. Markets may also need to be defined in the application of Article 85 of the Treaty, in particular, in determining whether an appreciable restriction of competition exists or in establishing if the condition under Article 85 (3) b) for an exemption from the application of article 85(1) is met.

The criteria to define the relevant market are applied generally for the analysis of certain behaviours in the market and for the analysis of structural changes in the supply of products. This methodology, though, might lead to different results depending on the nature of the competition issue being examined. For instance, the scope of the geographic market might be different when analysing a concentration, where the analysis is essentially prospective, than when analysing past behaviour. The different time horizon considered in each case might lead to the result that different geographic markets are defined for the same products depending on whether the Commission is examining a change in the structure of supply, such as a concentration or a cooperative joint venture, or issues relating to certain past behaviour.

Basic principles for market definition.

Competitive constraints

Firms are subject to three main sources of competitive constraints: demand substitutability, supply substitutability and potential competition. From an economic point of view, for the definition of the relevant market, demand substitution constitutes the most immediate and effective disciplinary force on the suppliers of a given product, in particular in relation to their pricing decisions. A firm or a group of firms cannot have a significant impact on the

prevailing conditions of sale, such as prices, if its customers are in a position to switch easily to available substitute products or to suppliers located elsewhere. Basically, the exercise of market definition consists in identifying the effective alternative sources of supply for the customers of the undertakings involved, both in terms of products/services and geographic location of suppliers.

The competitive constraints arising from supply side substitutability other than those described in para 20-23 and from potential competition are in general less immediate and in any case require an analysis of additional factors. As a result such constraints are taken into account at the assessment stage of competition analysis.

Demand substitution

The assessment of demand substitution entails a determination of the range of products which are viewed as substitutes by the consumer. One way of making this determination can be viewed, as a thought experiment, postulating a hypothetical small, non-transitory change in relative prices and evaluating the likely reactions of customers to that increase. The exercise of market definition focuses on prices for operational and practical purposes, and more precisely on demand substitution arising from small, permanent changes in relative prices. This concept can provide clear indications as to the evidence that is relevant to define markets.

Conceptually, this approach implies that starting from the type of products that the undertakings involved sell and the area in which they sell them, additional products and areas will be included into or excluded from the market definition depending on whether competition from these other products and areas affect or restrain sufficiently the pricing of the parties' products in the short term.

The question to be answered is whether the parties' customers would switch to readily available substitutes or to suppliers located elsewhere in response to an hypothetical small (in the range 5%-10%), permanent relative price increase in the products and areas being considered. If substitution would be enough to make the price increase unprofitable because of the resulting loss of sales, additional substitutes and areas are included in the relevant market. This would be done until the set of products and geographic areas is such that small, permanent increases in relative prices would be profitable. The equivalent analysis is applicable in cases concerning the concentration of buying power, where the starting point would then be the supplier and the price test allows to identify the alternative distribution channels or outlets for the supplier's products. In the application of these principles, careful account should be taken of certain particular situations as described under paragraphs 56 and 58.

A practical example of this test can be provided by its application to a merger of, for instance, soft drink bottlers. An issue to examine in such a case would be to decide whether different flavours of soft drinks belong to the same market. In practice, the question to address would be if consumers of flavour A would

switch to other flavours when confronted with a permanent price increase of 5% to 10% for flavour A.. If a sufficient number of consumers would switch to, say, flavour B, to such an extent that the price increase for flavour A would not be profitable due to the resulting loss of sales, then the market would comprise at least flavours A and B. The process would have to be extended in addition to other available flavours until a set of products is identified for which a price rise would not induce a sufficient substitution in demand.

19. Generally, and in particular for the analysis of merger cases, the price to take into account will be the prevailing market price. This might not be the case where the prevailing price has been determined in the absence of sufficient competition. In particular for investigation of abuses of dominant positions, the fact that the prevailing price might already have been substantially increased will be taken into account.

Supply substitution

Supply-side substitutability may also be taken into account when defining markets in those situations in which its effects are equivalent to those of demand substitution in terms of effectiveness and immediacy. This requires that suppliers be able to switch production to the relevant products and market them in the short term [\(4\)](#) without incurring significant additional costs or risks in response to small and permanent changes in relative prices. When these conditions are met, the additional production that is put on the market will have a disciplinary effect on the competitive behaviour of the companies involved. Such an impact in terms of effectiveness and immediacy is equivalent to the demand substitution effect.

These situations typically arise when companies market a wide range of qualities or grades of one product; even if for a given final customer or group of consumers, the different qualities are not substitutable, the different qualities will be grouped into one product market provided that most of the suppliers are able to offer and sell the various qualities under the conditions of immediacy and absence of significant increase in costs described above. In such cases, the relevant product market will encompass all products that are substitutable in demand and supply, and the current sales of those products will be summed to calculate the total value or volume of the market. The same reasoning may lead to group different geographic areas.

A practical example of the approach to supply side substitutability when defining product markets is to be found in the case of paper. Paper is usually supplied in a range of different qualities, from standard writing paper to high quality papers to be used for instance to publish art books. From a demand point of view, different qualities of paper cannot be used for a specific use, i.e. an art book or a high quality publication cannot be based on lower quality papers. However, paper plants are prepared to manufacture the different qualities, and production can be adjusted with negligible costs and in a short time frame. In the

absence of particular difficulties in distribution, paper manufacturers are able therefore to compete for orders of the various qualities, in particular if orders are passed with a sufficient lead time to allow to modify production plans. Under such circumstances, the Commission would not define a separate market for each quality of paper and respective usage. The various qualities of paper are included in the relevant market, and their sales added up to estimate total market value and volume.

When supply side substitutability would imply the need to adjust significantly existing tangible and intangible assets, additional investments, strategic decisions or time delays, it will not be considered at the stage of market definition. Examples where supply side substitution did not lead the Commission to enlarge the market are offered in the area of consumer products, in particular for branded beverages. Although bottling plants may in principle bottle different beverages, there are costs and lead times involved (in terms of advertising, product testing and distribution) before the products can actually be sold. In these cases, the effects of supply side substitutability and other forms of potential competition would then be examined at a later stage.

Potential competition

The third source of competitive constraint, potential competition, is not taken into account when defining markets, since the conditions under which potential competition will actually represent an effective competitive constraint depend on the analysis of specific factors and circumstances related to the conditions of entry. If required, this analysis is only carried out at a subsequent stage, in general once the position of the companies involved in the relevant market has already been ascertained, and such position is indicative of concerns from a competition point of view.

III EVIDENCE RELIED UPON TO DEFINE RELEVANT MARKETS.

The process of defining the relevant market in practice.

Product dimension

There is a range of evidence permitting to assess the extent to which substitution would take place. In individual cases, certain types of evidence will be determinant, depending very much on the characteristics and specificity of the industry and products or services that are being examined. The same type of evidence may be of no importance in other cases. In most cases, a decision will have to be based on the consideration of a number of criteria and different items of evidence. The Commission follows an open approach to empirical evidence, aimed at making an effective use of all available information which may be relevant in individual cases. The Commission does not follow a rigid hierarchy of different sources of information or types of evidence.

The process of defining relevant markets may be summarised as follows: on the basis of the preliminary information available or information submitted by the

undertakings involved, the Commission will usually be in a position to broadly establish the possible relevant markets within which, for instance a concentration or a restriction of competition has to be assessed. In general, and for all practical purposes when handling individual cases, the question will usually be to decide on a few alternative possible relevant markets. For instance, with respect to the product market, the issue will often be to establish whether product A and product B belong or do not belong to the same product market. It is often the case that the inclusion of product B would be enough to remove any competition concerns.

In such situations it is not necessary to consider whether the market also includes additional products and reach a definitive conclusion on the precise product market. If under the conceivable alternative market definitions the operation in question does not raise competition concerns, the question of market definition will be left open, reducing thereby the burden on companies to supply information.

Geographic dimension

The Commission's approach to geographic market definition might be summarised as follows: it will take a preliminary view of the scope of the geographic market on the basis of broad indications regarding the distribution of market shares of the parties and their competitors as well as a preliminary analysis of pricing and price differences at national and EU or EEA level. This initial view is used basically as a working hypothesis to focus the Commission's enquiries for the purposes of arriving at a precise geographic market definition.

The reasons behind any particular configuration of prices and market shares need to be explored. Companies might enjoy high market shares in their domestic markets just because of the weight of the past, and conversely, a homogeneous presence of companies throughout the EEA might be consistent with national or regional geographic markets. The initial working hypothesis will therefore be checked against an analysis of demand characteristics (importance of national or local preferences, current patterns of purchases of customers, product differentiation/brands, other) in order to establish whether companies in different areas do really constitute an actual alternative source of supply for consumers. The theoretical experiment is again based on substitution arising from changes in relative prices, and the question to answer is again whether the customers of the parties would switch their orders to companies located elsewhere in the short term and at a negligible cost..

If necessary, a further check on supply factors will be carried out to ensure that those companies located in distinct areas do not face impediments to develop their sales on competitive terms throughout the whole geographic market. This analysis will include an examination of requirements for a local presence in order to sell in that area, the conditions of access to distribution channels, costs associated with setting up a distribution network, and the existence or absence of

regulatory barriers arising from public procurement, price regulations, quotas and tariffs limiting trade or production, technical standards, monopolies, freedom of establishment, requirements for administrative authorisations, packaging regulations, etc... In short, the Commission will identify possible obstacles and barriers isolating companies located in a given area from the competitive pressure of companies located outside that area, so as to determine the precise degree of market interpenetration at national, European or global level.

The actual pattern and evolution of trade flows offers useful supplementary indications as to the economic importance of each demand or supply factors mentioned above, and the extent to which they may or may not constitute actual barriers creating different geographic markets. The analysis of trade flows will generally address the question of transport costs and the extent to which these may hinder trade between different areas, having regard to plant location, costs of production and relative price levels.

Market integration in the European Union

Finally, the Commission also takes into account the continuing process of market integration in particular in the European Union when defining geographic markets, especially in the area of concentrations and structural joint ventures. The measures adopted and implemented in the internal market programme to remove barriers to trade and further integrate the community markets cannot be ignored when assessing the effects on competition of a concentration or a structural joint venture. A situation where national markets have been artificially isolated from each other because of the existence of legislative barriers that have now been removed, will generally lead to a cautious assessment of past evidence regarding prices, market shares or trade patterns. A process of market integration that would, in the short term, lead to wider geographic markets may therefore be taken into consideration when defining the geographic market for the purposes of assessing concentrations and joint ventures.

The process of gathering evidence

When a precise market definition is deemed necessary, the Commission will often contact the main customers and the main companies in the industry to enquire into their views about the boundaries of product and geographic markets and to obtain the necessary factual evidence to reach a conclusion. The Commission might also contact the relevant professional associations, and where appropriate, companies active in upstream markets, so as to be able to define, insofar as necessary, separate product and geographic markets, for different levels of production or distribution of the products/services in question. It might also request additional information to the undertakings involved.

Where appropriate, the Commission services will address written requests for

information to the market players mentioned above. These requests will usually include questions relating to the perceptions of companies about reactions to hypothetical price increases and their views of the boundaries of the relevant market. They will also include requests to provide the factual information the Commission deems necessary to reach a conclusion on the extent of the relevant market. The Commission services might also discuss with marketing directors or other officers of those companies to gain a better understanding on how negotiations between suppliers and customers take place and better understand issues relating to the definition of the relevant market. Where appropriate, they might also carry out visits or inspections to the premises of the parties, their customers and/or their competitors, in order to better understand how products are manufactured and sold.

The type of evidence relevant to reach a conclusion as to the product market can be categorised as follows .

Evidence to define markets - Product dimension.

An analysis of the product characteristics and its intended use allows the Commission, in a first step, to limit the field of investigation of possible substitutes. However, product characteristics and intended use are insufficient to conclude whether two products are demand substitutes. Functional interchangeability or similarity in characteristics may not provide in themselves sufficient criteria because the responsiveness of customers to relative price changes may be determined by other considerations also. For example, there may be different competitive constraints in the original equipment market for car components and in spare parts, thereby leading to a distinction of two relevant markets. Conversely, differences in product characteristics are not in themselves sufficient to exclude demand substitutability, since this will depend to a large extent on how customers value different characteristics.

The type of evidence the Commission considers relevant to assess whether two products are demand substitutes can be categorised as follows:

Evidence of substitution in the recent past. In certain cases, it is possible to analyse evidence relating to recent past events or shocks in the market that offer actual examples of substitution between two products. When available, this sort of information will normally be fundamental for market definition. If there have been changes in relative prices in the past (all else being equal), the reactions in terms of quantities demanded will be determinant in establishing substitutability. Launches of new products in the past can also offer useful information, when it is possible to precisely analyse which products lost sales to the new product.

There are a number of quantitative tests that have specifically been designed for the purpose of delineating markets. These tests consist of various econometric and statistical approaches: estimates of elasticities and cross-price elasticities (5) for the demand of a product, tests based on similarity of price movements over time, the analysis of causality between price series and similarity of price levels

and/or their convergence. The Commission takes into account the available quantitative evidence capable of withstanding rigorous scrutiny for the purposes of establishing patterns of substitution in the past.

Views of customers and competitors. The Commission often contacts the main customers and competitors of the companies involved in its enquiries, to gather their views on the boundaries of the product market as well as most of the factual information it requires to reach a conclusion on the scope of the market. Reasoned answers of customers and competitors as to what would happen if relative prices for the candidate products would increase in the candidate geographic area by a small amount (for instance of 5%-10%) are taken into account when they are sufficiently backed by factual evidence.

Consumer preferences. In cases of consumer goods, it might be difficult for the Commission to gather the direct views of end consumers about substitute products. Marketing studies that companies have commissioned in the past and that are used by companies in their own decision making as to pricing of their products and/or marketing actions may provide useful information for the Commission's delineation of the relevant market. Consumer surveys on usage patterns and attitudes, data from consumer's purchasing patterns, the views expressed by retailers and more generally, market research studies submitted by the parties and their competitors are taken into account to establish whether an economically significant proportion of consumers consider two products as substitutable, taking also into account the importance of brands for the products in question. The methodology followed in consumer surveys carried out ad-hoc by the undertakings involved or their competitors for the purposes of a merger procedure or a procedure under Regulation 17 will usually be scrutinized with utmost care. Unlike pre-existing studies, they have not been prepared in the normal course of business for the adoption of business decisions.

Barriers and costs associated with switching demand to potential substitutes. There are a number of barriers and costs that might prevent the Commission from considering two prima facie demand substitutes as belonging to one single product market. It is not possible to provide an exhaustive list of all the possible barriers to substitution and of switching costs. These barriers or obstacles might have a wide range of origins, and in its decisions, the Commission has been confronted with regulatory barriers or other forms of State intervention, constraints arising in downstream markets, need to incur specific capital investment or loss in current output in order to switch to alternative inputs, the location of customers, specific investment in production process, learning and human capital investment, retooling costs or other investments, uncertainty about quality and reputation of unknown suppliers, and others.

Different categories of customers and price discrimination. The extent of the product market might be narrowed in the presence of distinct groups of customers. A distinct group of customers for the relevant product may constitute a narrower, distinct market when such group could be subject to price

discrimination. This will usually be the case when two conditions are met: a) it is possible to identify clearly which group an individual customer belongs to at the moment of selling the relevant products to him, and b) trade among customers or arbitrage by third parties should not be feasible.

Evidence to define markets - Geographic dimension.

The type of evidence the Commission considers relevant to reach a conclusion as to the geographic market can be categorised as follows:

Past evidence of diversion of orders to other areas. In certain cases, evidence on changes in prices between different areas and consequent reactions by customers might be available. Generally, the same quantitative tests used for product market definition might as well be used in geographic market definition, bearing in mind that international comparisons of prices might be more complex due to a number of factors such as exchange rate movements, taxation and product differentiation.

Basic demand characteristics. The nature of demand for the relevant product may in itself determine the scope of the geographical market. Factors such as national preferences or preferences for national brands, language, culture and life style, and the need for a local presence have a strong potential to limit the geographic scope of competition.

Views of customers and competitors. Where appropriate, the Commission will contact the main customers and competitors of the parties in its enquiries, to gather their views on the boundaries of the geographic market as well as most of the factual information it requires to reach a conclusion on the scope of the market when they are sufficiently backed by factual evidence.

Current geographic pattern of purchases. An examination of the customers' current geographic pattern of purchases provides useful evidence as to the possible scope of the geographic market. When customers purchase from companies located anywhere in the EU or the EEA on similar terms, or they procure their supplies through effective tendering procedures in which companies from anywhere in the EU or the EEA do submit bids, the geographic market will be usually considered to be Community-wide.

Trade flows/pattern of shipments. When the number of customers is so large that it is not possible to obtain through them a clear picture of geographic purchasing patterns, information on trade flows might be used alternatively, provided that the trade statistics are available with a sufficient degree of detail for the relevant products. Trade flows, and above all, the rationale behind trade flows provide useful insights and information for the purpose of establishing the scope of the geographic market but are not in themselves conclusive.

Barriers and switching costs associated to divert orders to companies located in other areas. The absence of transborder purchases or trade flows, for instance, does not necessarily mean that the market is at most national in scope. Still,

barriers isolating the national market have to be identified before concluding that the relevant geographic market in such a case is national. Perhaps the clearest obstacle for a customer to divert its orders to other areas is the impact of transport costs and transport restrictions arising from legislation or from the nature of the relevant products. The impact of transport costs will usually limit the scope of the geographic market for bulky, low value products, bearing in mind that a transport disadvantage might also be compensated by a comparative advantage in other costs (labour costs or raw materials). Access to distribution in a given area, regulatory barriers still existing in certain sectors, quotas and custom tariffs might also constitute barriers isolating a geographic area from the competitive pressure of companies located outside that area. Significant switching costs in procuring supplies from companies located in other countries constitute additional sources of such barriers.

On the basis of the evidence gathered, the Commission will then define a geographic market that could range from a local dimension to a global one, and there are examples of both local and global markets in past decisions of the Commission.

The paragraphs above describe the different factors which might be relevant to define markets. This does not imply that in each individual case it will be necessary to obtain evidence and assess each of these factors. Often in practice the evidence provided by a subset of these factors will be sufficient to reach a conclusion, as shown in the past decisional practice of the Commission.

IV CALCULATION OF MARKET SHARES.

The definition of the relevant market in both its product and geographic dimensions allows to identify the suppliers and the customers/consumers active on that market. On that basis, a total market size and market shares for each supplier can be calculated on the basis of their sales of the relevant products on the relevant area. In practice, the total market size and market shares are often available from market sources, i.e. companies' estimates, studies commissioned to industry consultants and/or trade associations. When this is not the case, or also when available estimates are not reliable, the Commission will usually ask each supplier in the relevant market to provide its own sales in order to calculate total market size and market shares.

If sales are usually the reference to calculate market shares, there are nevertheless other indications that, depending on the specific products or industry in question, can offer useful information such as, in particular, capacity, the number of players in bidding markets, units of fleet as in aerospace, or the reserves held in the case of sectors such as mining.

As a rule of thumb, both volume sales and value sales provide useful information. In cases of differentiated products, sales in value and their associated market share will usually be considered to better reflect the relative position and strength of each supplier.

V ADDITIONAL CONSIDERATIONS.

There are certain areas where the application of the principles above has to be undertaken with care. This is the case when considering primary and secondary markets, in particular, when the behaviour of undertakings at a point in time has to be analysed under Article 86. The method to define markets in these cases is the same, i.e. to assess the responses of customers based on their purchasing decisions to relative price changes, but taking into account as well constraints on substitution imposed by conditions in the connected markets. A narrow definition of market for secondary products, for instance, spare parts, may result when compatibility with the primary product is important. Problems of finding compatible secondary products together with the existence of high prices and a long life time of the primary products may render relative price increases of secondary products profitable. A different market definition may result if significant substitution between secondary products is possible or if the characteristics of the primary products make quick and direct consumer responses to relative price increases of the secondary products feasible.

In certain cases, the existence of chains of substitution might lead to the definition of a relevant market where products or areas at the extreme of the market are not directly substitutable. An example might be provided by the geographic dimension of a product with significant transport costs. In such cases, deliveries from a given plant are limited to a certain area around each plant by the impact of transport costs. In principle, such area could constitute the relevant geographic market. However, if the distribution of plants is such that there are considerable overlaps between the areas around different plants, it is possible that the pricing of those products will be constrained by a chain substitution effect, and lead to define a broader geographic market. The same reasoning may apply if product B is a demand substitute for products A and C. Even if products A and C are not direct demand substitutes they might be found to be in the same relevant product market since their respective pricing might be constrained by substitution to B.

From a practical perspective, the concept of chains of substitution has to be corroborated by actual evidence, for instance related to price interdependence at the extremes of the chains of substitution, in order to lead to an extension of the relevant market in an individual case. Price levels at the extremes of the chains would have to be as well of the same magnitude.

(1) The focus of assessment in state aid cases is the aid recipient and the industry/sector concerned rather than identification of competitive constraints faced by the aid recipient. When consideration of market power and therefore of the relevant market are raised in any particular case, elements of the approach outlined here might serve as a basis for the assessment of state aid cases

(2) For the purposes of this notice, the undertakings involved will be in the case of a concentration the parties to the concentration. In investigations under

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Article 86 of the Treaty, the undertaking being investigated or the complainants. For investigations under Article 85, the parties to the agreement.

(3) Definition given by the Court of Justice in Hoffmann La Roche (CJEC Sentence of 13.02.1979, case 85/76), and confirmed in subsequent judgements.

(4) i.e. the period which does not imply a significant adjustment of existing tangible and intangible assets (see para 23).

(5) Own price elasticity of demand for product X is a measure of the responsiveness of demand for X to percentage change in its own price. Cross-price elasticity between products X and Y is the responsiveness of demand for product X to percentage change in the price of product Y.



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APPENDIX 1A

INTRODUCING GAME THEORY

A1.1. Introduction: Aims and Learning Outcomes

I can only really 'scratch the surface' in this fascinating area. I wanted to include this chapter because it represents the application of an important and recent addition to the stock of knowledge in a number of fields: notably biology, political science, and economics. Its origins are with the work of John von Neumann in the 1930s but it has really gained prominence since the late 1980s. I suggest that you read Poundstone (1993) for some biography on von Neumann and an introduction to the games here. You might also read the work of Richard Dawkins (1989) who applies it to Darwinian biology. If you want to see how it is applied to business situations then read Dixit and Nalebuff (1991) though it is pervasive in books by economists about strategy (see Kay, 1993; Macmillan, 1992; Dixit and Skeath, 1999).

Game theory has enormous applicability to our everyday understanding of human behaviour and particularly our understanding of rationality, co-operation, reciprocity, trust, punishments and learning. Thus, it has an important bearing on the understanding of how core competences develop. It is also relevant to our understanding of behaviour within dynamic frameworks and so has a bearing on the next chapter. Thus, the aim of this chapter is to explore behaviour between individuals using game theory as our guide.

In order to examine the implications of game theory for issues in general we need to explore some concepts. This requires a logical approach and an element of mathematical understanding. However, the maths involved will be kept to an absolute minimum. We will see that strategy in game theory involves a choice between alternative policies and that the one adopted depends upon how the player reasons. In some cases there will be 'dominant strategies' such that it does not matter what other players do because this policy choice offers greater net benefits than any alternative. However, where the gains are not clear-cut individuals or organisations have to anticipate what they believe their opponents might do. Throughout the early part of this chapter I will try and use examples taken from the public and private sectors where possible to avoid being esoteric. At the end of this chapter I will briefly relate theory to explain the development of partnerships / strategic alliances in the public and private sectors.

After following this chapter and carrying out the associated activities you will be able to

- Identify a dominant strategy and a Nash equilibrium.
- Identify with co-ordination problems like that associated with the battle of the sexes game.
- Critically examine behaviour within the Prisoner's Dilemma game and make reference to the implications of such behaviour within your own organisation.
- Evaluate the importance of eliciting co-operation through 'Tit for Tat' strategies.
- Critically examine the assumptions of game theory, notably that of rationality.
- Synthesise the knowledge gained from the theory and apply it more widely.

A1.2. Basic Concepts in Game Theory

The essence of Game theory is that there is interdependence when making strategic decisions, i.e. what one player does affect and may have been affected by other players. To understand the essence of games we have to look for solutions but such solutions can be rather difficult to deduce. We will begin with the easiest, a dominant strategy equilibrium and then examine the Nash strategy equilibrium.

1. Dominant strategy

This can be defined as the strategy which yields the optimal pay off irrespective of what its rival(s) is (are) doing.

One of Dixit and Nalebuff's rules for game theory is

“If you have a dominant strategy use it” (1991, p.66).

To see how it works consider Figures **A1.1** and **A1.2**. Figure A1.1 shows how a local authority and a potential inward investor might arrive at a mutually advantageous situation. There are two choices (strategies) for the Local Authority: adopt an active or a passive (non-active) inward investment policy towards private firms. The payoffs for the local authority are expressed in Gross Domestic Output in millions of £s (though we could use wider social objectives or even votes). The payoffs for the private firm are measured as millions of £s profit. (Note that in all the figures the left hand side figure in the parentheses represents the pay off for the player noted at the side of the matrix whilst the right hand side figure is the pay off for the player denoted on the top. These are also known as the row and column players respectively).

The resulting equilibrium occurs when the local authority engages in an active inward investment policy and the private firm invests in local authority A. Why? Well, the firm sees that it has a better pay off from investing in Local authority A irrespective of what the authority does (Its profits of 10 or 8 are greater than 5). Likewise Local authority A sees that by adopting an active industrial policy the returns to the local economy in terms of Gross Domestic Output are either 20 or -5 which is better than similar outcomes for not acting positively in attracting firms to the area (5 and -8). So both players have a 'win-win' outcome. Note that in game theory jargon 'non-active' and 'invest in B' are **Dominated strategies** for each player.

Figure A1.2 involves a slight variation on a dominant strategy equilibrium. Here there are two Housing Associations (these are providers of social housing provision in the UK, though you can substitute two chemical firms if you wish). The payoffs in the matrix are profits measured in millions of £s. We see that Housing Association 2 (HA2) has a dominant strategy, that of seeking an alliance (profits of 4 and 3 are greater than 2 irrespective of what strategy Housing Association 1 adopts). HA1 does not have an outright dominant strategy but (and here we are making an assumption that information is perfect) it can see that HA2 has a dominant strategy of seeking an alliance. In this case it would be folly (given the rationality implied by the payoffs) for HA1 not to seek an alliance.

Figure A1.1. Foreign Investment in a local economy.

		Private Firm	
		Invest in A	Invest in B
Local Authority A	Active	(20, 10)	(-5, 5)
	Non-Active	(5, 8)	(-8, 5)

Figure A1.2. A Housing Association (H.A.) Merger

		H.A 2	
		Alliance	No Alliance
H.A 1	Alliance	(3, 4)	(2, 2)
	No Alliance	(1, 3)	(4, 2)

Note that it is possible to distinguish between strong and weak dominance. Figures A1.1 and A1.2 are examples of strong dominance for one or both players. Consider A1.3. In this example, player 1 will never play down whilst player 2 will never play right. This is sub-optimal. They will play left, up though they would be better playing down, left. The reason for this inefficient outcome is the possibility of defection by one of the players.

Figure A1.3. Weak Dominance.

		FIRM 2	
		Left	Right
FIRM 1	Up	(7, 2)	(5, 2)
	Down	(7, 4)	(2, 0)

Activity A1.1

Try your brain on the following

The Rational Pigs.

Two pigs, one dominant and the other subordinate, are put in a box. There is a lever at one end of the box which, when pressed, dispenses food at the other end. Thus, the pig that presses the lever must run to the other end; by the time it gets there, the other pig has eaten most, but not all, of the food. The dominant pig is able to prevent the subordinate pig from getting any of the food when both are at the food. Assume that pig survival depends upon getting the most food it possibly can, which pig will press the lever?

Incidentally, you might interpret this as a large and small firm and the payoffs could be profits. You can think about the strategies.

Email your responses to the discussion board. Don't panic if your lost I will help you out. However, if you want to see the answer consult the reference below.

Source: Macmillan (1992). Reproduced with permission of Oxford University Press.

2. Nash strategy

This can be defined as a set of strategies where each player does their best given what they assume the other(s) is (are) doing. Thus, no player can improve upon his or her payoff by adopting an alternative strategy.

Named after the mathematician, John Nash, who discovered the concept in the late 1940s, this is a stable, self-enforcing and generalised equilibrium concept in Game theory. It arises because not all games have dominant strategies. So again using a Dixit and Nalebuff rule

“Having exhausted the simple avenues of looking for dominant strategies or ruling out dominated ones, the next thing to do is to look for an equilibrium of the game” (1991, p.77).

To understand how the Nash equilibrium works consider the following game in Figure A1.4. This is a game of best replies. Further we must remember that in this and other games described in this chapter

“there is complete but imperfect information. It is complete because both know the strategies and payoffs available to each other, yet imperfect because decisions have to be made before the other's choice has been revealed.” (Lyons, *ibid.* p.98)

Individuals are making their choices independently of one another though they recognise that what they do will be affected by the other's independent choice. Look at Figure A1.4. If X plays Top then Y's best response is to play Right and get 5. If X plays Bottom then Y should play Left. The better of these two payoffs obtained by Y is 6 so they will play Left. Similar reasoning yields that Player X is better off playing Bottom. If Y plays Left then X's best response is Top, where they gain 4. If Y plays Right then X should play then Y should play Bottom where they would gain 6. The Nash Equilibrium is thus Left, Bottom.

(If you found the use of X and Y and Left, Right and Top, Bottom rather esoteric why not substitute the players and strategies from Figure A1.2.)

The Nash equilibrium is a more powerful solution concept than dominant strategy equilibrium (indeed, the latter are a subset of the former). But clearly a Nash equilibrium is a non-trivial

solution. It requires that individuals are game theoretic thinkers with a powerful logic to their reasoning.

In this game the Nash Equilibrium yields the optimal payoff for both players (although there are unequal distributions of the gains). There are, however, problems for Nash equilibrium. In the next section we examine two.

		Player Y	
		Left	Right
Player X	Top	(4, 1)	(2, 5)
	Bottom	(3, 6)	(6, 2)

Figure 6.4. Determining a Nash Equilibrium

Self Assessment Exercise

Look again at Figures A1.1, A1.2 and A1.3 and consider the Nash equilibrium.

A1.3. Problems for Nash Equilibrium

1. Multiple equilibria in one-shot games

Figure A1.5 shows the Battle of the Sexes game so called because it recognises potential difficulties between individuals in relationships. The matrix shows the strategies and pay offs for two individuals sitting at work wondering what to do in the evening. Both want to be together, though they have slightly different preferences as to what they want to do. Being apart is the worst outcome and this is given a payoff of zero points of satisfaction. As to the co-ordinated activity that may take place, 'getting your own way' yields more than 'giving in' and is rewarded with 2 rather than one point.

		Her	
		Knitting	Sumo
Him	Knitting	(2, 1)	(0, 0)
	Sumo	(0, 0)	(1, 2)

Figure A1.5: The Battle of the Sexes Game

There are two Nash equilibrium – (knitting, knitting) and (sumo, sumo) – and we need two Nash Equilibrium ‘like we need two heads’ (Poundstone, 1993, p.199). How might the problem be resolved?

- ❑ Well there could be a hierarchy between the players (one of them is dominant and the other acquiescent)
- ❑ It might be that one of the players makes what game theorists term a ‘credible commitment’. For example, she could ‘burn her bridges behind her’ (another game theory phrase) and buy tickets for the Sumo.
- ❑ Alternatively, there might be a convention between the players. One chooses one week and the other the next. Thus game theorists often talk about ‘focal points’ in games. These arise because of the historical, legal, cultural or social background between the players (Schelling, 1960).

(There is also a mixed equilibrium strategy that can be adopted here but it has little value to the resolution of the problem in the short term.)

The Battle of the Sexes Game has implications in any co-ordination issue. In the public services, mergers between Housing Associations might be seen as beneficial but there may be a dispute over the method of implementation. Similarly, multi-agency approaches to problems are commonplace in the public services. However, establishing an appropriate solution is rather more difficult. The game might also be characterised by wage bargaining or the allocation of scarce funds between parties.

Figure A1.6 illustrates an example from the private sector taken from John Kay (1993) showing the importance of co-ordination in a standards game. Again there may well be parallels with situations such as installing a particular IT system. It could also be that public service providers agree on the need for partnership activity but not on its form.

		Consumer 2	
		Buy VHS	Buy Betamax
Customer 1	Buy VHS	(Best, Good)	(Bad, Bad)
	Buy Betamax	(Bad, Bad)	(Good, Best)

Figure A1.6: A Simple ‘Battle of the Sexes’ Standards Game

In Figure A1.6 there are 2 possible outcomes each buy VHS or each buy Betamax. However, one consumer does not optimise their payoffs.

What is required is

1. Hierarchy - governments often attempt to establish a particular standard.
2. Commitment. This means
 - The rapid achievement of an installed base, e.g. In the provision of satellite TV Sky won against the British Satellite Broadcasting Company in spite of the fact that it was sponsored by the European Commission.
 - Establishing reputation and credibility quickly, e.g. JVC offered an open licensing policy to win the VHS/Betamax game.

Self Assessment Question

Can you think of other examples where organisations have had to establish credibility in order to win battle of the sexes games?

2. A Classic Game: The Prisoner’s Dilemma (Due to A.W. Tucker)

In this game 2 prisoners have been brought in for questioning by the police about a serious crime. The police have some information and so can make some charges hold but they need to question the suspects if they are to get the whole picture. The police interview the suspects in separate rooms. The prisoners now find themselves in a dilemma. The game is shown in the matrix below. Both have two choices, to confess or not confess. The payoffs in Figure A1.7 for prisoner 1 are shown in the right of the bracket and those for prisoner 2 on the left. They are negative to reflect years in prison.

Both prisoners will get either 5 years or 6 months in prison for confessing and 10 years or 1 year if they keep quiet. Given the possibility of a 6 month sentence both players find themselves confessing. Why? Well put yourself in the place of one of the prisoners (say Prisoner 1) and consider the case of not confessing. You can see that by co-operating with each other you would only face 1 year each in prison. But you ask yourself; ‘will prisoner 2 behave like this?’ You can see from the payoffs that there is a huge incentive for Prisoner 2 to defect from this arrangement – they might only get 6 months in gaol. The logic of Game theory would imply that Prisoner 2 would employ similar reasoning in determining the likely strategy of Prisoner 1.

The implications of the Prisoner's Dilemma Game are clear enough. If they follow the logic of game theory then both players will obtain a sub-optimal payoff – They each get 5 years in prison when they could cooperate with each other and get out in one year's time.

Figure A1.7. The Prisoner's Dilemma

		Prisoner 2	
		No Confession	Confession
Prisoner 1	No Confession	(-1, -1)	(-10, -0.5)
	Confession	(-0.5, -10)	(-5, -5)

So the Prisoner's Dilemma game sits uneasily with a simple use of rational behaviour. But this and all the other games represented in Figures A1.1 to A1.7 are what game theorists call 'one-shot' games. We need to examine the repeated game to understand how the players obtain the optimal payoffs. Perhaps you've already figured out that the Prisoners have learnt how to play the game (They say there is 'honour among thieves').

Questions

Do we want the Prisoner's to win the game? What mechanisms have been developed by the authorities to prevent Prisoners winning the repeated game?

Can you think of any other situations where you would not want the players to co-operate?

However, before entertaining the repeated game which will enable us to understand how co-operation develops between players, Figure A1.8 below provides a general format to understand the Prisoner's Dilemma game.

		Player 2	
		Cooperate	Defect/Compete
Player 1	Cooperate	(Good, Good)	(Worst, Best)
	Defect/Compete	(Best, Worst)	(Okay, Okay)

Figure A1.8. A more General Version of the Prisoner's Dilemma

This figure shows the stark contrasts available to the players. They can compete or cooperate. If player 1 was XYZ Incorporated and player 2 was ABC inc. and they had two strategies charge high prices or sell at low prices then they would be better off co-operating with each other and charging higher prices. This, of course, would be good for the players but bad for society. It would also be illegal because the firms would be deemed as acting as a cartel. Further the powerful forces indicated by game theory would suggest that both firms would compete against each other and their profits would be acceptable (or, as I've expressed it in Figure A1.8, Okay). This is, of course, what consumers want and so the 'Prisoner's Dilemma' game works to society's advantage. But this is not always the case. Indeed, there are situations where one party might defect rather than cooperate. For example,

- ❑ **Consider the collection of taxes to pay for emergency services or services such as street lighting.** People want the benefits from taxation but do not want to pay. There is a "free-rider" problem, which suggests that defect (competitive) strategies develop. To see this, think about it from the point of view of the individual. Society would be better off if everyone participated in providing public goods and services. However, an individual may reason that if I do not pay then my net pay off is higher than if I do pay. I get the benefits of health care (or whatever) but not the costs. Clearly, if everyone behaves like this then society loses out.
- ❑ **Consider why some team members shirk in the work place.** If we work in teams then the rewards an individual gets from an extra unit of effort are diluted among our colleagues. If there are 10 people in a team and one person puts in the extra unit of effort the payoffs (and these can be non-pecuniary payoffs like satisfaction from seeing the team succeed, as well as monetary rewards) are shared by the other 9. Again we have the 'free rider' problem as some team members take advantage of the hard work of others. Of course, if everyone does this then the organisation will collapse. Appropriate punishment and reward systems have to be put in place to overcome the problem but this can create other difficulties.

Some relationships do not even get started or start off badly.

- ❑ **Why do employers and unions play tough guy strategies in industrial relations strategies** (tantamount to our defect/compete choice in Figure A1.8)? Would a more professional, co-operative approach give higher returns?
- ❑ **Why do strategic alliances or, more generally, partnerships fail to get off the ground?** Most players play the game cautiously to begin with. They might recognise the benefits of an alliance but they are unwilling to commit themselves or resources initially because that would mean upsetting the status quo or perhaps they believe potential partners could perceive it as a sign of weakness.

We will examine the latter in a little more detail later. For the moment let us acknowledge that the Prisoner's Dilemma game is pervasive in social and organisational settings. How does game theory set about resolving the problem?

A1.4. Eliciting Co-operation through 'Tit for Tat' Punishments: A repeated Prisoner's Dilemma Game

If the participants in a Prisoner's Dilemma game believe that they will face each other on more than one occasion then there exists a repeated game in which players may signal that they are willing to act co-operatively. However, there are powerful forces acting to push players back towards the Nash Equilibrium. Why? Because the payoffs are greater to an individual if they defect whilst the other continues to act co-operatively (the so-called 'sucker's payoff'). To develop co-operative behaviour and to ensure that such mutual co-operation persists over the long term game theorists have suggested that a system of punishments is adopted. The most well known punishment strategy is '**Tit-for tat**' (TFT). This, of course, requires that the game is played repeatedly over an undetermined length of time (preferably infinitely), otherwise the incentives to defect increase. It also requires that

the players recognise co-operation when it occurs and that once mutual co-operation is established that the 'agreement' is effectively monitored and appropriate punishment metered out.

Why has TFT emerged as such an important punishment strategy? The reason is fairly simple. A political scientist, Robert Axelrod held a tournament in which he invited game theorists to submit a computer program that would resolve the Prisoner's Dilemma. The winner was TFT submitted by Anatole Rappaport. The program was very simple, TFT

- Acted co-operatively in the first round.
- In subsequent rounds, it adopted its opponent strategy from the previous round.

In the tournament each program

- Competed head-to-head against another
- Competed against itself
- Competed against another that was randomly selected by a computer.

Clearly, TFT would always lose out if it met up with a permanent defector but when it met a co-operative player or a similar TFT player they would achieve the optimal payoffs. When defectors met defectors then they would achieve the sub-optimal payoff. Players who were permanent co-operators would lose out in a big way to defectors as they always wanted to co-operate whilst the defector continued to compete. See Table A1.1 for an illustration of the process using two players – a TFT and a permanent defector.

As Axelrod noted TFT won the tournament because it is

- Nice (a player starts out co-operatively and is not the first to defect)
- Provocable (a TFT player will punish defection quickly)
- Forgiving (a TFT player will act co-operatively again if their opponent signalled co-operation in period $t - 1$)

Table A1.1: Tit for Tat versus Permanent Defection

Assume that there are two players, a TFT player and a permanent defector. The payoffs are measured in £s and shown in Figure A1.9. The defector will always play defect. The TFT will play as outlined in the text.

		Player 2	
		Co-operate	Defect
Player 1	Co-operate	(300, 300)	(100, 400)
	Defect	(400, 100)	(200, 200)

Figure A1.9: Payoff Matrix

To see why TFT was so successful we shall play the game over 10 rounds (though the players won't know this) using the Axelrod tournament rules. We will be Player 1 in Tables A1.1a and A1.1b below and play TFT. First, we play against a player (Player 2) who always defects (D) – this is the dominant strategy in a one shot game.

Table A1.1a

	Player 1 Tit for Tat	Player 2 Defect Strategy
Round 1	C 100	D 400
Round 2	D 200	D 200
	↓	↓
Round 9	D 200	D 200
Round 10	D 200	D 200
Total Profits	1900	2200




In the next game we will play another TFT player (itself).

Table A1.1b

	Player 1 Tit for Tat	Player 3 Tit for Tat
Round 1	C 300	C 300
Round 2	C 300	C 300
	↓	↓
Round 9	C 300	C 300
Round 10	C 300	C 300
Total Profits	3000	3000

Now the firm playing a defector has to play against itself (a similar player).

Table A1.1 continued**Table A1.1c**

	Player 2 Defect Strategy	Player 4 Defect Strategy
Round 1	D 200	D 200
Round 2	D 200	D 200
		
Round 9	D 200	D 200
Round 10	D 200	D 200
Total Profits	2000	2000

We can see that TFT wins in terms of the cumulative payoffs. The TFT player has cumulative payoffs of 4900 whilst the Defector player has payoffs of 4200.

The implication of the Prisoner's Dilemma is that whilst players will compete against each other in one shot games, in repeated (multiple shot) games, where there is no knowledge of the length of the game, co-operation may lead to the development of a form of trust. This, of course, was an important determinant of organisational architecture in Chapter 4. However, Axelrod (1984) puts a different emphasis on the development of co-operation. He suggests that we need to

- Teach people to care about each other
- Improve recognition abilities and
- Teach reciprocity

But Axelrod is not an altruist. For Axelrod the foundation of co-operation is not really trust but the durability of a relationship in which we can elicit co-operation through the use of punishment for defection. We saw that TFT was a particularly successful strategy but it did suffer from fairly obvious problems, notably in one off games against defectors. However, studies have shown that TFT is a very high ranking strategy. Where there are a sufficient number of TFT players interacting with each other and with others playing different strategies Dawkins (1989) has convincingly argued that 'Nice guys finish first!' However, there are situations where the population is made up largely of defectors and where TFT players hardly interact with each other. In such cases sub-optimal outcomes for the players can be expected. In these circumstances regulations may be put in place to elicit co-operation.

A1.5. Partnerships and Alliances

We now have some quite substantive building blocks to apply game theory to the real world. There is more that can be stated but space and time constraints prevent an in-depth analysis. However, we can use and develop this framework to analyse how game theory might be used to explain a topical issue in strategic management, namely strategic alliances. We can only scratch the surface in analysing the types and rationale for alliances, which include mergers, equity and non-equity joint ventures, and public sector partnerships (see Johnson and Scholes, 1999, for some further analysis).

However, it is clear that these are classic 'Prisoner Dilemma' games. An alliance to supply a new and expensive product or service (or an existing service more effectively) would yield benefits to both parties but there are powerful forces to defect rather than cooperate. Clearly, we could rely on TFT strategies to establish co-operation but that could take a very long time. Some sectors such as the multimedia, entertainment and computing sectors are developing very rapidly. Moreover, the public and not-for-profit sectors are under political and public pressure to deliver services that cut across traditional organisational boundaries. Thus, whilst punishment strategies such as TFT may be relevant other mechanisms can be employed to create and sustain alliances.

Many organisations from the public and private sector want to realise the enormous potential benefits from creating and sustaining strategic alliances but are aware that the risks could create ruin. International strategic alliances in new technologies might lead to sharing of the huge research and development costs, create new market opportunities, shape the future competitive environment and even reduce trade restriction costs if the alliance engages players in those parts of the world where neo-protectionist arguments circulate. It could also lead to a cross-fertilisation of technical knowledge but this may lead to knowledge loss and the very existence of an alliance could lead to the opportunistic behaviour by one or other of the parties to the exchange process as we noted in chapter 4. To overcome these problems many of the high-technology firms in fast moving sectors have developed a number of solutions including

- The establishment of Property Rights through the use of majority equity arrangements. For example a 51:49 share ownership overcomes some of the opportunism issues because on key strategic issues the majority owner has more votes.
- The use of contracts. As we noted in chapter 4 contracts can bind parties in to the exchange process because the aggrieved have redress to the courts. They also provide a framework in which respect and co-operation can develop. Again as we noted in chapter 4 the parties can make self-enforcing agreements to bind themselves to the exchange process. They can show commitment by allowing independent scrutiny of activities, perhaps through transparent accounting of the project.

The implication is that where the external environment is complex and dynamic the nature of information and knowledge about the transaction becomes more ambiguous. As a result the analysis of payoffs becomes problematic and the game theoretic solutions we sought in the earlier sections require greater mathematical sophistication. So game theory is not dead it is very alive but requires sophisticated analysis beyond the scope of this course.

We can conclude this analysis by examining one other resolution to the Prisoner's Dilemma game of partnerships, the creation of **incentives**. The UK government has created a framework of laws that are to encourage the development of multi-agency-(public, private and voluntary sector) partnerships by only allowing funding for joint working on particularly difficult and inter-related socio-economic problems such as inner city housing, health and education, rising crime rates, poverty and unemployment. There is now an attempt toward a holistic approach, and talk is of 'joined-up thinking' and 'joined-up policy'. For example, urban economic development initiatives such as City Challenge and the Single Regeneration Budget usually involve local authorities, the police force, Health Trusts and charitable organisations. The overall payoffs are in terms of targeted outcomes such as lower crime rates, lower levels of social exclusion, and the greater empowerment of local people who will be more involved in community-based regeneration initiatives and the management of the process. Sustainable social and economic regeneration is the key long-term goal.

The successful bids for urban regeneration funding have usually come from those areas where there has been a well established, relatively harmonious, set of working relationships among key agents within formal organisational structures (community-based bids have fared less well). However, some have noted how the initial provision of funding-led initiatives in urban regeneration is creating it's own inter-organisational dynamic. Thus, the creation of formal partnerships through financial incentives from government may lead to the development of more 'informal' network structures in which social and economic relationships will flourish (Lowdnes et al, 1997). Transactions will then embody trust, co-operation and mutual advantage through the use of incentives rather than punishments.

A1.6. Summary

In this chapter we have used game theory to explore the issue of interdependence in decision-making. We argued that it allowed us study the logic of the situation in a scientific manner. Further, we used game theory to explore some important and complex strategic issues. For the main part we examined the 'Prisoner's Dilemma' game as a one-shot and as a repeated game. In particular we noted the importance of punishment strategies in resolving the Prisoner's Dilemma game and to development of a form of trust. However, to facilitate a more in depth understanding of the strategic possibilities embodied in game theory to elicit co-operation we examined the strategic issue of partnerships in the private and public sector. Here we saw that information and knowledge asymmetries between the parties involved in the creation of alliances may resort to contractual devices to avoid opportunistic behaviour. Additionally, incentive systems can help to create trust in exchange.

Activity A1.2

Read the article by Jackson PM and Stainsby L (2000) Managing Public Sector Networked Organisations, *Public money and Management*, no. 1, pp.11-16.

Summarise the article in no more than 300 words and consider the following question:

To what extent are alliances, partnerships and networks important to your organisation and how effective are they? Try and use the language of transaction costs and game theory to guide your answer.

Post your findings on the discussion board.

Selected Reading (= Key Reading)**

Axelrod R (1984) *The Evolution of Co-operation*, Basic Books, New York.

Dawkins R (1989) *The Selfish Gene*, second edition, Penguin, London.

** Dixit A. K. & Nalebuff B.J. (1991) *Thinking Strategically. The Competitive Edge in Business, Politics, and Everyday Life*. W. W. Norton & Company. London.

Dixit A and Skeath K (1999) *Games of Strategy*, WW Norton and Co., London

Hargreaves-Heap S & Varoufakis Y (1995) *Game Theory. A Critical Introduction*, Routledge. London. (This book was given a 'Health Warning' by a reviewer in a 1996 edition of the Economic Journal. for a couple of omissions and an error. However, I would strongly recommend this book as a theoretical introduction to the area for non-economists)

Hargreaves-Heap S *et al* (1992) *The Theory of Choice. A Critical Guide*, Blackwell, London. Chapters 7-12.

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** Johnson G and Scholes K (1999) *Exploring Corporate Strategy*, Prentice Hall Europe, London, 5th Edition. Chapter 7, pp 337 -344.

Kay J. (1993) *Foundations of Corporate Success. How Business Strategies Add Value*. Oxford University Press. Oxford.

Lowndes V, Nanton P, McCabe A, Skelcher C (1997) Networks, Partnerships and Urban Regeneration, *Local Economy*, February, pp.33-342.

**McMillan J (1992) *Games, Strategies, and Managers. How Managers can use Game Theory to make better Business Decisions*. Oxford University Press. Oxford.

Poundstone W. (1993) *Prisoner's Dilemma. John von Neumann, Game Theory, and the Puzzle of the Bomb*. Oxford University Press. Oxford.